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Assoc. Prof. Dr. Ugur SEN

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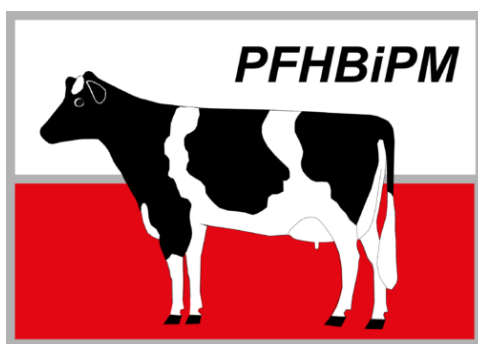**Organized by**

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PREFACE

This volume contains the papers presented at the VII. International Congress on Domestic Animal Breeding Genetics and Husbandry - 2023 (ICABGEH-23) was held on September 18 - 20, 2023, in Krakow, POLAND.

The ICABGEH-23 has been organized by the Agricultural Faculty of Ondokuz Mayıs University and Animal Breeding, University of Agriculture in Krakow and Biology Faculty of Bydgoszcz University of Science and Technology. ICABGEH-23 is the seventh international event of the congress series with the participation of top-rated invited speakers: Dr. Margrethe THERKILDSEN (Aarhus University, Denmark), Dr. Laurent JOURNAUX (Génétique Elevage, France) and Dr. Petr SLÁMA (Mendel University in Brno, Czechia). This event has been planned to bring together leading researchers, engineers, and scientists in animal science worldwide. It also provided opportunities for the delegates to exchange new ideas and application experiences, establish business or research relations, and find global partners for future collaboration. The organizing committee has done severe planning and preparation to ensure that the international animal science community meets the challenges and moves safely and successfully into the advanced information era. To this end, ICABGEH-2023 has focused on recent developments and research in animal science to protect the environment and food safety. Thus, ICABGEH-2023 has achieved its main twofold objective: Firstly, the presentation of current research works in the field of animal science, and secondly, connecting the animal science community.

Prof. Dr. Hasan ONDER,

President of ICABGEH-23

TABLE OF CONTENT

ORAL PRESENTATIONS

TABLE OF CONTENT

SUSTAINABLE BEEF PRODUCTION – IMPACT ON BEEF QUALITY

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Abstract

The journey towards a sustainable beef production requires multiple actions, like minimizing the impact of the beef production itself, but also minimizing the waste of the produced products. That is, a sustainable beef production system should at the same time secure production of high-quality products and meet the consumer demand. Beef production is in most countries based on beef cattle, where the main output is meat, however a more sustainable production can be obtained from the dairy production (Mogensen et al. 2015). With the increased use of sexed semen in the dairy herd to deliver replacement heifers, there is a surplus of dairy cows, that can deliver calves for beef production. Although meat from purebred dairy breeds in older studies have comparable quality with beef breeds (e.g. Andersen et al. 2001), the EUROP payment system is unfavourable to the dairy breeds. Thus, recently this has been addressed by increased use of beef semen for the surplus dairy cows, to deliver offspring with increased growth rate and EUROP conformation – i.e., the beef on dairy production system. The beef breeds have traditionally been improved from a pure-breed perspective, however beef bulls used for a sustainable beef on dairy production should be selected on traits that can minimize the impact on the environment e.g. methane emission and feed efficiency. Likewise, to minimize waste of final products (i.e. increase value) the breeding bulls also must deliver high meat quality that fulfils the consumer demand. Methane emission, feed efficiency and some meat quality traits have demonstrated moderate heritability (Berry et al. 2014; Lassen et al. 2016; Utrera and Van Vleck, 2004), Nevertheless, their applicability within a crossbreeding framework requires further confirmation. Other than having the right genetic potential for a sustainable production, focus should also be on a sustainable feeding and production strategy towards a continuous effort to minimize the environmental impact. However, also for these traits' awareness is required due to the possible impact on the final meat quality. Age, sex and feeding strategy and composition do have an impact on efficiency but also on meat quality. Flavour, fatness, and colour increase with age, but so does the contribution from collagen to toughness. Heifers and steers deposit more intramuscular fat compared with bulls, but bulls have better feed efficiency and growth performance. Inferior growth rate may restrict tenderization due to reduced protein turnover. Grass-based feeding is in favour of specific unsaturated fatty acids beneficial for humans, but grass-feeding may also lead to specific flavours preferred by some but rejected by others. Thus, several dilemmas exist in the aim of producing sustainable high-quality beef, which is appreciated by the final consumer. The beef on dairy should further pay attention to the culled dairy cows, which is not only a byproduct, but can, by focused finishing or selection on the slaughter line, deliver high quality beef. Strategies that can increase the value of the meat from dairy cows have been demonstrated with finishing feeding (Vestergaard et al. 2007; Therkildsen et al. 2011), however, to be attractive, feedback (premium) to the farmers based on the quality is crucial. Currently the European payment system have no relationship with meat quality traits (Bonney et al. 2016; Guzek et al., 2016), thus methods to measure meat quality on-line is required. This approach has been tried for decades testing several technologies (Farmer and Ferrell, 2018), however lately camera solutions predicting the amount of marbling seems promising. Thus, future sustainable beef production should 1) consider the difference in environmental impact of meat from either a beef cattle or dairy system, 2) include genetic selection for traits with impact on sustainability and meat quality, and 3) have a focused approach towards optimised quality of the meat during production, which can lead to satisfied consumers and thus reduced waste.

Keywords: Beef on dairy; genetic improvement; production strategy; meat quality; consumer satisfaction

HOW FRENCH ORGANIZATIONS SUCCEED TO IMPLEMENT GENOMIC SELECTION FOR ALL RUMINANT SPECIES?

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Abstract

Genomic selection is the major improvement for animal breeding in the XXI century. It consists in using a set of genotyped and phenotyped animals, to estimate marker-phenotype association which makes possible to predict the breeding value of a candidate without the need for direct or offspring performances. The selection efficiency is linked to the size of the reference population design (animals with performances and genotyping) and the access to an informative SNP chip suited to the population. In France, the organisation of genetic improvement opened this technology to all the ruminant species. An efficient transfer of knowledge and technologies from dairy cattle to beef cattle, dairy sheep, dairy goats and meat sheep and from larger breeds to smaller ones was made possible for 2 major reasons. First of all, the cooperation of research and development, with breeding organisations and their components (performance recording organisations, artificial insemination centers...), in the frame of disposals of mutualization (large national data base of pedigree and performances, specific program to fund genomic selection research), is well established since the 70's. Secondly, the French strategy of development has included for years the domestic biodiversity management and adapted breeding schemes for small populations. In dairy cattle, the first detection of microsatellite was performed in 1996. In 2000 France had the first tool of marker assisted selection. With the use of Illumina SNP chip in 2008, France published the first genomic breeding values in 2009 for males and 2011 for females. For the Holstein breed, France was leader to create the Eurogenomics reference population. During the last 15 years, the technology was continuously improved by increasing the reference population (including female) and, last year, the implementation of a single steep computation of breeding values. Genomic selection is available for 8 breeds, the smallest one, the vosgienne breed, has only 1 200 cows with performance recording. In Beef cattle, research program was developed from 2011 to 2014. Genomic selection is now routinely available for the 3 major beef breeds (Charolais, Limousin and Blonde d'Aquitaine). It will be extended to all the breeds with the publication of single steep breeding values in 2024.   In dairy sheep (5 breeds) and dairy goat (2 breeds), France has the most structured breeding schemes in the world. Thanks to this expertise, the breeding organisations, in collaboration with research teams (INRAE, Idele), developed specific tools for genomic selection and determined the adapted economic conditions of use. In sheep, France was an important partner of international consortium for the development of SNP chip. In goats, INRAE was the scientific co leader with China to sequence the goat genome and to develop a commercial chip. Today, for these 2 species, genomic selection is used routinely to create and choose artificial insemination males. In meat sheep, genomic information has been used for many years in an approach of selection by genes for scrapie, prolificity, muscular development... The new Ovigen platform open the doors for genomic selection for quantitative traits in routine.

Keywords: *Genomic selection, France, Ruminants, Cattle, Sheep, Goat, Organisation*

3D CELL CULTURE: THE FUTURE OF ANIMAL RESEARCH?

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Abstract

Recently, three-dimensional (3D) cell culture systems are used for human and also for animal research. There are more types of 3D culture including scaffold-free (spheroid techniques, organoid techniques) and scaffold-based systems (solid scaffolds, hydrogels). There are more advantages of 3D cell culture systems comparing to 2D cell systems. One of them is that 3D systems mimic tissue conditions, therefore cells can be in the similar conditions as in in vivo experiments. Cells are able to do their functions, they have the normal morphology and physiological properties. In phagocytic cells, there are able to use phagocytosis and chemotaxis normally. Other important advantage is that we are able to reduce number of animals that are used for experiments which is also in accordance with ethical problems that arise in relation with killing animals at the end or during experiments. We think that 3D cell culture systems will be routine methods for animal and human research within ten years.

Keywords: *Cell culture, 3D, 2D, Phagocytes, Animal research*

EFFECT OF LAVENDER EXTRACT USED IN RUMINANT ANIMAL NUTRITION ON METHANE RELEASE

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Abstract

Methane, which is one of the greenhouse gases formed as a result of the digestive activities of ruminant animals and released into the environment, is among the issues that have been emphasized recently. Methane is formed due to fermentation in the rumen of ruminant animals and this is undesirable. There is a loss of energy (5-15% of digestible energy) for the gases formed in the rumen to be thrown out by the animal. Today, the fact that we are faced with the problems of global warming causes an increase in studies on this subject. In addition to its harmful effects on the environment, it can cause energy and nitrogen loss in ruminant animals, resulting in a decrease in animal performance, feed consumption, live weight gain, and low productivity. With the increase in the number of animals due to the increasing need for animal protein, this issue comes to the fore every day. To reduce this gas released by ruminant animals during the production of meat, milk, and similar animal products, several strategies related to care and feeding are implemented. It is aimed to reduce methane emissions with the feeding strategies to be proposed in the farms. In order to improve feed raw materials and compositions and increase the digestibility of feed, some additives can be used to reduce methane emissions. Similarly, increasing the ratio of concentrated feed in the ration, the use of quality roughage, the structure of the carbohydrate to be used, the use of inhibitors, organic acids, probiotics, phenolic-containing plants used in the ration, the rate of passage of the feed through the digestive tract, the structure and level of the fat in the ration, and the reduction of methane release is effective on. Essential oils, which are plant secondary metabolites, are natural alternatives that can be used instead of antibiotics. In this review, it was aimed to examine the rumen fermentation and antimetachonic effect of lavender (Lavandula angustifolia) oil, which is one of the herbal extracts, antibacterial, antifungal, immunostimulating, and used in the treatment of respiratory disorders.

Keywords: _Lavender (Lavandula angustifolia) oil, Rumen fermentation, Antimethanogenic effect, Methanogenesis_

INTRODUCTION

Globally, there are concerns about the accumulation of gases that can trap heat in the atmosphere and lead to an increase in average global temperatures, and it is reported that carbon dioxide (CO_2), the most important greenhouse gas, causes about 77% of global warming (Forster et al., 2007; Pirondini, 2014). Industrial activities, fossil fuels, energy use are among the factors that cause CO_2 production. However, most of the other greenhouse gases that cause global warming (sulfur hexafluoride, nitrous oxide, some carbons, ozone, and methane) are natural (animal guts, oceans, sweet water bodies, wetlands, swamps, non-wetlands, landfills, gas hydrates and forest fires) and anthropogenic (caused by human population) emissions in the atmosphere. Methane (CH_4) is one of the important gases causing global warming, accounting for 14% of anthropogenic greenhouse gas production (Forster et al., 2007).

Ruminant animals (cattle, buffalo, sheep, goat, deer, etc.) convert the unused energy source in the lignocellulosic structure into volatile fatty acids, which are usable energy sources. Ruminant animals break down cellulose, hemicellulose and lignin into monomers (hexoses and pentoses), while hexose and pentoses are oxidized to volatile fatty acids with the release of carbon dioxide and hydrogen. Reduced cofactors such as NADH and NADPH are produced from monomers fermented in anaerobic conditions. Production of methane, hydrogen sulfide and ammonia occurs by these reduced cofactors. If this production does not occur, feed energy is used as the fermentation of carbohydrates is stopped. Therefore, methane must be produced in the rumen for animals to continue to release energy (Kamra et al., 2012). Many strategies are applied to reduce methane release in ruminant animals, but these

applications cannot be used practically in animal nutrition due to the toxic effect that occurs during the fermentation of feed in the rumen and has certain limitations (Kamra et al., 2012; Kılıç and Boga, 2021). It is emphasized that plant secondary metabolites (tannins, flavonoids, saponins and essential oils) used as feed additives can be used to reduce methane release, especially in recent years. Plant secondary metabolites with antimicrobial properties are a wide variety of chemical compounds synthesized in plants that are not involved in primary biochemical growth and reproduction processes. It is seen as a result of the demand to meet the increased demand for animal products through the release of CH4 (enteric fermentation and methanogenesis from manure storage) in ruminant animals. The effects of animal husbandry on greenhouse gases continue today. Capper et al. (2009) 3-8% and Pulina et al. (2011) reported 3%. They stated that CH4, which is an anthropogenic greenhouse gas, may cause energy (2-12% of gross energy) and nitrogen loss in ruminant animals, leading to a decrease in animal performance, feed consumption and yield (Ingale et al., 2013; Pirondini, 2014; Kılıç and Boga, 2021). Due to these negative effects on animals and the environment, there are some strategies based on animal nutrition (such as the use of plant secondary metabolites, the use of oil, the use of organic acids) to reduce CH4 release (Pirondini, 2014; Kılıç and Bull, 2021). It is thought that the animal-induced part of the global warming problem can be reduced by using secondary plant extracts, such as tannins, flavonoids, saponins and essential oils, to reduce methane release. Tannins form compounds with proteins and can prevent digestion in the rumen by causing proteins to take place like bypass proteins. These proteins, which are digested in the small intestine, can be used to reduce methane release and reduce the loss of 2-12% of the gross energy taken with feed. These effects are affected by the structure of the grain, its amount and the type of animal and its physiological structure (Boga et al., 2021). Flavonoids are plant secondary metabolites that are used to keep feeds intact for a long time and protect against antioxidant and cell oxidizing agents. Saponins are plant secondary metabolites used in many functions such as increasing feed consumption, binding ammonia, antibacterial, antifungal, antioxidant and preventing urease activity. The effect of saponins varies depending on the amount, structure, and physiological condition and species of the animal (Boga et al., 2022). Plant secondary metabolites, which have an antimethanogenic effect due to their antioxidant and antimicrobial properties, can be used in animal nutrition because they do not have a negative effect on animal health and performance. Organic acids, on the other hand, can reduce methane release by increasing propionic acid production in the diet (Kılıç and Boga, 2021). It has been reported that methane emissions can be reduced by 17% by acting as a hydrogen source of organic acids. Thus, the production of propionic acid in the diet is stimulated and the release of CH4 decreases (Castillo et al., 2004). It has also been reported to reduce CH4 emission by 17%, as it serves as a source of propionate hydrogen in ruminant rations (McAllister and Newbold, 2008).

USE OF HERBAL EXTRACTS IN ANIMAL NUTRITION

Plants produce organic compounds such as saponin, tannin and essential oil produced from secondary metabolisms that indirectly affect growth and development periods (Balandrin and Klocke, 1985; Calsamiglia et al., 2007; García-Gonzalez et al., 2008). The use of herbal extracts (plant extracts, phytofactors, essential oils) is one of the natural alternatives used in animal nutrition since the use of antibiotics was banned (Kılıç et al., 2011). The reason why it is not used in vivo is that it is not practical in terms of animal nutrition, since it will affect rumen fermentation, the taste of feed and toxicity. It has also been reported that apart from these side effects, it will increase the cost of the ration (Pirondini, 2014).

Herbal extracts; are oily-looking secondary metabolites obtained by steam distillation from volatile fractions of the plant, including flowers, roots, fruits, leaves and stems (Hart et al., 2008). Some of the main effects of using herbal extracts; It is related to the stimulation of rumen fermentation and inhibition of methanogenesis (Mohammed et al., 2004). The effect on the animal depends on feed quality, feed consumption, concentrate feed characteristics, ration content and rumen pH (Calsamiglia et al. 2007). Although many of the herbal extracts have antimicrobial properties against rumen microorganisms, they increase animal performance and reduce methane release by manipulating the rumen microbial population to increase cellulose feed digestibility (Dong et al., 2010; Kılıç et al., 2011).

In the dry period, rumen fluid taken from Holstein cows was added to the ration containing barley, wheat straw and soybean meal, thyme (Origanum vulgare), black cumin (Nigella sativa), Mediterranean laurel (Laurus nobilis), cumin (Cumminum cyminum), garlic (Allium sativum), reported that essential oils obtained from anise (Pimpinella anisum) and cinnamon (Cinna momum zeylanicum) plants and their combinations affected rumen fermentation (Kılıç et al., 2011). The addition of oregano oil at

different levels (0, 400, 800 and 1200 mg/l) significantly reduced in vitro gas production, organic matter digestibility and metabolic energy value of the feed. They reported that the dose of essential oil should be considered in ruminant animal nutrition, and that essential oils used in very high doses will affect microbial fermentation negatively by changing the rumen function (Benchaar et al., 2007; Canbolat et al., 2011).

In moderate doses (50-500 mg/L), some essential oils alter rumen fermentation by altering VFA production and N metabolism or both, thus, it has been reported that when essential oils are added to the diet, methanogenesis will be reduced due to a decrease in the "acetate: propionate" ratio and an increase in butyrate level (Benchaar and Greathead, 2011). Some of the plants showing in vitro methane inhibition are; Allium sativum, Azadirachta indica, Emblica officinalis, Eugenia jambolana, Ficus benghalensis, Foeniculum vulgare, Lotus pedunculatus, Mangifera indica, Ocimum sanctum, Populus deltoides, Sapidium java, Ficus benghalensis, Sapindium mukorosperum, Sapindusum chebula and Yucca schidigera. It has been reported that there is a significant reduction of 1-2% in vivo methane emission when some of these plants are used (Kamra et al., 2012). Herbal extracts from plants such as thyme, cinnamon, garlic, and horseradish decreased the production of CH4 in a dose-dependent manner in vitro (Benchaar and Greathead, 2011). Plant secondary metabolites prevent methane emission, the antimicrobial properties of these compounds can directly inhibit methanogens, they have an antiprotozoal activity that may indirectly cause a decrease in the number of methanogens, and the digestibility of the feed is affected by reducing the number of bacteria and fungi due to antimicrobial activity (Kamra et al., 2012).

USE OF LAVENDER OIL IN ANIMAL NUTRITION

Essential oils obtained from Lavandula angustifolia, which is in the Lamiacea family, have antiseptic, anti-inflammatory, antinociceptive, antifungal and antibacterial properties (Cavanagh and Wilkinson, 2005). Essential oils can be added to milk or milk replacer feeds and starter feed mix in calf feeding (Asghari et al., 2021). Since essential oils do not adversely affect rumen microorganisms due to their ability to bypass the use in animal nutrition, it is thought that by manipulating the microbial population, they will increase animal performance and reduce methane release.

Lavender oil, one of the essential oils, has been used in animal nutrition in a few studies. They reported that lavender (Lavandula latifolia) essential oil reduces methane production in cattle by 20-30% in vitro (Tekippe et al., 2012). Lavender oil (Lavandula officinalis or L. angustifolia) and lavender oil (Lavandula hybrid) used in animal nutrition do not affect rumen fermentation but reduce the volatile fatty acid concentration (Giordani et al., 2004; Papachristos et al., 2004). The use of lavender essential oil in beef cattle feed is not recommended as it will not cause any effect (Castillejos et al., 2008). Lavender essential oil changes in vitro gas production depending on the dose. It has been reported that low doses increase gas production, while high doses decrease gas production (Broudiscou and Lassalas, 2000; Yadeghari et al., 2015). However, it has been reported that the use of essential oils at high doses (500mg/l) inhibits rumen microbial fermentation, causing high volatile fatty acid concentration and low N concentration (Castillejos et al., 2008). Essential oils from Lavandula angustifolia and Thymus vulgaris, which are a permanent substitute for synthetic antibiotics used against Staphylococcus and Streptococcus pathogens, have a very high antibacterial activity (Abboud et al., 2015). Due to this antibacterial effect, Lavandula angustifolia, which is used instead of antibiotics, is thought to increase animal performance and reduce methane release by manipulating the rumen microbial population. They reported that extracts of Lavandula officinalis and Solidago virgaurea, which have a high flavanoid content, increase rumen fermentation, and Equisetum arvense and Salvia officinalis reduce methane production (Ozturk, 2015).

In vitro gas production, methane production is shown in Table 1. Gas production increased with the addition of 1.5 µl/ml lavender essential oil, but decreased with the addition of 3.0 µl/ml lavender essential oil ($p < 0.01$).

Table 1. Gas productions, organic matter digestibility, and in vitro gases production by the addition of lavender essential oil at different doses (Coskuntuna et al., 2023).

	Lavender essential oil, %			Standard error	p- value
	0	0.05	0.10		
Cumulative gas production (12 h, mL)	36.00	30.00	32.00	1.26	0.2930
Gas production rate constant (%)	0.074	0.073	0.076	0.003	0.7830
Potential gas production (mL)	65.15	56.89	0.59.85	2.28	0.2741
Organic matter digestibility %	67.95	59.66	63.01	1.49	0.0953
Methane gas production, mL	7.01	5.51	6.41	0.27	0.2058
Carbon dioxide gas production, mL	38.60	32.74	31.93	1.63	0.0329

At the same time, Yadeghari et al. (2013) reported that lavender essential oil has an inhibitory effect in the rumen on in vitro methanogenesis with sheep rumen fluid. They reported that the addition of 3.0 µl/ml peppermint essential oil ($p>0.05$) in the rumen normal pH range (6.5 to 7.0) increased ruminal acetate production and decreased propionate and butyrate production.

However, Broudiscou et al. (2002) reported that lavender essential oil has a stimulating effect on the production of essential fatty acids. Lavender essential oil does not affect rumen fermentation up to 500 mg/L (Castillejos et al., 2008). Table 2, that lavender essential oil does not affect rumen essential fatty acids production and pH ($p>0.05$).

Table 2. The effect of adding lavender essential oil at different levels on pH and essential oil values in the buffalo rumen (Beyzi, 2020).

	Lavender essential oil, µl/ml 1.5			Standard error	p-value
	0	1.5	3.0		
pH	6.82	6.85	6.83	0.04	0.741
Acetate, %	64.33	65.15	64.54	0.52	0.078
Propionate, %	28.08	27.36	28.16	0.24	0.114
Butyrate, %	7.58	7.49	7.30	0.28	0.158
Acetate / Butyrate	2.30	2.38	2.29	0.04	0.180

CONCLUSIONS

Some strategies have been developed for agriculture and animal husbandry to reduce the methane emissions that cause global warming. It should be taken into consideration that methane release cannot be prevented but can be reduced due to the digestive system mechanism in ruminant animals. Many of the strategies developed based on animal husbandry cannot be implemented because they are expensive and not applicable. Especially essential oils that do not have a negative effect on animal health and performance can be used on methane release. In addition to all these, the nutrient composition of the feeds in the ration, rumen pH, feed quality, feed consumption, properties of concentrated feed, ration content and the effect of essential oils may vary depending on the rumen pH. However, the dose of the herbal extract to be used in the ration determines the level of effect.

The effect of lavender oil on methane release in animal nutrition has been discussed due to its many antimicrobial, antibacterial, antifungal and immunostimulating effects. It has been stated that lavender essential oil, which is used at high rates or with essential oils such as peppermint, has an antimethanogenic effect.

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THE LIGHT AND SCANNING ELECTRON MICROSCOPIC STRUCTURE OF PECTEN OCULI IN THE GOOSE (ANSER ANSER)

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Abstract

This study aims to establish the light and electron microscopic structure of the pecten oculi in the goose (Anser anser). For this purpose, 12 samples of pecten oculi extracted from 6 goose eyes were used. In the study, it was found that the goose pecten consists of 13-14 pleats. The maximum transversal length of the eye was approximately 10 mm, the corneal diameter was 5 mm, the basal length of the pecten was 7 mm, the apical length was 1.5 mm, and the height of the pecten was 5.55 mm (n=6). In pecten pleats, the mean diameters of two separate vessels, primary and secondary, were 48.94 and 23.36 μm respectively. The primary vessels located at the centre of the pecten pleats were surrounded by the secondary vessels. It was observed that the melanocytes in pleats gradually intensified from basal to apical regions. Pecten covered to the vitreo-pecteneal limiting membrane and, hyalocytes were found on this part. This study revealed that the goose pecten has a structure similar to the avian species in the waterfowl family.

_Keywords__: Goose, Light microscope, Pecten oculi, Scanning Electron microscope, Structure_

LACTOBACILLUS Spp. AS AN ANIMAL NUTRITION

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Abstract

The level of utilization of feed has a direct effect on growth, development and yield in animals. In this sense, probiotics are often used as dietary supplements. Probiotics are microorganisms that are beneficial for health. Although it has been considered the best alternative for antibiotics from the past to the present, it is currently recommended for solving many different health problems. Lactobacillus spp. are the leading species that are often used. Lactobacillus spp contains 261 species that are very diverse in terms of phenotypic, ecological and genotypic aspects. However, species are constantly being re-evaluated based on modern molecular biology methods and whole genome-based techniques. Lactobacillus starins are gram-positive, rod-shaped bacteria and do not hydrolyze casein. But the majority of strains produce small amounts of soluble nitrogen. They deconstruct sugar into lactic acid quickly through simple metabolic pathways and are among the important probiotics. The most commonly used types are L. acidophilus, L. lactis, L. plantarum, L. bulgaricus, L. casei, L. Helveticus and L. salivarius. In general, there are some scientific studies that these bacteria improve health conditions by inhibiting harmful bacteria. For example, it has been shown to prevent E. coli adhesion by L. rhamnosus and L. plantarum. There are studies indicating that Lactobacillus species added to the diet in animals increases the level of immunoglobulin, and boosts immun system. Also it increases meat and milk yield according to the animal type. In addition, there are studies showing that as well as the antimicrobial peptides, the protein compounds produced by lactobacilli beneficial to animal health and effective in eliminating various stress factors. There is also an emphasis on Lactobacillus supplementation, especially in poultry farming. It is emphasized that lactobacilli can meet the need for supplements in poultry without showing harmful effects, and probiotics can increase the growth rates of broiler. In addition, the most current effect of lactobacilli, which is of increasing importance, is its potential effects on cancer cells. While studies conducted in this area usually focus on the prevention or treatment of colon cancer in humans, they have not been at the forefront due to the low incidence of cancer in animals. Keeping in mind in these the common fact is that there is a need more studies to be done about lactobacilli. This study focuses on the effects of using lactobacilli as a dietary supplement on animal health.

Keywords: Lactobacillus spp., Animal Health, Animal Nutrition, Probiotic, Food Supplement.

CARCASS EVALUATION AND IMMUNOLOGICAL RESPONSE OF BROILER CHICKENS ADMINISTERED ETHANOLIC EXTRACTS OF PETIVERIA ALLIACEA AND SOLANUM ERIANTHUM TO NEWCASTLE DISEASE VACCINATION

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Abstract

An eight-week study conducted to investigate the effect of administering varying concentration levels of Petiveria alliacea and Solanum erianthum leaves ethanolic extracts on the carcass and immune response to Newcastle disease Vaccinations (LaSota strain) of broiler chickens. A total number of 90 day-old Arbor acre broiler chicks of mixed sex were used for this experiment. The experimental birds were allotted to three treatments (Control, PAL and SER), which were replicated three times with 10 chicks per replicate. The concentration levels of both experimental plants leaves ethanolic extracts were 50mg/mL, 100mg/mL and 200mg/mL. At the end of the ethanolic extracts administration, three birds from each replicate were randomly-selected for carcass evaluation and HA/HI analysis (haemagglutination assay and haemagglutination inhibition assay) to test for immune responses. Data collected were subjected to Statistical Analysis System (SAS) and errors were presented as standard errors of means (SEM). The results indicated that there were significant differences ($p < 0.05$) effect on the carcass, in the weight of the right shank and left shank as influenced by the treatments. The treatment SER 2 (administered 100mg/mL ethanolic extract of S. erianthum) had the highest live weight of 2860.00g, while CC (control) had the lowest live weight of 2400.00g. CC(control) had the highest dressing percentage of 76.64% and SER 3 (administered 200mg/mL ethanolic extracts of S. erianthum) had the lowest dressing percentage of 70.76%, SER 2 (administered 100mg/mL ethanolic extract of S. erianthum) had the highest eviscerated weight of 2171.93g and SER 3 (administered 200mg/mL ethanolic extracts of S. erianthum) had the lowest eviscerated weight of 1834.57g. The immunological response to Newcastle disease vaccination showed that birds administered 100mg/mL ethanolic extract of P. alliacea (PAL 2) had the highest antibody titre values of and CC (control) had the lowest antibody titre. It was concluded that administering ethanolic extracts of Petiveria alliacea and Solanum erianthum to broiler chickens is beneficial and thus help in boosting the immune system and also serve as an alternative to synthetic antibiotic growth promoters without having any negative effect on the carcass yield.

Keywords: Carcass Evaluation, Immunological Response, Chickens, Broiler, Solanum Erianthum, Petiveria Alliacea, Ethanolic Extracts, Newcastle Disease, Vaccination

EFFECT OF PARTIAL REPLACEMENT OF BARLEY WITH PARTLY DESTONED OLIVE POMACE (DOP) ON REPRODUCTIVE PERFORMANCES OF OULED DJELLAL RAMS IN EASTERN ALGERIA

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Abstract

Eighteen Ouled Djellal rams breed were used to study the effect of partial substitution of barley concentrate by destoned olive pomace on semen characteristics, testicular measurements, plasma lipids and testosterone. Rams were divided into 3 groups of six rams each. In the first group, no substitution of barley was made (0DOP:100% barley+0 DOP), in the second (20DOP) and third groups (40DOP) substitution of barley was of 20% and 40% DOP, respectively. After substitution, the overall means of reproductive parameters and biochemical lipids were assessed, including: scrotal circumference (SC) sperm quality (volume, concentration and motility), plasma levels of testosterone and lipids (triglycerides, cholesterol, HDLc and LDLc). The effect of diet on sperm parameters and testicular measurements showed that the highest means were recorded for 40DOP, inducing in statistical analysis a difference ranging from significant ($p<0.05$) to highly significant ($p<0.001$) when comparing 0DOP vs. 40DOP. For the testicular measurements, the 40DOP group present the highest values compared to the two other groups, for all the measurements analyzed except for right testicular thickness with highly significant differences ($p<0.001$). While, for plasma parameters, cholesterol and LDLc were lower with the 40DOP diet with a highly significant difference ($p<0.001$) in the comparison 40DOP vs 0DOP and 20DOP. For triglycerides, the lowest average was recorded in the 0DOP group and the difference was highly significant when comparing 0DOP vs 20DOP and 40DOP. No significant difference was noted either for HDL or for plasma testosterone. In conclusion, partial substitution of barley concentrates of around 40% by DOP present a positive impact on reproductive performances in rams.

Keywords: Rams- Destoned olive pomace- Reproductive performances- Blood parameters

INTRODUCTION

Alternative resources are widely available in the Mediterranean basin, and their use in animal feed is highly recommended. In fact, the milling industry generates a large number of various by-products from the processing of olives, which must be managed correctly to limit serious environmental impacts. Due to their high organic content, the byproducts produced after the extraction of olive oil are a possible environmental concern. The main solid by-product, known as olive pomace, accounts for 35 to 40% of the weight of all processed olives (Gullon et al. 2020). Farmers in Algeria preferred the Ouled Djellal (OD) breed of sheep, often known as the great white Arabian breed, because of its high zootechnical potential and its ability to thrive in dry and semi-arid environments. The economic market dominance of the OD breed is creating a delicate scenario for other local breeds, as some of them are subject to uncontrolled crossbreeding with the preferred breed and/or real marginalization. This is because the OD breed supplants and jeopardizes the existence of other Algerian ovine breeds (Saadi et al., 2016; Harkat et al., 2015). In fact, barley is the main source of conventional energy for sheep in these areas throughout the year, notably in the fall and winter (Bourbouze, 2000; Mouhous, 2007), leading to a shortage and an increase in the price of the grain. It is advised that, in order to address this issue, a portion of the traditional livestock feed resources be replaced with unconventional resources (Allaoui et al., 2018; Dorbane et al., 2016; Djaalab et al., 2016; Mebirouk-Boudechiche et al., 2015). Numerous research conducted in Mediterranean nations have demonstrated that many livestock species can consume olive pomace without any negative effects on their health, blood parameters, carcass qualities, or milk and meat quality (Habeeb et al., 2017). Studies have shown that fatty acid composition, particularly unsaturated fatty acids, is very important; their incorporation into feed in any form is a significant energy source (Chiafolo et al., 2004) and a source with the potential to improve the quality and/or quantity of animal products intended for human consumption, such as milk and its derivatives

(Hadjipanayiotou, 1999; Vargas-Bello-Pérez et al., 2013;; Castellani et al., 2017; Hadhoud et al., 2021; Neofytou et al., 2021), meat (Owaimer et al., 2004; Mioc et al., 2007; Abo Omar et al., 2012; Faye et al., 2013; Ozdogan et al., 2017; Chiafolo et al., 2020; Tzamaloukas et al., 2021), eggs (Abd El-Galil et al., 2017). To avoid wasting these by-products with high nutritional value in bioactive compounds and numerous health benefits, various alternatives offer themselves for their use after extraction, including their introduction into human and animal food (Petraru Ancut and Amariei, 2020). The potential use of olive pomace as a substitute for part of the cereal concentrate or straw in diets for small ruminants has been explored, as this might partially contribute both to solving the problem of the disposal of olive pomace and to reducing production costs for livestock feeding. Also, this co-product represents an essential source of vegetable oil (approximately 18 to 25%) (Chiofalo et al., 2004). Olive pomace has been shown to improve the digestibility of straw during the dry period (Houmani and Tisserand, 1999) and increase animal performance (Molina-Alcaide & Yáñez Ruiz, 2008). Morever, the rational administration of plant oils to ruminants could improve their reproductive performances (Tran et al., 2016), and even the consumption of olive pulp for a long period improves the proportion of PUFA in the spermatozoon membrane and has no detrimental effect on the sperm quality of rams (Faraji et al., 2012). For this reason, partly-destoned olive pomace may have better nutritive value than other olive pomace by-products (crude olive pomace, exhausted olive pomace, and partly-destoned exhausted olive pomace) while improving body weight gain, growth rates, and feed conversions such as increasing nutritive value and digestibility (Sadeghi et al., 2009). Our experiment aimed to investigate for the first time the effect of partial substitution of barley by partly destoned olive cake on testosterone and some lipid levels in the blood, scrotal circumference, and semen quality of Ouled Djellal rams.

MATERIALS AND METHODS
Site of Study and Climate
The experiment was carried out at the experimental farm of Laaziz Belgacem (Ouled Rahmoun, Constantine), which is situated in the semi-arid region at longitude 6°42'19" and latitude of 36°10'58" N and at altitude between 600 and 900m above mean sea level for a total period of 14 weeks (to November 2018 to mars 2019). During the study period the mean environmental temperature and relative humidity ranged between

Animals and Experimental Design
Eighteen healthy sexually mature Ouled Djellal rams (2-5 years old) were unleaded in this study. The mean live body and circumference scrotal were 80 kg and 36 cm respectively. Rams were separated from ewes and reared in individually pens in well- ventilated covered building. They were randomly divided into three groups. The first group was considered as control received 650 g barley and 1kg straw 0%. The second and third groups received the same diet with a substitution of 20% and 40% of barley by partly destoned olive pomace (DOP) respectively.

Diets Composition
The chemical compositions of the diets were determined (Table 1). The dry matter, organic matter, ash, crude protein, and ether extract were estimated in accordance with Association of Official Analytical Chemists (AOAC) methods (AOAC, 1997), whereas neutral and acid fiber fractions were assessed according to the method of Van Soest (Van Soest et al., 1991).
The DOP used in the current work was the crude obtained after smashing the whole fruit and extracting the olive by two phase centrifugations and then passing it through a sieve (3 mm) in a fresh form and spread on a plastic sheet for sun drying.

Table 1. *Composition of Ram Diets (0DOP, 20DOP, 40DOP)*

	Diets		
	0DOP	20DOP	40DOP
Mean body weight of rams (kg)	89 ($n = 6$)	89.2 ($n = 6$)	92 ($n = 6$)
Diet composition			
Barley straw (kg/head/day)	1.00	1.00	1.00
Barley (kg/head/day)	1.00	0.80	0.60
DOP (kg/head/day)	0.00 (0%)	0.20 20%)	0.40(40%)
Minerals and vitamins mixture	2%	2%	2%
Dry matter intake (kg)	1.82	1.816	1.812
Chemical composition of DM (g/kg)	91.10	90.89	90.68
Organic matter (% of DM)	94.65	94.99	95.32
Crude protein (% of DS)	5.73	5.88	6.03
Grass matter (% of DM)	1.69	2.26	2.83
Mineral matter (% of DM)	3.05	3.35	3.65
Neutral detergent fiber (% of DM)	53.70	57.02	60.34
Acid detergent fiber (% of DM)	27.58	30.07	32.56
Cellulose (% of DM)	44.69	42.87	41.05
Acid detergent lignin (% of DM)	4.14	5.59	7.05

Note: DOP = partly destoned olive pomace; DM = dry matter.

Scrotal and testicular measurement
In our study the scrotal circumference was carried out as described by Boussena et al (2014). Scrotal circumference (SC) was measured with flexible plastic tape after pushing the testicular to the bottom of the scrotum. This parameter was recorded monthly before semen collection.

Semen collection and evaluation
Semen samples were collected two weeks before incorporation of DOP in the diet and at 0, 4,8,12 weeks after this incorporation from each ram using an electro-ejaculator (ECe 320, minitub Germany). Immediately after ejaculation; volume (measured directly from the graduated collecting tube), appearance, and consistency of semen were estimated. Following this macroscopic evaluation semen samples were diluted 1:1 v/v with a pre-warmed (37°c) Tris extender and transported to the laboratory of the National Center for Biotechnology CRBT Constantine within 30 minutes after collection. The semen samples were analysed for sperm concentration and motility.
Sperm concentration was measured using a following dilution of aliquot of semen with 0.05% normal saline 1:400. The total of sperm per ejaculate was then calculated (volume *density).
 Sperm motility was evaluated by a computer-assisted sperm analyzer (CASA; Sperm class analyzer, SCA Microptic, S.L., Version3.2.0, Barcelona, Spain) as described by (Benhenia et al., 2018). Ten microliters of semen (diluted to 20×106 spermatozoa/mL in Tris-extender) sited in a pre-warmed Makler® chamber (Haifa, Israel) (37°C) were used for CASA motility analysis. Kinetic parameters were assessed at magnification ×10 for at least 200 spermatozoa (SPZ). Those parameters relate the total motility (TM, %) and progressive motility (PM, %); knowing that, the TM is defined by the sperm rate with VCL>10 m/s, while PM is the percentage of SPZ with VCL > 25 m/s and STR >80% (Tamayo-Canul et al., 2011).

Blood sampling for testosterone and biochemical assays
Blood samples were collected before the morning feeding from all rams via jugular venepuncture into vacutainer heparinized tubes at every month. At once, the samples are placed on ice and transported to the laboratory for centrifugation at 3500g for 20 minutes and stored at –20°c until analysis.
Determination of testosteronaemia was obtained by using a Testosterone Electrochemiluminescence kit (Roche Diagnostic, Mannheim, Germany; measuring range: 0.025–1.5 ng/mL).

The concentrations of triglycerides, cholesterol, HDLc and LDLc and triglycerides were performed by enzymatic colorimetric test in an automated biochemical analyzer version (PHD, DIAMS 2300» using a commercial kits (SPINREACT) Espagne. The analytical methods were based on the quantitative determination of serum triglycerides by the GPO-POD, serum cholesterol, HDLc and LDLc by the CHOD-POD.

Statistical Analysis
Statistical analysis was carried out using Statview V.4.02 software (Abacus Concepts Inc., Berkeley, CA, USA). Data were examined for normality. For data that were not normally distributed, logarithm and square-root transformations were used where appropriate. The effect of fixed factors, dietary group (0DOP, 20DOP, and 40DOP), month (time over which experiment was carried out, 5 months), and also the interaction of diet and month, was analysed using analysis of variance for repeated.

RESULTS
Effect of Dietary Regimen on Scrotal Circumference and some sperm parameters (Table2; figure 1)

Scrotal circumference
The data regarding the effect of dietary inclusion of olive pomace on SC are shown in table 1 & Figure 1. Scrotal circumference monthly evolution was significantly (p <0 .05) decreased in control and 20DOP and maintained in the 40DOP group. The results of overall means showed a significant (p<0.05) improvement in SC of 40DOP compared to the control group.
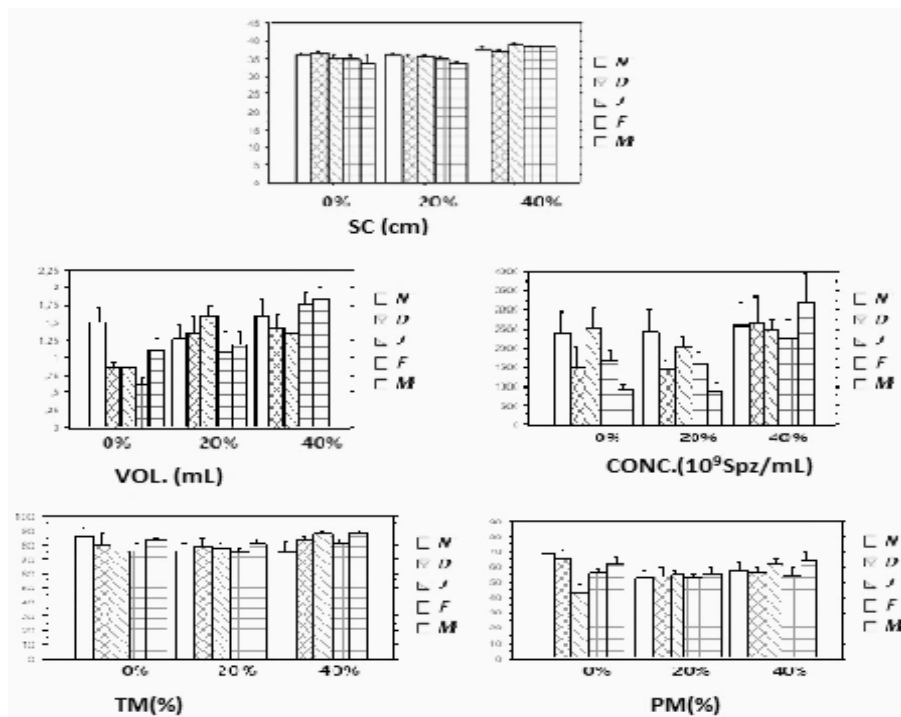
Figure 1: Effect of ram diets on monthly variations in Scrotal circumference (SC), Volume (VOL), Concentration (CONC.), Total Motility (MT), and Progressive Motility (PM).

Volume, concentration and motility (total and progressive)

The results of spermatic parameters are presented in Table 2. Regarding the volume of sperm, the 40DOP diet reveals a significant monthly progression (p ≤0.05), inversely to the significant regression (p ≤ .05) observed in the control. As for the sperm concentration, a significant monthly progression (p ≤0.05) was observed in the 40DOP group. The overall means results indicated a significant improvement (p≤0.001) in sperm VOL of 40DOP compared to the control.

The interaction of diet*month between studied groups reveals for SC in January a highly significant difference (p≤0.001) for 0DOP vs 40DOP and very significant difference (p≤0.01) for 20DOP vs 40DOP. A significant difference (p 0.05) was observed during February and march when comparing the 0DOP vs 40DOP; and during December, January and February to the

comparison between 20DOP vs 40DOP. While, for sperm volume, the results shown a highly significant difference during January and February in comparison between 0DOP vs 20DOP and 40DOP respectively. The very significant difference was observed during February and March in comparison group 20DOP vs 40DOP; whereas only one significant difference was obtained to the comparison between 0DOP vs 40DOP during March. Concerning the effect on concentration, a highly significant difference was observed during March when comparing the 40DOP group with 0DOP and 20DOP groups. As for this interaction on motility, the ANOVA results showed difference only for the progressive motility during January varying to significant to highly significant when comparing 0DOP group with 20DOP and 40DOP groups respectively.

Table 2: Effect of ram diets, time (month) and interaction diet x month on the scrotal circumference and sperm parameters (Vol., CONC., TM and PM) in relation with diet, month and diet*month).

Diet	SC (cm) ***	VOL. (mL) *	CONC. (SPZ x10⁹) NS	TM (%) NS	PM (%) NS
0DOP	35.10 ± 0.51[a]	0.99 ± 0.08[a]	1.80 ± 0.20	80.29 ± 2.6	59.12 ± 3.1
20DOP	35.13 ± 0.23[a]	1.28 ± 0.10[a, b]	1.67 ± 0.17	77.8 ± 1.8	54.00 ± 1.7
40DOP	38.23 ± 0.16[b]	1.67 ± 0.90[b]	2.62 ± 0.25	82.85 ± 1.9	58.90 ± 2.1

Month	NS	NS	NS	NS	NS
Nov. (N)	36.64 ± 0.52	1.44 ± 0.13	2.47 ± 0.30	78.41 ± 3.6	59.10 ± 4.2
Dec. (D)	36.55 ± 0.38	1.21 ± 0.12	1.81 ± 0.32	81.03 ± 3.0	58.08 ± 3.0
Jan. (J)	36.41 ± 0.36	1.27 ± 0.11	2.35 ± 0.18	81.30 ± 2.6	53.77 ± 2.8
Feb. (F)	36.19 ± 0.52	1.24 ± 0.17	1.83 ± 0.22	77.02 ± 2.1	54.66 ± 2.0
Mar. (M)	35.29 ± 0.79	1.50 ± 0.15	1.71 ± 0.37	93.94 ± 1.8	60.55 ± 2.6
Diet* Month	***	***	***	NS	***
0DOP vs 20DOP	NS	(J) ***	NS	NS	(J)*
0DOP vs 40DOP	(J)*** / (F, M)*	(F) *** / (M)*	(M)***	NS	(J)***
20DOP vs 40DOP	(D, F, M)* / (J**)	(F, M)**	(M)***	NS	NS

SC: Scrotal circumference; VOL.: volume; CONC.: concentration; TM: total motility; PM: progressive motility.

N (Nov.), D (Dec.), J (Jan.), F(Feb), and M (Mar): months; VS: versus. Different superscripts a, b, c, and d within the same column indicate significant differences, NS: nonsignificant; *: $p<0.05$; **: $p<0.01$; ***: $p<0.001$.

Total and progressive motility of ram sperm are shown in Figure 2. The results of TM and PM monthly kinetic revealed no significant effect of all diet groups, except a significant ($p \le .05$) PM regression from November to January in the control group. No significant differences ($p \ge .05$) in overall means of both parameters were observed. The results of the effect of diet*month on motility reveal a difference only in progressive motility during January, which is significant with $p \le 0.05$ in the comparison between 0DOP and 20DOP and highly significant ($p \le 0.001$) in the comparison between 0DOP and 40DOP. No significant difference was observed in this effect on total motility for all comparisons.

Effect of Dietary Regimen on hormonal and lipid blood parameters

Testosterone Levels

The results of the monthly evolution of testosterone showed a significant ($p < 0.01$) increase in testosterone from January to February for the control and 40DOP groups (Table 3). Overall testosterone means revealed no significant differences between the groups (Table 2). The diet*month interaction only reveals a significant difference ($p \le 0.05$) in November when comparing 0DOP vs 40DOP, and in December and January when comparing 20DOP vs 40DOP.

Lipid blood parameters

• *Triglycerides*

The observation of triglyceridemia (Table 3) showed the highest values in rams supplemented with olive pomace (20DOP and 40DOP); with the following mean values : 0.25± 0.01 g/L, 0.22± 0.00g/L. Statistical analysis shows a highly significant difference (($p \le 0.001$)) between the 0DOP diet and the 20DOP and 40DOP diets, while no difference was observed between the 20DOP and 40 DOP groups.

The results of the monthly evolution of triglyceridemia and the interaction between diet and month were assessed. In overall monthly evolution, the lowest value was recorded in November (0.16±0.01g/L); this value showed a highly significant difference ($p \le 0.001$) compared to other months. In terms of the diet*month interaction, the most significant differences were observed between the ODOP and 20DOP diets, with highly significant differences ($p \le 0.001$) in December and February and significant differences ($p \le 0.05$) in March. For the comparison between 0DOP and 40DOP, a significant difference ($p \le 0.05$) was only observed in February.

Table 3: Effect of different ram diets, time (month), and diet*month on hormonal and biochemical blood parameters (TESTO, TG, CHOL, HDLc and LDLc)

Diet	TESTO (ng/mL) NS	TG (g/L) ***	CHOL (g/L) ***	HDLc (g/L) NS	LDLc (g/L) ***
0DOP	3.16 ± 0.25	0.16 ± 0.00[a]	0.56 ± 0.02[a]	0.27 ± 0.01	0.25 ± 0.01[a]
20DOP	3.72 ± 0.24	0.25 ± 0.01[b]	0.56 ± 0.01[a]	0.27 ± 0.01	0.24 ± 0.01[a]
40DOP	2.58 ± 0.12	0.22 ± 0.01[b]	0.48 ± 0.02[b]	0.26 ± 0.01	0.17 ± 0.01[b]

Month	**	***	***	***	NS
Nov. (N)	3.31 ± 0.25^a	0.16 ± 0.01^a	$0.48 \pm 0.03^{a,d}$	0.21 ± 0.03^a	0.23 ± 0.02
Dec. (D)	3.19 ± 0.35^a	0.21 ± 0.02^b	$0.52 \pm 0.02^{a,c}$	0.25 ± 0.02^b	0.21 ± 0.02
Jan. (J)	2.24 ± 0.27^b	0.25 ± 0.02^b	0.61 ± 0.02^b	0.34 ± 0.02^c	0.21 ± 0.02
Feb. (F)	3.65 ± 0.24^a	0.23 ± 0.02^b	$0.56 \pm 0.02^{b,c}$	0.27 ± 0.00^b	0.24 ± 0.02
Mar. (M)	3.36 ± 0.25^a	0.21 ± 0.01^b	$0.51 \pm 0.02^{c,d}$	0.28 ± 0.02^b	0.20 ± 0.02
Diet* Month	*	***	***	NS	***
0DOP vs 20DOP	NS	(D, F)***/ (M)*	NS	NS	NS
0DOP vs 40DOP	(N)*	(F)*	(J)** / (F)***/(M)*	NS	(J)* /(F, M)***
20DOP vs 40DOP	(D, J)*	NS	(F)***	NS	(F, M)***

DOP: partly destoned olive pomace; TESTO: testosterone; TG: triglycerides; CHOL: Cholesterol, HDLc: Hight density lipoprotein cholesterol; LDLc: Low-density lipoprotein cholesterol. N, D, J, F, and M: months; VS: versus Different superscripts a, b, c, and d within the same column indicate significant differences; NS: nonsignificant *: $p<0.05$; **: $p<0.01$; ***: $p< .001$.

- *Cholesterol*

Our results presented in Table (3) show
It appears that the cholesterol level was lower in the 40DOP group (0.48±0.02 g/l) compared to the 0DOP and 20DOP groups (0.56±0.02 and 0.56±0.01 g/l, respectively). The statistical analysis showed a highly significant nutritional effect (p ≤0.001) when comparing the 40DOP group with the 0DOP and 20DOP groups, but no significant difference was found between the latter two groups.

In terms of the effect of month (figure2) on cholesterol level evolution, there was a highly significant difference (p ≤0.001) between all months, for example: November and December showing a different evolution compared to January and February. When looking at the diet*month interaction, the most significant differences were observed in the comparison between 0DOP and 40DOP, with differences ranging from very significant (p ≤0.01) to very high significant (p ≤0.001) and to significant (p ≤0.05) in January, February, and March, respectively.
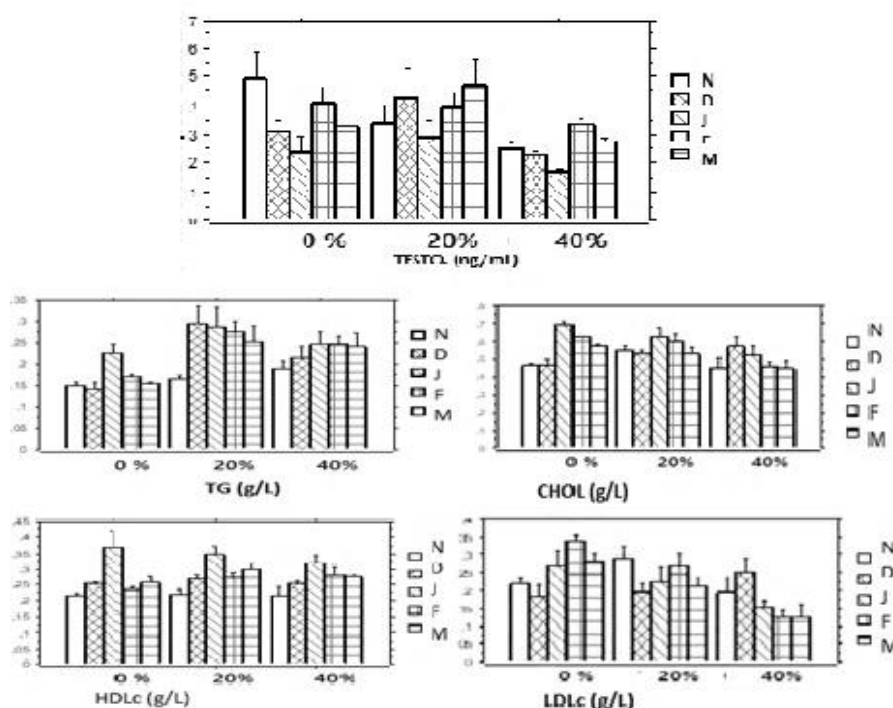
Figure 2: Effect of ram diets on monthly variations in blood testosterone (TESTO), Triglycerides (TG), Cholesterol (CHOL), HDLc and LDL

- *HDLc*

Conferring to the results showed in table 3, it appears that there was no significant diet effect on the parameter being studied, as the values obtained were almost equal. However, when looking at the overall monthly evolution of the parameter, low and high levels were observed in November (0.21±0.03g/L) and January (0.34±0.02g/L), respectively. This led to highly significant differences (p ≤0.001) in the statistical analysis, first between these two months and then between these two months and the other months. In terms of the diet*month interaction, no significant differences (p≥0.05) were observed in the comparisons between 0DOP, 20DOP, and 40DOP.

- *LDLc*

According to the results presented in table 3, it appears that the 40DOP diet had a very low value of 0.17±0.01 for this parameter. This led to a very highly significant difference (p<0.001) in the statistical analysis for the effect of diet when comparing 40DOP with 0DOP and 20DOP. No significant difference was observed for the overall monthly effect.

In terms of the diet*month interaction, significant differences were observed when comparing 0DOP with 40DOP, with differences ranging from significant in January to very highly significant in February and March. The same result was obtained when comparing 20DOP with 40DOP in February and March.

DISCUSSION

The present study was carried out to investigate the partial substitution of barley as an energy source in the ram diet by olive pomace, a by-product, and to investigate the effects of this substitution on scrotal circumference, spermatic parameters (volume, sperm concentration, total and progressive motility), testosterone levels, and lipid profile parameters in blood (triglycerides, cholesterol, HDLc and LDLc). Given the relationship between scrotal measurements, and sperm parameters with fertility; likewise, the relationship between the blood biochemical profile, as an indicator of the nutritional and sanitary state of the animals, and the aforementioned reproductive parameters. Many trials have established a very close relationship between male fertility and testicular biometrics, especially scrotal circumference. For this reason, scrotal-testicular measurements can be used as important biomarkers of male reproductive performance (Toe et al., 2000; Gimenez and Rodning, 2002; Salhab et al., 2003; Hassan et al., 2009; Focsăneanu et al., 2014). Testicular morphometry is an inherited trait and is considered to predict sperm production and is

often used to assess the fertility of rams (Zamiri et al., 2010; Ghorbankhani et al., 2015; Maksimovic et al., 2016). According to Maquivar et al. (2021), rams with an important SC and large testicular volume may have better libido and sperm quality. Similarly, Belkhiri et al. (2017) reported that the measurement of scrotal circumference in OD rams could be used in breeding centers to select suitable breeding males for artificial breeding purposes. Thus, the highest values for scrotal circumference are desirable for breeding purposes. In this study, the values obtained in all groups are within physiological standards for this breed; while noting that the highest values are recorded in the batch 40DOP with a very highly significant difference in ANOVA (p <0.001). The average recorded for the volume of ejaculates and their concentrations revealed that DOP can substitute barley in the ram diet with some positive effects at 20%, particularly on the evident beneficial effects observed at 40% on all studied parameters (SC, volume, concentration, and motility); where the highest values are recorded in rams receiving 40% DOP than for other rams, except for progressive motility which was higher in rams that did not receive substitution.

In this study, the scrotal circumference was significantly increased by the diet containing 40% DOP compared to the diets with 0% and 20% DOP. This was reflected in the statistical analysis with the recording of a highly significant difference (p<0.001) for almost all parameters studied when comparing the 40DOP diet vs 0DOP and 20DOP. Indeed, the beneficial influence of incorporating olive pomace into the diet, recorded in our study, is corroborated by the study carried out by Abed-El-Aziz and Zyada (2015); where they noted that a substitution of 20% rice straw with olive pomace significantly improves reaction time, number of jumps, and number of ejaculations in Rahmani rams. These results could indicate an improvement in ram fertility associated with a 40% substitution of barley by partly destoned olive pomace. According to Hafez and Hafez (2000), total or mass and progressive motility are important parameters to measure sperm quality as they are indicators of sperm performance in its own accessory fluid; where age, spermatogenesis, and availability of energy reserves are the endogenous factors most affecting sperm motility. Knowing that for fertilization to occur, sperm must be able to pass quickly through the sheep's reproductive system and enter the ovum (David et al., 2015).

The data suggests that unsaturated fatty acids are responsible for the activation of the hypothalamic-reproductive axis, leading to an improvement in sperm production in the 40DOP group. The positive effect of the rational

integration of olive by-products on ram fertility has been recorded by Faraji et al. (2012) and David et al. (2015). Blache et al. (2002) and Selvaraju et al. (2012) assumed that fatty acids play a key role in reproductive responses to changes in nutrition. High levels of oleic and linoleic acids in the 40DOP diet could be responsible for the improvement of reproductive parameters (Chiofalo et al., 2004). MohdHafizal et al. (2018) attested that the distribution of a ration supplemented with canola oil, rich in oleic acid, can stimulate the development of seminiferous tubules. Banihani (2017) adds that the preservation of sperm quality by olive oil is due to the improvement of gonadal function and the reduction of oxidative damage. Abed-El-Aziz and Zyada (2015) also obtained good results on spermatic parameters using olive pomace at 60% DM at a rate of 20% in replacement of the same percentage of rice straw. Testosterone is the main hormone involved in male reproductive performance, particularly in sperm quality (Kishk, 2008). In the testis, testosterone is produced by Leydig cells and acts as a paracrine factor that diffuses into the seminiferous tubules to regulate spermatogenesis (Smith & Walker, 2014). This steroid hormone also diffuses into blood vessels to enter blood circulation (Smith & Walker, 2014). It has been reported that the mean blood testosterone concentration in Ouled Djellal rams was between 1.75 ng/mL and 4.50 ng/mL (Taherti et al., 2014). Similarly, the overall blood testosterone levels of control and DOP batchs in the present experimentation were between 2.24 ng/mL and 3.65 ng/mL, indicating that DOP had no negative effect on plasma testosterone levels. In addition, a similar pattern of monthly evolution of control and 40DOP was observed with high concentrations in January. In the Ouled Djellal breed, many studies have reported that the main factor influencing monthly variation of testosterone is the season (Allaoui et al., 2018; Belkadi et al., 2017; Belkhiri et al., 2017). In our study, the season could be implicated in the monthly fluctuation of testosterone. Despite the differences observed between the testosterone levels of the 3 diets, no significant effect (p >0.05) was observed in the statistical analysis on this parameter regarding the addition or not of olive pomace in the diet of rams. However, the only probable explanation for the decrease in testosterone levels in the 40DOP group compared to the other two diets, 0DOP and 20DOP, is that the rams in this group had a higher weight. This observation is in line with those reported on Dorper rams by Schoeman and Combrink (1987) and Fourie et al. (2005), who established a negative but weak correlation between body weight and testosterone levels. In the same

context, El Hamid et al. (2016) showed that diets rich in saturated or monounsaturated fatty acids do not influence testosterone synthesis or Leydig cell function. This is consistent with previous observations by Adibromadi et al. (2012), Selvaraju et al. (2012), and Jofaroghli et al. (2014), who found that the addition of polyunsaturated fatty acid sources to the diet does not affect blood testosterone levels.

Despite the differences observed between the triglyceride levels of rams supplemented with olive pomace in this study, no significant effect (p>0.05) was observed on this parameter regarding the addition or not of olive pomace in the diet. Molina-Alcaide and Yanez-Ruiz (2008) report that the ether extract of olive pomace is highly digestible (0.60 to 0.90), resulting in an increased rate of TG synthesis in the intestinal mucosa. Our results are in agreement with those obtained by El Tarabany et al. (2018) who reported that ewes supplemented with 30% olive cake had higher triglyceride levels than those receiving control and 15% olive cake diets. Similarly, Jofaroghli et al. (2014) found that triglyceride levels were significantly higher in rams supplemented with fish oil than in controls. Selvaraju et al. (2012) found that triglyceride levels were higher in rams receiving corn grains than in those receiving sunflower oil rich in PUFA (linoleic acid C18:2; n-6), but without statistical significance. The same observation was reported by Bionda et al. (2022) on bulls receiving low (10% olive cake) and high olive cake supplementation in diet (15%) compared to bull control.

Cholesterol is synthesized in response to liver energy metabolism, using glucose and amino acids as key precursors. Nutritional status and dietary fatty acid composition appear to be determining factors of blood cholesterol levels (Mugabe et al., 2017). Previous studies have reported different ways in which fatty acids can regulate cholesterol concentration. Cholesterol synthesis is known to be increased with a high intake of saturated fatty acids and decreased with polyunsaturated fats (Widiyanto et al., 2010; Abdel-Fattah et al., 2013; Bionda et al., 2022). In this study, the elevation of cholesterol and LDLc levels in rams consuming the 0DOP and 20DOP diets during the period from November to January is consistent with the results of Belkadi (2017) who found that serum cholesterol levels were significantly (p <0.05) higher during the winter season. This elevation could be due to an exacerbation of basal metabolism to maintain body temperature within constant limits.

According to Chiafolo et al. (2004), the Dietary Guidelines emphasize the health benefits of oleic acid on cholesterol and other health-related outcomes in humans, although the cholesterol-

lowering effect of the polyunsaturated class is greater than that of the monounsaturated class. González-Rámila et al. (2023) found that consumption of olive pomace oil in humans over some time resulted in an improvement in blood lipid profile by lowering LDL-C, apo B, and LDL/HDL in both healthy and at-risk volunteers. The reduction in total cholesterol and LDLc levels in the diet containing 40% DOP compared to the other diets (0% DOP and 20% DOP) may be due to the presence of phenolic compounds such as oleanolic acid and maslinic acid (which belong to the triterpenoid group) contained in olive pomace oil. In the same context, Shaaban et al. (2021) concluded that the reduction in blood cholesterol levels in Barki sheep-fed olive cake silage treated with a fibrinolytic enzyme reflected the balance between monounsaturated and polyunsaturated fats in olive cake and that this maintained the balance between HDLc and LDLc. Ianni et al. (2021) found that olive leaf feeding was effective in lowering blood cholesterol levels in Saanen goats. However, Amiri et al. (2013) reported contradictory results. They found that feeding silage with 70% olive crisps did not affect the cholesterol levels of Iranian rams. Similarly, Hadhoud et al. (2021) found no effect on Barki dairy ewes. In our study, a positive correlation between plasma testosterone concentration and HDLc was demonstrated by Dai et al. (1984), suggesting that the increase in HDLc level observed in January may be related to the increase in testosterone level observed for the 20GO and 40GO diets from January to March. Filipponi et al. (2007) reported that a low LDL: HDL ratio indicates a beneficial effect of diet on maintaining adequate cholesterol levels in animals. Mensink and Katan (1989) concluded that olive pomace plays a pivotal role in providing a source of monounsaturated and polyunsaturated fats that may have a positive effect on cholesterol levels by helping to maintain the balance between HDLc and LDLc cholesterol. Our result shows that the lowest ratio is achieved with the 40DOP diet, which can be considered healthier compared to other diets.

CONCLUSIONS

In conclusion, referring to the results obtained in this study, it's interesting to see that the inclusion of 40% partly destoned olive pomace (DOP) into a concentrate-based diet of Ouled Djellal rams can improve their reproductive performances after 2 months of feeding and their lipid metabolic profile, inducing a reduction of blood cholesterol and LDLc. It's also good to know that olive by-products can safely be included as a substitution for conventional concentrate without negative effects on ruminants. This finding could be useful in reducing feeding costs and improving the reproductive performances of farm animals.

Animal Welfare Statement
The protocols and procedures applied in this study were in accordance with ethics decreed by the Institutional Animal Care Committee of the National Administration of the Algerian Higher Education and Scientific Research (Ethical approval number: 98-11, Law of August 22, 1998) under the supervision of the National Council for Bioethics and Good Practical Animal Usage in Scientific Experimentations.

Ethics Committee Approval:
This study was approved by Ethics committee of Institutional Animal Care Committee of the National Administration of the Algerian Higher Education and Scientific Research, (Date: August 22, 1998, Approval No: 98-11).

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IN-VITRO SCREENING OF LACTIC ACID BACTERIA FOR THEIR ABILITY TO INHIBIT SALMONELLA SPECIES IN BROILER CHICKENS

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Abstract

Salmonella is the second most prominent foodborne zoonotic pathogen reported in the European Union. As poultry is one of the major sources of Salmonella, it is imperative to mitigate its prevalence in poultry. Many strains of lactic acid bacteria (LAB) have demonstrated anti-Salmonella characteristics attributed to different metabolites at varying degrees and spectrums. However, the production of these compounds and consequent antimicrobial properties are highly strain dependent. Therefore, the current study was performed to select the most promising LAB and identify its possible mode of action in inhibiting different strains of Salmonella strains, in-vitro. Lactiplantibacillus plantarum (LP), Lacticaseibacillus casei (LC), Limosilactobacillus reuteri (LR), Lacticaseibacillus rhamnosus (LRh), Leuconostoc mesenteroides (LM) and Pediococcus pentosaceus (PP) were used in spot overlays, well diffusion, co-culture and co-aggregation assays against three Salmonella strains (Salmonella typhimurium, Salmonella enterica and Salmonella braenderup). Organic acid characterization of culture supernatants was performed using HPLC. Based on the results of spot overlay assays, LRh, LM and PP displayed the most significant anti-Salmonella effects and were subsequently selected for well diffusion assays in which all three LAB displayed equally significant inhibition of Salmonella typhimurium. Interestingly, the inhibition was not evident when the pH of the probiotic culture supernatants was neutralized. The co-culture experiments indicated a complete eradication of Salmonella typhimurium by 24 hours of incubation with the three selected LAB strains. A considerable change in the pH in the co-culture was observed indicating organic acid production had a possible role in the bactericidal activities observed. Lactic and formic acid profiles of the bacterial culture supernatants were positively correlated with the inhibition observed in the antimicrobial assays indicating that these are the most likely candidates for the anti-Salmonella effects observed. Overall, Leuconostoc mesenteroides displayed the most significant anti-Salmonella effects when compared to the other strains of LAB studied, indicating its potential for use in future in-vivo studies. This research was funded by the European Union's Horizon 2020 research and innovation programme under the Marie-Sklodowska-Curie grant agreement No 955374.

Keywords: _Antimicrobial, Co-culture, Organic acids, Well diffusion assay, Spot overlay assay_

HUMAN AND ANIMAL INTERACTION: THE BENEFITS AND CHALLENGES OF OWNING PETS

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Abstract

The American Veterinary Medical Association states that the human-animal bond is a dynamic and mutually beneficial relationship influenced by decisions that prioritize the well-being of both humans and animals. In the Philippines, pet ownership is widespread, with dogs being the most popular pets, followed by cats, fish, and birds. Research suggests that owning a pet can have positive effects on emotional and physical well-being, increasing life satisfaction and happiness while reducing feelings of loneliness, anxiety, and depression. However, some parents express concerns about pet aggression and the responsibilities involved in pet care. This study aims to examine the overall experiences of pet ownership by identifying both the benefits and challenges associated with owning pets. Data was collected through semi-structured interviews conducted with at least five(5) pet owners from each of the municipalities: Bangar; Balaoan; and San Juan La Union. The results indicate common challenges faced by pet owners, including the high maintenance required, financial burdens, and emotional distress. Similarly, the benefits of pet ownership were found to include companionship, personal growth, well-being, unconditional love, a sense of security, and improved lifestyles. These findings are consistent with theories such as the social exchange theory and attachment theory, providing further support for the observed experiences of pet owners.

Keywords: *Pet ownership, Benefits, Challenges, Social exchange theory, Attachment theory*

EFFECT OF IN OVO STIMULATION WITH XOS AND MOS PREBIOTICS ON GUT MICROBIOTA AND GENE EXPRESSION IN INTESTINAL MUCOSA

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Abstract

The intestinal mucosa acts as the first line of defense protecting the epithelial surface from pathogens and damage. The intestinal mucosa stimulates colonization by commensal bacteria, providing an optimal environment for digestion and simplifying nutrient transport. It is densely colonized by microorganisms capable of metabolic activity. It serves as a link between the gut microbiota and the host organism. The aim of this study was to modify the host gut microbiota by in ovo stimulation on day 12 of egg incubation with xyl-oligosaccharide (XOS) and manno-oligosaccharide (MOS) prebiotics, and to determine the changes occurring in gut fragments (caecum and ileum) in broiler chickens after stimulation. 300 incubated eggs of Ross 308 broiler chickens on the 12th day of incubation were injected with saline in the control group and prebiotics: XOS3, XOS4, MOS3 and MOS4, respectively. The mucosa of the cecum and ileum, as well as the intestinal contents, were collected postmortem on day 42 after hatching to isolate RNA and bacterial DNA. Gene expression analysis was performed by RT-qPCR for a panel of genes: innate immune response genes (IL-2, IL-4, IL-6, IL-8, IL-10, IL-12, IL17, IL1-ß , IFNγ , IFNß), nutrient sensing genes (FFAR2, FFAR4, GLUT1, GLUT2, GLUT5), host defense peptides (AvBD1, CATHL2) and barrier function genes (MUC6, CLDN1, TJAP). The relative abundance of bacteria was determined by qPCR for few bacteria (Akkermansia muciniphilla, Bifidobacterium spp., Clostridium difficile, Escherichia coli, Faecalibacterium prausnitzii, and Lactobacillus spp.). In ovo probiotic stimulation caused significant changes in the expression of genes such as IL-2, IL-12, IL-17, AvBD1, CATHL2 and FFAR4 with GLUT1 in the XOS4 and MOS3 groups in the cecum. Stimulation with probiotics caused changes in the abundance of bacteria (Lactobacillus spp. and Bifidobacterium spp.) in the intestines, while Clostriudium was not found in both sections. The immunomodulatory effect of the given prebiotics within the intestinal mucosa, as well as changes in the bacterial profile of the intestines, was demonstrated.The results described here obtained will be continued in further extended studies. The study was financed by grant UMO-2021/41/B/NZ9/02562 funded by the National Science Centre (Poland).

Keywords: _In Ovo Stimulation, Microbiota Modification, Manno-Oligosaccharides, Xylo-Oligosaccharides_

NUMBER AND LOCATION OF NODES IN MODELING OF LACTATION CURVE EFFECT ON AUTOCORRELATION

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Abstract

As it is known, piecewise regression models have been widely used in mathematical modeling of lactation curves recently. In piecewise regression models, point distributions are segmented from parts determined by the researcher, called nodes. Then, modeling is done for each part separately. One of the limiting factors here is the relationship between the error terms. In other words, it is autocorrelation. In this study, 305-day control milk days were taken into account. Different number of nodal points were determined and autocorrelation values were examined. For this purpose, Durbin-Watson values were examined comparatively.

Keywords: *Piecewise Regression, Durbin-Watson Values, Nodal Points.*

INTRODUCTION

In dairy cattle breeding studies, the shape and parameters of lactation curves are widely used information sources to increase the degree of accuracy in selection and selection and to develop forward planning. For this reason, it is of great importance to create lactation curves, known as the graph of daily milk production against time, with appropriate and accurate models. The shape of the lactation curve appears to increase after calving until it peaks, then gradually decrease until weaning. Silvestre et al. (2006) showed that the accuracy of estimations made with functions containing time-dependent variables is sensitive to inspection day intervals and is negatively affected by the period between calving and the first control day(Orhan and Kaygısız, 2002). For this reason, the use of models that are less affected by control day intervals has come to the fore. The fact that cubic piecewise regressions have a high fit perfection and more flexible curves have led to their widespread use in modeling lactation curves. This will only be possible by determining the node in the appropriate number and position. n this study, the effect of different locations and number of nodes on the Durbin-Watson test, which is one of the criteria determining the effectiveness of the model, was investigated. In other words, it was tried to determine the effect of the nodal points in obtaining the prediction equations with high reliability.

MATERIALS AND METHODS

In this study, 305-day lactation milk yields of Holstein dairy cattle were used. Initially, days 60, 90, 120, 150, 180, 210, 240, and 270 were considered nodes. In the second step, two nodes are defined. The two nodes are 240-270, 180-240, 150-180, 90-120, 60-90 and 90-240.

Cubic Piecewise Regression

While different regions of point distributions show the same or different functional distributions, the situation where the functions created before and after any determined node give the same "yi" value at this node is called "continuous piecewise regression" (Poirier, 1973). Cubic Piecewise Regression is a type of regression in which all parts that make up a piecewise regression model are in cubic form (Smith, 1979). The cubic piece function was first introduced by Holladay in 1957 (Moreton, 1992). Cubic piecewise regression without any endpoint requirement, the required number of parameters is "k + 3" excluding β_0. In this case, the two-node cubic piece regression function can be written as follows (Sahin and Efe, 2021, Abaci et al. 2020).

$$Y(t) = \beta_0 + \beta_1 t + \beta_2 t^2 + \beta_3 t^3 + \beta_4(t-a)^3 + \beta_5(t-b)^3$$

Here, $\beta_0, ..., \beta_5$: regression parameters, Y(t): t. milk yield at time (kg), t: time (day), a and b: node points.

Durbin-Watson Test

Autocorrelation, which is expressed as a relationship or sequential dependency between error terms, can be determined by methods such as rank test, Durbin-Watson test, Von-Neumann ratio test. In this study, Durbin-Watson test was considered (Gok et al. 2021, Tahtalı et al. 2020).

Durbin-Watson test is a common method used to test whether the error terms of the obtained model are correlated. The fact that the value obtained with this test is around 2 is a strong indication that there is no autocorrelation. The DW value is always between 0 and 4. The weakness of the test is that the D distribution, from which the test statistic is calculated, contains unstable regions. The Durbin-Watson test is obtained with the following equation.

$$DW = (\sum_{i=2}^{n} (e_1 - e_2)^2)/\sum_{i=1}^{n} e_1^2$$

Here n: sample size, e_i: error term. A Durbin-Watson value below 1 indicates positive autocorrelation, and close to 3 indicates negative autocorrelation. In the case of autocorrelation, the least squares estimators of the parameters are unbiased and consistent and are not efficient (Yavuz et al. 2019). The estimator of the variance of the error term is biased, and therefore the variances of the parameters are also biased. If there is a positive autocorrelation, the deviation will be negative. That is, the variances are small. As a result, the t test statistic value is large. Thus, the probability of a nonsignificant coefficient being significant increases. R^2 also rises. Therefore, the F value is found to be greater than it is. As a result, t and F tests lose their reliability and give misleading results.

Prameter estimates and lactation curves were made in the SAS package program. (SAS, 1999).

RESULTS AND DISCUSSION

Error and Durbin Watson values of 8 single node piecewise regressions (days 60, 90, 120, 150, 180, 210, 240 and 270) are given in Table 1 and Table 2. The results of the randomly selected 6 double-node piecewise regressions are given in Table 3 ((240-270), (180-240), (50-180), (90-120), (60-90) and (90-240) node pairs).

Table 1. Error terms and Durbin Watson values for 60, 90, 120, and 150 node days.

		Selected Node Points (ei)			
t	y	Cubic	Cubic2	Cubic3	Cubic4
30	15	-0.00	-0.06	-0.12	-0.10
60	15	0.47	0.52	0.49	0.36
90	14	-0.87	-0.73	-0.47	-0.39
120	14	-0.10	-0.14	-0.13	0.04
150	13	0.42	0.33	0.16	0.09
180	11	0.36	0.30	0.15	-0.00
210	9	0.36	0.36	0.35	0.28

		Selected Node Points (ei)			
t	y	Cubic	Cubic2	Cubic3	Cubic4
240	6	-0.92	-0.86	-0.74	-0.67
270	6	0.14	0.21	0.35	0.49
305	6	0.13	0.07	-0.03	-0.11
DW		2,45	2,64	3,02	3,38

*Cubic:60th day, Cubic2:90 th day, Cubic3:120 th day, Cubic4:150 th day, DW: Durbin-Watson, t: time, y:observation value, ei: residual value.

Table 2. Error terms and Durbin Watson values for 180, 210, 240, and 270 node days.

		Selected Node Points (ei)			
t	y	Cubic5	Cubic6	Cubic7	Cubic8
30	15	-0.02	-0.04	0.19	0.25
60	15	0.21	0.23	-0.05	-0.11
90	14	-0.43	-0.40	-0.68	-0.74
120	14	0.18	0.19	0.21	0.20
150	13	0.23	0.19	0.53	0.58
180	11	-0.10	-0.23	0.17	0.26
210	9	0.14	0.07	0.03	0.08
240	6	-0.66	0.00	-1.00	-1.10
270	6	0.61	0.00	0.64	0.56
305	6	-0.15	0.00	-0.06	0.00
DW		3,27	3,16	2,52	2.36

* Cubic5:180 th day, Cubic6:210 th day, Cubic7:240 th day, Cubic8:270 th day, DW: Durbin-Watson, t: time, y:observation value, ei: residual value.

Estimated lactation curves of single node piecewise regression models are given in Figure 1.
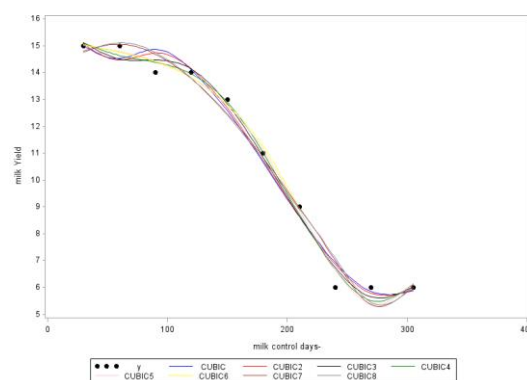
Figure 1 . Single-node piecewise regressions.

Table 3. Error terms and Durbin Watson values for (240-270), (180-240), (50-180), (90-120), (60-90) and (90-240) node pairs.

		Selected Node Points (ei)					
t	y	Cubic	Cubic2	Cubic3	Cubic4	Cubic5	Cubic6
30	15	0.00	-0.00	-0.10	-0.11	-0.03	-0.05
60	15	-0.00	0.00	0.36	0.36	0.21	0.42
90	14	0.05	-0.03	-0.39	-0.35	-0.42	-0.66
120	14	-0.14	0.02	0.04	0.08	0.20	-0.03
150	13	0.03	0.00	0.09	0.02	0.22	0.34
180	11	0.05	-0.03	-0.00	-0.19	-0.22	0.19
210	9	0.33	0.29	0.28	0.45	0.00	0.21
240	6	-0.68	-0.65	-0.67	-0.38	0.03	-0.87
270	6	0.43	0.50	0.49	0.13	-0.00	0.48
305	6	-0.08	-0.12	-0.11	-0.01	-0.00	-0.04
	DW	3,00	3,49	3,39	3,49	3,37	2,89

*Cubic:240-270th days, Cubic2:180-240 th days, Cubic3:150-180 th days, Cubic4:90-120 th days, Cubic5:60-90 th days, Cubic6: 90-240 th days, DW: Durbin-Watson, t: time, y:observation value, ei: residual value.

Estimated lactation curves of double node piecewise regression models are given in Figure 2.
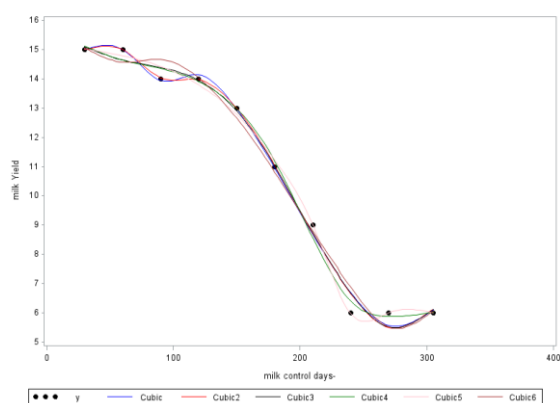
Figure 2 . Double-node piecewise regressions.

As seen in Table 2, when the 2nd and 3rd Milk Control days are taken as the nodal point, it is seen that the Durbin Watson value is close to 2 and there is no autocorrelation. When the 4th and 5th milk control milk days are taken as the nodal point, it is understood from the Durbin Watson values that there is a relationship between the error terms in the model obtained. When Table 2 is examined, it is seen that the Durbin Watson values obtained when the 6th and 7th milk control days are taken as the nodal point, are problematic just like the 4th and 5th milk control days. In Table 2, there is no problem at the last 2 nodes. When Table 3 is examined, it is seen that the Durbin Watson values of the first 5 node pairs are quite high. The last pair of nodes gave relatively better results than the others. When the last pair of nodes (Cubic6: 90-240 th days) are examined, it is seen that one of the nodes is at the beginning of the milk control days and the other at the end. In other words, the results of single and double nodal points support each other. The lactation curve distributions in figure 1 and figure 2 also support these results.

CONCLUSIONS

In order to use the piecewise regression models used in the modeling of lactation curves effectively and accurately, if a single node point is used, it should be selected from the regions close to the beginning or end of lactation. If double knots are to be used, it was concluded that one of them should be chosen at the beginning of the lactation and the other at the end of the lactation.

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PASTINNOVA PROJECT, SUSTAINABLE PASTORAL MOBILITY LIVING LAB: CASE STUDY TURKEY

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Abstract

PASTINNOVA is one of the approved projects by the PRIMA foundation of the European Union HORIZON 2020 program. The general target of PASTINNOVA is to increase the resilience of small-scale farms producing in rural areas under the pressure of changing climatic conditions, to improve production and marketing opportunities with innovative approaches, and to create sustainable business and organizational models for the economic empowerment of rural women. Living Labs (LL) is an open, user-oriented system whose overall scope is principle-based, based on the discovery and discovery of tangible objects in living communities. Within the scope of the project, we are also starting our efforts to establish the first Regional Living Lab, which is highly preferred in the international disciplines, which will adapt to Mediterranean animal husbandry. Living Laboratories are application-oriented networks where all relevant stakeholders are involved, where problems are identified, new solutions are developed, and which facilitate and encourage the implementation of open, collaborative, innovative practices in pastoral livestock production. In this study the contributions of stakeholders, Identification of problems and first meeting outputs of the 1st RLL meeting in Adana-Turkey will be presented.

Keywords: PASTINNOVA Project, Living Lab, Pastoral Mobility, Rural Life, Turkey

SMART VILLAGE MODEL IN SUSTAINABLE RURAL DEVELOPMENT: ADANA CASE

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Abstract

Rural areas are places that are administratively far from the center, within the scope of villages, and where most agricultural production is carried out. Rural development (agricultural development) is to mobilize the initiatives and efforts of rural communities in the direction of development with the cooperation and assistance of the public sector. Sustainability is one of the most important issues to be considered in rural development where agricultural activities are at the forefront. Therefore, in the concept of sustainable rural development, social, economic, and environmental issues should be considered together. The loss of attractiveness of rural areas and the increase in migration towards city centers have also caused regressions in agricultural activities, which are the basis of rural areas. Grants and support given to economically based youth and women for the agricultural sector and the COVID-19 pandemic process encourage the start of the rural return movement. However, the quality of the support and the problematic points in the implementation were insufficient to achieve stable dynamics of rural-urban migration. In this context, it is important to realize rural attraction center projects based on the idea that people living in both rural and urban centers have equal social, cultural, and environmental opportunities, with holistic projects that will cover all segments of society with the understanding of Sustainable Community. The smart village model is a project in which crop and animal production models are included, and the factors that cause poverty and deprivation in rural areas are eliminated. This model requires the consideration and differentiation of rural policies on a multi-sectoral basis. In addition to economic, social, and environmental projects, a model in which women´s organizations take an active role is implemented in smart attraction villages. Thus, all projects that both live in rural areas and encourage returning to rural areas can be implemented together. In this presentation, animal and plant production-based development models and production and marketing proposals based on women´s cooperatives will be put forward within the smart attraction villages model

Keywords: *Rural development, Agriculture, Sustainability, Smart Farms, Women Cooperatives*

EVALUATION OF DIFFERENT DOSES OF COMBINATION OF METHYLTIOPHANATE + TRICYCLAZOLE ON HISTOPATHOLOGIC EFFECTS OF PANCREAS IN FEMALE WISTAR RAT

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Abstract

Background: One of the common agricultural pesticides to deal with blast fungal disease is the combination of Methyltiophanate and Tricyclazole. Studies indicate that the remains of this combination in water and soil cause the contamination of agricultural products from these lands. This mixed pesticide has digestive absorption and can cause histopathological lesions in tissues such as the pancreas. Methods: Twenty-four female rats were divided into Four groups, group1, control group; group 2, rats that received the combination of Tricyclazole (12.5 mg/kg b.w./day, PO) and Methyltiophanate (332 mg/kg b.w./day, PO); group3, were treated with the combination of Tricyclazole (18.75 mg/kg b.w./day, PO) and Methyltiophanate (498 mg/kg b.w./day, PO); group4, were treated with the combination of Tricyclazole (25 mg/kg b.w./day, PO) and Methyltiophanate (664 mg/kg b.w./day, PO). At the end of the study, the tissue of pancreas obtained and pancreatic changes were examined. Results: The examination of histopathologic lesions showed a mild hyperemia and necrosis in the group 2 and again mild necrosis in the group 3. However hyperemia and necrosis became more significant by elevating the dose of The combination. Conclusion: It is obvious that elevating levels of the Combination of the pesticides can causes destructive effects on rats and nutrition health and it should be considered as subsequences of this pesticide intakes so its recommended some Propose to review and implement serious measures for the consumption of such pesticides.

Keywords: *Tricyclazole, Methyltiophanate, Pancreas, Histopathology*

THE IMPACT OF CONTINUAL APPLE VINEGAR SUPPLEMENTATION TO THE DRINKING WATER OF THE QUAILS ON PERFORMANCE, MEAT COLOR AND SERUM CHOLESTEROL

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Abstract

This study was conducted to determine the effects of apple vinegar (AV) supplementation in drinking water of quails in the growth period on performance, meat color, meat pH, and serum cholesterol concentration. For this purpose, a total of a hundred and fifty, 14-day-old quails (Coturnix coturnix japonica) were used and randomly allocated into 2 treatment groups. The control group was fed a basal diet and AV-free drinking water; the treatment group was fed a basal diet, but %3 AV was added to the drinking water. The trial lasted 3 weeks and body weight (BW), weight gain (WG), feed intake (FI), and feed conversion ratio (FCR) were determined, at the end of the experiment 15 quails from each treatment, a total of 30 quails were slaughtered and carcass weight (CW), carcass yield (CY), meat color, meat pH and serum concentrations were detected. Results showed that AV supplementation in drinking water decreased WG and CW, and increased FCR significantly (P≤0.05), but did not affect BW, FI, and CY of the quails. Meat color L*, a* and b* values, meat pH and serum cholesterol concentration were not affected by the presence of AV in the drinking water. In conclusion, the level of 3% AV negatively affected the growth performance parameters and not changed color of meat and not affected the serum cholesterol of quails. In a summary, the level of 3% AV supplementation seems not suitable for growth period of quails as a natural feed additive.

Keywords: Body weight, Feed intake, Meat pH, Acetic acid

INTRODUCTION

In the poultry industry to keep production high and for protection against microbiological diseases natural components such as organic acids have been came forward. Vinegar is a source of organic acids, AV is made from fermented apple juice, where bacteria and yeast turn the fruit sugars into ethanol cider and then, in a second fermentation step, turn ethanol into acetic acid (Launholt et al., 2020). The prime organic acid of the AV is acetic acid but succinic, ascorbic, formic, citric, and oxalic acids may be found too. (Soltan & Shehata, 2012). Apple vinegar is also known as rich in bioactive molecules such as polyphenolic compounds known for their several therapeutic effects (Heikefelt, 2011). Vinegar is used as a protective food additive and flavouring agent for thousands of years but in recent years, there is an increased interest in the health-beneficial effects of apple vinegar such as anti-bacterial and antioxidant, blood pressure-reducing activity, and prevention of cardiovascular diseases (Ozturk et al., 2009). Because of the organic acid content and bioactive compounds, the AV has been used in animal experiments have been committed but, generally in-vivo studies have been conducted with rats and aimed to reveal the beneficial effects on human health. On the other hand, data regarding the use of AV as a natural feed additive on poultry health and production have been limited. However, organic acids separately or mixed have been subjected and used in poultry nutrition and studies reported that organic acids may improve growth performance and even take place of antibiotics as an alternative growth promoter (Khan & Iqbal, 2016). Moreover, EFSA has been issued an opinion on the safety and efficacy of acetic acid and reported has the potential to be efficacious as a preservative in feeding stuffs and water for drinking (EFSA, 2021). The current study, due to considerable acetic acid and bioactive compound contents, aimed to reveal the effects of AV supplementation on growth performance, meat features, and the serum cholesterol of quails. Quail are considered to be good laboratory models for a variety of human and animal diseases, and are used in production, behavior, and welfare studies (Dixon & Lambton, 2021). The Japanese quail was chosen for the present study due to its early maturity, rapid life cycle, low production costs, low body weight, and high disease resistance (Nasr et al., 2017) and also Japanese quail is phylogenetically closely related to the broiler chicken (Stock & Bunch, 1982). Therefore, in this study, AV at the level of 3% was consistently added to the drinking water of quails for 3 weeks and the effects on growth performance parameters, meat color, and meat pH and serum cholesterol levels were determined.

MATERIALS AND METHODS

Housing, feed, water, and experimental design

A total of one hundred and fifty, 14-day old quails (*Coturnix coturnix japonica*) were randomly allocated into 2 treatment groups with 5 replicates, each replicate containing 15 quails. The quails were reared in multi-layer quail cages (Cimuka -CB25 /5, Ankara, Turkey) with full heat (automatic temperature control with thermostat) and light (E 27 bulb) control. Each cage had a water tank with a capacity of 20 litters and each compartment had nipples and a feed manger. The experiment lasted 3 weeks, light was provided for 23 hours/day. Feed and water were provided ad-libitum. Quails were fed with the basal diet that was formulated according to NRC (NRC, 1994) for quails in the growth period. The nutrient composition of the basal diet has presented in Table 1. The treatment groups were formulated according to given drinking water and designed as control group (CG) (basal diet - tap water) and apple vinegar (AVG) (Basal diet - 3% apple vinegar mixed water) group. The tap water was provided by city supplying water network and pH value was 7.33. The Apple vinegar purchased from local commercial vinegar producer (Fıcı, Istanbul, Turkiye) and 3% apple vinegar mixed with tab water homogenously. The pH value of 3% apple vinegar mixed water was determined as 3.91. Water tanks was renewed with fresh water daily.

Growth performance parameters

On days 14, 21 and 35 of the experiment, all birds in each compartment and residual feed in mangers weighed and recorded. Body weight gain was calculated from the weekly changes in body weight of the birds, and feed intake (FI) was determined from the amounts of feed given and remaining. The feed conversion ratio (FCR) was calculated using the formula feed intake/body weight gain (FI /BWG). On the 35th day of the experiment, 3 bird from each replicate, 15 birds from each treatment and a total of 30 birds were randomly selected and slaughtered using the cervical dislocation method (Leary et al., 2013). The slaughtered birds were de-feathered, eviscerated and the carcasses were weighed and recorded. Carcass yield (CY) was calculated from the ratio between live weight and carcass weight.

Meat pH and color values

After slaughter, the carcasses were stored at 4 °C for 24 hours and the breast meat was separated for detection of pH, color. The pH values of the samples were measured via a pH-meter (Cola-Parmer-WTW2A20-1012, Cambridgeshire, UK) as reported by Lambooij et al. (1999). L*, a* and b* color values of the chicken samples were determined via a colorimeter (Minolta CR 300, Osaka, Japan) with illuminate D65, 2° observer, Diffuse/O mode, 8 mm aperture of the instrument for illumination and 8 mm for measurement.

Serum cholesterol

From each slaughtered quail, 5 mL of blood was taken from the jugular vein in tubes. Serum was collected by centrifuging the blood at 3500 rpm for 5 min in standard ambient temperature as 25 °C. Serum color concentration were determined by the photometric method using the Abbot c8000 chemistry analyzer (Diamond Diagnostics Inc., Holliston, US).

Statistical analysis

Statistical analysis was performed using Minitab (Minitab 2000). The trial design was a completely randomized model and differences were determined using by T-test (P< 0.05).

RESULTS

The results of the apple vinegar-supplemented drinking water on growth performance parameters in quails are presented in Table 2. Body weight on 14, 21, and 35 days of the experiment was not statistically significant, however, numerically final body weight on day 35 in the control group was higher than apple vinegar-supplemented group. Weight gain of quails was affected by vinegar-supplemented drinking water and, AV in water significantly decreased the WG (P<0.05). Similar with BW results, AV presence in the water was not changed feed intake significantly but numerically in the control group FI was higher than AVG and therefore FCR was affected and increased significantly in the AVG group (P<0.05). The carcass weight difference was significant between the two treatment groups and parallelly with body weight apple vinegar water decreased the CW (P<0.05), but carcass yield was similar between treatment groups.

The results of apple vinegar supplementation to drinking water on meat color and pH values and serum cholesterol concentrations of quails are presented in Table 3. Meat color L*, a*, b*, and pH values of meat were not affected by apple vinegar supplementation. Differences in serum cholesterol concentrations were not significant between treatments but, numerically was higher in the control group than the apple vinegar-supplemented group.

DISCUSSION

Limited studies on the effects of AV in poultry diets on performance reported various results, Chabalala (2022) reported that 5 or 10 ml/L apple vinegar supplementation was ineffective on

growth performance and did not benefit broiler performance. Similarly, Efe (2020) stated that 0,5% apple vinegar addition to quails' drinking water had no effect on body weight, feed intake, and FCR. Another study stated that apple vinegar in the drinking water of broiler chickens affect the weight gain in favor and decreased the FCR but not affected the feed intake significantly (Mohanad & Saleem, 2018). Jahantigh et al. (2021) reported that apple vinegar in the diet of broiler chickens' diet at the levels of 1, 2 and 3% levels caused higher body weight gain, but FCR did not changed. A study compared the effects of probiotic and vinegar supplementation treatments on the growth of broiler chickens and reported that the average daily feed intake and feed conversion ratio during 1–10 days of age significantly decreased in the group that drank supplemented water with vinegar. However, they stated that experimental treatments did not have a significant effect on performance during other growth periods and carcass yields (Allahdo et al., 2018). Hayajneh (2019) reported that vinegar supplementation to broiler diet reduced weight gain and feed intake at first 14 days but did not affect between 14-35 days. Acetic acid is the primary acid in apple vinegar, and it has been reported that organic acids have a significant role in better utilization of the available nutrient resulting in improved growth rate and feed conversion efficiency (Denli et al., 2003). Moreover, It has been known that organic acids eliminate acid-intolerant pathogenic bacteria in the gut and therefore have enhanced poultry growth (Samanta et al., 2010). On the other hand, clinical research asserted that apple vinegar has anti-glycaemia properties (Hlebowicz et al., 2007), may inhibit disaccharidase activity (Ogawa et al., 2000), and may improve insulin sensitivity (Sakakibara et al., 2006). Thus, body weight changes in poultry species may be explained by the effects of vinegar on metabolism and these effects may depend on the dosage, physiological condition, or administration time of apple vinegar. In this study, AV presence did not affect the meat pH, color, and serum cholesterol level, similarly. Chabalala (2022) reported that AV addition in broiler diets did not affect meat pH significantly. Compatible with the current study, Hayajneh (2019) stated that apple cider vinegar supplementation in broiler chickens had no effects on either meat color or serum cholesterol concentration. On the other hand, some studies reported that vinegar supplementation lowered serum cholesterol levels in broiler chickens (Berrama et al., 2018). Mohanad et al. (2019) reported a similar result and stated that apple vinegar supplementation decreased blood cholesterol in broiler chickens. Apple vinegar contains polyphenols which are bioactive compounds (Budak et al., 2014). Some in- vivo studies stated that apple polyphenols decreased serum low-density lipoprotein (LDL) levels in healthy humans and increase serum high-density lipoprotein (HDL) in rats (Launholt et al., 2020). Although some previous studies reported that apple vinegar supplementation may affect serum cholesterol levels it is clear that this effect may depend on administration level and duration moreover the studies on the effects of apple vinegar addition in poultry diets on meat features are very limited.

CONCLUSIONS

In conclusion, the current study revealed that 3% apple vinegar supplementation to drink the water of quails during the growth period negatively affected weight gain and FCR and not affected meat pH and color and also serum cholesterol. In a nutshell, apple vinegar addition for three weeks at a level of %3 has not beneficial for the fattening performance of quails and displayed that required more research on apple vinegar supplementation in poultry nutrition.

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COMPARISON OF GROWTH CURVE MODELS IN PEKIN DUCKS

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Abstract

In this study the aim was to compare the Bertalanffy, Brody, Gompertz, Logistic and Negative Exponential models onbody weight of Pekin duck. Data were collected from 120 male and 115 female geese for eight time points weakly. Predictedvalues from the Negative Exponential model was found to be the worst according to larger distances betweenestimates and observed, which was a result of over-estimation. The curves obtained from the Bertalanffy and Gompertz models were found to give the best fit. According to the results, the Gompertz model can be suggested forexamining goose growth because RMSE values of the Gompertz model were lower than for the Bertalanffy model andhad a high coefficient of determination.

Keywords: Pekin duck, Growth curve, Growth, Estimation, Model

INTRODUCTION

Animal production has a high importance in Turkey's economic structure and it is important for a balanced human nutrition (Ocak and Onder, 2014; Atasevet et al., 2015). To meet the requirement of protein of animal origin from an increasing population, the production of poultry other than chicken, such as turkeys, ducks and geese, is increasing (Sarıca et al., 2014). As of 2017, duck existence in Turkey is 492 thousand and duck breeding is mostly done in the West Marmara Region with a share of 31%. The Middle East Anatolian Region (11%) and the Western Black Sea Region (10%) are the other regions with the highest number of ducks. The province with the highest duck breeding in Turkey; Balıkesir with 24%. In terms of the number of ducks; Muş (8%) and Samsun (6%) are the most important provinces after Balıkesir (Eriş ve Elmacı, 2022). Duck production generally depends on the free range backyard type for home consumption. However, a small number of semi-intensive and intensive producers of Pekin duck is present (Demir et al., 2010).

Growth traits are important characteristics for both economic profitability and population dynamics (Sedinger et al., 2001). Growth is an increase in size (height, length, weight) with age and growth curve models provide a visual assessment for growth as a function of time. The models can be used for predicting body weight for a specific age from a dimensional perspective (Ngeno et al., 2010).

In this study we aimed to compare Brody and Gompertz, models on body weight of Pekin ducks raised in Türkiye.

MATERIALS AND METHODS

The study was conducted at the Ondokuz Mayıs University Agricultural Faculty's Experimental Farm between August 01 and 29, 2023. Pekin ducks (n = 249: 115 male and 134 female) were used as animal material in the study. All ducklings were transferred to a production house.

Live weights were evaluated at 1-week intervals from hatch to age of a month (experiment is continuing). All weights were measured using a scale with a sensitivity of up to 0.5 g.

For each sex group, the Brody and Gompertz, models were fitted to the data of the average growth curve and for the individual growth curves. Parameters were estimated using NLREG. The convergence criterion was used as 1.0E-10. SPSS software was used to analyze the data. To compare the fit, data determination coefficients (adjusted R^2) was used as goodness of fit criteria. Functions of the models were given in Table 1 (Atil et al., 2007; Mohammed, 2015; Onder et al., 2017). Interesting functions and their properties are given in Table 1. Inflection points of Brody and Negative Exponential functions were not given because they do not exist (Koya and Goshu, 2013).

Table 1. Function and Inflection points for Brody and Gompertz models

Models	Function
Brody	$y=a*(1-b* e^{(-k*t)})$
Gompertz	$y= a*e^{(-b*e^{(-k*t)})}$

Here;
a: Asymptotic or predicted final mature weight
b: Scaling parameter (constant of integration)
k: Instantaneous growth rate (per time unit) parameter
t: Age at the inflection point
e: 2.718281
IPA: Inflection Point Age
IPW: Inflection Point Weight
MI: Maximum Increment

RESULTS and DISCUSSION
Estimates of parameters and goodness-of-fit criteria are given in Table 2 for Brody and Gompertz models. For Brody model IPA, IPW and MI were not estimated because a greater than zero second derivation of the functions could not be satisfied for any value of time (Koya and Goshu, 2013).

Table 1. Parameter estimates and goodness of fit criteria of the models

	a	b	k	adj R^2
Brody				
Male	165900	2.781	0.0413	0.982
Female	236000	1.889	0.0179	0.981
Gompertz				
Male	10511.82	7.265	0.270	0.963
Female	7510.00	7.174	0.333	0.964

The greatest scaling parameter (b) was observed from the Gompertz model for both sex. The greatest growth rate per time unit (k) was observed from the Gompertz model and growth rate of females was found higher than males in Gompertz model. Growth rate of male animals was greater than females in Brody model. The highest adjusted coefficient of determination was observed from Brody model. Predicted average and observed growth curves are given in Figure 1. When the curve from the Brody model was examined, the estimated values were closer to the observed ones after the age of 3.5 weeks. Before that time estimations were higher or lower than the observed ones for both females and males.

When the curve from the Gompertz model was examined, the estimated values were closer to the observed ones after the age of 3.5 weeks for male animals. For female animals the estimated values were not closer to the observed ones for Gompertz model. The adjusted coefficient of determination values also support the graphs.

Body weight and growth rates are economically important features for duck production. According to the present results, The Brody model can be suggested for examining duck growth for early stages of the life because the sigmoid shape of growth gives the best fit.
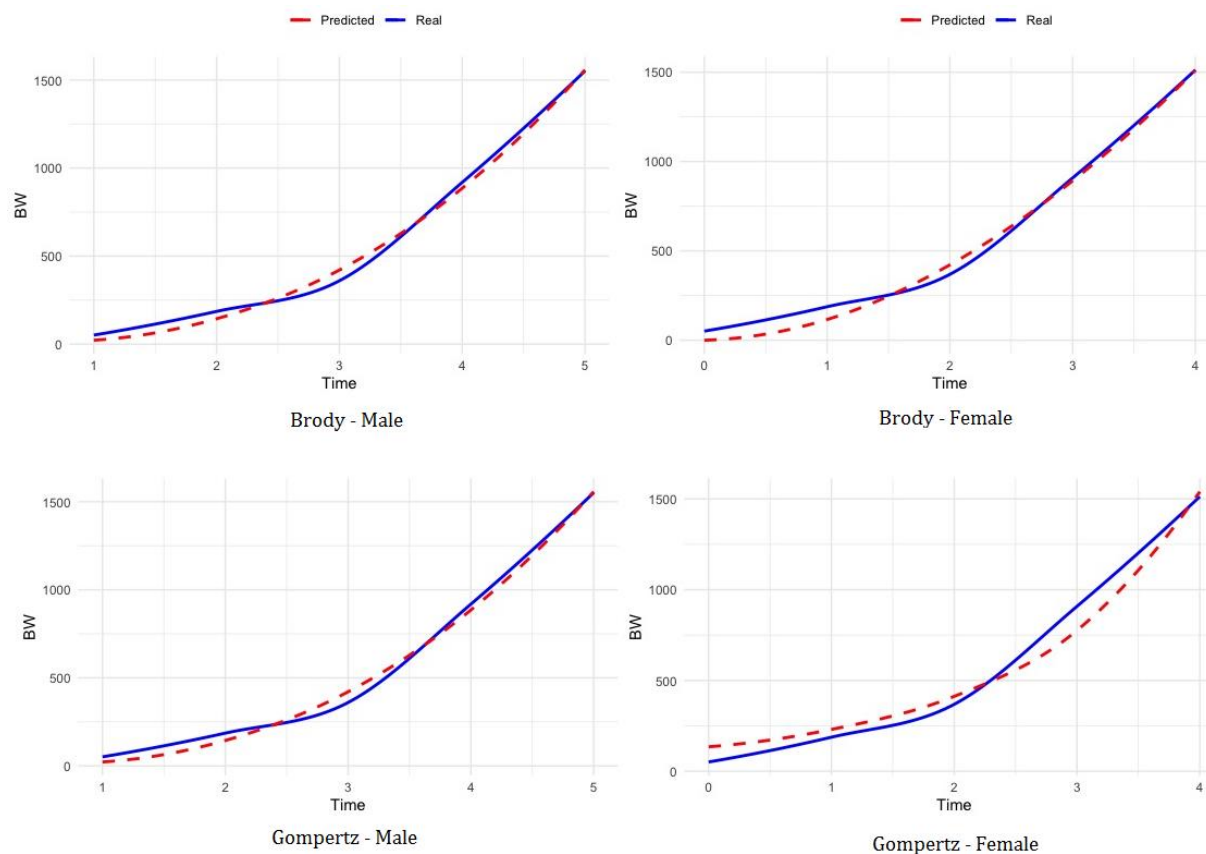
Figure 1. Predicted average and observed growth curves for Brody and Gompertz models.

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PREDICTION OF 6TH MONTH OF BODY WEIGHT FOR SAANEN GOAT WITH MARS ALGORITHM

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Abstract

The aim of the present study was to predict 6th month of body weight for Saanen goat breed. For this aim, 82 Saanen goats were used which the data were taken from a private farm Samsun province of Turkiye. The data set were evaluated within the scope of multivariate adaptive regression splines algorithm. For performing the analysis, the data set was divided into 2 different data set as named train and testing set which was the proportion of 70%-30%, respectively. To evaluate the model performances, several goodness of fit criteria such as MSE, RMSE, rRMSE, MAPE, MAD, R^2, R^2_{adj} and AIC were used. According to the results of this study, determination coefficients for train and testing set were determined 0.982 and 0.962 as the common goodness of fit criteria, respectively. In addition, the relationship between actual and predicted 6th month of body weight were determined as 0.991 and 0.981 for train and testing set, respectively. In conclusion, the usage of the MARS algorithm is suggested for predicting the 6th month of body weight for goat breeders.

Keywords: *MARS, Saanen, Goat, Body Weight, Train Set, Testing Set*

INTRODUCTION

The Saanen goat is a breed of dairy goat that originated in the Saanen Valley of Switzerland. Saanen goats are primarily raised for milk production and are recognized as a popular dairy breed worldwide. These goats are white in color, with short white fur except for their eyes and horns. Both horned and naturally hornless (polled) individuals can be found. They generally have a medium-sized and straight body structure. Saanen goats are often noted for their good body conformation and muscle development. They are known for their high milk yield. On average, they can produce around 3,000 to 3,500 liters of milk per year. Their milk has high fat and protein content, making it preferred for dairy product production. Saanen goats have a calm and friendly temperament, which makes them a popular choice among breeders and farmers. Their intelligence and adaptable nature make their care and management relatively easy. With proper care, including clean water, suitable feed, and proper shelter, they can remain healthy. Regular health checkups and timely vaccinations are necessary. Saanen goats are primarily bred for milk production. Thanks to their high-quality milk, they are favored for the production of dairy products such as cheese, yogurt, and butter. Due to their milk production and friendly characteristics, Saanen goats are popular in many countries. However, it's important to remember that they are living creatures requiring proper care and management. Acquiring more information about goat farming and adhering to local guidelines is essential for successful Saanen goat breeding (Onder and Abacı, 2015; Onder et al., 2015).

Saanen goats generally have a healthy and robust constitution. However, like other animal species, they can be susceptible to various diseases. Taking various measures to keep Saanen goats healthy and protect them from illnesses is important. Diseases such as mastitis, parasitic infections, respiratory tract infections, hoof problems, and mineral deficiencies are some common ailments that Saanen goats might encounter. Providing a clean and hygienic environment is crucial in reducing the risk of mastitis. Parasite control and regular internal and external parasite treatments can help prevent these issues. Goats living in cold weather conditions or crowded environments might be prone to respiratory tract infections. Appropriate shelter and hygienic conditions can reduce the risk of such infections. Foot infections can occur in goats living in damp or dirty areas. Maintaining a clean and dry environment can help preserve hoof health. To address mineral deficiencies, providing a healthy diet, particularly one rich in minerals like calcium, phosphorus, and selenium, can prevent issues arising from their scarcity. While Saanen goats are generally healthy and resilient, it's important for farmers and breeders to conduct regular veterinary check-ups, provide a clean and hygienic environment, ensure proper nutrition and water supply, administer vaccinations on time, and monitor their overall health. Following the recommendations of professional veterinarians and adhering to local animal health

42

standards are crucial in maintaining the health of Saanen goats (Ocak et al., 2006).

The body weight of Saanen goats can vary based on factors such as gender, age, nutrition, genetic factors, and care conditions. Male (buck): between 75 and 100 kilograms, female (doe): between 50 and 70 kilograms. Newborn Saanen goats typically weigh an average of 3 to 4 kilograms, and this weight can vary depending on birthing conditions, nutrition, and other factors (Ocak et al., 2006).

Saanen goats are primarily bred for dairy production, which is why they are generally not preferred for meat production. This is due to their high milk yield and the fact that they can produce more milk compared to meat. Saanen goats typically yield milk with low fat and high protein content, making them more valuable for milk and dairy product production. However, in certain cases, Saanen goats can be used for meat production. Especially the meat of individuals with decreased milk yield or those that have aged can be processed for meat. Saanen goats play an important role in dairy production in Turkey. The dairy products industry holds significant importance in Turkey, and Saanen goats are a preferred breed for high-quality milk production in this sector. These characteristics are some of the key reasons why they are favored for quality milk production in Turkey's dairy industry. Dairy products such as cheese, yogurt, and butter are traditionally consumed and industrially produced important foods in Turkey. The high milk yield of Saanen goats can enhance the quality of milk used in the production of these items. Turkish dairy products are in demand both domestically and in the international market. High-quality milk and dairy products derived from Saanen goats could increase export potential or decrease the need for imports. Saanen goats can contribute to rural development by supporting livestock activities in Turkey's rural regions. Goat farming can revitalize village economies and create employment opportunities. Saanen goats can also offer farmers and those involved in livestock the opportunity to learn modern livestock techniques and dairy production methods, which can contribute to the development of the livestock sector (Pisanu et al., 2013).

In Turkey, Saanen goats are predominantly bred for milk production, which is why there is a lower inclination towards specialized meat production. However, knowing the live weight is important for both fattening and selecting breeding candidates for appropriate feeding programs. In Turkey, meat production is more focused on meat goat breeds or hybrid breeds. Meat goat breeds are preferred due to their genetic suitability for meat production. As a result, the role of Saanen goats in meat production in Turkey is limited, and they are primarily used for milk production purposes (Onder et al., 2015; Gokdai et al., 2020).

Determining the live weights of animals is crucial from both a husbandry and animal breeding perspective. With advancements in information technology, there is a growing trend towards developing methods for estimating live weights from images. For accurate live weight estimation from images, obtaining body measurements and utilizing these measurements to predict live weight using a model is essential. One of the most suitable methods for this purpose is Multivariate Adaptive Regression Splines (MARS) analysis. MARS analysis is more flexible than traditional linear regression analysis and can capture complex relationships. This method divides the data space into particles, which are basic functions representing linear and non-linear relationships among variables. These particles automatically explore and represent relationships and interactions in the dataset by partitioning the effects of variables in different regions of the data, making it highly suitable for modeling both linear and non-linear relationships among variables (Aksoy et al., 2019; Akin et al., 2020; Faraz et al., 2021).

MATERIAL AND METHOD

In this study, MARS analysis was employed to predict the live weights of Saanen goats at 6 months of age. A dataset of 82 Saanen goats was collected from a private farm in Samsun, Turkey.

MARS analysis (Multivariate Adaptive Regression Splines) is a statistical analysis technique primarily used for regression analysis. MARS is employed to discover relationships within a dataset and construct complex regression models. It is utilized to uncover intricate patterns and create models that capture relationships within the data (Tırınk et al., 2021).

Multivariate Adaptive Regression Splines (MARS) refers to a statistical modeling technique that focuses on capturing complex relationships within a dataset when performing regression analysis. MARS is particularly utilized to predict outcomes and understand relationships between variables in datasets that involve non-linearity and interactions.

MARS analysis operates using fundamental functions called "particles." These fundamental functions divide the dataset into specific segments and represent the effects of variables within these segments. MARS analysis is referred to as "adaptive" due to its adaptability to complex structures within the dataset.

Multivariate and Adaptive Approach: MARS is employed to model the relationship between multiple independent variables (or features) and a

43

dependent variable. This technique can handle complex relationships and create models that can adapt better to the data.

Capturing Nonlinear Relationships: Traditional linear regression is used to model linear relationships within a dataset. However, in many cases, relationships are not linear. MARS analysis provides flexibility to capture nonlinear relationships as well.

The First Step of the Approach - Basis Functions: When initiating MARS analysis, fundamental functions are constructed for each variable in the dataset. These functions serve as building blocks of the model and are employed to partition the data into segments.

Segmentation and Branching: The dataset is partitioned into segments defined by the basis functions. Each segment is represented by the best-fitting basis function for the data. Subsequently, these segments are further branched, and more specific functions can be assigned.

Control of Model Complexity: MARS analysis has the ability to control model complexity to prevent overfitting. Complexity can be adjusted by limiting the number of segments and basis functions or by excluding low-impact variables.

Model Evaluation and Selection: The performance of the generated MARS model is typically tested on a separate portion of the dataset. This helps predict how the model will perform on real-world data. Model selection is based on these performance evaluations.

MARS analysis can be effective, especially when dealing with large and intricate datasets. It is used to model nonlinear relationships and solve regression problems. However, MARS analysis also has its limitations, such as potential challenges in cases of extremely low data or very large datasets.

MARS analysis can be a valuable tool for statisticians, data analysts, and data scientists aiming to solve predictive modeling problems, especially in datasets involving complex and nonlinear relationships. It is employed to make predictions in datasets containing intricate and nonlinear relationships. It can also be used to comprehend and elucidate relationships between variables. In datasets featuring complex interactions or nonlinear relationships, MARS analysis can provide a better understanding of these relationships. In scientific research, particularly in the field of bioinformatics, MARS analysis can find application in genetic data analysis, medical research, and understanding biological processes (Tırınk et al., 2021).

When conducting MARS analysis, the initial step involves preparing the data for analysis. Your dataset should contain a dependent variable (target variable) and independent variables (features). Additionally, handling missing or outlier values in your dataset is important. MARS analysis utilizes a set of basis functions to segment the data. These basis functions are employed to partition the data into specific segments and assign an appropriate basis function to each segment. At this stage, various algorithms and techniques are used to segment the data into regions. The basis functions assigned to each region are selected to best represent the data within those regions. Basis functions are typically chosen to be linear functions, cubic functions, or even more complex non-parametric functions. After the initial assignment of basis functions, the model proceeds to the branching step. In this stage, regions are further subdivided into sub-regions, and more specific basis functions are assigned. This step is used to increase or decrease the complexity of the model. The generated MARS model should be optimized to best fit the dataset. In this stage, parameter adjustments or complexity modifications can be made to enhance the model's performance. A separate test dataset can be used to evaluate the performance of the generated MARS model. This is crucial to understand how the model performs on real-world data. The results of the model and the insights derived should be interpreted based on the purpose of the analysis. The significance of variables, relationships in the model, and extracted information need to be evaluated. When conducting MARS analysis, it is important to follow the steps according to the characteristics of your dataset and the objective of the analysis.

RESULTS

The descriptive statistics were given in Table 1. According to Table 1, birth weight of the males were higher than females. The body weight of male Saanen goats were showed similar trends in the next months.

Table 1. Descriptive statistics of the Saanen goats

Sex	Variables	n	mean	sd	min	max
Male	Birth weight	38	4,03	0,88	2,2	5,7
	1st month body weight	38	10,3	1,27	7,8	12,7
	2ndmonth body weight	38	14,88	1,51	12	17,6
	3rd month body weight	38	19,26	1,49	16,3	22,2
	4th month body weight	38	23,26	1,98	19,2	26,6
	5th month body weight	38	27,65	2,22	23	31,2
	6th month body weight	38	31,86	2,57	26,8	36
	Birth weight	44	3,55	0,67	2	4,7
	1st month body weight	44	8,59	0,86	7	10,2
	2ndmonth body weight	44	12,29	1,27	9,7	14,5
	3rd month body weight	44	16,06	1,64	12,6	18,8
	4th month body weight	44	20,44	1,83	16,8	23,6
	5th month body weight	44	24,99	1,8	21,4	28
Female	6th month body weight	44	29,24	1,73	26	32,5

The relationship between explanatory variables was shown using Pearson's correlation coefficient. In this aspect, the obtained correlation coefficient is given in Table 2. According to the Table 2, the whole correlation coefficient were statistically significant ($p<0.001$). In addition, the correlation coefficients were highly correlated.

Table 2. The correlation coefficient for the explanatory and response variables.

	Birth weight	1st month BW	2ndmonth BW	3rd month BW	4th month BW	5th month BW	6th month BW
Birth weight	1						
1st month BW	0,853	1					
2ndmonth BW	0,791	0,971	1				
3rd month BW	0,724	0,940	0,983	1			
4th month BW	0,756	0,911	0,960	0,967	1		
5th month BW	0,764	0,887	0,932	0,936	0,990	1	
6th month BW	0,759	0,860	0,897	0,895	0,969	0,984	1

The MARS algorithm were performed the data for predicting 6th month of body weight for Saanen goat breed. When the process were finished, we obtained an equation for predicting the 6th month of body weight for Saanen goat breed. In this context, the obtained MARS equation model was given in Table 3.

Table 3. The obtained MARS prediction model Coefficient

	Coefficient
(Intercept)	28.9987027
h(19.8-3rd month BW)	0.1511942
h(25.4-5th month BW)	-1.0306835
h(5th month BW -25.4)	1.2033265

According to Table 3, the obtained MARS equation model has 4 term for predicting 6th month body weight. The first term of the prediction model was an intercept with a coefficient of 28.9987027. The second term was significant for the 3rd month BW with the cut point of 19.8 kg. In addition, the coefficients of the second term 0.1511942. The third and fourth term were significant for 5th month of BW with the

cutpoint of 25.4 kg. These terms had -1.0306835 and 1.2033265 coefficients, respectively.

The MARS model was evaluated with goodness of fit criteria in Table 4. According to Table 4, Rsq values were determined as 0.981 and 0.962 for train and testing set, respectively. In addition, the other goodness of fit criteria were shown as the best fit for predicting the 6th month of BW. Especially, the Pearson's correlation coefficients were over 0.90 for train and testing set.

Table 4. *The goodness of fit criteria*

	Train	Test
Criterion	Value	Value
Root mean square error (RMSE)	0.336	0.471
Relative root mean square error (RRMSE)	1.105	1.542
Standard deviation ratio (SDR)	0.132	0.195
Coefficient of variation (CV)	1.110	1.570
Pearson's correlation coefficients (PC)	0.991	0.981
Performance index (PI)	0.555	0.778
Mean error (ME)	0.000	-0.029
Relative approximation error (RAE)	0.000	0.000
Mean relative approximation error (MRAE)	0.001	0.003
Mean absolute percentage error (MAPE)	0.855	1.124
Mean absolute deviation (MAD)	0.263	0.333
Coefficient of determination (Rsq)	0.982	0.962
Adjusted coefficient of determination (ARsq)	0.981	0.954
Akaike's information criterion (AIC)	-118.527	-128.110
Corrected Akaike's information criterion (CAIC)	-117.772	-126.004

These findings showed strong estimation performance on body weight like Fatih et al. (2021) mentioned in their study on camels.

Conclusion

In conclusion, the MARS algorithm can be used for predicting body weight from several measurements. Rural conditions are quite harsh for sustainable livestock. In this context, the absence of some materials can be resolved using different statistical models.

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USABILITY OF CANNABIS PLANT IN POULTRY NUTRITION

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Abstract

Cannabis (Cannabis sativa L.) is an annual plant with 2n=20 chromosomes, one-year, C3 group, cultivated for its long and strong fibers and seeds. It is a plant that should be cultivated in a controlled manner due to the presence of THC in its natural structure. Producers who avoid control and monitoring have turned to alternative products instead of hemp farming. Countries that cultivate cannabis in large areas; France, China, and Canada. Some countries are updating their cannabis-related laws and making efforts to increase hemp acreage. It is known that hemp farming has been practiced in Anatolia since 1500 BC. Various products such as hemp seeds, hemp pulp, hemp oil have been used in various studies in poultry feeding studies, while no negative results have been encountered, but various positive results have been suggested and their use is recommended. It is of great importance to investigate the effects of cannabidiols, which have strong antimicrobial, antioxidant and immunostimulant effects, as they are expected to support the immune system in poultry, especially broilers. Some of the studies in which hemp products are used in poultry nutrition are as follows; Addition of hemp meal to laying hen diets has been reported to make no significant difference in egg production, feed consumption, feed utilization, body weight gain or egg quality, but results in lower palmitic acid concentrations and higher LA and ALA concentrations, which are healthier for human consumption. Hemp seeds and hemp oil used in chicken rations caused an increase in the omega-3 polyunsaturated fatty acid content and color intensity of egg yolks, but no adverse effects were observed on the sensory profiles of cooked eggs. Addition of cannabis meal to fast growing broiler diets did not affect performance or mortality, and no effect on the number of Clostridium perfringens in the cecum was reported. Khan et al. (2010) concluded that cannabis seeds have a remarkable effect on the growth of broiler chicks and can help reduce feed expenditures for broiler rearing. In this paper, the use and usability of the cannabis plant, whose production areas are expanding rapidly, in poultry will be examined.

Keywords: Hemp, Cannabis, Animal, Nutrition, Fiber, Poultry Nutrition

THE RELATIONSHIP BETWEEN THE SMALL ANIMAL SPECIES AND MILK PRODUCTION IN TURKEY

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Abstract

In this study; It is aimed to determine the relationship between the average milk yield of the groups obtained from the ovine species milked in Turkey within the specified years, and the number of ovine milked according to the years, directly or to what extent there is a relationship between milk yield. For this purpose, data were obtained from the ovine species milked in the statistical tables between the years 1991-2019 published by the Turkish Statistical Institute (TUIK) and the milk yield (tons) by years. ANOVA test was used to determine the relationship between the milk yield averages of the groups formed in the obtained data set, and the scatter diagram analysis was performed to determine the direct or to what extent there is a relationship between the number of dairy cattle milked by years and milk yields. According to the research results; At least one of the 4 groups, which were milked as domestic sheep, merino sheep, hair goat and angora goat, differed significantly from the others in terms of milk yield, and the domestic sheep type was better than merino sheep, goat-hair and goat-lint in terms of milk yield, Considering the merino sheep species in small ruminant species by years, the milk yield will be the lowest regardless of their number, and the milk yield will be the highest in the domestic sheep, and the best milk yield will be obtained from domestic sheep, goat-hair, goat-mohair and merino sheep, respectively. type was determined by the analysis.

Keywords: *Milked sheep and goats-1, milk yield-2, years-3, no-parametric test-4*

INTRODUCTION

Animal husbandry has been the most important source of livelihood and economic activity of humanity since the time it landed on the earth. Animal husbandry is an extremely important factor in terms of adequate, healthy and balanced nutrition of the population, which tends to increase continuously. In addition, the livestock sector has an important place in terms of raw material supplies in livestock related industries. Livestock is a sector that benefits the country's economy, creates the highest added value for unit investment and provides employment opportunities at the lowest cost (Demir, 2012).

In our age, animal husbandry has an important place both in economy and industry all over the world, especially in developed societies, while the demand for the food needs of the world population, which tends to increase, is increasing day by day. It has important social and economic functions such as increasing national income and employment in terms of balanced and adequate nutrition of people, supplying raw materials to milk, meat, leather, cosmetics, textile and pharmaceutical industries, contributing to development and increasing foreign currency inflow through exports (Anonymous , 2020).

Livestock farming is divided into two groups as cattle and sheep farming. Ovine husbandry is not only the most prominent source of livelihood for people living in rural areas, but it is also known as the economic source of especially developing societies (Guven et al., 2017).

Sheep and goats, one of our sheep and goats, which have a special importance in Turkey, are animal species that make good use of low-yielding pastures, fallow lands, areas that are not suitable for stubble and plant production, and where other species cannot benefit. However, it is one of the rare animals that have the ability to evaluate the grazing areas and to convert them into meat, milk, fleece and hair (TMMOB Chamber of Agricultural Engineers, 2022).

It is reported that the production of sheep and goat milk is an important part of the national economies of many countries, especially in the Mediterranean and the Middle East, and production is generally well organized in countries such as France, Spain, Italy and Greece (Park et al., 2007; Riberio and Riberio), 2010). According to TUIK data, the number of sheep and goats in 2019 is approximately 48.5 million heads. The number of sheep milked is 25.3 million heads, of which approximately 19.8 million are sheep and 5.5 million are goats. According to TUIK's 2019 milk production data, the total milk production is approximately 23 million tons, and 2.1 million

tons of this is obtained from sheep and goats. 1.5 million tons of the total ovine milk obtained consists of dark milk and 577 thousand tons of goat milk. Annual average milk production per milked animal is 77 kg in sheep and 105 kg in goats (TUIK, 2021; HAYGEM, 2022). According to the 2019 data of FAO, the annual average amount of sheep milk per milked animal in the world is 79.75 kg, and the amount of goat milk is 193 kg (FAO, 2022). Annual sheep and goat milk yield per animal in Turkey is below the world average. According to TUIK Animal Production Statistics, the total number of sheep and goats in Turkey in 2021 is 57.5 million, and the number of sheep has increased by 7.2% and the number of goats by 3% compared to 2020 (TUIK, 2022).

In this study; It is aimed to determine the relationship between the average milk yield of the groups obtained from the ovine species milked in Turkey within the specified years, and the number of ovine milked according to the years, directly or to what extent there is a relationship between milk yield.

MATERIALS AND METHODS

The data set in this study was obtained from the ovine species milked in the statistical tables between 1991 and 2019 published by the Turkish Statistical Institute (TUIK) and the milk yield (tons) by years. In Table 1, Table 2, Table 3 and Table 4, the number of sheep milked and milk yields by years are given.

Table 1. Number of sheep and goats milked by years.

Years	Domestic Sheep	Merino Sheep	Coat-Bristle	Coat-Lint
1991	22731840	490405	5275399	602091
1992	21909840	489423	5082446	519690
1993	21044902	486947	4991455	472414
1994	20018292	489177	4769131	393404
1995	18801878	460615	4544493	363091
1996	18411011	479072	4379230	346645
1997	16685799	482907	4111256	295930
1998	16278560	497676	3988811	258378
1999	16015358	457982	3843219	243044
2000	15489474	430685	3604719	187988
2001	14427794	419474	3590165	183301
2002	13265493	371701	3412094	141344
2003	12115951	361266	2999110	127546
2004	9591015	328176	2379038	97536
2005	9837155	328936	2331556	95437

Table 2. Number of sheep and goats milked by years.

Years	Domestic Sheep	Merino Sheep	Coat-Bristle	Coat-Lint
2006	9884636	361258	233514	86128
2007	9698433	411258	2190602	73027
2008	9224076	418094	1937387	60302
2009	8963064	444802	1778420	52393
2010	10070029	513579	2516200	66339
2011	10998040	563103	2968157	64954
2012	12374732	693696	3439708	62564
2013	13491002	796235	3878404	64914
2014	13586214	938050	4322503	77666
2015	14348611	1014316	4483672	94822
2016	14160816	988598	4466406	88699
2017	16330147	1173267	4877554	86027
2018	17497602	1321682	5234796	92370
2019	18348724	1488261	5378349	92737

Table 3. Milk yield of sheep and goats milked by years (tons).

Years	Domestic Sheep	Merino Sheep	Coat-Bristle	Coat-Lint
1991	1110534	16909	322084	322084
1992	1072445	16728	308356	308356
1993	1030609	16771	304149	304149
1994	975381	16420	288567	288567
1995	918495	16005	269670	269670
1996	904623	17039	258159	258159
1997	809553	16795	243044	243044

50

Year				
1998	795773	17305	240121	240121
1999	789084	15612	231420	231420
2000	759875	14504	216328	216328
2001	709503	13843	215881	215881
2002	645465	11922	206403	206403
2003	754979	14980	274350	274350
2004	756001	15715	255468	255468
2005	774344	15533	250246	250246

Table 4. Milk yield of sheep and goats milked by years (tons).

Years	Domestic Sheep	Merino Sheep	Coat-Bristle	Coat-Lint
2006	777385	17296	250594	250594
2007	762930	19657	234883	234883
2008	726894	19978	207385	207385
2009	712784	21435	190286	190286
2010	792122	24710	270476	270476
2011	865577	27245	318273	318273
2012	973619	33388	367208	367208
2013	1062274	38739	413444	413444
2014	1069441	44496	460518	460518
2015	1129237	47990	477824	477824
2016	1113469	46943	476234	476234
2017	1288041	56738	520197	520197
2018	1382026	64245	558418	558418
2019	1449351	72105	573786	573786

In this study, ANOVA test was used to determine the relationship between the milk yield averages of the groups obtained from the ovine species milked in the first stage. Normality analysis was performed on the data set obtained from the Turkish Statistical Institute (TUIK), and as a result of the analysis, the Kruskal Wallis test, which is a no-parametric test, was used because it did not comply with the normal distribution. Kruskal Wallis test; It is a method used to compare the means of three or more groups in groups with continuous variables that do not have a normal distribution. The Kruskal-Wallis test is accepted as an alternative to non-parametric one-way analysis of variance (ANOVA). The data to be analyzed should be equally spaced or proportionally scaled. The Kruskal-Wallis test investigates whether the main masses have the same characteristics in samples taken from k different, independent populations with k>2. These samples are combined and ranked, and H statistics are obtained with their rank sums.

The test hypotheses regarding the Kruskal-Wallis test are as follows;

$$KW = \frac{12}{n(n+1)} \sum_{j=1}^{k} n_j (\bar{R}_j - \frac{n+1}{2})^2 \qquad (1)$$

H_0= c main mass distributions are equivalent to each other.

H_1= At least one main mass is not equivalent to the others.

The total number of observations in c samples,

$$N = \sum_{i=1}^{c} n_i \qquad (2)$$

If it is expressed by it is the smallest observation with a rank value of 1, and the largest observation with a rank value of 2. Thus, the rank ordering process continues until the largest observation N rank value is obtained, and the common rank value of the available values is found by taking the average of the counted ranks against the connected values (Puri & Sen, 1971; Randles & Wolfe, 1979).

If the group variances are different, it is appropriate to prefer the Tamhane T2 test to compare the k-group mean in pairs simultaneously with the different variance approach (Ozdamar, 2013). The test is a conservative pairwise comparison test based on the t test (Anonymous, 2015). Procedures of the test;

$$SH_{i-j} = \sqrt{\frac{S_i^2}{n_i}} + \sqrt{\frac{S_i^2}{n_j}}; V_{i-j} = \frac{\left(\frac{S_i^2}{n_i} + \frac{S_i^2}{n_j}\right)}{\left(\frac{S_i^2}{n_{i-1}} + \frac{S_i^2}{n_{j-1}}\right)} 2; \alpha_{yeni} = \left(1 - (1-\alpha)^{\frac{1}{c}}\right);$$

$$TamhaneT2_{i-j} = t\alpha_{yeni}; V_{i-j} \times SH_{i-j}. \qquad (3)$$

Scatter diagram analysis was also used to determine whether the number of dairy cattle milked by years was directly or in what degree a relationship with milk yield. Scatter diagram; These are the diagrams in which the level of relations between two data sets, which are thought to be mutually related, is examined. One of the variables is located on the horizontal axis and the other on the vertical axis. A set of points is obtained by determining the intersection points of the value of the variable on the vertical axis against a certain value of the variable on the horizontal axis. In the scatter diagram, the relationship between any problem and its cause is determined via the x-y axis. The slope of the set of points indicates a negative or positive relationship. This relationship can be expressed with a first-order function or a curve (Gumusoglu, 2000).

RESULTS

In this study; It is aimed to determine the relationship between the average milk yield of the groups obtained from the ovine species milked in Turkey within the specified years, and the number of ovine milked according to the years, directly or to what extent there is a relationship between milk yield. For this purpose, data were obtained from the ovine species milked in the statistical tables between the years 1991-2019 published by the Turkish Statistical Institute (TUIK) and the milk yield (tons) by years. In the obtained data set, the presence of ANOVA was determined to determine the relationship between the average milk yield of

the groups formed in the first stage. Scatter diagram analysis was also used to determine whether there is a direct relationship or to what extent there is a relationship between the number of sheep and goats milked by years and their milk yields.

According to the research results; At least one of the 4 groups, which were milked as domestic sheep, merino sheep, bristle goat and angora goat, differed significantly from the others in terms of milk yield, and the domestic sheep type was better than merino sheep, goat-bristle and goat-lint in terms of milk yield, Considering the merino sheep species in small ruminant species by years, the milk yield will be the lowest regardless of their number, and the milk yield will be the highest in the domestic sheep, and the best milk yield will be obtained from domestic sheep, goat-bristle, goat-mohair and merino sheep, respectively. type was determined by the analysis. In order to obtain better results in the data set obtained from the ovine species milked and milk yield (tons) according to the years in the statistical tables between the years 1991-2019 published by the Turkish Statistical Institute (TUIK), the number of observations in the data set should be wider, It should be taken into account that the data set should be increased according to the number of animals, since the milk yields will vary according to the number of animals when the number of sheep and goats milked in Turkey is grouped according to their species. In order to avoid these and similar problems in future articles or thesis research, the deficiencies mentioned should not be ignored.

DISCUSSION
The data set in this study was obtained from the ovine species milked in the statistical tables between 1991 and 2019 published by the Turkish Statistical Institute (TUIK) and the milk yield (tons) by years. In the data set obtained, the presence of ANOVA was determined to determine the relationship between the milk yield averages of the groups obtained from the ovine species milked in the first stage. Scatter diagram analysis was also used to determine whether the number of dairy cattle milked by years was directly or in what degree a relationship with milk yield.

Normality analysis was performed on the data set obtained from the Turkish Statistical Institute (TUIK), and as a result of the analysis, the Kruskal Wallis test, which is a no-parametric test, was used because it did not comply with the normal distribution.

In the results of the analysis;

Table 5. The result of Kruskal Wallis analysis of milked ovine species and milk yield.

	Y
Chi-Square	97.049
df	3
Sig.	.000

In Table 5 It was determined by the analysis that at least one of the 4 groups, which were milked as domestic sheep, merino sheep, hair goat and angora goat, differed significantly from the others in terms of milk yield. Post-Hoc Tamhane's T2 no-parametric analysis was used to understand which of the 4 groups differed from the other In Table 6, it is determined that the domestic sheep type is better than the merino sheep, goat-hair and goat-mohair in terms of milk yield and the best milk yield according to the years is the domestic sheep, goat-hair, goat-mohair and merino sheep types, respectively. determined.

Table 6. Post-Hoc Tamhane's T2 analysis of milked ovine species and milk yield.

		Mean Difference	Sig.
Domestic Sheep	Merino Sheep	901405.793*	.000
	Goat-Bristle	610622.138*	.000
	Goat-Lint	610622.138*	.000
Merino Sheep	Domestic Sheep	-901405.793*	.000
	Goat-Bristle	-290783.655*	.000
	Goat-Lint	-290783.655*	.000
Goat-Bristle	Domestic Sheep	-610622.138*	.000
	Merino Sheep	290783.655*	.000
	Goat-Lint	.000	1.000
Goat-Lint	Domestic Sheep	-610622.138*	.000
	Merino Sheep	290783.655*	.000
	Goat- Bristle	.000	1.000

As a result of the scatter diagram analysis, in order to determine whether there is a direct relationship or to what extent there is a relationship between the number of sheep and goats milked by years and their milk yield;
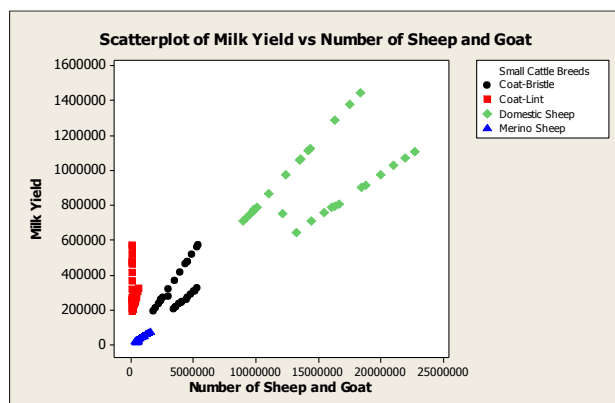
Figure 1. The results of the analysis of the scatter diagram of the number of sheep milked and milk yield by years.

When looking at merino sheep species in small ruminant species over the years in Figure 1, it has been determined by the analysis that the milk yield will be the lowest regardless of their number, and the domestic sheep will also have the highest milk yield.

In a study, the economic analysis of agricultural enterprises that include goat breeding for milk production in the province of Kahramanmaras was made and the market supply of products obtained from goats and the situation of agriculture-based industrial enterprises that process goat milk were investigated. As a result of the research, the ratio of farm capital within active capital is 48.99% and the ratio of working capital is 51.01% in the enterprises examined. 83.53% of the animal production value is obtained from goat breeding. In goat breeding, 44.86% of the production value is obtained from the milk production value. Vegetable production value constitutes 14.71% of the gross production value and animal production value constitutes 85.29%. Goat breeding (71,24%) has the biggest share in the gross production value. 92.0% of the total family income obtained in the enterprises is agricultural income and 8.0% is non-agricultural income. As a result of the economic analysis, it has been determined that large enterprises are more successful than small enterprises. Milk has the largest share among the products obtained from goat breeding. The marketing rate of the milk obtained in the enterprises is 65.28%. The marketing ratio increases with the size of the business. 32.43% of the milk obtained from goats is supplied to the market as cheese, 16.07% as drinking milk, 12.97% as yoghurt and 3.81% as butter. As the size of the business increases, the supply of products to the market increases. 81.80% of the agricultural-

based industrial enterprises examined buy goat milk for ice cream production and 18.20% for cheese production. Industrial enterprises based on agriculture may have difficulties in supplying goat milk due to both the increasing demand for goat milk and the lack of production. It was concluded that 45.50% of the agricultural-based industrial enterprises examined had difficulties in obtaining goat milk (Paksoy, 2007). In a study, the estimation of the monthly evaporation amount in the Tahtakopru dam was investigated using the Scatter-Plot scatter diagram in the Artificial Neural Networks (ANN) method. As a result of the research, it was concluded that the ANN model solution results used in the estimation of the monthly evaporation amount of the dam reservoir gave a better approach when compared to the classical methods (Unes et al., 2011). In a study, the general situation of sheep and goat breeding in Turkey was investigated. As a result of the research, it was determined that there was a significant decrease in animal existence in the sheep and goat farming sector between 1994 and 2009, and it was concluded that the sector could not meet the demand for other animal products, especially meat and milk, for the sheep and goat farming sector of the country between 1994 and 2013 (Semerci and Celik, 2007). 2016). In a study, the economic factors affecting the sustainability in the dairy production activity of sheep and goats in Antalya province were investigated. As a result of the research, it has been concluded that feed costs are the largest expense item with a share of 40% in the dairy production activity of sheep and goats (Ozalp and Sayın, 2018). In a study, it was investigated how non-parametric tests are used in different fields and applications according to data type. As a result of the research, it was concluded that no significant differences could be obtained between the scales and demographic characteristics (Tanriverdi, 2019). In a study, it was investigated to determine the socio-economic structures of the small cattle breeding enterprises, to reveal the annual activity results and to determine the marketing structures, to determine the efficiency of the enterprises and to determine the factors affecting the success in breeding. As a result of the research, the sum of the variance percentages of the factors obtained for the goat farms in the factor analysis results is 74.616%. The total percentage of variance obtained for sheep farms is 70.650%. The Gross Product (GSH) value in goat enterprises is 94523.3 TL and the share of Gross Production Value (GSU) is 97.25%. 69.20% of the Gross Production Value (GSUD) consists of

income from goat production activities. The Gross Product (GSH) value of sheep enterprises is 123178.1 TL and the share of Gross Production Value (GSU) is 97.56%. 75.50% of the Gross Production Value (GSUD) consists of income from sheep production activities. It has been concluded that the average technical efficiency of goat enterprises in the region is 0.80, while sheep enterprises are 0.77 (Yılmaz, 2019). In a study, the activities carried out in the field of animal husbandry between 1923-1950 were investigated. As a result of the research, the republican state established stud farms and stallions in various places for the development of livestock, free feed was distributed at times, continuous laws and decrees on animal diseases were published, veterinarians were sent all over the country due to illness, and the price of meat and milk was tried to be minimized. , animal exchange was established, exhibitions and fairs were established to encourage people to produce, improvement studies were carried out and it was concluded that taxes were collected (Ozer, 2019).

In a study, the evaluation of the changes in Turkey's ovine stock and milk production in the last period and the determination of possible trends until 2025 were investigated. As a result of the research, it is expected that the increase in the number of sheep and goats will continue in the coming periods, the regression coefficient has increased by 85%, the milk production amount has increased continuously depending on the years, this increase is expected to continue, the regression coefficient is 93%, a regular increase in the annual milk yield per milked animal. and it is expected to continue in the future and it was concluded that the regression coefficient was determined as 82% (Sevinc et al., 2022).

AUTHOR CONTRIBUTIONS

The authors declare that they have contributed equally to the article.

CONFLICT OF INTEREST

The authors of the article declare that there is no conflict of interest between them.

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USE OF INDUSTRIAL PLANTS IN POULTRY NUTRITION

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Abstract

The rapid increase in the human population has also increased the demand for raw materials in many fields. The increasing population has brought along the problem of opening agricultural areas to settlement. For this reason, versatile plants that bring high efficiency from the unit area without harming the existing natural resources and can contribute in many fields such as food, textile, biofuel and animal nutrition arouse excitement among scientists. Industrial plants also provide the diversification of agriculture, enable the simultaneous development of plant and animal production, and make significant contributions to local economies, especially in developing countries. Industrial crops play a crucial role in various aspects of human society, economy, and sustainability. Their importance extends beyond food production and consumption, as they contribute to a wide range of industries and offer several benefits. One of these sectors which affected by industrial plants is poultry nutrition. Industrial crops are utilized to meet the energy, protein, vitamin, fibre, Omega-3, antioxidant, phytochemicals, phosphorous and mineral requirements of poultries. Such as soybeans, sunflower, maize, cottonseed and flax are widely used in the feeding of poultries. They serve as high-energy and protein sources, promoting healthy growth and productivity. These crops are specifically cultivated to provide essential nutrients and meet the dietary needs of poultries. As a conclusion, industrial crops serve as essential ingredients of poultry feeding methods, providing the crucial nutrients, energy, and protein required for the appropriate growth, development, and productivity of poultries. Their inclusion in diets ensures the optimal health and well-being of poultries in various agricultural settings. This review article has examined some important industrial plants as poultry feed.

Keywords: Field Crops, industrial Crops, Animal Nutrition, Poultry Nutrition

EVALUATION OF DIFFERENT DOSES OF METHYLTIOPHANATE ON THE BLOOD GLUCOSE LEVEL IN FEMALE WISTAR RAT

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Abstract

Background: The increasing use of agricultural pesticides is associated with an increase in soil and water pollution. Among the commonly used pesticides in rice blast pest control is Methyltiophanate. This pesticide has the ability to be digested and can affect different body tissues, including the pancreas. Methods: Twenty-four adult female Wistar rats weighing 200 ± 20 were distributed semi-randomly to 4 groups of six. Group Control, group A that received Methyltiophanate (664 mg/kg b.w./day, PO); group B, were treated with Methyltiophanate (996 mg/kg b.w./day, PO) and group C, were treated with Methyltiophanate (1328 mg/kg b.w./day, PO). Study period was 4 weeks. Blood samples were taken from all rats. serum samples obtained from all groups and were used to measure of the insulin and glucose. Data obtained from the measurements was compared using statistical analysis Duncan technique. Results: There was not a meaningful dose - dependent relation between the increase in levels of Methyltiophanate and glucose values in dosages of 664, 996 and 1328 mg/kg body weight (p>0.05). Conclusion: According to mounted levels of glucose, it ought to be reckoned that Methyltiophanate does not have negative impacts on human and animal health and toxicity effect on pancreas tissue at this dosage of pesticide.

Keywords: Methyltiophanate, Pancreas, Glucose, Wistar Rat

A NEWLY RECORDED NATIVE GOAT GENOTYPE OF TURKIYE CALLED AS MANAVLI

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Abstract

For each region where breeding is undertaken, its own genetic resources are of great importance. Indigenous breeds have an important and special place in the livestock policies of countries. Native goat breeds are an important component of livestock biodiversity, and their breeding has been gaining importance in recent years. While performing studies for existing native goat breeds in detail was important, it was also said that research aimed at revealing and introducing new native gene resources. Manavlı goats are reared by the Turkish Manavlı nomads for nearly a century in the certain places of West Anatolia. But to the authors' knowledge, there is no previous project and report published about it. According to findings of the first project (supported by TUBITAK), carried out by authors under breeder conditions higher birth and twin rate values were determined according to the literature reports about domestic goat breeds of Turkiye. It was seen that the live weights (29.13 kg for males and, 27.19 kg for females at the 120th day of age) and body measurements of kids were higher than the other native goat breeds including Turkish Hair goat. Additionally, the live weights (around 80 kg for aged between 4-4.5 year for Manavlı does and around 110 kg or aged between 2-2.7 year for Manavlı bucks) and zoometric body size values are significantly and remarkably higher than the averages reported for Turkish Hair Goats. The above-mentioned findings and evaluations obtained from breeder condutions reveal that the positive advantages of Manavlı goat which no features have been revealed to date should be investigated. It is thought that the preliminary results related to Manavlı goats can make a positive contribution to the biodiversity and production range of Turkiye. More detailed and "genetic-based" studies, especially involving the Turkish Hair goat, are needed to define the Manavlı genotype in many aspects.

Keywords: _Manavlı, Goat, Genotype_

SEXUAL DIMORPHISM AND AGE INFLUENCE ON MORPHOLOGICAL TRAITS OF SOUTH AFRICAN NON-DESCRIPT INDIGENOUS GOATS

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Abstract

Non-descript indigenous goats' farmers are unable to perform proper management of their goats due to absence of weighing scales. This study was conducted to assess the effect of sexual dimorphism and age on morphometric traits and determine relationship between body weight and morphometric traits in goats. 368 unimproved indigenous goats of different sexual dimorphism, between one to three years old were used in the study. The age of the goats was estimated using a dentation chart, while linear body measurements (BL= body length, HG = heart girth, WH = withers height, RH = rump height and RL= rump length) were measured through tailor tape measure in (cm) and body weight (BW) was taken using a weighing scale in (kg). Analysis of Variance and Pearson correlation were employed for data analysis. The findings indicated that sexual dimorphism had a highly statistically significant (p< 0.01) effect on HG and RL, a statistical significance (p< 0.05) effect on BW, and a non-significant (p> 0.05) effect on WH, and RH. Age indicated a highly statistically significant (p<0.01) on BW, BL, HG, WH and RH, and non-significant (p> 0.05) on RL. Correlation indicated that BW was highly correlated (p<0.01) to BL, HG, RL, and RH, respectively, and correlated (p<0.05) to WH. In conclusion, results of the study suggest that sexual dimorphism and age can be used as determining factors for morphometric traits in goats. The findings suggest that all the linear body measurements traits can be used as selection criteria to improve body weight of goats.

Keywords: _Body length, Heart girth, Withers height, Rump height, Rump length_

INTRODUCTION

South African non-descript indigenous goats are known as unimproved goats kept in the communal land of South Africa for meat and milk. They are known for their unique characteristics of hardiness which lead them to survive in harsh environments (Mpebea et al., 2018). The understanding of livestock weight evaluation remains the background to which all animal production management practices are attached (Asefa et al., 2017). The body weight of animals associated with the management practices such as determining correct feed levels, administering the correct dose of treatments to use, during the slaughtering period, and breeding for the selection of males and female animals to use as parents of the next generation (Putra et al., 2014; Mokoena et al., 2022). Regardless of body weight being trait of economic importance that can assist in animal production management decision supports, it was found that smallholder farmers find it difficult to practice proper animal management due to the lack of a weighing scale (Chay-Canul et al., 2019). This challenge leads the farmers to rely on subjective methods like visual judgement which its accuracy revolves on one's experience in the field (Tesema et al., 2019). It also led livestock farmers not to get the fair price for their animals when selling, since the sales is done on negotiations due to lack of resources. Morphometric traits have been noticed as growth indicators in livestock and can be employed to indirectly estimate the body weight carcass trait of animals where there's no weighing scales (Kurma et al., 2018). Different models were established to predict body weight of different goat breeds from morphometric traits under diverse environmental conditions (Iqbal et al., 2013). Several studies have been conducted using different models for prediction of live weight through morphometric traits in livestock and found heart girth as the best predictor of body weight in cattle (Vanvanhossou et al., 2018), goats (Kamarudin et al., 2011), sheep (Kurma et al., 2018). According to our knowledge, none of the study has been conducted to examine the influence of sex and age on morphometric traits of South African non-descript indigenous goats. Therefore, this study was conducted to (1) investigate the influence of sexual dimorphism and age on body weight and some linear body measurements (2) investigate the relationship between body weight and some morphometric traits.

MATERIALS AND METHODS
Study area

The study was conducted in three villages (Lesetsi, Lekurung and Morotse) in Lepelle-Nkumpi Local Municipality within Capricorn District of Limpopo Province, South Africa. Lepelle-Nkumpi Local Municipality is located fifty-five kilometers South of Polokwane City and the district municipality. Climate conditions of the municipality is good for farming, including small ruminants farming. The area is subtropical, with mild winters, mostly frost-free, and very, mostly dry. The Lepelle-Nkumpi Local Municipality has a higher average temperature of 26.02°C and the low average temperature is low at 12.10°C. (CDM, 2009). The area consists of North-eastern Mountain grasslands and sour lowveld bushveld (Agricultural Strategy for Capricorn District Municipality, 2009).

Experimental animal, management, and study design

The study used unimproved indigenous goats of different sexes, from the age of 1 to 3 years old. The animals were reared under traditional production system, where they were allowed to go and graze in bush and later closed into the kraals. During the study sick and pregnant animals were replaced. The study applied a cross-sectional study design, where researcher visited the farmers and collect data once from each individual goat.

Sampling procedure

Multi-stage sampling procedure was used in the study for sampling. Stage 1: Lepelle-Nkumpi Local municipality was purposively selected due to its high population size of goats as compared to another municipality in Limpopo province. Sepitsi, Lenting and Morotse villages were purposively selected due to enough goats' farmers working in hand with one of the extension officers in the municipality. A minimum of 30 smallholder indigenous goat famers with at least 6 goats in their herd were selected from each village. A minimum of at least 6 goats of different sex aged between 1 to 3 years were randomly selected for morphometric measurements. The study then used 368 indigenous goats.

Data collection

A livestock mass scale was used to scale body weight of goats in kilograms. Linear body measurements (Withers height, Heart girth, Rump height, Rump length and Body length) were taken following the procedure of Yakubu (2009). Measuring tape calibrated in centimeters was employed to measure the linear body measurements. To ensure the precision when taking measurements, the goats were handled in a human manner that will also give accurate results. The age of the goats was taken through a dentition chart, where: one permanent pair incisor was regarded as one year: two permanent pair incisors: two years; three permanent pair incisors: three years. The gender of the goats was taken through observation.

Statistical analysis

Statistical Package for Social Sciences (SPSS, 2019) version 27.0 software was employed. Analysis of Variance (ANOVA) and Pearson correlation were employed to achieve objectives of the study. Least Significant difference (LSD) was used for mean separation at a level of (P<0.05).

The following equation below for the analysis of variance was used:

$$Y_{ij} = u + G_j + e_{ij} \qquad (1)$$

Where: Y_{ij} is the observation of the ith goats on the jth sex/age

U = mean

G_j = fixed effect of the jth sex/age

e_{ij} = random residual error

RESULTS

Table 1 display the effect of age on body weight and linear body measurements traits of unimproved indigenous goats of Lepelle-Nkumpi Local Municipality. Age groups 1PPI, 2PPI, 3PPI, had highly significant effect (P < 0.01) on BW, BL, HG, WH and RH, and non-significant (P > 0.05) effect on RL.

Table 1: Effect of age on body weight and some linear body measurements

| | Age | | | |
| | 1PPI | 2PPI | 3PPI | |
Traits	Mean ± SE	Mean ± SE	Mean ± SE	P- value
BW	24.94±1.45[c]	29.57±0.47[b]	36.35±0.47[a]	0.00
BL	57.52±1.09[c]	64.42±0.58[b]	69.69±0.42[a]	0.00
HG	64.00±1.48[b]	71.71±0.62[a]	73.56±0.51[a]	0.00
WH	58.06±0.86[b]	63.58±0.50[a]	64.09±0.38[a]	0.00
RH	59.11±1.18[b]	64.24±0.52[a]	63.83±0.41[a]	0.00
RL	16.00±0.73	16.14±0.19	16.63±0.17	0.13

1PPI: One Pair of Permanent Incisor; 2PPI: Two Pair of Permanent Incisor; 3PPI: Three Pair of Permanent Incisor; BW: Body weight; BL: Body length; HG: Heart girth; WH: Wither's height; RH: Rump height; RL: Rump length; [a, b, c]: superscripts that displays the variation between means; SE: Standard Error.

Table 2 indicates effect of sexual dimorphism on body weight and some linear body measurements of unimproved indigenous goats of Lepelle-Nkumpi Local municipality. Sex had a significant effect ($P < 0.05$) on BW, highly positive statistical influence ($P <0.01$) on HG and RL, and non-significant influence on WH and RH.

Table 2: Effect of sexual dimorphism on body weight and some linear body measurements

| Traits | Sex | | |
	Females Mean ± SE	Males Means ± SE	P-value
BW	34.20±0.59[a]	32.40±0.49[b]	0.02
BL	67.72±0.52	66.64±0.53	0.15
HG	73.47±0.57[a]	71.42±0.53[b]	0.01
WH	63.37±0.40	63.83±0.44	0.45
RH	63.92±0.45	63.60±0.45	0.61
RL	16.81±0.19[a]	16.05±0.16[b]	0.00

BW: Body weight; BL: Body length; HG: Heart girth; WH: Withers height; RH: Rump height; RL: Rump length; P-value: Significant level [a,b] superscripts that indicate difference between means.

Table 3 shows phenotypic relationship between body weight and some linear body measurements of South African non-descript indigenous goats. Findings showed that BW had a highly significant ($P<0.01$) correlation with BL ($r = 0.57^{**}$), HG ($r = 0.27^{**}$), RL ($r = 0.25^{**}$) and RH ($r = 0.17^{**}$), and significant ($P < 0.05$) correlation with WH ($r = 0.11^{*}$). BL showed a highly significant ($P<0.01$) correlation with HG ($r = 0.14^{**}$) and WH ($r = 0.22^{**}$), and non-significant ($P>0.05$) RH ($r = 0.10^{ns}$) and RL ($r = 0.03^{ns}$). HG showed a non-significant ($P>0.05$) correlation with WH ($r = 0.09^{ns}$), RH ($r = -0.01^{ns}$) and RL ($r = 0.06^{ns}$). WH showed a highly significant ($P<0.01$) correlation with RH ($r = 0.24^{**}$) but non-significant ($P>0.05$) correlation with RL ($r = 0.03^{ns}$), while RH showed significant ($P<0.05$) with RL ($r = 0.13^{*}$).

Table 3: Phenotypic correlation between body weight and some linear body measurements of South African non-descript indigenous goats.

Traits	BW	BL	HG	WH	RH	RL
BW	1					
BL	0.57**	1				
HG	0.27**	0.14**	1			
WH	0.11*	0.22**	0.09ns	1		
RH	0.17**	0.10ns	-0.01ns	0.24**	1	
RL	0.25**	0.03ns	0.06ns	0.03ns	0.13*	1

BW: Body weight; BL: Body length; HG: Heart girth; WH: Wither's height; RH: Rump height; RL: Rump length; **: $P < 0.01$; *: $P < 0.05$; ^{ns}: non-significant.

DISCUSSION

Age and sexual dimorphism can be employed as factors that determine body weight and linear body measurements (Aliyu et al., 2021). The study focused on the influence of sexual dimorphism and age on body weight and some morphometric traits of unimproved indigenous goats of South Africa. Analysis of Variance (ANOVA) was employed to determine the effect of age and sexual dimorphism on body weight and morphometric traits. The current study revealed that age had a highly significant influence on rump length, body length, heart girth, withers height and body weight and non-significant influence on rump length.

Results of the study differ from the results of Bekalu et al. (2016) who indicated that all morphometric traits employed in the study were influenced by age. Aliyu et al. (2017) further revealed the findings that were in contrast with the current findings, where it was found that body weight, heart girth, body length and rump height were not influenced by age. This may be due to variation in breeds, location, and age. Results of the current study were in line with the findings of Abegaz et al. (2013) in Abergelle and Western lowland goats of Ethiopia and Western highland goats. The current study results showed a sharp raising trend of all traits correlated with body weight across all age groups except rump length. Age group three had the highest mean values in all morphometric traits. This means that unimproved goats gain more live weight at a later stage. According to Sowande et al. (2010) maturity contribute on the variation of body weight of animals. This means that age of the animals can be used during selection of animals for breeding. The study further looked at the influence of sexual dimorphism on morphometric traits. The findings of this study revealed that sexual dimorphism influenced body length, heart girth, body weight and rump length. The study further indicated that female non-descript indigenous goats had higher mean values as compared to the male non-descript indigenous goats. The study results were

in disagreement with the results of Hulunim et al. (2017), and Yemane et al. (2020), who reported that bucks were heavier in weight and better in some morphometric traits as compared to does. Variation can be caused by breed and the area where animals are found. The males are the ones which are normally known to be heavier than females due to hormone variation between the sexes (De Funentes-Fernandez et al., 2016). Alphonsus et al. (2015) and Aliyu et al. (2021), reported findings that are parallel to the current study findings, where does were found to have better weight as compared to bucks in two Nigerian indigenous goat breeds. On correlation the current study revealed that body weight had a positive highly statistical correlation with body length, rump length, heart girth and rump height, respectively and significant correlation with withers height. The results reported by Khargharia et al. (2015), were in line with the results of the study except rump height and withers height assam hill goats and in disagreement with the results of Tyasi et al (2022), who found heart girth not being correlated to body weight in unimproved South African goat kids. The current study further indicated a great association between body weight and body length. The results were in disagreement with the findings of Dudusola et al. (2019) where heart girth was found as the biometric trait having highest correlation with body weight in West African Dwarf goats. the Difference might be breeds, area, and age. However, the findings reported by Karn et al. (2020), were in concord with the current study finding that stated heart girth was highly associated with body weight. Bekele and Tadesse (2021), results were in disagreement with the results of the study, where heart girth was highly associated with body weight in Horro sheep. These might be due to different species used. The relationship between biometric traits and body weight in the current study means that all the measured traits can be employed to enhance body weight of the goats.

CONCLUSIONS

Sexual dimorphism had positive statistical influence on heart girth, body weight, body length and rump length and none-statistical influence on withers height and rump height, while age had positive statistical influence on body length, heart girth, body weight, withers height and rump height, and non-statistical influence on rump length. These conclude that sexual dimorphism and age can be employed as a determining factor for morphometric traits of unimproved indigenous goats. The correlation coefficient showed that body weight had association with heart girth, withers height, rump height, body

length and rump length. It further indicated the highest correlation between BW and BL. Therefore, the study conclude that BL can be employed as a section criterion for genetic improvement of undescript indigenous goats of South Africa. Therefore, more studies need to be conducted with large sample size, different location, and different animal of interest.

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THE EFFECT OF SODIUM BUTYRATE ADMINISTERED IN OVO ON THE INTESTINAL MICROBIOTA PROFILE AND INTESTINAL MUCOSA IN POULTRY

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Abstract

The administration of bioactive substances is one of the methods of improving health and performance in poultry production. Butyric acid is one of the main metabolites of probiotic bacteria in the body of chickens. Administration of a biochemically available form - sodium butyrate (SB) - allows it to be converted in the host´s digestive tract to the form of butyric acid. As one of the main short-chain fatty acids, it promotes beneficial intestinal microbiota and improves production parameters. The study aimed to determine the effect of early in ovo stimulation of chickens with SB on production parameters, the abundance of indicator bacteria, and the profile of genes expression related to the local immune response in the intestinal mucosa and a panel related to the intestinal barrier function. The in ovo injection into the egg air chamber was performed on the 12th day of incubation. 1000 ROSS 308 hatching eggs were divided into four groups: control (C, injected with physiological saline), SB 0.1% (M1), SB 0.3% (M2), and SB 0.5% (M3). During rearing, chickens were weighed (1, 14, 35, and 42 days of rearing) and feed intake was measured. Body weight, growth rate, body weight gain, average daily body weight gain, feed intake, average daily feed intake, feed conversion ratio, European Production Efficiency Factor, and European Broiler Index were calculated. On the 42nd day of rearing, the chickens were slaughtered and dissected. The intestine content and mucosa of the cecum and ileum were collected for molecular analyses. The relative abundance of indicator bacteria: Lactobacillus spp., Bifidobacterium spp., Escherichia coli, and Faecalibacterium prausnitzii, was determined using the qPCR method. RT-qPCR determined gene expression for two panels: immunological panel including cytokines (Il-1β, Il-2, Il-4, Il-6, Il-8, Il-10, Il-12, IFNγ), and avian beta defensin 1 (AvBD1), and a panel related to the intestinal barrier function: cathepsin (CATHL), Tight Junction Associated Protein (TJAP), Claudin 2 (CATHL2), Mucin 2 and 6 (MUC2 and MUC6). The obtained results for production traits and normalized values for the relative abundance of bacteria and relative gene expression were subjected to statistical testing with post-hoc tests. In ovo administration of SB did not have a statistically significant effect on the production parameters of chickens. In the cecum, SB in each dose significantly (p<0.5) reduced the abundance of Lactobacillus spp., the addition of 0.3% affected the promotion of Bifidobacterium spp. and Faecalibacterium prausnitzii. An increase in the abundance of Faecalibacterium prausnitzii was also determined at a dose of 0.1% in the cecum. In the ileum, the highest dose of SB, 0.5%, resulted in a significant increase in the abundance of Bifidobacterium spp. compared to the other groups. The analysis of relative gene expression in the cecum mucosa showed that in the immune panel, there was a significant increase in the level of Il-1β (M3 compared to the other groups, FC=2.41) and Il-8 in the M1 compared to C (FC =4.64). In M1 and M2, the MUC2 level increased significantly compared to the C (FC=3.92 and FC=3.61, respectively). The lowest dose of SB resulted in a lower relative MUC6 level (FC=0.3) compared to the control and the 0.3% dose. In the ileum, IL-4 was decreased relative to all groups in the M1 (FC=0.27), IFNγ decreased in the M1 (FC=0.7) compared to the M2 (FC=1.82) but no differences were found for C, also the level of defensin AvBD1 in the M1 increased statistically significantly (FC=3.77). Higher doses of SB in M2 and M3 resulted in a decrease in CATHL2 expression (FC=0.11 and 0.12, respectively). MUC6 was down-regulated in all groups after the administration of SB. In the experiment, in ovo administration on the 12th day of egg incubation of SB in three doses did not significantly affect the production parameters of chickens. A high dose of 0.5% SB may have a positive effect on the presence of Bifidobacterium spp. in the ileum, while lower doses of 0.1% and 0.3% seem to be more favorable for the bacterial profile in the cecum. Taking into account the local immune

response at the mRNA level and the gene kinetics related to the poultry intestinal barrier, the lower dose of SB resulted in a greater response from the cecum and ileum mucosa. This was reflected in activating some pro-inflammatory factors such as Il-1β, Il-8, INFγ, and down-regulation of anti-inflammatory IL-4. Significant up-regulation of MUC2 responsible for maintaining the level of mucus that protects the intestinal lumen was determined at doses M1 and M2, which has a beneficial effect on the health of the host. A better understanding of the effect of SB administered in ovo during the embryonic development of chickens requires further research. The study was financed by grant UMO-2021/43/D/NZ9/01548 funded by the National Science Centre (Poland).

Keywords: Poultry; Sodium Butyrate; Microbiota; Gene Expression; Intestinal Health

PREDICTING BODY WEIGHT OF PELIBUEY LAMBS THROUGH BODY MEASUREMENTS WITH MARS ALGORITHM

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Abstract

The present study was performed to estimate body weight (BW) through body measurements, such as Height at Withers (HW), Rump Height (RH), Heart Girth (GC), Abdominal girth (AC), Rib Depth (RD), Body Diagonal Length (BDL), Body length (BL), Pelvic Girdle Length (PGL), Rump Depth (RuD), Hip width (HBW), Abdomen Width (AW), respectively. The data set was taken from El Rodeo commercial farm (17˚ 84″ N, 92˚ 81″ W) located at 14 km along the Villahermosa-Jalapa highway in Tabasco, Mexico. In this respect, 28 Pelibuey lams were used. To predict BW, it was used with the MARS (Multivariate Adaptive Regression Splines) algorithm. The control parameter of the MARS algorithm was used with nprune: 2-38 and degree: 1-11. According to the results of this study, it was showed that determination coefficient (R[2]) was determined as 0.81. In addition, the relationship between actual and predicted BW values were determined as 0.899 within the scope of Pearson's correlation coefficient. As a result, the MARS algorithm may allow breeders to obtain an elite population and to identify body sizes influencing BW as indirect selection criteria to define breed definition in Pelibuey lambs and assist rural development with sustainable livestock farming in Mexico.

Keywords: *Pelibuey, lamb, MARS, body measurement, determination coefficient*

DETERMINATION OF IN VITRO METHANE PRODUCTION OF POMEGRANATE PEEL AND OREGANO PULP SUPPLEMENTATION IN RUMINANT DIET

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Abstract

This study was carried out to determine the effects of pomegranate peel and oregano pulp additives at different ratios (2, 4, 6, 8%) in sheep rations on methane production and rumen fermentation using in vitro gas production technique. In the study, 9 rations were prepared without additives and containing 4 different levels of pomegranate peel and oregano pulp. Rumen fluid was taken from 2 cows fed mainly with roughage, and a total of 36 feed samples, 4 repetitions and 4 blanks for each feed group, were put into syringes and incubated for 24 hours. Total gas production of oregano pulp was lower than control ($p < 0.010$). No difference was observed between the additive levels and interactions of pomegranate peel and oregano pulp. The use of pomegranate peel and oregano pulp reduced rumen fluid VFA levels. However, 2% pomegranate peel additive increased VFA levels. Pomegranate peel did not change in vitro organic matter digestion and metabolic energy levels compared to the control group, while oregano pulp decreased these parameters. These results suggest that pomegranate peel and oregano pulp can be used at the level of 2% in terms of reducing the cost of forage in ruminant animals.

Keywords: Ruminant, Methane Production, Rumen Parameters, Pomegranate Peel, Oregano Pulp

USING MULTIVARIATE ADAPTIVE REGRESSION SPLINES TO ESTIMATE BODY WEIGHT AT WEANING OF SOUTH AFRICAN SUSSEX COWS

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Abstract

The Sussex cattle is one of the pure breeds in South Africa that is reared for beef meat production. The use of multivariate adaptive regression splines (MARS) to predict the live body weight at weaning age of the South African Sussex cows remain poorly understood. This study was conducted to determine the effect of linear body measurement traits on the body weight of South African Sussex weaner cows using MARS data mining algorithm. A total of 57 South African Sussex cows at weaning between six to eight months old were used to collect the body weight (BW) and linear body measurements such as sternum height (SH), withers height (WH), heart girth (HG), hip height (HH), body length (BL), rump length (RL), and rump width (RW). Multivariate adaptive regression splines was used to design the model to predict the BW at weaning from linear body measurements of South African Sussex cows. The predictive model was achieved from the training dataset with the highest Pearsons correlation coefficient and coefficient of determination (0.84 and 0.71) respectively. The BW was positively influenced when the HG > 142cm and HH > 111cm with a coefficient of 3.69 and 3.30 respectively. Our finding suggest that MARS can be used by reseachers to predict live body weight of South African cows. These finding might be useful to cattle farmers in the selection criterions of breeding stock at weaning age.

Keywords: _Body length, goodness of fit criteria, Correlation, Linear body measurements_

INTRODUCTION

Sussex cattle animals are one of the oldest and pure breeds of English cattle used for meat production in the world (Bila, 2019). Moreover, the Sussex cattle breed is characterized by a red to dark-red colour coat with a unique white tail switch of beef cattle from the Weald of Sussex, Surrey and Kent in South Eastern England (Bila, 2019). The live body weight is used by farmers on daily basis for farm management activities such as assessment of response to a different diet, growth rate and determining the growth traits (Hlokoe et al., 2022). Moreover, the knowledge of animal weight and weight changes is also important in determining responses to genetic selection (Lukuyu et al., 2016). Faraz et al. (2021) reported that Multivariate Adaptive Regression Splines (MARS) and Classification and Regression Tree (CART) data mining algorithms overcome the multicollinearity problems in predicting body weight. Fatih et al. (2021) reported that the MARS data mining algorithm is a non-parametric regression technique that does not need any supposition about the distribution of the variables and correlation among the variables entered into the predictive model to be built into statistical

evaluation. MARS have been used to predict body weight in Holstein-Friesian and Brown Swiss Cattle (Aytekin et al., 2018), camel (Fatih et al., 2021) and Kars Sheperd dogs (Celik and Yilmaz, 2021). However, based on our knowledge, there is limited information on the use of MARS to predict the effect of linear body measurements on body weight of South African Sussex weaner cows. Hence, the objective of the study was to determine the effect of linear body measurements on the body weight of South African Sussex weaner cows using MARS data mining algorithm. This study might help cattle farmers to use linear body measurements during selection programs for breeding purposes to improve the body weight of cows.

MATERIALS AND METHODS
Study area
This research study was carried at Huntersvlei farm known as Rhys Evans Group (RE) in the Free State Province, South Africa (Figure 1). The farm is located in Viljoenskroon, under Fezile Dabi municipality; the site, temperatures, latitudes, longitude, and rainfall of the study area similar as described by Bila (2019). Huntersvlei farm is one

of the oldest and leading Sussex cattle stud herd in South Africa.

Figure 1. Map of Huntersvlei farm in the Free State Province of South Africa.

Animal management

All the animals used in this study were exposed to a traditional management grazing system which allows animals to freely graze in the camps during the day and afternoon. Fresh clean water was available in the camps at all times. Animals received a routine inspection and dipping for herd health management purposes. The linear body measurements were taken while the animal was in a standing position with head raised up and weighed on all four feet. A functional handling facility with a crowding pen, working crush and head clamp was used for handling the animals to minimize movement during the measuring process.

Data collection

Linear body measurements and live body weight at weaning were taken in 57 Sussex cows at weaning. The animals used in the study at weaning age were between six to eight months old. The live body weight (BW) at weaning as well as calf birth weight (CBW) was measured using a balance weighing scale whereas linear body measurements were measured using a measuring tape calibrated in centimetres (cm). The body weight at weaning and linear body measurements namely sternum height (SH), withers height (WH), heart girth (HG), hip height (HH), body length (BL), rump length (RL), and rump width (RW) were measured following the guideline defined by Bila et al., (2021) and Hlokoe et al., (2022). To prevent individual variations in the measurements, only one individual was taking the body weight and linear body measurements.

Statistical analysis

The Statistical Package for Social Sciences (IBM, 2021) version 28.0 with a probability of 5% for significance was used for analysis. Package in R was used to construct the heat map for the correlation among linear body measurements using the study of Eyduran et al. (2019). Decision tree algorithms were used to design the model to estimate body weight at weaning from linear body measurements of SA Sussex cattle weaners using the study of Eyduran et al. (2019). The cross-validation was kept at 10, as recommended by Celik and Yilmaz, (2018). Moreover, the goodness of fit criteria was used to perform the estimation

of body weight at weaning from linear body measurements of SA Sussex cattle weaners of MARS (Faraz et al., 2021).

Multivariate adaptive regression spline algorithm

The multivariate adaptive regression spline algorithm is a non-parametric machine learning algorithm introduced by Friedman (1991) for handling pattern recognition problems in regression. For this purpose, the MARS model fits a series of linear regression functions for predicting the values of the continuous dependent variable Iqbal et al., (2023). A multivariate adaptive regression spline algorithm was carried out as described by Hlokoe et al., (2022) and Iqbal et al., (2023). MARS data mining algorithm can be defined as:

$$f(x) = \beta_0 + \sum_{M=1}^{M} \beta_m \prod_{k=1}^{k_m} h_m(X_{v(k,m)})$$

Where:

f(x) is the estimated value of the dependent variable, β_0 and β_m are intercept, $h_m(X_{v(k,m)})$ is the basis function, where $v(k, m)$ is an index of the predictor for the m_{th} component of the k_{th} product, K is the parameter regulating the order of interaction. After building the most suitable MARS model, the basic functions that did not contribute much to the model fitting performance were removed in the pruning process based on the following generalized cross-validation error (GCV) (Hlokoe et al., 2022, Eyduran et al., 2019; Zarboski et al., 2019).

$$GCV(\lambda) = \frac{\sum_{i=1}^{n}(y_i - y_{ip})^2}{\left(1 - \frac{M(\lambda)}{n}\right)^2}$$

Where:

n is the number of training cases, y_i is the observed value of a response variable, y_{ip} is the estimated value of a response variable, and $M(\lambda)$ is a penalty function for the complexity of the model with λ terms.

Performance of the MARS model: Package in R was used in the statistical evaluation of the MARS data mining algorithms using EhoGof package (version 0.1.1) introduced by Eyduran (2020).

RESULTS

Descriptive statistics of calf birth weight, body weight at weaning age and linear body measurements for both female weaners are presented in Table 1.

Table 1. Descriptive statistics of body weight and linear body measurements in South African Sussex weaner cows.

TRAITS	MEAN ± SD	Minimum	Maximum
CBW (kg)	38.75 ± 5.49	25.00	47.00
BW (kg)	236.23 ± 39.55	162.00	316.00
HL (cm)	39.32 ± 2.10	35.00	45.00
HW (cm)	12.54 ± 0.93	10.00	15.00
EL (cm)	13.39 ± 1.03	11.00	17.00
EW (cm)	9.91 ± 0.54	8.00	11.00
SH (cm)	58.77 ± 0.43	52.00	64.00
WH (cm)	104.42 ± 5.04	95.00	115.00
HG (cm)	147.61 ± 8.99	131.00	165.00
HH (mm)	111.12[b]± 6.56	97.00	122.00
BL (cm)	117.47 ± 10.17	92.00	135.00
RL (cm)	38.84 ± 3.38	31.00	48.00
RW (cm)	31.93 ± 3.94	24.00	39.00

CBW: calf birth weight, BW: body weight, SH: sternum height, WH: withers height, HG: heart girth, HH: hip height, BL: body length, RL: rump length, RW: rump width, SD: standard deviation.

Figure 2 depicts Pearson's correlation coefficients for estimating the correlation between body weight at weaning and linear body measurements. The body weight of Sussex cows at weaning age was highly correlated with HG 0.76 ($p < 0.01$) followed by HL 0.74 ($p < 0.01$) while insignificant correlated with SH 0.23 ($p > 0.05$). Moreover, the body weight at weaning age was found highly significant ($p < 0.01$) correlated with WH (0.60), HH (0.62), BL (0.44), RL (0.41) and RW (0.60). On the other hand calf body weight showed a highly significant ($p < 0.05$) correlated with WH 0.41 and HG 0.41.
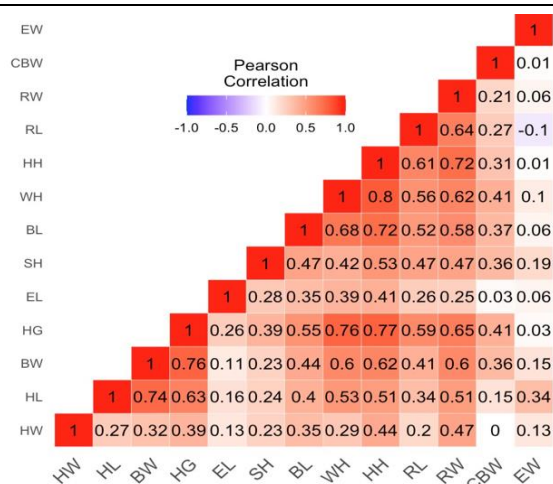
Figure 2. Heat map of body weight correlation of measured traits in South African cows at weaning age. Correlation colour demonstration is as follows: high correlation is red, mid correlation is white and low correlation is blue. CBW: calf birth weight, BW: body weight, SH: sternum height, WH: withers height, HG: heart girth, HH: hip height, BL: body length, RL: rump length and RW: rump width.

Table 2 below shows the MARS data mining algorthm model results. The MARS model created showed that HG and HH were included in the model. The established model showed only two basic functions from the MARS model with two single order term variables with an intercept of 198.42. Furthermore, the MARS described the

influence of linear body measurements with positive coefficient on BW. Lastly, the influence on body weight of Suusex weaner cows was in a positive direction, thereby the model coefficeint was 3.69 when HG was greater than 142 cm and the model coefficient was 3.30 when the HH was greater 111 cm.

Table 2. MARS model

BF	Equations	Coefficients
Intercept		198.42
BF1	Max (0; HG − 142)	3.69
BF2	Max (0; HH − 111)	3.30

BF: basic function, Max: maximum, HG: heart girt and HH: hip height

Performance of the MARS model
The performance for the MARS model results of training and test dataset based on goodness of fit is given in Table 3. The results indicated that the best estimative model was realized from the training dataset for the proportion 77% (Training) – 23% (Test). Furthermore, the training set had the lowest RMSE, RRMSE, SDR, MAPE, CV, RAE, PI, and ME. While, the test set had the lowest AIC, MAD, Rsq and ARsq than those of the training set. Lastly, the Pearson's correlation values for the training set were higher than those of the test set.

Table 3. Predictive performances of the MARS model for training and test data sets

CRITERIONS	Training	Test	DECISION
Pearson's correlation coefficient (r)	0.84	0.76	Greater is better
Root mean square error (RMSE)	20.87	29.61	Smaller is better
Relative root mean square error (RRMSE)	8.78	12.94	Smaller is better
Standard deviation ratio (SDR)	0.54	0.66	Smaller is better
Coefficient of variation (CV)	8.87	12.39	Smaller is better
Mean absolute percentage error (MAPE)	6.96	9.08	Smaller is better
Relative approximation error (RAE)	0.01	0.04	Smaller is better
Akaike's information criterion (AIC)	291.60	73.76	Smaller is better
Performance index (PI)	4.77	7.37	Smaller is better
Mean error (ME)	0.00	3.55	The expected value is zero
Mean absolute deviation (MAD)	16.12	20.54	Smaller is better
Coefficient of determination (Rsq)	0.71	0.47	Greater is better
Adjusted coefficient of determination (ARsq)	0.69	0.21	Greater is better

DISCUSSION
The body weight estimation approach based on linear body measurements are broadly used to determine the relationship between linear body measurement traits of animals (Rashijane et al., 2023). Morphological traits have an important role in predicting body weight particularly where the precision can be up to 90% of the actual body weight (Hlokoe et al., 2022). Firstly, the study

determined the descriptive statistics of the body weight and linear body measurements of SA Sussex weaner cows. The descriptive statistics showed that the minimum calf birth weight was 25 kg while the maximum calf birth weight was 47 kg. These findings are in-lined with the findings of Bila et al., (2022) who reported a birth weight mean numeric value of 35 kg in SA Sussex cattle. Secondly, the study examined the correlation between body weight and linear body

measurements of SA Sussex cows. The correlation results showed that the body weight at weaning had a high positive significant correlation with HG, HL, WH, HH, BL, RL and RW. These findings are similar with the reports made by Hlokoe et al. (2022) in Nguni cows who revealed that the body weight was highly significant correlated with rump height, body depth, heart girth, head length, body length, withers height and sternum height. While on the other hand, the calf birth weight was highly significant correlation with WH and HG. Furthermore, Hlokoe et al., (2022) reported that when characteristics are positively correlated, it means that those characteristics are controlled by one gene. The current findings are in-agreement with the reports made by Putra et al., (2015) in Aceh cattle and Lukuyu et al. (2016) in crossbred dairy cattle in smallholder farmers in Kenya. Our correlation findings suggest that that improving HG, HL, WH, HH, BL, RL and RW improve body weight of South African Sussex weaner cows. Rashijane et al. (2023) reported that the correlation coefficient does not provide the effect of linear body measurements on body weight. Hence the MARS data mining algorithm was adopted to examine the effect of the linear body measurements on body weight. The MARS results showed that the best predictive model was achieved from the data with a proportion of 77:23 thereby 77% was for the training and 23% was for the test. Furthermore, the predictive performance of the MARS data mining algorithm of the present study showed that RMSE, RRMSE, SDR, MAPE, CV, RAE, PI, and ME had the lowest training dataset than the test. While, the test set had the lowest AIC, MAD, Rsq and ARsq than those of the training set. Pearson's correlation values for the training set were higher than those of the test set. Our findings are similar with the reports made by Rashijane et al., (2023) in Savana goats. Fatih et al., (2021) reported that MARS can be used for estimate live body weight in Camel breeds in Pakistan with a higher coefficient of determination and adjusted coefficient of determination (0.95 and 0.92) as compare to our findings. Our MARS data mining algorithms results shows that MARS might be used to estimate live body weight from linear body measurements of SA Sussex weaner cows using 77:23 dataset proportion for training and test datasets. These findings agree with Rashijane et al. (2023) in Savana goats and Agyar et al. (2022) who indicated that multivariate adaptive regression splines data mining algorithm had better identification properties than other prediction models.

CONCLUSIONS

The current study revealed that HG and HH had an effect on the body weight of South African Sussex weaner cows as indicated by the multivariate adaptive regression splines. Further studies are recommended on the use of MARS and other data mining algorithms using bigger samples and other cattle breeds to examine the effect of linear body measurements on the body weight.

Author's contributions

L Bila., D.P Malatji. and T.L Tyasi conceptualization of the manuscript. L Bila. was responsible for the data analysis and writing the original draft. D.P Malatji. and T.L Tyasi, responsible for the supervision, project administration and the assessment of the final manuscript. All the authors have read and agreed to the published version of this manuscript.

Data availability

For data requests, please contact the author L Bila

Ethics approval

The experimental procedures were conducted following the University of South Africa (UNISA) Ethics code for the use of live animals in research, ethics reference number: 2022/CAES_AREC/171.

Conflict of interest

The authors declare no conflict of interest.

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EFFECT OF GENOTYPE AND HOLDING DURATION ON SOME POST-HATCH TRAITS OF DAY-OLD BROILER PURE LINE CHICKS

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Abstract

In this study, it was aimed to investigate the effects of varying holding durations on some post-hatching characteristics of broiler pure line chicks with different selection backgrounds. In the study, 50 day-old chicks from each of 3 dam (A1: slow- feathering, A2: fast- feathering, A3: slow- feathering) and 1 sire (B1: fast- feathering) ANADOLU-T broiler pure lines were used. Ten chicks of each genotype were treated with holding durations of 12, 24, 36 and 48 h. At the end of each holding duration, individual chick weight (g), weight loss (g, %), chick length (mm), wing feather length (mm), rectal temperature (oC), yolk sac weight (g, %) and yolk-free body mass (g) were determined. Hatching egg weights were similar in A1 (60.9 g), A2 (60.9 g) and B1 (61.1 g) lines, but higher than A3 (59.2 g) (P<0.001). Chick weights were significantly different between genotypes both at hatch and at each holding duration (P<0.01) and B1 line chicks were the heaviest, A3 the lightest. Absolute and relative weight loss occurred in the A3, B1, A1 and A2 lines as 3.7 g and 8.6%, 3.6 g and 8.8%, 3.0 g and 7.3% and 3.1 g and 7.2%, respectively (P<0.01). As the holding duration progressed, the weight loss also increased and the 12, 24, 36 and 48 h holding durations caused a weight loss of 4.4%, 6.8%, 8.3% and 12.4%, respectively (P<0.001). While the chick length increased linearly as the holding duration progressed in the B1 and A2 lines, it decreased after the 12 h holding period in the A1 line chicks (Interaction effect, P=0.026). The A1 (11.1 mm) and A3 (9.8 mm) line chicks had significantly shorter wing feather lengths (P<0.001) than A2 (15.4 mm) and B1 (15.1 mm) chicks. Rectal temperature values were lower in the A1 line than the others (P<0.01). Genotype x holding duration interaction on yolk sac weight and percentage was significant (P<0.05). A3 chicks with the highest yolk sac weight (6.2 g) and percentage (15.2%) at hatching had higher yellow sac absorption than other genotypes during the 48 h holding period. Yolk-free body mass was the highest in B1 (36.7 g) and lowest in A3 chicks (34.5 g) (P<0.001). In conclusion, chick weight, chick length and yolk-free body mass were greatly influenced by egg weight. Regardless of the genotype, the extended holding durations at hatch resulted in deterioration in the general chick quality. Further studies are needed to reveal embryonic development and early post-hacth chick characteristics that are likely altered by different selection strategies for each pure line.

Keywords: *Broiler; Pure Line; Selection; Hatching; Holding Duration; Chick Quality*

INVESTIGATION OF SHEEP WELFARE MODELS WIDELY USED IN THE WORLD

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Abstract

In this review, existing protocols for assessing the welfare of sheep are reviewed. Among these protocols, the similarities and differences between animal-based protocols were revealed. A total of 6 protocols were examined in the study. These; Protocol of Napolitano (2009), AWIN Protocol (2015), Protocol of Munoz (2018, 2019), Protocol of Stubsjøen (2011) and Protocol of Phythian (2019). A total of 32 animal-based criteria were identified in these protocols. Four of these criteria were examined in all protocols. These; Lameness / Gait score, Body condition score, Tail length / Mutiliations and Skin lesions. Also, 5 criteria were examined in at least 5 protocols. These; Fleece cleanliness, Hoof overgrowth / Hoof condition, Faecal soiling / Diarrhoea, Fleece quality / Fleece condition and Mastitis or other udder problems. As a result, all protocols can be applied to animals with little inconvenience, without extra cost and with little labour. Also, these protocols may provide preliminary information for other species. In addition to the proposed methods for determining the welfare of sheep, it may be suggested to include Precision Livestock Farming (PLF) devices.

Keywords: Sheep, Welfare, Animal-based

INTRODUCTION

Sheep breeding is important in the world in terms of nutrition, employment, rural development and rural sociology, and in the evaluation of weak pastures and fallow lands. Indigenous sheep breeds, especially, have a wide range of adaptive traits that have evolved for thousands of generations with natural and artificial selection, which constitute the main pillars of food security and sustainable production in many countries.

Animal welfare has always been an issue of concern to varying degrees in our society and has evolved enormously over the years (Zufferey et al., 2021). Considering the increasing consumer sensitivity, in order to evaluate the welfare level of farm animals, animal welfare indicators can be sorted in three categories: 1. animal-based (general health conditions, foot health, injuries, body condition score, etc.), 2. resource-based (settlement density, floor quality, compartment sizes, ventilation, etc.) and 3. management-based (farmers' policies and management practices, etc.). Animal-based parameters are particularly relevant to sheep that are traditionally housed for short periods in winter (Napolitano et al., 2009). However, resource-based parameters are also important as these animals are often kept indoors at night (Caroprese et al., 2016). Therefore, animal-related indicators should be included in welfare systems by monitoring the welfare of sheep. To meet these expectations, it is imperative that a valid and understandable protocol, based on coherent indicators, must be developed to attest welfare (Zufferey et al., 2021).

The purpose of this review is to examine the feasibility of animal-based welfare protocols in sheep and to reveal the similarities and differences between these welfare protocols. Protocols based on animal-based welfare indicators are discussed under the following headings.

Protocol of Napolitano

This protocol elaborated by Napolitano et al. (2009) in Italy. The protocol is based on four categories (Locomotion/social interaction, Flooring, Environment and Management) derived from the Animal Needs Index for cattle (Bartussek, 2000). In addition to these four categories, a fifth category was added directly on animals. The list of criteria examined according to the Napolitano protocol is presented in Table 1.

Table 1. According to Protocol of Napolitano detailed scores

Categories	Min/Max Score
Ⅰ) Locomotion/social interaction	−0.5 / 20.5
a. Indoor space allowance	0.0 / 3.5
b. Herd structure	0.0 / 2.0
c. Management of replacement	−0.5 / 3.0
d. Space at manger	0.0 / 3.0
e. Water availability	0.0 / 2.5
f. Outdoor space allowance	0.0 / 3.0
g. Pasture months/year	0.0 / 3.5
Ⅱ) Flooring	−1.0 / 12.0
a. Comfort	−0.5 / 2.5

b. Cleanliness	0.0 / 2.5
c. Slipperiness	0.0 / 2.5
d. Ease of passage	0.0 / 1.0
e. Slipperiness	0.0 / 2.0
f. Floor	−0.5 / 1.5
Ⅲ) Environment	0.0 / 10
a. Thermoregulation - Pasture	0.0 / 1.5
b. Thermoregulation - Barn	0.0 / 1.5
c. Outdoor Paddock	0.0 / 1.5
d. Pasture - Grass quality	0.0 / 1.5
e. Pasture - Steepness	0.0 / 1.5
f. Pasture - Months/year	0.0 / 2.5
IV) Management	−1.0 / 7.0
a. Cleanliness of feeding area	0.0 / 1.5
b. Cleanliness of drinking area	0.0 / 1.0
c. Cleanliness of resting area	0.0 / 1.5
d. Conditions of equipments	0.0 / 1.0
e. Animal checking	0.0 / 1.0
f. Hospital pen	−1.0 / 1.0
V) Animal-based parameters	−8.0 / 22.0
a. Condition of integument	−1.0 / 3.0
b. Cleanliness of sheep	−1.0 / 3.0
c. Condition of hooves	−1.0 / 3.0
d. Lameness	−1.0 / 3.0
e. Lesions	−1.0 / 3.0
f. Body condition	−1.0 / 3.0
g. Mutilations	−1.0 / 1.0
h. Culling age	−1.0 / 1.0
Total Score	−10.5 / 71.5

The animal-based parameters examined in this section are scored as Optimal (3), Good (2), Medium (0) and Poor (-1). Each measure results in a score depending on its prevalence in the herd. The more frequent violations for a specific indicator are observed within the herd, the lower the assigned score. Calculate the percentage of affected animals as indicated in Table 2 after at least 20% of the herd has been observed. The separate indicator scores are then expressed as numeric values and summarized to a final score.

Table 2. Evaluation percentages of applications on animals according to the protocol

Evaluation	Criteria a, b	Criteria c, d, e, f
Optimal	≥5	≥5
Good	≥10	≥10
Medium	≥50	10-25
Poor	<50	<25

It was reported that the indicators included in this system for on-farm assessment of animal welfare are valid (meaningful with respect to animal welfare), reliable (reflecting the tendency to give the same results on repeated measurements) and feasible (concerning time and financial requirements) (Napolitano et al., 2009).

AWIN Protocol
Animal-based measures are considered by EFSA to be "the most appropriate indicators of animal welfare and a carefully selected combination of animal-based measures can be used to assess the welfare of a target population in a valid and robust way" (EFSA, 2012). The European Commission emphasizes the use of science-based animal welfare indicators as a possible means to simplify the legal framework and allow flexibility to improve competitiveness of livestock producers (EFSA, 2012).

Figure 1. Welfare principles and criteria according to Welfare Quality®

The first welfare assessment protocols built on animal-based measures were developed by the Welfare Quality® project for pigs, poultry, dairy and beef cattle (Keeling et al., 2013). Then, it developed a scheme where the needs of animals are related to four principles and twelve criteria, considered necessary to cover all aspects of animal welfare (Fig. 1). This approach was the basis for future research on welfare assessment at farm level.

The AWIN protocol is based on a two-level approach, a firstly herd-level approach and

secondly an in-depth individual-level assessment (Dwyer et al., 2015). The number of animals to be examined according to the number of animals in the barn is shown in Table 3. At the first level, a screening of the flock is carried out with robust and rapid animal-based indicators with no or minimal animal handling. Performing the second level assessment is recommended when there is non-compliance with the current animal welfare legislation or if the assessment of specific indicators results in the assessed farm belonging to the lowest 5% of the farms in the reference population. The second level consists of a more detailed and in-depth assessment requiring restraining the animals and collecting individual data. According to this method, animals are examined according to the scheme shown in Table 4 (Dwyer et al., 2015).

Table 3. The number of sample brood sheep to be examined in the farms (AWIN, 2015)

Number of sheep	Suggested sample	Minimum samples	Number of sheep	Suggested sample	Minimum samples
<15	All animals	All animals	225-249	68	53
15-19	13	13	250-299	70	54
20-24	17	16	300-349	73	56
25-29	20	19	350-399	76	57
30-34	23	21	400-449	78	57
35-39	26	24	450-499	80	58
40-44	29	26	500-599	81	59
45-49	31	28	600-699	83	60
50-59	33	29	700-799	85	61
60-69	37	32	800-899	86	62
70-79	41	35	900-999	87	63
80-89	44	37	1000-1099	88	63
90-99	47	39	1100-1299	89	64
100-124	49	41	1300-1499	90	65
125-149	55	44	1500-1699	91	65
150-174	59	47	1700-1799	91	66
175-199	63	49	>1800	92	66
200-224	65	51			

Table 4. According to AWIN animal welfare indicators for sheep (Dwyer et al., 2015)

Welfare Principles	Welfare Criteria	Welfare Indicators
1. Good feeding	Appropriate nutrition	1a. Body condition 1b. Score lamb mortality
	Absence of prolonged thirst	1c. Water availability
2. Good housing	Comfort around resting	2a. Fleece cleanliness
	Thermal comfort	2b. Panting 2c. Access to shade / shelter (outdoors only)
	Ease of movement	2d. Stocking density (housed animals only) 2e. Hoof overgrowth (housed animals only)
3. Good health	Absence of injuries	3a. Body and head lesions 3b. Leg injuries 3c. Lameness 3d. Faecal soiling
	Absence of disease	3e. Mucosa colour 3f. Ocular discharge 3g. Mastitis and udder lesions (lactating ewes only) 3h. Respiratory quality 3ı. Fleece quality
	Absence of pain	3j. Tail length
4. Appropriate behaviour	Expression of social behaviour	4a. Social withdrawal
	Expression of other behaviour	4b. Stereotypy 4c. Excessive itching
	Good human-animal relationship	4d. Familiar human approach test
	Positive emotional state	4e. Qualitative behaviour assessment

Protocol of Phythian

This protocol described to assess the welfare of sheep by Phythian et al. (2019). Sixteen animal-based indicators of sheep welfare, previously selected by a stakeholder panel, and based on the Farm Animal Welfare Council (FAWC) Five Freedoms, were assessed in terms of the level of inter-observer agreement achieved during on-farm testing. Eight observers independently tested the 16 indicators on 1158 sheep from 38 farms in England and Wales. The recommended criteria according to this protocol are presented in Table 6. These indicators may be applied by producers, veterinary surgeons, farm assurance and certification assessors, or farm animal welfare inspectors as robust and feasible tools in on-farm assessments.

Protocol of Stubsjøen

This protocol described to assess the welfare of sheep in 36 farms in Norway by Stubsjøen et al. (2011). They adapted the animal welfare protocol established for dairy cattle, based on the "Five Freedoms" to sheep. These five freedoms: 1. freedom from hunger and thirst, 2. freedom from discomfort, 3. freedom from fear and stress 4. freedom from pain, injury or disease and 5. freedom to express normal behaviour (Brambell, 1965). Sixteen animal-based, 15 resource-based and three measurements on production records (slaughter weight, carcass classification and fat class) were selected. The animal-based indicators are presented in Table 6.

There were two parts to the protocol; the animal- and resource-based measurements obtained during farm visits, and the analysis of production data. A fear test was conducted, and ewes were scored on a scale from 0 to 3. The assessment starts with a flock observation to detect signs of clinical disease, lameness and coughing. Finally, resource-based indicators such as relative humidity or temperature are measured three to 27 times, depending on the farm's sizes, and an average is calculated. On average, three to five hours are needed to carry out the assessment and all the observations are carried out indoors. The second part, the analysis of production data, includes individual information on carcass weight, fat class and carcass classification. Then ten randomly selected animals undergo a clinical examination. The assessment took place during lambing season. Finally, in the animalbased measurements, the animal's behaviour is observed to assess anxiety levels and the human–animal relationship.

Protocol of Munoz

Two protocols published by Munoz et al. (2018, 2019), include animal-based indicators and were developed for extensively managed sheep. The first protocol was tested on 100 randomly selected ewes from a larger flock of about 3000 breeding ewes in Victoria, Australia. Each animal was studied at three key stages: pregnancy, lactation and weaning. The ewes were kept in four groups of 25 animals. The criteria examined in this protocol are presented in Table 5. The indicators included in this protocol were able to detect impaired welfare and welfare risks in extensively managed systems (Munoz et al., 2018).

The second protocol is an adaptation of the first one (Munoz et al., 2019). This protocol was tested on 32 commercial sheep farms in Victoria, Australia. Farms in the study were visited twice (at mid-pregnancy and weaning). For the protocol, six animal-based indicators were considered to be the most important (Table 5). In addition, the number of ewes that required further care, defined as sick or injured, was recorded.

Table 5. According to Protocol of Munoz animal welfare indicators (Munoz et al., 2018; 2019)

Welfare Indicators	Score Range	Munoz (2018)	Munoz (2019)
Body condition score	1-5	*	*
Rumen fill	0-1	*	
Fleece cleanliness	0-3	*	
Fleece condition	0-2	*	*
Skin lesions	present / not	*	*
Tail length	0-1	*	*
Dag score	0-5	*	*
Foot-wall integrity	0-3	*	
Hoof overgrowth	0-2	*	
Lameness	0-3	*	*

Conclusion

This review, a total of five protocols and 33 animal-based indicators were identified validated in the literature. All the protocols need limited resources, effort and can be applied with little disturbance for the animals. Although a direct comparison between sheep and cattle is not possible, the models used here may also provide preliminary information for other species.

Generally, conditions such as poor quality grazing, harsh weather conditions, very primitive shelters are likely to occur in the holdings. In these cases, factors such as nutritional shortage, heat stress, decreased survival rate of newborn lambs and metabolic diseases adversely can affect animal welfare. In addition, the shortage of skilled labor is another negative factor.

Future studies should develop practical technologies that can assist in the detection of the welfare issues identified in this study. In recent years, with the development of agricultural technological tools, the use of Precision livestock farming (PLF) in the field of animal welfare has increased. For example; such as automatic weighing and BCS measurement at the entrance of the barns, practical GPS tracking sensors, remote temperature monitoring, pregnancy diagnosis, blood parameter measurements. In addition to the proposed methods for determining the welfare of sheep, it may be suggested to include PLF devices.

Further work examining the effect of farm management type and seasonal influences on physical outcomes of sheep health and welfare could provide further evidence of the validity of these animal-based welfare indicators.

Table 6. List of animal-based sheep welfare indicators included in the different assessment protocols

Indicator	Napolitano (2009)	AWIN (2015)	Munoz (2018)	Munoz (2019)	Stubsjøen (2011)	Phythian (2019)
Lameness / Gait score	*	*	*	*	*	*
Body condition score	*	*	*	*	*	*
Tail length / Mutiliations	*	*	*	*	*	*
Skin lesions/ Integument condition	*	*	*	*	*	*
Fleece cleanliness / Abdomen Cleanliness	*	*	*		*	*
Hoof overgrowth / Hoof condition	*	*	*		*	
Faecal soiling / Diarrhoea / Breech Cleanliness		*	*	*	*	*
Fleece quality / Fleece condition / Wool Loss		*	*	*	*	*
Mastitis or other udder problems		*	*	*	*	*
Familiar human approach / Fear / Flight distance		*	*	*		
Excessive itching / Pruritis		*	*			*
Ocular discharge / Eye abnormalities		*			*	*
Panting		*	*			
Social withdrawal		*	*			
Qualitative behaviour assessment		*	*			
Respiratory quality / Coughing		*			*	
Swollen joints					*	*
Lamb mortality		*				
Water availability		*				
Access to shelter		*				
Stocking density		*				
Mucosa colour		*				
Stereotypy		*				
Rumen fill			*			
Aggression			*			
Animal appears sick					*	
Callus on carpus					*	
Nasal discharge					*	
Ear tag torn out					*	
Dental Abnormality						*
Leg injuries / Injuries and Wounds						*
Myiasis						*
Fit – Fat – Thin						*

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ANTIMICROBIAL SUSCEPTIBILITY STUDY OF PATHOGENIC AND COMMENSAL BACTERIA RECOVERED FROM CATTLE AND SHEEPS

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Abstract

Administering antibiotics to animals in their food leads to the emergence of multidrug resistant bacteria that makes the treatment of infections more challenging. Enterobacteriaceae of livestock, though commensal in nature, serves as reservoir for antimicrobial resistance with the potential of disseminating them. This study sought the antimicrobial resistance profiles of the antimicrobial resistance profiles of third generation cephalosporin (3GC) resistant Enterobacteriaceae in broilers, pigs, and cattle in coli in broilers, pigs, and cattle in Batna, northeast Algeria. A total of 57 rectal swabs were analyzed for Enterobacteriaceae by using biochemical techniques. Susceptibility to antibiotics was determined by the Kirby–Bauer disk diffusion technique. The prevalence of 3GC-resistant enterobacteriaceae was 50% in cattle and 28% in sheep. The predominant species were Escherichia coli and Enterobacter cloacae (56.52%), followed by Klebsiella oxytoca Citrobacter freundii then Serratia odorifera, Klebsiella pneumoniae, and Proteus mirabilis Antibiotic sensitivity testing revealed varying resistance rates, the highest being 68.75% towards amoxicillin-clavulanic acid, 56.29% for tetracycline, 50% for cefotaxime and 12.5% for gentamycine for cattle isolates, 71.42% of strains resistant to amoxicillin-clavulanic acid and tetracycline, 57.14% to cefotaxime for sheep isolates. All enterobacteriaceae isolates were susceptible to imipenem. Extendedspectrum ß -lactamase (ESBL) isolates was observed in 62.5%, 57.14% of cattle and sheep respectively.high resistance of 93.75% to amoxicillin, an intermediate resistance of 87.5% to amikacin. 29.27% of C3G-resistant enterobacteria were BLSE producers.

Keywords: Antimicrobial Resistance, Extended-Spectrum Beta-Lactamase; Enterobacteriaceae, Cattle, Sheep

CERVICO VAGINAL MUCUS RNA QUALITY, QUANTITY, AND INTEGRITY IN CATTLE FOR NGS STUDIES

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Abstract

In the presented project, the aim is to optimize the cervico-vaginal mucus (CVM) nucleic acid isolation technique and to reach the minimum required RNA quality, quantity and integrity for further NGS studies. For this purpose inseminated cattle in the critical period from the embryo´s recognition by the mother to the implantation, which is one of the most important stage of reproduction in cows, has been used. CVM secreted by epithelial cells covers the vagina, cervical canal, uterus and ovaries. Recent studies shown that CVM can be used as an important biomarker tool for disease diagnosis, monitoring disease progression and pregnancy process in cows. Nucleic acids originating from the destruction of leukocytes, epithelial cells and symbiotic bacteria are also found in the mucus of healthy animals. After isolation process recommended by the commercial kit the total RNA concentration measured by nanodrop was ranged from 11,2 to 221,5 ng/µl, by qubit from 5 to 64 ng/µl which meet most molecular studies minimum sample input quality requirements. RNA integrity measured by Bioanalyzer was ranged from N/A to 3,5 which shows that most of the long RNAs are degraded. To conclude, CVM total RNA can be used for small RNA studies(sRNA-seq) but may not be suitable for transcriptomic studies. Since small RNAs(18-40nt) are not degraded but long mRNAs.

Keywords: Cervico vaginal mucus (CVM), RNA quality, Cattle, NGS, Yerli Kara (Native black), Holstein

THE RELATIONSHIP BETWEEN DRY MATTER INTAKE AND THE AVERAGE DAILY GAIN

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Abstract

The productivity of animals is closely related to the quality of the diet and of dry matter intake. Dry matter intake (DMI) is a factor that needs to be assessed before an animal's diet can be calculated correctly. Purebred bulls of the Kazakh white-headed breed in the amount of 70 heads of 7-8 months of age were selected for the experiment. By the end of the test, the bulls were about 11-12 months old. The average weight of the bulls when put to the test was 248.47 ± 2.46 kg, at the end of the test their average weight was 319.7 ± 3.44 kg. It is worth noting that the largest average daily increase was 2.46 ± 0.05 kg, which was in a bull that consumed 6.26 kg of dry matter per day, while the lowest average daily increase was 0.36 ± 0.05 kg, which was in a bull that consumed 5.67 kg of dry matter.

Keywords: *Bulls; Beef, Live Weight; Average Daily Gain, Dry Matter, Dry Matter Intake*

INTRODUCTION

According to Uskenov et al. in the Republic of Kazakhstan, there has always been enough grazing cattle on natural pastures. However, the growing demand for high-quality beef, unlike other types of meat, agriculture poses new challenges and priorities for increasing production for producers and improving the quality of the products obtained.

Ed Rayburn points out that the over the years, scientists have worked on many aspects of feeding and rational use, which has led to achievements related to the efficiency and overall productivity of animals.

According to Michael L.Galyean et al. dry matter intake (DMI) is an important parameter in the compilation of quantitative indicators to meet nutritional needs, predict daily weight gain of animals and assess the profitability of the farm, mainly in feedlots. Thus, in order to reduce the cost of speed and use cheaper ingredients in diets, it is necessary to keep animals with high productivity.

Tadeu Silva De Oliveira write that the productivity of animals is closely related to the quality of the diet and the dry matter intake (DMI). Dry matter intake (DMI) is a factor that needs to be assessed before an animal's diet can be calculated correctly. Mertens believed that, for any successful nutrition or production program, it is important to understand and predict dry matter intake (DMI). DMI depends on the interaction of the animal, the diet, and the feeding environment.

Accurate estimates of feed intake are essential for predicting the extent to which diets meet requirements for maintenance and production of various classes of beef cattle. Nonetheless, because of the multifactorial nature of its control in ruminants (Forbes, 2003), predicting intake accurately is a significant practical challenge.

The formation of a new variable may not have a nonparametric distribution, and in this case it approximates the nonparametric Cauchy distribution (Ruzgas et al., 2021). According to Detmann et al. (2005) and Lage et al. (2019), the relationship between DMI and ADG does not take into account that a significant portion of raw materials can be used to meet maintenance needs. Thus, changes in the portion of feed used to maintain the basic metabolism will lead to deviations that may not be easy to detect if a conclusion about production is made based on this relationship.

The purpose of this study is to compare a single-factor analysis (the relationship between dry matter intake (DMI) and average daily gain (ADG).

MATERIALS AND METHODS

The object of the study is the bulls of the Kazakh white-headed breed. Purebred bulls of the Kazakh white-headed breed in the amount of 70 heads of 7-8 months of age were selected for the experiment. By the end of the experiment, the bulls were about 11-12 months old. The animals were selected considering the live weight. During the test period, the bulls were in the same feeding

and maintenance conditions. In our study, the diet of experimental bulls consisted of feed produced on the farm. The main feed was hay, haylage, barley and premix. The feeding norms during the period of scientific research corresponded to the breed, live weight, and physiological condition of the bulls.

The place of research is Akmola region, Bulandyn district, Novobratskoye and K LLP.

To determine the live weight of bulls, the Brazilian Intergado system was used, which allows to obtain daily data on average daily gain, and control weightings of animals were carried out on the electronic scales of Novobratskoye LLP. Growth and development were monitored by weighing on the first day of evaluation, then every 28 days for 70 days in the morning before feeding. The bulls were divided into 3 groups according to

the average daily gain. On average, the average daily gain in the first group was 0.75 kg, in the 2nd group 0.97 kg and in the 3rd group 1.2 kg. The data obtained served as the basis for establishing the average daily weight gain.

Chemical analysis of feed was carried out in the laboratory of "BKN Nova" LLP, and were also investigated in the laboratory of zootechnical analysis of feed and milk of S.Seifullin KATU on the FOSS NIRS DS2500 F analyzer. The SPSS 25.0 software was used to obtain descriptive statistics.

RESULTS

To study the relationship, a chemical analysis of feed was carried out, the main indicators such as dry matter, metabolic energy, crude fiber, crude fat, crude protein, calcium, and phosphorus were calculated.

Table 1. Diet

Feed	Giving, kg	DM%	ME, MJ	ADF, %	NDF, %	CP%	CF%	Ca, g	P, g
Haylage	15	38,8	10,47	27.1	43.0	13,1	3,85	18	15
Hay	3	86,4	8,12	45.8	73.2	10,7	1,99	12	5
Barley	4	87,4	13	7.09	19	12,7	2,2	20	8
Premix	0,1							5	4
Total	22,1	54	104	25.2	42.5	12,4	3,1	50	28

According to Table 1, on average, bulls consumed 54% of dry matter, crude protein in the diet was 12.4%. The amount of crude fiber was 44.9%, the diet contained 3.1% of crude fat. The diet also had 25.2% and 42.5% ADF and NDF. Also, the amount of calcium and phosphorus in the diet was 50 and 28 grams, respectively.

Table 2 shows the average indicators for the dry matter intake and for the average daily weight gain of the three groups that were formed by the average daily weight gain. To verify the assumption of the ANOVA test based on dry

matter intake data, the normality of the data was checked using the Kolmogorov-Smirnov test (P =0.200). The observed data value coincides with the expected value, that is, the degree of deviation of the data from the theoretical distribution is minimal, which indicates the normality of the distribution (P>0.05). Using the Livin test, it was found that the deviations were homogeneous P= 0.302. The results of the statistical analysis are shown in Table 2.

Table 2. Indicators for dry matter intake and average daily gain

	Groups	N	Average	δ	Min	max
DM	Group 1	21	5,3 ±0,37	1,7	1,73	9,48
	Group 2	25	6,5±0,29	1,4	3,81	9,50
	Group 3	24	6,9±037	1,8	3,83	9,32
	Total	70	6,32±0,21	1,78	1,73	9,50
	P <0,05					
ADG	Group 1	21	0,75±0,02	0,13	0,36	0,87
	Group 2	25	0,97±0,01	0,06	0,9	1,09
	Group 3	24	1,2±0,05	0,26	1,10	2,46
	Total	70	1,01±0,03	0,28	0,36	2,46
	P <0,05					

On average, the bulls consumed 6.32±0.21 kg of dry matter and the average daily gain was 1.01±0.03 kg. Group 1 consumed 5.3 ±0.37 kg of dry matter and the average daily increase of this

group was 0.75±0.02 kg, while group 2 consumed 6.5±0.29 kg of dry matter and the average daily gain was 0.97±0.01 kg, which is 22% more than group 1. Group 3 consumed an average of

6.9±037 kg of dry matter and the average daily gain was 1.2±0.05 kg. Compared with group 1 and 2, the average daily gain of group 3 is 37.5% and 19.1% more, respectively. It is worth noting that the largest average daily gain was 2.46±0.05 kg, which was in a bull that consumed 6.26 kg of dry matter per day, which is a descendant of the Cactus line, while the lowest average daily increase was 0.36± 0.02 kg, which was in a bull that consumed 5.67 kg of dry matter and is a descendant Veteran lines.

To test the assumptions of the ANOVA test according to the average daily gain, the normality of the data was checked using the Kolmogorov-Smirnov test (P=0.08). The observed data value coincides with the expected value, that is, the degree of deviation of the data from the theoretical distribution is minimal, which indicates the normality of the distribution (P>0.05). Using the Livin test, it was found that the deviations were homogeneous P=0.229.

Table 3. Relationship between dry matter intake and average daily weight gain

Groups	N	Average DM	ADG
Group 1	21	5,3 ±0,37	0,75±0,02
Group 2	25	6,5±0,29	0,97±0,01
Group 3	24	6,9±037	1,2±0,05
Total	70	6,32±0,21	1,01±0,03
Correlation		R=0.95	

These studies were conducted to study the relationship between the average daily gain and the dry matter intake. In the course of the study, it was revealed that there is a positive correlation between dry matter intake and the average daily gain (R= 0.95). It follows that the more bulls consume dry matter, the more they gain weight.

DISCUSSION

During the study, it was revealed that the bull of group 3, the Cactus line consumed 6.26 kg of dry matter per day and the average daily gain was 2.46 ± 0.05 kg, which is the largest gain, while the lowest average daily gain was 0.36± 0.02 kg, which was in the bull that consumed 5.67 kg of dry matter and is a descendant of the Veteran line. Vickers M. in his research indicates that the low level of average daily growth is probably due to the nutritional properties of feed, as well as the genetics of beef cattle. When studying the possibilities of providing feed, it is important to take into account the content of DM in each potential source to assess the efficiency of feed production for beef cattle; this is closely related to the average daily gain. The success of feed management can be determined by the level of average daily growth.

Also, the results of these studies show that there is a positive correlation (R=0.95) between the consumption of dry matter and the average daily increase. The dry matter intake was positively correlated with the average daily gain, which is confirmed in the studies of Archer et al., which can lead to a significant increase in the dry matter intake and, accordingly, the live weight of animals (Heard et al.).

CONCLUSIONS

In the course of the analysis, it was revealed that group 3 consumed an average of 6.9 ±037 kg of dry matter and the average daily increase was 1.2 ± 0.05 kg. Compared with group 1 and 2, the average daily increase of group 3 is 37.5% and 19.1% more, respectively.

It is also worth noting that the goby of group 3, the Cactus line consumed 6.26 kg of dry matter per day and the average daily gain was 2.46 ± 0.05kg, which is the largest gain, while the lowest average daily gain was 0.36± 0.02 kg, which was in the goby that consumed 5.67 kg of dry matter and is a descendant Veteran lines.

The results of these studies show that there is a positive correlation (R=0.95) between the consumption of dry matter and the average daily increase.

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NUTRITIONAL STATUS ASSESSMENT OF PASTORALISTS RESIDING ADJACENT OR AWAY FROM CITIES

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Abstract

The study was planned to identify the nutritional status, life satisfaction, economic achievements and social status of camel pastoralists inhabiting near cities or in the desert areas of Punjab, Pakistan where they maintain herds of camel in intensive and/ or extensive production regimes and to provide suggestions to progress. For this purpose, 200 pastoralists families were selected (100 of each category) at random in 10 union councils of three districts of Punjab to fill out an on-site questionnaire. Pastoralist were interviewed about their eating habits, health status, working routine, physical activities, Body Mass Index, health status, education of children and socio-economic status. Land less pastoralists had the opportunity to mover from desert to the nearby cities. Although there are some benefits like virtuous price of their commodities like camel milk, camel calves, camel meat and services but their nutritional status, living standard and family security was extremely compromised. In contrast to the pastoralists residing in the villages, they enjoy food and general family security, chances of education of their progenies but their commodities and services have valued down grade. The family and animal health cover was better in pastoralists residing near cities as compared to those residing in desert areas. The very important recommendation in this regard is to register pastoralists and their herds by the government and to invest an attractive amount on their wellbeing and education, provide soft loans to expand their family business to be able to contribute in the national economy.

Keywords: Nutritional status, Pastoralists, Health cover, Desert areas

GENERAL STATUS OF RUMINANT LIVESTOCK IN THE TURKISH REPUBLIC OF NORTHERN CYPRUS

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Abstract

Among other agricultural activities, animal production has strategic importance for a country's economy. In the Turkish Republic of Northern Cyprus (TRNC), animal production constitutes 45% of the total agricultural production. In response to the growing population, there is an increasing need for food of animal origin. State hatcheries and many private companies run animal production activities along with small-scale family enterprises. Almost all feedstock of animal feed with parent and hybrid materials are imported. On the other hand, most of the food of animal origins that is marketed (e.g. meat, milk, egg etc.) is produced in TRNC and the rest is imported when it is necessary. Halloumi, which covers almost all animal-based imported goods, is imported into many countries especially Turkey and Kuwait and contributes to the country's economy. This study concentrates on the general state of animal production in TRNC and aims to present the current state of ruminant animals (66 thousand head of cattle, 197 thousand head of sheep and 78 thousand head of goat) in the country's livestock farming, their contributions to the economy and the type of their production.

Keywords: TRNC, Agriculture, Animal Husbandry, Import-Export, Halloumi

THE EFFECT OF SPIRULINA SUPPLEMENTATION ON THE PERFORMANCE, AND EGG YOLK COLOR OF JAPANESE BREEDER QUAILS

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Abstract

This study was carried out to determine the effects of adding different levels of spirulina (spirulina platensis) to the diets of Japanese breeder quails (Coturnix coturnix japonica) on performance, and egg yolk color. A total of 48 female and 24 male 10-week-old Japanese quails were randomly distributed to 4 dietary groups with 6 replicates. Four different trial diets were used, including the basal diet (0-control) and 3 different diets containing spirulina at 0.75%, 1.5% and 2.25% levels. The trial period is 8 weeks. Result showed that egg production, egg weight and egg mass were not influenced by spirulina supplementation. Feed consumption and feed conversion ratio decreased with increasing spirulina level(P<0.05). While egg yolk L* value decreased with increasing spirulina, a* and b* values increased(P<0.05). In a conclusion: the use of spirulina platensis in breeder quail diets had significantly positive affect feed intake, feed conversion ratio and egg yolk color.

Keywords: Breeder quail, Egg Yolk Color, Performance, Spirulina Platensis

HERITABILITY OF COWS´ MILK ELECTRICAL CONDUCTIVITY RECORDED BY MILKING ROBOTS FOR INDIVIDUAL UDDER QUARTERS

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Abstract

Some research results suggested that the electrical conductivity of cow's milk (EC), along with somatic cell count, could be successfully used in breeding programs as an additional indicator of mastitis. The electrical conductivity increases in milk produced by cows with mastitis due to damage to cells in the mammary tissue. The aim of the study was to estimate the daily heritability index EC of milk from quarter milkings of Polish-Holstein-Friesian cows milked in barns equipped with Automatic Milking System. A total of 608,984 daily records of EC belonging to 2,432 cows from 23 herds in first (L1) and second lactation (L2) were used in this study. The EC heritability was estimated individually for each udder quarter, i.e. left front - LF, right front - RF, left rear - LR, right rear - RR. Univariate Random Regression Model (RRM) and fourth-order Legendre polynomials for the regression on the number of milking days (from test day 5 to test day 305) were applied. The heritability was estimated using the Wombat package (Meyer, 2007). It was shown that the average EC of milk from cows in lactation 2 was 1.72 mS higher than in the first lactation (70.20 vs. 68.48 mS). The value of this trait varied depending on the quarter of the udder and the day of lactation, ranging from 67.26 mS (L1 - RF) to 71.71 mS (L2 - LF). Daily heritability indicators of EC showed high variation during lactation and udder quarters. In the first lactation, heritability values ranged from 0.043-0.084 for LF, 0.035-0.075 for LR, 0.053-0.286 for RF, and 0.008-0.419 for RR. In turn, in the second lactation, the analogous ranges were: 0.013-0.168 for LF, 0.058-0.310 for LR, 0.364-0.670 for RF, 0.014-0.409 for RR. It was recorded that the average EC heritability for four udder quarters and the entire first lactation was at a level of 0.086, and for the second lactation equalled 0.218. The corresponding indices determined for individual quarters of the udder in the first lactation were: LF - 0.060, LR - 0.054, RF - 0.158, RR - 0.086, and in the second lactation: LF - 0.048, LR - 0.237, RF - 0.510, RR - 0.078. Summing up the results of the research, it should be stated that the heritability of milk electrical conductivity changed depending on the analyzed quarter of the udder. At the same time, these results suggest that the best response to selection in this respect may be expected in the case of the right front quarter.

Keywords: Automatic Milking System, Electrical Conductivity, Individual Udder Quarters, Genetic Parameters, Dairy Cattle

RELATIONSHIP BETWEEN BODY CONDITION SCORE AND MILK PRODUCTION OF DAIRY COWS

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Abstract

In recent years, a non-invasive visual method of Body Condition Score (BCS) assessment has been used in agricultural practice. This article presents the results of research on studying the relationship between Body Condition Score and milk productivity indicators of Holstein breed dairy cows on the basis of "Dairy Farm "Aina" LLP. Studies have found that BCS scores vary between 2.77-3.36, which corresponds to the minimum recommendations. At the same time, low indicators of the condition do not allow to fully demonstrate the potential milk yield of dairy cows. According to the results of control milking, the average daily milk yield for the herd is about 17 kg, the amount of milk fat and protein in group 1 is 9.47±0.94 and 9.79±1.01 kg, in group 2 is 21.65±1.25 and 21.50±0.86 kg, in group 3 is 25.15±1.9 and 24.97±1.35 kg and in group 4 is 19.57±2.38 and 20.13±1.63 kg, respectively. The analysis of the obtained results showed that there is a correlation between BCS and milk productivity. And thus, regular assessment of condition can be used as an effective tool in dairy herd management.

Keywords: _Body Condition Score, Milk production, Average daily milk yield, Fat and protein content, Correlation_

INTRODUCTION

According to the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan the number of cattle, as well as milk production in the country is growing from year to year. Dairy farms are among the most technologically advanced enterprises in the agricultural industry. For further development of this industry, it is necessary to strictly observe the norms of housing and feeding, as well as the introduction of achievements of science and technology. One of the effective tools used in dairy cattle breeding is condition monitoring.

The most common method for monitoring condition in foreign countries is a non-invasive visual method, which is based on an assessment of the thickness of the subcutaneous fat layer on a 5-point scale (Body Condition Score). This method was developed by Jeffries B. (1961), Edmondson and Metzner (1989-1993), and Ferguson (Loker S., 2012). According to Bezborodov (2017) many scientific studies have shown a significant relationship between the condition of animals and indicators of their productivity, fertility and general health.

In recent years, the non-invasive method of BCS condition assessment has been used not only by foreign researchers, but it has also found its application in domestic practice of agricultural production, namely in zootechnics, veterinary medicine, automation of production processes in dairy cattle breeding and is an actual method at the moment (Roche J.R., 2007).

It is important not only to assess the condition, but also to interpret the results and their relationship with performance indicators. According to a group of foreign scientists, the relationship between BCS and milk productivity can be most reliably traced by monitoring the animal's condition in dynamics, especially during the dry period, during calving and milking (Aitmukhanbetov D.K. et al., 2023; Karlikova G. G., 2018). A group of European scientists has established a relationship between BCS, live weight and milk production. The results of studies have shown that a significant decrease in the condition score after calving has a negative effect on further milk production (Berry D.P., 2007). According to Sivkin N.V. the assessment of the condition of cows positively correlates with milk yield for 305 days of lactation. A relationship has also been established between BCS and the content of fat, protein and somatic cells in milk. At the early stage of lactation, a higher condition

score corresponded to a higher content of protein in milk and a low content of somatic cells; no relationship was found with fat content (Roche J.R., 2007). A number of other scientists noted a positive correlation between BCS and fat content in milk (Singh V. et al., 2015). At the same time, earlier Irish authors stated that cows that reduced BCS at the beginning of lactation more than others gave more milk with higher fat content and protein concentration, the opposite effect was observed with too much loss in condition (Montiel–Olguín L. J., 2019). Thus, studies regarding the relationship between the Body Condition Score and milk production indicators have given conflicting results (Singh V. et al., 2015).

The purpose of this study is to study the relationship between condition (BCS) and milk production indicators of dairy cows.

MATERIALS AND METHODS OF RESEARCH

The object of the study are dairy cows of the Holstein breed. The number of experimental groups was 109 heads in the first group, 115 in the second, 131 in the third, and 35 in the fourth. The first group includes cows with low productivity, the second group - average, the third group - cows with high milk yield, the fourth group - cows at the milking stage.

The study was conducted on the basis of "Dairy Farm "Aina" LLP, located in the Kenesary rural district of the Burabay district of the Akmola region from September 2022 to February 2023.

The condition of the dairy herd of the Holstein breed was assessed monthly according to the 5-point Body Condition Score system. At the first stage of the assessment, the pelvic region of the animal is viewed from the side. Attention is paid to the line from the maklok to the ischial tuberosities. According to the state of the triangle formed by the makloks, ischial tuberosities and hip joints, a decision is made to assign a score of 3.0 points and below or 3.25 points and above. If the line of the triangle forms a smoothed V, then the score is 3.0 points or less. The line forms a crescent or a smoothed U, the condition of the animal is 3.25 points and above. Second stage: V - shaped line score 3.0 points or less, if the makloks are rounded, then 3.0 points are assigned, and if the makloks are angular - 2.75 points or less. Next, the ischial tubercles and ribs are examined from their ends to the spinal column, as well as the hip joint and sacral ligament (Berry D.P., 2007). The recommended BCS score depends on the physiological state and stage of lactation.

Milk productivity was evaluated monthly by the method of control milking using the UZKM-1 zootechnical milk control device. Milk yield was recorded using the UNIFORM-Agri software. Milk samples for fat (%), protein (%) and somatic cells (thousand/ml) were examined in the laboratory of the Testing Center of "Kazakh Research Institute of Animal Husbandry and Forage Production" LLP on the CombiFoss FT+ milk analyzer.

The primary research material was processed by methods of variation statistics using Microsoft Excel spreadsheet tools.

RESEARCH RESULTS

In the period from September 2022 to February 2023, the condition assessment (BCS) of dairy cows of 4 technological groups was carried out at "Dairy Farm "Aina" LLP. The results of this assessment are presented in Table 1.

Table 1. Assessment of fatness of dairy cows, score

Period	Group	n, head	BCS average
September, 2022	1	109	3,30±0,05
	2	115	3,00±0,04
	3	131	2,92±0,03
	4	35	3,00±0,04
October, 2022	1	109	2,90±0,09
	2	115	2,88±0,10
	3	131	2,99±0,04
	4	35	3,00±0,07
November, 2022	1	109	2,90±0,04
	2	115	2,95±0,03
	3	131	3,01±0,03
	4	35	2,89±0,37
December, 2022	1	109	3,00±0,09
	2	115	3,03±0,09
	3	131	3,00±0,09
	4	35	2,86±0,08
January, 2023	1	109	3,29±0,25
	2	115	3,28±0,33
	3	131	3,36±0,41
	4	35	2,77±0,36
February, 2023	1	109	2,85±0,02
	2	115	2,93±0,02
	3	131	2,87±0,02
	4	35	2,89±0,08

This table shows that the average BCS score varies between 2.77-3.36, which is in line with the recommended norms. The BCS score is influenced by factors such as physiological condition of the animal, production cycle, season and feeding.

Also during the above mentioned period, milk productivity of dairy cows in four technological groups was evaluated, and the results are shown in Table 2.

**Table 2.** Milk productivity and milk composition of dairy cows

Period	Group	Average daily milk yield, kg	Fat content, %	Amount of milk fat, kg
September, 2022	1	5,47±0,45	3,81±0,03	6,252±0,389
	2	18,11±0,63	3,68±0,07	19,993±0,811
	3	19,21±0,76	3,42±0,04	19,709±0,914
	4	14,85±0,48	3,74±0,03	16,661±2,280
October, 2022	1	8,26±0,36	3,85±0,08	9,519±0,488
	2	19,11±0,69	3,77±1,06	17,857±0,715
	3	21,27±0,99	4,04±0,15	21,678±0.964
	4	17,16±1,50	3,48±0,76	12,942±1,39
November, 2022	1	8,66±0,38	3,63±0,31	11,190±0.728
	2	19,18±0,46	3,65±0,29	26,993±1,045
	3	21,90±1,26	3,79±0,30	29,886±1.97
	4	17,83±2,59	3,73±0,48	25,536±5,086
December, 2022	1	7,37±0,32	4,6±0,35	7,633±0,481
	2	18,09±0,44	4,2±0,64	21,877±0,727
	3	19,50±1,11	4,06±0,15	21,931±0,625
	4	12,89±1,70	4,25±0,17	14,252±2,141
January, 2023	1	8,87±2,13	3,44±0,20	9,583±0,572
	2	19,29±2,30	3,6±0,11	20,871±0,755
	3	21,00±1,60	3,88±0,10	26,929±0,987
	4	22,96±2,35	3,88±0,14	26,725±2,356
February, 2023	1	10,37±0,43	3,95±0,16	12,621±0,704
	2	17,53±0,70	4,24±0,17	22,320±0,820
	3	26,95±1,12	3,71±0,15	30,788±0,797
	4	17,75±0,70	3,82±0,15	21,293±2,143

Period	Group	Protein, %	Amount of milk protein, kg	Somatic cells, thousand/ml
September, 2022	1	3,24±0,03	5,316±0,412	413,29±19,01
	2	3,28±0,04	17,820±0,843	327,93±8,89
	3	3,41±0,04	19,651±0,947	531,45±158,10
	4	3,29±0,03	14,656±2,374	220,93±5,15
October, 2022	1	3,42±0,07	10,536±0.458	323,26±26,40
	2	3,40±0,75	23,644±0.588	284,67±6,76
	3	4,04±0,06	27,148±0.668	147,5±29,20
	4	3,43±0,79	21,452±1,682	377,15±5,90
November, 2022	1	3,49±0,27	10,269±0,489	328,36±13,66
	2	3,45±0,29	22,902±0,585	440,08±9,18
	3	3,42±0,08	24,602±0.691	85,0±41,00
	4	3,45±0,31	21,064±3,632	118±10,90
December, 2022	1	3,42±0,60	9,046±0,45	707,06±23,40
	2	3,2±1,4	20,868±0,506	234,88±16,5
	3	3,7±0,08	23,102±0,47	275,6±84,60
	4	3,14±1,40	17,122±2,34	257,65±11,25
January, 2023	1	4,03±0,04	10,963±0,546	466,94±39,75
	2	3,9±0,05	22,703±0,593	396,29±50,40
	3	3,8±0,03	26,341±0,728	480,30±56,70
	4	3,82±0,05	26,312±2,183	485,89±41,00
February, 2023	1	4,07±0,07	12,641±0,539	457,33±255,60
	2	3,95±0,06	21,060±0,715	521,87±291,70
	3	3,39±0,06	28,948±0,553	290,5±162,30
	4	3,89±0,07	20,181±1,475	268,02±149,80

Table 2 presents data on average milk yield, fat and protein content in milk, average amount of milk fat and protein, as well as the number of somatic cells. High milk yield was observed in group 3 of highly productive cows, it was 26.95 kg in February. The cows of the first group had the smallest milk yield - 5.47 kg in October. The content of fat and protein in milk is above the minimum requirements of the standard of 3.6 and 3.2%, respectively. By the amount of milk fat and

protein, the leading position is occupied by the third technological group, which has the highest milk productivity. The monthly increase in milk yield for all technological groups during the period of research is associated with the adjustment of feeding rations. As a result of the analysis, a sufficiently high content of somatic cells relative to the limit of 500 thousand/ml is observed. Previous studies (Ussenbayev A. Ye. Et al., 2023) have also shown that the percentage of cows with a high number of somatic milk cells reaches a significant value of 8.75%. This indicator serves as evidence of the presence of mastitis in a herd of dairy cows, one of the reasons for which may be non-compliance with the conditions of housing, feeding, and milking.

On the basis of the obtained data of milk productivity and assessment of the condition of dairy cows in order to establish the relationship between these indicators, the average values of BCS, milk yield, amount of milk fat and protein were calculated (Fig. 1).
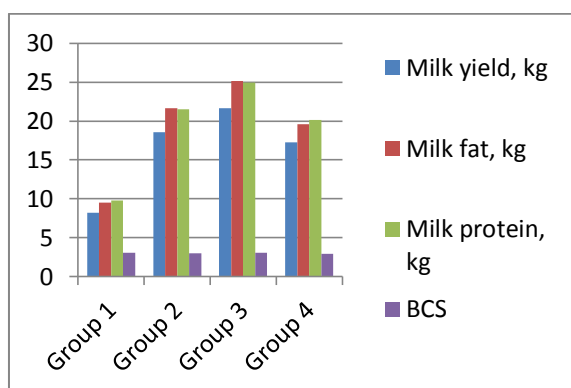
Figure 1. Average milk production and BCS by groups

BCS for the period of experiment was 3.04±0.49 points for group 1, 3.01±0.35 points for group 2, 3.02±0.42 points for group 3, and 2.9±0.22 points for group 4. According to the data obtained, the lowest BCS score was observed in group 4, dairy cows in which are at the milking stage.

The average daily milk yield for 6 months in average for the experimental groups was observed as follows: Group 1 - 8.17±0.67 kg; Group 2 - 18.55±0.3 kg; Group 3 and 4 21.64±1.14 and 17.24±1.39 kg, respectively.

The amount of milk fat and protein in group 1 was 9.47±0.94 and 9.79±1.01 kg, in group 2 was 21.65±1.25 and 21.50±0.86 kg, in group 3 was 25.15±1.9 and 24.97±1.35 kg and in group 4 was 19.57±2.38 and 20.13±1.63 kg, respectively.

Further, correlation analysis method was used to establish the relationship between BCS condition score and milk productivity in the herd of dairy cows, the results of which are presented in Table 3.

Table 3. Relationship of BCS with milk production and milk composition of dairy cows

Group	1st indicator	2nd indicator	Correlation coefficient (r)
1	BCS	Average daily milk yield, kg	-0.595
	BCS	Amount of milk fat, kg	-0.674
	BCS	Amount of milk protein, kg	-0.615
2	BCS	Average daily milk yield, kg	0.319
	BCS	Amount of milk fat, kg	-0.032
	BCS	Amount of milk protein, kg	0.014
3	BCS	Average daily milk yield, kg	-0.297
	BCS	Amount of milk fat, kg	0.105
	BCS	Amount of milk protein, kg	0.132
4	BCS	Average daily milk yield, kg	-0.553
	BCS	Amount of milk fat, kg	-0.681
	BCS	Amount of milk protein, kg	-0.631

Based on the results obtained, we can say that a moderate negative correlation between BCS and average daily milk yield is observed in all groups, except for the second group, which has an average level of milk productivity. A weak positive correlation is observed between BCS and the amount of milk protein in the second and third groups, as well as between BCS and the amount of milk fat in the third group. In the other groups, the correlation between these indicators is moderately negative.

DISCUSSION

In the course of the study, it was found that BCS scores ranged between 2.77–3.36, which corresponds to the minimum recommendations published by Pennsylvania State University. The condition of the animal depends on such factors as the physiological state, the production cycle, the season of the year, and feeding also plays an important role. The lowest mean score was

observed in group 4 and amounted to 2.9±0.22. This group includes animals at the milking stage, which explains the decrease in BCS. In the post-calving period, the reserves of the animal's body are mobilized to establish lactation. During this period, it is especially important to monitor the condition, as excessive exhaustion (BCS<2.75) negatively affects further milk production.

The average daily milk yield, as well as the amount of milk fat and protein in the milk were determined to assess milk productivity. Low condition indicators do not allow to fully show the potential milk yields of dairy cows. The average daily milk yield for the herd is about 17 kg, which is not the limit for this dairy herd under appropriate conditions.

The analysis of the obtained results showed that there is a correlation between BCS and milk productivity. Between the condition and the average daily milk yield, a moderate negative relationship was found in all groups of animals, except for group 2. A weak positive correlation was found between BCS and the amount of milk fat and protein in groups with medium and high milk production, which is confirmed by other authors (Roche J.R. et al. 2007; Singh V. et al., 2015).

CONCLUSION

In the course of the study, BCS was established for 4 technological groups with different levels of milk production, for the period of experience for each group it corresponded to: group 1 - 3.04±0.49 points, group 2 - 3.01±0.35, 3 showed 3.02±0.42 points, and group 4 - 2.9±0.22. Thus, the lowest BCS score was observed in group 4 where dairy cows are at the milking stage.

Group 3 showed the highest average daily milk yield - 21.64±1.14 kg, as well as the highest amount of milk fat and protein - 25.15±1.9 and 24.97±1.35 kg, respectively.

According to the results of the study, it was found that there is a correlation between the Body Condition Score and milk production. For BCS and average daily milk yield, it is moderately negative, and between BCS, the amount of milk protein and fat in cows with medium and high milk yields, it is positive.

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DETERMINATION OF POLYMORPHISM OF THE GDF9 GENE IN SHEEP OF THE KAZAKH MEAT-AND-WOOL BREED

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Abstract

Considering the high social importance of the sheep breeding industry for the population of the Republic of Kazakhstan, the importance of obtaining high-quality meat products in sufficient volumes, obtaining information about the various genotypes of the differential growth factor gene in meat-and-wool sheep, which can make it possible to identify the most promising animals, is very significant. The aim of the work is to study the polymorphism of the differential growth factor gene in Kazakh meat-wool sheep of domestic breeding. 300 sheep were selected from the "Kuatzhan" farm in Almaty region with the help of breeders and peripheral blood samples were taken from them as biomaterial. The ReliaPrepTM Blood gDNA Miniprep System kit was used to isolate the genomic DNA molecule from the biomaterial. The concentration of DNA molecules was determined using a NanoDrop One spectrophotometer (ThermoFisher Scientific, USA). The primers used in the work were synthesized on an ACM800 synthesizer (Novosibirsk, Russia). The GDF9 gene was amplified by polymerase chain reaction (PCR) with primers designed based on published gene sequences (2 ovine GDF9 genomes, AF078545). We used the following PCR primers: GDF9 (G-1: 5´-GAAGACTGGTATGGGGAAATG-3´ and 5´-CCAATCTGCTCCTACACACCT-3´). Using the PCR-RFLP method in the studied population of the Kazakh meat-and-wool breed, C and D alleles of the differential growth factor gene (GDF9) were identified. The frequency of occurrence of alleles C and D was 0.89 and 0.11, respectively. The frequency of occurrence of the homozygous CC genotype was 78.7%. The heterozygous CD genotype, which is desirable for us, since this mutation is associated with an increase in the rate of ovulation, was found in 19.6% of individuals. The homozygous DD genotype was found in only 1.7%.

Keywords: GDF9, Sheep Genes, Kazakh Meat-Wool Sheep, PCR-RFLP.

THE EFFECT OF PROCESSING WITH OZONE GAS ON THE NUTRITIONAL VALUE OF RED GRAPE POMACE

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Abstract

This study aimed to investigate the effect of the red grape pomace (RGP) processing with ozone (O3) gas on the contents and activity of the phenolic compounds, chemical composition, ruminal degradability of the nutrients and milk production performance of fat tailed ewes fed processed RGP substituted for alfalfa hay. In the first trial, experimental treatments were designed as non-processed RGP (control), O3-processed RGP for 6 hours (h; treatment 1), O3-processed RGP for 12 h (treatment 2), and O3-processed RGP for 24 h (treatment 3). In the second experiment, 48 healthy multiparous fat tailed ewes (Ghezel breed) were. Four experimental treatments were includes ewes receiving the control diet (Control, 0% RGP) and diets which contains processed RGP for 12 h, replaced with 20, 40 and 60 % of the alfalfa hay. Dry matter (DM) and crude protein (CP) contents of the O3 processed RGP for different processing times was significantly increased compared to the control (P<0.05). However, the ash content was not affected by the processing. Ether extract (EE) Exhibited a remarkable reduction compared to the control after processing for 12 and 24 h (P<0.05). Processing with the O3 gas significantly reduced neutral detergent fiber (NDF) and acid detergent fiber (ADF) compared to the control, but the duration of O3 application did not affect the NDF and ADF content. Processing with O3 gas caused a significant reduction in total phenolics, total tannins, condensed tannins, protein-bound tannin, and fiber-bound tannin compared to the control (P<0.05). Processing with O3 gas significantly increased the in vitro GP, but the metabolizable energy (ME24) content was almost the same in different processing time durations. Dry matter degradability of RGP was showed a significant increase compared to the control due to processing with O3 for 6 and 12 h (P < 0.05). In the second trial, incremental replacing of the processed RGP in the diet, did not influenced the total volatile fatty acids (VFA), but increased propionate concentration compared to the control. The Digestibility of DM and NDF exhibited a remarkable rise in comparison to the control, but the digestibility coefficients of the CP and EE did not affected by processing. Milk production was significantly increased as a result of replacing processed RGP with alfalfa, but milk components were not affected (p<0.05). Plasma glucose concentration showed a significant increase in animals used diet with the highest inclusion rate of RGP compared to the control. According to the findings of this study, treating the RGP with O3 gas for 12 h significantly improves its nutritional value.

Keywords: Clean Processing, Circular feed, Condensed tannin, Ozone, Waste recycling

MATHAPOGENETIC POLYMORPHISM OF GENES RELATED TO FECUNDITY IN KAZAKH MEAT-WOOL SHEEP BREED

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Abstract

Kazakh meat-wool sheep is known as high fertility breed in Kazakhstan. It is interesting to study on gene level their fecundity performance by PCR-RFLP analysis. A total of 100 individuals of Kazakh meat-wool sheep were chosen to collecting blood samples. To study polymorphisms of GDF9 and BMP15 genes the G1, G8 and B2, B4 mutations were examined, respectively. Conducting PCR-RFLP analysis the following primers were used: for G1 and G2 mutations of GDF9 gene, F-GAAGACTGTATGGGGAAATG R-CCAATCTGCTCCTACACACCT and F:CTTTAGTCAGCTGAAGTGGGACAAC R:ATGGATGATGTTCTGCACCATGGTGTGAACCTGA, while B2 and B4 mutations of BMP15 gene, F:CACTGTCTTCTTGTTACTGTATTTCAATGAGAC R: GATGCAATACTGCCTGCTTG and F:GCCTTCCTGTGTCCCTTATAAGTATGTTCCCCTTA R:TTCTTGGGAAACCTGAGCTAGC. As a results, PCR-RFLP analysis presented that all determined exons were monomorphic in the studied sheep population, except G1 exon. Further to analyze of G1 mutation the Hha1 restriction enzyme was used. After PCR-RFLP analysis there were appeared three genotypes: the wild homozygous GG genotype, the mutant heterozygous GA genotype and the mutant homozygous AA genotype. Our results showed that G1 mutation is polymorphic in Kazakh meat-wool sheep. Further, we will increase of individuals of sheep to check frequency of G1 mutation and perform its effect to fecundity level for Kazakh meat-wool sheep.

Keywords: *GDF9, BMP15, sheep fecundity genes, Kazakh meat-wool sheep, PCR-RFLP*

EVALUATION OF DIFFERENT DOSES OF HEXAFLUMURON ON THE HISTOPATHOLOGICAL EFFECTS ON PANCREAS TISSUE OF FEMALE WISTAR RAT

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Abstract

Among environmental pollution, excessive exposure to pesticides is considered one of the factors that cause various diseases in humans and animals. Pesticides are considered the main source of ecological pollution. Pesticides have found wide applications in horticulture and veterinary medicine and have the potential for accidental effects on normal life, humans, and domestic animals. One of the most common insecticides is hexaflumuron. Twenty-four adult female Wistar rats weighing about 200 gr were distributed semi-randomly to 4 groups of six. Group Control, group Alfa that received Hexaflumuron 11 mg/kg b.w./day, PO); group Betta, was treated with Hexaflumuron 16.5 mg/kg b.w./day, PO) and group sigma, were treated with Hexaflumuron (22 mg/kg b.w./day, PO). The study period was 4 weeks. Then, the tissue of the pancreas was obtained and pancreatic changes were examined. The examination of histopathologic lesions showed increasing hyperemia and necrosis in the groups according to Hexaflumuron dose elevation. There was significant fibrosis and infiltration of edematous cells in the group sigma. It is obvious that elevating levels of Hexaflumuron can cause destructive effects on rats and nutrition health and it should be considered as a subsequence of this pesticide intake so it recommended some Propose to review and implement serious measurements for the consumption of such pesticides in the future.

Keywords: Wistar Rat, Hexaflumuron, Pancreas, Pesticide

INVESTIGATING HEREDITARY DISORDERS OF SIMMENTAL FROZEN BULL SPERMS IMPORTED TO TURKEY DURING 10-YEAR PERIOD

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Abstract

This study was aimed to determine Hereditary defects of frozen Simental bull sperms imported to Turkey between 2013 and 2022. As the source of this study, the websites of various companies that produce sperms, bull catalogues, and databases of bull sperms companies have been used. A total of 13 websites including Simental sperm databases and bull catalogues were investigated. The result of the study showed that 438 of 1301 frozen Simental bull sperms carry at least one genetic defect during 10-year period of import. The most common hereditary defects are Bovine Male Sterility (BMS) for 164 frozen bull sperms, Trombopathia (TP) for 155 bull sperms and Fleckvieh Haplotype 4 (FH4) for 127 bull sperms respectively. Significant effect was observed between different years and the rate of carriers was significantly decreased after 2019. As for origin of bull sperms, the bull sperms imported from Czech Republic showed significantly the least hereditary defect rate compared with those imported from Austria, Germany and Italian.

Keywords: Simmental, Bull semen, Hereditary disorder, Genetic defects,

INTRODUCTION

The practice of artificial insemination (AI) is so prevalent in Turkiye. Nearly all the cows and heifers in the registered farms get pregnant by AI. A great portion of frozen sperm used in Turkiye is imported. The procedures and principles regarding the import of sperm, ovum and embryo were issued by General Directorate of Livestock of Ministry of Agriculture and Forestry. There are some important hereditary diseases which should be taken into consideration. However, there is no regulation or prohibition against importing Simental bull frozen sperm carried hereditary disorders. Hereditary defects are important for genetic pollution of livestock herds in the worldwide. Therefore, the raised bulls or the frozen sperms should be tested for hereditary diseases and the results of analyses should be specified in pedigrees or information cards.

This study was aimed to determine Hereditary defects of frozen Simental bull sperms imported to Turkey between 2013 and 2022.

MATERIALS AND METHODS

The name and ID of the bull, the importing company and the number of straws is in the list of imported bulls issued by General Directorate of Livestock of Ministry of Agriculture and Forestry. In this study, hereditary status of imported Simental bulls between 2013 and 2022 were examined and separated into years and origins. Some bulls with beef origin were excluded from the study due to the fact that their pedigrees don't include hereditary disorders. It appeared that some of the imported bulls in the list were the same bulls imported by different companies were combined for general examination which reduced to 1302 bulls (13.113.327 straw).

Table 1 showed websites of various companies that produce sperms, bull catalogues and databases of bull sperms in Simmentals.

Table 1. Websites of various companies used in the study.

Company	Websites
Center of Moruzzo	www.en.ctsmoruzzo.it
Libro Genealogico	
Zuchtwert Austria	www.online.anapri.it
ST Genetics	
Accelerated Genetics	www.zuchtwert.at
Synetics	www.stgen.com
Swiss Genetics	www.accelgen.com
Superbrown	www.evolution-xy.fr
Gopelgenetik	www.swissgenetics.com
CBBA	www.superbrown.it
Munster Bovine	www.goepelgenetik.de
Melapolskie Centrum	www.db.cschms.cz
Aberekin	www.munsterbovine.ie
	www.mcb.com.pl
	www.aberekin.com

Effect of number of carriers on different year and origin was analyzed using Chi-Square analysis in SPSS (ver. 25.0). %5 confidence interval was accepted for the significance level of the tests

RESULTS AND DISCUSSION

Simental breeding in Turkey is getting popular day by day. The purpose of Simmental cattle breeding imported to Turkey is for dairy production. So the majority of the Simmental bulls imported between 2013 and 2022 were for dairy production. Totally, 438 of 1301 bulls carried at least one genetic defect as a result of the research. The type of each hereditary defects of Holstein bulls were summarized in table 2.

Among 1301 Simmental bulls, It was determined that 4 bulls carried Dwarfism, 8 bulls carried Zinc Deficiency. Flekvieh Haplotype 2 (FH2) gene causing deficiency of growth in Simmentals can be another form of dwarfism. It was determined that 55 Simmental bulls carried FH2. FH4 gene for Simmentals decreases the pregnancy rate like Holstein haplotype genes. Calves with FH4 genes can't survive; causing death at zygote stage. It was determined that 127 Simmental bulls of frozen sperms carried FH4. FH5 is a new haplotype for simmental causing death with symptoms of heart and liver failure in 48 hours after birth. 9 Simmental bulls carried FH5. 42 Simmental bulls carried Braunvieh Haplotype 2 (BH2) gene which is normally found in Brown Swiss Haplotype. Calves carrying BH2 genes as homozygous are either born dead or die after birth. 37 Simmental bulls were determined to be carrier of Trombopathia characterized by impaired blood coagulation. 32 bulls were found to have carrier of Bovine Male Subfertility gene causing sterility of bulls and not problem for Turkey (Table 4).

It would be a problem in case Turkey will be start to have AI bulls for breeding. Given that 4.705.983 straws of frozen sperms belonging to these bulls were imported and used in Turkiye, which can be concluded that Simmental breeding faces a grave serious genetic pollution.

Table 2. Hereditary Defects of the Simmental frozen sperms imported between 2013-2022.

HD[1]	n	Straw, n
A[2]	0	0
DW[3]	4	25964
FH2[4]	55	360811
FH4[5]	127	906108
FH5[6]	51	468718
BH2[7]	42	403256
BMS[8]	164	1386618
ZL[9]	8	53121
TP[10]	155	1101387

[1]Hereditary Defect, [2]Arachnomelia, [3]Dwarfism, [4]Flekvieh Haplotype 2, [5]Flekvieh Haplotype 4, [6]Flekvieh Haplotype 5, [7]Braunvieh Haplotype 2, [8]Bovine Male Subfertility,[9]Zinc Deficiency, [10]Trombopathia,

Frequency of hereditary defects in Simmental frozen sperms imported different years was presented in Table 2. Significant differences were observed among different year groups (P<0.001). Frequency of carriers was significantly decreased after 2018.

Table 2. Effect of year on occurrence of hereditary Defects of the Simmental frozen sperms.

Year	n	CR[1] (n)	SNC[2]	TSN[3]
2013	92	39,1^{ab} (36)	176599	533881
2014	146	44,5^a (65)	414876	1008256
2015	168	45,8^a (77)	596778	1252819
2016	233	42,1a (98)	682012	1705780
2017	159	39,0^{ab} (62)	524924	1472013
2018	229	31,4^{abc} (72)	764619	2171580
2019	183	24,6^{cd} (45)	344425	1454485
2020	244	30,3^{bcd} (74)	467988	1343418
2021	214	26,2cd (56)	333572	1258967
2022	174	21,8d (38)	186432	912128

a, b, c, d; different superscripts in the same column show significant differences (P<.0,001). [1]Carriers Rate, [2]StrawNumber of Carriers [3]Total Straw Number

Table 3 shows frequency of hereditary defects in Simmental frozen sperms with different origins. Significant differences were observed among origin groups. The frozen sperms from Germany showed highest frequency of carriers while those from Czech Republic showed lowest carriers. The possible explanation of low frequency in the bulls from Czech Republic is insufficient information in the related pedigree websites to compare those from other countries such as Germany and Austria.

Table 3. Effect of bull origin on occurrence of hereditary defects of the Simmental frozen sperms.

Origin	n	CR[1] (n)	SNC[2]	TSN[3]
AT[4]	227	30,8^b (70)	830146	2073004
CZ[5]	103	17,5^c (18)	237278	877278
DE[6]	861	38,2^a (329)	2391557	6558026
IT[7]	48	35,4^{ab} (17)	73601	441074

a, b,; different superscripts in the same column show significant differences (P < 0.001) [1]Carriers Rate, [2]Straw Number of Carriers [3]Total Straw Number [4]Austria [5]Czech Republic [6]Germany [7]Italy

This study highlights the importance of genetic pollution in imported bull sperms. Even though there was a limited study investigating hereditary defects of imported sperms to Turkiye in 2015 (Inal and Cam, 2015); this research was the first to examine all hereditary disorders throughout ten-year period. The result of this study encourages authorities to make more precautions during importing frozen bull sperms against genetic pollution.

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EFFICIENCY OF AUTOMATED PROCESSING OF CATTLE WITH ECTOPARASITES

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Abstract

This article determined the species composition of ectoparasites of cattle in one of the farms of the northern region of Kazakhstan: Musca spp., Culex spp., Simulum sp., Tabanus spp., Bovicola sp., Dermacentor spp. with the establishment of the index of abundance and the index of occurrence: The index of abundance and the index of occurrence in the winter period in the withers Bovicola bovis is Ia - 10 specimens, Io - 100%. In the spring period, the abundance index and the occurrence index are for Dermacentor spp. Ia - 1.2 specimens, Io - 25%; in Bovicola bovis Ia - 8.6 specimens, Io - 100%. In summer: Musca spp. Ia - 0.7 specimens, Io - 20%; in Simulium spp. and Culex spp. Ia - 4.3 specimens, Io - 100%; in Tabanus sp. Ia - 3.5 specimens, Io - 33.3%; in Dermacentor spp. Ia - 3.2 specimens, Io - 35%; in Bovicola bovis Ia - 11 specimens, Io - 100%. An automated method of treating animals with a long-acting insectoacaricide - Biorex-GC, was used in pasture conditions with a high degree of efficiency, while the aqueous emulsion of the drug is evenly distributed throughout the coat of cattle. The parameters of the application of the insecticidal preparation Biorex-GC were determined: dilution 1:2000. treatment exposure 60 ± 10 seconds, the amount of the working solution of the drug 500 ± 100 ml per animal, with an interval of 15 days.

Keywords: _Cattle -1, Ectoparasites -2, Automated -3, Biorex-Gh-4, Kazakhstan-5._

INTRODUCTION

Ectoparasites of cattle are widespread throughout the world and it is quite difficult to get rid of them completely. Regardless if it is dairy cattle or beef cattle, parasitic insects quickly and actively affect the livestock population if the complex of anti-insecticide preventive measures is improperly organized and carried out [1,2,3].

The basis for the development of an automated animal processing plant is the need for the veterinary industry to switch to modern methods of planning and organizing effective preventive, therapeutic, anti-epizootic, veterinary and sanitary measures using modern digital technologies in accordance with the recommendations of international veterinary and medical organizations (OIE, FAO , WHO) [4,5].

Despite the existence of the problem, practical veterinarians do not have a unified system of measures that would simplify and systematize control and prevention measures against parasitic arthropods [6,7]. It is to combat these problems that the automation and digitalization of veterinary work is of particular relevance, which will reduce negative factors in animal husbandry, ensure animal health and obtain high-quality livestock products.The goal of research is to evaluate the effectiveness of automated treatment of animals from ectoparasites with aqueous solutions of insectoacaricides in pasture conditions.

MATERIALS AND METHODS

The study was conducted from April 2021 to July 2023 in the North Kazakhstan region.

As part of the scientific work, a survey of 60 heads of cattle was carried out by examining the skin of the head, neck, back, sides, abdomen and limbs. Identified insects were removed from the skin of animals with fingers in rubber gloves. Ticks found in animals were collected with tweezers, and adults were collected with rubber-gloved hands. Collected mites and insects were transferred into 70% alcohol or Barbagallo liquid (3% formalin aqueous solution). Deep scrapings were taken from the bald areas of the skin of the animals using an abdominal scalpel, they were transferred to a laboratory dish (Petri dishes), and examined by the vital method. The species affiliation of the detected parasites was determined using a magnifying glass, a Mikmed-5 microscope, and a parasitological atlas (Richard L. Wall, David Shearer 2008).

The index of abundance and the index of occurrence of ectoparasites on animals were determined. The abundance index (Ia) is the average number of parasites per individual or cattle examined. Abundance index (Ia) was calculated using the formula:

$$Ia = m/N$$

where, m is the number of detected parasites; N is the number of studied hosts.

Occurrence index (Io) - the number of samples in which individuals of the studied species were found, expressed as a percentage of the total number of samples analyzed. The occurrence index was calculated by the formula:

$$Io = n/N \times 100\%,$$

where, n - is the number of infected host individuals; N - is the number of studied host individuals.

For the treatment of animals, the insecticidal drug Biorex GH 10% - (emulsifiable concentrate - e.k.) was used as an active substance (DV) contains 2.5% or 5% cypermethrin and auxiliary components. In appearance, it is a homogeneous oily transparent liquid of yellow-orange color (opalescence is allowed). The drug emulsifies well with water, forming a milky-white emulsion, stable during storage.

For spraying cattle, an automated platform was used, which was created by specialists in radio electronics of the S. Seifullin Kazakh Agrotechnical Research University, within the framework of the project 'Development and creation of scientifically grounded Smart farms (herd horse breeding, beef cattle breeding) with the use of at least 3 different digital solutions for each area of digitalization implementation for the actual production tasks of the agro-industrial complex entities and the formation of the necessary this reference database for training employees of farms and peasant households and transferring digital knowledge to learning students'.

The basis of the platform is a metal structure. The platform has scales, a system for spraying animals from ectoparasites, and drinkers for watering animals (Fig. 4).
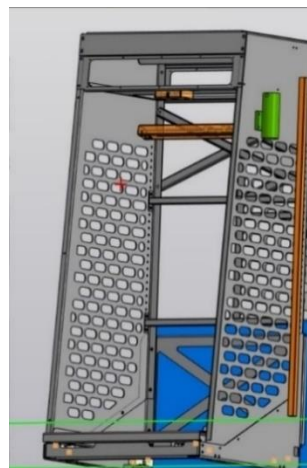
Figure 1. Scheme of automatic installation

The automated plant is designed for automated processing of animals from ectoparasites in the pasture. Four nozzles are installed on the platform, which provide spraying insecticides and repellents on the animal's skin. Nozzles 1 and 2 are located in the front of the unit at a distance of 24 cm from each other, the divergence angle is 45°. These nozzles provide spraying of animals from the front side, that is, the drug falls on the forelimbs and neck. In addition, 3 and 4 nozzles are located from the base of the unit at a height of 176 cm, the distance between the nozzles is 7 cm. animal croup.

Figure 2. Treatment of cattle against ectoparasites using an automated installation.

RESULTS

Analyzing data on the distribution of ectoparasites, it should be noted that the number of ectoparasites varies in different seasons. In winter, only one species was recorded - Bovicola bovis. The index of abundance in spring differs from that in winter, the abundance and species of ectoparasites increase, and Dermacentor spp. In summer, the number and species of ectoparasites are much greater than in spring. The species composition in summer consists of: Musca spp., Culex spp., Simulium spp., Tabanus sp., Bovicola bovis, Dermacentor spp. In autumn, the number and species composition of ectoparasites are preserved, which may vary depending on weather conditions. The index of abundance and the index

of occurrence in the winter period in the withers Bovicola bovis are Io - 10 specimens, Iv - 100%. In the spring period, the index of abundance and the index of occurrence in ixodid ticks Dermacentor spp. Ia - 1.2 specimens, Io - 25%; in Vlas-eaters Bovicola bovis Ia - 8.6 specimens, Io - 100%. In summer, the abundance index and occurrence index increase significantly, in particular, in the pasture flies Musca spp. Ia - 0.7 copies, Ио - 20%; in midges Simulium spp. And blood-sucking mosquitoes Culex spp. Io - 4.3 specimens, Iv - 100%; horseflies Tabanus sp. Io - 3.5 specimens, Iv - 33.3%; in ixodid ticks Dermacentor spp. Io - 3.2 specimens, Iv - 35%; in the withers Bovicola bovis Io - 11 specimens, Iv - 100%.

Animals were treated with Biorex GC by medium-volume spraying with an aqueous solution with a dilution of 5 ml of 10% emulsion per 10 liters of water (according to DW), dilution 1:2000. The duration of action of the insecticidal preparation was determined at intervals of every 7 days after its application (7, 14 and 21 days).

Treatment of animals with an insecticide-acaracid preparation is carried out automatically on the developed platform during the period when the animal approaches the drinker. At the same time, the platform itself determines by the identification number of each animal which animal is to be processed in a given period of time. Technically, this is done as follows: each watering of an animal on an automated drinker lasts approximately 60 ± 10 seconds, when the animal stands on the platform and the watering begins, the system starts injecting the diluted preparation through nozzles onto the upper body along the spinal column. At the same time, within 60 seconds, through 4 sprayers, an average of 500 ml of solution enters the animal.

As can be seen from Figure 2, Biorex GC is effective against all types of ectoparasites.
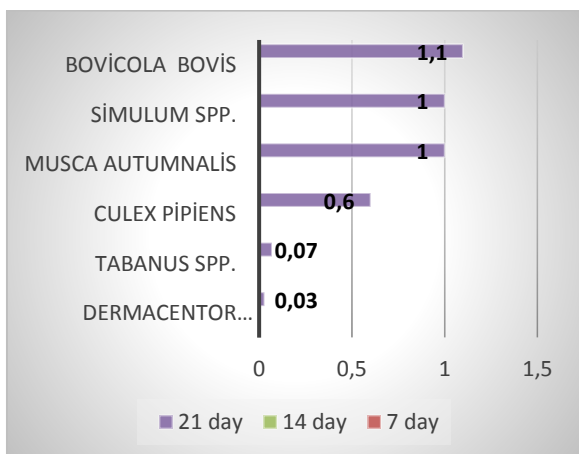
Figure 2. Index of occurrence of ectoparasites after treatment with Biorex GC

The data obtained showed that at this dilution of the drug using an automated animal handling device, the efficiency was 100% within 7-14 days. After 21 days, the index of occurrence of different types of ectoparasites ranged from 1.3 to 12.1%. Figure 3 shows the abundance index of ectoparasites after drug treatment over time. After 21 days, fluctuations in the abundance index ranged from 0.03 to 1.1 ind.
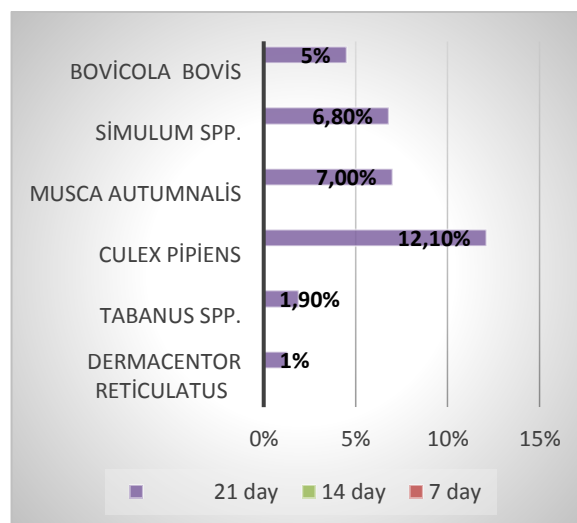
Figure 3. Abundance index of ectoparasites after treatment with Biorex GC

DISCUSSION

As a result of scientific work, the species composition, abundance index and occurrence index of ectoparasites were determined. The index of abundance and the index of occurrence in the winter period in the withers Bovicola bovis are Ia - 10 specimens, Io - 100%. In the spring period, the abundance index and the occurrence index are for Dermacentor spp. Ia - 1.2 specimens, Io - 25%; in Bovicola bovis Ia - 8.6 specimens, Io - 100%. During the summer, Musca spp. Ia - 0.7 specimens, Io - 20%; in Simulium spp. and Culex spp. Ia - 4.3 specimens, Io - 100%; in Tabanus sp. Ia - 3.5 specimens, Io - 33.3%; in Dermacentor spp. Ia - 3.2 specimens, Io - 35%; in Bovicola bovis Ia - 11 specimens, Io - 100%. Studies to determine the species composition and degree of infection with ectoparasites in recent years have been carried out on the territory of the southern Kazakhstan [8,9]. Data on infection are somewhat different, this is primarily due to the different climatic conditions of the northern and southern regions of Kazakhstan.

100% efficiency of the insectoacaricidal preparation "Bioreks GH" was determined using an automated installation in pasture conditions. Various automated plants for spraying animals against midges are used in veterinary practice [10]. The parameters for the use of the insecticidal preparation Biorex GH were established: dilution of 5 ml of 10% emulsion per 10 liters of water (according to AI), consumption per animal ranges

from 500 ± 100 ml. Processing should be carried out during the pasture period with an interval of 15-20 days. The drug Biorex GC is registered in Kazakhstan and is widely used in veterinary practice, the efficacy and safety of the drug has been described by a number of authors [11,12]. We managed to select the required concentration and exposure during automatic processing, which greatly facilitates the work of the veterinarian. Due to the automation of the process, the quality of spraying the hairline of animals with aqueous solutions of insectoacaricides in pasture conditions is improved.

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FATTENING PERFORMANCE OF INDIGENOUS GERZE CHICKEN MALES

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Abstract

Gerze chicken breed, one of the indigenous breeds of Turkey, was registered in 2004 and was taken under protection in 1995 by Agricultural Ministry of Turkey [2]. It isa a local egg-meat breed bred in Gerze district, around the province of Sinop in the Black Sea Region. They have low egg production and produce about 90 eggs annually. Their mature live weight is 1500 grams in females and 1800 grams in males. Therefore Gerze chickens are not produced for commercial purposes. In this study, after Gerze females left for egg production at 18 weeks, males were fed with maize and commercial feed until 20 weeks. A total of 90 males were divided to two groups each containing 45 birds. One group was fed with commercial diet, and 10 grams maize per bird given daily additional to commercial diet. Chickens fed with only commercial diet had significantly higher body weight (1662,2 g vs 1452,3 g; P<0,001). Dressing percentages did not significantly differ between groups; but carcass weights of birds fed with commercial diet (1223,6 g) were significantly higher than group with additional maize (1039,1 g). The differences between carcass part and abdominal fat ratios were not significant. The ratio of edible inner organs to live weight was significantly higher in maize fed group (4,60% vs 3,63%; P<0.05).

Keywords: *Gerze Chicken, Broiler, Fattening, Maize*

COMPARISON OF EXPRESSION LEVELS OF MYOGENIC FACTOR 5 AND 6 GENES ASSOCIATED WITH SKELETAL MUSCLE DEVELOPMENT IN SAANEN AND HONAMLI KIDS

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Abstract

Myogenic factor 5 (Myf5) and 6 (Myf6) genes, which are members of the myogenic regulatory factors family, are among the genes that regulate the development and differentiation of muscle cells and the main regulators of skeletal muscle tissue formation. Determination of the expression levels of Myf5 and Myf6 genes in goats of Saanen breed reared in goat milk production in our country and Honamlı kids reared for combined (meat-milk) production may help to reveal the fattening potential of both breeds at molecular level. Therefore, the aim of this study was to determine the expression level of Myf5 and Myf6 genes in Longissimus-dorsi (LD) and Semitendinosus (ST) skeletal muscles of 3-month weaning-year-old Saanen (n=5) and Honamlı (n=5) kids. Total RNA in muscle samples was isolated using a commercial RNA extraction kit as recommended by the manufacturer. Isolated RNA was converted to cDNA using a commercial cDNA kit in a Thermal Cycler device. The Myf5 and Myf6 gene expression level in LD and ST skeletal muscles was determined by real-time quantitative polymerase chain reaction. The birth and 3-month weaning weight and daily body weight gain of the Honamlı male kids were higher than the Saanen kids (P < 0.05). In the study, although Saanen kids had higher (P < 0.05) RNA content in LD and ST muscles than Honamlı kids, Honamlı kids had higher Myf5 and Myf6 gene expression levels than Saanen kids (P < 0.05) in both muscles. The results of this study show that Honamli kids may have higher muscle growth than dairy Saanen kids due to higher Myf5 and Myf6 gene expression levels. As a result, it was concluded that Myf5 and Myf6 genes are expressed in Saanen and Honamlı kids and that animals suitable for fattening can be selected according to the expression differences of these genes.

Keywords: *Saanen, Honamlı, Muscle development, Myf5, Myf6, Growth*

INTRODUCTION

Today, the main problem of the farmers dealing with goat breeding for milk and combined production in Turkey is that they are suspicious of how much profit male kids born from female individuals will make under fattening, so dairy farms are very meticulously approaching the issue of fattening male kids. The biggest reason for this is that the fattening performance potential of male offspring of dairy breeds is not known enough and the studies on this subject are superficial or insufficient. If this problem is solved with studies that will enable to reveal the fattening potential of male offspring obtained from dairy breeds, our chances of finding a sustainable way for the future in meat production from dairy breeds will increase.

The Myf5 gene is a member of the myogenic regulatory factors (MRF) family, which plays an important role in the formation of muscle fibers and transcription of muscle-specific genes, and it has been reported to affect the level of meat fat (Fujisawa-Sehara et al., 1990; te Pas et al., 2007). ; Verner et al., 2007; Wang et al., 2017). The Myf5 gene is recognized as a core transcription factor involved in muscle development during embryonic myogenesis. Myoblasts proliferate during Myf5 regulation (Park et al., 2015). Tatusova and Madden (1999) revealed in their study that Myf5 is involved in the myogenic process, especially in the muscle differentiation stage (Wang et al., 2017). The Myf5 gene has been associated with meat yield and has been reported to have significant effects on lean meat content, fillet weight and muscle fat levels in animals (Te Pas et al., 2004; Verner et al., 2007). It has been reported that Myf5 gene polymorphism is associated with growth in sheep (Nattrass et al., 2006). According to recent studies, SNPs in the exon region of Myf5 have proven to have significant associations with carcass and meat quality traits in animals (Hedayat-Evrigh et al., 2016). In recent years, many candidate genes have been identified that have an impact on many important economic yields, especially meat yield, milk yield and reproductive efficiency in cattle, sheep, goats, chickens and pigs. The most important of these are the genes belonging to the MyoD family. The myf5 and myf6 genes belonging to this family are the genes we targeted in the study.

As a result, it has been determined that Myf5 and Myf6 genes belonging to the MyoD gene family have very important effects on skeletal muscle development in the fetal and post-fetal period, as well as on the growth and development of Myf5 and MYF-6 genes belonging to the MyoD gene family in farm animals. It is thought to have an effect on muscle development and growth, which is associated with meat production. Based on the above-mentioned issues, the main aim of this study is to determine the expression levels of Myf5 and Myf6 genes, since studies on the performance of Saanen and Honamlı goats, which are being reared in Turkiye, are limited, will make a very strong contribution in this direction.

MATERIALS AND METHODS

In the study, Saanen and Honamli kids reaching the weaning age of 90 days were slaughtered according to standard slaughtering procedures in a commercial slaughterhouse. Longissimus-dorsi (LD) and Semitendinosus (ST) muscles on the right side of the carcass were isolated immediately after slaughter, and the muscle masses were divided into 2×5×2 cm samples and frozen in liquid nitrogen. Frozen samples were stored at -80 ºC until the day of analysis.

A commercial RNA kit (NucleoSpin® RNA kit) was used for RNA isolation in muscle samples and the process was carried out as recommended by the manufacturer of the commercial kit. After genomic DNA was eliminated by digestion with DNase I (Thermo Scientific, Waltham, USA), the RNA quality and quantity were determined using NanoDrop 2000 (Thermo Scientific, Waltham, USA), all RNA samples showed A260/A280 values within the range of 2.01 to 2.08 and A260/ A230 values above 2. Commercial cDNA kit (BIORAD iScript cDNA, 1708890) and Thermal Cycler (BIORAD) device were used for cDNA synthesis and the analysis was done as recommended by the manufacturer of the commercial kit. Primer and reference gene base sequences in the 5 'and 3' directions used in Real-Time PCR are shown in Table 1.

Table 1. Primer and reference gene base sequences in the 5 'and 3' directions used in Real-Time PCR

Genes r	Primer sequences	Product size	Genbank
Myf5-F	5' CACGACCAACCCTAACCAGAG 3'	101 bp	JF829004 (Zhong et al., 2013)
Myf5-R	5' TCTCCACCTGTTCCCTTAGCA 3'	101 bp	JF829004 (Zhong et al., 2013)
Myf6-F	5' CGGAGCGCCATTAACTACAT 3'	101 bp	NM_001285602 (Huang et al., 2016)
Myf6-R	5' AAATCCGCACCCTCAAGATT 3'	101 bp	NM_001285602 (Huang et al., 2016)
GADPH-F	5' GCA AGT TCC ACG GCA CAG 3'	118 bp	AF035421 (Cheng et al., 2012)
GADPH-R	5' TCA GCA CCA GCA TCA CCC 3'	118 bp	AF035421 (Cheng et al., 2012)

In detail, the PCR was carried out in a reaction system of the total volume of 50 µL containing 25 µL premix TaqTM, 17.5 µL 0.1% 114 DEPC water, 2.5 µL forward primers (10 µmol/L), 2.5 µL reverse primers (10 µmol/L) and 2.5 µL cDNA template. PCR procedure was carried out as follows: 98 °C for 4 min, followed by 32 cycles of 98 °C for 40 s, 60 °C for 40 s, 65°C for 30 s, and then 90 °C extension for 10 min, finally 4 °C to terminate the reaction. Relative quantification of all transcripts was performed by qRT-PCR using the real-time PCR system. Realtime quantitative PCRs were run with SYBR Premix Ex TaqTM II. The reaction system was in a total volume of 10 µL containing 5 µL 2 × SYBR Premix Ex Taq II, 0.4 µL forward primer (10 µmol/L), 0.4 µL reverse primer (10 µmol/L), 0.2 µL 50 × ROX Reference Dye, 3 µL 0.1% DEPC water and 1 µL template cDNA. PCR amplification was carried out as follows: a denaturation of 98 °C for 30 s, followed by 40 cycles of 98 °C for 5 s, specific annealing temperature 60°C for 30 s. The $2^{-\Delta\Delta Ct}$ method was used to analyze the mRNA expression levels.

The data we obtained during the study were analyzed using SPSS 20.0 package license package programs. According to the results of Shapiro-Wilk test, it was determined that the distribution normality of the obtained data was suitable for normal distribution (P>0.05) and that the data were suitable for analysis of variance, and the variances were homogeneous (P>0.05) as a result of the Levene homogeneity of variance test. One-way analysis of variance was used to compare breeds.

RESULTS

Total RNA amounts in Longissimus-dorsi (LD) and Semitendinosus (ST) muscles of Honamlı and Saanen male kids are presented in Table 2. In the

study, the Saanen breed male kids had a higher (P < 0.05) RNA amount than the Honamlı male kids.

Table 2. Total RNA amounts in Longissimus-dorsi (LD) and Semitendinosus (ST) muscles of Honamlı and Saanen male kid

	Honamlı	Saanen
LD	86,98 ± 2,61[b]	130,92 ± 7,82[a]
ST	87,57 ± 9,58[b]	135,93 ± 17,10[a]

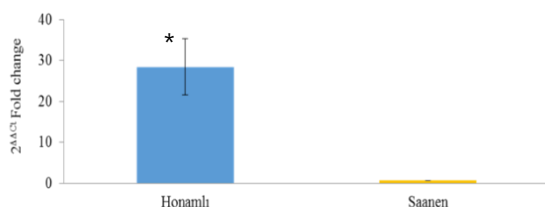[a,b] Means in lines with different letters are significantly different at P<0.05.

The expression levels of myogenic factor 5 (Myf5) gene in Longissimus-dorsi (LD) skeletal muscle of Saanen and Honamlı kids are presented in Figure 1. In the study, there was a very significant difference between the two races in terms of the expression level of the Myf5 gene in LD muscle. The Myf5 gene was expressed 28.39 times compared to the reference gene in the LD muscle of Honamlı kids, while it was 0.59 times expressed in Saanen kids (P < 0.05).
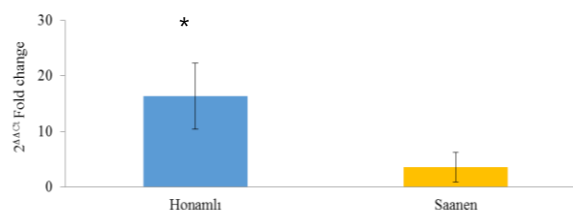
The expression levels of myogenic factor 5 (Myf5) gene in Semitendinosus (ST) skeletal muscle of Saanen and Honamlı kids are presented in Figure 2. In the study, the Myf5 gene was expressed 16.35-fold in the ST muscle of Honamlı kids compared to the reference gene, while it was 3.53 times expressed in Saanen kids (P < 0.05).

The expression levels of myogenic factor 6 (Myf6) gene in Longissimus-dorsi (LD) skeletal muscle of Saanen and Honamlı kids are presented in Figure 3. In the study, he Myf6 gene was expressed 163.67 times in the LD muscle of Honamli kids compared to the reference gene, while it was 4.17 times expressed in Saanen kids (P < 0.05).
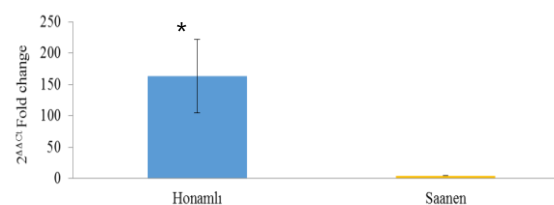
The expression levels of myogenic factor 6 (Myf6) gene in Semitendinosus (ST) skeletal muscle of Saanen and Honamlı kids are presented in Figure 4. In the study, the Myf6 gene was expressed 205.12-fold in the ST muscle of Honamlı kids compared to the reference gene, while it was 4.53 times expressed in Saanen kids (P < 0.05).
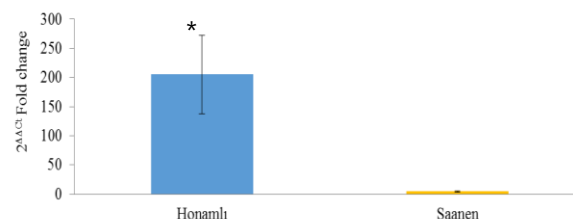

Figure 1. The expression levels of myogenic factor 5 (Myf5) gene in Longissimus-dorsi (LD) skeletal muscle of Saanen and Honamlı kids.

Figure 2. The expression levels of myogenic factor 5 (Myf5) gene in Semitendinosus (ST) skeletal muscle of Saanen and Honamlı kids.

Figure 3. The expression levels of myogenic factor 6 (Myf6) gene in Longissimus-dorsi (LD) skeletal muscle of Saanen and Honamlı kids

Figure 4. The expression levels of myogenic factor 6 (Myf6) gene in Semitendinosus (ST) skeletal muscle of Saanen and Honamlı kids

DISCUSSION

Growth, which is related to carcass weight, which is one of the important indicators of meat yield, is classified in two categories as prenatal and postnatal growth. The attachment of the embryo to the uterus during muscle development, growth, maturation and development of functions is a multidimensional chain of events involving cellular increase and specialization (Ujan et al. 2011a). This chain of events is primarily controlled by the myogenic determination MyoD gene family. It is known that MRFs regulate myogenesis from stages in the formation, development and proliferation of muscle fibers to postnatal muscle

maturation, differentiation and function (Zhong et al., 2013; Patel et al., 2014; Siqin et al., 2017).

The growth and development of muscle cells in farm animals is regulated by the MyoD gene family, MyoG, Myf5 and Myf6. Evolutionary analyzes of the amino acid sequences of this transcriptional activator family have reported that the vertebrate genes MyoD1, Myf5, Myog (myogenin), and Myf6 are derived by gene copies from a single ancestral gene (Haghes and Schiaffino, 1999). These genes are shaped in the formation of muscle cells in the embryonic period and control the maturation and functions of muscle fibers after birth (Haghes and Schiaffino, 1999).

Comprehensive studies are needed to more precisely determine the relationships between meat production and meat quality parameters of the MRF gene family. Muscle expression of certain genes, such as myogenic transcription factors, can significantly affect the meat content and meat quality of carcasses. Therefore, transcription analysis of genes related to muscle development will provide valuable genetic information for meat production.

In this study, it was determined that there were differences between breed in terms of expression levels of Myf5 and Myf6 genes in LD and ST muscle. Because of this result, the comparison of the expression level of Myf5 and Myf6 genes can show that each Honamli breed has high fattening potential and can also reveal the possibility of using them as molecular markers in breeding studies on meat yield traits. The genetic information from this research can be used to develop ways to accelerate genetic improvement in breeding and possible future research directions. In other words, determining the expression levels of the MRF gene family, especially Myf5 and Myf6, can provide important information to more descriptively and clearly define the meat production of our domestic goat breeds and to increase meat production. However, by comparing with dairy breeds, it will be an important tool in determining the breeds that are thought to have poor meat yield. In addition, the fact that the genes responsible for muscle fiber development of Honamlı kids and Saanen kids will be compared for the first time, and this will pave the way for the elimination of a deficiency in this area. Moreover, it will contribute especially to breeding and crossbreeding studies in terms of determining the meat production potential of goat breeds other than meat productive breeds in Turkiye.

CONCLUSIONS

Significantly different degrees of expression of Myf5 and Myf6 in goat skeletal muscle were presented in this study. As a result of this study, it is thought that Honamlı kids may have higher muscle growth due to their higher Myf5 and Myf6 gene expression levels compared to Saanen kids, and positive results will be obtained as a result of correct feeding programs to be applied to male kids of this breed. Finally, the determination of the expression level of Myf5 and Myf6 genes is not only limited to the breeds with high meat yield, but the determination of the meat yield potential of the breeds bred for different purposes has been proven with the study that will make great contributions to the sustainability of meat production with the increasing population of today.

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INTEGRATING MULTI-FACETED STRATEGIES FOR DISEASE CONTROL IN FARM ANIMALS: A PATHWAY TO ENHANCED HEALTH, PRODUCTIVITY, AND SUSTAINABILITY

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Abstract

Effective disease management within farm animals plays a pivotal role in maintaining the sustainability of agriculture. In this extensive study, we introduce an innovative approach to disease control that entails a harmonious amalgamation of early detection protocols and meticulously optimized management practices. By proactively implementing rigorous biosecurity measures, robust vaccination protocols, continuous behavioral monitoring, proactive laboratory testing, disease-free nutritional strategies, and stress-reducing husbandry techniques, we establish a comprehensive and resilient framework aimed at significantly curbing the transmission of diseases. Our intricately designed research underscores that the seamless integration of these diverse strategies not only markedly contributes to preventing diseases but also profoundly elevates the overall health and well-being of farm animals. Through a meticulous examination of critical livestock health markers, disease incidence rates, and production outputs, we furnish compelling empirical evidence that attests to the remarkable advantages stemming from our approach. This groundbreaking study not only adds to the corpus of scientific knowledge but also imparts invaluable practical insights for farm proprietors, veterinarians, and all stakeholders invested in animal husbandry. The strategies expounded within this research serve to not only mitigate the perils associated with diseases but also provide unparalleled support for driving augmented productivity and profitability within the agricultural realm. Our research unequivocally emphasizes the paramount significance of embracing a comprehensive approach to disease control, thereby ensuring the optimal health and enduring viability of farm animals, while simultaneously upholding the long-term sustainability of agricultural practices.

Keywords: Biosecurity, Disease Control, Early Detection, Vaccination, Sustainable Agriculture

REPRODUCTIVE BIOLOGY OF WHITE SEABREAM, *DIPLODUS SARGUS* FROM NORTHEASTERN AEGEAN SEA, TURKIYE

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Abstract

White seabream Diplodus sargus (Linnaeus, 1758) is one of the economic and common species in the Northern Aegean Sea. And it has wide geographical distribution from Bay of Biscay to Angola in the Eastern Atlantic, and from Gibraltar to to Black Sea. This study indicated that the reprodcutive biology of Diplodus sargus, White seabream in the Northeastern Aegean Sea. The specimens were obtained by a small-scale fisherman between August 2020 and July 2021 around Northeastern coasts of Turkiye. Total of 322 specimens were analysed. It was determined that 143 female and 176 male individuals. The female:male ratio was calculated as 0.8:1.0. The length as first maturity (L_{50}) was determined as 22.69 cm for females, 25.2 cm for males, respectively. The GSI value was maximum in May and minimum was is August for females and maximum April and minimum in October for males. The mean total fecundity and the fecundity-length relationship equation was calculated as 64446 ± 10505 and $F=15001*TL-311254$, respectively. It has been determined that the breeding season of White seabream takes place between February and June.

Keywords: First maturity length, Gonadosomatic index, Condition factor, Reproductive period, Diplodus sargus.

INTRODUCTION

The population and reproductive characteristics of fish are key elements in the consideration and control of fisheries resources (Froese 2004). The components of reproductive biology such as first sexual maturity, spawning season, fecundity, condition factor and gonadosomatic index reveal an important indicator for the fisheries management authority. Without valuable data on these aspects, the implementation for controll become impossible. Under these conditions, so as many fish stocks, rapid collapses occur after overfishing. A knowledge on spawning season enable to determine fishery closures, which useful enforcement due to provide protective measures for spawning success (Yıldız and Ulman, 2020). Similarly, length and age at first sexual maturity is an essential information in order to determine minimum landing size, that give a chance to spawn at least one before fished (Froese et al., 2008).

There is a gap in the literature about reproduction parameters of Diplodus sargus. Only a few study indicetes first reproductive length and spawning season of the species (Mouine et al. 2012; Benchalel and Kara, 2012; Ayyıldız and Altın, 2020; Boufekane et al. 2021).

Therefore, this study is important as it presents the first findings of reproduction parameters (first sexual maturity length, reproductive season, fecundity) of *D. sargus* in the Northeastern Aegean Sea, Eastern Mediterranean.

MATERIALS AND METHODS

The specimens were obtained by a small-scale fisherman between August 2020 and July 2021 around Northeastern coasts of Turkey. A random sampling of minimum 30 individuals per month from different sizes were conducted from commercial catchs of handline and longline fishing gears for White Seabream and trammel nets for Salema. A total of 322 specimens of White Seabream was collected, respectively.

The total length (TL) were measured with measuring board to the nearest mm and total weight (TW) and gonad weight (GW) were weighted to the nearest 0.01 g. Sex and maturity stages were analysed macroscopically and maturity stages were determined according to five digit maturity scale of Holden and Raitt (1974).

Gibson and Ezzi's (1980) and King's (1995) formula were used for determining Gonadosomatic Index (GSI) and length at first maturity (L_{50}), respectively. For fecundity analyses, each pair of ovaries was dried and weighed. A subsample of 0.05 g from 3 parts (front, middle and back) were taken from each ovary. All samples were counted under a stereozoom microscope and the mean value was calculated. Absolute fecundity was calculated with Bagenal's formula (equation 1) (Bagenal 1978);

$$F = N \times (G/g) \qquad (1)$$

where N is the mean number of eggs in each gonad, G is the total weight of gonad, and g is weight of the female individual. The total length-fecundity, the total weight-fecundity and age-fecundity relationship were estimated for females using linear and and exponential regression which equations best fit.

RESULTS

The gonadomomatic index and condition factor value monthly calculated for *D.sargus*. The GSI values were between 0.01-9.71 and the maximum GSI value was determined in February, minimum GSI value was determined in August for females. In male individuals the maximum GSI was in April, minimum GSI was in November (Figure 1).
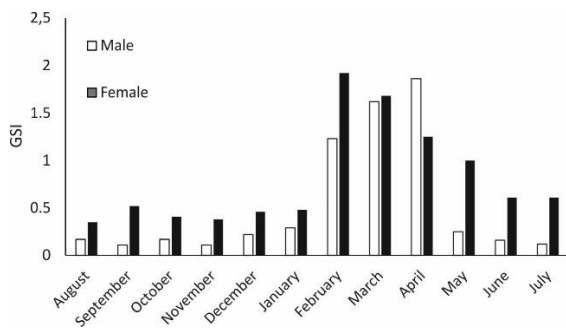
Figure1. Monthly GSI variation of *D.sargus*

The condition factor varies between 0.87 and 2.13 in all individuals. The minimum CF value was determined in November (1.47) and the maximum CF value in October (1.79) in all individuals.

The CF value in females varied between 0.87 and 2.10, the minimum CF value was determined in November and the maximum CF value was determined in October.

In males, CF varied between 1.18 and 2.15, the minimum was in November and the maximum was in October.

Although no significant difference could be detected between female and male CF values. The lengths at 50% maturity of *D.sarhus* were calculated as 22.69 cm in females and 25.2 cm in males.

The monthly sexual maturity stages (Figure 2), GSI and CF values were evaluated together the reproductive period of *D.sargus* was determined between February to June.
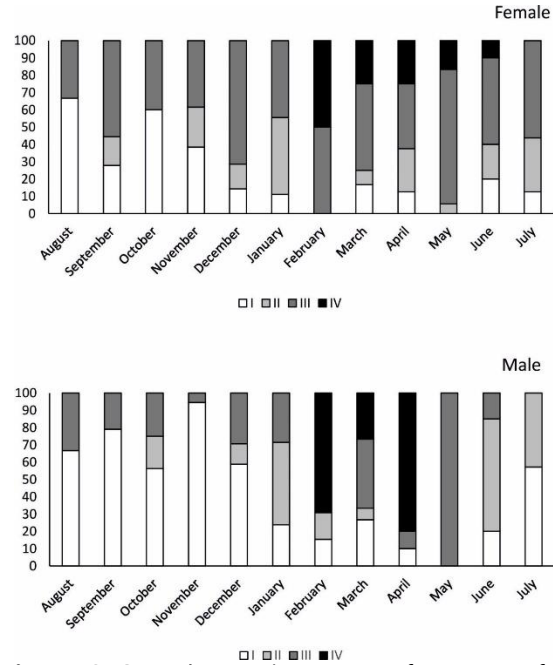
Figure 2. Sexual maturity stages of *D. sargus* for females and males.

The total fecundity and mean fecundity were calculated between 16914 to 112144 eggs, and 64446±10505. Fecundity length relationship equation were determined as F=15001*TL-311254 (r^2=0.87) (Figure 3).
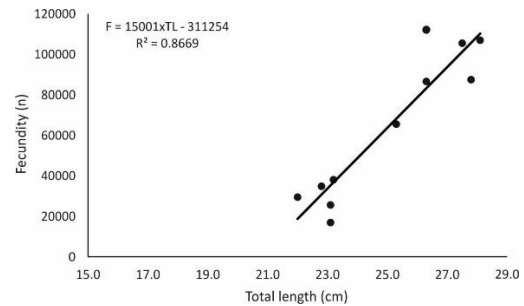
Figure 3. Fecundity – total length relationship of *D.sargus*

It was determined that the fecundity increased as the length increased. Fecundity weight relationship equation was calculated as F=461.99*TW-62486 (r^2=0.84) (Figure 4).
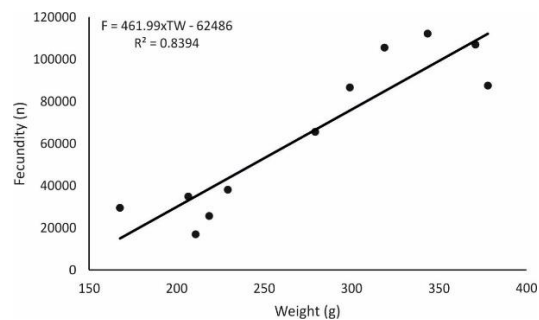
Figure 4. Fecundity – total weight relationship of *D.sargus*

DISCUSSION

Mouine et al. (2012) determined that the first sexual maturity length of *D.sargus* in the Gulf of Tunisia was 21 cm. Benchalel and Kara (2013) calculated that it was 20.2 cm in males and 20 cm in females in the eastern coast of Algeria. Boufekane et al., (2021) found that the reproductive season between January to May and spawning occurred in spring, and calculated the size at first sexual maturity (TL_{50}) was 20.55 cm for both sexes

In our study, L_{50} values were determined 22.69 cm TL in females and 25.2 cm TL in males. L_{50} values of females are similar with other studies, while L_{50} value of males is higher than the other studies. It is thought that this may be due to the smaller number of male individuals being sampled in other studies and the difference in catching power.

Ayyıldız and Altın (2020) investigated the growth and retrospective catching dates of *D.sargus* in the northern Aegean Sea at the juvenile stage. It was determined that reproduction took place between January and June and 3 breeding peaks were observed as March-April, February and May, although it varies according to the sampling regions. In this study, reproduction peaked between February and April. It was determined that the results of these two studies, which were carried out in the same region and whose reproductive period was determined by different methods, were parallel.

ACKNOWLEDGEMENTS

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EFFECT OF INOCULANT CONCENTRATION ON CORN SILAGE QUALITY AND IN-VITRO GAS PRODUCTION IN BEEF CATTLE

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Abstract

This study aimed to evaluate the effect of bacterial inoculants on corn silage quality and gas production. To improve fermentation, digestibility and silage quality and also decrease in methane production, bacterial inoculants under use in farms when silage materials ensiling. In this experiment treatments as follows: 1) Control (C, no additives), 2) 0.5% addition of inoculant (a mixture of Lactobacillus buchneri, Lactobacillus plantarum, Enterococcus faecium, Silamix Granul, Royal ilac Co. Ltd, Kayseri, Turkiye) 3) 1% addition of inoculant, and 4) 2% addition of inoculant. For each concentration, inoculants were dissolved in 0.5 lt water and from this mixture 20 ml spray was applied on 20 kg of chopped corn plants and then mixed homogeneously by manual. Silage samples were filled 2 litres plastic container cups with 5 replicate and fermented for 60 days in room temperature. To determine gas production beef cattle rumen liquor was obtained from slaughterhouse and used in syringe technics in in-vitro condition. There were no significant changes in terms of pH, dry matter, crude ash, neutral detergent cellulose (NDF) and acid detergent cellulose (ADF) values of silages. Crude protein was higher in the 0.5% and 1% inoculant added groups than control group (P<0.01), however similar with 2% inoculant added group. Addition of 0.5% inoculant group's crude fat concentration was higher than those of other treatment groups (P<0.01). Gas production values of 2% inoculant added group was higher than those of control and 0.5 and 1% inoculant added groups at 6 h (p<0.01), and 12 h (P<0.05) measurement. There was no significant differences in total gas production values at 24 h among the groups. Methane production were lower in 0.5 and 1% inoculant added group than control and 2% inoculant added groups and control group's methane production was lower than 2% inoculant added group (P<0.01). In conclusion, bacterial inoculants with 2% corn silage improved silage quality.

Keywords: Corn silage, Chemical Composition, Gas Production, Sustainability, Environment

WATER CONSUMPTION AND FAECAL PRODUCTION DEPENDING ON LIVE WEIGHT IN GEESE

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Abstract

The aim of this study was to determine the average daily water consumption, daily faeces and faecal dry matter content in relation to body weight in Turkish geese. For this purpose, 24 adult male geese aged 48 weeks were used. The geese were weighed in terms of live weight at the beginning of the experiment and divided into 3 groups as low (3124 - 3864 grams), medium (3865 - 4160 grams) and high (4161 - 4780 grams). Data were taken from the geese for 24 hours one day every week for 4 weeks. Within 24 hours, water consumption and the amount of faeces produced by male geese fed with 200 g feed were determined. Faecal dry matter content was also determined. In the study, the amount of daily faeces did not differ according to the live weight groups and the average faeces amount was determined as 237.83 grams. Again, there was no difference in the amount of water consumed according to body weight, and an average water consumption of 600 ml was determined. The average faecal dry matter content was found to be 78.19%. The results of the study showed that daily water consumption was 3 times the average amount of feed consumed.

Keywords: Goose, Feed Intake, Water Intake, Amount of Faeces, Dry Matter

STERNUM HEIGHT AND WITHERS HEIGHT AS SELECTION CRITERIA FOR PREDICTION OF BODY WEIGHT IN DORPER RAMS

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Abstract

The current study was carried out at the University of Limpopo's experimental farm, which is located 10 kilometers west of the university aiming to predict body weights from the growth traits of ram Doper sheep. The growth traits will help rural farmers who lack weighing equipment to anticipate the body weights of their animals for a variety of reasons, including feeding, medication, and breeding purposes. Data on growth traits such as body length, heart girth, sternum height, withers height, rump height, and body weight were collected for one day from 50 Dorper sheep aged 1 to 2 years. Pearson's correlation and simple linear regression analysis were used to achieve study's objectives. Pearson's correlation results indicated that body weights showed to be positively and statistically correlated to withers and sternum height. Simple linear regression demonstrated the highest coefficient with the lowest mean square error on sternum and withers height in rams. Correlations suggest that increasing withers and sternum height in rams might cause body weights to increase. The regression analysis revealed that sternum or withers height contributes 61% of the variation. In conclusion, to improve body weights, withers and sternum heights and heart girth, may be selected.

Keywords: *Sternum height, Withers height, Body length, Heart girth, rump height.*

INTRODUCTION

Sheep farming is recognized as the most important industry, supplying a significant amount of food to the human population (Gorlov *et al.*, 2017). Valencia *et al.* (2022) documented that sheep contribute to the economy through the production of wool, milk, meat, and skin, and their faecal matter is used as fertilizer. Villatoro et al. (2021) classified Dorper sheep as the mutton sheep breed that can survive and adapt to extreme macroclimatic conditions moreover, they are adaptable fast-growing animal producing heavy meat resulting in attractive cuts for retailers. Body weight is an important factor in the animal industry when it comes to selecting animals for breeding and selling (Lakew *et al.*, 2017). Growth traits are of key interest during breeding for economic traits, particularly for meat purposes (Dakhlan et al., 2020). However, due to a shortage of measuring scales (weighing scales), rural farmers rely on animal physical appearance and body weight estimates, resulting in bad decisions on medical dosing, selling, and feeding their animals, as well as poor selection criteria (Abdel-Mageed and Ghanem, 2013). Jahan et al. (2013), estimating body weights using growth traits is the cheapest and easiest way that communal farmers can use. Asefa *et al.* (2017) revealed that because they are easy and quick to measure, they can be used indirectly to determine body weights. Growth traits, according to Verma *et al.* (2016), provide information on an animal's skeletal structure, growth, and development capabilities. Several authors have used growth traits to predict body weights in many breeds of sheep (Younas *et al.*, 2013) because growth traits provide important details about the morphological structure and potential for the development of the animals (Shirzeyli *et al.*, 2013). The purpose of the livestock and meat industry, according to Younas *et al.* (2013), is to establish a reliable and objective assessment method for analysing the economic features of animals and predicting the weight, prices, and merit of the carcass of a living animal, hence the objectives of the study was to determine the relationship between body weights and growth traits and to estimate the best model to predict live body weights using various growth traits.

MATERIALS AND METHODS

Study area

The current study was carried out at the University of Limpopo's experimental farm, which is located 10 kilometres west of the university. The farm experiences semi-arid climatic conditions with temperatures ranging between 5°C and 28°C in winter and summer temperatures range from 10°C to 36°C and the average annual rainfall is less than 400mm (Kutu and Asiwe, 2010).

Ethical approval

All procedures were performed following the standards and protocols set by the University of Limpopo Animal Research Ethics Committee

(AREC) and ethical approval of number AREC/08/2021: PG was granted by the university of Limpopo Animal Research Ethics Committee (ULAREC) before the commencement of the study.

Data collection

Fifty (50 rams) Dorper sheep between the age of 1 and 2 years were used. The animals were raised extensively, and water was always provided. Vaccination and dipping programs were conducted regularly during lambing, weaning, and breeding. A cross-sectional experimental design with one replicate per Dorper sheep was used as an experimental design. All Dorper sheep were chosen at random for their growth traits. Body length (BL), heart girth (HG), sternum height (SH), withers height (WH), and rump height (RH) of Dorper sheep were measured using a measuring tape calibrated in centimeters (cm). At the same time, the body weight of each sheep was measured in kilograms (kg) using an ST-0606 sheep, goats, and pigs professional scale (crate scale 300kgx100g) from Scale Tronic services. Data collection occurred for a one. Growth traits measurements were taken following the recommendations of (Birteeb *et al.*, 2012). Shortly, withers height is defined as the vertical distance from the highest point of the shoulder (wither) to the ground surface concerning the level of the forelegs, body length is defined as the distance between the anterior shoulder point and the posterior extremity of the pin bone, sternum height is defined as the vertical distance from the lower tip of the sternum to the ground as the animal stands, and rump height is defined as the distance from the top of the pelvic girdle to the ground surface. To avoid variation, arguments, and bias, measurements were all taken by the same person.

Statistical analysis

For statistical analysis, the Statistical Package for Social Sciences (IBM SPSS, 2020) software version 27 was used, Pearson's correlation coefficient was used to estimate the relationships between body weight and growth traits, and simple linear regression analysis was used to estimate the best model to predict live body weights using various growth traits. Body weight was used as a dependent variable, and growth traits were used as independent variables; only correlated variables were used, beginning with the most highly correlated. The following model was used for regression analysis:

$Y = a + b_1X_1$

Where Y = dependent variable (body weight); a = regression intercept; b = coefficient of regression; X_1 = independent variable (s) (withers height, body length, sternum height, heart girth and rump height).

The accuracy of the models was evaluated by the goodness of fit test such as determination coefficients (R^2), Root mean squared error (RMSE), Akaike information criterion (AIC), and Bayesian information criterion (BIC). The following criteria were used:

$$R^2 = 1 - \left(\frac{SST}{SSE}\right)$$

$$RMSE = \sqrt{\frac{SSE}{N - p - 1}}$$

$$AIC = N \, Ln\left(\frac{SSE}{N}\right) + 2p$$

$$BIC = N \, Ln\left(\frac{SSE}{N}\right) + p \, Ln \, N$$

Where:

R^2 = coefficient of determination; SST = is the total sum of a square; SSE = is the residual sum of a square; RMSE = is the residual mean square error; N = is the number of observations; P = is the number of parameters in the regression equation; AIC = is the Akaike information criterion; BIC = is the Bayesian information criterion; Ln = is the natural logarithm in the calculator.

RESULTS

Data of all the measured traits for rams were summarised by descriptive statistics as revealed in Table 1.

Table 1. Descriptive statistics of growth traits of Dorper rams

Traits	Mean	Std. Deviation	CV (%)
BW (Kg)	30.53	4.13	84.81
WH (cm)	60.71	5.41	8.91
RH (cm)	66.86	6.23	9.32
BL (cm)	74.86	6.57	8.78
SH (cm)	40.86	3.85	9.42
HG (cm)	82.71	3.15	3.81

BW: Body weight, WH: Withers height, RH: Rump height, BL: Body length, SH: Sternum height, HG: Heart girth, CV: Coefficient of variance, Std. Deviation: Standard deviation.

Pearson's correlation was used to establish the relationship between growth traits (BW and HG, WH, BL, SH, RH) of Dorper sheep (Table 2). Pearson's correlation revealed that relationship the between growth traits ranged from - 0.28 to 0.78. BW showed a high positive statistical correlation with WH and SH at $P < 0.01$ moreover had a negative statistical correlation with RH and positive statistical correlation with HG at $P < 0.05$ however no significant relationship was observed with BL. Relationship within traits, WH was negatively highly correlated to RH, highly

positively correlated to SH at P < 0.01, positively correlated to BL (P < 0.05) but no significant correlation with HG, RH was not significantly correlated to HG however it was found to be negatively correlated to BL and SH (P < 0.05), BL was found not significant towards SH but negatively correlated to HG (< 0.05) lastly SH showed a highly statistical correlation with HG (P < 0.01).

Table 2. Phenotypic correlation between growth traits of Dorper rams

Traits	BW	WH	RH	BL	SH	HG
BW (Kg)		0.78**	-0.28 *	0.06 ns	0.78**	0.34*
WH (cm)			-0.76**	0.39*	0.79**	0.19 ns
RH (cm)				-0.41*	-0.45*	0.14 ns
BL (cm)					0.05 ns	-0.36*
SH (cm)						0.70**

BW: Body weight, WH: Withers height, RH: Rump height, BL: Body length, SH: Sternum height, HG: Heart girth, **: Correlation is significant at the 0.01 level (2-tailed), *: Correlation is significant at the 0.05 level, ns: non-significant.

The cause-effect relationship between variables was achieved through simple linear regression. Model for prediction of BW using WH, BL, SH, and RH as independent variables generated from simple linear regression analysis of rams are shown in Table 3. SH and WH may be used to predict and improve body weights. Their model (BW = - 3.70 + 0.84SH) and (BW = - 5.55 + 0.60WH) showed equal highest R^2 value of 0.61 with the lowest AIC (-0.98) and BIC (-3.07) for SH and lowest AIC (-2.77) and BIC (-3.07) for WH. According to the current results, SH and WH had the same coefficient of determination, accounting for 61% of the variations in body weights.

Table 3. Simple linear regression of Dorper rams

Regression parameters	Model	RMSE	R^2	AIC	BIC
SH (cm)	-3.70 + 0.84SH	7.95	0.61	-2.98	-3.07
WH (cm)	-5.55 + 0.60WH	8.03	0.61	-2.77	-3.07
RH (cm)	42.72 - 0.18RH	18.87	0.08	15.79	15.49
BL (cm)	27.66 + 0.04BL	20.34	0.00	17.79	17.12
HG (cm)	5.54 + 0.30HG	19.33	0.05	16.32	16.01

WH: Withers height, RH: Rump height, BL: Body length, SH: Sternum height, HG: Heart girth, RMES: Mean square error, R^2: Coefficient of determination, SST: Total sum of a square, SSE: Residual sum of a square, N: Number of observations, P: Number of parameters in the regression equation, AIC: Akaike information criterion, BIC: Bayesian information criterion, Ln: natural logarithm in the calculator.

DISCUSSION

The current study's first goal was to use Pearson's correlation to determine the relationship between body weights and body length, heart girth, sternum height, withers height, and rump height in Dorper sheep. Body length was the only trait that did not have a statistical relationship with body weights. Shirzeyli *et al.* (2013), indicated that there is an increase in studies on the prediction of body weights using different growth traits on different animal breeds. Temoso *et al.* (2017) conducted a study on goats and sheep of communal rangelands in Botswana, they agreed with the current study report that there is a positive statistical correlation between body weights and sternum height in rams however the same study disagree with the current correlation whereby body weights had no statistical relationship with heart girth in rams, the contrary may be due to use of different breeds and environmental conditions during data

collection.Boujenane and Halhaly (2015) estimated body weights from height girth in Sardi and Timahdite sheep using different models. Their results agreed with current reports that there is a strong relationship between body weights and heart girth. Current correlation reports are consistent with Yakubu's (2010) findings on Yankasa lambs, which showed a positive statistical relationship between body weights and heart girth in rams. Furthermore, Shirzeyli *et al.* (2013) reports disagree with the current study stating that body length can be used as a selection criterion in females because it had a high correlation with body weights. According to Rather *et al.* (2021), wither height was the best predictor of body weight for farmers who do not have a weighing scale. Furthermore, Kumar *et al.* (2018) observed a positive and statistical phenotypic relationship between body weights and heart girth in the prediction of body weights from growth traits in sheep, which agreed with the

current results that heart girth is the best variables to be used when predicting body weights and the same author stated that the traits can be further refined. Musa *et al.* (2012) in Sudanese Shogur, Ravimurugan *et al.* (2013) in Kilakarsal sheep, and Kumar *et al.* (2018) in Harnali sheep all agreed with the current results that heart girth can be used to estimate live weights.

Current phenotypic correlation results suggested increasing withers height or sternum height may increase body weights. The discovered relationship between growth traits suggests that these traits are influenced by the same gene (s) (pleiotropy) (Mathapo *et al.*, 2022). Correlation experiments, only measure the association between two variables; they do not reveal how they affect each other (cause-effect relationship). As a result, the second study goal was to use simple linear regression to develop models for estimating body weights from body length, heart girth, sternum height, withers height, and rump height in Dorper sheep. The results of the regression analysis agreed with those of Kumar *et al.* (2018), who established a model to predict the body weight of sheep from growth traits, and the highest coefficient was found on heart girth, indicating that it has the greatest variation in body weights, making it a suitable trait to be used as a predictor of body weights which disagree with the current study. Recent study regression analysis reports are consistent with the findings of Rather *et al.* (2021) on Kashmir merino sheep concluded that a model consisting of withers height is the best equation to use when predicting body weights. The findings of the study showed that an increase in one centimeter of sternum height will increase body weight by 0.84 kg, and a model consisting of wither height reveals that an increase in one cm of withers height will lead body weights to increase by 0.60 kg.

CONCLUSIONS

Study reports revealed that there is a correlation between body weight and some growth traits of Dorper sheep. Withers height, sternum height and heart girth may be selected to improve body weight. Regression analysis results showed that sternum height or withers height contributes 61 % of variation. Models consisting of sternum height or withers height might be used by breeders when advising farmers on how to predict and improve their body weight. Current report will assist breeders in advising farmers on how to determine the body weight of their animals without the use of a weighing scale to make proper decisions for feeding, marketing, replacement, and health purposes for management purposes. However, more studies need to be done on the estimation of body weights from growth traits of Dorper

sheep using larger sample size and more growth traits.

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AN APPROACH TO DEVELOP ADDITIONAL MICROSATELLITE MARKERS ON THE BTA7 REGION CONTAINING THE QTL FOR OVATION RATE

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Abstract

For most dairy and beef producers, having twins is undesirable because twins are associated with several disadvantages, including lower calf survival and less efficient cow reproduction rates. Understanding genetic control of reproduction is improved by mapping QTL (Quantitative Trait Loci) for ovulation rate. BTA5, 7, and 19 have already been shown to be QTL for ovulation rate. In this study, comparative map information from swine genome was used to identify genes in the regions of interest. Based on this information and synteny mapping, 10 porcine microsatellites were used as primers in bovine genomic DNA, resulting in 8 heterologous PCR products. Unfortunately, based on the cloning and sequencing results, none of the heterologous PCR results on BTA7 could be identified as a potential bovine microsatellite affecting QTL regions on BTA7. *This oral presentation is part of Hasan KOYUN's Ph.D. thesis

Keywords: Cross-Specific Amplification (Heterologous Pcr), Microsatellites, Comparative Gene Mapping, Cattle Ovulation Rate, And Chromosome 7 (Bta7)

THE EFFECT OF DIFFERENT ECOLOGICAL DISINFECTANTS (ANIONIC OXYGEN AND SILVER COLLOID) USED TOGETHER WITH INTRAVAGINAL SPONGE APPLICATION ON GENITAL FLORA AND PREGNANCY IN OESTRUS SYNCHRONISATION IN EWES

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Abstract

Oestrus synchronisation protocols are carried out in order to obtain early oestrus, high fertility, and more lambs in ewes in the field. For this purpose, the prostaglandin F2 alpha injection method is frequently used during the season, However, especially in the off-season and/or transition period, an intravaginal progesterone (P4) sponge and PMSG-containing injection protocol is preferred. However, in ruminants, antimicrobial agents are not used before the routine vaginal sponge insertion in the field. Indeed, this condition (with no antimicrobials during synchronisation) often causes mild 'vaginitis' and malodour in synchronised ewes. Therefore, in our project (TUBITAK-2209 A, 2022), we used antimicrobials (disinfectants; Active Anionic Oxygen-AAO or Silver Colloid-SC) by deep intravaginal route (fornix area) before the sponge insertion in order to achieve greater reproductive outcomes by contributing to animal health and welfare. A total of 60 healthy fertile ewes (aged 2-5 years) in the transition period, with similar condition scores (group BCS average around 2.5 units, 1-5 scale), were divided into four groups, as follows: Group I (P4+AAO, n=15); Before inserting the sponges, 5 cc Active Anionic Oxygen (UB20 O8®, BAYNOVA, Ankara) was given deep intravaginally. After 30 minutes, the sponges of 60 mg MAP (P4, Esponjavet®, HIPRA, Istanbul) were inserted on day -12, then 500 IU PMSG (Oviser PMSG®, HIPRA) i.m. injection was administered on day 0 (zero), as followed by the inclusion of the alternating 2 rams into the female group. Group II (P+SC, n=15); First, 5 cc Silver Colloid (Green GENITAL®, ALDO Ciftlik Market, TURKIYE) was given deep intravaginally. After 30 minutes, the sponges were inserted routinely followed by PMSG injection, along with ram inclusion as above. Group III (PC, n=15); First, 5 cc saline (0.1% NaCl, as Positive Control) was administered before the sponge insertion for 12 days, followed by the withdrawal and PMSG injection and rams inclusion as above. Group IV (NC-Control, n=15); Ewes receiving no hormonal or disinfectant treatment applications (Negative Control) were kept along with rams within the flock routinely. Oestrus symptoms (standing/mating) in the application groups (I, II, and III) were mostly started 24 hours after the sponge removal/PMSG injection and continued especially on the second/third days after the ram inclusion. For examination of vaginal flora/exudate, the samples were collected (with a plastic injector placed deep in the vagina), 3 times in total before the insertion, remaining, and withdrawal of the sponge. Although the initial vaginal exudate examinations showed some degree of pus in some ewes while detailed checkings of genital flora status by Giemsa-stained smears (especially the potential presence of neutrophil leukocytes) are underway. Findings of oestrus, pregnancy, and lambing were recorded already, as all to be analyzed statistically by using ANOVA and Chi-Square methods together. As preliminary results of oestrus synchronisation, the potential favourable effects of using vaginal Progesterone sponges/PMSG injection to be combined with prior genital disinfectant(s) (AAO and/or SC) application (based on genital flora, oestrus, and pregnancy/lambing success) in ewes are expected. Keywords: Sheep, Synchronisation, Disinfectant, Progesterone, Pregnancy #Project no: TUBITAK 1919B012203128 (2022/1.Term)

Keywords: Sheep, Synchronisation, Disinfectant, Progesterone, Pregnancy

FEATHER DNA EXTRACTIONS: COMPARING METHODS FOR PIGEONS AND COCKATIELS

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Abstract

This study aimed to compare different DNA extraction methods to achieve higher amounts and purity levels from molted feathers of pigeons (Columba livia f. domestica) and cockatiels (Nymphicus hollandicus). We evaluated 226 animals consisting of 202 pigeons and 24 cockatiels for these purposes. We performed three commercially available DNA extraction kits to isolate DNA from the feather samples. These kits were compared regarding DNA yield and quality depending on the different applications made during the isolation. DNA concentration (ng/mL) and absorbance ratio were measured using a Nanodrop spectrophotometer. Kruskal-Wallis tests were performed for the statistical comparisons. The mean DNA concentration was the highest in isolation with the Thermo Scientific kit. However, the highest isolation value was obtained from the Nucleogene kit. Among three commercial kits, statistically significant differences were observed concerning nucleic acid concentration (ng/µl) (p<0.001). Also, the best 260/280 nm ratio absorbance was obtained with the Nucleogene kit, while the lowest value was obtained from Rosche. Moreover, the concentration and purity of DNA were detected as higher in Cockatiels than in Pigeons, and the significant differences were determined between birds based on spectrometric measurements (p<0.001). In conclusion, the reported findings in this study may be helpful for the DNA extraction from the feather samples collected non-invasively in the field for genetic analysis in birds.

Keywords: Feather, DNA Extraction, Pigeon, Cockatiel, DNA Quality, Spectrophotometer

INTRODUCTION

In avian study, the accurate extraction of DNA is vital for a wide range of studies, including population genetics, phylogenetics, and conservation biology. Reliable DNA extraction methods enable us to obtain high-quality genetic material that can be used for various downstream applications. The choice of appropriate extraction protocols is particularly critical when comparing different bird species, as variations in feather structure and composition can affect the efficiency and quality of DNA extraction (Taberlet and Bouvet, 1991; Bello et al., 2001; Freedman et al., 2008).

Traditionally, obtaining genetic information required invasive methods, such as capturing birds and collecting blood or tissue samples. However, these methods can be stressful for birds and time-consuming forresearchers. Non-invasive sampling methods have emerged as a promising alternative, allowing scientists to extract DNA without physically handling the birds (Horvath et al., 2005; Presti et al., 2013; Zemanova, 2021).

Pigeons (Columba livia) and cockatiels (Nymphicus hollandicus) are two avian species commonly studied due to their diverse genetic backgrounds and population dynamics of bird species. However, there is a lack of standardized protocols for extracting DNA from feathers in these species. Therefore, it becomes crucial to evaluate and compare various DNA extraction methods specifically tailored to pigeons and cockatiels (Yılmaz and Boz., 2012; Grindol, 1998).

Pigeons and cockatiels, in particular, have long been favored for their unique qualities. Pigeon breeding is an ancient practice that has been refined over generations. The domestic pigeon has been bred for different purposes for 6,000 years or more. More than 800 breeds have been described since it was domesticated. They are bred for their beauty in appearance, ability to fly and navigation, and meat. Pigeons can be grouped as diver, tumbler, reeler, spinner, fleet flyer, high flyer, mail, ornamental and passerine according to their breeding purposes (Yılmaz and Boz, 2012).

By selecting pigeons with desired traits such as feather patterns or flight capabilities, breeders have been able to create a wide variety of pigeon breeds.

Cockatiels, on the other hand, are beloved for their intelligence and ability to mimic human speech. Breeding parrots requires a deep understanding of their complex social structures and behavioral patterns. By pairing parrots with compatible personalities and ensuring optimal living conditions, breeders aim to produce healthy and well-adjusted offspring. This not only enhances the welfare of the birds but also contributes to the conservation efforts of

endangered parrot species (Grindol, 1998; Banaszewska et al., 2015).

Commercial DNA extraction kits provide reagents and spin column filters to isolate DNA from feather samples. Kits often use lysis buffers and Proteinase K to break down feather material, then DNA is bound to a silica membrane spin column and washed. Kits can be more expensive but convenient, avoiding toxic chemicals and providing high-quality, concentrated DNA. Kits designed specifically for isolating DNA from hair, feathers, or other keratinized materials tend to work best for feather samples (Senturk et al., 2023).

Although the use of shed feathers is preferred because it is difficult to take blood and tissue samples in birds, the keratin structure of the feathers complicates the process. However, determining the practical method of DNA isolation is essential for the continuity of genetic analysis. In this context, the study aims to compare the effectiveness of different DNA isolation methods from the molted feathers of birds.

MATERIALS AND METHODS

Sample collection:
Feathers were pulled from the wing and tail parts of the birds with the help of ethanol-sterilized forceps and placed in tubes for DNA analysis. Pigeon feathers typically expect 10-30 nanograms of DNA per feather, while parrot feathers expect around 5-15 nanograms. For this reason, at least 3-5 feathers per bird were collected to obtain enough high-quality DNA for your study. Samples in each tube were labeled with the bird's identity, feather type, and collection date and stored at +4°C until DNA isolation. The critical point to note here is that the earlier the DNA is isolated, the better results can be obtained since the yield and quality of DNA may decrease over time.

DNA extraction

Feather samples were obtained from individual breeders to isolate genomic DNA. Two hundred twenty-six birds consisting of 202 pigeons and 24 cockatiels were chosen randomly and used in this study. Under sterile conditions, feathers are placed on the petri dish to cut each sample. Before applying commercial isolation kits, the DNA-containing part of two different areas for feathers, which are the basal tip of the calamus and blood clot from the superior umbilicus, were cut with the help of a scalpel and divided into small pieces (Horvath et al., 2005).

Three commercial DNA extraction kits were used to isolate DNA from feather samples, following each kit protocol based on manufacturer instructions.

Statistical analysis

Kruskal-Wallis tests were performed for the statistical comparisons. A probabilty level of < 0.05 was accepted as statistically significance.

RESULTS AND DISCUSSION

The relationship between the selected extraction kits and bird species with regard to nucleic acid concentration was presented in Tables 1 and 2, respectively. The mean DNA concentration was the highest in isolation with the Thermo Fisher Scientific (ThermoSci) kit, followed by Rosche and Nucleogene kit results. However, it was observed that the highest isolation value was obtained from Nucleogene. The difference between these three kits was found to be statistically significant (p<0.001).

Table 1. Means, standard errors, minimum and maximum values for nucleic acid concentration (ng/µl) based on the isolation with the different commercial kits.

Kit	Mean	Min	Max
Nucleogene	$16,81 \pm 3,33^a$	1,00	331,80
ThermoSci.	$6,076 \pm 0,98^b$	0,400	58,100
Rosche	$24,01 \pm 5,76^c$	1,30	108,50

[a,b,c.] Means with different superscripts are different ($P < 0.001$).

When we compare DNA concentration concerning the species, DNA concentration was higher in Cockatiels than in Pigeons; the difference between birds was statistically significant (p<0.001).

Table 2. Means, standard errors, coefficient of variation, minimum and maximum values for nucleic acid concentration (ng/µl) based on bird species.

Species	Mean	CV	Min	Max
Pigeon	$11,32 \pm 1,21^a$	152,61	0,40	108,50
Cockatiel	$31,5 \pm 13,3^b$	206,64	6,5	331,8

[a,b,] Means with different superscripts are different ($P < 0.001$). CV refers to Coefficient of Variation.

The ratio between the absorbance of the sample at the wavelength of 260 and 280 nm is used to assess DNA purity and integrity. A ratio of about 1.8 is generally accepted as "pure" for DNA. If the ratio is lower than 1.6, it may indicate the presence of phenol or other contaminants that absorb strongly at or near 280 nm. Higher ratios can indicate that DNA has contaminated isolated proteins (William et al., 1997).

The relationship between the selected extraction kits and animal species with regard to the absorbance ratio of 260/280 nm was presented in Tables 3 and 4, respectively. In this study, the ideal 260/280 ratio value was obtained with the Nucleogene kit, while the lowest value was obtained from Rosche. Significant differences in DNA purity were observed between the three kits. DNA concentration was the highest in isolation with the ThermoSci. kit, followed by Rosche and Nucleogene kit results. However, it was observed that the highest isolation value was obtained from Nucleogene. The difference between these three kits was found to be statistically significant (p<0.001). Several studies reported that the quality and quantity of DNA obtained from non-invasive samples can vary significantly, requiring optimization of extraction techniques and the development of standardized protocols (Avanos and Koenhemsi, 2018; Senturk et al., 2023).

Table 3. Means, standard errors, minimum and maximum values for the absorbance ratio of 260/280 nm based on the isolation with the different commercial kits.

Kit	Mean	Min	Max
Nucleogene	$1,82\pm0,02^a$	1,24	2,32
ThermoSci.	$1,92\pm0,28^b$	0,10	20,85
Rosche	$1,55\pm0,03^c$	1,14	1,93

[a,b,c] Means with different superscripts are different ($P < 0.001$).

In addition, when the 260/280 nm absorbance ratio was compared according to bird species, it was found that DNA purity was better in cockatiels than in pigeons. The difference between birds was again statistically significant (p<0.001).

Table 4. Means, standard errors, coefficient of variation, minimum and maximum values for the absorbance ratio of 260/280 nm based on bird species.

Species	Mean	CV	Min	Max
Pigeon	$1,82\pm0,13^a$	103,29	0,10	20,85
Cockatiel	$1,85\pm0,02^b$	6,23	1,49	2,000

[a,b] Means with different superscripts are different ($P < 0.001$). CV refers to Coefficient of Variation.

When the results obtained in this study are compared to the standard phenol-chloroform isolation method used in many studies, even though the standard method is cost-effective and yields higher levels of genomic DNA, the traditional phenol-chloroform extraction is a complex and time-consuming process. Commercial DNA isolation kits are designed to provide a standardized and reproducible DNA isolation protocol and consistent results between experiments. This eliminates the need for manual optimization and reduces the possibility of human error (Silva et al., 2020; Senturk et al., 2023; Sakyi et al., 2023).

CONCLUSIONS

DNA isolation is the most essential step in genetic analysis. High quantity and quality DNA samples are indispensable for successful genetic analysis. Therefore, the determination of DNA isolation methods is of great importance. The structure of the tissue to be isolated also affects the quality of the isolated DNA sample. Some methods need to be modified in keratin-rich tissues, such as feathers. This study details the effects of three different methods and the effects of modifications on DNA quality and quantity based on commercially available DNA isolation kits. As a result, it may be thought that the results obtained will shed light on a wide range of studies in the fields of bird molecular genetics, population genetics, and phylogenetics.

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EFFECT OF FLAVONOIDS (QUERCETIN AND TAXIFOLIN) ON IN VITRO NUCLEAR MATURATION OF BOVINE OOCYTES

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Abstract

Reactive oxygen species negatively affect oocyte nuclear and cytoplasmic maturation and antioxidant enzyme activity in in vitro oocyte maturation culture. Quercetin and Taxifolin are plant-derived flavonoids that have antioxidant properties and function as free radical scavengers and are less toxic than other flavonoids and synthetic antioxidants. Therefore, in the present study, the effects of Quercetin and Taxifolin added to in vitro maturation medium on cumulus cell expansion and nuclear maturation of bovine oocytes were investigated. After slaughter, 2–8 mm diameter follicles on the ovaries brought to the laboratory in saline (0.96% NaCl) at 25–30 °C were aspirated and cumulus-oocyte complexes (COCs) were obtained. After washing several times in commercial tissue culture medium (TCM-199) with Hepes buffer, the COCs were transferred to commercial sodium bicarbonate buffered TCM-199 maturation medium supplemented 10% fetal calf serum, 10% antibiotics and added 1 µg/mL Quercetin or 1 µg/mL Taxifolin and without (control) transferred. Then, the COCs were cultured for 22 hours in an incubator at 38.5 °C, containing 5% CO_2 and 95% humidity. At the end of maturation, the cumulus cell expansion of the COCs belonging to each experimental group were examined and they were fixed in a 3/1 acetic acid/ethanol mixture for 24 hours to determine the nuclear stages. Fluorescent staining (fluorescent bis-benzimide dye; Hoechst H33258) method was used to detect nuclear maturation of the oocyte, and nuclear maturation (metaphase II) was detected at X40 magnification under a microscope with a fluorescent light source and a UV filter. In the study, the supplementation of Quercetin to the culture medium in the in vitro maturation of bovine oocytes increased the expansion rate of cumulus cells observed at the end of the maturation period by approximately 17% ($\chi 2= 9.23$; $P<0.05$), while the supplementation of Taxifolin increased approximately 21% compared to the control group ($\chi 2= 9.68$; $P<0.05$). In addition, the supplementation of Quercetin to the culture medium increased the proportion of oocytes that reached metaphase II (M-II) at the end of the maturation period ($\chi 2= 9.63$; $P<0.05$). Moreover, the proportion of oocytes in the Quercetin group that reached the metaphase I (M-I) stage was found to be lower than those in the other experimental groups ($\chi 2= 11.07$; $P<0.05$), while the proportion of oocytes in other stages was found to be statistically significantly higher in the control group ($\chi 2 = 10.48$; $P<0.05$). In conclusion, in the light of the data obtained from the study, treatment of bovine oocytes with Taxifolin and Quercetin, which are important sources of plant antioxidants, may have improved the nuclear maturation of oocytes and cumulus cell expansion by affecting cellular antioxidant activity.

Keywords: Phytogenic Antioxidants, Bovine oocyte, In vitro culture, Oxidative stress

INTRODUCTION

Oocytes show substantially similar metabolic activity in vivo and in vitro. However, while in vivo conditions, the ovulated oocyte is protected against free radicals within the antioxidant systems of the female reproductive system (follicular fluid, oviduct fluid) that can be biologically recognized (Jana et al., 2010), whereas in in vitro production systems, it is generally used synthetically. Antioxidants, which have been prepared and have the potential to cause some negative effects in different doses, are used (Yuh et al., 2010). However, the effects of antioxidants added to the medium can be added by various factors such as the culture medium used, the additional components used, and the purity of the water used (Gordon, 2003). Therefore, it is necessary to investigate the effects of natural antioxidants that are biologically acceptable to oocytes and that can protect the oocyte against oxidative stress and have no side effects on in vitro oocyte development.

In recent years, the effects of bioactive flavonoids on human health, especially due to their antioxidant activity, have attracted a lot of

attention (Zhang, 2005). Although flavonoids are an important phytogenic chemical found in plants, they are not synthesized in humans and mammals (Zhang, 2005). Flavonoids show wide-ranging biochemical and pharmacological effects with their antioxidant, anti-inflammatory (tissue destruction and pain reliever), antiplatelet (coagulation-reducing; aspirin-like) and antiallergic properties (Yeh et al., 2005). Quercetin and Taxifolin, which are members of the flavonoids family, are chemical substances that have many biological effects, along with the antioxidant effect found abundantly in vegetables and fruits (Zhang, 2005; Kang et al., 2016). Quercetin and Taxifolin, due to their antioxidant potential, bind to reactive oxygen sources such as hydrogen peroxide and superoxide, which damage the cell and cell membrane, which are formed as a result of many metabolic activities, and free oxygen radicals and neutralize them (Dok-Go et al., 2003; Kang et al., 2016).). At the same time, Quercetin and Taxifolin play an important role in binding to metal ions formed in the cell and transporting them and preventing the oxidation of lipids (Kang et al., 2016). In addition, Quercetin and Taxifolin minimize oxidative damage caused by hydrogen peroxide (Musonda and Chipman, 1998) and UV-induced (Yeh et al., 2005) in macromolecules such as lipid and DNA. Moreover, by binding to various free radicals that can cause breakage in one or both strands of the DNA chain, it can suppress the breaks that may occur in DNA (Sestili et al., 1998). Due to all these functions, Quercetin and Taxifolin are defined as plant-derived antioxidants that bind divalent cations, scavenge or remove free radicals, protect DNA against oxidative damage, prevent free radicals that damage cell membranes, and prevent lipid oxidation (Zhang, 2005).

Although many synthetic antioxidants are used in the production of bovine embryos in vitro today, a standard antioxidant procedure has not been reached yet to support maximum embryo production in terms of both toxic effects and biological compatibility. Quercetin and Taxifolin are plant-derived flavonoids that have antioxidant properties and function as free radical scavengers and are less toxic than other flavonoids and synthetic antioxidants. Therefore, the aim of the present study is to determine the effects of phytogenic antioxidants Quercetin and Taxifolin on in vitro maturation parameters (expansion of cumulus cells and nuclear maturation; those reaching metaphase-II) of bovine oocytes.

MATERIALS AND METHODS

Bovine ovaries were obtained from a local slaughterhouse. Ovarian follicles measuring 2-8 mm in diameter were aspirated with an 18-gauge needle attached to a 10 mL disposable syringe. Aspirated follicular fluid was pooled in conical tubes. The contents the bottom of tubes were searched for oocytes, which were placed in TL Hepes. The follicular materials were then searched under stereomicroscope and COCs were classified based on cumulus investment according to cytoplasm cumulus cells around. COCs with homogeneous cytoplasm and an intact cumulus cells around were selected in vitro maturation. Selected COCs were washed three times in TL Hepes medium and placed into 500 µl of maturation medium in four-well dishes (Nunc, Roskilde, Denmark), as 25-35 oocytes per well. Each well of maturation medium were covered with 300 µl mineral oil. All incubations were performed at 39°C in a humidified atmosphere of 5% CO_2 in air for a period of 24 h.

TCM-199 containing Earl salts, L-glutamine and 2.2 mg/ml sodium bicarbonate supplemented with 5.5 µg/ml sodium pyruvate, 1% v/v penicillin-streptomycin (10.000 U/ml penicillin G, 10.000 µg/ml streptomycin) was used as basal medium for maturation. Quercetin and Taxifolin were added to the maturation media; there were three different treatments: Treatment 1 (T1) = Basal medium supplemented with 1 µg/mL Quercetin; Treatment 2 (T2) = Basal medium supplemented 1 µg/mL Taxifolin; Treatment 3 (T3) = Basal medium supplemented without antioxidant supplementation.

COCs were evaluated and cumulus expansion degree was recorded at the end of the culture period to assess the effect of treatments on cumulus cell expansion (CCE) under a stereomicroscope. Oocytes with expanded cumulus considered as matured oocytes.

After maturation for 24 h, the COCs were denuded of cumulus cells by vortexing, and the denuded oocytes were subsequently fixed with acetic acid: ethanol (1:3) for 24 h. The fixed oocytes were mounted on glass slides with 90 % glycerol in dPBS containing 10% (w/v) Hoechst 33342 (pH 7.4) at room temperature for 15 min and stained oocytes were examined under fluorescent microscope. Excitation was induced at 365 nm and the emission is viewed through a 420 nm barrier filter. Nuclear maturation was evaluated without knowing the treatment groups by evaluator and classified as germinal vesicle breakdown (GVBD), metaphase I (M I) (including anaphase 1 and telophase-1), metaphase II (M II), and degenerate The degree of cumulus expansion and M II stage of oocytes were used as endpoint parameters for assessing the effect of treatments on expansion and maturation of bovine oocytes in vitro.

To evaluate the differences between experimental groups Chi-square analysis was performed. Because of its independency from the distribution

non-parametric tests such as Chi-square are successful in many cases where parametric tests are not. Differences with P<0.05 were considered significant.

RESULTS

Cumulus cell expansion ratios of bovine oocytes matured in vitro in culture media supplemented with Quercetin and Taxifolin are presented in Table 1. The addition of Quercetin to the culture medium increased the expansion rate of cumulus cells observed at the end of the maturation period by approximately 17% ($\chi 2= 9.23$; P<0.05), while the addition of Taxifolin increased approximately 21% ($\chi 2= 9.68$; P<0.05).

Table 1. Expansion rates (%) of cumulus cells in bovine oocytes to which Quercetin and Taxifolin were added to the in vitro maturation medium

	COCs (n)	CCE (n)	NCCE (n)
Quercetin	108	80,55±5,12 (87)[a]	19,45±3,80 (21)[a]
Taxifolin	112	84,82±4,09 (95)[a]	15,18±3,18 (17)[b]
Control	105	63,81±3,12 (67)[b]	36,19±4,12 (38)[b]

[a,b] Means in columns with different letters are significantly different at P<0.05. CCE= cumulus cell expansion, NCCE= non-cumulus cell expansion.

The ratios of nuclear stages of bovine oocytes matured in vitro in culture media supplemented with Quercetin and Taxifolin are presented in Table 2. The addition of Quercetin to the culture medium in the in vitro maturation of bovine oocytes increased the ratio of oocytes that reached the metaphase II (M-II) stage at the end of the maturation period ($\chi 2= 9.63$; P<0.05). In addition, the rate of oocytes in the Quercetin group that reached the metaphase I (M-I) stage was found to be lower than those in the other experimental groups ($\chi 2= 11.07$; P<0.05), while the rate of oocytes in other stages was found to be statistically significantly higher in the control group ($\chi 2 = 10.48$; P<0.05).

Table 2. The ratio (%) of nuclear stages of bovine oocytes added to in vitro maturation medium with Quercetin and Taxifolin

	Oocytes (n)	M-I (n)	M-II (n)	Others (n)
Quercetin	70	20,00±3,12 (14)[b]	57,17±3,33 (40)[a]	22,83±2,80 (16)[b]
Taxifolin	75	32,00±5,04 (24)[a]	49,33±6,60 (37)[ab]	18,67±3,15 (14)[b]
Control	71	29,58±6,02 (21)[a]	30,99±1,84 (22)[b]	39,43±4,39 (28)[a]

[a,b] Means in columns with different letters are significantly different at P<0.05. M-I = metaphase I, M-II = metaphase II, Others = germinal vesicle, germinal vesicle destruction and degenerated oocytes.

DISCUSSION

In vitro maturation conditions of bovine oocytes affect the fertilization and embryo development ability of the oocyte (Gordon; 2003). Today, the preference of media with high nutrient content in the culture stages of in vitro embryo production and the addition of animal origin such as serum, intrafollicular fluid and cell culture to the culture media may affect the biochemical activity of oocytes and embryos. The oocyte or embryo, which is exposed to unexpected environmental factors in vitro, may show various metabolic differences and become stressed in order to protect or maintain vitality (Leese et al., 2008). Different antioxidants are added to culture media in order to protect the oocyte or embryo against oxidative stress at different stages of in vitro embryo production and to increase the success rate. Among the antioxidant systems, antioxidant enzymes (ascorbate, dithioerythritol, catalase; cat, glutathione peroxidase, superoxide dismutase; sod, pyruvate), thiol compounds (glutathione, cysteine, cysteamine, taurine, hypotaurine), vitamins (E, A and C), proteins (hydrolysates), mannitol (Guérin et al., 2001). These antioxidants are added to culture media in order to reduce the negative effects of free oxygen radicals on oocyte or embryo development. However, purification of the oocyte or embryo culture medium from oxidative stress and oxidative stress factors is an inevitable and at the same time complex problem. It is sometimes difficult to determine the antioxidants and their doses to be used in culture media, and it is observed that excessive doses of antioxidants added to the environment have toxic effects (Camargo et al., 2006). Early embryos show broadly similar metabolic activity in vivo and in vitro. However, while in vivo conditions the oocyte

or embryo is protected against free radicals in the antioxidant systems of the female reproductive system (follicular fluid, oviduct fluid) in which it lives and can be biologically recognized (Jana et al., 2010), in in vitro production systems it is generally synthetic. Antioxidants, which have been prepared in different doses and have the potential to cause some negativity in the embryo, are used (Yuh et al., 2010). However, a wide variety of factors such as culture media, the components used and the purity of the water used are responsible for the effects of antioxidants added to the medium (Gordon, 2003). For this reason, it is necessary to investigate the effects of natural antioxidants on in vitro embryo development, which can be accepted biologically by the oocyte or embryo and can both protect the oocyte and embryo against oxidative stress and can be added to culture media without side effects.

The maturation of bovine oocytes is closely associated with structural changes as well as functional changes (Bevers et al., 1997). The nuclear maturation of the oocyte is due to the structural changes of the chromatin. Functional changes of oocytes during final maturation (cytoplasmic maturation) can be indirectly evaluated by their ability to fertilize and further embryonic development (Bevers et al., 1997; Gordon, 2003). Although bovine oocytes can easily reach metaphase II (nuclear maturation) in vitro, their ability for subsequent embryonic development is limited when compared to mature oocytes in vivo (Hyttel et al., 1997). This may be an indication that current in vitro maturation systems are still far from normal animal physiology. In the present study, it was determined that the addition of Quercetin and Taxifolin as a herbal antioxidant source to the culture medium in the in vitro maturation of bovine oocytes increased the expansion rate of cumulus cells observed at the end of the maturation period. Similarly, it was determined that the addition of quercetin to the culture medium increased the proportion of oocytes that reached metaphase II (M-II). Similar to the results of our study, Banihosseini et al. (2018) reported that the addition of 10 μg/ml quercetin to the in vitro maturation medium of mouse oocytes increased cumulus cell expansion and the number of oocytes in the M-II stage. However, the same authors reported that high (20 μg/ml) and low (5 μg/ml) quercetin concentration reduced cumulus cell expansion at the end of in vitro maturation culture. Kang et al. (2016) reported that the addition of 1 μg/ml Taxifolin to the in vitro maturation medium of pig oocytes increased the number of oocytes in the M-II stage, while the addition of 50 μg/ml Taxifolin decreased the number of oocytes in the M-II stage. These results show that the addition of Quercetin and

Taxifolin as a herbal antioxidant source to the culture medium in the in vitro maturation of bovine oocytes may increase the success rate in in vitro maturation, but also show that the concentration used affects the success rate.

CONCLUSIONS

In conclusion, in light of the data obtained from the study, treatment of bovine oocytes with Quercetin and Taxifolin, which are important sources of herbal antioxidants, may have improved the nuclear maturation of oocytes and cumulus cell expansion by affecting cellular antioxidant activity. However, it is not clear whether the concentrations used have the optimal effect on in vitro maturation of bovine oocytes. Therefore, further studies are needed to determine the optimal supplementation of Quercetin and Taxifolin as herbal antioxidant sources and their beneficial effects on post-fertilization cattle development.

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AS HONEY BEE HEALTH AND FUNCTIONAL GENOMIC STUDIES; RNAI METHOD

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Abstract

Decreased natural habitats, increasing diseases and pests threaten the extinction of honey bees. Therefore, the RNAi (Ribonucleic Acid Interferase) method, which has been widely applied and developed in honey bees recently, is a manipulation method with an RNA-mediated sequence-specific post-transcriptional gene silencing mechanism. The RNAi method has shown that it is an effective method especially in protecting the health of honey bees. It also enables us to discover new genes in honey bees. RNAi, which is effective in eliminating disease-causing factors with its gene silencing feature, is environmentally friendly compared to other gene silencing methods. It is not a risky application since there is no permanent manipulation in case honey bees escape from the laboratory or off target gene manipulation occurs. Genome editing studies in honey bees; It has revealed the potential that honey bees can be used as a model organism and can be applied in many areas from disease and pest control, to improving yield and quality characteristics, to elucidating the genetic basis of honey bee behavior.In this study, functional genomic studies in honey bees and RNAi studies, which is an effective method in colony immunity, were compiled.

Keywords: _Biotechnology, Honey bee, RNAi_

DETERMINATION OF LIGNINOLYTIC ENZYMES RELATED GENE EXPRESSION AND ACTIVITIES IN SOME EDIBLE FUNGI SPECIES

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Abstract

Plant cell walls consist of complex lignocellulosic composites containing cellulose, hemicellulose, and lignin. The polysaccharide components in lignocellulose form densely packed microfibers embedded within layers of lignin, which protect these components from hydrolytic enzymes and other external agents. However, for these polysaccharide fibers to be utilized as an energy source, lignin must be removed from lignocellulosic biomass. Certain edible fungi species are among the most efficient lignin decomposers known in nature. In this study, we aimed to determine the expression levels of genes encoding ligninolytic enzymes and enzyme activities in edible fungal species, namely, Morchella esculenta (Morel), Pleurotus ostreatus (Oyster mushroom), Ganoderma lucidum (Reishi), Lentinula edodes (Shiitake), and Trametes versicolor (Turkey tail). Ligninolytic enzyme expression of laccase (Lcc1), lignin peroxidase (LiP), and manganese peroxidase (MnP) mRNA were identified in various parts of the fungi, including the gills, caps, stems, and all tissues. The highest Lcc1 expression was observed in the gill and stem sections of L. edodes and in the stem of G. Lucidum (P<0.05). The highest expression of LiP and MnP was observed in the cap of T. versicolor (P<0.05). Additionally, the total protein concentration was higher in M. Esculenta (2.03 mg/ml) than in the other fungi species (P<0.05). On the other hand, the specific activities of laccase and manganese peroxidase were higher in T. versicolor, while the specific activity for lignin peroxidase was higher in G. Lucidum (P<0.05). Overall, the highest gene expression and ligninolytic enzyme activity were observed in T. versicolor and G. Lucidum, respectively. In conclusion, these fungi species, whether added directly to feed or through the purification or heterologous production of these enzymes, can be utilized as feed additives in ruminant nutrition. Thus, utilization of lignocellulosic materials by ruminants could be further improved.

Keywords: lignocellulosic biomass, fungi, ligninolytic enzymes, activity, gene expression, ruminant

THE RELATIONSHIP BETWEEN THE NUMBER OF BIG RUMINANTS IN TURKEY AND THE PRODUCTION OF MEAT AND LEATHER

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Abstract

In this study, it is aimed to determine the relationship between the number of slaughtered cattle and buffaloes and meat and leather production in Turkey within the specified years, and to determine how the number of cattle and buffalo to be slaughtered in the following years will increase or decrease in the production of their meat and skins. For this purpose, data were obtained from the number of slaughtered cattle and buffaloes, their meat (tonnes) and skins in the statistical tables between the years 2001-2020 published by the Turkish Statistical Institute (TUIK). Correlation analysis was used to determine the size of the relationship in the obtained data set, and trend analysis was carried out to predict how the number of cattle and buffaloes to be slaughtered in the following years will increase or decrease in the production of meat and skins.

According to the estimation results; At the 1% significance level, with a rate of 95.3%, the highest correlation was determined by the number of slaughtered cattle and buffaloes and meat production, and the number of cattle and buffalo to be slaughtered and meat and leather production in the coming years will be in an increasing trend.

Keywords: *Number of cattle and buffalo, meat and skin, Trend analysis, Years*

INTRODUCTION

The beginning of the history of humanity has brought the need for nutrition simultaneously, and therefore agriculture within the scope of both plant and animal production in the past. Within the scope of animal production, cattle, sheep and poultry breeding have a long history in this sense. On the other hand, it is known that animals such as horses, donkeys, and camels, especially cattle and buffaloes, are known to be named within the scope of "cattle animals" because they can yield more than other animals (which are raised for their meat and milk) in terms of size and live weight. In addition, obtaining milk yield from cattle during lactation periods (for females), and obtaining meat yield and skin in non-lactation periods (for both females and males) are the natural results of their rearing.

While the existence of cattle and buffaloes in the world is constantly increasing depending on the population; On the other hand, the cattle population is increasing in our country, and the buffalo population in Turkey, which was 1,178,000 between 1970 and 2008, decreased to 84,705 (Anonymous, 2010). While the number of animals slaughtered in beef cattle is 296,244,213 in the world, it is reported as 2,791,034 in Turkey (Anonymous, 2016). In the total meat production of cattle in the world; It is reported that with 69.5 million tons, they have the 3rd largest share after pork and poultry meat with a rate of 21%, and the 2nd largest share after pork with a rate of 35% in red meat production (Anonymous, 2019a).

While the cattle presence in Turkey was 9,803,498 in 2002, it is reported to be 17,850,543 with an increase of 82.08% in 2021, while the number of buffaloes was 121,077 in 2002 with an increase of 53,26%, it is reported as 185,574 in 2021. While the total cattle stock of Turkey was 9,924,575 in 2002, it increased to 18,036,117 with an increase of 81.73% in 2021 (Anonymous, 2023a).

The ability to convert animal skins slaughtered for meat production in the food sector into added value in the industrial sense is one of the best examples for the abattoir products of the livestock sector. On the other hand, processing raw leather into valuable products such as shoes, bags, coats and fur is important for national economies. According to the Ministry of Commerce Information System; It is reported that Turkey's leather and leather products exports reached 1.9 billion dollars in 2021 with an increase of 38.6% compared to the previous year (Anonymous, 2023b). In addition, according to TUIK; It is reported that 3,228,632 cattle and 34,935 buffalo skins were recorded within the scope of leather production in 2020 (Anonymous, 2023c). In terms of leather production in the world, it is stated that Turkey ranks 4th after Italy, China and India (Anonymous, 2019b).

In this study, it is aimed to determine the relationship between the number of slaughtered cattle and buffaloes and meat and leather production in Turkey within the specified years, and to determine how the number of cattle and buffalo to be slaughtered in the following years will increase or decrease in the production of their meat and skins.

MATERIALS AND METHODS

The data set in this study was obtained from the number of slaughtered cattle and buffalo, their meat (tonnes) and hides in the statistical tables between 2001 and 2020 published by the Turkish Statistical Institute (TUIK). In Table 1, the number of slaughtered cattle and buffaloes, meat and leather production by years are given.

Table 1. Number of slaughtered cattle and buffalo, meat (ton) and skin by years.

Years	Cattle and Buffalo Numbers	Cattle and Buffalo Meat (tonnes)	Cattle and Buffalo Skin
2001	2868984	500249	2010836
2002	2824511	501926	1932305
2003	27113405	494619	1738794
2004	2627076	493508	2020240
2005	2583267	496189	1783960
2006	2644426	518484	1923593
2007	2736905	553860	2189290
2008	2818920	585625	1905326
2009	2846301	612202	1645248
2010	2951180	650852	2617966

Table 2. Number of slaughtered cattle and buffalo, meat (ton) and skin by years.

Years	Cattle and Buffalo Numbers	Cattle and Buffalo Meat (tonnes)	Cattle and Buffalo Skin
2011	3145505	714432	2579020
2012	3441927	794061	2798460
2013	3478942	803364	3433126
2014	3549108	820678	3714684
2015	3732059	867398	3766468
2016	4021556	961650	3901806
2017	4363510	1099709	3608238
2018	4877100	1287749	34228060
2019	4892212	1337319	3634068
2020	4853831	1349870	3263567

In this study, correlation analysis was used to determine the size of the relationship between them in the first stage. Correlation analysis; It is a test that measures the level of relationship between two variables. If the obtained data set is normally distributed, if the Pearsan correlation

test is not, the Spearman's correlation test is the most widely used test. In this study, Sperman's test was used because the data were not normally distributed. Sperman's test; It is a quick and simple test for investigating the existence of a linear trend, and this test, which is based on rank statistics, is used to determine whether there is a significant correlation between two observation series. The rank statistic R(xi) is determined by ordering the observations from smallest to largest or largest to smallest, and is calculated with Spearman's Rho test value (rs) expression.

$$r_s = 1 - \left[\sum_{i=1}^{n} R(x_i) - i^2 \right] / (n^3 - n)$$

R(xi) i. the sequence number of the observation, i the observation order of the data, and n the total number of observations. The test statistic of rs is calculated with the z-value equation.

$$z = r_s \sqrt{n-1}$$

If |z| If the value of α is greater than the z_α value determined from the standard normal distribution table at the chosen α significance level (|z|> z_α), the H0 hypothesis, which is based on the fact that the observation values do not change over time, is rejected and it is concluded that there is a certain trend (Alpar, 2013).

Trend analysis was also used to predict how the number of cattle and buffalo to be slaughtered in the following years will increase or decrease in the production of meat and skins. Trend analysis; It is the representation of the long-term fundamental trend in a time series with a curve or a straight line (Yavuz, 2016). In the trend analysis method, the trend equation that best describes the time series is determined and predictions are made for the next times. Trend analysis method can be applied with estimation, moving average analysis method, semester analysis method and least squares analysis method. However, in order to obtain the equation of the trend line, it is necessary to observe various types of equations (logarithmic, exponential, etc.) apart from the least squares analysis method (Witt and Witt, 1992).

RESULTS

In this study, it is aimed to determine the relationship between the number of slaughtered cattle and buffaloes and meat and leather production in Turkey within the specified years, and to determine how the number of cattle and buffalo to be slaughtered in the following years will increase or decrease in the production of their meat and skins. For this purpose, data were obtained from the number of slaughtered cattle and buffaloes, their meat (tonnes) and skins in the statistical tables between the years 2001-2020 published by the Turkish Statistical Institute (TUIK). Correlation analysis was used to determine

the size of the relationship in the first step in the obtained data set, and trend analysis was used to predict how the number of cattle and buffaloes to be slaughtered in the following years will increase or decrease in the production of meat and skins. According to the results of the research, the highest correlation with 95.3% at the 1% significance level was determined by the number of slaughtered cattle and buffaloes and meat production, and the number of cattle and buffalo to be slaughtered and meat and leather production in the coming years will be in an increasing trend.

In order to obtain better results in the data set obtained from the number of slaughtered cattle and buffaloes, meat (tonnes) and skins in the statistical tables between 2001 and 2020 published by the Turkish Statistical Institute (TUIK), the number of observations in the data set should be kept wider, the group between selected years and increasing the data in each group and whether the number of cattle slaughtered in Turkey is proportional to the increasing population in recent years should be taken into account. In order to avoid these and similar problems in future articles or thesis research, the deficiencies mentioned should not be ignored.

DISCUSSION

The data set in this study was obtained from the number of slaughtered cattle and buffalo, their meat (tonnes) and hides in the statistical tables between 2001 and 2020 published by the Turkish Statistical Institute (TUIK). In the obtained data set, the existence of correlation was determined in order to determine the size of the relationship between them in the first stage. Trend analysis was also used to predict how the number of cattle and buffalo to be slaughtered in the following years will increase or decrease in the production of meat and skins.

Normality analysis was performed on the data set obtained from the Turkish Statistical Institute (TUIK), and the Sperman test, which is a no-parametric test, was used in the correlation analysis since it did not comply with the normal distribution as a result of the analysis.

In the results of the analysis;

Table 3. The result of the correlation analysis of the number of slaughtered cattle, meat (tons) and skin.

		Cattle Numbers	Cattle Meat	Cattle Skin
Numbers	CorrelationCoefficient	1.000	.958**	.820**
	Sig.	.	.000	.000
Meat	CorrelationCoefficient	958**	1.000	.798**
	Sig.	.000	.	.000
Skin	CorrelationCoefficient	.820**	.798**	1.000
	Sig.	.000	.000	.

In Table 3, it was determined that the highest correlation at the 1% significance level of cattle slaughtered in the cattle category by years was between the number of cattle and beef (ton) at a rate of 95.8%.

Table 4. The result of correlation analysis of slaughtered buffalo number, meat (ton) and skin.

		Buffalo Numbers	Buffalo Meat	Buffalo Skin
Numbers	CorrelationCoefficient	1.000	.674**	.033
	Sig.	.	.001	.089
Meat	Correlation Coefficient	.674**	1.000	.117
	Sig.	.001	.	.062
Skin	Correlation Coefficient	.033	.117	1.000
	Sig.	.089	.062	.

In Table 4, it was determined that the highest correlation at the 1% significance level of slaughtered cattle in the buffalo category was 67.4% between the number of buffaloes and buffalo meat (tons).

Table 5. The result of correlation analysis of slaughtered cattle and buffalo numbers, meat (tons) and skin.

		Cattle And Buffalo Numbers	Cattle and Buffalo Meat	Cattle and Buffalo Skin
Numbers	Correlation Coefficient	1.000	.953**	.823**
	Sig.	.	.000	.000
Meat	Correlation Coefficient	.953**	1.000	.798**
	Sig.	.000	.	.000
Skin	Correlation Coefficient	.823**	.798**	1.000
	Sig.	.000	.000	.

In Table 5, it was determined that the highest correlation at the 1% significance level of slaughtered cattle and buffaloes by years was 95.3% between the number of slaughtered cattle and buffaloes and their meat (tons).

As a result of the trend analysis that predicts how the number of cattle and buffaloes to be slaughtered in the following years will increase or decrease in the production of their meat and skins;
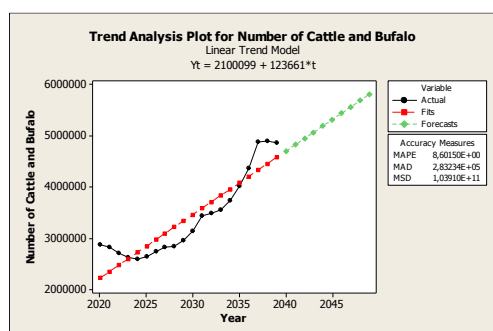
Figure 1. Result of trend analysis of slaughtered cattle and buffalo numbers.

Mean absolute percentile errors (MAPE) measure how much the values estimated by this measure deviate from the true values. From this point of view, a low MAPE value means a better estimation has been made. In Figure 1., since the MAPE value is 8.6015, it is concluded that a good estimation has been made.
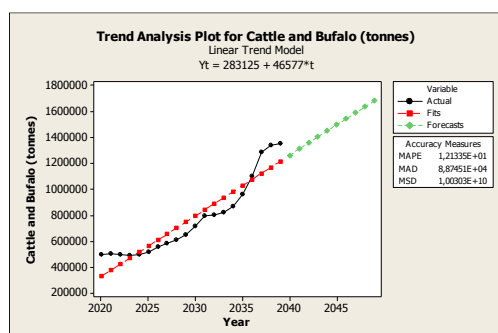
Figure 2. Result of the trend analysis of slaughtered beef and buffalo (tonnes).

Mean absolute percentile errors (MAPE) measure how much the values estimated by this measure deviate from the true values. From this point of view, a low MAPE value means a better estimation has been made. Since the MAPE value is 1.2133 in Figure 2., it is concluded that a good estimation has been made.
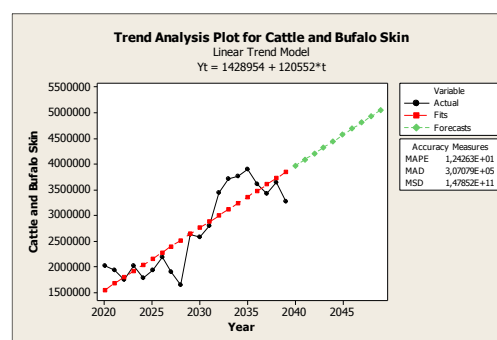
Figure 3. The result of the trend analysis of cut bovine and buffalo hides.

Mean absolute percentile errors (MAPE) measure how much the values estimated by this measure deviate from the true values. From this point of view, a low MAPE value means a better estimation has been made. Since the MAPE value is 1.2426 in Figure 3, it is concluded that a good estimation has been made.

In a study, the current situation of the livestock sector in Turkey was investigated. As a result of the research, it was concluded that the problems were identified and solutions were offered (Sahin et al, 2015). In a study, it was concluded that there is a positive causal relationship between the population and the number of cattle, a negative relationship between the population and the number of buffaloes, and a mutual causality relationship between the number of cattle and the number of buffaloes (Celik, 2015). In a study, Turkey's cattle and small cattle stock data between 1996-2014 were investigated. As a result of the research, they made predictions for 2020 using trend analysis. They estimated that domestic cattle breeds would decrease throughout the country and increase in the TR83 Region (Amasya, Corum, Samsun, Tokat). According to the accuracy margin results, it was concluded that the Quadratic (2nd Degree) Trend Model was the most appropriate model (Erdal et

al, 2016). In a study, the current situation of the red meat sector in Turkey was investigated. As a result of the research, it was concluded that some policies should be developed in order to become a country that exports meat, not an importing country (Saygin and Demirbas, 2017). In a study, the cattle breeding situation in Turkey between the years 2002-2017 was investigated. As a result of the research, it was concluded that the population growth rate of the country was higher than the increase in the number of cattle (Tapki et al, 2018). In a study, they used the non-parametric Spearman Correlation Coefficient method in order to determine the reason for the low rate of animal life insurance in cattle and sheep farms and the factors affecting the relevant rate (Mat et al, 2020). In a study, the relationship between Turkey's ovine stock and milk production was investigated using trend analysis. As a result of the research, the results of the regression coefficients; It has been concluded that the increase in the number of sheep and goats is 85%, the annual milk production is 93% and the annual milk yield per milked animal is 82% (Sevinc et al, 2022).

The difference of this research from the studies in the literature is to determine the relationship between the number of slaughtered cattle and buffaloes and meat and leather production in Turkey over the years, and to determine how the number of cattle and buffaloes to be slaughtered will increase or decrease in the production of their meat and skins.

AUTHOR CONTRIBUTIONS
The authors declare that they have contributed equally to the article.

CONFLICT OF INTEREST
The authors of the article declare that there is no conflict of interest between them.

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MILK MIRNA PROFILING AND PATHWAY ANALYSIS IN DAIRY COWS WITH S. AUREUS MASTITIS

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Abstract

Abstract Background: Cow mastitis, which is the mammary gland inflammation, is the most prevalent disease and remains a major problem in the dairy industry worldwide also results in losses in milk quality and quantity. Staphylococcus aureus (S. aureus), a gram-positive bacterium, is one of the most common bacterial causes of mastitis. Despite considerable research on mammary gland infection, the molecular basis of S. aureus mastitis has not yet been elucidated. The purpose of the present study was to investigate the expression pattern of certain important miRNAs, which are associated with S. aureus pathogen in subclinical mastitis infections in dairy cows to elucidate the molecular basis of S. aureus mastitis related to innate immunity. Methods: For this purpose, firstly, S. aureus pathogen-specific innate immune system-associated core genes in subclinical mastitis infections in cows were identified by in-silico analysis. Secondly, RNA was isolated from 10 healthy and six S. aureus-infected subclinical mastitis milk samples and RT-qPCR analyses were performed for bta-miR-15a, bta-miR-23a, bta-miR-27a-3p, bta-miR-103, bta-miR-146b and bta-mir-374b. Results: The expression patterns of miRNAs bta-miR-27a-3p, bta-miR-103, bta-miR-146b, and bta-mir-374b were differentially expressed between healthy cows and cows with subclinical mastitis infected with S. aureus. Conclusions: In conclusion, utilizing bioinformatics tools for determining the disease-related hub genes can be successfully applied and also provides to interpret and gain greater insight into the molecular pathways of the mammary glands in cows with mastitis. Taken together, our results indicated that analyzed miRNA expressions in this study vary between healthy and cows with subclinical mastitis infected with S. aureus. Berna Kaya would like to thank TUBITAK-2209 for the financial support with project number 1919B012107210.

Keywords: Subclinical mastitis, S. aureus, milk miRNAs, Cow, Innate immunity, Bioinformatic

GENDER DETERMINATION WITH TWO DIFFERENT PRIMERS IN DIFFERENT BIRD SPECIES

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Abstract

Molecular gender determination is important in species where morphological gender cannot be determined in poultry. It has been reported that the W-linked chromosomal domain helix DNA binding (CHD-W) gene is present on the W chromosome of all birds except ostriches and their relatives. Different primers were designed by examining the gender-specific CHDW and CHDZ gene regions of different orders of birds. In this study DNAs samples used which isolated from the shed/tail feathers of 30 different bird species from Passeriformes (n=6), Psittaciformes (n=23) and Galliformes (n=1) by phenol-chloroform method (TUBITAK-2209-A, Project Number: 1919B012003921). In the planned study, it was aimed to examine the gender determination determined by the 2550F/2718R primer pair in the TUBITAK-2209-A project, with two different primers reported as 1237L/1272H and P2/P8. According to the results obtained, band images were obtained in 11 samples with the 1237L/1272H primer pair, while PCR images were obtained in 13 samples with the P2/P8 primers. As a result, while gender determination analysis could be performed according to the expected and observed band sizes in all samples in the 2550F/2718R primer pair, but gender determination could not be performed according to the expected and observed band sizes in both primers (1237L/1272H and P2/P8).

_Keywords__: Gender determination, CHD-W, poultry, 1237L/1272H, P2/P8_

EXPLORING NANOTECHNOLOGY'S ROLE IN ADVANCING REPRODUCTIVE BIOTECHNOLOGIES: THE CURRENT LANDSCAPE AT ERCIYES UNIVERSITY AND TURKIYE

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Abstract

Advancements in technology and science have revolutionized the development of a wide range of materials that find applications across different industries. These materials can vary in size, spanning from macroscopic dimensions to the nanoscale. Nanomaterials generally refer to particles in the range of 1 to 100 nanometers. These nanoparticles find applications in various fields such as health, energy, metallurgy, physics, chemistry and engineering. The production of nanomaterials involves various methods, including chemical synthesis and the utilization of biological structures. In the field of nanotechnology, biocompatible nanomaterials have gained particular importance in the field of medical science. These nanomaterials have found applications in oncology, tissue engineering, and drug delivery, among others. While certain areas have experienced remarkable progress in nanobiotechnology, other areas such as reproductive biotechnologies, are gradually and cautiously exploring the potential uses of nanomaterials. Progress in this field, akin to a baby's crawling, is being made gradually, with ongoing studies revealing surprising developments each day. The use of nanomaterials in reproductive biotechnologies is evident in various areas, such as transgenic animal production, the transport of pharmaceutical or chemical substances to gametes, the use of nanomaterials as antioxidants or cryoprotectants during gamete freezing, sperm selection and purification, antimicrobial effects, improvements in sperm analysis, in vitro fertilization, and embryo transfer manipulations. Additionally, the relatively new use of nanomaterials in reproduction has prompted studies on the potential toxicity of these materials, including genotoxicity and apoptosis in reproductive tissues and organs. Therefore, this presentation aims to provide an overview of the current state of nanotechnology in reproductive biotechnologies in Turkey, particularly at Erciyes University. In the presentation, scanning electron microscopic images of NGO, Fe_3O_4 and Curcumin nanoparticles and field research details in the project coded TSA-2022-12015, supported by Erciyes University Scientific Research Projects Coordinatorship, were included. It will explore the utilization of nanomaterials in various aspects of reproductive biotechnologies and sperm freezing studies while considering their potential benefits and any associated toxicological concerns.

Keywords: *Nanotechnology, Nanoparticles, Reproduction, Sperm, Toxicity*

EFFECTS OF EGG YOLK AND SOYBEAN LECITHIN ON SPERM QUALITY IN CHILLED DOG SPERM

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Abstract

Chilling of semen is a promising alternative to cryopreservation and is easily adapted for clinical use. Egg yolk is widely used as a cryoprotectant in dog semen extenders but there are some concerns and risks with the use of egg yolk including a risk of bacterial contamination and a potential risk of causing disease. Recently new extenders have been tested and several commercial vegetable-origin extenders have been reported to show promising results. The egg yolk contains low-density lipoproteins that protect the sperm against damage during the storage process and protect the sperm membrane from cold shock. An alternative to egg yolk in extenders is soybean lecithin, a natural mixture of phosphatidylcholine and several fatty acids that confer structural stability to cells. In recent decades, soybean lecithin was reported to have neither a cytotoxic effect nor a negative effect on sperm. Soybean lecithin contains antioxidant composites. In this study, semen was collected from 4 dogs by digital manipulation into a pre-warmed glass collection tube. The volume of each ejaculate was determined. Motility was assessed subjectively using a phase-contrast microscope with a warm slide. Sperm viability and morphological examination were determined by the eosin-nigrosin staining method. The results were presented as mean±standard error, and differences were considered significant at P<0.05. One-way ANOVA analysis of variance was used to evaluate the data, and the Duncan Test was used to determine the differences between the groups. In the motility evaluation, 20% egg yolk was the highest and the 0.4% soy lecithin group was the lowest at 0 hours. Between 12-60. hours, 20% egg yolk group and 0.8% soy lecithin groups were found similar and higher motility than the 0.4% soy lecithin group (P<0.05). In terms of the rate of dead spermatozoa, the 0.4% soy lecithin group at 0 hours was the highest and the 20% egg yolk group was the lowest. At the 12th and 36th hours, the 0.4 soy lecithin group had the highest rate of dead sperm, and the group containing 0.8% soy lecithin and 20% egg yolk were found to be similar to each other. At the 24th and 48th hours, the 0.4% soy lecithin group had the highest death rate, while the 0.8% soy lecithin group had a significantly higher death rate than the 20% egg yolk group. In the 12-hour examinations carried out until the 72nd hour, the highest rate of dead sperm was found in the soy lecithin group 0.4%, and the lowest rate in the soy lecithin group was 0.8%(P<0.05). Abnormal spermatozoa rate was highest in the 0.4% soy lecithin group at 0 hours, and lowest in the 20% egg yolk group. At 12 hours, 0.8% soy lecithin and 20% egg yolk groups were similar to each other and had significantly lower abnormalities than the 0.4% soy lecithin group. At 24 hours, the 0.4% soy lecithin group was significantly higher than the 0.8% soy lecithin group; at the 36th hour, the 0.8% soy lecithin group had a significantly higher abnormal sperm ratio than the 0.4% soy lecithin group. At the 48th hour, the highest abnormality was detected in the 0.4% soy lecithin group, and the lowest in the 20% egg yolk group (P<0.05). There was no difference between the diluent groups at the 60th and 72nd hours. In conclusion, the extender with 0.8 % lecithin preserved sperm quality better than the extender with 0.4 % lecithin and egg yolk was superior to either of the two rate soybean lecithin-based extenders used in this study.

Keywords: *Chilled Dog Semen, Egg Yolk, Soybean, Lecithin, Extender.*

THE CAMEL - A FOOD SECURITY ANIMAL

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Abstract

Pakistan is at 5th number regarding population explosion in the world, where livestock contributes in livelihood support and food provision to almost 35 million people. About 8 million rural families depends on livestock sector for its day-to-day needs. The Camel is an important livestock specie which have reasonable population of 1.1 million; hence make the 8th position of Pakistan in world. Largely the camel husbandry is being practiced in desert abodes of country where there is harsh environment for other livestock species. But due to urbanization and population need pressure, the system is shifting to urban and peri-urban regions of arid and semi-arid areas. People mainly rely on camel for milk and meat production along with draft use, riding, racing and aesthetic purpose. While in past there was a taboo regarding the use of camel milk but now the drift has been changed. The reason behind this is also the therapeutic worth of camel milk which is being used now for the treatment of many diseases, like diabetes, tuberculosis, liver disorders, asthma, piles, spleen ailments, food allergies and arthritis. The camel milk is also considered as an aphrodisiac in many cases. Further apart the camel milk is richer in vitamin and mineral contents especially vitamin C and Phosphorus contents, so considered superior than milk of other domestic animals. Camel meat is also on greater demands due to higher food requirements and also here the health concerns as the carcass have less lipids & cholesterol with relatively high PUFA contents. It is also used as therapeutic agent in the treatment of hypertension, hyperacidity, pneumonia and respiratory diseases. Along with this all, the camel makes up the 30% of the annual caloric diet of pastoral community. The reported daily milk production is far high in desert environment in semi-intensive or extensive managing systems like 6-13 liters with longer lactation period of about18 months which definitely ensures the food security in deep deserts and arid and semi-arid environments. The daily weight gain is found to be about 0.7 to 1 kg in camel calves reared on feedlots in Pakistan. Hence, it is observed that the camel has changed the conception of "ship of the desert" to a "food security animal".

Keywords: Camel, Milk, Meat, Food Security, Desert

REAL-TIME FEED MANAGEMENT: OLD THEORIES WITH NEW METHODS

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Abstract

Farm animals are complex systems that differ from individual to individual because of their productivity, their reproductive biological parameters and their state of health, which can change at any time. An important aspect of efficient feed management is an understanding of the interaction between feed resources, animal physiology and market demands. Therefore, frequently evaluating the cost, availability, and nutrient content of feed ingredients. Adapting feed formulations based on fluctuations in ingredient prices and market preferences is crucial to maintaining profitability. Aligning livestock feed management with production goals requires a flexible and adaptable approach, which can be achieved through the implementation of precision feeding techniques. Utilizing data-driven insights from real-time monitoring and analytics allows for targeted adjustments in feed rations, optimizing nutrient intake in response to animal performance and physiological needs. By tailoring feed practices to specific objectives, using precision feeding technologies, and taking into account economic and animal welfare factors, agricultural enterprises can increase production efficiency and economic returns in the sphere of livestock farming. The field of animal husbandry has seen significant progressions in the assessment of feed quality methods. Real-time feed analytics has emerged as a contemporary approach alongside traditional laboratory feed testing. Real-time feed analytics involve the use of sensor-based technology and data processing algorithms to monitor and analyse the nutritional composition and quality of animal feed in situ. This technique has the advantage of providing continuous monitoring, allowing for the immediate adjustment of animal diets based on real-time insights. However, challenges related to sensor accuracy and calibration, as well as data processing complexity, can pose limitations. On the other hand, traditional laboratory feed testing while delivering precise data, might lead to delayed decision-making due to analysis duration. In conclusion, the choice between real-time feed analytics and traditional laboratory feed testing depends on specific operational requirements and objectives. A hybrid approach, combining the strengths of both methods, could potentially provide a comprehensive solution for optimizing feed quality and animal nutrition in the modern livestock industry. Further research is essential to refine the capabilities of real-time analytics and address its current limitations.

Keywords: *Real-Time Analysis, Feed Management, Laboratory*

ENVIRONMENTAL FACTORS AFFECTING MILK SOMATIC CELL COUNT OF ANATOLIAN BUFFALO COWS

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Abstract

Somatic cell count (SCC) has been accepted as one of the reliable markers to determine the quality level of raw milk or intramammary infection status of milking animals. This investigation aimed to reveal the effectiveness of non-genetic factors on SCC in Anatolian buffalo cows raised in Turkey conditions. The SCC values were obtained from ten research results those published in the scientific journals between 2011 and 2022. The mean of the SCC was calculated to be 216x103 cells/ml, and found within the acceptable thresholds by Turkish Food Codex for human consumption of milk. The highest effects (14.81% and 14.81%) of the factors were noted for farm and stage of lactation. In conclusion, eliminating all non-genetic factors has expressly been suggested to farm owners for boosting the quality degrees of milk taking from Anatolian buffalo cows.

Keywords: Anatolian buffalo, dairy, milk quality, non-genetic factors, somatic cell count

INTRODUCTION

In today's animal husbandry, achieving livestock with high genetic merit and obtaining high quality and quantity products are the principal objectives in many countries. To reach these targets, eliminating all non-genetic factors has also been regarded as an essential rule of animal science (Atasever, 2022). Besides, producing more organic materials from farm animals has gaining an elevated trend in different locations of the world. Water buffaloes are one of the ruminant species those had a feature on easily adaptation to the poor environmental conditions (Sel et al., 2020).

In Turkey, water buffaloes have been termed as Anatolian Buffalo that belongs to Mediterranean Buffalo variety that one of the main sub-groups of River Buffaloes. Due to their facility characteristics by feeding forages with relatively low nutrient value, water buffaloes may be referred as economical farm animals. Also, these animals are sources of organic food materials such as yoghurt, cream and cheese. In this context, obtaining more amount of these products from water buffaloes is seen an important issue by farm owners.

To maintain high quality milk from water buffaloes, direct or indirect techniques for determining quality level of raw milk have been applied during or after milking process in the farms. Of these, somatic cell counting of milk has widely been used to be one of the reliable method throughout the world. Normally, somatic cells present in all milk samples while the low amounts point out to normality and high amounts refer to an abnormality of milk or an intra-mammary infection (Atasever, 2022). In Turkey, the limit of somatic cell count (SCC) of milk per ml has been declared to be 400x10^3 by Turkish Food Codex (TFC).

Some studies had been conducted on the determination of SCC of buffalo milk in Turkey conditions (Ozenc et al, 2008; Sekerden, 2011; Sahin, 2012; Atasever and Erdem, 2014; Atasever, 2022). However, no detailed study that compared and commented the environmental factors on SCC of this animal species has been revealed. Therefore, this paper aimed to reveal the effectiveness of non-genetic factors on SCC in Anatolian buffalo cows raised in Turkey conditions.

MATERIALS AND METHODS

In order to determine SCC means of Anatolian buffaloes in Turkey conditions, ten study results those published in the scientific journals between 2011 and 2022 were noted. All environmental factors those investigated in the articles were separately recorded to Excel program and their percentages were calculated. Thus, the main environmental factors effective on SCC of Anatolian buffalo milk were determined.

RESULTS AND DISCUSSION

The summary of the study that carried out on the SCC of raw milk obtained from of Anatolian buffaloes is given in Table 1.

Table 1. Field study results on SCC of Anatolian buffaloes between 2011 and 2022 in Turkiye conditions

Researchers	Year	SCC (cells/ml)	Factor
Atasever	2022	136841	AWS
Atasever and Erdem	2014	436978	F, L
Atasever et al.	2011	829359	F, TD
Sel et al.	2020	82400	L, AM, EM, S, CM, AUC
Ozcan and Erdem	2022	93667	BT
Ozenc et al.	2008	107000	S
Sahin et al.	2016	134731	F, P, SL, ML, MT
Sahin et al.	2017	90701	P, SL, CS
Sahin	2012	166100	P, A, SL
Sekerden	2011	90800	F, CY, SL

SCC: somatic cell count; AWF: animal welfare score; F: farm; TD= test day; L: location; AM: age of the milker; EM: education level of the milker; A: age; CM: characteristic of the milker; AUC: application of udder cleaning; BT: barn type; S: season; SL: stage of lactation; ML: month of lactation; MT: milking time; P: parity; CS: calving season; CY: calving year

As seen, the range was changed between 82400 and 829359 cells/ml. This case might be assumed to be a wide distribution and strongly possible due to different locations and husbandry applications in the farms. The overall mean of the studies was calculated to be 216×10^3 cells/ml. In spite of no official thresholds have been declared on SCC for water buffaloes, this mean was found as normal value by EU and TFC directives for dairy cows. However, when compared to physiologic structures and milk production capacity of water buffaloes with dairy cows, reducing the estimated SCC mean should be seen as a compulsory process at Anatolian buffalo farms investigated here.

Many studies pointed out the close relations of non-genetic factors with SCC which can be referred as a strong marker of raw milk quality and udder infection status of dairy animals. At this point, it may be stated that removing the effects of all environmental factors on SCC could be performed and principally regarding these effects should be taken into consideration by the farm managers.
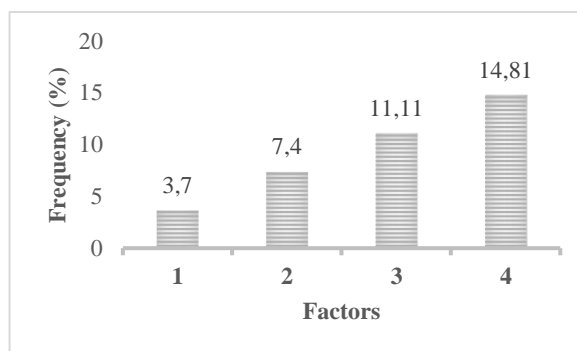
Figure 1. Frequency of environmental factors affecting SCC of Aatolian buffaloes (1= AWF, BT, AM, EM, CM, AUC, A, TD, ML, MT, CS, CY; 2= L, S; 3= P; 4= F, SL)

Percentages of all environmental factors investigated in this paper is presented in Figure 1. According to Figure 1, the highest (14.81%) two effects were caused by stage of lactation (SL) and farm (F).

Sahin et al. (2017) points out that SCC is high at the early phase of the lactation; thirty days later it decreases, then upon the completion of lactation it increases again. Therefore, differences in SCC vales throughout the lactation and the higher percentage of SL as an effective factor on SCC might be assumed to be expected cases.

Like SL, differences in SCC was noted by the farms investigated papers in the Table 1. This case might also be seen as a normal result because of different management programs applied in each farm.

Parity (P), location (L) and season (S) were observed other important factors in addition to SL and F.

As a general knowledge, SCC of a dairy animal increases with advanced parities together with increased milk production. Besides, higher SCC level for first and advanced parities may be resulted from different defence mechanisms against mammary infection in various parities (Sahin et al, 2017).

In addition to F factor, location (L) might be seen an important factor due to the difference in various topographic structure and climate of the areas where the investigated studies in Table 1 were conducted.

Season (S) was another important environmental factor affecting SCC of buffalo milk. Especially high ambient temperature and humidity might be caused to important difference in SCC collected in hot seasons. Therefore, taking measure in these moths might be advised to the farm owners according to this concept.

Finally, different and multi environmental factors effected SCC of raw milk in Anatolian buffaloes

raised at farms located in different parts of Turkiye.

CONCLUSIONS

Environmental factors played an important role on SCC which reflects the quality degree of raw milk or udder inflammation status in Anatolian buffaloes according to investigated data.

Stage of lactation, farm, parity, location and season were attractive among these factors.

It can be concluded that eliminating all environmental factors has expressly been suggested to farm owners for increasing the quality level of milk taking from Anatolian buffalo cows

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DEVELOPMENT OF A METHOD OF DRY SANITATION USING ALUMINOSILICATE MIXTURES IN LIVESTOCK FACILITIES IN THE FORM OF RECOMMENDATIONS SUPPORTING THE REDUCTION OF THE IMPACT OF SELECTED ARTHROPOD SPECIES AS DISEASE VECTORS IN POULTRY PRODUCTION

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Abstract

_Regardless of the direction of use, poultry flocks are kept in facilities that are a living environment for arthropods. Mites and insects as vectors of diseases threaten the health of birds, which means actual treatment costs or loss of production profitability. At the same time, available sanitizing substations seriously impact the natural environment. Aluminosilicates are natural minerals chemically inert to the environment and poultry. They are characterized by a high capacity to bind water solutions, they impact the reduction of the evaporation process and the emission of harmful gases - ammonia, hydrogen sulphide or carbon dioxide. They are cheap and safe to use. Used as bedding powders (dry sanitization) they support the prevention of poultry flocks, ensuring an increased hygienic standard of the bedding. The study aimed to determine the effect of adding a combination of aluminosilicates (zeolite and halloysite with a particle size of 40-50 μ) on the populations of mites and insects present in the bedding during the production and maintenance of poultry. Dry sanitization was performed with a blend of zeolite and halloysite (1:1) in the amount of 0.5 kg per 1 m2 of the surface area in the facility, calculated as 1/5 of the floor surface (0.1 kg/1 m2 of floor area). The experiment was carried out in a flock of laying hens Rosa 1 (A) and in a flock of chickens for fattening ROSS 308 (B). The mix was administered five times. The first backfills were made before settlement. The others, respectively: A - on the 14th, 28th, 36th and 4th day, for B - on the 7th, 14th, 21st and 35th day. Litter samples (10 repetitions) of 500 cm3 were collected on these dates. Acarological analyses were performed in a modified Tullgren apparatus. The obtained specimens were preserved, divided, and marked as species. The obtained results were subjected to statistical analysis using Friedman´s rank test, ANOVA, standard deviation (SD) was assessed, statistical mean values were calculated. The significance of differences between the groups was verified. From the 36th day of rearing, a decreased population of mites was observed (4445.0 pc/250 cm3 of litter) compared to the 28th day of rearing (83591.0 pc/250 cm3 of litter). The dose of 400 g of zeolite and halloysite is suggested to reduce the occurrence of mite populations in the litter. Reducing the occurrence of Sancassania berlesei - a vector of coccidiosis in poultry. The intensity of insects in the litter decreased significantly on the 36th day. The reduction in the occurrence of insects is related to the species´ life cycle, damage to the setae on the surface of their body and dehydration. Of particular importance was the reduction of the population of Dermanyssus galinae. The use of aluminosilicates reduces the populations of mites and insects in poultry facilities. Aluminosilicates change the litter environment and inhibit the life processes of arthropods. They are cheap and safe for birds and the environment. They have no grace period. Dry sanitization with aluminosilicates significantly reduces the population of mites and insects inhabiting various beddings used for poultry. The adopted method of sanitation has a vast practical dimension - it increases the standards of poultry welfare, reduces the level of threats resulting from the transmission of diseases and improves poultry welfare. Founding: Research work was carried out as part of a grant awarded for pre-implementation work - increasing the level of implementation readiness (TRL) implemented by the UTP_SCUTP consortium as part of the "INCUBATOR OF INNOVATION 4.0" project_

Keywords: _Aluminosilicates, Red Mites, Sancassania berlesei, Dry sanitization, Poultry welfare_

THE RELATIONSHIP BETWEEN COAT COLOR OF COWS AND INSULIN, PROLACTIN AND NEFA LEVELS UNDER HEAT STRESS CONDITIONS

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Abstract

Heat stress presents one of the biggest problems for dairy cows worldwide, especially with the continuous increase in temperature levels in the last few years. Furthermore, black or dark-skinned animals have been noted to be more susceptible to heat exhaustion due to increased solar radiation absorption. The main objective of this paper is to study the relationship between the percentage of black and white colors in the coat of Holstein cows and their heat tolerance under heat stress conditions. A total of 34 Holstein Friesian cows with different levels of black and white coat color were used for the experiment. Blood samples were taken after the cows were subjected to a daily walking routine under direct sunlight. The samples were collected to evaluate insulin, prolactin, and NEFA. As a result, a negative correlation was found between the percentage of white color on the coat of cows and insulin (-0.16) and the same with NEFA (-0.17). In contrast, a positive correlation was found between the white color and prolactin (0.41). In conclusion, the coat color can have an effect on heat tolerance in cows.

Keywords: Heat stress, Cows, Porlactin, Insulin, NEFA

EFFECT OF γ -POLYGLUTAMIC ACID ON CHICKEN EMBRYO DEVELOPMENT: TOXICITY MICROBIAL CONTROL AND IMMUNOMODULATION PROPERTIES

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Abstract

Polyglutamic acid (PGA) is a strongly anionic natural polymer produced by bacteria of the Bacillus spp genus as a fermentation product secreted into the medium. It is a water-soluble, biodegradable, nontoxic substance. PGA stimulates and improves immune and antibacterial activity, making it suitable for the selective delivery of chemotherapeutic agents. The aim of the study was to investigate the toxic and bactericidal effect of the polyglutamic acid-based Saverum preparation on the development of the chicken embryo. The y-polyglutamic acid produced as a result of a specific biofermentation with the use of three bacterial strains (Bacillus licheniformis, B. subtilis and B. amyloliquefaciens) can be used as a purified form (0.25um filters), without bacterial cultures (only metabolites, filtrate), and with live bacterial cultures (permeate). The effect of both fractions on the survival, toxicity and control of chicken embryos, as well as immunomodulatory properties, was studied under controlled hatching conditions in hatchers. On the basis of the results of the HET-CAM test, it can be concluded that both the permeate and the filtrate are nontoxic substances. The filtrate and permeate also had no harmful effect on the embryos when injected on day 0 or 17 of incubation. Microbiological analyses indicate that the filtrate and permeate inhibit staphylococcal growth on egg shells. The blood leukocytogram of one day old chicks showed significant effect of PGA filtrate on the modulation of leukocytes, basophils, and leukocytes. This opens the possibility of using preparations based on y-PGA as a carrier and substance that stimulates the postnatal development of chicks (so-called in ovo feeding). This aspect seems interesting from the perspective of commercial use of the preparation and requires further research.

Keywords: *Y-Polyglutamic Acid, Chicken Embryo, Toxicity, Antibacterial, Immunomodulation*

THE RELATIONSHIP BETWEEN SOMATIC CELLS AND UDDER MORPHOLOGY IN MORKARAMAN SHEEP

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Abstract

This study was carried out to determine the relationship between udder morphology and the number of somatic cells in milk (SCC) in Morkaraman sheep. In order to determine the somatic cell number and udder morphology, 70 Morkaraman sheep were used in the study. The birth season started in April and continued until the end of May. Control milking was done every 15 days, including the suckling period, in the evening. Before the milking process, the udders of the sheep were wiped with clean and damp cloths and sterilization was ensured. In order to determine the SHS after the milking process, samples were taken from the milked milk by writing the ear tag numbers of the animal on 50 ml tubes. Collected samples were brought to Ataturk University Faculty of Agriculture Department of Animal Science Milk Analysis Laboratory and analyzed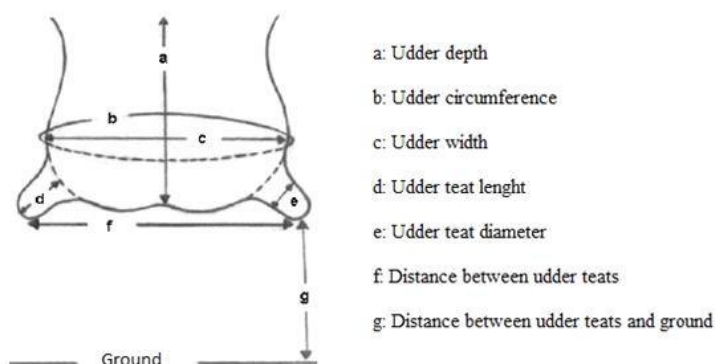 in a DeLaval DCC device. Determination of udder morphologies was done between 55 and 65 days in the middle of lactation 2 before milking. An electronic caliper was used for measurements made to determine udder morphology characteristics. In order to determine the udder morphology of the sheep used in the study, udder depth, udder circumference, udder width, udder length, udder diameter, the distance between teats, and the distance between the teat and the ground were measured. To determine the udder types, the udders of the sheep were scored from 1 to 6. Scoring from 1 to 9 was used to determine breast characteristics. According to the results found in the study, no correlation was found between somatic cell count and udder characteristics.

Keywords: Morkaraman, Somatic Cell Count, Udder Morphology.

INTRODUCTION

Sheep breeding has an important place in livestock organization. The choice of breed in sheep breeding varies according to the climatic conditions, consumption preferences and cultural structures of the countries (Kaymakcı 2010; Koyuncu and Taskın 2013, Turkyılmaz 2014). Sheep livestock production has a very important place in the Turkish economy. In terms of the number of sheep, our country has a very important place in the world ranking. However, our numerical superiority does not apply to yield per animal (Kaymakcı 2010). Although studies on the relationship between udder morphology and milking characteristics started in the 1970s (Sagi and Morag, 1974), the interest in sheep udder morphology has increased in recent years with the increase in mechanization in milking systems (Makovicky et al. 2014). Many studies have been conducted on the linear scoring of both udder and udder types (Epstein 1985). In raising a lamb, the anatomical structure of the sheep udder is very important for the lamb to be able to suckle milk (Kaygısız ve Dag, 2017). Somatic cell is a mammary secretion consisting of cells from blood and udder tissue (Yoney 1998). From leukocytes and mammary epithelial cells; epithelial cell debris and anucleated cells; The group of cells consisting of red blood cells (erythrocytes), plasma cells, colostrum corpuscles and leukocytes is called somatic cell (Cedden et al 2002; Onal and Ozder 2007). SHS in milk varies according to age, climatic conditions, lactation period, milking style and hygiene conditions (Anonymous 2000). SHS determination, which is made to determine milk quality, is also very important to determine that there are no health problems in production and sheep, and therefore to determine the milk price. A high SHS is a sign of an infection in the udder. Except for infection, SHS may be high in milk taken during the estrus or late lactation period of the animal (Kalantzopoulos et al. 2004; Raynal-Ljutovac et al. 2005). While the high number of somatic cells causes negative effects in terms of human health, it also causes some problems during the processing of milk and reduces the quality of milk and dairy products (Yalcın et al., 2000; Cedden et al., 2002). Dunham and Smith (1985) found that lower amounts of cheese were obtained from milk with high SHS have reported. There is an inverse relationship between SHS and milk yield and shelf life. With the increase in SCC, the yield decreases and the shelf life of milk and dairy products is shortened (Coban et al. 2007). It has been reported that besides genotypic characteristics, milking type, milking time and

milking frequency have an effect on SHS (Rekik et al. 2008).

According to the literature studies, it has been observed that there are significant relationships between udder type and SHS. In our country, especially in recent years, it has been reported that machine milking is more effective in studies examining the relationship between udder morphology and lactation milk yield (Dogan et al., 2013; Altincekic et al., 2011). In this study, it was aimed to determine the relationship between somatic cell count and udder morphology in Morkaraman sheep.

MATERIALS AND METHODS

The study was carried out at Ataturk University Food and Livestock Application and Research Center. 70 Morkaraman sheep were used in this study. Milk samples were collected in 50 ml tubes for determination of SHS. Collected samples were brought to Ataturk University Faculty of Agriculture Department of Animal Science Milk Analysis Laboratory and analyzed in DeLaval DCC device. It was analyzed optically and automatically with the using DeLaval DCC instrument (Fig 1.) for SHS measurement. Samples transferred to plastic tubes for SHS measurement were taken into measurement cassettes by turning them upside down several times after the tube was closed and homogenized. The milk sample was drawn into the cassette, the loaded cassette was placed in the measuring window of the device, and its SCCs were determined by evaluating it as 1 ml.

Figure 1. DeLaval SCC Device

Determination of udder morphologies was done between 55 and 65 days in the middle of lactation 2 before milking. Electronic caliper was used for measurements made to determine udder morphology characteristics. The udder width, udder depth and teat location distance were measured with a measuring stick. Udder circumference was measured at the widest part of udder and just over the udder teats by using tape measure. Udder teats length was measured from

linking udder to tip of teats. Udder teats diameter was measured at the thickest portion of teats by using caliper.

In the study, udder depth, udder circumference, udder width, teat length, teat diameter, distance between teats and distance between teat and ground were included in order to determine the udder morphology of sheep (Figure 2). Udder measurements were measured using the method specified by Altıncekic and Koyuncu (2011). Electronic caliper, tape measure and measuring stick were used during the measurements.

a: Udder depth
b: Udder circumference
c: Udder width
d: Udder teat lenght
e: Udder teat diameter
f: Distance between udder teats
g: Distance between udder teats and ground

Figue 2. Udder measurements scheme (Akcapinar et al. 2008).

The udder type in sheep was determined as reported by Epstein (1985) and Dogan et al. (2013) (Fig. 2).
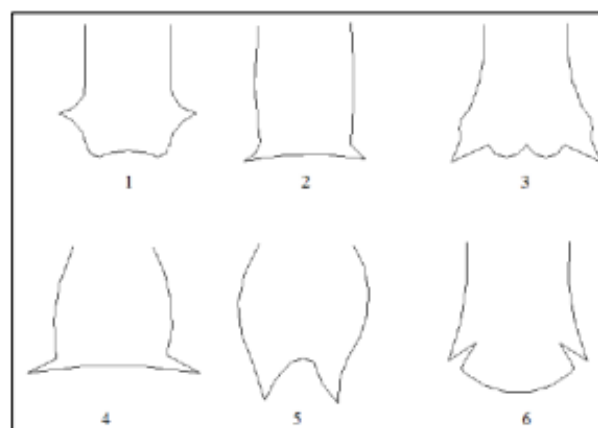
Figure 3. Udder types in sheep (Epstein 1985; Dogan et al. 2013).
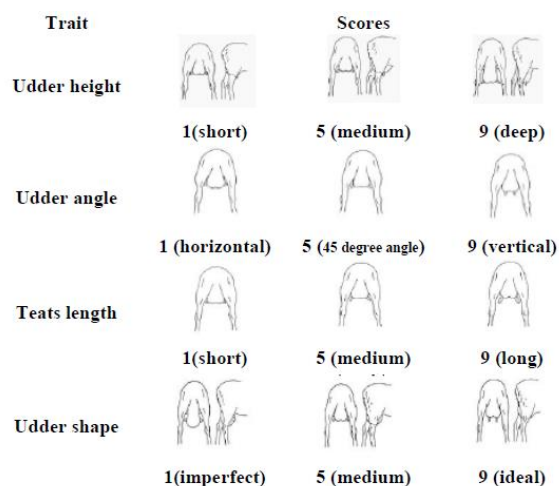
Figure 4. Linear scores of udder traits (Caja et al. 1981).

Linear udder scores was determined according to the method (Fig. 3) reported by Fuente et al. (1996). Fuenta et al. (1996) used breast height, teat angle, nipple length and breast type for linear breast characteristics according to the method used by. Scores between 1 and 9 were used in linear scoring (Fig 4).

SPSS 19.0 (2010) packaged GLM procedure Software was used to analyze the variance of the data obtained in the study. The least squares method was used to determine the differences in udder characteristics between races and the correlation coefficients between udder characteristics and SCC were calculated.

RESULTS

Correlation analysis between breast characteristics and SCC was performed in the study.

According the findings there was negative correlation between udeer depth and udder circumference (r=-0,419; p<0,01), and there was positive correlation with udder width (r=0,643; p<0,01), udder height (r=0,353; p<0,01). There was negative correlation between the udder circumference and udder width (r=-0,494; p<0,01), udder height (r=-0,579; p<0,01) and teats lenght (r=-0,174; p<0,01). There was positive correlation between the udder width and udder type (r=0,327; p<0,01), udder height (r=0,432; p<0,01), teats angle (r=0,329; p<0,01) and udder shape (r=0,280; p<0,05). There was positive correlation between the udder type and teats angle (r=0,389; p<0,01) and udder shape (r=0,276; p<0,05). There was positive correlation between the udder height and teats angle (r=0,257; p<0,05). There was positive correlation between teats angle and udder shape (r=0,712; p<0,01).

According to the results found in the study, no correlation was found between SCC and breast characteristics.

Table 1. Udder traits and SCC correlation table.

	Udder Depth	Udder circumference	Udder width	Udder type	Udder height	Teats angle	Teats length	Udder shape
Udder circumference	-0,419**							
Udder width	0,643**	-0,494**						
Udder type	0,156	-0,155	0,327**					
Udder height	0,353**	-0,579**	0,432**	0,112				
Teats angle	-0,032	-0,152	0,329**	0,389**	0,257*			
Teats length	0,075	-0,174**	0,208	0,078	0,078	0,225		
Udder shape	-0,046	-0,199	0,280*	0,276*	0,154	0,712**	0,17	
SCC	-0,091	0,014	-0,017	-0,033	0,046	0,05	0,076	-0,126

*: Significant (P< 0.05); **: Highly Significant (P< 0.01).

DISCUSSION

The literature study on the detection of SCC in sheep is limited, the studies focused on cow's milk and quality standards were determined by limiting SCC in milk. However, there is no restriction for small cattle yet. This situation creates a gap in terms of quality standards of milk and dairy products obtained from sheep and goats. Our study constituted a step to fill the gap in this area and it is recommended to carry out new studies in order to overcome this deficiency.

CONCLUSIONS

According to the results of the study, no relationship was found between SCC and breast characteristics. It is recommended to examine the relationship between SCC and udder characteristics in sheep. In addition, while there is an SCC scale that can be determined in cows for our country, there is no such scale in sheep. The results of the studies carried out are in the

direction of increasing the number of researches in this context.

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TEXT MINING AND ITS APPLICATIONS IN AGRICULTURE

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Abstract

Big data analytics has found applications in many industries because of its ability to transform large amounts of data into insights to make informed functional decisions. Text mining is one of these analysis methods. Text mining can also be defined as the process of obtaining high-quality information from texts. An increasing amount of text files are available today, and most of them are also available via the Internet. This has brought about text mining tools that can deal with unstructured information. Text classification is a text mining process that aims to classify a set of text documents according to certain criteria. If the criterion is the subject of the text, text classification techniques try to classify the texts according to their subject. In this case, the metadata of the documents (title, publication date, list of authors, organization) is processed for further statistical and semantic analysis. The importance of text mining applications has increased in recent years due to the large number of web-enabled applications. The use of text mining in the context of data feeds and emerging platforms such as social networks is increasing. Today, studies are carried out in each branch of science by taking into account the large amount of information stored both in print and in electronic media (internet). The situation is not different in the field of agriculture. Agricultural researchers, as in other fields, have recently accessed large collections of agricultural texts such as scientific articles and news. These texts can be analyzed with text mining techniques to solve agricultural problems or extract information. Despite the popularity of these techniques, text mining is a relatively underused technique in agriculture. Therefore, this research aims to provide an up-to-date research on the application of text mining techniques in agriculture.

Keywords: *Information Technology, Big Data, Text Mining, Internet, Agriculture*

CLUSTERING OF COUNTIES OF SAMSUN ACCORDING TO THE PRESENCE OF CATTLE BREEDS

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Abstract

In Samsun which is one of the leading provinces in cattle population, there is a great diversity in terms of cattle breeds. In this study, the cluster analysis method was used to examine the applicability of similar breeding policies for all districts when the statistical distribution of cattle in Samsun according to breeds was examined. The dimention reduction using PCA method was used to eliminate the variables that have no effect on the data set and to prevent the multicollinearity problem. As a result of the analysis, the explanatory power of the cluster analysis increased from 51,7% to 64,1% by using the dimention reduction. Different breeding policies should be developed for Bafra, Vezirkopru, Carsamba and Tekkekoy districts compared to other districts, according to the results obtained by looking at the clustering graph formed when the ineffective variables are removed from the data set with the dimention reduction method. Policies for dairy cattle breeding can be proposed in these districts.

Keywords: Cattle breeds, 3-D Clustering, Principal Componet Analysis, Accuracy

INTRODUCTION

The livestock sector has a strategic importance in the adequate and balanced nutrition of the rapidly increasing population in Turkey, as in the world, in using it as an industrial raw material and in realizing rural development (Aral, 1996; Yılmaz and Koknaroglu, 2007). The aim of livestock policies and supports is to increase the production required for a balanced diet in terms of animal protein, and to realize a higher quality and economical production (Demir, 2012).

The growing food crisis all over the world underlines the need to take important strategic steps in the field of agriculture and animal husbandry. It is important for countries to develop productive policies in line with their geography and food source. Since cattle breeding is used both in food and industrial areas in our country, where animal husbandry is also very common in agriculture, the implementation of priority policies in order to ensure its continuity will continue the development in these areas.

It is necessary to repeat some studies in order to identify and solve the problems in livestock enterprises, to monitor the changes in the sector and to make realistic plans for the future (Oren and Bakır, 2020).

Statistical methods are used for development policies in many fields such as agriculture. Appropriate statistical analyzes are applied according to the variable structures obtained as a result of the experiments. Cluster Analysis, one of these analysis methods, is a multivariate statistical method that aims to divide a set of observations into a limited number of groups or clusters. Separation is made so that while observations in the same group are similar to each other, observations in different groups are different from each other (Neil, 2002).

In this study, it is aimed to classify the provinces of Samsun city according to cattle breeds in Turkey by clustering analysis on the applicability of similar breeding policies for districts according to cattle breed existence.

MATERIALS AND METHODS

In this study, a total of 64 cattle breeds from 17 counties in Samsun (Ondokuz Mayıs, Alacam, Asarcık, Atakum, Ayvacık, Bafra, Canik, Carsamba, Havza, Ilkadım, Kavak, Ladik, Salpazarı, Tekkekoy, Terme, Vezirkopru, Yakakent) 392,289 cattle were used for analysis. Analysis results R software 4.2.2. version obtained.

The cattle breeds used in the study; Aberdeen Angus, Aberdeen Angus Crossbreed, Angler, Angler Crossbreed, Aubrac, Avrupa Kırmızısı, Bazadaise Crossbreed, Belcika Mavisi, Belcika Mavisi Crossbreed, Blonde D'aquitaıne, Blonde D'aquitaıne Crossbreed, Boz Irk, Boz Irk Melezi, Brangus, Brangus Crossbreed, Brown Swiss, Brown Swiss Crossbreed, Charolais, Charolais Crossbreed, Chıanına, Clavel Aleman, Clavel Aleman Crossbreed, Dogu Anadolu Kırmızısı, Dogu Anadolu Kırmızısı Melezi, Danimarka Kırmızısı Crossbreed, Eston Kırmızısı, Guney Anadolu Kırmızısı, Guney Anadolu Kırmızısı Crossbreed, Hereford, Hereford Crossbreed, Holstein KA, Holstein SA, Holstein KA M, Holstein SA, Holstein SA M, Isvec Kırmızısı, Isvec Kırmızısı

Crossbreed, Jersey, Jersey Crossbreed, Leton Kırmızısı Crossbreed, Limousin, Limousin Crossbreed, Marchıgıana Crossbreed, Montbeliarde, Montbeliarde Crossbreed, Normande, Normande Crossbreed, Norvec Kırmızısı, Norvec Kırmızısı Crossbreed, Piedmentosa, Piedmentosa Melezi, Red Angus, Red Angus Crossbreed, Salers, Salers Crossbreed, Simental, Simental Crossbreed, Yerli, Yerli Guney Sarısı, Yerli Guney Crossbreed, Yerli Kara, Yerli Kara Crossbreed, Zavot, Zavot Crossbreed, Zebu variables consisting breeds were used.

Cluster analysis, which is accepted as one of the multivariate statistical methods, is applied to group many complex data and compare the resulting groups, and it is often preferred because it is easy and the results can be clearly understood (Tekin, 2015). Cluster analysis is a technique that allows data to be collected in discrete clusters in terms of their similarity to each other according to units or variables (Cakmak, 1999).

The main goal of cluster analysis is to classify and make sense of a group of data whose origin is unknown. Therefore, cluster analysis is used to classify units or objects according to their basic properties (Abonyi and Feil, 2007). In short, it can be stated that the general purpose of clustering analysis is to separate the similar from the different (Everitt et al., 2001).

Principal component analysis (PCA), which is a transformation technique that enables the dimensions of the data set, which includes a arge number of interrelated variables, to be reduced to a smaller size by preserving the existing changes in the data as much as possible, facilitates various evaluations (Cilli, 2007). The analysis aims to determine the best transformation that can express the available data with fewer variables. The variables obtained after the transformation are called the principal components of the initial variables. The first principal component has the largest variance value and the other principal components are ordered in descending order of variance values. (Alpar, 2003).

Analysis R program to develop breeding policies by using cluster analysis to group cattle breeds in Samsun according to districts 4.2.2. made with version.

RESULTS AND DISCUSSION

According to the results of the clustering analysis applied to examine the distribution of cattle breeds by districts, it was understood that the districts were divided into 5 classes. Looking at Figure 1, it is observed that Bafra, Carsamba,

Tekkekoy and Vezirkopru districts are clustered far from other districts. Therefore, it has been determined that a separate breeding policy can be followed in these districts compared to other districts. Looking at the hierarchical clustering map, it is understood that the explanatory power is 51.7%.

When Figure 2 was evaluated, it was determined that the explanatory power of the dimensions for cluster analysis was 78%.
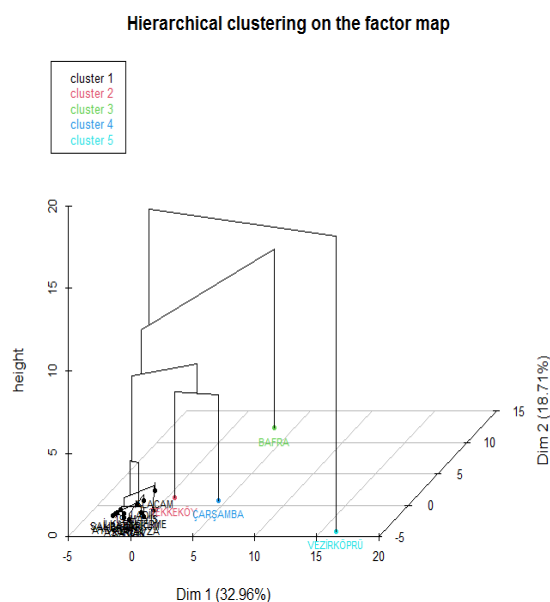
Figure 1. 3D clustering map of districts according to animal breeds.
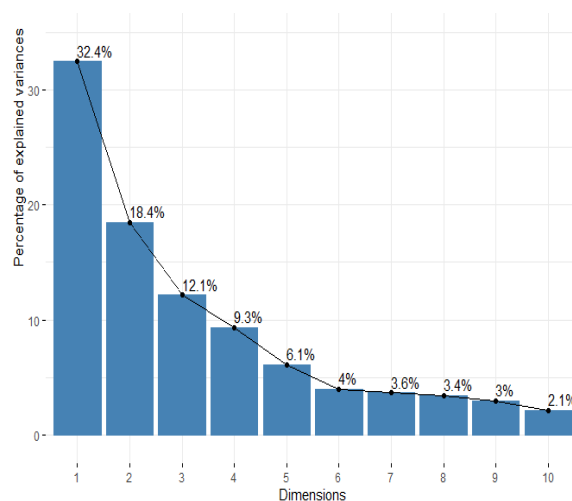
Figure 2. Variance explanatory power of dimensions.
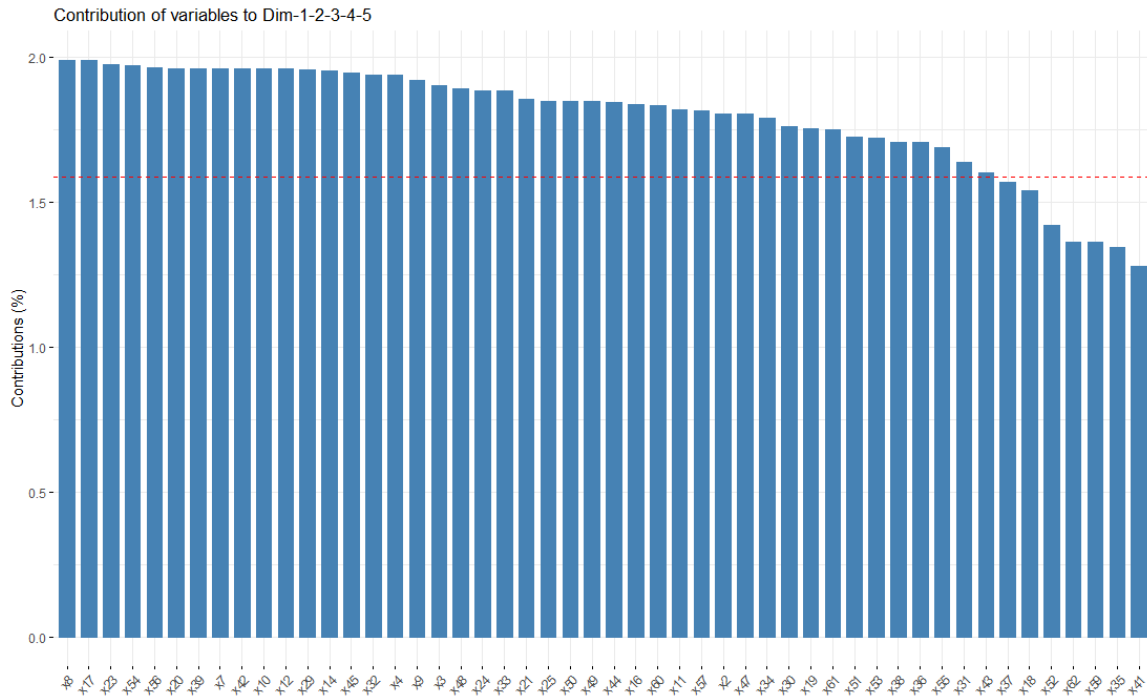
Figure 3. Variables that are significant for data after PCA.
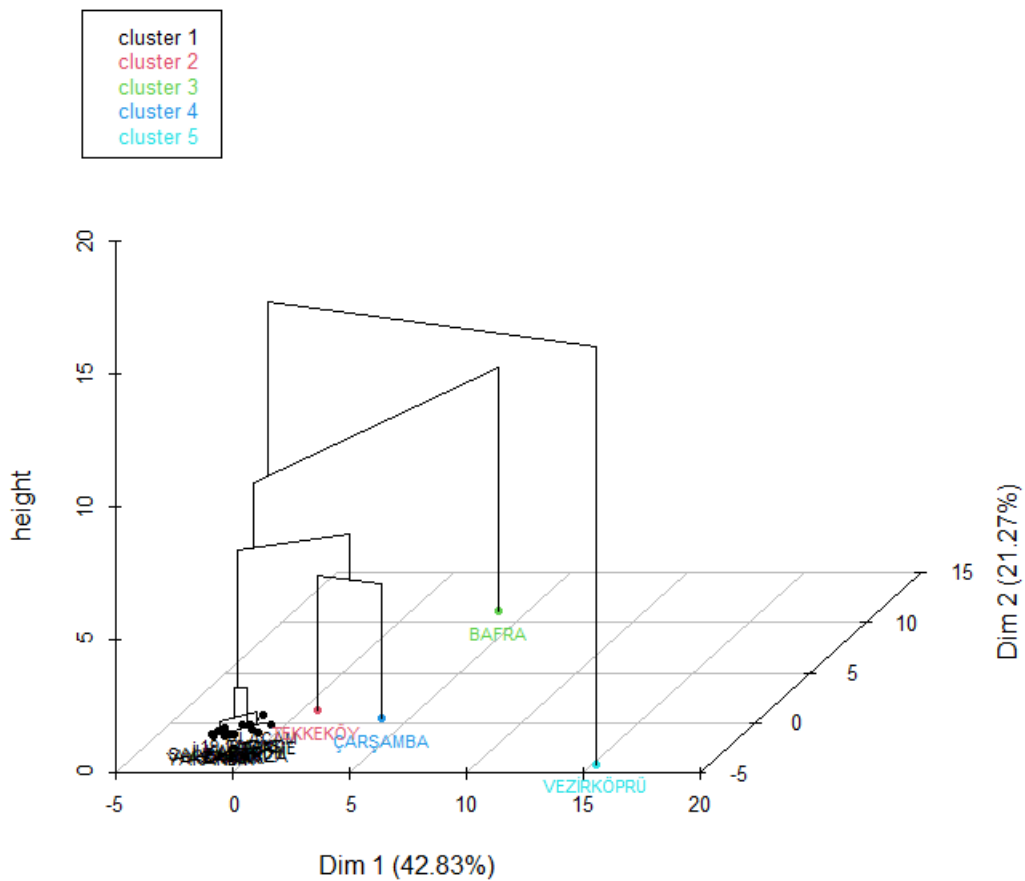
Figure 4. 3D clustering map formed after applying PCA.

After PCA is done, the variables of the remaining cattle breeds after the insignificant variables in the data set are eliminated are shown in the Figure 3. Animal breeds excluded from the data set in this study; Aberdeen Angus, Aubrac, Avrupa Kırmızısı, Boz Irk Crossbreed, Brangus Melezi, Charalails, Clavel Akman Crossbreed, Estan Kırmızısı, Guney Dogu Anadolu Kırmızısı, Guney Dogu Anadolu Kırmızısı Crossbreed, Isvec Kırmızısı, Jersey, Limosin, Limosin Crossbreed, Normande Crossbreed, Red Angus Crossbreed, Yerli Guney Sarısı, Yerli Guney Sarısı Crossbreed, Zavot, Zavot Crossbreed, Zebu are breeds that were not significant for analysis.

After the variable elimination method was applied, it was observed that all 5 clusters got closer to each other in the new clustering map, when the variables that were meaningless for the data set were removed. It has also been observed that a separate breeding policy can be applied for Bafra, Carsamba, Tekkekoy and Vezirkopru districts according to the animal breeds raised between the districts. The explanatory power of cluster analysis after PCA increased from 51.7% to 64.1%. Therefore, the applicability of PCA is recommended for data sets with too many variables (Figure 4).

It has been determined that the same breeding policies cannot be applied in all districts for cattle breeds in Samsun. Accordingly, as a result of the analyzes made, the sustainability of dairy cattle is important for Bafra district, where dairy breeds such as Holstein, Jersey, and Montofon are mostly raised. When we look at Carsamba county, in addition to dairy breeds, the Yerli Kara Crossbreeds which is a meat breed, is mostly seen, and it may be more suitable for breeding both dairy and meat breeds for this county. Considering the ratio of beef cattle to dairy cattle, it can be said that beef cattle breeds such as Charolais Crossbreeds are suitable for breeding policies as well as dairy breeds for Tekkekoy district. n terms of separate breeding policies, it can be suggested that dairy cattle and beef cattle breeds should be preferred in Vezirkopru district, as the district where the Yerli Kara which is one of the beef cattle breeds, is outnumbered.

Traceability of the same cultivation policies is appropriate for other districts, which we can define as cluster 5.

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ANALYSIS OF FACTORS AFFECTING AGGRESSION IN CATS

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Abstract

The aim of the following thesis is which factors, such as place of living, presence of other animals, gender, physical condition or breed may have on domestic cats. The results of the research is based on a survey conducted for 147 cat owners. The questionnaire contained 31 questions, which mainly refered to cats´ lifestyle, daily activities and the cats´ environment or their breed. Furthermore, the survey helped to indicate on the aggressive behavior of these animals. 8 types of aggression were distinguished: territorial, anxiety-based, learned, out of frustration, out of excessive grooming, in play, idiopathic and redirected aggression. The relationship between the aggresive behaviour origin and further analysed features, may be checked by the usage of the chi-square χ^2 test. The SAS statistical program and the FREQ procedure was used in the preparation of the statistical analysys (SAS, 2014). Through the study, it was shown that cats which have the opportunity to go outdoors, most often show territorial aggression. While aggression from predominated frustration is often observed among cats which spend time exclusively indoors. It was also proven that cats whose owner spends more than 2 hours per day playing with them, present aggression from frustration to a lesser extent, as they have no time for boredom. Analyzing the gender factor, it was noticed that female cats showed much more aggressive behavior resulting from territorialism and fear. Further analysis shown that the presence of other animals reduces the occurrence of aggressive behavior among cats, stemming from territory defense or fear. Thus, it can be assumed that the cats considered in the survey have become accustomed to the presence of mates of other species and have developed rules for mutual existence. Carrying out a chi-square χ^2 test has given the possibility to determine the influence of a factor on aggressive behavior among cats and has clearly indicated a significance of such indicators as lifestyle, daily activities, gender, the presence of other animals in the house or the breed of the domestic cat. ($p \leq 0,05^*$, $p \leq 0,001^*$, $p \leq 0,0001^{**}$).

Keywords: Cat, Aggressive Behavior, Types Of Aggressive Behavior, Behavioral Disorders, Fear, Territorial Aggression

NUTRITIONAL FACTORS IMPACT ON IMMUNITY IN POULTRY

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Abstract

Poultry production performance primarily depends on animal health and also the effectiveness of the immune system. Primary lymphoid organs such as the Bursa Fabricius and Thymus have crucial roles to provide an immunity strength against diseases. Additionally, the spleen, cecal tonsils, immunoglobulins, and various forms of mucosal immunity - including bronchus-associated lymphoid tissue and GALT-associated lymphoid tissue - are also vital to their overall health. In poultry production, management factors (environmental conditions, heating, lighting), and feeding practices (feed ingredients, composition, and feed additives) significantly impact the immunity of birds and subsequently performance. For this reason, the usage of various feed additives for example probiotics, prebiotics, vitamins, minerals and organic acids, are essential to maintain hormonal, physiological, and immune processes. These additives including probiotics, vitamins (vitamin A, C, D, E) and mineral (selenium) supplementations and organic acids enhance the immune system's activity against microbial pathogens and physiological stress mechanisms. This review focuses on stimulant effects of feed additives on immune system development and also productivity in poultry production.

Keywords: *Immune system, B and T cells, vitamins, selenium, organic acids*

INTRODUCTION

The immune system consists of various organs and tissues, including in Bursa Fabricius, thymus, bone marrow, spleen, the harderian gland, lymph nodes, circulating lymphocytes, and lymphoid tissue in the alimentary tract in poultry (Panda et al., 2015).

Lymphoid tissue could be specialized into two types: primary and secondary. The thymus and Bursa Fabricius are considered primary organs, whereas the spleen is secondary types of lymphoid tissue. The Bursa Fabricius is unique to birds and is absent in mammals due to evolution. In both hens and mammals, primary lymphoid tissue shows a reduction after puberty due to the effects of sex hormones (Junior et al., 2018).

Additionally, immune system and nutritional relationship in poultry has crucial importance and indirectly affect productivity. In chickens, nutritional deficiency could result in deterioration in growth and development, and and maturation of the immune system (Korver, 2012).

This review focused on poultry immune system and nutrional factors impact on poultry immunity.

Primary Immune Organs

In avian immune system, there are two primary organs. The first one is Bursa Fabricius which is associated with B-cells, and the second is the Thymus, that is associated with T-cells. Both organs produce B and T cells to improve poultry immunity. T and B cells move to the secondary lymphoid tissue, for providing a defense, which includes the spleen and mucosa-associated lymphoid tissue (MALT) (Yasuda et al., 2003).

The primary lymphoid tissue plays a crucial role in selecting lymphocytes (including T-cells and B-cells), for a strong immune response while preventing autoimmunity. The lymphoid stem cells in the bone marrow generate the T and B cell precursors (Ratcliffe, 2006; Ifrah et al., 2017).

Bursa Fabricius is placed in the dorsal of the cloaca, and is responsible for the maturation of B lymphocytes, the killing of autoreactive B cells, and the synthesis of hormones. The Bursa Fabricius produces B-cells, which are responsible for synthesizing antibodies. In chickens, Bursa Fabricius and Thymus organs are essential for adaptive immunity. If a bird lacks bursal lymphoid tissue but has a normal thymus, no circulating antibody will be detected after exposure to different antigens (Korver, 2012).

Thymus is located at the ventral region of neck and located under the thyroid gland, in front of the chest cavity. It is surrounded by a thin capsule composed of connective tissue. The compartments of the thymus gland contain reticular cells and lymphocytes. The thymus gland protects the body from infection by activating lymphocytes before and immediately after birth. From the maturation of T lymphocytes in poultry, autoreactive T is responsible for killing cells and thymic hormone synthesis (Sarıca et al., 2009).

Secondary Lymphoid Organs

Spleen, bone marrow, harderian gland (in the orbit), pineal gland (in the brain), mucosa associated lymphoid tissues (MALT), bronchial lymphoid tissues (BALT), intestinal lymphoid tissues (GALT), connective lymphoid tissues (CALT) are secondary lymphoid organs in birds. MALT, BALT, GALT, and CALT lymphoid tissues consist of approximately 50% of the cells in the spleen: These lymphoid tissues accumulate on the skin or mucosal surface, where foreign antigens enter the body (Gurjar, 2013).

Spleen is the largest one of the secondary lymphoid organs and is surrounded by a capsule composed of connective tissue. It has several functions against aging erythrocytes, erythrocytes production in fetal life and granulocytes in postnatal life, to contribute the formation of the antibodies through B lymphocytes, phagocytosis through macrophage and storing red blood cells (Júnior et al., 2018).

Otherside, spleen size increase through hyperplasia tissue, known as splenomegaly, after exposure to pathogens. Lymphocyte hyperplasia has also been observed in MALT. The germinal center is where avian antibodies are effectively produced (Lewis, 2019).

Additionally, chickens have three classes of immunoglobulins similar to mammals: IgA, IgM, and IgY (equivalent to IgG). Although it has been suggested that chickens also have antibodies similar to mammalian IgE and IgD, this has not been proven. Chicken IgY and mammalian IgG have immunological similarity, and the DNA sequence of chicken IgY is more similar to that of human IgE (Karachaliou et al., 2021).

Nutrition and Immunity

Nutrition plays a crucial role in boosting the immune system of the birds. Its function for immune system to fight against stress and reduces the negative impact of stress, which in turn improves the chicken's recovery from stressful periods, and to protect against pathogenic diseases. By reducing the negative effects of stress and preventing immune suppression, a balanced diet could boost the overall health of chickens. Nutritional factors have potential to affect the immune system of chickens in various ways, providing multiple benefits to their well-being and health status (Butcher and Miles, 2002). Due to the banning of antibiotic usage as growth parameters in animal production. Also, poultry industry have focused on improving feed efficiency, decreasing the risk of disease and increasing the performance (Sozcu and Ipek, 2017). Therefore, some of feed additives have been currently become a current issue in poultry nutrition as alternatives to antibiotics, due to their potential positive effects for growth rate, feed conversion and, resistance against pathogeic diseases (Fonseca et al., 2010; Ganan et al., 2012).

Probiotics

A healthy bacterial population in the avian gut is crucial for proper immunological function and better feed efficiency with probiotics. Probiotics include live beneficial microorganisms for host animal's health aand welfare, due to stimulating effects for intestinal microbial balance (Patterson and Burkholder, 2003; Moreno et al., 2006).

Bacterias have a mutually beneficial relationship with the intestinal cells and microorganisms in the gastrointestinal tract. Probiotics significantly contribute to changes in the intestinal structure and digestive processes, as well as to the stimulation of the immune system. They also inhibit the growth of pathogenic bacteria, leading to an improvement in overall performance (Awad et al., 2009; El-Shenway and Soltan, 2015).

Probiotics offer several benefits to the immune system, such as increased activity of macrophages, lymphocytes, and NK cells. They also increase the oxidative burst of heterophils, leading to an increased production of immunoglobulins (IgG, IgM, and IgA). Probiotics have the potential to stabilize the stomach and regulate the immune system, which could maintain an ideal balance between anti-inflammatory and pro-inflammatory cytokines. Additionally, probiotics may increase the population of lamina propria lymphocytes (LPL) and intestinal epithelial lymphocytes (IEL) in the small intestine while inhibiting the growth of harmful microorganisms (Yesilyurt et al., 2021).

Selenium

Selenium is essential for optimal immune response and is involved in both the innate and acquired immune systems. This essential trace element is a component of selenoproteins, which are involved in various physiological processes in animals. Although plants and fungi don't need selenium, they have ability to convert mineral forms of selenium present in the soil into various organic forms, such as selenomethionine and methyl selenocysteine, as a strategy of adaptation. Selenoproteins influence immunity through multiple mechanisms, and nutrition could modulate the immune system to help to struggle with pathogens. Selenium is involved in regulating oxidative stress, redox, and other cellular processes in all tissues and cell types, including those involved in immune responses. Also, selenium affects vitamin E in tissues to protect biological membranes from oxidative damage (Allmang et al., 2009).

Vitamins

Vitamins are essential for maintaining a healthy immune system in poultry. Insufficient vitamin levels may result in immune dysfunction, infection, or inflammation. Vitamins A, D, E, and C have the most significant impact on immune system function through various mechanisms. Vitamin A enhances mucosal immunity, reduces free radicals, and maintains epithelial cell integrity. Vitamin D has anti-inflammatory effects and reduces the level of pro-inflammatory cytokines. Vitamin E induces strong antioxidant and anti-inflammatory effects, increases the number and functionality of immune system cells, and stimulates antibody release. Vitamin C is beneficial for combating oxidative stress, infection, and inflammation, with antioxidant and anti-inflammatory mechanisms (Shojadoost et al., 2021).

Vitamin A is made up of several brightly colored and fat-soluble molecules, including retinol, retinal, retinoic acid (RA), and pro-vitamin A carotenoids. Carotenoids have various functions, such as immune regulation and stimulation, antioxidant, antimutagenic, and anticarcinogenic properties. Unlike plants and microorganisms, avian and mammalian species can not synthesize carotenoids, therefore, they need to obtain carotenoids from their diet. In chickens, vitamin A is initially supplied by the yolk during embryonic development. However, after hatching, they require dietary sources of vitamin A (Khan et al., 2023). Chicks hatched from eggs that lack carotenoids show impaired immune responses, which can be marked by increased signs of systemic inflammation after administration of lipopolysaccharide (LPS). This indicates that vitamin A has a critical role in the development of immune system function post-hatch. Compared to some other vitamins, the biological properties of vitamin A, including its effects on the immune system, are well-defined. These effects are mediated through interactions of RA with nuclear-hormone receptors in immune system cells (Shojadoost et al., 2021).

Vitamin D is a type of fat-soluble vitamin that could be obtained either through exposure to sunlight or by taking supplements. When consumed with the diet, it is absorbed by the small intestine and then taken up by the liver, where it is converted into 25-hydroxyvitamin D_3 (25(OH)D_3), which is the stored form of vitamin D in the body. The biologically active form of vitamin D is 1,25-dihydroxyvitamin D_3 (1,25(OH)2D3), which is produced in the kidneys with the help of 1a-hydroxylase. This form is responsible for the biological actions of vitamin D, including regulating bone and mineral metabolism and modulating immune responses.

Vitamin D also plays an important role in regulating immune responses (Jaime et al., 2020). *Vitamin E* is an antioxidant that gets dissolved in fat and exists in four different functional forms. Among these forms, a-tocopherol is the most biologically active and naturally abundant. This vitamin is well-known for its potential to counteract the negative effects of free radicals on cell integrity that can occur during normal cell metabolism and inflammation. In poultry production, it is crucial to supplement the diet with vitamin E to maintain fertility and hatchability in parent stocks, and to prevent nutritional encephalopathy and myopathies in chickens and turkeys. When oxidizable fats are included in the feed, vitamin E supplementation (or other antioxidants) becomes even more important. This is because it helps to prevent the release of metabolically harmful free radicals that could adversely affect poultry health. Supplementing chicken feed with vitamin E helps to prevent the oxidation of unsaturated fats. However, the amount of active vitamin E and unsaturated fat used in poultry nutrition may be effective on intestinal absorption mechanism, which may decrease the antioxidant status in poultry due to an increase in lipid peroxidation (Pompeua et al., 2018).

Vitamin C, also known as L-ascorbic acid (AA), is a water-soluble vitamin that would be synthesizes from glucose by the body (Sahin et al., 2003). Unlike fat-soluble vitamins, the body does not store vitamin C, and excess amounts are rapidly excreted by the kidneys, resulting in decreased absorption (Johnston et al., 2006).

Vitamin C is an antioxidant that protect cells from damage caused by free radicals generated by infection or toxins. Poultry can naturally produce vitamin C due to an enzyme called L-gulonolactone oxidase present in their renal tissue, which converts l-gulono-g-lactone into ascorbic acid. However, when chickens experience stressful conditions such as beak trimming, vaccination, transportation, thermal stress, or infection, their vitamin C requirements show an increment. Therefore, supplementing vitamin C may alleviate the negative effects of these stressful conditions (Hooper et al., 2001; Abidin and Khatoon, 2013).

Vitamin E is an essential nutrient that has crucial role in the immune response of poultry. It acts as an immune system booster by inhibiting the synthesis of prostaglandins that can cause inflammation and hinder the immune response. Vitamin E also prevents oxidation, which is responsible for the production of prostaglandins. A deficiency of vitamin E and selenium may impair the immune response in poultry, as indicated in the research conducted by Lewis et al. (2019).

Vitamin E is primarily known for its antioxidant properties, which help in reducing the damage caused by free radicals during normal metabolic stress and immune challenges. Vitamin E controls the production of free radicals, thereby affecting the signal transduction events mediated by them. Additionally, it also regulates gene expression caused by free radical signaling. This information was stated by Packer and Suzuki (1993).

Organic Acids

Organic acids are a type of feed additive that may promote good health and stimulate immunity in poultry. These acids are classified as organic chemical compounds that contain the carboxyl group, COOH, in their structure. Typically, formic, acetic, propionic, malic, fumaric, and citric acids are used in poultry nutrition (Hajati, 2018; Khan et al., 2022).

It has been found that organic acids have a beneficial effect on feed hygiene as preservatives. Additionally, organic acids may inhibit the growth of harmful microorganisms by reducing the pH level of the environment. By penetrating the biological membranes of microorganisms and disrupting their cell function through electrolytic dissociation, organic acids may also restrict bacterial growth (Feye et al., 2021; Pope et al., 2022).

Studies have shown that formic acid may have beneficial effects on broiler chickens, improving production indicators such as body weight gain, feed intake, and feed conversion ratio. It may also promote the growth of intestinal villi and improve immune function by increasing the number of lymphocytes in the spleen and antibody titers against disease (Tawfeeq and Al-Mashhdani, 2020).

CONCLUSIONS

As a result, a strong immunity and feed practices are closely dependent upon each other, especially under commercial conditions with a huge variable factors, inluding heat stress, feed deficiencies, heat stress, and another negative factors during production period. Therefore, strategic using of different feed additives is a critical issue to stimulate the immunity of birds. There are many additives that have potential effects for immune system, for example, probiotics, vitamins, minerals, organic acids. Understanding of the action pattern of each feed additive is necessary to optimum and corrects usage and provide a strong immunity.

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EFFECT OF VARIETY ON THE POTENTIAL NUTRITIVE VALUE OF OAT HAYS

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Abstract

This study was conducted in Kahramanmaras province to determine the chemical composition, in vitro gas production, metabolizable energy (ME), and in vitro organic matter digestion (IVOMD) of oat varieties including Kucukyayla, Kahraman, Kırklar, ST-4, Yeniceri, Sebat, and Arslanbey, harvested during the flowering period in the 2019–2020 season. The in vitro findings of this study revealed significant differences among oat hay varieties in terms of their chemical composition, in vitro gas production, methane production, ME, and IVOMD (P<0.001). The crude protein (CP) content of oat hays ranged from 7.61% to 9.57%, neutral detergent fiber (NDF) ranged from 64.46% to 72.96%, acid detergent fiber (ADF) ranged from 36.74% to 41.70%, crude ash (CA) ranged from 6.56% to 7.91%, metabolizable energy ranged from 6.96 to 7.98 MJ kg-1 DM, IVOMD ranged from 67.30% to 74.90%, and methane production rate ranged from 15.42% to 16.35%. The Yeniceri variety stood out with a NDF content of 64.46%, an ADF content of 36.74%, a ME of 7.98 MJ kg^{-1} DM, and an IVOMD of 74.90%. ST-4 had the highest in vitro gas production with 49.46 ml, while Sebat had the highest methane production rate with 15.42%. In conclusion, considering the chemical composition and fermentation parameters, the Yeniceri variety can be considered a potential source of forage, but further in vivo studies are needed to assess their effects on feed intake.

Keywords: *oat hay varieties, in vitro, methane production, metabolic energy*

INTRODUCTION

Oats are preferred as a feed ingredient in animal nutrition due to their high nutritional value, antioxidant content, and facilitative effect on digestion (Naneli & Sakin, 2017). Oat grain is known as a functional food due to its distinct chemical composition, nutritional value, and beneficial effects on health compared to other cereals (Sterna et al., 2016). Consequently, significant efforts have been made in recent years in agronomic research, leading to the emergence of a substantial number of new oat varieties with different agronomic characteristics (Buerstmayr et al., 2007; Martínez et al., 2010).

The nutrient content of forages included in the rations of ruminant animals and their microbial digestion in the rumen, as well as the extent to which they are converted into metabolic energy, are of vital importance for ruminants (Ørskov & McDonald, 1979). Ruminants, due to their digestive system, undergo ruminal fermentation of the consumed feed, resulting in the production of methane (CH_4), which is released into the environment. This emission leads to an energy loss of approximately 12-16% from the feed (IPCC, 2001; Johnson & Johnson, 1995). Therefore, low methane-producing feeds should be preferred in ruminant rations (López et al., 2010). Additionally,

factors such as the timing of forage harvesting, maturity stage, and processing methods applied to these feeds, such as grinding, drying, wilting, etc., greatly affect their potential nutritional values and fermentation parameters (Doane et al., 1997; Filya et al., 2002; Sanderson et al., 1997).

The aim of the current experiment was to evaluate effect of variety on chemical composition; in vitro gas production, methane production, ME and IVOMD.

MATERIALS AND METHODS

The trial was conducted at the experimental field of the Faculty of Agriculture, Kahramanmaras Sutcu Imam University, during the 2019–2020 season. Seven oat genotypes (Kucukyayla, Kahraman, Kırklar, ST-4, Yeniceri, Sebat, and Arslanbey) were used in the study. The experiment was set up in a randomized complete block design with three replications. The plot size was 7 m long and 6 rows wide, with a spacing of 20 m between rows. The seeding rate was maintained at 500 seeds/m2. Fertilization was applied at a rate of 12 kg/ha of pure nitrogen, half of which was applied as diammonium phosphate (DAP) fertilizer as top dressing, while the other half was applied as urea during the tillering stage. The oat varieties were harvested during the flowering period, and the

remaining oat hay was brought to the laboratory for further analysis.

Dry matter, crude ash, crude protein and ether extract of oat hay samples were analyzed using the method of AOAC (1990). NDF and ADF contents of oat hay samples were analyzed with the method sug-gested by Van Soest (1991). All chemical analyses were carried out in triplicate.

The in vitro gas production technique was utilized to determine the gas production and methane production of oat hay. Rumen fluid was obtained from three fistulated sheep from a private abattoir in Kahramanmaras province and transferred to the laboratory in a thermos. The rumen fluid was then filtered through four layers of cheesecloth while being agitated with CO2. Approximately 200 mg of oat hay samples were weighed into 100 ml glass syringes in triplicate. Subsequently, 30 ml of buffered rumen fluid (1:2 V/V) was added to the glass syringes containing oat hay samples and transferred to a water bath set at 39°C for 24 hours of incubation. To obtain blanks, the same amount of buffered rumen fluid without substrate was added to four glass syringes (Menke et al. 1979). Gas and CH4 production of the oat hay samples were measured after 24 hours of incubation. After the 24-hour incubation, the total gas production and the percentage of CH_4 in oat hay samples were determined using an infrared methane analyzer (Sensor Europe GmbH, Erkrath, Germany) (Goel et al., 2008).

The methane productions of oat hay samples as ml were calculated as follows:

CH_4 production (ml) = Total gas production (ml) X Percentage of CH_4 (%)   (1)

The ME and IVOMD of oat hay samples were estimated with equations suggested by Menke and Steingass (1988).

ME (MJ/kg DM) = 1.06 + 0.1570GP + 0.084CP + 0.220EE-0.081CA   (2)

IVOMD (%) = 28.49 + 0.7967GP + 0.325CP   (3)

GP: Gas production of 200 mg sample at 24 h incubation (ml)

CP: Crude protein (%)

EE: Ether extract (%)

CA: Crude ash (%)

Statistical Analyses

One-way analysis of variance (ANOVA) was used to determine the effect of variety on chemical composition, in vitro gas production, methane production, ME and OMD of oat hay samples. Differences (P<0.05) among the mean of oat hay varieties were determined with Tukey's multiple range tests.

RESULTS

The effect of variety on the chemical composition of oat hay is presented in Table 1. Variety had a significant impact on the chemical composition of oat hay (P < 0.05). The dry matter content of oat hay varieties ranged from 23.25% to 26.26%. The crude ash content of oat varieties ranged from 6.56% to 7.91%, with the highest values observed in ST-4, Kucukyayla, and Kahraman, while Kırklar had the lowest value. The crude protein content of oat hay varieties ranged from 7.61% to 9.57%, with the highest values found in Kucukyayla and the lowest in Kırklar. Previous studies have reported crude protein contents of oat hay ranging from 4.2% to 9.2% (Sehu, 1996; Gursoy, 2023). The NDF (neutral detergent fiber) and ADF (acid detergent fiber) contents of oat varieties ranged from 64.46% to 72.96% and 36.74% to 41.70%, respectively.

Table 1. Effect of variety on chemical composition of oat hays

Variety	DM	CA	CP	EE	NDF	ADF
Kucukyayla	24.89[ab]	6.56	9.57[c]	3.06[a]	66.76[ab]	37.33[ab]
Kahraman	25.87[ab]	6.56	8.64[abc]	3.14[a]	69.37[bc]	40.20[bc]
Kırklar	24.97[ab]	7.33	7.61[a]	3.53[ab]	72.96[d]	41.70[c]
ST-4	25.08[ab]	7.91	8.02[ab]	3.46[ab]	68.70[bc]	39.13[abc]
Yeniceri	23.25[a]	6.86	8.82[bc]	4.90[bc]	64.46[a]	36.74[a]
Sebat	23.76[ab]	7.72	8.73[bc]	5.73[c]	70.41[cd]	38.06[ab]
Arslanbey	26.46[b]	7.56	9.52[c]	3.08[a]	66.85[ab]	37.09[a]
SEM	0.88	1.34	0.30	0.42	0.98	0.87
P	.036	.901	.000	.000	.000	.000

abcd Column means with common superscripts do not differ (P>0.05. SEM: standard error mean. DM – Dry matter (%), CA- Crude Ash (% of DM), CP – Crude protein (% of DM), EE – Ether extract ((% of DM), ADF – Acid detergent fiber (% of DM), NDF – Neutral detergent fiber (% of DM).

The effect of variety on gas production, methane production, metabolizable energy (ME), and in vitro organic matter digestibility (IVOMD) of oat hay is shown in Table 2. Variety had a significant impact on methane production, ME, and IVOMD of oat hay. Gas production and methane

production ranged from 50.17 to 58.73 ml and 7.98 to 9.37 ml, respectively. The percentage of CH_4 in oat hay ranged from 15.42% to 16.35%. ME and IVOMD of oat hay from different varieties ranged from 6.96 to 8.42 MJ (kg/DM) and 67.30% to 74.87%, respectively, with the highest values observed in Yeniceri and the lowest in ST-4.

Table 2. Effect of variety on gas, methane, metabolic energy and in vitro organic matter digestibility of oat hay

Variety	GP (ml)	CH_4 (ml)	CH_4 (%)	ME	IVOMD
Kucukyayla	58.40[c]	9.09[bc]	15.55	7.97[bc]	74.87[c]
Kahraman	52.93[ab]	8.65[abc]	16.35	7.31[ab]	69.66[ab]
Kırklar	56.90[bc]	9.10[bc]	15.99	7.78[bc]	72.96[bc]
ST-4	49.46[a]	7.99[a]	16.15	6.96[a]	67.30[a]
Yeniceri	58.73[c]	9.37[c]	15.95	8.42[c]	74.90[c]
Sebat	53.13[ab]	8.20[ab]	15.42	7.98[c]	70.70[abc]
Arslanbey	50.17[a]	7.98[a]	15.55	7.04[a]	68.55[ab]
SEM	0.88	1.34	0.30	0.42	0.98
P	.000	.002	.304	.000	.000

[abc] Column means with common superscripts do not differ (P>0.05. SEM: standard error mean. GP: Gas production (ml), CH4 – Methane emission (ml), CH4 – Methane emission (%), ME – Metabolisable energy (MJ / kg DM), IVOMD – In vitro organic matter digestibility (%).

DISCUSSION

Gas production in feeds occurs as a result of the reaction between fermentable carbohydrates and buffer solutions, leading to the production of volatile fatty acids (Wolin, 1960). It has been reported that an increase in ruminal gas production may be associated with an increase in fermentable carbohydrate content (Sampath, 1995). The in vitro gas production values in the study indicate that the Yeniceri and Kucukyayla varieties fermented well compared to other varieties. In a study conducted by Lopez et al. (2010), feed ingredients were classified based on their anti-methanogenic properties. Feed ingredients with percentages ranging from 11% to 14% were classified as low, 6% to 11% as moderate, and 0% to 6% as high anti-methanogenic character. The findings of the current study revealed that oat hay varieties did not exhibit any anti-methanogenic effect according to the classification by Lopez et al. (2010).

It has been reported that if the crude protein (CP) content of feed ingredients is below 8%, the enzymatic activities of microorganisms in the rumen may be limited, resulting in an inadequate supply of ammonia in the rumen (Norton, 2003; Cappellozza et al., 2013). With the exception of the Kırklar variety, the CP levels of oat hay varieties in the study can be considered sufficient for the proper functioning of microbial activity in the rumen. The difference in CP contents of oat varieties between the two experiments is possibly associated with differences in climatic conditions, fertilization, and soil type of the growing site (Sehu, 1996; Gursoy, 2023).

In rations, it is desired to have low acid detergent fiber (ADF) levels as it is difficult to digest in the rumen (Van Soest, 2018). An increase in ADF levels in the ration has been reported to result in a feeling of fullness in ruminants, leading to a decrease in feed intake and consequently a decrease in the utilization of energy and protein from the feed (Yavuz, 2005). Therefore, it is recommended to have ADF levels in ruminant rations between 21% and 30% (Balthrop, 2011). The ADF contents of oat hay varieties in the study were found to be higher than the desired optimal level.

The metabolizable energy (ME) values of oat hays obtained in the current experiment are consistent with the values indicated by NRC (2007). Furthermore, an increase in the cell wall content in feeds has been reported to result in a decrease in ME and organic matter digestibility (OMD) values (Sagocak, 2011).

CONCLUSIONS

Variety had a significant effect on chemical compositions, gas production, CH_4 production, ME and IVOMD of hay. There is considerable amount of variation among oat varieties in terms of chemical compositions, gas production, CH_4 production, ME and IVOMD of oat hay. The oat hays from different varieties had provided new raw materials with a range of nutritional characteristics and will provide not only energy and protein but also fiber for ruminant animals. Based on the chemical composition and fermentation parameters, variety Yeniceri can be recommended for hay production since it has a high CP, ME and IVOMD. However, in vivo studies

are needed to determine the effects of oat hay varieties on feed intake and growth performance on ruminant animals.

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THE EFFECT OF DIETS WITH HIGH PROTEIN LEVEL AND QUALITY ON SCORPION SERUM PRODUCTION PERFORMANCE IN SERUM HORSES

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Abstract

In the study, serum horses were used as animal material in order to determine the effect of feeding high and quality protein-containing dietary the horses from which scorpion serum is produced on antibody formation. Horses divided to two groups contain 6 horses and each groups contain 3 horses (2 female and 1 male). Groups are classified two groups. Two feeding period was realized in these groups. One of is control group that horse's diet contain respectively %13,65 crude protein, the other one is trial group that horse's diet contain respectively %18,05 crude protein. Control and experimental group repeated twice by changing. Horse's daily feeding periyod is 4 kg of concentrated feeding, 3 kg of alfalfa hay and 2 kg of barley straw. All horses received water ad libitum. This study investigated the antibody titer, biochemical and hematological blood parameters that high-quality dietary fed in horse.

There was no statistically significant differences were shown in terms of trial and control groups. Also, no statistical difference was found when the groups were analyzed by separating them as male and female. A statistically significant differences were observed in terms of different genders(P=0.004). But antibody titers increase of %40,2   in trial groups, %4,8 in female horse and %42,6 in male horse. This study was assess the biochemical and hematological parameters in trial and control groups. Serum total protein values, albumine and globulin levels observed change. But there was no statistically significant differences(P≥0.05).As a result of the study, it has observed that there are individual antibody consist of great variation, while a istatiscally significant has not important. But it could be said that the amount and quality of proteins greatly increases the production of antibodies in quantitative.

Keywords: Antibody Titer, High And Quality Protein, Horse, Methionine, Lysine.

USE OF ARTIFICIAL INTELLIGENCE IN THE CLASSIFICATION OF APIS MELLIFERA BASED ON THEIR WING VENATION AND MORPHOLOGICAL FORM, A REVIEW PAPER

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Abstract

The classification of bees based on wing venation and morphology is an essential research topic in bee science and conservation. Classification of honey bees using wing geometric morphometrics requires the manual annotation of 19 landmarks located at vein intersections on honey bee forewings. These landmarks are utilized to capture the shape variation of the forewing and to classify honey bee subspecies based on the geometric morphometrics of their wings. DeepWings uses machine learning to determine the coordinates of these landmarks automatically, eradicating the need for manual annotation and significantly accelerating the classification process. The use of machine learning and automation to classify honey bees has significant implications for bee research and conservation efforts, as it can contribute to the understanding and preservation of bees and their ecosystems. In addition, the development of DeepWings can pave the way for similar methodologies to be developed in other areas of biological research and conservation. The identification of honey bee species through wing venation and geometric morphometric analysis can also provide insights into the variations of wing venation among honey bee species, which can aid in the comprehension of their evolution and adaptation. Overall, the classification of bees based on wing venation and morphology is a promising area of study that can contribute to the preservation of bees and their ecosystems.

Keywords: Artificial intelligence, Machine learning, Classification, Apis mellifera, Wing venation, Morphological form, Image analysis, Computer vision, Feature extraction, Neural networks, Deep learning, DeepWings.

MODELING OF EGG CURVES IN LAYER HENS

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Abstract

In this study, the modeling of egg curves (Lohmann LSL Classic) with five different mathematical equations is examined. For this purpose, eggs from the Lohmann LSL Classic white hybrid drive (n = 31831) were used. In the study, weekly egg yields were used from the 22nd week to the 62nd week. Modeling; Gompertz, Gamma, Richard, Logistic and Cubic-piece regression models are taken into account. As a result, and error squares averages were taken into account, the best model Cubic-piece regression and the worst model was determined as the Gompertz model.

Keywords: *Modeling, Curves, Chickens*

INTRODUCTION

For many years mathematical models have been used in a wide variety of disciplines to expose causal relationships to show and interpret data obtained by observation or measurement. Many models used in animal science are being created. The aim of these models is mathematical models formulated from the point of view and they are usually very gradual. Models that explain economic prosperity in animals, eg. Growth, milk or egg production has been shaped in many forms. the most commonly used models are empirical models and mechanical models. The most widely accepted forms of empirical functions are linear and nonlinear models. Empirical models can be converted to more mechanistic structures (Alvarez et al., 2007). Numerous studies have been conducted to investigate carcass yields and carcass quality as well as egg production from poultry. After hatching, rapid growth is followed by a linear period of increase following an asymptotic route, resulting in a sigmoidal growth pattern for poultry (Ricklefs, 1968). Almost all of the models have been used to describe the growth of the poultry models with three or four biologically meaningful parameters (Akbas et al., 19980). Gompertz, Gamma, Richard, Logistic and Cubic-piece regression models were used in the study (Brown et al., 1976; Yavuz et al., 2019). In the published literature, egg production modeling is scarce compared to studies that model growth in broilers, probably because it takes longer to follow egg production. Models with biologically interpretable parameters are not as well-established as for growth models. Indeed, it is difficult to assess egg production with asymptotic functions. Egg production begins at the age of sexual maturity, quickly reaches the peak production level, following a linear trend after a while, and then decreases to zero, and hence more closely resembles milk production, and indeed some functions used in modelling egg production could also be used in the lactation curves of dairy cows (Gavora et al., 1982). Non-linear regression and multi-stage modelling methods can be used in modelling egg production (Ipek et al., 2007; Tolun et al., 2023).

This review aims to introduce and compile the functions used for modelling egg production, and to underline the differences among these functions utilising the data obtained from commercial layer breeder flocks. Egg yield is defined as the number of eggs from a poultry house (hen-housed) or the total number of eggs produced by live animals (hen-day) during a specific time period (daily, weekly, monthly, annually) or as the ratio of the total eggs produced by the number of animals. Egg production of an animal during the production period can be accumulated, however, this is not the method of choice for breeding or rearing purposes. Non-linear regression models for time-dependent egg changes Yield, for example, Gamma, usually three to seven estimated parameters. A total of five mathematical models have been examined. In this study, modeling of egg curves (Lohmann LSL Classic) with five different mathematical equations is used. For this purpose, Lohmann LSL Classic white hybrid drive eggs were released and weekly egg yields were taken from week 22 to week 62. Modelling; Gompertz, Gamma, Richard, Logistics and Cubic Tracks.

MATERIALS AND METHODS

The study used eggs from randomly mated Lohman LSL Classic hybrid drive chicks, without selection between the ages of 17-20 weeks old. Lohman LSL Classic hybrid drive chickens were taken as 16 weeks old. The duration of

illumination of the chickens was 16 hours in total. During the feeding period of the chickens, 17 weeks% 5% egg pre-meal until the yield of eggs 2750-2800 ME Kkal / Kg% 17.50 Calculated as raw. Chickens were grown in closed system poultry, 4 rows of 5 storey cage. Lohman LSL A total of 31831 eggs from classical breeding chickens were used in mathematical models.

Demonstration of mathematical models,

Gamma $Y_t = at^b e^{-ct}$

Gompertz $R = ab^{c^t}$

Logistic $Y = \frac{a}{(1+2.7182^{(b-cx)})}$

Richard $Y = ax(1 - e^{c-bx})^c$

Cubic- piece regression $Y = a + bx + cx^2 + dx^3 + (x - x_1)x^3 + (x - x_2)x^3$

Cubic- piece regression $Y = a + bx + cx^2 + dx^3 + (x - x_1)x^3 + (x - x_2)x^3$

RESULTS and DISCUSSION

This Mielenz and Muller (1991) fitted linear, exponential, Adams-Bell, and McMillan models for 450-d egg yield of laying hens and reported that all models fit equally well to the data. They indicated that any change in time interval led to changes of model performances. Miyoshi et al. (1996) fitted the Compartmental, Modified Compartmental, Gamma and Adams-Bell functions to annual egg production data (accumulated at 10-days intervals) for two lines of White Leghorn in which a longterm divergent selection for yolk content of albumen was applied. It was reported that the four models used in the study performed well in modelling the egg yields in terms of the goodness of fit criteria indicating that the models are adequate in modelling the egg production of the flock.

Narinc et al. (2013) investigated long-term egg production (using an average of 52 weeks as of the age of sexual maturity) in a random bred Japanese quail flock. Different non-linear models (Gamma, McNally, Adams-Bell, and Modified Compartmental) for hen-day egg data were compared using goodness of fit criteria.

Cason and Ware (1990) investigated the best fitting model among three modified (increasing and decreasing terms modified) growth curves (Nelder, Richards, Von Bertalanffy), and two egg-production models (Adams-Bell and Logistic) using the data collected up to 20 or 24 weeks of lay in 12 first-cycle flocks, selected for having ideal production curves. They reported that all models gave very good fit with R^2 values of 0.99. However, when the models were used for extrapolation, the Nelder increasing and the linear decreasing term performed best. The Adams-Bell model or a simple linear regression exhibited better fitting performances from peak production to 20 or 24 weeks of production. Cason (1990) compared the

Adams-Bell and Logistic-curvilinear models for weekly hen-day egg production data up to 24 weeks in 45 ielenz and Muller (1991) fitted linear, exponential, Adams-Bell, and McMillan models for 450-d egg yield of laying hens and reported that all models first-cycle flocks. It was concluded that the Adams-Bell model was preferable, as its linear decreasing term provides better fits than the Logistic decreasing term for modelling the entire egg production curve of the flock.

Modeling; Gompertz, Gamma, Richard, Logistic and Cubic-piece regression models are taken into account. As a result, and error squares averages were taken into account, the best model Cubic-piece regression and the worst model was determined as the Gompertz model .

Table 1. Model coefficient of determination and error squares average

Models	R^2	ESA
Gamma	0.867	377012
Gompertz	0.921	395255
CubicSpline	0.967	354213
Logistics	0.933	355836
Richard	0.922	391366

Figure 1. Model curves and graphs
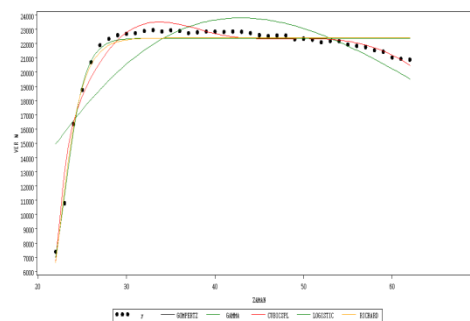
CONCLUSIONS

Studies on egg production modelling have been carried out for many years. In this review, a great amount of the models are examined, and the studies in this field are summarised. Almost all of these functions have been developed to allow modelling based on flock averages. Most of the models have a mechanistic structure and there are few parameters that have biological meaning. In poultry, the number of studies on modelling growth is relatively higher than those for egg production. Studies for growth curves can be grouped under headings; 'determination of best-fit growth model', 'comparison of various experimental growth of poultry species or groups' and 'estimates of genetic parameter for growth

curve parameters'. However, almost all of the studies which modelled egg production used the 'determination of best-fit model' - only three studies were conducted in the other two subjects. The main reason for this situation is thought to be that the developed models have a more empirical structure, and so the comprehensibility of the models are low. To better understand the biology of egg production, and for genetic selection programs, it is necessary to study the egg production of individual hens. More biologically meaningful parameters need to be used in the individual models to be developed for this purpose.

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SPERM CHARACTERISTICS VARIATION OF LOCAL ALGERIAN RABBIT'S POPULATION UNDER DIFFERENT TEMPERATURES

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Abstract

The main study aims to evaluate the temperature effect on quantity and quality of rabbit semen raised in semi-arid environment of Tiaret region. The study was conducted at the experimental farm of Ibn Khaldoun university of Tiaret. A total of 20 rabbit bucks of the local Algerian population (5-11 months of age) weighting between 3010g and 4540g were collected under an extensive rhythm. The average value of libido was 24,99±20,96 seconds (sec.). The ejaculate volume was 1,17±0,43 ml and the mean of pH was 7,45±0,39 and significantly affected (p<0,05). The analyses of semen show no significant for mass and individual motility (6,91±1,56 and 2,99±1 respectively). The rate of vitality was affected and equal to 61,78±17,03. However, the evolution of temperature has significantly affected the concentration and abnormal spermatozoa (p<0,05). In this study, most of semen parameters were influenced by temperature variation and better semen can be obtained under moderate temperatures.

Keywords: Fertility, Rabbit, Semi-Arid, Spermogram, Temperature.

SUSTAINABLE HUNTING AND WILDLIFE SAMPLE OF KEKLIKOLUK STATE HUNTING

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Abstract

Keklikoluk State hunting ground is located in the Mediterranean Region of Turkiye, within the borders of Afsin District of Kahramanmaras province. It covers an area of 54.600 hectares, which is approximately 160 km from the city center. Hunting ground and its surroundings; It was registered in 2009 by the Republic of Turkiye, Ministry of Agriculture and Forestry, due to the shelter of Turkiye's wildlife resources and to bring these resources to the national economy. Hunting contributes to rural development with hunting and wildlife activities of the province and district in which it is located. Although it contains many game animals; It has been registered for Wild Boar, Fox, Red -Partridge, Hare, Marten, Wood Marten, Rock Pigeon, Quail and Dovetail species. The animals found in the hunting grounds are among the natural species found in the region and Turkiye. Small streams in the hunting grounds meet the water needs of plants and animals in the area. The main purpose of the hunting grounds; It ensures the protection and reproduction of the natural population in the area where it is located. For this reason, it is one of the projects that have recently been given importance by the Ministry of Agriculture and Forestry, which is the relevant ministry. It is important to determine the survival and reproduction rates of wild animals that are allowed to be hunted in the hunting grounds with controlled hunting. With this study, it is aimed to introduce Keklikoluk State Hunting, which is one of the state hunting grounds that are important for hunting and wildlife. In addition, the hunting activities in the hunting grounds between the years 2019-2022 will also be compared.

Keywords: *Poultry, Red partridge (Alectoris chukar), Rabbit, Hunting*

INTRODUCTION

Hunting is a physical activity that has existed since the existence of animals. While it fulfills the basic needs of people, it becomes an expensive activity over time. In addition to the taste of the meat of the hunting material, the trophies also play an important role. (Erdem, 1991 ve Ozkan et all., 2021).

Turkiye's hunting industry has made significant developments. The Ministry of Agriculture and Forestry of the Republic of Turkiye pays special attention to its conservation and production. Production bases have been established in many regions of the country. (Ozkan et all., 2020; Ozkan ve Basdogan, 2020; Ozkan, 2020).

On the basis of nature protection, the continued existence of animal species is guaranteed. The motto of the responsible department is to achieve sustainable hunting without harming the subsistence population in the ecosystem. (Ozaydın, 1991., Ogurlu, 2008). Various legal protections and regulations have been promulgated under Land Hunting Law No. 4915 to protect and develop sustainable hunting and wildlife sources in Turkiye. The source of the disturbances caused by this law is the establishment of hunting areas and ensuring that hunting operations are carried out within the framework of specific hunting plans. (Official Newspaper, 2003).

Keklikoluk National Game Ground has also been approved by the General Directorate of Nature Conservation and National Parks dated 04/13/2005 and B.18.0. It was spun off and established from the Kahramanmaras Conservation and National Parks Division on 29 May 2008 under grant number DKMPG.0.03.00/250.03-44/2484. Tourist hunters at home and abroad organize hunting organizations in this demonstration hunting area through authorized agencies to hunt (Anonymous., 2008 and 2022).

MATERIALS AND METHODS

The Keklikoluk National Game Area is located within the administrative borders of Kahramanmaras Province and Goksun and Afsin districts. It is approximately 130 km from the center of Kahramanmaras. The hunting area is 54600 hectares (Figure 1). The Keklikoluk National Game Area is rich in plant diversity. Many streams find water every month of the year. Fields have leafy plants, meadow grasses in streams and valleys, bulbous plants, mice, insects and molluscs. Oak (Quercus sp.) and juniper (*Juniperus sp.*), blackthorn (*Paliurus aculeatus*), alder oak (*Quercus aucheri*), rouge oak (*Quercus coccifera*) and thorn tree (*Rubus caesius*) are the most common trees in the genus.
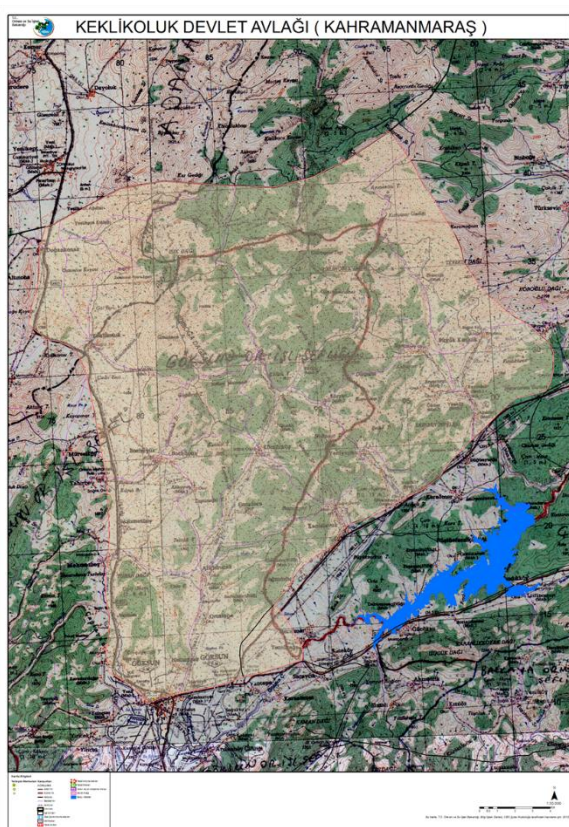
Figure 1. Keklikoluk hunting ground map. (Anonymous,2022).

RESULTS AND DISCUSSION

State hunting at Keklikoluk; the result of consultations with villagers surrounding the hunting area; wild populations such as wild goats, wild boars, partridges and rabbits have been granted Avalak status as they are in fairly good condition. (Anonymous, 2022). The hunting ground has 280 wild boars, 30 foxes, 1680 partridges, 1575 hares, 1250 pigeons, 6000 quails and adult animals per year; it can also be hunted outside of companion breeding and breeding. (Anonymous, 2022). Hunting contributes to the promotion, economy and hunting potential of Kahramanmaras both at home and abroad. It also enables hunters to hunt outside of the hunting season. Hunting potential has increased across the province. It also offers the opportunity to see and hunt plenty of wildlife. With the announcement of the hunting grounds, there has been a phenomenon of safari tourism in the area due to the hunting tourists who come for safari tourism (Ozkan, 2020., Ozkan et all.,2021).

CONCLUSIONS

The hunting ground must first be handed over to the hunting ground operator, who will monitor and control the grounds and carry out any necessary restoration and improvement work on the grounds. Wildlife hunting areas should be established exclusively for foreign hunters. It presents an opportunity to expand the no-hunting zone in Kahramanmaras province. Going beyond; going beyond; promoting through social, visual, written and audio media will help Turkiye's international and domestic safari tourism and reveal the importance it places on wildlife.

ACKNOWLEDGEMENTS

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CARCASS AND ORGAN EVALUATION OF BROILER CHICKENS ADMINISTERED ETHANOLIC EXTRACTS OF ALTERNANTHERA BRASILIANA AND HOSLUNDIA OPPOSITE

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Abstract

This study was conducted for eight (8) weeks to evaluate the carcass and organ of broiler chickens administered ethanolic extracts of Alternanthera brasiliana and Hoslundia opposita. The experimental design was a factorial arrangement (3x3x3) in a Completely Randomised Design (CRD) involving ninety (90) day-old Arbor Acre broiler chicks. The chickens were allotted to three (3) treatment groups of three (3) replicates with each replicate comprising (10) birds. The treatment groups were: Control (no extract administered), HOP (ethanolic extract of H. opposita administered) and ABR (ethanolic extract of A. brasiliana administered). Ethanolic extracts of H. opposita and A. brasiliana at concentrations of 50, 100 and 200mg/mL were administered to respective replicates. Phytochemical screening of Alternanthera brasiliana and Hoslundia opposita revealed the presence of tannins, saponins, phenols, steroids, terpenoids, flavonoids and cardiac glycosides. The data obtained after termination were analyzed and results revealed that the chest (highest in ABR 200mg/mL 774.53g but lowest in Control 558.37g), back (highest in ABR 200mg/mL 407.97g but lowest in HOP 50mg/mL 325.57g) and right drumstick (highest in ABR 200mg/mL 144.37g but lowest in HOP 50mg/mL 115.73g) were the carcass parameters with significant ($p<0.05$) differences while the heart (highest in ABR 100mg/mL 12.68g but lowest in Control 9.65g) and spleen (highest in HOP 50mg/mL 3.14g but lowest in HOP 200mg/mL 1.41g) were the only organ parameter that had significant ($p<0.05$) differences. It was concluded that ethanolic extracts of Alternanthera brasiliana and Hoslundia opposita are veritable sources of alternative to synthetic antibiotic growth promoters in broiler chicken production as there was no deleterious effect on their growth performance, carcass and organ characteristics. It was recommended that the medicinal plants could be further explored for more benefits in the rearing of poultry and other animals.

Keywords: A. brasiliana, H. opposita, Carcass, Organ, Broiler Chicken

UDDER CHARACTERISTICS OF LACTATING WEST AFRICAN DWARF DOES FED WHEAT OFFAL SUBSTITUTED WITH TIGER NUT DIET

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Abstract

This study is aimed to investigate the effect of substituting wheat offal with tiger nut on udder characteristics and milk quality of lactating West African Dwarf Does. Twenty lactating does were randomly assigned to 5 dietary treatments: control diet (T1), 5% tiger nut (T2), 10% tiger nut (T3), 15% tiger nut (T4), 20% tiger nut (T5), supplemented with guinea grass (panicum maximum). The experimental animals were fed concentrate (experimental diet) in the morning and guinea grass in the afternoon. This study lasted for 12 weeks, during which udder characteristics and milk quality parameters were measured. Result shows that there were no significant differences ($p > 0.05$) across the experimental diets in udder length (UL) and teat length (TL), but other parameters such as; distance between teat (DBT), udder circumference (UC), udder width (UW), udder volume (UV) and teat circumference (TC) all experienced significant differences ($p < 0.05$). However, milk from T5 dietary treatment had significantly ($p < 0.05$) higher crude protein (4.12%), crude fat (3.72%), crude ash (0.77%), total solid (14.95%), and gross energy (3.50 mj/kg) content compared to other dietary treatments. This study suggests that substituting tiger nut at 20% with wheat offal at 0% (T5) in the diet of lactating West African Dwarf Does could improve better udder development which will result in better milk yield, and milk quality, which can solve the problem faced in WAD does milk production in Nigeria and contribute to the Nigeria economy.

Keywords: Lactating West African Dwarf Does, Panicum Maximum, Tiger Nut, Udder Characteristics

EFFECTS OF DIFFERENT COLORED SIDEWALL POLYMER ON PERFORMANCE AND THERMAL CONDITIONS OF BROILER STARTER CHICKS

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Abstract

Broiler chicken production is an important component of the poultry industry, and the design and management of broiler chicken housing can significantly impact bird performance and health. This study aimed to investigate the effects of different coloured sidewall polymers on the growth rate, feed conversion efficiency, and thermal conditions of broiler starter chicks. In this study, four (4) brooding polymer colours were used namely; white, blue, black and green. Two hundred and fifty (250) day-old-chicks were acquired from a reputable hatchery, only two hundred and forty was (240) used for this experiment. For each of the polymer colour treatments which were further divided into six (6) replicates, that is ten (10) chicks per replicate in a Completely Randomized Design (CRD). The birds were fed ad-libitum and regularly supplied clean water for a duration of six weeks. The result of the study showed that the birds raised under the green-coloured sidewall polymer had the highest weight gain (683.83g) while the last weight gain (680.33g) observed in birds that were housed in the black-coloured sidewall polymer. For the cloaca temperature, it was observed that the broiler starter which were reared under the white-coloured sidewall polymer (40.48ºC) had the highest value while those that were housed under the black-coloured polymer had the least value (39.25ºC) for the first week. (40.11ºC) was the highest value in the second week for the animal that raised under black and (39.84ºC) for the green which were the least. During the third week, birds on white colour polymer had the highest (40.47ºC) while birds on green colour polymer had the lowest (39.66ºC). The highest environmental temperature (33.90 ºC) was recorded for the birds on black colour polymer while the least was (33.89 ºC) for green coloured polymer. The result futher showed a decrease in the environmental temperature as the weeks goes by. It can be concluded that green coloured polymer help maintain lower temperature in the chicken house, potentially reducing heat stress and improving bird performance.

Keywords: Ad-libitum, Weight Gain, Environmental Temperature, Cloaca Temperature, Coloured Polymer.

EVALUATION OF HETEROSIS ON CHICKS' HATCH-WEIGHT IN CROSSING POTCHEFSTROOM KOEKOEK AND VENDA CHICKEN BREEDS

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Abstract

This study was conducted to estimate heterosis effects existing within chicks' hatch-weight. A crossbreeding system involved two indigenous chicken breeds namely Potchefstroom Koekoek (P) and Venda (V) were used to produce two purebreds (P x P, V x V), one crossbred (P x V) and one reciprocal (V x P). The body masses of 100 chicks recorded at hatching, were used to make an estimation of heterosis. General linear model was used to estimate the effect of genetic group on chicks' hatch weight. The results indicated that Potchefstroom Koekoek had the highest body weight at hatch as compare with other genetic groups but not significantly different with the crossbred (P x V) at p < 0.05. Heterosis results showed that there were positive heterosis effects on cross and reciprocal genetic groups. It is concluded that Potchefstroom Koekoek chicken breed might be used in the crossbreeding with other indigenous chicken breed to improve hatch weight for early selection of the body weight.

Keywords: *Crossbred, purebred, reciprocal, indigenous chicken breeds*

INTRODUCTION

In South Africa, there are several indigenous chicken genotypes (Malatji et al., 2016) including Potchefstroom Koekoek and Venda. Potchefstroom Koekoek chicken breed is a composite chicken genotype which was developed from three European poultry breeds namely White Leghorn, Black Australorp and Bared Plymouth Rock (Mphaphathi et al., 2016). While Venda chicken breed was firstly discovered in Venda region of South Africa and is dual purpose, moderately large and multi-coloured predominated with white, black and red colours (Mphaphathi et al., 2016). Despite the importance of indigenous chicken breeds, indigenous chickens have slow growth rates and relatively low mature weight (Norris and Ng'ambi, 2007). The aim of the study was to find the heterotic effects for chick's hatch-weight two-way cross between Potchefstroom Koekoek and Venda chicken breeds. Understanding the crossbreeding effects at hatching might help in early selection on chickens during breeding.

METHODS AND MATERIALS

he study was conducted at the University of Limpopo Experimental farm, Limpopo Province, South Africa. Four pens were prepared in the poultry breeding house for this experiment. A total of 24 chickens (12 per breed) were used in the study for breeding. The experiment was conducted as shown in the layout below.

Table 1. Crossbreeding experimental layout

Cocks / Hens	Potchefstroom Koekoek (P)	Venda (V)
Potchefstroom Koekoek	5P Hens: 1P Cock	5V Hens: 1P Cock
Venda	5P Hens: 1V Cock	5V Hens: 1V Cock

Chickens were fed with standard commercial feed and the water was provided *ad libitum.* A total of 160 eggs were collected (40 from each pen) for hatching. After egg collection for hatching, the breeding stock was removed, and the house was cleaned. A total of 100 chicks were randomly selected for data collection. Chick's hatch weight was collected from all the four genetic groups. The data was analyzed using SAS version 9.4 (SAS, 2021). The effect of genetic group on chick's hatch weight was examined using ANOVA. The significant difference was observed at $p < 0.05$.

The following equation was used to determine heterosis effect according to the procedure of Fairfull (1990):

$$H\% = \left[\frac{AB(0.5AA+0.5BB)}{(0.5AA+0.5BB)}\right] \times 100$$

Where: H% = percentage heterosis, AB = crossbred breed, AA = sire, and BB = dam.

RESULTS

Effect of genetic group on chick's hatch weight

Table 1 shows the results of chick's hatch weight of different genetic groups. The results showed the significant different (P < 0.05) on chick's hatch weight among four genetic groups. Potchefstroom Koekoek had higher hatch weight followed by P x V. Nonetheless, there was no substantial variance (P > 0.05) between P x P and P x V at hatch. Results also indicated that the reciprocal genetic group (V x P) had a higher (P < 0.05) body weight than Venda chicken breed at hatch.

Table 2. Effect of genetic group on chick's hatch weight

Genetic group	Number of chicks	Hatch weight
Purebreds		
Potchefstroom Koekoek	25	30.00[a]
Venda	25	20.00c[c]
Cross		
Potchefstroom Koekoek x Venda	25	29.60[a]
Reciprocal		
Venda x Potchefstroom Koekoek	25	28.00[b]

[a-c] means in the same column with different superscripts differ significantly ((P<0.05).

Heterosis effect

Heterosis results (Fig. 1) with respect to cross and reciprocal showed a positive heterosis for both genetic groups. The results indicated that the cross (P x V) had a higher heterosis as compared with the cross (V x P).
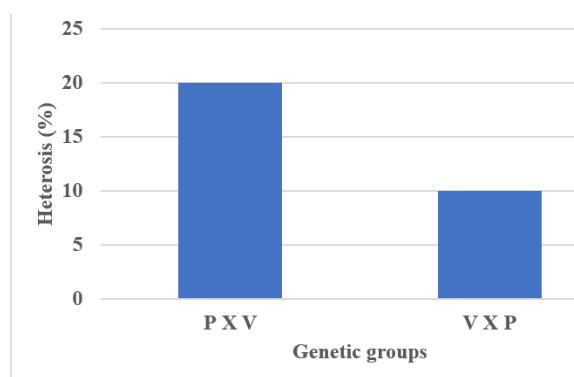
Figure1. Heterosis percentages for chick's hatch weight. P X V is the cross between Potchefstroom Koekoek sires and Venda dams. V X P is the reciprocal between Potchefstroom Koekoek dams and Venda sires.

DISCUSSION

This study was directed to investigate crossbreeding effects on chick's hatch-weight after crossing two South African indigenous chicken breeds; namely Potchefstroom Koekoek and Venda. Effects of genetic group was evaluated firstly, the results indicated that there was a significant difference observed between the four genetic groups on chick's hatch weight. Potchefstroom Kokeokok had a higher hatch weight while the Venda chicken breed was the least. Our results based on cross for heterosis, the effects for chick's hatch weights were positive and ranged from 10.00% to 20.00%. However, Musa et al. (2015) reported that heterosis for body weight ranged from -9.44% to 13.48% after crossing three breeds of Nigerian indigenous chickens. Furthermore, the results of the current study revealed that the P x V cross had encouraging heterosis at hatching stage when compared to its reciprocal V x P. These findings indicate that Potchefstroom Koekoek sire and Venda dams gave the highest heterosis chick's hatch weights. However, Nwenya et al. (2017) reported a positive heterosis for body weight after crossing Naked neck and Frizzled feather chickens. These findings might stand as an encouraging element for the poultry breeders in South Africa to cross these two breeds (Venda female and Potchefstroom Koekoek male to get hybrid vigor in chick's hatch weight for early selection of body weight. It is concluded that heterosis estimations indicate that cross between the Venda dams and Potchefstroom Koekoek sires provided the highest heterosis effect for body weight at hatching.

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EVALUATION OF DIFFERENT DOSES OF COMBINATION OF METHYLTIOPHANATE + TRICYCLAZOLE ON AMYLASE AND LIPASE IN FEMALE WISTAR RAT

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Abstract

Background: One of the environmental health and animal life threatening stuffs is agricultural pesticides. In agriculture, the most common pesticide to fight against rice blast, which is one of the most important agricultural pests, is the combination of two pesticides, Tricyclazole and Methyltiophanate. Researches have shown that these two pesticides separately have negative effects on different organs, including the pancreas. Methods: This study is a case-control study that was performed on 24 female Wistar rats in the weight 200±20 g. Wistar rat were divided into 4 groups of 6 under the groups of treatment consist of: group A that received the combination of Tricyclazole (12.5 mg/kg b.w./day, PO) and Methyltiophanate (332 mg/kg b.w./day, PO); group B, were treated with the combination of Tricyclazole (18.75 mg/kg b.w./day, PO) and Methyltiophanate (498 mg/kg b.w./day, PO); group C, were treated with the combination of Tricyclazole (25 mg/kg b.w./day, PO) and Methyltiophanate (664 mg/kg b.w./day, PO) and the control one. The treatment groups (A, B, and C) were placed on gavage over 28 days. serum samples obtained from all groups and were used to measure Amylase and Lipase. Results: Biochemical evaluations demonstrated that there is a dose - dependent relation between elevated Methyltiophanate and amylase and lipase values ($p<0.05$). In other words, by increasing the dose of the combination of Methyltiophanate and Tricyclazole, amylase and lipase values drop. In addition, Methyltiophanate (664 mg/kg/day) and Tricyclazole (25 mg/kg/day) cause lowest, whilst highest levels were linked to control group. Conclusion: Through this research, it can be manifested by lower amylase levels of amylase and lipase, it can cause adverse effects on rats and pancreatic factors should be considered as subsequences of this pesticide intakes.

Keywords: Methyltiophanate, Tricyclazole, Pancreas, Amylase, Lipase

CERVICO VAGINAL MUCUS RNA QUALITY, QUANTITY, AND INTEGRITY IN CATTLE FOR NGS STUDIES

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Abstract

Semen freezing and storing has been widely used in the field of reproductive biotechnology. It applies to certain males of economic and scientific values, including livestock breeds or animal species with economic value, such as the Angora goat, in terms of their products. The main aim of this study is to establish a suitable goat extender model to prevent the deterioration of sperm DNA integrity. The Angora goat ejaculates were collected and pooled. The pooled ejaculates were divided into 7 equal volumes and each of them was diluted at 37°C with the extenders of the experimental groups with additives: Liposome (Lpz) 50µl, Lpz 150µl, Melatonin (M) 0.25mM, M 1mM, Lpz 50µl+M 1mM, Lpz 150µl+M 0.25mM and no additives, then frozen. After freze-thawing process, sperm damaged DNA and abnormal DNA were assessed. All additives groups (Lpz 50 µl, Lpz 150 µl, M 0.25 mM, M 1 mM, Lpz 50µl+ M 1 mM, Lpz 150µl/5 mL+ M 0.25 mM) provided more cryoprotective effects compared to no additives (p <0.05). it can be concluded that the use of additives at all doses decrease cryodamage of sperm DNA.

Keywords: Angora goat, Sperm, Freeze-thawing, Liposome, Melatonin

POSTER PRESENTATIONS

TABLE OF CONTENT

THE EFFECT OF DIFFERENT SHARE OF LEGUMES IN PIG FEED ON FATTENING PARAMETERS AND SLAUGHTER VALUE OF CARCASSES

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Abstract

In many countries, the basic component of feed for fattening pigs is soybean, characterized by a high protein content and a lower content of anti-nutritional substances than in other legumes. However, this is the result of subjecting it to genetic modifications, which raise concerns about their possible impact on the meat product, and ultimately on human health. In addition, in many European countries, soybean cultivation is limited by unfavourable climatic conditions, affecting the high yield variability. This mainly results in soybean imports, which in turn drives its high price. An alternative to soybean meal seems to be other plants from the legume family, which are grown in European countries. As numerous studies show, it is possible to significantly reduce the use of soybean and replace it with pea, lupine or field bean seeds in the nutrition of fatteners without lowering the results of fattening and carcass traits. The aim of the study was to evaluate the effect of replacing soybean with domestic sources of protein in the diet of fatteners on their fattening and slaughter value. The experiment was carried out on 60 F2 fatteners [F1(Polish Large White x Polish Landrace) x F1(Pietrain x Duroc)]. The animals were divided into three feeding groups; C - I and II phase of fattening 100% protein of post-extraction soybean meal; E1 - I fattening phase 50% soy protein and 50% pea and lupine protein, phase II 25% soy protein and 75% pea and lupine protein; E2 - I fattening phase 50% soy protein and 50% pea and lupine protein, II phase 100% pea and lupine protein. During the fattening period, the animals´ daily gains and the average amount of feed consumed by the fattening pig in individual phases and during the entire fattening period were determined. The amount of feed used for the increase of 1 kg of body weight was calculated. After fattening, the animals were slaughtered. The meatiness of the carcasses was estimated, the hot carcass weight was determined and the slaughter yield was calculated. Their length and backfat thickness were measured in five places on the carcass. The cross-sectional area of the longissimus dorsi muscle was determined. Next, culinary dissection of the half-carcasses was carried out, determining the weight of selected cuts. The daily gains of the fattening pigs and the total weight gain of the pigs for the whole fattening period as well as in individual fattening phases were equal in all the examined groups. The amount of feed consumed by all pigs was very even. Its consumption per 1 kg of body weight gain was slightly more than 3 kg in all the studied groups. There was no effect of nutrition on the meat content of the fatteners, which was similar in all groups and exceeded the value of 56%. The average backfat thickness from 5 measurements as well as the values of individual measurements on different sections of the carcass were very similar. All the cuts subjected to weighing were characterized by a similar weight, regardless of the group. The results of the research allow to conclude that it is possible to use a protein supplement in the form of pea and lupine in the nutrition of fattening pigs and to completely replace soybean with them in the final phase of fattening.

Keywords: Fatteners, Diet, Legumes Protein, Quality Of Fattening, Carcass Traits

CLINICAL APPLICABILITY OF EXTERNAL AND INTERNAL BODY DIMENSIONS IN PREDICTING DYSTOCIA IN LATE-GESTATION HOLSTEIN-FRIESIAN HEIFERS

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Abstract

Dystocia (defined as a prolonged or difficult parturition) poses a serious problem in cattle herds because it increases cow and calf mortality, delays uterine involution, decreases reproductive performance and milk yields, and increases the costs of veterinary care, thus leading to considerable economic losses. The objective of this study was to determine the clinical applicability of maternal intrapelvic area (PA) and selected morphometric parameters that can be measured before parturition in predicting dystocia in dairy heifers. The measurements were performed in 374 late-gestation Holstein-Friesian (HF) heifers. Inner pelvic height and width were measured using a pelvimeter, and PA was calculated. The heifers were monitored continuously around the time of calving, and calving difficulty was categorized as: unassisted calving (UC), slight assistance (SA), considerable difficulty (CD) and veterinary assistance (VA). Calving performance was analyzed with the χ 2 test, and the effect of body dimensions on the course of parturition was evaluated by one-way analysis of variance (ANOVA). Dystocia was predicted with the use of the classification tree method. For this purpose, calving performance was scored on a binomial scale: 0 – UC and SA, 1 – CD and VA (dystocia). CD + VA accounted for 29.14% of all deliveries. The percentages of stillbirths and retained placenta increased (P<0.01) with increasing calving difficulty. Average PA immediately before parturition was smaller (P<0.01) in group VA (223.2 cm2) than in group UC (253.3 cm2). The calving difficulty score was positively associated with the cannon circumference and body weight of heifers and sire's body size (P<0.05). Higher RA values had a positive (P<0.01) influence on parturition. According to the classification tree, dystocia may occur (74.07% odds) in heifers with PA<254.2 cm2 and RA <5.68˚ before parturition. Measurements of heifer´s cannon circumference and sire's body size improve the accuracy of dystocia prediction.

Keywords: Dystocia, Dairy Heifers, Intrapelvic Area, Rump Angle, Pelvimeter

THE INFLUENCE OF MUSIC GENRE ON THE BEHAVIOUR AND WELFARE OF CHINCHILLAS (CHINCHILLA LANIGERA)

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Abstract

The aim of this study was to analyze the research results to examine the influence of different music genres (silence, pop, rock, classical music) on the welfare and behavior of chinchillas (Chinchilla lanigera). During the analysis, observed differences were defined, with the type of played sound having an impact on their occurrence. The study lasted a total of 112 days and involved 61 individuals. Elements of welfare (appropriate behavior - reaction to the human hand intrusion to the cage) and daily activity were characterized using two tools: the behavioral "hand test" and ethograms (created based on 24-hour video recordings). The analysis of the obtained results confirmed the hypothesis of chinchillas´ gentle temperament. Statistically significant differences were also found between the temperament (reaction to humans) of animals exposed to pop music and silence, and the temperament of animals exposed to classical and rock music (the animals showed a calmer temperament). A rapid reaction of chinchillas to the cessation of the sound source was also observed, resulting in an increase in the average temperament score. The prepared ethograms characterized chinchillas as nocturnal animals, spending over 76% of the day sleeping or resting. Based on the obtained results, the type of played sound was found to influence the daily activity of chinchillas. The most significant differences in behavior were observed during the influence of classical music - the animals appeared much calmer during this time, spending more time sleeping or resting. The conducted study demonstrates the impact of the type of played music on chinchillas, and the results suggest that classical music should serve as the acoustic background in the breeding rooms of these animals.

Keywords: Chinchilla, Music Influence, Welfare, Behaviour

GENETIC CORRELATIONS BETWEEN RUMINATION TIME AND MILKING TRAITS IN POLISH HOLSTEIN-FRIESIAN COWS

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Abstract

Rumination activity, including rumination time (RT), has been widely discussed in terms of physiology and pathology associated with rumination disorders; however, in regard to the genetic aspect, the knowledge of this trait is relatively limited. The objective of the research was to estimate genetic and phenotypic correlations of rumination time, as well as traits associated with milk yield and milking of dairy cows of the Polish Holstein-Frisian breed kept in cowsheds equipped with an automatic milking system. The research considers daily results for milking in the first and second lactation, from 1486 cows of the Polish Holstein-Frisian breed milked in 2013–2015. Cows were housed in 20 free-stall barns and fed a Partial Mixed Ration feed. The RT values were gathered based on results taken from the Lely Qwes HR-LDn tags. The device was used to record individual cow activity, as well as eating and rumination behavior. The cows received a varied dose of the concentrate, either in the milking robot or the feeding station, depending on the level of their milk yield. Estimates of (co)variance components were obtained using the Restricted Maximum Likelihood (REML) method by the WOMBAT package (Coskun et al., 2020). The animal model includes repeated individual measurements (at least 5 and up to 10 repeats) for estimating the variance components and breeding values. In the case of RT, the only statistically significant genetic correlation occurred with urea in milk (-0.418); the others proved to be statistically insignificant. It was demonstrated that RT was positively, but insignificant, correlated with milk yield (0.341) and milking efficiency (0.208). A negative, insignificant relationship was estimated between RT and fat content (-0.164), protein content (-0.141), lactose content (-0.075), dry matter (-0.181), and somatic cells (-0.355). Only very modest, near zero, and mostly negative relationships (between -0.064 and 0.048) were found between RT and the other analysed traits. It needs to be stressed that in as many as 7 cases they were considered as highly significant statistically. From this 4 examine traits (milk yield (kg), milk speed (kg/min), electric conductivity (mS/cm), and milking efficiency (kg/min)) were positively and significantly correlated with RT. Based on the estimated genetic correlations, one can assume that selection for rumination time will result in a lower level of urea in milk. Moreover, it is worth noting the fact confirming a favorable trend related to the selection of milking time with regard to the improvement of milk yield and decreasing the somatic cell count. Taking into account the discrepancies between the obtained results, it is recommended a larger dataset is required to verify whether RT could have the capacity to be used in selection programs.

Keywords: Milk Traits, Correlation, Automatic Milking System, Robots, Selection Programs

COMPARISON OF SELECTED ZOOHYGIENIC PARAMETERS ON THE FARM DURING HATCHING IN THE TRADITIONAL AND ON-FARM SYSTEM

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Abstract

The welfare of the chick from the first day of life is one of the priorities of modern poultry production. For this reason, the latest solutions in hatching technology make possible feeding drinking of chicks in the hatcher. However, these solutions don't eliminate the distress that caused microclimatic factors and the risk of perinatal contamination present in the hatcher chamber. These risks seem to be avoided by another alternative hatching system, that of "on-farm hatching". Therefore, it was interesting to compare the microclimate and hygienic conditions during hatching in the traditional system and the "on-farm system". Hatching eggs of chicken broiler Ross 308 (Aviagen) were incubated in setter (Pas Reform) of commercial hatchery (DanHatch Poland JSC.). The 2250 eggs were candled at 441 hour of incubation, and embryonated eggs were selected and randomly divided into three parallel groups. The incubation of the control group (5 baskets) was continued in the hatcher. The other eggs were transported (1 h) into the experimental chicken house and set on litter (L-litter group) or plastic trays (T-tray group). The hatchability in the hatcher was 96.4% in compare to 93.9 and 95.8% for "on-farm" litter and tray groups, respectively (P> 0.05). More importantly, there were found only 0.1-0.3% crippled or dead chicks in the "on-farm system" but 2.1% in the traditional system (P<0.05). Microclimatic parameters during "on-farm hatching" were: temperature 33.8 ±3 4°C, RH 18,4-±1,5. litter surface temperature 32-34°C. Analysis of the quantitative and qualitative composition of the eggshell and litter microflora did not reveal the presence of Enterobacteriaceae, P.aeruginosa, Listeria monocytogenes, Staphylococcus aureus and Bacillus cereus. The total number of mesophilic aerobic microflora on the surface of shells and litter after hatching in group "hatcher" was estimated at the level of 4-5 log CFU/g of shell, and about 5 log CFU/g of litter, which was about twice as large then "on-farm hatching" groups. In summary the "on-farm hatching" in compare to tradition one seems to be more hygienic and friendly to chicks.

Keywords: Chicken Broiler, Hatchability, Microbiology, Microclimate

THE EFFECT OF DIETARY DIATOMACEOUS EARTH SUPPLEMENTATION ON THE PERFORMANCE OF BROILER CHICKENS

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Abstract

Diatomaceous earth (diatomite - DT) is a naturally occurring sedimentary rock which consists of fossilized diatoms and is made up of almost amorphous silicon dioxide (80-90%), with minor contains of alumina (2-4%) and iron oxide (0,5-2%). In feed industry its insecticide and anti-caking proprieties have been widely recognized. Diatomite is also a source of biologically available silicon and has many other positive physiological properties for animals. However, chemical pollution of this material, especially with heavy metals, may limit its nutritional suitability. Our earlier work was shown, that mobility and toxicity of heavy metals from DT may be reduced through the use of bentonite. The aim of this study was to determine the effect of DT (75%) and bentonite (25%) mixture supplementation to the complete diets for broiler chickens on body weight gain (BWG) and feed conversion ratio (FCR). The trial was carried out on 960 Ross 308 broiler chickens divided into 2 experimental groups throughout the entire rearing period lasting 6 weeks. The birds were fed complete granulated diets without (group C) or with experimental mixture (group E) in an amount of 1% from the 11 day of life. Complete nutritionally balanced diets were used in 2 types according to the age of the broilers: grower (d 11–34) and finisher (35 to 42 d of life). The mean BWG differed between nutritional groups in favour of the group E only in the finisher period (P<0.05), with a tendency for a higher overall BWG (P=0.097) in this group. No differences in FCR were observed (P>0.05) between C and E groups, however, tendencies for higher final body weight of birds in the group E were found at 42 days of life (2997 vs 3055g, respectively; P=0.086). In conclusion, the use of diatomite in a mixture with bentonite as a feed additive to the broiler chicken diet in an amount of 1% resulted in a favourable increase in body weight gain in the finisher period, with a tendency to higher overall final body weight of the birds. More research with greater share of the diatomite-bentonite mixture in the complete diet of broiler chicken is needed.

Keywords: Diatomaceous Earth, Diatomite, Bentonite, Clay Minerals, Broiler Chicken, Production Indices

BODY MEASUREMENTS AND THEIR INTERACTION WITH CARCASS CHARACTERISTICS RELATED TO THE SHEEP BREED IN EAST ALGERIA

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Abstract

The aim of the research was to provide information's on relationships between ante-mortem and post-mortem measurements sheep as a genetics selection criterion and key product quality traits in two breeds. This study was carried out on 151 male sheep belonged to Ouled Djellal breed (n=118) and Hamra breed (n=33) during (March – June 2023) at the municipal slaughterhouse in the wilaya of Tebessa. The animals were adult's ≥ 12 months. The data revealed that before slaughter of the rams, the body weight was (68.31±11.14 versus 61.83±5.04) kg respectively in Ouled Djellal and Hamra breeds; there were significant differences in ante-mortem traits: heart girth, scapular-ischial length, and dactyl-thoracic index among the breed (P<0.05). After slaughter, the weight carcass were (34.96±7.82 versus 30.53±4.33) kg and the carcass yield were (51.51 versus 49.15) consequently, the carcass characteristics are significantly higher in Djellal than in Hamra breed (P<0.05). Therefore, the sheep of the Ouled Djellal breed were the heaviest; they have a very wide chest, a long carcass. However, the carcass conformation was best in Hamra breed (P<0.05) This work has also made it possible to detect the excellent meat performances of animals breed and to propose ways of improving these breeds whose qualities of adaptability and hardiness are no longer to be demonstrated. Further research is needed to clarify weights of tissues

Keywords: Algeria, Breed, Carcass, Meat, Sheep

GENETIC DIVERSITY AND MATERNAL ORIGIN OF PALESTINIAN AWASSI SHEEP BASED ON MITOCHONDRIAL GENOME

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Abstract

Awassi is a versatile sheep breed, selectively bred for meat, milk, and wool production, and exhibits remarkable adaptability to challenging environmental conditions. It is extensively raised across southern Turkey, Iraq, Saudi Arabia, Palestine, Jordan, and Syria. However, factors such as prolonged droughts, diseases, climate fluctuations, intense selection, and crossbreeding have collectively led to a substantial reduction in the genetic diversity and biological richness of the Awassi sheep population in the Fertile Crescent region. As a result, it becomes crucial to identify these breeds, ascertain their phylogenetic relationships, and institute protective measures. Preserving the genetic heritage of Awassi sheep holds paramount significance given its historical and ecological importance. In this Study, the mtDNA D-loop region of Awassi sheep reared in Palestine, was sequenced, information about domestication processes and haplogroups were obtained and phylogenetic analyses were performed by revealing genetic similarities/differences. For this purpose, a total of 75 sheep were sampled, the control region (D-loop region) of mtDNA was amplified by PCR and then sequenced. The median-joining network analyses conducted on Awassi sheep raised in Palestine resulted in the majority of the studied samples being grouped together with HPG-B.

Keywords: *Awassi, Genetic diversity, Haplogroup, MtDNA D-loop, Phylogenetic analysis*

INTRODUCTION

According to information gathered during excavations, sheep, goats, and cattle were domesticated 11,000, 10,500, and 10,000 years ago, respectively. It is generally believed that domestication took place in the "Fertile Crescent", a region stretching from central Anatolia to northwestern Iran. Wild sheep are the ancestors of domesticated sheep. The distribution of wild sheep in the world is quite large. The theory that domestic sheep (O. aries) descended from Urial, Argali and Mouflon sheep has long been debated in the literature. But archaeological excavations and molecular genetic studies have shown that domestic sheep descended from the European mouflon (Hiendleder et al. 2002).

According to archaeologists and geneticists, sheep were first domesticated around 11,000 BC in various regions of the Fertile Crescent, including the region between central Anatolia and the northern Zagros Mountains. These regions correspond to present-day Iraq, Jordan, Palestine, Syria, Iran and Turkey (Zeder et al. 2008; Demirci et al. 2013; Larson and Burger 2013). The sheep populations of these countries exhibit higher levels of genetic diversity (based on microsatellite, SNP, mtDNA and nuclear DNA studies) compared to sheep from other regions in Asia, Africa and Europe (Pereira et al. 2009; Benjelloun et al. 2011; Gaouar et al. 2015; Ahmed et al. 2017).

The genetic diversity and origin of livestock species have always been critical elements for promoting the sustainable management of genetic resources to ensure food security for humans. The mtDNA analysis is one of the most valuable tools in the fields of evolutionary and population genetics. Sequencing of mtDNA revealed the existence of five different HPGs named A, B, C, D and E in domestic sheep (Meadows et al. 2011). HPGs A and B are the two most prevalent HPGs among modern breeds and are predominant in almost all regions of Asia, Africa and Europe (Meadows et al. 2005; Singh et al. 2013; Resende et al. 2016). In contrast, HPGs C, D and E are relatively rare (Demirci et al. 2013). Palestine is located at the crossroads of the major domestication centers of multiple livestock species: goat, sheep, cattle (Rashaydeh et al. 2020). The genetic diversity of the local livestock species in Palestine has not been identified until now. So, this study is the first in the region. The purpose of this study is to analyze the genetic diversity of Awassi sheep reared in Palestine and to identify their haplogroups by sequencing of mtDNA D-loop region.

MATERIALS AND METHODS

In this study, a total of 75 sheep were sampled, and Genomic DNA was extracted using the salting-out method. In addition to the 75 sheep

samples, several reference sequences from previous studies (from each mtDNA D-loop haplogroup) and wild sheep sequences (*O. musimon*, *O. ammon,* and *O. vignei*) will be used for the statistical analyses.

PCR amplification and sequencing of mtDNA D-loop region

In this presented study, a 531 bp fragment of the control region in mtDNA spanning nucleotide sites 16,006 to 16,537 of the sheep reference sequence AF010406 (Hiendleder et al., 1998b) was amplified. The primers CR400F (5'-ACTGCTTGACCGTACATAGTAC-3') and CR1099R (5'-AGTATTGAGGACGGGGTA A-3') were used for the amplification of the 531 bp fragment. The PCR products were separated by electrophoresis on 2% agarose gels. After gel electrophoresis, the PCR products were sent for DNA sequencing.

Statistical Analyses

We used FinchTV 1.5.0 (Geospiza Inc., Seattle, WA) to view the data from Sanger DNA sequencing. The sequences, 531 base pairs in length, from the mtDNA D-loop region were aligned using MEGA 7 software (Kumar et al., 2008). To calculate the position and number of polymorphic sites, as well as corresponding haplotypes, we utilized DNASP software (Librado and Rozas, 2009). We constructed an unrooted neighbor-joining (NJ) tree of the sheep breeds under study using Splits Tree4 software (Huson and Bryant, 2006). Furthermore, to determine haplotypes, we generated haplotype median-joining networks using NETWORK 4.1 software based on reference sheep mtDNA sequences from NCBI.

RESULTS
Analysis Results of Palestinian Awassi Sheep

The 531-bp-long mtDNA D-loop region of the samples belonging to the Palestinian Awassi breed was saved in FASTA format after alignment and dendrogram creation. Haplotype analysis, heat-map analysis, and Neighbour Joining phylogenetic tree construction were performed using the R and R-studio programs. Median-joining network analysis between the sheep populations used as materials and reference sheep, based on mtDNA D-loop haplotypes, was conducted using the NETWORK 5.0 program.

Figure 1. illustrates that Palestinian Awassi sheep share similar haplotypes and exhibit mtDNA sequences closely related to the worldwide reference sheep haplogroup B and the wild-type Mouflon. In contrast to the other samples, two individuals (16A and 19A) possess distinct mtDNA sequences, which are, however, like those found in haplogroups C and E, as well as the haplotypes of Urial and Argali sheep. Conversely, consistent outcomes emerged from Median-joining network

analyses encompassing Urial, Mouflon, Argali sheep, and Palestinian Awassi haplotypes, encompassing five distinct mtDNA haplogroups.
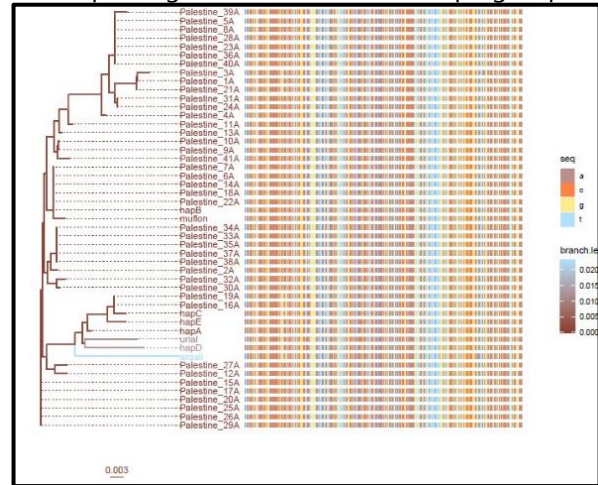
Figure 1: Dendrogram based on aligned mtDNA D-loop sequences of Palestine-bred Awassi sheep and reference samples (Urial, Mouflon, Argali, and haplogroups A, B, C, D, and E)

After analyzing the mtDNA D-loop sequences, a total of 19 haplotypes were identified in the Palestinian Awassi population. The most frequent haplotypes within the Palestinian Awassi population were H5, H6, and H11. Among these haplotypes, 15 polymorphic regions were identified (Figure 2).

Haplotipler	Polimorfik nükleotitler
H1	TGAATTTCTCCATGG
H2	CA.G.CC.C.TGC..
H3	..............A.
H4	CA..........C..
H5	CA.......T.....
H6	CA...CC.C.TGC..
H7	CA...CC.CT.GC..
H8	CA....C.C..GC..
H9	CA...CC..TTGC.A
H10	CA...CC.C..GC..
H11	CA...CC.CTTGC..
H12	..G.CC...TTGC..
H13	CA.............
H14	CA...CC...TT.C..
H15	CA....C.CTTGC..
H16	CA.G..C.CTTGC..
H17	CA.G.CC.CTTGC..
H18	CA.....G.T.....
H19	CA...C..CT.GC..

"**Figure 2:** displays the haplotype sequences of Awassi sheep bred in Palestine. Identical nucleotides are denoted by (.)"

The genetic distance between the haplotypes of Awassi sheep bred in Palestine was visualized through a heatmap and represented in a phylogenetic tree (Figure 3). In the heatmap, each branch of the phylogenetic tree corresponds to

the respective haplotype on the map. Among the displayed haplotypes, 19 belong to Palestinian Awassi sheep, while the remaining 7 haplotypes (H20: HPG-A, H21: HPG-C, H22: HPG-D, H23: HPG-E, H24: Mouflon, H25: Argali, H26: Urial) pertain to reference samples.
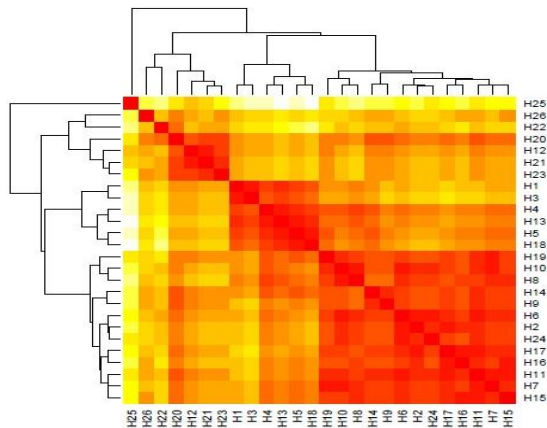

Figure 3: Heatmap generated in the Palestinian Awassi population.

Median-joining network analyses were conducted using the NETWORK 5.0 program to elucidate the phylogenetic relationships among Awassi sheep bred in Palestine. The aim was to ascertain their genetic associations with one another, as well as to establish their genetic connections with pre-defined reference haplogroups and wild-type sheep (Figure 4). Furthermore, a neighbor-joining phylogenetic tree was constructed to elucidate genetic relationships based on similarities and differences in DNA sequences of the examined samples (Figure 5).

The results of both the median-joining network analyses and the neighbor-joining phylogenetic tree demonstrate that Awassi sheep raised in Palestine exhibit mtDNA sequences closely aligned with the reference sheep haplogroup B and the Mouflon wild sheep. In contrast to the other samples, two individuals (16A and 19A) possess distinct mtDNA sequences, yet they bear resemblance to haplogroups C and E, as well as Urial and Argali sheep.
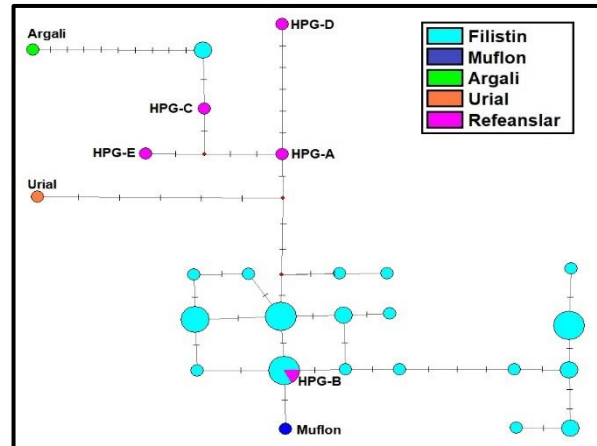
Figure 4: illustrates the results of median-joining network analyses conducted on the Palestine Awassi sheep population, as well as reference populations including haplogroups A, B, C, D, and E, along with wild-type sheep
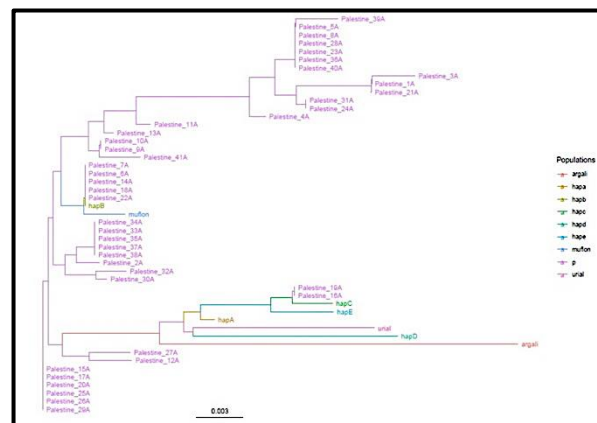
Figure 5: Phylogenetic tree of the Palestinian Awassi population and reference populations (haplogroups A, B, C, D and E and wild-type sheep)

DISCUSSION

Mitochondrial DNA, particularly the control region (mtDNA D-loop), exhibits significant variation at the intraspecies level. As a result, it contains a high number of haplogroups and haplotypes within the species. The mtDNA D-loop is a highly employed molecular marker for unraveling the evolutionary history and phylogeny of various animals.

In this study, the median-joining network analyses conducted on Awassi sheep raised in Palestine resulted in the majority of the studied samples being grouped together with HPG-B, while some were closely associated with HPG-C. This study represents the inaugural effort to ascertain the genetic origin and haplogroup of Palestinian Awassi sheep.

CONCLUSIONS
This section is not mandatory but can be added to the manuscript if the discussion is unusually long or complex.

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THE FREQUENCY OF OCCURRENCE OF ENDOPARASITES AMONG DOGS

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Abstract

Endoparasites use the host organism as a source of food as well as a place of existence and development, while having a devastating effect on this organism. They are pathogenic not only to animals, but can also cause zoonoses and carry diseases to humans. There are many species of parasites in Europe, the final hosts of which are dogs. The aim of the study is to determine the frequency of internal parasites in a group of dogs under veterinary care by a selected clinic based on data obtained from files and interviews with their owners. The data for the conducted analyzes came from surveys in which 540 respondents, dog owners from Poland, participated. The survey consisted of 11 questions, single and multiple choice. In addition, the description of 51 cases of internal parasites in dogs registered at the Dogtorzy veterinary clinic in Elbląg was used. The chi-square test was used to determine the statistical factors associated with the occurrence of parasites in dogs. Studies have shown that in a group of dogs over one year of age, where deworming was carried out at a level of over 96%, only less than 9% had parasites in the faeces. In the group of dogs less than a year old, 98.80% were dewormed and 22.89% of them had parasites. The conducted statistical analysis showed that there is a relationship between the infection of dogs with parasites and their weight, age, previous infestations and the frequency of deworming.

Keywords: Endoparasites, Dogs, Infection

ANTIMICROBIAL ACTIVITY OF Y-POLYGLUTAMIC ACID ITS POTENTIAL APPLICATION IN POULTRY INDUSTRY

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Abstract

г -polyglutamic acid is one of the key metabolites of Bacillus bacteria accumulated in the form of extracellular biofilm. Its main role is related to the elimination of negative effects of external factors on bacterial cells (cytoprotective function) and the control of other microorganisms in the immediate vicinity (antimicrobial function). This metabolite, as a form of glutamic acid homopolypeptide with bonds, undergoes degradation in the digestive tract of vertebrates; however, the presence of peptide bonds slows down this process. These properties can be widely used as a feed additive or complementary feed, which, thanks to cytoprotective properties, protects the microbiome of animals and at the same time allows for the reduction of pathogenic or pathogenic microorganisms that live in the feed and in the environment of farm animals. The development of this type of feed additive would reduce the use of other preventive measures, such as antibiotic therapy, which should be used only in extreme cases, and at the same time would reduce losses in cultures caused by pathogenic microorganisms and diseases caused by them. The purpose of the study was to test the antimicrobial properties of individual fractions of a mixture of glutamic acid homopolypeptides with different chain lengths (A -> 106kDA, B - >106kDA, B – 106-102kDA, C – 10 kDa - 200Da) in relation to six strains of pathological significance for animals. A strong antimicrobial effect of all three fractions was observed against Gram strains of Escherichia coli and Pseudomonas aeruginosa (MIC=150µl 1l-1). Strain-inhibiting properties were also observed against Gram+ strains of Staphylococcus epidermidis and S. aureus (MIC=200µl 1l-1). No inhibitory properties against the Candida albicans were noted. To evaluate the effectiveness of the antimicrobial properties of the PGA fraction on E.coli strains , the experimental colibacillosis of chicken embryo was obtained, reaching the CFU up to 1010 of the bacterial units. We observed significant inhibitory values of E.coli of all three fractions, but the low molecular weight fraction (C) was the most efficient. Our results indicate that the low molecular weight faction of Bacillus broth can be used sufficiently in prevention of colibacillosis during the development of chicken embryos.

Keywords: Bacillus, Metabolites, Antimicrobial, Nanofiltration, E.coli, Gram+, Gram-

THE VISCOSITY OF THICK ALBUMEN AND AMNIOTIC FLUID AND THE LYSOZYME ACTIVITY IN VARIOUS-COLORED HATCHING EGGS OF PHEASANTS

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Abstract

The egg is an optimal environment for the embryo. All possibilities for correct development should be given, including protection. The study aimed to analyze the changes in viscosity and lysozyme activity in thick albumen and amniotic fluid from pheasant eggs with various eggshell colors during incubation. In the research, 1415 hatching eggs with various eggshell colors (blue, brown, green) from pheasants were incubated for 25 days. The hatching parameters were registered. The thick albumen for analyses was collected from fresh eggs (day 0) on days 7 and 14. The amniotic fluid was obtained from days 14 and 21. The collected material was frozen and then analyzed (thawed, 18 samples per day). The viscosity was measured using the Brookfield viscometer (Brookfield Ametek, DVNext, LV, Labo Plus, Warsaw, Poland). The samples were measured under 23-24 °C. The cone/plate measuring system was used (small-volume samples). The shear rate was 20 rpm. The lysozyme enzymatic activity was done by the spectrophotometric method (SP830 Plus, Metertech, Taipei, Taiwan). The Micrococcus lysodeikticus bacteria suspension was prepared. The analysis was based on lysozyme lysis properties of bacterial cell walls. The activity was calculated based on the absorbance (ΔA450) changes. The analysis of variance was used in the statistical program (Statistica 13.3 StatSoft). In green-colored eggshell hatching eggs, the highest fertilization and hatching rate was found (P<0.001). The viscosity of thick albumen was the highest on day 14 of incubation in the green-colored group. Slightly lower viscosity was in the brown-colored group on day 14 in thick albumen. The lower values were noticed on day 7 in thick albumen of blue- and blown-colored eggs, as well as in blue-colored eggs on day 14 (thick albumen), but the lowest values were obtained in amniotic fluid in blue-, brown-, and green-colored groups on day 14 (P<0.001). There also was an effect of incubation days (P<0.001) and the eggshell color (P<0.001) when a one-way analysis of variance was used. Similarly, the highest lysozyme activity was noticed on day 14 in the thick albumen of all eggs, and the lowest activity was found in the amniotic fluid on day 14 (P<0.001). There was an effect of incubation days (P<0.001), but the eggshell color did not influence the hydrolytic activity of lysozyme (P=0.920). The thick albumen and amniotic fluid have a critical, bioactive value during the embryogenesis of pheasants. The results have shown that the viscosity and lysozyme activity could be interdependent. It may be concluded that the viscosity of thick albumen was noticed due to the water flow. The amniotic fluid on day 7 is almost sterile, with the lowest lysozyme activity on day 14 (critical moment for embryos), and the substances flow between the thick albumen and amniotic fluid. The highest activity was found in green-colored hatching eggs. The research was funded by the Bydgoszcz University of Science and Technology (PBS, Poland) under grant No. 24/2023 in the Young Scientist Activities program (Działania Naukowe Młodych).

Keywords: _Phasianus Colchicus, Hatching Eggs, Incubation, Lysozyme, Viscosity_

GROWTH PERFORMANCE AND SLAUGHTER YIELD OF BROILER DUCKS FED A DIET WITH 1% ZEOLITE ADDITION

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Abstract

Introduction: The use of zeolites (clinoptilolite) as a natural feed additive in poultry nutrition has many prospects. Clinoptilolite has been tested as a growth-promoting ingredient in various animal species. The study aimed to evaluate the chemical composition of diets, body weight, gains, feed intake indicators, and slaughter yield of broiler ducks fed a diet with the addition of zeolite at a 1% level. Methods: In the research, a total of 200 Cherry Valley ducks of both sexes (1:1 ratio) were reared for 42 days. Ducks were divided into two treatments. The control group was fed a commercial diet, and the Zeolite group was fed a commercial diet with a 1% addition of zeolite. During rearing, the body weight was measured on days 1, 28, and 42. Daily feed intake was controlled. Body weight gain, feed conversion ratio, European Production Efficiency Factor, and Broiler Index Factor were calculated. The viability of ducks was also monitored. The analysis of the chemical composition of starter and grower diets was done according to the standards of AOAC International. The gross energy, dry matter, crude ash, crude protein, ether extract, acid detergent fiber, neutral detergent fiber, and acid detergent lignin were analyzed. On day 42, 10 ducks per group were slaughtered, and the slaughter yield was calculated, based on the carcass and individual elements' weight. The data was processed in the Statistica program. The mean values and pooled SEM were calculated. One-way analysis of variance was used, with Tukey's test, assuming P-value <0.05. The statistical model was used based on the formula: $Yd = \mu + Dd + ed$, where Yd is the dependent variable; μ is the overall mean; Di is the effect of diet (d = control, zeolite); ei is the residual error. Results: When analyzing the chemical composition of both starter and grower diets, the higher gross energy, dry matter (P<0.05), and the lower crude ash content (P<0.001) in the control diet were found. In the starter diet with a 1% addition of zeolite, the lower content of ADF, ADL, and starch was noticed (P<0.05). In turn, the grower diet with 1% zeolite was characterized by a lower ether extract content (P=0.003). The production results were similar in both groups (P>0.05). However, the beneficial effect of 1% zeolite in the grower diet was found due to the statistically significantly lower feed conversion ratio of broiler ducks (P=0.034). The carcass yield of broiler ducks in both treatments was similar (P>0.05). Conclusion: The addition of zeolite at a 1% level to starter and grower diets for Cherry Valley broiler ducks had an influence on the chemical composition of diets (nutrient content). Zeolite was presented in the feed due to the higher crude ash content. Zeolite had no adverse effect on the growth performance and slaughter yield. The feed conversion was beneficially affected in the second stage of the ducks' rearing period by the addition of zeolite. Funding: The research was carried out as part of project No. UMO-2021/43/D/NZ9/01756, financed by the National Science Center (NSC, Poland).

Keywords: Aluminosilicates, Body Weight Gain, Carcass Yield, Feed Conversion, Waterfowl

DIFFERENT VARIETIES OF INDIGESTIBLE FOREIGN BODIES IN THE FORESTOMACH AND THEIR RELATED COMPLICATIONS IN CATTLE SLAUGHTERED AT BATNA SLAUGHTERHOUSE, ALGERIA

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Abstract

A cross-sectional study conducted to ascertain the prevalence of foreign bodies syndrome in the rumen and reticulum of cattle. The study aimed to identify the various types of foreign bodies present and the prevalent diseases associated with their occurrence. A total of 289 cattle were examined at the Batna municipal slaughterhouse in Algeria. The examinations took place immediately following slaughter to determine the presence or absence of foreign bodies in the forestomaches of the cattle, and any resulting lesions were documented. The results showed that out of the 289 cattle examined, 151 (52.24%) were found to be positive for different types of foreign bodies in their rumen and/or reticulum. Specifically, 56 (19.37%) were positive for vulnerating foreign bodies (VFB), while 95 (52.24%) were positive for non-vulnerating foreign bodies (NVFB). The range of foreign bodies encountered included wire segments, needles, nails, hair clips, ropes, cloth, sand, glass pieces, trichobezoar, and plastic bags. Plastics were the most commonly found foreign bodies, with 61 (23.92%) found in males and 34 (79.06%) in females. The study also revealed that the most common lesions observed in the rumen of cattle with foreign bodies were traumatic reticulo-peritonitis (TRP), periarticular abscess, esophageal obstruction, and non-penetrating reticulum and/or ruminal foreign bodies, occurring at rates of 3.79%, 12.65%, 1.26%, and 82.27%, respectively. In conclusion, this study highlights the prevalence of plastics in the rumen of cattle slaughtered at the Batna municipal slaughterhouse, suggesting their potential role in cattle health issues. The findings shed light on the types of foreign bodies encountered and their association with various lesions and diseases in cattle's rumen and reticulum.

Keywords: Cattle, Foreign bodies, Lesions, Forestomach, Traumatic-reticulo-peritonitis.

INTRODUCTION

Pollution of the bovine environment by non-biodegradable objects is increasing all the time. Among these pollutants emerge vulnerating and non-vulnerating waste. The latter is dominated by plastic waste, which is becoming a global scourge. In fact, its production reached 139 million tonnes in 2021, 6 million tonnes more than the previous year. These pollutants more readily induce foreign body syndrome in cattle than in other ruminants. Their susceptibility is linked to the specificity of their feeding behaviour; they gather large amounts of food with their discriminative power-deprived tongue. Foreign bodies contained within the ingested mass pass more easily into the oesophagus due to the very rudimentary initial chewing. The anatomical shape and the histological structure cattle's reticulum resembling respectively an inverted funnel and honeycomb predispose them to the capture of ingested foreign bodies. Foreign body syndrome induced is often associated with various digestive and nutritional disorders such as glossitis, esophagitis, ruminitis, rumen impaction, traumatic reticulo-peritonitis (TRP) and traumatic pericarditis (TP). These disorders can cause substantial morbidity and even mortality. (McCurin and Basser, 2006; Tesfaye and Mersha, 2012; Abu-Seida and Al-Abbadi, 2016). The penetration and migration of foreign bodies into the body's tissues give rise to various complications, which are conditioned by the nature of the foreign body and the manner of its penetration into the tissue (Semieka, 2010). The Traumatic reticulo-peritonitis (TRP) is frequently observed in the event of ingestion of vulnerating foreign bodies that sit in the cranio-ventral part of the reticulum (McCurin and Basser, 2006) and can sometimes cause traumatic pericarditis (Braun and al., 2007. Non-vulnerating foreign bodies in the reticulo-rumen can cause recurrent ruminal tympany in cattle. Trichobezoars; masses trapped in the rumeno-reticular area have often been associated with acute tympany in young calves and cattle. These trichobezoars are sometimes present in the abomasum of ruminants (Maxie, 2007, Vanitha and al., 2010). Over time, these materials form large, compact masses inside the rumen, leading to anorexia, reduced production and loss of body weight (Tyagi and Singh, 1993). Cattle that have ingested plastic foreign bodies may even suffer displaced abomasum and

reduced milk production (Al-Majali and al., 1995). Cases of erosive rumenitis and focal hyperplasia were reported by Hailat in 1998. Several pathological hyperplasia may be a precursor of neoplastic proliferation. The origin of the hyperplastic changes observed in cattle remains uncertain. It is either attributed to mechanical irritation caused by the plastics themselves, or to some of the chemicals released, which trigger proliferation of the ruminal epithelium (Bakhiet, 2008).

MATERIALS AND METHODS
Study area
The study was carried out in the city of Batna; which is an important wilaya for cattle, sheep and poultry breeding, with a population of nearly one million and an important industrial fabric. Every day, the city generates a large amount of domestic and industrial waste. Open-air markets and landfills, without any protection, are the main source of environmental pollution for livestock.

Animals
The study was conducted on 298 apparently healthy cattle, including 245 males and 43 females, at Batna slaughterhouse between January and August 2022. Slaughtered cattle were identified.by sex, age and breed. Age was determined based on teething (Otesile and Obasaju, 1982). After evisceration, the rumen was rinsed with water to remove food adhesions and to record foreign bodies and lesions.

RESULTS

Table 1. Prevalence of different types of foreign bodies extracted from positive animals

Animals Examined	positive animals with FB	positive animals with VFB	positive animals with NVFB
298	151	56	95
Prevalence (%)	50,67 %	18.79 %	21.87

151 of the 298 animals tested were positive, which is a total of 50.67%. Vulnering foreign bodies (VFB) accounted for 56 (19.79%), while non-vulnering foreign bodies (NVFB) accounted for 95 (21.87%) as shown in Table 1.

Table 2: Sex distribution of rumen foreign bodies in cattle

Sex of animals	Examined animals	Positive animals with foreign bodies	Prevalence (%)
Male	255	114	75.49%
Female	43	37	24.50%
Total	298	151	50.67%

Out of 255 males and 43 females surveyed on examination, foreign bodies were found in the rumen in 114 males (75.49%) and 37 females (24.50%) respectively (Table 2).

The types of foreign bodies present in the rumen-reticulum in decreasing proportion were:
nails (26.79%), pieces of wire (25%), foreign bodies indistinguishable (17.85%), magnets (14.28%), bottle cap (10.71. %), needles (3.58%) and hairpins (1.79%).

Table 3: Varieties of VFB foreign bodies present in the rumen-reticulum

Type of FVB	Number of VFB	Frequency of occurrence (% of animals)
Wire segment	20	14(25%)
Needels	02	02(3.58%)
Nails	15	15(26.79%)
Hair clips	02	01(1.79%)
Bottle cops	06	06(10.71%)
Non differentiated FB	10	10(17.85%)
Magnet	08	08(14.28%)
Total	63	56

Table 4: Frequency of non-vulnering foreign bodies (NVFB) in the rumen-reticulum

Type of FB	Number of NVFB	Frequency of occurrence (% of animals
Plastic bags	50	52 (54.73%)
Rope	10	09(9.47%)
Piece of cloth	05	05(5.27%)
Caps	08	08(8.42%)
Stones	03	03(3.16%)
Sand	02	04(4.21%)
Glass	10	10(10.53%)
Trichobézoards	03	04(4.21%)
Total	81	95

Non-vulnering foreign bodies are dominated by household waste such as plastic bags and glasses, rope, corks and pieces of fabric.
Their percentages are respectively 54.73%, 10.53%, 9.47%, 8.42% and 45.27% (table 4).

Table 5: Illustration of different affections caused by foreign bodies syndrome

Type of diseases	Exami ned female	Exami ned male	Tot al	Prevale nce %
Traumatic reticuloperit onitis (TRP)	03	-	03	3.79%
Perireticular abscess	10	-	10	12.65%
Œsophageal obstruction	-	01	01	1.26%
Non penetrating reticular and /or ruminal foreign bodies	15	50	65	82.27%
Total	28	51	79	%

The affection caused by foreign body syndrome are presented in the following order:
82.27% foreign body in the rumen web, 12.65% perineal abscess, 3.79% traumatic peritonitis (TRP) and 1.6% esophageal obstruction (Table 5).

DISCUSSION
The presence of foreign bodies in the gastrointestinal tract is one of the most common problems on livestock farms (Aref and Abdel-Hakiem, 2013). Cases have been reported in Jordan (Majali and al. 1995), Pakistan (Jan Mohammad Khan and al. 1999), Nigeria (Igbokwe, 2003; Remi-Adeyunmi and al. 2004) Sudan (Mohammed and al., 2004). 2006 Ghurashi, 2009; (Vanitha, 2010; Hussain and Uppal, 2012, Khurshaid and al. 2013), India Germany (Bhatt and al. 2011) Rwanda (Mushonga and al. 2015), Iraq (Abu-Seida, 2016) and Algeria (Rouabah and al. 2017). The present study showed that the incidence of ruminal-reticular foreign bodies was 50.67% (n=298). Consists mainly of plastic waste. The high foreign body rates in this study may be related to the increased and unrestricted use of plastic bags as well as the distance from the landfill to the farm.
A similar prevalence of 59.14% was reported by Khurshaid and al. (2013) in Pakistan. Controversial frequencies of 12 and 38.6% were reported in Ethiopia, respectively, by Ngoshe (2012) and Akinbobola and al. (2016) in Nigeria
he lower frequency of foreign body syndrome in females than males are due to the fact that fewer females are slaughtered than males (Rouabah and al. 2017). This result is consistent with the results of Mekuanint and al. (2017), who reported the

difference in prevalence observed in bulls of 155 heads (23.8%) and cows of 114 heads (22.7%). However, this result is inconsistent with the results of Mushonga and al. (2015), Akinbobola and al. (2016), Kassahu and Tesfaye (2017) who detected more foreign bodies in cows (20.0%)), (18.42%), (17.22%) compared to men (15.7%), (8.06%) and (17.15%). Most foreign bodies are accidentally ingested, but animals may also intend to consume them to correct nutritional deficiencies. The variety of foreign bodies mainly depends on the environment in which the animal is raised. Igbokwe and al. (2003) reported that various objects such as metal, dried seeds and strings can be ingested indiscriminately when combined with other palatable foods. However, some authors report that plastic is the most common foreign body in cattle (Igbokwe and al. 2003, Adeyunmi and al. 2004, Tesfaye and al. 2012, Shepherd and al. 2014, Negash and al. 2015 and Akinbobola and al. 2016). The present study reports that traumatic peritonitis (TRP) and periretinal abscess are more or less common diseases in cattle with foreign body syndrome. This review is shared by Misk and al. (2001), who found 32 cases of TRP and 6 peri-retinal abscesses.

CONCLUSIONS
Ingestion of foreign bodies is common in cattle slaughtered at Batna City slaughterhouse. The main cause is plastic waste. Foreign body syndrome leads to many disorders and complications that are detrimental to Cattle breeding farms health and productivity, such as rumen occlusion, perireticulare abscess and traumatic reticulo-peritonitis (TRP)

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ANALYSIS OF BLUE WATER CONSUMPTION OF DAIRY COWS IN THE CONTEXT OF CLIMATE CHANGE

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Abstract

Agriculture plays a significant role in climate change, both as a contributor to greenhouse gas emissions and as an industry vulnerable to the impacts of climate change. Agriculture is a major consumer of water, accounting for a significant proportion of global freshwater withdrawals. Agricultural water use refers to the amount of water used for irrigation, livestock and other agricultural activities. Exact water use varies by region, climate, crop type and farming practice. Water use on dairy farms can vary widely depending on factors such as farm size, number of animals, type of dairy system (conventional vs. pasture-based), climate and management practices. Dairy farms use water for a variety of purposes, including drinking water for cattle, cleaning and sanitation, cooling systems and irrigation for feed crops. The aim of this research is to determine the blue water use and consumption of five observed dairy farms in south-eastern Hungary. The focus of our study was on the extent of process water consumption and the possibilities for its reduction. The number of cows varied between 222 and 1280 (mean=589; standard deviation=342). The average number of lactations on the five farms was 2.01 (minimum = 1.84; maximum = 2.34). Four farms used a milking parlour and one farm used a robotic milking system. The number of milking units per parlour was 24, 32, 40 and 64. The robotic milking system worked with 12 milking units (6 robots with 2 units).The capacity of the cooling tanks was on average 23 m3 (minimum = 11; maximum = 40) for the five farms. We found that blue water consumption in the hottest summer month (August) was 55% higher than in the coldest month (January).The results clearly showed that the largest proportion of blue water consumption on a dairy farm is drinking water. In the hot summer period, 84% of the total water consumption was drinking water. In the winter this was 75% (55% cow and 20% growth).The average annual blue water consumption per cow was 120 m³. 90% of this was drinking water and the annual technological water requirement was 9.3 m³ per cow. The greatest amount of water was used on farms where udder washing was carried out.The blue water requirement for udder washing was on average 36% of the total process water (minimum = 26%; maximum = 51%). This value depended on the number of daily milkings and the type of udder washing technology. Overall, it was found that the consumption of blue water by dairy cows can be significantly reduced, mainly by appropriate, less wasteful washing practices and by eliminating udder washing.

Keywords: *Climate Change, Dairy Production, Water Consumption Of Animal Production,*

EFFECT OF THE ADDITION OF PRO- AND PREBIOTICS TO FEED ON THE GROWTH PERFORMANCE AND MEAT QUALITY OF ILE-DE-FRANCE LAMBS

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Abstract

The study was conducted in the sheep farm at the Agricultural Institute - Stara Zagora. A total of 45 lambs were included in the experiment, divided into three groups of 15 each - one control and two experimental groups. The three groups of animals were formed by the method of analogues in terms of live weight, sex and type of birth. The animals of the first experimental group received 4 g of Zoovit probiotic individually once a day, and those of the second experimental group received the same amount of probiotic with the addition of 8 g of the prebiotic Immunobeta. The following indicators were analyzed - live weight at the beginning and end of the experiment, average daily growth and slaughter age in days. The duration of the experiment was until reaching a live mass of 23-25 kg. After reaching this live weight, 5 male lambs from each group were slaughtered. Musculus Longissimus Lumborum meat samples were taken from each slaughtered animal. The samples were analyzed to determine chemical composition and technological properties. It was found that the animals of the I experimental group had a 21.74% (P≤0.01) and those of the II experimental group a 17.39% (P≤0.01) higher growth compared to the control group. The two experimental groups of animals reached the slaughter age in a shorter time compared to those of the control P≤0.001. No significant differences were found between the groups in terms of carcass yield. It was found that the Water Holding Capacity in the meat of both experimental groups was lower, compared to the control, which is an indication that the loss of water in the meat in the lambs of the I and II experimental groups were higher than those of the animals of the control group. No significant and reliable differences were reported between the groups regarding the chemical composition, amino acid and fatty acid composition of the meat. As a result of the conducted research, it can be claimed that the addition of 4 d of probiotic Zoovit and 4 g of probiotic Zoovit + 8 g of prebiotic Immunobeta has a positive effect on the intensity of growth of lambs.

Keywords: Ile de France, Pro- And Prebiotics, Meat Quality

SNPS IN BOAR SPERMATOZOA AND THEIR ASSOCIATION WITH SEMEN FREEZABILITY

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Abstract

The artificial insemination (AI) using cryopreserved semen enables a widespread diffusion of gametes with superior genetics and, if managed appropriately, holds economic advantages. However, the physical changes induced during freezing and subsequent thawing can lead to alterations in the morphology and function of spermatozoa, compromising their viability and reducing their fertilization capacity. To address this issue, several techniques have been developed to enhance the cryopreservation of spermatozoa, including the formulation of novel cryoprotective agents and the optimization of semen freezing methods. Nevertheless, the utilization of cryopreserved boar semen in AI remains restricted due to the poor quality of semen post-thawing. The primary challenge remains in achieving a post-thaw percentage of viable sperm that ensures this practice economically sustainable within the swine industry. In recent years, the advancement of molecular genetic techniques has facilitated the identification of associations between specific genes and semen quality, including motility and membrane integrity, Therefore, there has been an increasing interest in uncovering the molecular mechanisms that influence semen quality. The aim of this study was to evaluate the associations between gene polymorphisms and post-thawed semen quality in boars with varying semen freezability. A panel of 10 single nucleotide polymorphisms (SNPs) proposed as potential markers of freezability by Mankowska et al. 2020 (Int. J. Mol. Sci. 21, 1902.) for Polish Large White boars was used. Five SNPs (MAP3K20, RAB3C, FBXO16, PLBD1 and SCLT1gene) were genotyped by Real Time PCR, whereas the other five (MS4A2, PRICKLE1, EML6, ROBO1, and OXSR1 gene) were analyzed by Sanger Sequencing. The study included 41 boars aged between 6 and 12 months. The semen was collected in the non-summer periods with three collections performed for each boar. Semen was frozen at a concentration of 1200 million/mL in 500 μL straws by programmable freezer. After thawing, the percentage of Total Motility (TM) and Membrane Integrity (MI) was measured by automatic systems. The semen freezability was evaluated by calculating the Percentage of Viable Sperm (PSV) using the lower value between TM and MI and high semen freezability level was defined when it exceeded the third quartile of PSV (37.2%) All semen collections for each boar exhibited the same level of freezability, therefore it was possible to define the semen freezability level per boar; 7 boars had a high semen freezability (PSV > 37.2%), while the other 34 had a medium-low semen freezability. SNPs allelic frequency per boar was analyzed by Fisher´s exact test and an association between allelic frequency and semen freezability level was observed for SNPs in the RAB3C and PLBD1 genes (p value <0.01). The results of this study suggest that SNPs within the RAB3C and PLBD1 genes are promising candidate markers for the implementation of genetic selection strategies aimed at enhancing semen freezability in Duroc and Large White boars.

Keywords: Boar, Sperm, Freezability, SNP

THE INFLUENCE OF SODIUM BUTYRATE ON THE IMMUNE GENES EXPRESSION IN THE SPLEEN AND CECAL TONSILS OF BROILER CHICKENS

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Abstract

The relation between bioactive nutrition additives (BNA) and intestinal immunomodulation health management of chicks is a subject with an increasing interest in research. An increase research is also associated with the ban on the use of antibiotics in industrial poultry farming. Therefore, the effect of BNA on the peripheral immune system is significant for growth of chicken as a part of ONE health conception. The spleen is a secondary lymphoid organ which most important functions are: production and storage of primarily B lymphocytes; 2 filtration of blood and destruction of erythrocytes and antigens. The cecal tonsils (CT) are positioned as the largest lymphoid aggregates of avian gut-associated lymphoid tissue. They are adjacent to intestinal microbiota- associated molecular patterns. Also they elicit protective immune responses against bacterial and viral pathogens in the intestinal tract of avian species. Short chain fatty acids such as sodium butyrate could play an important role in targeted regulation of the gut microbiome quality for local and systemic immunity. Changing of gut microbial and depletion of luminal butyrate have been well documented in the publications of systemic and GI inflammatory disorders. Due to substantial contrasting results of sodium butyrate (SB) as component of feeding additives for chicken, there is heightened interest in in-ovo pre-immunomodulatory by resetting of gut microbiome program or by increasing its beneficial metabolites. The aim of this study was to analyze the effect of in-ovo supplemented of postbiotic on the expression of immune genes encoding cytokines in the spleen and cecal tonsils. One thousand fertilized eggs of Ross 308 broiler chicken on d 12 were set in an incubator under standard conditions. On the 12th day of incubation, the eggs were randomly divided into 4 experimental groups with 250 eggs in each group. The groups were injected with: 1) the control group injected with 0.2mmol/L physiological saline (0.9%), 2) postbiotic SB(0.1%), 3) postbiotic SB (0.3%), 4) postbiotic SB (0.5%). After hatching 60 chicks were selected for rearing. The tissues of spleen and cecal tonsils for RNA isolation was collected post-mortem at 42th day of life. Collected tissues were stored in stabilizing buffer (fix RNA). Relative gene expression analysis was performed by RT-qPCR for the following genes: IL-1ß, IL-2, IL-4, IL-6, IL-8,IL-12 IL-10, IL-17 , IFN-ß and IFN-ɣ . The results shows that the expression of most studied genes in cecal tonsil cells differed significantly between groups (p<0.05). The addition of SB decreased the expression of IL-6, IL-17, IL-12 genes and increased IL-10 and betta interferon (IFN- ƃ). The results of gene expression in the spleen were similar but less pronounced. The optimal administered dose of SB corresponds to the data of GROUP 2(SB 0.3%) and GROUP 3 (0.5%). In conclusion, sodium butyrate is partly effective at anti-inflammatory cytokines while induces an anti-inflammatory response. The study was financed by grant UMO-2021/43/D/NZ9/01548 funded by the National Science Centre (Poland)

Keywords: *Sodium Butyrate, Postbiotic, Spleen, Cecal Tonsils*

BEDDING MITES AND INSECTS IN LIVESTOCK FACILITIES IN TERMS OF DRY SANITIZATIION USING ALUMINOSILUCATE MIXTURES

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Abstract

Arthropods, especially mites among them, associated with the environment of poultry farms, pose a serious threat to birds as disease vectors in poultry production. Parasitic mites in livestock production are a stressor that reduces potential rearing performance and can even lead to episiotics. To date, no effective method of reducing their impact has been developed without the use of dedicated insecticides. Aluminosilicates, as natural minerals, have a high sorption potential for water and dissolved chemicals, including nitrogenous compounds. The physical property of aluminosilicates is characterized by high clinginess, which enhances the ability to permanently adhere to the body of invertebrate organisms, and they also have the effect of lowering the relative humidity of the environment. Dry sanitization can support bioassurance measures in livestock facilities, both on large-scale and small-scale farms. The purpose of this study is to determine the effect of using dry sanitization on mite and insect populations found in litter during poultry production and maintenance. Dry sanitization was carried out after washing livestock facilities prior to stocking using an aluminosilicate mixture and a dedicated blower at a rate of 0.5 kg per 1 m2 of floor area in the facility at a rate of 1/5 to the floor area (0, 1 kg/ 1 m2 of floor area). During rearing, pollination was repeated in the presence of flocks on the 14th, 28th, 36th and 41st days of the experiment, taking into account the production cycles in the production units. On these dates, before sanitization as well as after, during rearing, litter samples were taken according to acarological methods, in 10 replicates, each with a volume of 500 cm3. The sampled material was subjected to the weeding process (14 days) using modified Tullgren apparatuses. Captured specimens were preserved in 90% denatured ethanol in glass vials. The essence of the Tullgren apparatuses is, among other things, to reduce the moisture content of the material in the samples, which causes the fauna to escape from the samples into the vials. The extracted material was subjected to selection with the life of a stereoscopic microscope in order to taxonomically identify individuals of each group of organisms. Selected and sectioned specimens were placed in Durham tubes and ethanol vials. Biological preparations were made with Hoyer´s fluid or lactic acid for determination using light microscopes. For the results, quantitative analysis was performed using analytical and synthetic indicators, followed by statistical analysis. A total of 1,331,670 mite specimens were obtained, among which Caloglyphus berlesei (Michael, 1903) (Acari: Astigmata: Acaridae) accounted for 99.8% of the total Acari found. Among mites, Dermanyssus gallinae, Histiostoma sp., Glycyphagus sp., Cheyletidae were also found. From the group of insects, 148 individuals were obtained, 99.9% of which were Alphitobius diaperinus. The highest average abundance of mites was recorded on the 28th day of maintenance (83,581 individuals in 500 cm3). The maximum abundance of mites per gram of litter was 1,911 individuals. The mite population relative to the control plot increased 164-fold, on the 14th day of maintenance the population again increased more than 8-fold, on the 36th day of maintenance the mite population decreased 2.4-fold and on the 41st day of maintenance the mite abundance decreased 8-fold, which was confirmed statistically significantly (P<0.001). Insect abundance relative to the control on the 14th day of maintenance of the flock decreased nearly 9 times (8.6), then on the 28th day of maintenance, insect abundance decreased again 4 times, until it completely disappeared on the 36th day and 41st day of maintenance, i.e. the decrease occurred by 100% to zero abundance. Dry sanitization with aluminosilicates significantly reduces the population of mites and insects present in the litter bed in poultry farms. The adopted method of sanitization has a great practical dimension, increases the standards of poultry welfare, reduces the level of risks from disease transmission, especially protozoa.

Keywords: *Mites, Calogyphus berlesei, Aluminosilicates, Dry sanitization, Livestock building*

PROBIOTICS PERFORMANCE IN THE DIET OF BROILERS

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Abstract

The impact of biotechnology in poultry nutrition is of significant importance. Biotechnology plays a vital role in the poultry feed industry. Great deal of attention has recently been received from nutritionists and veterinary experts for proper utilization of nutrients and the use of probiotics for growth promotion of poultry. Probiotics in animals as well as in humans are being extensively studied, due to its effect on the restoration of the intestinal microbiota, reversal of dysbiosis (gastrointestinal imbalance), and safety in its use. In addition to bacteria, fungi, and yeast strains, mainly from the species of Saccharomyces cerevisiae and Kluyveromyces are also used as probiotics. Several probiotic strains are included in poultry diets to promote animal growth and health, especially when conditions are challenging for health. In broiler, however, even today, it is still not possible to accurately predict the effect of probiotics, due to several intrinsic and extrinsic factors that interfere with their use and results tend to be different between studies. The purpose of this study is to critically analyze the main effects of probiotics applications in broilers diet. Thus, the present study was planned to evaluate the effect of different probiotic products (produced be Enzym Group) on broiler performance, antioxidant and biochemical indexes, microbiota state and intestinal health. Research was conducted at the Institute of Animal Biology (Lviv, Ukraine). Fifty fifteen–day–old Ross broiler chicks were divided into 5 groups (by the principle of analogues). Before experiment started broilers have need vaccinated (according to vaccination program). Grower (21–35 d) and finisher (35–42 d) diets were formulated by using 4 different probiotics (control group – standard diet, 1st experimental group - Saccharomyces cerevisiae, 2nd experimental group – Kluyveromyces marxianus Ch2 (produced in R&D Enzym Group), 3rd experimental group – Kluyveromyces marxianus M13 (produced in R&D Enzym Group) and 4th experimental group – commercial strain of Kluyveromyces marxianus B03. Significant differences in the growth performance were observed during all trial periods. Weight gain was significantly increased by probiotic supplementation compared to control diet. Compared to control group weight of broilers that got S. cerevisiae in the diet was higher by 45% (p<0.005); broilers that got Ch2 – by 34.5% (p<0,05); broilers that got M13 – by 44.3% (p<0,0001); broilers that got B03 – by 39.3% (p<0,005). The results of microbiological studies of the caecal content of chickens showed intergroup differences as well. The abundances of E. coli tend to increase in the control birds. In the same time the the lowest level was noticed in the groups with S.cerevisiae and M13 in the diets. The abundances of Lactobacillus and Bifidobacterium increased in the caecal content of chickens of all experimental groups, but the highest level observed in the groups that were fed with S.cerevisiae and M13. The supplementation of probiotics in feed could improve the growth performance and positively influence the morphological characteristics of the intestine and ameliorate the community and structure of the intestinal microbiota of broiler chicks. In this context trials showed the best performance of S. cerevisiae and Kluyveromyces marxianus M13 (both produced by Enzym Group).

Keywords: *Probiotica, Yeast strains, Weight gain, microbiota*

RELATIONSHIP BETWEEN MILK YIELD, COMPOSITION OF MILK, SOMATIC CELL COUNTS AND FERTILITY OF POLISH HOLSTEIN-FRIESIAN COWS

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Abstract

Long-term, clearly targeted selection for the increase in milk yield of dairy herds has contributed to the decline in cows' health and the increase in the share of culled cows due to reproductive problems. Fertility traits are in many countries, including Poland, an important component of selection indices used in the improvement of dairy cattle. The aim of the research was to determine the strength and direction of the relationship between milk yield, its composition, the number of somatic cells and selected fertility traits of cows such as insemination index, service time, length of inter-pregnancy and inter-calving periods. The research included 243 cows in lactations from 1 to 3, used in a high-production farm in the Kuyavian-Pomeranian Voivodeship (Poland). The strength and direction of the relationship between milk yield and fertility characteristics were determined statistically by calculating Spearman´s rank correlation coefficients. The correlation analysis took into account the milk yield results for the first and second full lactation, as well as a division into subsequent phases of both lactations (5-100, 101-200, 201-305 days). As a result of the conducted analyses, a negative effect of milk yield in different stages of lactation, as well as in full lactations, was found on the fertility characteristics of cows. High, positive (unfavourable) correlations between milk yield in the first full lactation and the insemination index (0.710) and the time of service of primiparas (0.720), as well as the first inter-calving period (0.706) and inter-pregnancy period (0.706) require special emphasis. It is worth noting that the milk yield in the subsequent stages of lactation statistically correlated with the service time in the second lactation, and the strength of this relationship increased with the advancement of lactation - from 0.140 to 0.254. The determined relationships allow to conclude that too intensive selection of cows for milk yield may contribute to the deterioration of the profitability of production. At the same time, a number of negative, statistical relationships between lactose content in milk and fertility characteristics were found. In particular, the high (-0.698) relationship between lactose content in full primiparous lactation and the insemination index in the second lactation is emphasized. The above facts suggest that in a herd of dairy cows, the content of lactose in milk should be used as a selective feature.

Keywords: *Milk Production, Composition, Somatic Cell Counts, Fertility, Correlations*

ASSESSMENT OF GROWTH AND DEVELOPMENT OF HYBRID DUCKLING OFFSPRING

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Abstract

Currently, for agricultural enterprises of all ownership forms in the Republic of Kazakhstan, issues related to improving breeds, crosses, and lines of waterfowl remain important. Additionally, technologies for housing and feeding that enhance the survival and productivity of poultry are of great significance. The use of the genetic resources of domestic poultry breeds in breeding work, as well as the preservation of rare and endangered populations, holds special importance due to their high adaptive qualities in terms of both the quality and quantity of the obtained products, and their suitability for local feed and eco-climatic conditions. As a result of conducted research, an assessment of the quality of paternal and maternal lines of crosses from local duck populations in the Northern region of Kazakhstan has been performed, and indicators of growth, development, and survival of the obtained hybrid offspring have been studied. The conducted research has established that the "Ansar" crossbred ducklings exhibit higher growth energy along with a 94% survival rate of the offspring in early age.

Keywords: *Duck; Growth; Development; Line; Cross Selection; Safety.*

INTRODUCTION

Duck farming is a growing segment of the global poultry industry, and recently, there has been an increase in the production of duck farming products. As worldwide consumption of duck meat has increased, the efficiency of this component in poultry farming is gaining greater significance. Currently, experts from the Food and Agriculture Organization (FAO) observe a trend of rising duck meat consumption, and this trend is expected to continue in the future.

Moldajanov K.A. and others note that breeding work with waterfowl is aimed at improving previously developed lines and creating new ones, with a focus on high growth rates, reproductive performance, and low feed costs per unit of production. The production of duck meat in the Republic of Kazakhstan was previously based on the use of 4-5 lines and populations of Pekin breed, with the Medeo cross lines (M-1 paternal and M2-maternal) gaining the widest popularity. However, many domestic lines and populations, such as the "Bishkulskaya Tsvetnaya" and "Kyzylzhar" crosses, whose population is concentrated in the Northern region, represent a rich genetic resource and can be used in creating new crosses.

Conducted research evaluating the productive and breeding qualities of local duck populations in the Northern region of Kazakhstan has provided an opportunity for targeted breeding efforts to create and maintain high-productivity poultry. These efforts aim to ensure highly efficient production of eggs and meat, adaptable to both industrial conditions and the conditions of small-scale and farm enterprises.

In breeding work with domestic duck crosses, a program based on a scoring system for assessing the productivity of parents and the live weight of offspring is used. The selection of young birds for the breeding group is carried out at the age of 46-47 days. The scoring assessment conducted at this age allows for the selection of the most valuable young birds in terms of breeding.

Reiter Ya.S. and colleagues noted in their research that the reproductive qualities of ducks are to some extent dependent on the live weight of replacement drakes. Previous studies have indicated that for reproduction, drakes should be selected whose live weight at the time of selection for the breeding group exceeds the average value for the line by 0.5-1.5 times the standard deviation.

MATERIALS AND METHODS

A methodological approach for assessing the reproductive and productive indicators of ducks was developed through experiments and data

analysis of the "Kyzylzhar" and "Bishkulskaya Tsvetnaya" crosses from the collection flock at the "Bishkulskaya Poultry Farm" in the Republic of Kazakhstan. Subsequent works involving the practical testing and application of the obtained two-line poultry cross were conducted under the conditions of the "Qaz Astana" Farm in the Akmola region.

The ratio of drakes to ducks in each nest was 1:4. Drakes were evaluated for external indicators of reproductive organ development before being placed in nests. Individuals with inflammatory processes, underdevelopment, or injuries were eliminated.

During the selection and breeding of breeders, inbreeding was avoided due to the application of cyclic selection technology.

Duck live weight was determined through weekly weightings of 10% of marked control stock, from day-old chicks to 49-week-old birds. Based on the live weight data during different growth periods, absolute and average daily growth rates were calculated.

Biometric data analysis was conducted using the variation statistics method by N.A. Plokhinsky and E.K. Merkuryeva, as well as in the Microsoft Excel software.

RESULTS

For establishing duck lines, families with optimal live weight, high hatchability, viability, and standard egg production were used as paternal forms, while maternal forms consisted of families with high egg production (peak value and egg-laying stability), viability, and egg hatchability. In each specific batch of drakes, selection was based on the standard deviation of live weight from the line's average. Paternal drakes were selected based on a live weight 2δ or more above the average, and females were selected at $0.5\ \delta$ or more above. On the maternal side, drakes and ducks with average or higher live weight were chosen. According to the research methodology, ducklings were evaluated at 7 weeks of age based on live weight and meat body conformation.

During the research, the growth and development of the breeding stock were studied (Table 1).

Table 1. Live Weight of Breeding Stock, g

Age, days	Group	
	Ducks	Drakes
Day-old	49,5±0,37	49,9±0,39
7	207,6±0,65	210,7±0,29
14	438,4±0,78	511,7±0,76
21	824,2±0,98	861,6±0,87
28	1223,4±0,68	1380,8±0,85
35	1668,2±0,48	1776,7±0,84
42	2234,1±0,79	2435,3±0,29
49	2581,4±0,37	2792,3±0,63

Weighing ducks at 7 weeks of age revealed an average weight of 2,581 g, which was 7.6% lower than that of drakes. The selection of paternal line drakes for improved meat productivity and maintaining fertility levels allowed achieving a live weight at 7 weeks of age at 2,792.3 g for drakes and 2,518.4 g for ducks.

The productive indicators of ducks were studied over 40 weeks (Table 2).

Table 2. Productivity indicators of parental duck forms

Indicators	Line	
	Paternal	Maternal
Egg production at the start of the laying period over 40 weeks, eggs.	190	185
Average egg weight, g	65,3	69,7
Adult duck survival rate, %	95	96
Incubated egg yield, %	95	93
Egg fertilization rate, %	87	86
Duckling hatch rate, %	66	70
Day-old duckling survival rate, %	70	85
Duckling yield per parental pair, heads.	130	140

During the 40-week laying cycle, egg production for the maternal line amounted to 185 eggs, which is 2.6% lower than the paternal line. The average egg weight for the maternal line was 6.3% higher compared to the paternal line. The incubated egg yield was 2% higher in the paternal lines. It's noteworthy that the duckling survival rate was high at 85% for the maternal line, resulting in a duckling yield of 140 individuals from the maternal line.

The selection of birds based on the target traits was carried out without the use of inbreeding. This

approach in line selection significantly enhances poultry fertility, reduces feed costs for production, improves or maintains the achieved live weight of ducklings at 7 weeks of age, ultimately increasing the output of products from the parent flock and lowering its cost.

Duck live weight is a primary criterion for evaluating meat productivity. Broiler ducks have low carcass fatness, higher muscle yield, and a higher meat yield per individual.

The live weight and growth dynamics of ducklings aged 1-7 weeks are presented in Table 3.

Table 3. The dynamics of duckling live weight, g

Age, days	Live Weight
Day-old	61,22 ± 6,06
7	233,22 ± 21,93
14	566,64 ± 75,79
21	940,62 ± 67,29
28	1345,5 ± 129,19
35	1952,32 ± 105,17
42	2534,1 ± 222,60
49	2913,9 ± 243,41
Survival rate, %	94
Absolute growth, g	2852,7
Average daily growth, g	58,5

The obtained data indicates a normal physiological growth and development of the poultry. The study revealed that according to experimental results, the average daily weight of the obtained ducklings was 61.22 g, and at 7 weeks of age, their weight during weighing was 2913.9 g. At 7 weeks of age, the absolute growth of the ducklings was 2852.7 g, while the average daily growth was 58.5 g.

DISCUSSION

Thus, the results of this study are relevant and will be used to meet consumer demand for domestically bred waterfowl adapted to the natural and climatic conditions of the region. These ducks exhibit high growth rates and lower fat content in the carcass while requiring minimal feed per kilogram of growth. According to the study's findings, maintaining fertility levels in both the maternal and paternal lines requires monitoring the dynamics of average daily body mass gains. Deviations from optimal growth rates could lead to reduced reproductive performance in the breeding stock.

In a study conducted by Chinese researchers Zeng, Q., X. Huang, Y. Luo, X. Ding, S. Bai, J. Wang, Y. Xuan, Z. Su, Y. Liu, and K. Zhang, it was established that compared to large meat ducks of foreign breeding, small-sized meat ducks developed from local duck lines in China not only have a favorable taste but also exhibit high nutritional value, a high meat yield, and low feed conversion ratios.

CONCLUSIONS

The ducklings of the created dual-line cross "Ansar" exhibit higher growth energy along with a high survival rate in early age, reaching 94%, compared to the parental forms.

ACKNOWLEDGEMENTS

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ANTIBIOTIC RESISTANCE PROFILE OF ESCHERICHIA COLI ISOLATES FROM PIG FARMS

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Abstract

Due to the widespread use of antibiotics for various infections among ruminants, multidrug-resistant bacteria are now common in both humans and livestock. In order to control bacterial resistance in farm animals, antibiotic resistance profiles of isolated bacteria must first be determined. The aim of this study was to determine the in vitro resistance of Escherichia coli (E. coli) isolates against 17 antibiotics isolated from nasal and rectal swabs from two pig farms in Lublin, Poland. For this purpose, a total of 41 nasal swab samples and 36 rectal swab samples were collected from healthy pigs. The samples were cultured on blood agar, MacConkey agar and Eosin Methylene Blue agar. The isolated bacteria were identified using conventional bacteriological methods. A total of 38 E. coli isolates were obtained, 18 from nasal mucosa and 20 from fecal samples of pigs. While all E. coli isolates were resistant to penicillin and erythromycin, 33 isolates (86.8%) were resistant to amoxicillin-clavulanic acid, 30 isolates (78.9%) to amoxicillin, 22 isolates (57.8%) to tetracycline, 21 isolates (55.2%) to streptomycin and 19 isolates (50%) to doxycycline. Additionally, E. coli isolates were resistant to at least 3 antibiotics. As a result of this study, multi drug resistant strains were isolated against various antibiotics commonly used in veterinary medicine and the increasing problem of antibiotic resistance in pig farms was emphasized. It was concluded that the importance of antimicrobial susceptibility tests and the use of antibiotics without these tests should be avoided.

Keywords: *Antibiotic Resistance, Escherichia coli, Pig Farms*

MODELLING WITH THE USE OF THE DECISION TREE TECHNIQUE OF THE NUMBER OF ATTEMPTS TO CONNECT THE MILKING CLUSTER TO THE TEATS BASED ON THE CHARACTERISTICS OF THE COWS´ CONFORMATION

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Abstract

Due to the persisting lack of suitably qualified farm employees, modern technologies, such as automated feeding systems, robots pushing the feed on the table and milking robots, are being intensively developed and implemented. Therefore, it is important for the breeder to answer the following question: "What conformation should a dairy cow intended for automatic milking have?". The aim of the study was to indicate the specific features of the body structure that reduce the number of failed attempts to connect the robotic arm to the teats. The study was conducted in a herd of 68 Polish Holstein-Friesian cows. The cows, in lactations 1 to 4, were milked by 2 GEA milking robots - Dairy Robot R9500. Data on the milking parameters of the controlled cows were recorded in the period from December 2022 to March 2023 - a total of 8,932 daily yields were collected. The cows were subjected to an official conformation assessment in accordance with the ICAR guidelines. According to the purpose of the research, the number of attempts to connect the milking cluster to the teat was forecasted using the decision tree technique. The SAS® Enterprise Miner program was used to model the number of connection attempts. The ranking of variables in terms of their importance in creating divisions of the dataset was made on the basis of the "Importance" measure. The cows included in the study represented a high level of milk production with a lactation capacity of 10,386 kg. Based on the statistical analysis, it was found that the following factors had the greatest impact on the number of attempts to connect the milking cluster, according to the descending ranking of the Importance measure: rear teats position, front teats position, rear udder suspension and rear udder suspension and bone structure. Based on the graphical model of the decision tree, it can be concluded that the fewest attempts needed to correctly attach the milking cluster (1.13 attempts/milking) were needed for cows rated 5, 6, 7 or 8 in the area of hind teat position; 2, 3, 4 or 7 for the front suspension of the udder; 3, 4, 6, 7 or 8 for bone structure; 3, 5, 6 or 7 for croup positions and 4 or 7 for hind leg stances.

Keywords: *Decision Trees, Body Conformation, Number Of Attempts, Modelling, Cows*

SEQUENCING OF THE COMPLEMENTARY SEX DETERMINER (CSD) GENE IN APIS MELLIFERA

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Abstract

The beekeeping sector is experiencing the adverse effects of climate change, while genetic diversity within honey bee populations is critical in order to provide the ability to adapt to environmental changes as well as diseases. Multiple mating by social insect queens is a natural mechanism that maintains genetic diversity among colony members, increasing adaptability. At the same time, it may be useful to monitor genetic variability in case of increased consanguinity due to selection and rapidly changing contexts. In addition, the maintenance of locally adapted genetic resources is important for the long-term survival and sustainability of beekeeping. In Italy, Apis mellifera ligustica and Apis mellifera siciliana are Italian endemic subspecies, while A. mellifera mellifera and Apis mellifera carnica can be found in border and mountain areas. Studies on genetic markers are useful for monitoring genetic variability and hybridizations, among the methods available, it is possible to use SNPs panels, microsatellites, and mitochondrial DNA (mtDNA) markers. Additionally, the sequencing of the gene for complementary sex determination (CSD) can provide valuable information to limit the risk associated with consanguinity, besides being useful to increase our understanding of mutations in the CSD gene in Apis mellifera and monitor its evolution. Indeed, the CSD gene is responsible for controlling the sex-determination molecular switch. Bees that are heterozygous for CSD develop into females, whereas hemizygous bees develop into males; the worker bees destroy all diploid males during the early stages of their development. In the breeding of queen bees, in the Italian subspecies in our case, adding the monitoring of the haplotypes of this gene to the phenotypic information limits the risk of experiencing a rapid decrease in variability, with the known negative consequences on the brood of the hives. In this study, we analysed the polymorphism of the complementary sex determination (CSD) gene in 100 samples of Apis mellifera ligustica, carnica, caucasica, carpatica, mellifera and the buckfast hybrid. Genomic DNA was isolated using the Modified Qiagen DNeasy Tissue Extraction method. The 996 bp sequences were analysed using the Thermo Fisher Scientific 3500 Series Genetic Analyzer and 12 SNPs were identified in the CSD potential-specifying domain (CSD-PSD). These include SNP Y (IUPAC nucleotide code) located at position 129 of Exon 6 and SNP M at position 119 of Exon 7 in Apis mellifera ligustica; and SNP W and SNP M located at position 12 and 175 of Exon 7 in Apis mellifera carnica and caucasica, respectively. The results of this study show the effectiveness of analysing the CSD gene polymorphisms for different Apis mellifera subspecies, suggesting indeed its usefulness in the management of risks associated with consanguinity in honey bee populations.

Keywords: *Complementary Sex Determiner, Beekeeping,Genetic Variability*

THE EFFECT OF TWIN BIRTHS ON THE COURSE OF DELIVERY, SURVIVAL RATE AND BODY WEIGHT OF CALVES IN DAIRY CATTLE HERDS

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Abstract

The aim of the study was to analyze the influence of the type of birth in dairy herds on its course, survival rate and body weight of calves. A total of 10,000 calvings registered between 2006 and 2020 were analyzed. Breeding documentation for 4 farms rearing Polish Holstein-Friesian black-and-white dairy cattle was provided by the Polish Federation of Cattle Breeders and Dairy Farmers. Data included type of birth (single and twin), difficulty of the delivery (independent, easy, difficult, very difficult, miscarriage, caesarean section) as well as the body weight of calves. In our research, the percentage of twin births was observed at the level of 7%. Single pregnancies were more often characterized as having independent and easy deliveries compared to twin pregnancies (differences of 4.12% and 6.51% in comparison to twin pregnancies). Significant statistical differences, for both types of pregnancies, were found for the course of difficult labour. There was an 11.13% higher rate of difficult births observed for twin pregnancies compared to single pregnancies, however, it should be noted that the difference in the number of single (9348) and twin births (298) was substantial. There was no incidence of very difficult deliveries, miscarriages and caesarean sections registered for twins, while for single births the percentage was as follows 0.02%, 0.46% and 0.02%, respectively. Based on our research, it can be concluded that the occurrence of twin births does not affect calf survival compared to single births. The postpartum body weight of calves differed slightly between calves from single and twin birth. The average weight of all calves ranged from 32.7 for twins to 36.5 kg for single births.

Keywords: Dairy cattle, Survival rate, Calf body weight, Pregnancy, Twin pregnancy

Author Index

Nationality of Presenters

Country	n	%
Algeria	5	4,55
Bulgaria	1	0,91
Czechia	1	0,91
Denmark	1	0,91
France	1	0,91
Hungary	4	3,64
Iran	5	4,55
Italy	2	1,82
Kazakhstan	6	5,45
Mexico	1	0,91
Nigeria	4	3,64
Pakistan	3	2,73
Philippines	1	0,91
Poland	22	20
South Africa	4	3,64
Türkiye	48	43,64
Ukraine	1	0,91
TOTAL	152	100