REPUBLIC OF TÜRKİYE
MINISTRY OF AGRICULTURE AND FORESTRY
GENERAL DIRECTORATE OF AGRICULTURAL RESEARCH AND POLICIES
International Center for Livestock Research and Training

TAGEM
R & D - INNOVATION

4th International Livestock Studies Congress

15.09.2025 Abstract Submission Deadline
06.11.2025 Check in and registration
07-08.11.2025 Congress presentations
09.11.2025 Check out

Address
Selectum Family Resort
Belek/ANTALYA

Congress Topics

- Animal Biotechnology
- Animal Breeding and Genetics
- Domestic Animal Genetic Resources and Sustainable Conservation
- Animal Nutrition, Feed and Feed Additives
- Livestock Behaviour, Welfare, Herd Management and Health
- Reproduction, Obstetrics and Udder Health in Livestock
- Livestock Economy
- Sustainable Animal Production and Environment

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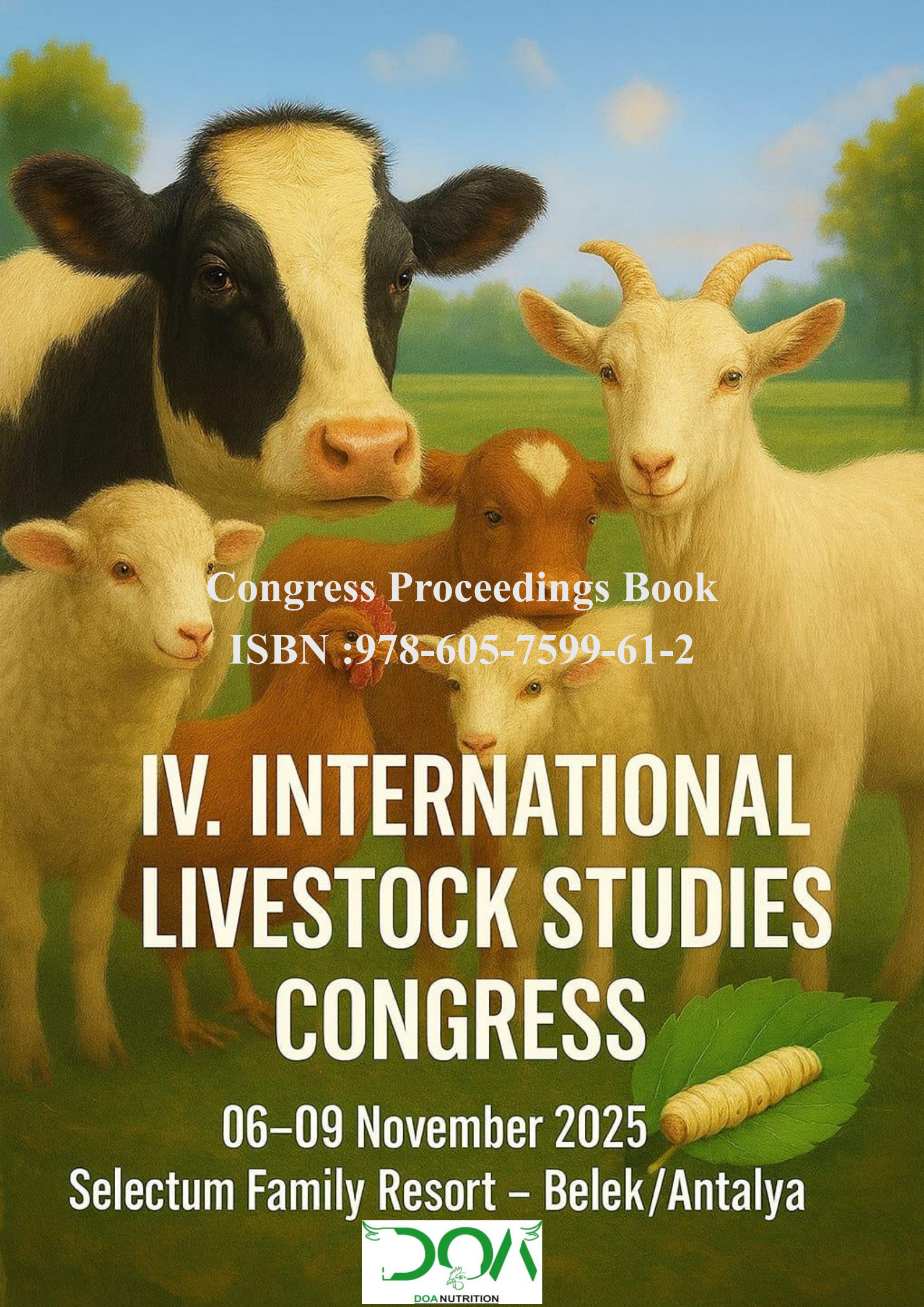
Congress Proceedings Book
ISBN :978-605-7599-61-2
IV. INTERNATIONAL LIVESTOCK STUDIES CONGRESS
06–09 November 2025
Selectum Family Resort – Belek/Antalya
DOA NUTRITION

IV. INTERNATIONAL LIVESTOCK STUDIES CONGRESS

International Center for Livestock Research and Training was established to study on Angora goat breeding and improvement of mohair quality in 1931. The Institute started to research and development studies in livestock study field in 1951 within the Ministry and continues its studies in Breeding, Genetics, Animal Husbandry, Herd Management, Animal Production, Animal Nutrition, Animal Biotechnology, Embryo Production and Transfer, Frozen Semen Production and Artificial Insemination. International Center for Livestock Research Training continues to serve with new scientific studies focused on problem-solving for the livestock sector with its strong technological and personnel infrastructure. It is a great pleasure and honor to invite you to IV. International Livestock Studies Congress will be held in Antalya/ Turkey, between 06.11.2025 and 09.11.2025. The meeting is where professionals meet to share ideas and advance scientific and technical knowledge. As this conference deals with the basics concepts, students, delegates, academicians and business people can attend the conference to root up the knowledge and excel in this field.

Conference Topics

Animal Biotechnology
Animal Breeding and Genetics
Domestic Animal Genetic Resources and Sustainable
Conservation Animal Nutrition, Feed and Feed Additives
Livestock Behaviour, Welfare, Herd Management
Health Reproduction, Obstetrics and Udder Health
in Livestock Livestock Economy
Sustainable Animal Production and Environment

Invited Speakers

Prof. Dr. Abdul Chaudhry

Prof. Dr. Heinrich Bollwein

Prof. Dr. Katrin Giller

Prof. Dr. Armağan Hayırlı

Dr. Dragos Gabriel Scarlet

Dr. Androniki Psifidi

Carolina Herrera

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Prof. Dr. Çiğdem TAKMA	Ege Üniversitesi

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ULUHAEM LALAHAN

TAGEM AR-GE & İNOVASYON

07.11.2025 SALOON A		
09:00	09:30	Opening Speeches
09:30	10:00	**Prof. Dr. Abdul Chaudry** / Innovative Diets to Optimise Animal Nutrition
10:00	10:15	**Prof. Dr. M. Kemal KÜÇÜKERSAN** / Effects of Purified Cannabidiol (CBD) Isolate on Growth Performance and Feed Conversion Ratio (FCR) in Broiler Chickens
10:15	10:30	**Yusuf MIZRAK** / DOA NUTRITION
10:30	10:50	Coffee Break
10:50	11:20	**Prof. Dr. Katrin GİLLER** / Spirulina as Alternative Protein Source with Biofunctional Properties in Ruminant and Monogastric Nutrition
11:20	11:35	**Dr. Ayten Aşkın KILIÇ**/ Histopathological Examination of Brain Changes Caused by Black Cumin Meal Added to the Diets of Chickens Exposed to Acute and Chronic Noise
11:35	12:05	**Dr. Murat Doğu**/ Pelemir (Cephalaria syriaca L.) Plant: A Sustainable Feed Source for Laying Hens
12:05	12:20	**Dr. Tuğba KARAKAN TUNCER** / The Role of Increasing Protein Levels in Artificial Diets on Shaping the Cocoon Quality of the Silkworm (Bombyx mori L.)
12:20	14:00	Lunch
14:00	14:15	**Prof. Dr. Armağan HAYIRLI** / Management of the Body Condition in Dairy Cows
14:15	14:30	**Dr. Burak ARTUT** / The Effect of Dried Modified Vinasse, Slow-Release Urea, and Ammonium Sulfate Additives on Rumen in situ Degradation Characteristics in Concentrated Feeds
14:30	14:45	**Dr. Serkan Süleyman ŞENGÜL** / Methane Emission and Methanogenic Microbiome in the Rumen of Boz Cattle
14:45	15:15	Coffee Break
15:15	15:30	**Doç. Dr. Sakine Ülküm ÇİZMECİ** / Some Biomarkers Used in the Diagnosis of Subclinical Mastitis
15:30	15:45	**Doç. Dr. Ayşe Merve KÖSE** / Is There a Relationship Between Somatic Cell Count and Udder Health in Saanen Goats
15:45	16:00	**Doç. Dr. Feray ALTAN** / Antibiotic Therapy in Subclinical Mastitis in Goats
16:00	16:15	**Dr. Tülay AVCI** / Quality Testing of Non Steril Veterinary Antimicrobial Products Used For Livestock in Turkey
16:15	16:30	**Dr. Serdar YAĞCI** / Status Assesmentof the National Small ruminant Breeding Project under Breeding Conditions
16:30	16:45	Coffee Break
16:45	17:00	**Dr. Oktay KANKILIÇ** / Integrated Project fort he Conservation and Sustainable Use of Domestic Animal Genetic Resources
17:00	17:15	**Prof. Dr. Mahmut KESKİN** / Can Goats be Utilized in the Prevention of Forest Fires
17:15	17:30	**Prof. Dr. Gürsel DELLAL** / Genetic Improvement of Angora Goat in Turkey: Current Situation, Obstacles, and Opportunities
17:30	17:45	**Doç. Dr. Erkan PEHLİVAN** / Effect of Some Environmental Factors on Hair Cortisol Concentrations in Newborn Akkeçi Goat Kids
17:45	18:00	**Dr. Nurgül ERDAL** / Farklı Çevre Koşullarındaki Akkaraman Irkı Koyunların Ham Lanolin Miktarının Belirlenmesi

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08.11.2025 SALOON A		
09:00	09:30	**Dr. Androniki Psifidi** / Livestock Genetics Towards Sustainable Agriculture, İmproved Animal Welfare and Public Health: The Examples of Cattle Lameness and Avian İnfluenza
09:30	09:45	**Doç. Dr. Yalçın YAMAN**/ Machine Learning–Driven Discovery of Host Genetic Factors for Paratuberculosis (Johne's Disease) in Goats Within the One Health Framework
09:45	10:00	**Doç. Dr. Seyrani KONCAGÜL** / Genomic Breeding Value Estimations in Holstein Friesian and Simmental Cattle in Türkiye: Applications from 2017 to 2025
10:00	10:15	**Dr. Mesut YILDIRIR** / Effect of Herd Size on First Lactation Milk Yield Trends in Holstein and Simmental Cattle in Turkey
10:15	10:30	**Anıl KASAKOLU** / Genome-Wide Association Study for Binary Traits with Logistic Mixed Model Method: Simmental- Fleckvieh Conformation Traits
10:30	10:45	**Semih YAZICI** / Comparative Evaluation of Machine Learning Models—LASSO and Elastic Net—for Genetic Association Mapping Using Simulated Phenotype Data
10:45	11:00	**Coffee Break**
11:00	11:15	**Prof. Dr. Orhan KARACA** / Evaluation of Reproductive and Growth Traits in Karya Sheep Breed based on Large-Scale Data
11:15	11:30	**Prof. Dr. İbrahim CEMAL** / Comparative Growth Performances of Kıl Goats in Different Production Environments
11:30	11:45	**Doç. Dr. Onur YILMAZ** / Environmental and Genetic Factors Affecting Growth Characteristics in Kıvırcık Sheep
11:45	12:00	**Dr. Aylin DEMİRAY** / Assessment of DNA Damage in Long-Term Cryopreserved Bovine Ear Fibroblast Cells Using the Comet Assay
12:15	12:30	**Nadia LOURENS** / Thermo Fisher Scientific
12:20	14:00	**Lunch**
14:00	14:30	**Prof. Dr. Heinrich Johann Bollwein** / Evaluation of bull fertility-functional and molecular approaches
14:30	15:00	**Prof. Dr. Carolina Herrera** / Effect of Sperm and Oocyte Quality on The Development of Bovine İn Vitro Produced Embryos
15:00	15:15	**Prof. Dr. Umut TAŞDEMİR** / Cryoprotective Effects of Flavonoids on Freezing of Ram Semen
15:15	15:30	**Coffee Break**
15:30	16:00	**Dr. Dragos Gabriel SCARLET** / Advances in in-vitro embryo production: A tool for sustainable herd improvement
16:15	16:30	**Dr. Gizem Güven ATEŞ** / Bovine Embryonic Stem Cell Derivation and Gastruloid Formation
16:30	16:45	**Abdurrahman ALAKUŞ** / Sperm ProAKAP4 Concentration in Goats: Seasonal and Breed-Dependent Variations and Associations with Post-Thaw Motility and Kinematic Parameters
16:45	17:00	**Dr. Mesut KIRBAŞ** / The Effect of Selective COX-2 and Non-Specific Nonsteroidal Anti-İnflammatory Drug Applications on Pregnancy Rate in Central Anatolian Merino Ewes
17:00	17:15	**ITECH ROBOTIC** / The Strategic Role of Autonomous System in Agriculture and Livestock

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ULAHAEM LALAHAN ULUSLARARASI HAYVANCILIK ARAŞTIRMA VE EĞİTİM MERKEZİ MÜDÜRLÜĞÜ

TAGEM AR-GE & İNOVASYON

07.11.2025 SALOON B		
09:00	09:30	**Opening Speeches**
09:30	09:45	**Prof. Dr. Orhan Karaca** / Perceptions and Expectations of Farmers on Traditional Free-Ranging Cattle Farming in Aydın and Muğla Provinces
09:45	10:00	**Prof. Dr. Mahmut Keskin** / How should the Kilis goat breeding project be revised
10:00	10:20	**Coffee Break**
10:20	10:35	**Prof. Dr. İbrahim CEMAL** / Reproductive Efficiency and Growth Dynamics of Esme Sheep under Different Environmental and Managemental Influences
09:35	10:50	**Dr. Muharrem SATILMIŞ** / Some Fertility Traits of Karacabey Merino Sheep in Rural Farms
11:05	11:20	**Doç. Dr. Onur YILMAZ**/ Multifactorial Influences on Growth and MLD Muscle Traits in Kıvırcık Sheep: Towards Sustainable Breeding Programs
11:20	11:35	**Dr. Mustafa DUMAN** / Determination of Growth Traits of Akkaraman Lambs Raised under Breeder Conditions in Nigde/Altunhisar District: II. Period
11:35	11:50	**Dr. Hasan Hüseyin ŞENYÜZ** / Effects of Intensive and Pasture Feeding on Milk and Colostrum in Anatolian Buffaloes
11:50	12:05	**Dr. Mehmet Ali YILMAZ** / Effect of Artificial Insemination at Different Times on Pregnancy Rates in Nulliparous and Multiparous Anatolian Water Buffaloes during Ovulation Synchronization
12:05	12:20	**Doç. Dr. Oğuz AĞYAR** / Effects of Maternal Lactation Order on the Growth Performance of Anatolian Water Buffalo Calves
12:20	12:35	**Dr. Yavuz KAL** / Evaluation of Machine Learning Techniques for Weaning Weight Estimation in Extensive Goat Farming Systems
12:35	14:00	**Lunch**
14:00	14:15	**Doç. Dr. Seyrani KONCAGÜL** / Effects of genetic and non-genetic factors on first age growth traits in Karacabey Merino sheep
14:15	14:30	**Doç. Dr. Şükrü DURSUN** / Increasıng the Fertile Yield of Central Anatolıan Merino Lamb by Usıng İn Breedıng at Early Ages
14:30	14:45	**Birusk KESKİN** / Determination of Some Physical Properties of Coarse and Down Fibers Obtained from Mahalli Goats
14:45	15:00	**Coffee Break**
15:00	15:15	**Mehmet ÇATALKAYA** / Recovery Of Silk Protein Sericin From Wastewater and Cocoon Residues in Silk Production Facilities and Its Economic Evaluation
15:30	15:45	**Dilek ÖĞDÜM** / Body Weight and Some Body Measurements of Kangal Dog Raised in the Sheep Breeding Research Institute
15:45	16:00	**Dr. Çağrı Melikşah SAKAR** / Investigation of Biometric Index Values in Akkaraman Sheep Raised in Extensive Conditions of Central Anatolia
16:00	16:15	**Dr. Atilla BAŞKURT**/ Investigation of Weaning Weights of Karacabey Merino Lambs by Season
16:15	16:30	**Dr. Abdülkadir ERİŞEK** / Evaluation of Birth Weight, Growth Performance and Mohair Production in Ankara Goats
16:30	16:45	**Coffee Break**
16:45	17:00	**Hüseyin ACAR** / Productive and Growth Traits of Zom Sheep in On-Farm Conditions
17:00	17:15	**Mehmet ÇATALKAYA** / Growth and Development Characteristics of Karakaş Sheep Raised by Farmers

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08.11.2025 SALOON B		
09:00	09:15	**Rıdvan YAKIŞAN** / Growth and Development Characteristics of Mahalli Goats Cubs Raised In Diyarbakır Rural Area
09:15	09:45	**Şahin TEZ** / Environmental Factors Affecting Birth Weight in Southern Anatolian Red Cattle Raised in Sason Districts
09:45	09:45	**Reşit Demir** / Effects of Year, Sex, Birth Type, and Dam Age on Lamb Performance Traits in Awassi Sheep under a Community-Based Breeding Program in Şanlıurfa
09:45	10:00	**Tülay CANATAN YILMAZ** / Reproductıve Performance, Body Measurements of Ewes, and Growth Traıts of Lambs İn Dağlıç Sheep
10:15	10:30	**Şahin TEZ** / Growth Characteristics of Zom Sheep in Farmer Conditions
10:30	10:45	**Yavuz HAN** / Environmental Factors Affecting Lactation Milk Yield in Southern Anatolian Red Cattle Raised in Silvan District
11:00	11:15	**Dr. Mehmet Emin VURAL** / Some Growth and Survival Characteristics of Koçeri Lambs Under Breeder Conditions
11:15	11:30	**Yusuf ZENGİN** / Some Mohair Characteristics of Angora Goats in Eskişehir TİGEM Farm
11:30	11:45	**Özlem BARITÇİ** / On-Farm Growth Characteristics and Performance of Hamdani Sheep
11:45	12:00	**Tülay CANATAN YILMAZ** / Some Reproductıve Characterıstıcs of Akkaraman Sheep Bred in Konya Provınce Karakaya Vıllage Condıtıons

Innovative Diets to Optimise Animal Nutrition

Dr. Abdul Shakoor CHAUDHRY
PhD (Cambridge); FHEA (UK); FCPS (Cantab); FCCS (UK); CAnimSci (RSB); Advisor (CSC)

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Newcastle upon Tyne, NE1 7RU, United Kingdom

Livestock plays a vital role in the supply of quality foods for people and other living organisms. Therefore, innovative diets are needed to maintain health, production and activities of animals, especially those that produce high quality protein food. These diets must provide balanced nutrients to support not only the nutrient requirements of different animal species but also to reduce their negative impacts on animal welfare and the environment. However, traditional diets may not be able to meet these objectives. Thus, novel strategies are needed to formulate innovative diets by using locally available feeds and supplements that are affordable and safe for animals, people and the environment. It is essential to source dietary ingredients from novel sources that are sustainable and effective to optimise animal nutrition and production. This presentation will explore novel ways to address potentials and problems of developing innovative diets to optimise animal nutrition. Ultimately, this approach may help promote sustainable livestock production most cost-effectively to achieve food security for both animals and people.

Keywords: Innovative Diets, Nutrition, Food, Livestock

Evaluation of Bull Fertility - Functional and Molecular Approaches

Heiner BOLLWEIN

Clinic of Reproductive Medicine

Vetsuisse Faculty, University of Zruich

With the term "assisted reproduction technologies" in modern cattle farming, one could imply the collection of techniques that aim at the optimal use of bovine gametes to produce animals of high genetic value in a time- and cost-efficient manner. The accurate characterization of sperm quality plays a critical role for the efficiency of several assisted reproduction-related procedures, such as sperm processing, in vitro embryo production and artificial insemination. Bull fertility is ultimately a collective projection of the ability of a series of ejaculates to endure sperm processing stress and achieve fertilization of the oocyte and production of a viable and well-developing embryo. In this concept, the assessment of sperm functional and molecular characteristics is key to bull fertility diagnostics and prognostics. Among others, functional features linked to motility, sperm plasma membrane, acrosome, mitochondria and DNA integrity are usually assessed as a measure of the ability of sperm to express the phenotypes that will allow them to maintain their homeostasis and orchestrate-in a strict temporal manner-the course of events that will enable the delivery of their genetic content to the oocyte upon fertilization. Nevertheless, measures of sperm functionality are not always adequate indicators of bull fertility. Nowadays, advancements in the field of molecular biology have facilitated the profiling of several biomolecules in male gametes. The molecular profiling of bovine sperm offers a deeper insight into the mechanisms underlying sperm physiology and, thus, can reveal novel candidate markers for bull fertility prognosis.

Spirulina as Alternative Protein Source with Biofunctional Properties in Ruminant and Monogastric Nutrition

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Spirulina (*Arthrospira platensis*), a filamentous cyanobacterium frequently referred to as blue-green microalga, has emerged as a promising alternative protein source in livestock nutrition. Spirulina cultivation is extremely resource-efficient, as it requires minimal freshwater, no arable land, and enables rapid biomass accumulation. Owing to its exceptionally high protein content (60–70% of dry matter), complete profile of essential amino acids, and abundance of bioactive compounds, including antioxidants and polyunsaturated fatty acids, spirulina offers considerable advantages over conventional protein feeds such as soybean meal.

In our research, replacement of soybean meal by spirulina in diets for dairy cows and fattening bulls sustained productivity and product quality, while enhancing the concentrations of bioactive constituents such as β-carotene and γ-linolenic acid in milk. In monogastric species, specifically gestating and lactating sows and their offspring, substituting soybean meal with spirulina modified composition of milk but not colostrum, and led to increased birth and weaning weights in piglets, with fattening performance and meat quality remaining largely unaffected. Spirulina is thus regarded an interesting alternative feedstuff to improve sustainability of animal-based food production while maintaining livestock productivity and product quality, and potentially supporting animal health.

The presentation will synthesize evidence from our studies and recent literature, critically evaluating the potential of spirulina as a sustainable protein alternative for both ruminant and monogastric livestock. Key topics will include effects on feed efficiency, product quality, greenhouse gas emissions, health aspects, and reproductive outcomes. Emphasis will be placed on species-specific responses and persistent knowledge gaps, notably regarding optimal inclusion rates, digestibility, bioactivity across developmental stages and underlying mechanisms, as well as long-term impacts on animal performance and health.

Keywords: Microalgae, Cattle, Pig, Performance, Product Quality

Metabolic Modifiers for Peripartum Dairy Cows

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Nutrition plays central role in maintaining health status and productivity in lactation and fertility. Management practices should ensure welfare. Easing adaptation from gestation to lactation requires understanding neurohormonal changes. During the periparturient period nutrient partitioning and nutrient uptake by tissues differ. Demand for glucose, amino acid, fatty acids, and calcium increase 2.7, 2.0, 4.5, and 6.8 folds in early lactation as compared to late gestation. Avoiding hypocalcemia through anionic salt feeding to activate PTH is essential. Non-hypocalcemic cows are less likely to have retained place and have faster increases in intake and milk yield. Moreover, in these cows ovarian cyclicity resumes earlier. The severity and duration of negative energy balance should be minimized to achieve high lactation yield simultaneously with reproductive functions. Body condition loss is an indicator of energetic status. Early lactation cows are supplemented with ruminally protected choline, niacin, methionine, lysine, and alpha linolenic acid for managing hepatic ketogenesis and lipidosis. Application of metabolic profile test during the 1st and 4th week of lactation should be one of the herd health protocols for productive lactation and fertility.

Key words: Metabolic profile, hypocalcemia, negative energy balance, lactation, fertility.

Effects of Purified Cannabidiol (CBD) Isolate on Growth Performance and Feed Conversion Ratio (FCR) in Broiler Chickens

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Previous studies evaluating hemp (Cannabis sativa L.) in broiler nutrition have used derivatives such as seeds, seed oil, and meal, and collectively reported improvements in body weight gain, feed efficiency, and certain health indicators. In this study, we assessed the effects of non-psychoactive purified cannabidiol (CBD; ≥98% isolate) on performance parameters in broilers. The experiment employed a completely randomized design with three groups: C (control), Q1 (0.02% CBD), and Q2 (0.04% CBD). Each group comprised six replicates with 10 chicks per replicate, totaling 180 one-day-old Ross 308 male broiler chicks. The trial lasted 39 days and was conducted at the Broiler Nutrition Unit of the Research and Application Farm, Faculty of Veterinary Medicine, Ankara University.

On day 39, average body weights in the control, Q1, and Q2 groups were 2745.66 ± 25.08 g, 2912.58 ± 33.01 g, and 2914.08 ± 30.88 g, respectively. Both CBD groups were significantly heavier than the control ($p < 0.05$), with no difference between CBD doses. Cumulative body weight gain (days 0–39) was 2703.70 ± 25.22 g, 2870.42 ± 33.01 g, and 2871.47 ± 31.88 g for control, Q1, and Q2, respectively; CBD supplementation yielded a significant increase versus control ($p < 0.01$) without differences between CBD doses. Total feed intake over the same period was 3669.00 ± 41.55 g, 3816.96 ± 39.47 g, and 3731.66 ± 44.69 g; intake was significantly higher in CBD groups than in control ($p < 0.01$), with no difference between CBD doses. Feed conversion ratio (FCR) was 1.36 ± 0.58 (control), 1.33 ± 0.42 (Q1), and 1.30 ± 0.29 (Q2); CBD reduced FCR, indicating improved feed efficiency ($p < 0.05$).

Conclusion: Dietary inclusion of CBD isolate at low levels (≤0.04%) significantly improved day-39 body weight, total weight gain, and FCR. Although feed intake increased with CBD, the decrease in FCR suggests enhanced efficiency of nutrient/energy utilization. The absence of a dose response between 0.02% and 0.04% implies a practical minimum effective level of 0.02%.

Keywords: Hemp, *Cannabis Sativa L.*, poultry nutrition, broiler nutrition

Histopathological Examination of Brain Changes Caused by Black Cumin Meal Added to the Diets of Chickens Exposed to Acute and Chronic Noise

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Note: This study was taken from the project titled 'Investigation of the Effect of Black Cumin (*Nigella sativa*) Meal Added to the Diets of White Layer Parents Exposed to Noise' supported by TAGEM.

This study aimed to investigate histopathological changes in the brain of layer breeder parents exposed to acute and chronic noise. For this purpose, as animal material, 252 breeding hens and 60 breeding roosters of AKBAY genotype's parents at 30 weeks of age in the Poultry Research Institute were used. Hens were randomly assigned to two birds per cage, while roosters were placed in individual cages. As feed material, the hens were fed a ration containing 17% HP and 2750 kcal/kg metabolic energy, supplemented with three different levels of black cumin meal. Until the end of the experiment (6 weeks), three groups were exposed to 55±10 dB sound intensity (standard poultry house environment); three groups were exposed to 100±10 dB sound intensity for 2 hours on the first day and to sudden and irregular 100±10 dB sound intensity for a total of 1 hour on the other days. 132 parents were euthanized by cervical dislocation (after acute noise exposure on the first day (6 hens and 5 roosters from each group) and after chronic noise exposure at the end of the trial (6 hens and 5 roosters from each group)). Brain tissue samples were taken and examined histopathologically. According to the histopathological evaluation, the addition of increasing amounts of black cumin meal to the diet was found to be statistically significant in reducing pathological findings such as gliosis, neuronal degeneration and necrosis caused by acute and chronic noise in chicken brains ($p<0.05$).

Keywords: Brain, Black Cumin Meal, Noise, Histopathology, Chicken

Pelemir (Cephalaria Syriaca L.) Plant: A Sustainable Feed Source for Laying Hens

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The compound feed industry is a crucial part of the animal food production chain, with a significant portion of activities related to feed costs. In Türkiye, most of the feed raw materials required for the poultry sector are imported and usedas human food; thus, alternative plants need to be developed. In this context, Pelemir (*Cephalaria syriaca L.*) plant emerges as an important alternative feed crop in the fight against climate change and drought. The economic value of this plant isenhanced by investigating its resistance to both cold and dry conditions andthe usability of the meal obtained after oil extraction in animal feeding. A preliminary study was conducted on the nutritional values of Pelemir meal,as well as their potential optimal use in poultry rations. In the study, it was observed that adding 10 % Pelemir Meal to the rations of Akbay native hybrid had no negative effect on performance and egg quality.

Keys Words: Pelemir (*Cephalaria syriaca L.*), Alternative Feed, Poultry Nutrition, Feeding of Laying Hens

The Role of Increasing Protein Levels in Artificial Diets on Shaping the Cocoon Quality of the Silkworm (*Bombyx mori L.*)

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Proper and balanced nutrition of silkworm larvae is directly related to cocoon quality and productivity. Traditionally, silkworms are fed with fresh mulberry leaves; however, the seasonal availability of leaves, fluctuations in their nutrient composition, and the inability to maintain continuous rearing throughout the year limit the sustainability of this method. Therefore, artificial diets formulated as alternatives to mulberry leaves play a crucial role in ensuring continuity in silkworm rearing and improving production efficiency. Artificial diets, especially in periods or regions where high-quality mulberry leaves are not available, provide a balanced composition of proteins, carbohydrates, vitamins, and minerals, thereby supporting the healthy growth of larvae and enabling silkworm production throughout the year. Moreover, proper formulation of such diets optimizes physiological and metabolic processes involved in cocoon formation, resulting in marked improvements in cocoon weight, moisture content, length, and width. In this study, the effects of artificial diets with different crude protein (CP) levels on cocoon quality characteristics of silkworms (*Bombyx mori L.*) were investigated. The CP levels of the artificial diets were adjusted to 20.50%, 21.50%, 22.50%, 23.50%, and 24.50%. As the protein content increased, the proportion of dried mulberry leaf powder in the diet decreased. The findings revealed that CP levels significantly affected cocoon characteristics ($P<0.001$). As the CP level increased, both fresh and dry cocoon weights increased markedly. When CP was 20.50%, the average fresh and dry cocoon weights were 1.25 g and 0.96 g, respectively, while at 24.50% CP, they increased to 1.51 g and 1.19 g. Moisture loss ratio decreased from 24.05–24.86% in silkworms fed with 21.50–22.50% CP diets to 21.15–21.40% with 23.50–24.50% CP diets. In addition, cocoon length and width increased from 30.11 cm to 32.08 cm and from 17.28 cm to 18.22 cm, respectively, with increasing protein levels. In conclusion, the protein level of artificial diets is a key determinant in improving cocoon quality in silkworms. Properly formulated artificial diets with optimal protein content not only enhance cocoon quality but also provide great potential for achieving sustainable and season-independent sericulture. These findings offer a scientific basis for the development of artificial diet technologies and the expansion of silkworm rearing practices in the future.

Keywords: *Bombyx mori*, artificial diet, cocoon quality, alternative feeding, sericulture

The Effect of Dried Modified Vinasse, Slow-Release Urea, and Ammonium Sulfate Additives on Rumen in situ Degradation Characteristics in Concentrated Feeds

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This study was conducted to determine the in situ ruminal dry matter and crude protein degradation rates of four different dairy cow rations formulated to be isonitrogenous and isocaloric. Accordingly, four different rations were prepared: modified dried vinasse (3.028%), slow-release urea (0.615%), ammonium sulfate (1.2%), and a control group. The prepared feeds were incubated in the rumen of three Holstein cows fitted with rumen cannulas, and dry matter and crude protein degradation rates were determined at 2, 4, 8, 12, 18, 24, 36, and 48 hours. The trial lasted 12 days. At the end of the study, dry matter degradation rates were found to be statistically significant between groups at all incubation times, while crude protein degradation rates were statistically significant at 4, 8, 12, 18, 24, 36, and 48 hours ($p \leq 0.002$). Similarly, the readily soluble fractions of dry matter and crude protein in the feed, as well as the effective degradation values of dry matter and crude protein, were found to be statistically significant ($p \leq 0.017$). In conclusion, the addition of modified dried vinasse, slow-release urea, and ammonium sulfate to the rations altered the in situ dry matter and crude protein degradation rates.

Keywords: Rumen degradation, modified dried vinasse, slow-release urea, ammonium sulphate, crude protein

Methane Emission and Methanogenic Microbiome in the Rumen of Boz Cattle

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In this study, the relative ruminal methane emission rates and microbiomes of the local genetic resource, Boz cattle, were investigated. A total of 19 rumen samples were analyzed for methane and total gas production using the ANKOM RF Gas Production System. The proportion of methane within the total gas was determined via gas chromatography (GC), and was found to range between 97.1% and 99.6% (mean 89.6%).

The rumen microbiome was characterized through 16S rRNA gene and methanogenic Archaea-specific amplifications, followed by long-read next-generation sequencing (NGS) (Nanopore). Taxa with relative abundances above 0.1% were filtered and included in the evaluation. The bacterial domain constituted 96.6–97.9% of the microbial community, whereas the archaeal domain accounted for 2.1–3.4%. Within the archaeal population, methanogens belonging to the kingdom Methanobacteriota comprised 1.8–3.2% of the total. Across all samples, a total of 2 phyla, 4 classes, 6 orders, 8 families, 10 genera, and 15 species of methanogens were identified, with many taxa at the species level being classified at the genus level. The most dominant group was Methanobacteriota (86.8–96.5%), including the class Methanobacteria and the order Methanobacteriales (86.1–95.6%). The genus Methanobrevibacter represented the majority (63–76.9%), followed by Methanosphaera (9.7–22.3%). The most frequently detected species across all samples was Methanobrevibacter ruminantium (33–44.9%), followed by M. olleyaei, M. gottschalkii, M. smithii, M. millerae, and M. thaueri. Within the genus Methanosphaera, M. stadtmanae was predominant (3–12.9%). The second archaeal phylum, Thermoplasmatota (3.5–13.2%), included the genus Thermoplasma (2.4–8.8%). In samples with relatively lower methane emissions, the OR clade of Methanobrevibacter (M. ruminantium, M. olleyaei) was more abundant compared to the SGMT clade (M. smithii, M. gottschalkii, M. millerae, M. thaueri). Furthermore, a relationship was observed between lower methane production and the presence of the genus Methanosphaera as well as the phylum Thermoplasmatota.

Keywords: Boz cattle; rumen methane emission; rumen microbiome; methanogenic Archaea; Methanobrevibacter

Some Biomarkers Used in the Diagnosis of Subclinical Mastitis

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This study was prepared to summarize the biomarkers used in the detection of subclinical mastitis affecting the mammary gland and to explain their mechanisms of action. As a result of the infectious process occurring in the mammary glands, numerous changes take place, including alterations in milk biochemical composition and oxidative stress markers. Biomarkers are defined as any substance, structure, or process that can be measured in the body or its products, and that may influence the incidence, progression, or outcome of a disease. In mastitis, the contact of bacteria with somatic cells (SHS) and epithelial cells in milk stimulates the innate immune system, leading to increased cytokine production. Some of these cytokines are associated with fever, leukocyte mobilization, and the enhanced production of acute phase proteins (APPs). Positive APPs include serum amyloid A, haptoglobin, C-reactive protein, and ceruloplasmin, whereas negative APPs include albumin, transferrin, and transthyretin. Other important biomarkers are antimicrobial peptides (AMPs) such as cathelicidins and β-defensins; which exhibit a wide range of immunomodulatory activities, such as enhancing chemoattraction, killing extracellular and intracellular bacteria, regulating pro- and anti-inflammatory responses, modulating apoptosis and pyroptosis, and promoting macrophage differentiation. Additional biomarkers include lactose, procalcitonin (PCT), enzymes, and microRNAs. PCT is almost absent in the circulation of healthy animals, but its concentration increases significantly during bacterial infections. Other enzymes that increase during inflammation include β-galactosidase, mannosidase, N-acetylglucosaminidase, and glucuronidase. Antioxidant activity in milk is provided by enzymatic compounds such as lactoperoxidase, glutathione peroxidase, xanthine oxidase, and catalase, as well as by non-enzymatic components including vitamins and provitamins. Detectable changes in milk or blood occur during mammary gland infections. Early diagnosis of mastitis using these biomarkers enables timely treatment, ensuring effective bacterial elimination before severe lesions develop in mammary tissue. Early detecting mastitis with biomarkers can benefit udder health and milk quality.

Key Words: Mammary gland health, APP, AMP

Is There a Relationship Between Somatic Cell Count and Udder Health in Saanen Goats?

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The present study aimed to determine whether somatic cell count in goats is a reliable indicator of mammary gland health and milk quality. The animal material for the study consisted of 142 Saanen goats. The goats underwent general clinical, udder, and milk examinations. Milk samples were taken from mammary lobes that showed no clinical signs during the general and mammary examination and no visible changes during the milk examination and samples delivered to the laboratory. The goats were divided into groups based on milk samples taken from both mammary gland halves: animals with no bacterial growth in either half (n:24) were designated as Group I, and animals with bacterial growth (n:26) were designated as Group II. The mean somatic cell counts (SCC) in Groups I and II were 870,777 and 12,092,474 cells/mL in the right mammary lobe and 1,023,593 and 12,249,371 cells/mL in the left mammary lobe, respectively. The minimum and maximum SHS values in Group I were 97,265 and 3,312,000 cells/mL, respectively, while in Group II, they were 1,170,340 and 21,245,000 cells/mL. While intramammary infections are the main source of variation in SHS in dairy cows, this is not the case for dairy goats. In goats, causes of variation in SHS include infections, lactation period, breed, number of births, and stress. In conclusion, our study revealed noteworthy variations in the minimum, maximum, and average somatic cell count (SCC) values in healthy and infected milk samples. Increased SCC decreases milk yield and changes milk quality and composition. Good hygiene on goat milk farms is key to producing milk with low SCC and minimizing risks to ensure optimal quality for consumption. However, appropriate standards and guidelines for goats are needed to prevent and eliminate subclinical mastitis using SCC in milk. This study was supported by TÜBİTAK (124O827).

Keywords: Subklinik mastitis, Goats, SHS

Antibiotic Therapy in Subclinical Mastitis in Goats

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Subclinical mastitis is a significant infection in goats that leads to a decrease in milk yield and quality and is difficult to diagnose. This review aims to systematically summarize the etiological profile of mastitis, antimicrobial resistance patterns, and current, evidence-based treatment strategies in goat farming. The pharmacokinetic and pharmacodynamic properties of antimicrobial agents used to treat subclinical mastitis, as well as their clinical applicability, have also been evaluated. The etiology of subclinical mastitis cases primarily involves bacterial pathogens such as *Staphylococcus simulans*, *Mannheimia haemolytica*, *Corynebacterium kroppenstedtii*, and *Pasteurella multocida*. Current studies indicate a widespread and increasing incidence of antimicrobial resistance, particularly among *Staphylococcus* species. For treatment, antimicrobial agents from various classes, such as beta-lactam antibiotics, macrolides, lincosamides, and tetracyclines, are recommended for either intramammary or systemic administration. However, it is emphasized that broad-spectrum agents such as fluoroquinolones (enrofloxacin, danofloxacin) should only be used in treatment-resistant cases and strictly under the guidance of an antibiogram. Recent studies in goats have revealed that, in addition to the traditional pathogen-focused approach, the ecological balance of the mammary microbiota must also be considered for the control and treatment of subclinical mastitis. To reduce the morbidity and economic impact of the disease, combining targeted pharmacotherapy with microbiota-friendly herd health management and prophylactic measures is a promising strategy. Therefore, for the control and treatment of subclinical mastitis in goats, it is essential to adopt a treatment protocol based on the identification of the etiological agent and consideration of the microbiota. This approach enables not only the optimization of clinical success rates but also the prevention of antimicrobial resistance and the minimization of antibiotic residues in the food chain. To reduce the morbidity and economic losses associated with the disease, it is necessary to combine targeted pharmacotherapy with herd health and mastitis control programs and prophylactic measures.

Keyword: Antimicrobial agent, udder health, treatment

Quality Testing of Non Steril Veterinary Antimicrobial Products Used For Livestock in Turkey

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This study aimed to evaluate the compliance of domestically produced and imported non-sterile veterinary antimicrobial products, obtained from veterinary pharmaceutical warehouses and clinics across various regions of Turkey, with shelf-life specifications as indicators of product quality.

The study was conducted at the Pharmaceutical Quality Control Laboratory of the Konya Veterinary Control Institute Directorate. For inspection purposes, a total of 594 non-sterile veterinary antimicrobial products were analyzed. These included 51 oxytetracycline, 6 doxycycline, 6 chlortetracycline, 56 enrofloxacin, and 30 amoxicillin-based products, with six samples collected from different batch numbers for each active ingredient. The products were evaluated based on their compliance with the shelf-life specifications declared by the manufacturers. The analyzed quality parameters included packaging information; organoleptic characteristics such as odor, color, appearance, and solubility; pH measurement (pH meter); density (densimeter); moisture content (moisture analyzer); water content (TitroLine device) and active ingredient quantification using validated methods with an HPLC-DAD system. All analyses are carried out in accordance with relevant pharmacopoeial standards and the legislation determined by the Republic of Turkey Ministry of Agriculture and Forestry.

As a result of this study, which reports for the first time the quality control parameters of domestically produced and imported non-sterile veterinary antimicrobial products used in the field in Türkiye, it was determined that all 594 analyzed products complied with the shelf-life specifications declared by the manufacturers.

The quality integrity of veterinary antimicrobial products manufactured in accordance with Good Manufacturing Practice standards is at risk of compromise at any stage of the logistics and distribution processes. Ensuring veterinarians have safe and timely access to high-quality antimicrobial agents will not only support effective animal health treatments but also protect public health and combat antimicrobial resistance. In this context, it is recommended that quality control easures be strengthened and implemented at all stages of the supply chain.

Keywords: Antibiotic, Quality Control, Antimicrobial Resistance

Status Assessment of the National Small Ruminant Breeding Project under Breeding Conditions

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This study evaluates the current status of the National Small Ruminant Breeding Project in Turkey and makes several recommendations. The project has been implemented by the Ministry of Agriculture and Forestry, General Directorate of Agricultural Research and Policies (TAGEM) since 2005. It is an important project carried out under breeder conditions and covering national improvement activities in the field of small ruminant breeding. The main objective of the project is to improve the genotypes of local sheep/goat breeds and their economically important productivity traits through various breeding practices (pure breeding, selection, etc.) and to contribute to meeting the country's need for quality breeding stock. The project involves 204 sub-projects and a total of 1,285,200 head animals. Each sub-project consists of 6,000 head female and 300 head male animals. The project is being implemented within the framework of three pillars are being carried out with multiple stakeholders, including Breeding Sheep and Goat Breeders' Associations, Universities, Research Institutes, and Goverment Provincial Directorates. When the data obtained is evaluated, it is observed that the expected progress has been made in the characteristics that are focused on and are of economic importance.

Key words: Breeding, sheep, goat, selection,

Integrated Project for the Conservation and Sustainable Use of Domestic Animal Genetic Resources

Oktay KANKILIÇ

Conservation efforts are defined by the United Nations Convention on Biodiversity as "genetic material of present or future value." The adoption of the Global Action Plan on Animal Genetic Resources and the Interlaken Declaration in 2007 gained momentum globally. The Action Plan recognized the characterization of genetic resources, their inventory, monitoring of trends and related risks, conservation, sustainable use and breeding, policy, infrastructure, and capacity building as strategic priorities.

As part of the "Integrated Project for the Conservation and Sustainable Use of Domestic Animal Genetic Resources," we continue to Conservation our domesticated animals, the guarantee of our future, in our institutes, in public (in their natural habitats), and in our gene banks (by freezing).

The project, launched in 1995 with cattle breeds at high risk of extinction, was expanded in 1996 and 1997 to include sheep, goats, buffalo, chickens, and silkworms, and in 2002, bees. Currently, a total of 12 breeds, including 4 cattle, 4 sheep, 1 goat, 2 chickens and 1 honey bee are under Conservation in 6 research institutes affiliated to our Ministry and Conservation studies are continuing.

In the project which was initiated with the aim of Conservation our local domestic animal breeds in their natural habitats, today a total of 29 breeds including 5 cattle, 11 sheep, 10 goats, 3 Honey bee breeds and 2 silkworm lines are under Conservation in 29 provinces. In the 2024 project year, a total of 28,731,050 TL in support payments were made in 2025, including 24,137 head of livestock, 18,576 bee colonies, and 32 kg of fresh cocoons belonging to 838 breeders in 29 provinces. Since the project's inception, 103,353,813 TL in support payments have been made.

Furthermore, a sensitive conservation program was launched in 2023, accelerating conservation efforts by providing higher support payments to endangered breeds.

Within the scope of cryopreservation in the Gene Bank, 82,868 genetic materials (semen, embryos, DNA, and cells) from 31 breeds—7 cattle, 19 sheep, and 5 horses—from our domestic domestic animal genetic resources are being preserved in the gene banks of the International Livestock Research and Training Center, Lalahan/Ankara, and the TÜBİTAK Marmara Research Center.

Within the scope of registration activities, from 2004 to the present, a total of 7 cattle, 6 of which are cattle and 1 buffalo breed, 34 sheep, 6 goat, 7 chickens, 8 bees, 6 pigeons, 3 silkworm, 3 dogs, 2 cats, 1 rabbit breed A total of 77 breeds.

Can Goats be Utilized in the Prevention of Forest Fires?

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Goats have been an essential part of the forest ecosystem since its inception. Since the 1980s, the relationship between goats and forests has been a topic of debate in Turkey, creating the perception that goats are damaging the forest. In the 1990s, when goats were banned from entering the forest, the number of goats declined rapidly. This mistake was later rectified, and controlled goat grazing within the forest was once again permitted, bringing the number of goats back to around 11 million by 2024.

In summary, goat farming in Turkey, particularly with the Hair Goat (*Kıl keçisi*), must coexist with forests. When grazing is carried out in a controlled manner, goats are not harmful but actually beneficial to forests. One such benefit is that goats can serve as a significant biological tool in the prevention of forest fires. When goats graze in forests, they consume grasses and shrub-type vegetation. As a result, their grazing habits and preferences reduce fire risk.

By consuming the ground vegetation in the forest, goats help reduce the biomass that could easily ignite during a fire. Especially in specific areas with intensive goat grazing, the thinning of plant cover creates natural firebreaks. This makes it easier to prevent the spread of fires and facilitates fire management efforts. Due to their ability to climb steep terrain where machinery and humans cannot easily reach, goats can graze intensively in such areas and act like natural cleaners, thereby reducing the fire sensitivity of those regions.

From this perspective, it can be seen that goats are not enemies of forests but rather their allies. Therefore, it would be beneficial to conduct studies on controlled goat grazing in forests, especially in fire-prone regions such as the Mediterranean, Aegean, and Marmara areas of Türkiye.

Key words: Forest fire, Goat, Grazing

Introduction

As in many parts of the world, an increase in forest fires has been observed in Türkiye recent years. These fires can be caused by human negligence, deliberately, or natural causes. It is believed that there is a link between the hotter and drier summer months in recent years and the occurrence of forest fires.

In our country, especially in regions with a Mediterranean climate, forest fires threaten the ecological balance. Biomass density also plays a role in the ignition and spread of fires. In maquis and shrubland areas, accumulated flammable material increases fire risk. Shrub species and herbaceous plants growing among mature forest trees form a ground-cover layer, and this layer is effective in the initiation and propagation of fires. From this perspective, in such areas, goat grazing (particularly by local goats) can be used as an ecological tool in fire management and prevention. This article evaluates the usability of goat breeding under extensive condition in preventing forest fires in areas where goat breeding is widespread.

Characteristics of Hair Goat Breeding in Türkiye

According to the Turkish Statistical Institute (www.tuik.gov.tr), Turkey's goat population in 2024 is approximately 10.5 million heads. About 97 % of these goats are local (hair) goats. Goat breeding in Türkiye is generally practiced in forest interior and edge zones under extensive systems. In the 1980s, the goat population was around 16 million; due to policies by the General Directorate of Forestry

banning goat grazing within forests, the number declined to 5.1 million by 2009. In subsequent years, with permission granted for controlled goat grazing in areas containing mature forest trees, the goat population has risen again. The changes observed in goat numbers associated with grazing inside forests constitute the clearest evidence in Türkiye of how inseparable goat rearing and forests are (Özcan, 1989; Keskin et al., 2015; Keskin et al., 2017; Aydın & Keskin, 2018).

Therefore, the magnitude of the goat population in Türkiye is closely related to the perspective of relevant governmental bodies toward goat breeding. The forestry administration aims to reduce goat numbers. In one study, it was stated that goats are incompatible with forests and that, for Kurban (Sacrifice) Bayram, favoring goats is beneficial. It was also claimed that because goats can walk 12 kilometers per day, they cause more soil and vegetation damage than sheep; thus, the goat population was to be reduced and sheep farming encouraged (Anonymous, 2015a). In this example, regardless of the number of hair goat breeders, their lifestyle, or the benefits goats provide to forests, the topic has always been addressed from a one-sided perspective.

More than 8 million people in Türkiye live in villages located within or near forests. Goats are vitally important to these villages, yet the primary solution proposed to protect forests is often to remove or cull local goats. Economic, social, administrative, and technical practices aiming to replace goats with other livestock have generally been carried out solely from a forestry standpoint. But every species has its own characteristics. For example, cattle cannot be raised without roughage; raising them would require purchased roughage, which is not sustainable. Recommending sheep to goat breeders without considering land characteristics is also inappropriate.

In Türkiye, hair goat breeding is practiced both in sedentary and transhumant (migratory) systems. Nationwide, and especially in the Mediterranean region, the culture of transhumant livestock farming still continues. Although milk and reproduction yields of hair goats are low compared to improved breeds in largely extensive systems, the meat and milk produced by these goats are high in quality and can be considered organic products (Özcan, 1989; Keskin et al., 2017; Aydın & Keskin, 2018).

Goats and Their Role in Forest Fire Prevention

A flock of goats can feed themselves by walking 15-20 km a day (Özcan, 1989). Because each herd is led by at least one shepherd, shepherds roam the forests throughout the day. Shepherds and the nomadic families who stay in forest areas during the summer months are the ones who can detect any potential problems, including fires, early and report them to the relevant authorities (Figure 1).

Figure 1: A nomadic girl grazing goats in the forest (Source:https://www.aa.com.tr/tr/yasam/yoruk-songul-ucarin-en-buyuk-mutlulugu-kecilerinin-karninin-doymasi/1664455)

Morever, in the areas where goats graze, they consume the herbaceous plants and shrub species, as well as lower branches of trees (Figures 2 and 3). Through this grazing behavior, goats provide ground-layer cleaning and under-branch pruning within the forest, contributing to the prevention of fire spread (Keskin et al., 2015).

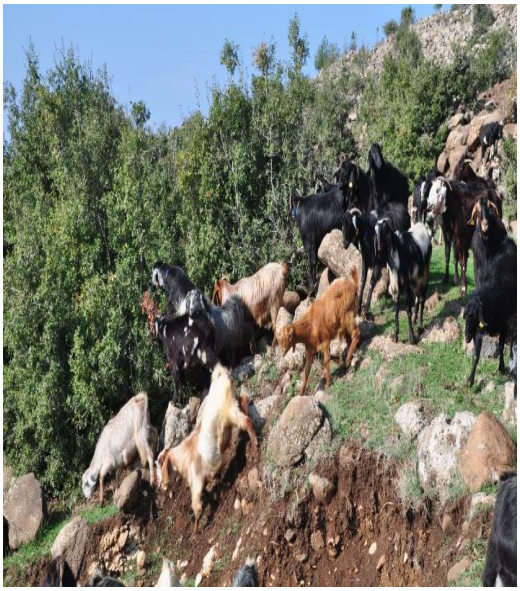

Figure 2: Goats grazing maquis-type plants

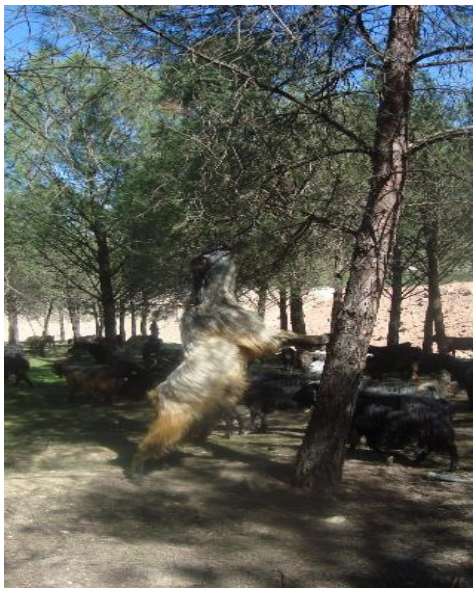

Figure 3. Goat eating lower tree branches

According to data from the General Directorate of Forestry, a forest area the size of approximately 13,000 football fields (11,456 hectares) burned in Türkiye in 2013 (Anonymous, 2015b). Around 99% of forest fires in Türkiye are caused by carelessness, negligence, or deliberate action, while only 1% are caused by lightning strikes (Anonymous, 2015c). Most forest fires start as surface fires, then spread to lower branches. In forests dominated by mature trees, fire begins as a surface fire: first, dry plant residues, grasses, and seedlings ignite quickly; humus layers and roots ignite more slowly. This is called a surface fire. As it proceeds, they spread to shrubs and saplings, becoming harder-to-extinguish fires. Allowing goats to graze surface vegetation significantly aids in preventing this type of fire (Keskin et al., 2015).

Gültekin (2014) also identified shrubs, which form a second layer beneath the forest and whose leaves contain aromatic oils, as primary factors in the initiation and spread of forest fires. If goats graze in these areas, they will prefer shrubs, which have higher nutritional value, to pine trees. Furthermore, goat paths in the forest will facilitate firefighting (Gültekin, 2014).

Gültekin et al. (2004) also stated that the fleshy parts of cones germinate better when eaten by animals. Researchers have noted that shrubs (bush-like plants) form a second layer beneath pine forests, preventing light from reaching the soil, making it difficult for pine seeds to germinate. They also noted that goats contribute to the ecological balance by grazing these plants. This is the primary reason why these forests have retained their splendor despite a significant portion of our country's goat population being found in pine forests. Goats and red pine trees support each other in an almost symbiotic relationship. Red pine transmits light downward, enabling the growth of shrubs, the goats' primary food source.

In the goat–forest relationship, a critical point regarding germination is that grazing should not be allowed until trees grow. The manure left by goats during grazing feeds insects. Soil fertilization has positive effects on germination and plant growth. The result is beneficial to the ecosystem.

Furthermore, the presence of goats and goat shepherds in the mountains contributes positively to security. Mustafa Kemal Atatürk said: “Friends! Go look at the Taurus Mountains. If you see a single Yörük tent there and smoke in that tent, you will know very well that no power or force in this world can defeat us.” Goat shepherds are people who know every inch of the forest and can generate alternatives even under the most adverse conditions.

Lovreglio et al. (2024) used FlamMap simulation software in their study in Sardinia, an area highly sensitive to forest fires, to model fire behavior under various grazing and environmental conditions to assess the impact of grazing on fire severity indicators such as flame length, spread rate, and fireline

density. Researchers have stated that grazing can reduce fire severity by reducing flammable biomass. They estimated reductions of 25.9 % in wet years, 60.9 % in moderate rainfall years, and 45.8 % in drought years.

According to a report in National Geographic (Anonymous 2022), goats have long been used to clean vegetation in landscapes. With increasing fires worldwide, grazing animals—especially goats—are beginning to be considered important tools for preventing forest fires in regions such as Greece, parts of Australia, and U.S. states like California, Arizona, and Colorado. In these cases, goats have been rented for clearing dense vegetation. It is noted that guard dogs are used to protect goats from predators and shepherding is employed. In Arizona, researchers observed that heavily grazed areas cleared of vegetation can act as fire barriers to stop forest fires in their early stages. In Greece, both goats and sheep grazing apparently help create an environment with reduced fire risk.

However, when grazing is practiced in forest interior and edge areas, it should be conducted under controlled conditions. Overgrazing can lead to erosion and habitat loss. Timing is also important. Grazing performed in late spring–early summer (before plants dry and before weed seeds fall into the soil) can greatly reduce fire risk.

Results and Conclusions

It would not be wrong to say that humans are primarily responsible for forest destruction. The most striking examples of this are fires, quarries, and damage to forests caused by clearing fields or vineyards. It should not be forgotten that goats are grazed in the forest, whether rightly or wrongly, by humans.

In this context, it is important to inform and raise awareness of shepherds about goat grazing without damaging the forest. To reduce the risk of fire, controlled grazing of goats should be ensured, especially in maquis areas where young saplings are absent.

In conclusion, the effects of goat grazing in preventing forest fires can be summarized as follows:

-Goats consume biomass, such as dry grass, leaves, brush, and small branches, which can easily ignite fires. This reduces the flammable material needed for fires to start and spread.

-They create natural fire strips: Vegetation becomes sparse in densely grazed areas. These areas can act as "natural barriers" that slow the progress of a fire. -Maquis and shrubland control: Goats are particularly effective in exploiting the maquis cover (kermes oak, rockrose, holm oak, etc.) prevalent in the Mediterranean region. These plants increase the risk of fire during the summer months.

In summary, when properly planned and managed, goat grazing is a highly effective tool for preventing forest fires, reducing fire risk, and preserving biodiversity.

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Genetic Improvement of Angora Goat in Turkey: Current Situation, Obstacles, and Opportunities

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The Angora goat breed (Capra hircus aegagrus) is one of Turkey's most important domestic livestock genetic resources. It has made, and continues to make, significant contributions to the country's economy, history, and folkloric culture. However, the Angora goat began to lose this importance more drastically after the early 1990s, experiencing significant declines in its numbers and its dirty mohair production until 2009. These rapid declines were attributed to the pressure from artificial fibers, negative changes in consumer perception of mohair products, low demand for goat meat in the Central Anatolia Region, and other structural problems. Indeed, the number of Angora goats and the dirty mohair production, which were approximately 1,185 million head and 1,379 tons, respectively, in 1991, declined to 147,000 head and 174 tons in 2009. However, the Ministry of Agriculture and Forestry (MAF) intervened at this critical juncture primarily through two solutions. The first of these was the support provided to Angora goats and mohair. This resulted in a resurgence of Angora goat numbers and greasy mohair production, reaching approximately 210,000 head and 350 tons, respectively, in 2023 (Mohair South Africa 2003). The second is the "Angora Goat Breeding in Public Hands" project, developed and implemented by the General Directorate of Agricultural Research and Policies (GDARP). The Angora Goat Breeding in Public Hands Project was initiated in Ankara province in 2005 and is being implemented in the districts of Ayaş, Beypazarı, Güdül, Polatlı, Kızılcahamam, and Nallıhan. The total number of goats in the project is approximately 30,000, with approximately 6,000 head in each district. The project is primarily based on selection for a single trait within the elite and base herd. In this project, the effectiveness of selection for kid growth and mohair yield and quality traits was first analyzed in a study conducted by Erdal (2025) and the genetic improvements for greasy fleece weight, average mohair diameter, comfort factor, spinning fineness, fiber curvature, Hauter value and New Zealand Fiber Volume traits during the 2018-2022 period were calculated as -0.0045 yr/0.001 yr2, -0.4503 yr/0.0704 yr2, 0.2593 yr/-0.0429 yr2, -0.0673 yr/0.0106 yr2, 0.044 yr/-0.0084 yr2, -0.0665 yr/0.01 yr2 and 0.0018 yr/-0.0003 yr2, respectively. The genetic improvement for average mohair diameter is quite promising. In addition, while significant advances have been made globally in recent years in the areas of greasy fleece weight systems, new textile quality traits and measurement techniques, and the genetic improvement of these traits (organic mohair production, RMS, new diameter-dependent

textile traits, genomic selection, etc.), efforts to utilize these traits in Turkey are not yet at a sufficient level. Therefore, this report aims to evaluate the studies conducted by GDARP in Turkey on the genetic improvement of mohair quantity and quality traits (in terms of structural and technical processes, selection methods, genetic trends, etc.), and to discuss the obstacles and opportunities that exist in adapting these studies to new global developments.

Key Words: Türkiye, Angora Goat, Genetic Improvement, Problems, Opportunities.

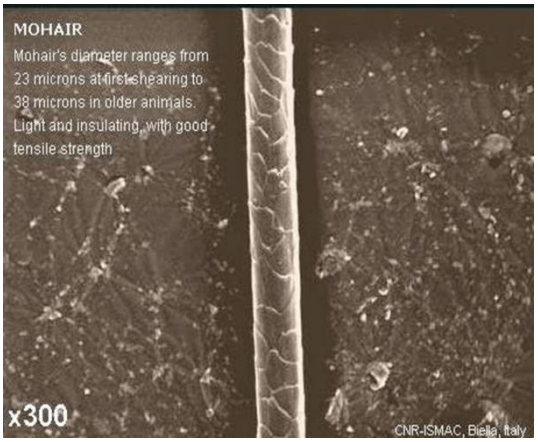
1. Introduction

1.1.Terminology

The Angora goat is a breed (***Capra hircus aegagrus***) within the goat species (***Capra hircus)*** and has been developed for mohair production through genetic selection spanning thousands of years. There are different opinions about the wild origin of the Angora goat. To date, two important species have been proposed as the wild ancestors of the Angora goat: ***Capra prisca*** (Antoniusi 1922, Adametz 1926 and 1928) and ***Capra aegagrus*** (Bezoar goat, Persian wild goat) (Schreiner 1898). However, there is a consensus that the Angora goat originated geographically from the high regions of the Asian Himalayas and/or Tibet.

Mohair (Figure 1) is the name given to all the fibers that are produced by the primary and secondary follicles in the skin of the Angora goat and form the total fiber coat. Mohair is most commonly known in the world as "mohair" and is formed by combining the Arabic word "muhayyer", meaning distinguished, with the English word "hair", meaning fiber. The most important yield of the Ankara goat is mohair and it is the only goat breed in the world that produces mohair fiber. Therefore, the Angora goat is a fiber animal (Dellal 2021).

Figure 1. Microscopic view of mohair fiber (Dellal 2021).



1.2. The history of the Angora goat in Anatolia and Türkiye: The history of Angora goat and mohair production in Anatolia and Türkiye is summarized in Table 1.

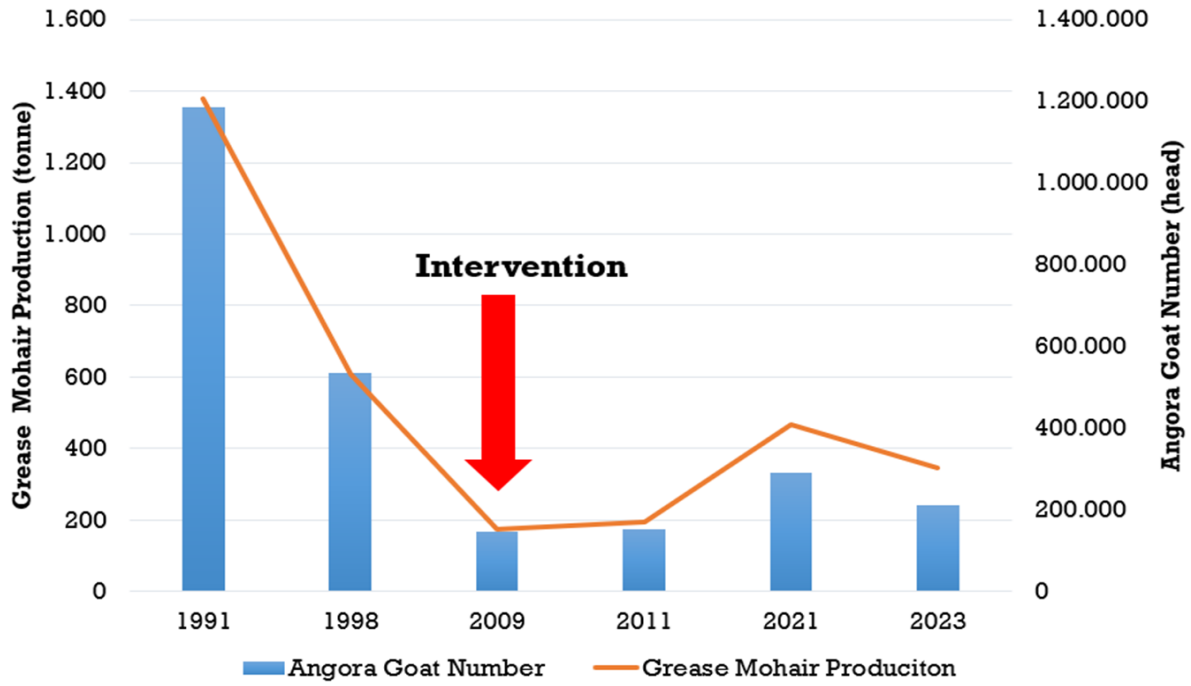
It came to the Central Anatolia and Ankara region as a race with the migration of Turks from the eastern region of the Caspian Sea from the 11th century AD. At the same time according to Hittite sources, the time of arrival goes back to approximately 1650 BC (Hittite History: 1650 - 1200 BC). However However, the Ankara goat acquired its main breed characteristics after coming to the Central Anatolia Region, mainly in the province of Ankara, as a result of natural selection lasting approximately 1000 years and scientific selection for the production of soft fabrics, other textile products and traditional handicrafts, and rightfully took its name from this city. Therefore, the original gene source of the Angora goat is Ankara (Anatolia/Turkey). In many sources, the origin of the Ankara goat is stated as Anatolia/Türkiye (Shelton 1983, Tamur 2003, Dellal 2021)

Table 1. A chronological summary of Angora goat and mohair production in Anatolia and Türkiye

History	Activities carried out
1071	The arrival of the Angora goat in Anatolia
1541	The Angora goat was first introduced outside of Anatolia. A pair of Angora goats were sent to the Roman-German Emperor Charles V by Suleiman the Magnificent.In the following years, it was sent to GAC (in 1839 and 1856-1896), USA (in 1849 and 1925), Australia (in 1856-1860), England (in 1881) and many other countries.
1849	However, until 1849, Ankara/Turkey was the only producer of mohair
1911	Turkey's Angora goat population constituted 38% of the world's total.
1930	The "Turkish Mohair Society" was established and branches were opened in the provinces of Kastamonu, Konya, Eskişehir, Afyonkarahisar, Çankırı, Çorum, Yozgat, Bolu, Kütahya, Kırşehir, Aksaray, Mardin, Sinop, Niğde, Zonguldak and Bilecik.
1931	Ministry of Agriculture (Ziraat Vekâlet' i) was established.
1933	Mohair Union
1940	Yerköy Beyazıtoğlu Farm (1940) was established and It continued under the name Yerköy Animal Husbandry Research Institute until 2000, and at that time the Angora goats here were brought to the Lalahan Animal Husbandry Research Institute in Ankara, as it was called at that time.
1959	the share of mohair in total export value reached a very significant rate of 4.56%.

1969	Tiftikbirlik was established which continues its activities today.
1984	Mohair Standards were determined by TSE with the code TS-4026.
2004	the Angora Goat was registered with the Communiqué on the Registration of Local Animal Breeds and Lines, and its morphological and physiological characteristics were determined (TOB-TAGEM)
2005	The program for the protection of the Ankara goat as a genetic resource and its genetic improvement (in public hands and research herds) initiated by TOB/TAGEM.
2009/2010:	The Ministry of Agriculture and Forestry has initiated financial support for the Angora goat and mohair
2019/2021/2023:	The geographical indication was received from the Turkish Patent Institute for Ankara Erkeç (Wether) Pastrami/Bacon in 2019, Ankara Mohair in 2021, and Ankara Sof Fabric in 2023.
2023	the Ankara Goat and Mohair Research and Application Center affiliated with Ankara University was established in the Güdül district of Ankara.

2. Current status of Angora goat rearing and mohair production globally and in Turkey: As can be seen from Graphic 1 and Table 2, two significant developments occurred in Turkey between 1991 and 2024. The first of these is the rapid decline in the number of Angora goats and the production of grease mohair, which were approximately 1.185 million head and 1.379 tons in 1991, respectively, to approximately 147,000 head and 174 tons by 2009. This decline can be attributed to four main reasons. These are: (a) The inability of mohair (like other animal fibers) to compete with synthetic/chemical fibers in Turkey, as is the case globally. (b) Changes in textile-related fashion, detrimental to mohair products. (c) Low consumer perception and demand for goat meat in the Central Anatolia Region, and particularly in Ankara. (d) Negative changes in the structural, economic, social, and cultural characteristics of Turkish agriculture. The second is MAF's intervention in 2009 to address the very negative situation that arose in the number of Angora goats and mohair production. It can be argued that this intervention occurred in two ways. This intervention can be argued to have occurred in two ways: (a) increasing and accelerating support for Angora goats and mohair, and (b) To develop new targets and action plans to make the Genetic Improvement of Angora Goat in Public Hands Project, which was initiated by TOB-TAGEM in 2005, more effective and to transfer them to the field. As a result of these studies by TOB, the number of Angora goats and the production of dirty mohair increased rapidly, reaching approximately 210,000 head and 347 tons, respectively, in 2024 (Table 2). According to data from Mohair South Africa (2023), Türkiye has risen to 4 th orderafter SA, Lestho and Argentina in the World in terms of grease mohair production (Table 3).



Graphic 1. Changes in the number of Angora goats and grease mohair production in 1991 - 2024 period in Turkey (TÜİK 1991-2023).

Table 2. Changes in the number of Angora goats and grease mohair production in 1991 - 2024 period in Turkey (TÜİK 1991-2024)

Years	**Number of Goats (Head)**	**Grease Mohair Production (tons)**
1991	1.184.942	1.379
2000	373.000	421
2009	146.986	174
2010	152.606	200
2023	210.184	347
2024	202.243	339
1991-2010 Değişim (%)	-87.12	-85.50
1991-2023 Değişim (%)	-82,26	-74,84
2010-2023 Değişim (%)	37,73	73,5

Tablo 3. 2000-2023 dönemi dünya tiftik üretimi değişimi (Mohair South Africa 2023)

World Grease Mohair Production (Tons)				
Countries	**2000**	**2023**	**2000–2023 Change (%)**	**Share in Total Production (2023, %)**
South Africa	4,300	2,470	-42.6	54.0
Turkey	400	350	-12.5	7.7
USA	1,000	230	-77.0	5.0
Argentina	300	360	20.0	7.9
Australia	300	90	-70.0	2.0
New Zealand	200	30	-85.0	0.7
Lesotho	500	710	42.0	15.5
Others	---	330	---	7.2
Total	7,000	4,570	-34.7	100.0

3.Genetic improving of the Angora goat at a global level

It is possible to divide the studies on the genetic improving of the Angora goat at the global level into two periods: 1960-1990 and 1990-2025.

3.1.1960-1990 period: The characteristics of the studies in this period can be summarized as follows: (1) Studies in this period were concentrated mainly in the USA (Davis and Shelton 1965, Shelton et al. 1965, Shelton and Bassett 1970, Shelton and Snowder 1983) and New Zealand (Nicoll 1985, Nicoll et al. 1989). (2) Growth, reproduction and body defects along with grease mohair characteristics are also emphasized as the selection criteria (Table 4). (3) Among the grease mohair properties, there are also properties that are measured subjectively (Table 4). (4) Conventional devices (microprojection, lanameter, etc.) were used to objectively measure diameter, length and strength properties of grease mohair. (5) The heritability and repetability rates of the dirty objective and subjective mohair traits were generally estimated to be moderate to high, although they varied between countries (Table 5).

Table 4. Selection criteria emphasized in Angora goats during the 1960-1990 period (Dellal 2021)

Mohair Characteristics	**Growth Characteristics**	**Reproductive Characteristics**	**Others**
high grease and clean mohair weight low average mohair diameter low fiber diameter variation low rate of medullated and kemp mohair single fiber and staple length staple type score - character, style, shine, softness	growth rate body weight conformation	number of weaned kids	Defects: leg and ear defects (usually reduced ear length) pendulous chin cryptorchism hornlessness mouth abnormalities

Tablo 5. Heritability and repetability levels of objective and subjective grease mohair traits in Angora goats (Dellal 2021)

Features	**TRK**	**ABD**	**GAC**	**FRS**	**DNM**	**ARJ**	**Repeatability (r)**
Body weight (obj)	0.24	0.07–0.50	0.18–0.47	-	-	-	0.18–0.68
Grease mohair weight (obj)	0.13	0.07–0.45	0.19–0.22	0.19–0.25	0.38	0.23-0,25	0.27–0.45
Mohair average diameter (obj)	0.19	0.08–0.33	0.26–0.30	0.32–0.51	0.48	0.33	0.30–0.53
Staple average length (obj)	0.12	0.33–0.42	-	0.18–0.35	-	-	0.03–0.19
Medullated mohair rate (obj)	-	0.00–0.39	-	0.16–0.25	0.32	0.10	0.29–0.39

Kemp(y) mohair rate (obj)	-	0.15–0.42	0.01–0.32	0.02–0.32	0.52	-	0.03–0.29
Lif Yoğunluğu (obj)	-	0.15–0.25	-	-	-	-	-
SF/PF rate (obj)	-	>0.25	-	-	-	-	-
Softness (subj)	-	-	0.07–0.33	-	-	-	0.31–0.32
Colour (obj vs subj)	-	-	0.43–0.49	-	-	-	0.62
Style (subj)	-	-	0.13–0.23	-	-	-	0.17–0.24
Character (subj)	-	-	0.14–0.34	-	-	-	0.35–0.39
Total kemp/mohair rate (subj)	-	-	-	0.14–0.37	-	-	0.20

3.2.1990 - 2025 period: Important developments in this period are summarized below:

(1) Developments in measuring instruments for grease mohair and mohair tops properties: The most important development in this period was the development of the OFDA 100 device in 1989 for measuring fiber diameter. Later, OFDA 2000,4000, 5000 devices were also developed. The grease mohair yield and its diameter are the two most important properties that determine the quality of the final products obtained from mohair and the total profit (McGregor and Butler 2009). For this reason, until approximately the early 1990s, research mainly focused on the yield, average diameter and VC of grease mohair. But the development of OFDA technology in 1989 led to: (a) Measurement of new diameter-dependent quality characteristics (fiber curvature, staple diameter profile, comfort factor, spinning fineness, etc.) in grease mohair and tops has become possible.(b) Mohair quality classification has become much more effective. (c)More reliable estimation of phenotypic and genetic parameters of mohair quantity and quality traits (measurements on thousands of samples/animals). (d)Incorporating new mohair traits into genetic breeding/selection programs. (e) Laboratory analysis standards have been developed: IWTO and ISO/IEC 17025 Testing and calibration laboratories.

(2) Estimation of genetic and phenotypic parameters of gerase mohair traits: The number of studies on the estimation of phenotypic and genetic parameters of the average grease mohair diameter and diameter-related quality traits, along with traditional dirty mohair traits, has increased. The study is mainly concentrated in the following countries: Avustralya (Gifford vd. 1990, 1991, Bolorma vd. 2009), Arjantina (Taddeo vd. 1998), France (Allain ve Roguet 2003, 2006), SA (Snyman ve Olivier 1996, 1999, Visser vd. 2009, Snyman 2012). During this period, the heritability and repetability levels of grease mohair traits in these countries were generally estimated at medium-high levels. Generally positive and negative genetic correlations (mainly peliotropy) were predicted respectively between the mean

diameter of the grease mohair and growth traits and milk and reproductive traits.

(3) National Genetic Improvement Program: In mohair producing countries (GA, Lesotho, USA, Argentina, Australia, France) have National Genetic Improvement Programs for Angora goats (NGIPAG) for many years. *NGIPAG's are mainly developed by the Ministries of Agriculture. Genetic improving method is mainly selection. There are differences between countries in terms of national genetic improvement programs, the traits emphasized in selection, and selection methods. In some countries, selection traits include body and mohair weight and diameter, and other quality traits, while reproductive traits are given less importance. In some countries, selection programs also include subjective traits such as mohair coat kemp and homogeneity score. However, in recent years, more emphasis has been placed on diameter-dependent quality traits measured with OFDA 100 and OFDA 2000 devices in selection programs (Snyman vd. 1996, Allain ve Roguet 2003, Ferguson ve McGregor 2005, Allain ve Roguet 2006).

(4) Selection methods: Although direct selection is the main method used in selection programs, indirect selection can also be applied. Direct selection methods include Tandem, Independent Selection Borders and Index Selection methods. Until the late 1980s, the genetic improvement of mohair quantity and quality traits was mainly based on the selection method for a single trait and tandem and independent culling limits applied to multiple features. But mainly because of positive and negative genetic correlations between gerase mohair growth and diameter traits and body growth and reproductive traits, from the early 1990s onwards, the index selection method for multiple tarits was adopted. In index selection, mohair, growth and reproductive traits measured objectively and subjectively can also be used as indirect selection criteria. A large part of genetic improvement programs are planned based on genetic parameters estimated from data on animals aged 8-12/18 months. Especially in young Angora goats, eliminating the effects of environmental factors (age, birth type and shearing order, etc.) on body and grease fleece makes a significant positive contribution to the effectiveness of the selection program (Snyman ve Olivier 1996, Snyman 2002, Visser vd. 2014).

(5) Example of Angora Goat National Genetic Improvement Programs: In Europe, the national genetic improvement program for the Angora goat is most extensively implemented in France and is carried out through selection practices linked to the national genetic database and performance recording system.

(a) Selection organization: the operation of the selection programmes is carried out in collaboration between the breeders' organization (Caprigene France), the National Institute for Agricultural Research (INRA) and the French Breeding Institute (Institut de I' Elevage).

(b) The main objective of the selection program: is to produce fleece with a high clean mohair weight and an average diameter of <30 µm, free of coarse, kemp and medullated mohair, primarily from 18-month-old Angora goats.

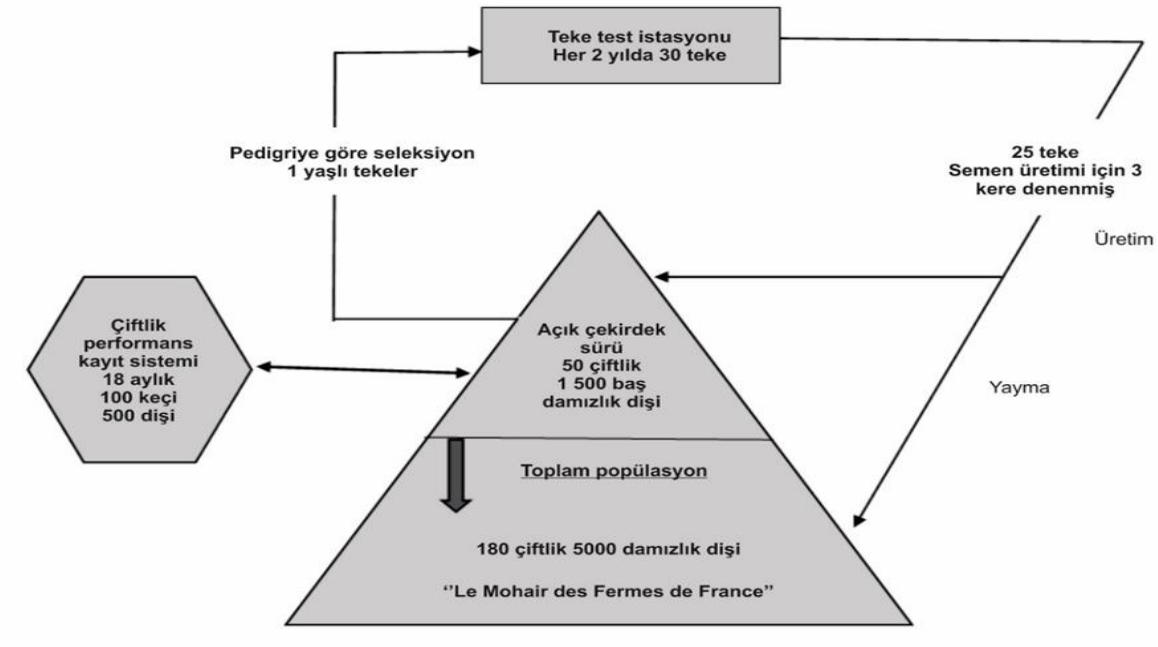
(c) The database for selection programs was established in 1988, and farms have an individual

registration system. Two different programs have been running in France since 1998:

Program 1: This program is implemented with an open nucleus herd system and its main components are: farm performance recording system, buck testing station and national genetic database (allowing for national breeding value estimations with single and multi-trait animal models) (Figure 2).

Program 2: Evaluation of all Angora goat farms: In France, all Angora goat farms, excluding open nucleus herds, are evaluated under the "Caprigene France" program. The commission visits farms annually, and the herds are evaluated based on the following characteristics: (1) General characteristics of animals.(2) Determining whether the animals have reached the target levels in terms of breeding purpose (mainly grease mohair weight). (3) Culling out animals with undesirable characteristics such as poor mohair fleece color, hornlessness, jaw deformity, inability to stand straight, cryptorchidism in young animals, excess coarse mohair and sheep-like mohair fleece. (4) Quality characteristics: Mohair average diameter, mohair diameter variation, rate of medullated and kemp mohair, grease staple length and type, homogeneity of the grease mohair staple and fleece, degree of body mohair coverage, and other quality characteristics. Yield and the rate of medullated and kemp lint are determined as a percentage.

Figure 2. Angora Goat Selection Program Implemented in France.



(6) Globally important points to note

a-The first OFDA technology, the OFDA 100, was developed in 1989 and subsequently tested and implemented in many countries. The OFDA 100 has been routinely used to measure grease diameter

and medulla distribution in SA since 1992, in Türkiye since 1998, and in France since 1999. The OFDA 2000 instrument is routinely used primarily at the farm level for measuring lint diameter and new diameter-related quality traits.

(b) The number of studies on covariance components and genetic parameter estimations of growth and mohair quantity and quality traits in Angora goats is quite low compared to cattle and sheep. There is significant variability among h^2 estimates and in many cases, they have relatively high standard errors. This is reported to be due to differences in the genetic makeup of the herds and the environmental factors they are exposed to, sample sizes, the structure of the prediction models, measurement techniques, etc.

(c) No research was conducted on the estimation of genetic parameters of mohair quantity and quality traits in Australia until 1991 and in SA until 1996.

(d) Most studies have used genetic models based on half-sibling and parent-offspring relationships (Shelton and Snowder 1983, Nicoll et al. 1989, Pattie et al. 1990, Gifford et al. 1991). Much less research has been conducted under animal models, focusing on direct genetic additive and estimating covariance components of maternal genetic effects (Gerstmayr et al. 1992).

(e) OFDA technology a significant contribution to the objective assessment of mohair quality traits, the estimation of their phenotypic and genetic parameters, and thus the efficiency of selection. Therefore, there is still room for genetic advances in mohair quality traits using OFDA technology. However, A very limited number of studies have been conducted on the phenotypic and genetic parameters of the lint diameter measured with OFDA 100 and OFDA 2000 devices and the new diameter-related traits (Allain ve Roguet 2003,2006, Snyman ve Olivier 1996, Visser vd. 2009)

(f) The Angora goat industry faces challenges in increasing reproduction and survival rates, and molecular tools have the potential for future genetic improvement in this area **(Visser vd. 2014).**

4.Genetic improving of the Angora goat in Türkiye

4.1. History of genetic improvement of the Angora goat in Türkiye: Studies on genetic improvement of Angora goats in Türkiye can be divided into 4 main periods (Table 6). While studies in the 1930-1965 period focused mainly on structural organizations, studies in the 1960-1980 period focused on inbreeding and selection. Between 1980 and 2002, the primary focus was on backcrossing projects between Ankara goat bucks originating in the USA and the SA and female Turkish Ankara goats. However, these projects failed to achieve their intended goals due to factors such as the general lack of recombination capacity and heterosis in the F1, F2, and G1 offspring, and the inability of the kids to adapt to environmental conditions. Two significant developments occurred between 2005 and 2025. The first was started the Genetic Improvement of Angora Goats in Public Hands Project by TOB-TAGEM in 2005. This project primarily aims to improve the traits of kid birth weight, kid 90th day weight, grease mohair weight, and grease mohair mean diameter through selection, and applications aimed at this goal continue through 2025. The second is the doctoral study carried out by Erdal (2024) in 2024. In this study, phenotypic and genetic parameters and genetic tendency estimations for kid growth and grease

mohair quantity and quality traits were carried out using the data sets of the 2018-2022 period of the Genetic Improvement of Angora Goats in Public Hands Project.

The characteristics and results of the doctoral study conducted by Erdal (2024) are as follows:

(1) This study is a TAGEM study, the first of its scope in Türkiye and the EU, and among approximately 10 studies in this field in the world.

(2) In this study, for the first time in Türkiye, the new mohair quality properties (staple diameter profile, spinning fineness, comfort factor, fiber curvature, houter value, New Zealand fiber volüme vb.) preferred by the textile industry in recent years were emphasized and the measurement of these properties was carried out with the OFDA 2000 device.

(3) The additive h^2 values of the features kid birth weight (KBW), kid 90.day weight (K90.W), Birth-90th day daily weight gain (Birth-90th DWG), grease mohair weight (GMW), mean mohair fiber (MMD), standard deviation of mohair diameter (SDMD), coefficient of variation of mohair diameter (CVMD), comfort factor (CF), spinning fineness (SF), fiber curvature (FC), standard deviation of fiber curvature (SDFC), houter value (HV), New Zealand fiber volüme (NZFV) are estimated as 0.13, 0.20, 0.19, 0.30, 0.55, 0.14, 0.12, 0.17, 0.16, 0.23, 0.23, 0.17, 0.11, respectively. Accordingly, the h^2 value of the MMD was high, the h^2 values of the Birth-90th DWG, GMW, CF, SDFC are medium, and the h^2 values of the KBW, Birth-90th DWG, SDMD, CVMD, CF, SF, HV, NZFV are in the low h^2 class.

(4) The genetic progress ((-0.4503 µm/year) achieved in the 2018-2022 period through selection to reduce the MMD trait can be considered quite satisfactory**.** However the negative genetic change for MMD in the 2018-2022 period (-0.4503 µm/year) is much higher than that for KBW, K90.W, GMW traits (-0.0045 kg/year; -0.0619 kg/year; -0.0023 kg/year, respectively). Because:

(a) In the selection program implemented by TAGEM, a higher negative change occurred for MMD due to the more intensive/accurate selection (approximately 9 years) for OTÇ compared to KBW, K90W, GMW (approximately17 years).

(b) Regardless of the weight/direction given to the selection of the 4 traits emphasized, since the Angora goat is essentially a mohair production-oriented goat breed, the MMD trait (and therefore mohair follicle physiology) responded to selection more quickly and with priority than the other 3 traits.

(5) Phenotypic and genetic parameter analyses of KBW, K90.W, Birth-90th DWG, GMW, MMD, SDMD, CVMD, CF, SF, FC, SDFC, HV, NZFV traits were carried out on approximately 38680, 30517, 30591, 5162 goat heads and 7303, 7240, 6092, 6101, 5926, 6050, 6100, 3295, 3196 dirty mohair samples, respectively. Therefore, it can be accepted that the findings and results obtained are reliable and will provide a good basis for the TAGEM-Ankara goat selection program.

(6) h^2, r^G, r^P relationships: When the h2 values for growth, grease mohair diameter, and diameter-dependent traits are evaluated collectively, it can be said that selection for a single trait is possible for most of them. However, the rG and rP values between them indicate that the most appropriate selection method for these traits is multiple trait selection (index selection).The h2 values of the kid growth traits

are lower than the rG and rP values between them. However, if the h2 values of the two traits under consideration are low but the rG and rP values between them are high, selection to improve these traits is possible.

Table 6. History of genetic improvement of the Angora goat in Türkiye.

Period	Studies/Applications
1930-1965	Institutional organization: Ministry of Agriculture (Ziraat Vekâlet' i 1931), Turkish Mohair Society (1930-Lalahan), Yerköy Beyazıtoğlu Farm (1940), Yerköy Animal Husbandry Research Institute (1942-2000)
1960-1980	Mainly inbreeding and selection studies but research on the estimation of phenotypic and genetic parameters of growth, mohair quantity, and quality traits is quite limited: Sincer (1967) and Yalçın et al. (1979).
1980-2002	-During this period, hybridization studies were carried out mainly in two different programs: The first crossbreeding program was carried out in 1983 between USA (Teksas) x Turkish Angora goats, second program was carried out between SA x Turkish Angora goats at the Anadolu (Çifteler). -Results of both crossbreeding programs were published in 1992-2002 (Gerstmayr 1991,Yalçın et al.1991, Gerstmayr et al.1992, Güneş 1992; Güneş et al.1992, Yalçın et al.1993, Gerstmayr and Horst 1995, Gerstmayr et al. 1995, Gerstmayr 1987 Güneş et al 1997, Yalçın et al.1997, Güneş 2001, Güneş et al.2002). According to the results, recombination and heterosis effects generally did not occur in the F1, F2 and G1 generations in the crossbreeding applications. - A single indirect selection (face mohair covering)study was also conducted during this period.
2005-2025	-TOB/TAGEM has initiated the "Projects for the protection of the Ankara goat as a genetic resource and its genetic improvement in the hands of the public". -Conservation project: Ankara (Lalahan - Ex Situ), Bolu (Ex Situ) province -The Genetic improving Project mainly includes Ankara (Ayaş, Güdül, Beypazarı, Polatlı, Nallıhan, Kızılcahamam) province and consists of a base herd (20 thousand goats) and an elite herd (10 thousand goats). In the Project, since 2005, the kid birth weight, kid 90th day weight and grease mohair weight traits have been taken as basis (approximately 17 years), and since 2015, the average mohair diameter (approximately 9 years has been included in these traits. The selection method is mainly based on a single trait. - 2024: Erdal 2024. Phenotypic and genetic parameters of some mohair yield and

	quality traits in Angora goats within the scope of the national animal breeding project in public hands (Doctoral Thesis/Ankara University, Institute of Science, Department of Animal Science/TAGEM/06TIF2012-04)

5. Challenges, opportunities and future prospects in genetic improvement of the Angora goat in Türkiye

5.1. Challenges and opportunities: Challenges and opportunities for genetic improvement of the Angora goat in Türkiye are given in Table 7.

Tablo 7. Challenges and opportunities for genetic improvement of the Angora goat in Türkiye

Challenges	(1) Stakeholder interest is low because consumption of mohair products is very low. (2) The needs and goals of the textile sector are not clearly defined. (3) The grease mohair procurement and marketing chain is maintained through traditional means, there are significant shortcomings in quality classification, and some units managing this chain are not positive about the genetic improvement approach. (4) Sustainable data collection and recording system(s) are inadequate.
Opportunities	(1) There is an ongoing project. (2) Four important institutions (TOB-TAGEM and HAYGEM, Ankara University, and the Ankara Province Breeding Sheep and Goat Breeders Association) have laboratories (OFDA 100 and OFDA 2000, etc.), expert personnel and knowledge. (3) Angora goat breeding and mohair production are supported by the State. (4) Farmers are volunteers.

5.1.Future: The following views can be put forward regarding the future of genetic improvement of the Angora goat in Türkiye. What should be done for the future?

(1) The Project initiated by TOB-TAGEM should be continued but the operation should be re-evaluated: The registration system should be re-established/adjusted based on all genotype groups/relatives, traits, and environmental factors. Selection traits and objectives should be re-discussed after a detailed analysis of the textile industry's demands and the global grease mohair, tops, and fabric market. For example: only the number of goats and the amount of medium-fine grease mohair can be increased; only the average mohair diameter and diameter-related traits can be emphasized; only high mohair amount and low average diameter can be emphasized.

(2) The number of studies on phenotypic and genetic analyses of new diameter-dependent mohair traits should be increased.

(3) If the goal is to combine breeding for kid growth, diameter, and diameter-related traits, a multiple trait selection method (index selection) must be applied. However, conditions may arise where this selection method can be combined with tandem and independent selection methods. Therefore, theoretical and simulation studies should be conducted to implement these selection methods, either individually or in combination, in the field.

(4) SNP, GIVAS and GENOMIC SELECTION studies should also be emphasized (However, it is also reported that investigating the possibility of applying MAS before genomic selection applications for mohair traits yields more useful results).

(5) Emphasis should also be placed on subjectively measured mohair characteristics and the application of indirect selection.

(6) The maintenance and calibration of OFDA 100 and OFDA 2000 devices must be monitored.

(7) Relevant laboratories must be certified according to the ISO-17025 Laboratory Certification Standard.

(8) Angora goats should definitely be used for meat production.

(9) Coordination and cooperation must be ensured among stakeholders.

(10) Emphasis should be placed on publication and training activities aimed primarily at genetic improvement of the Angora goat.

(11) Organization is essential for the success of genetic breeding: the marketing capacity of mohair depends significantly on national and international agricultural policies and fluctuations in world mohair market prices. For example, the French Mohair Breeding Model (Le Mohair des Fermes de France) is a prime example of a contract industry.

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Effect of Some Environmental Factors on Hair Cortisol Concentrations in Newborn Akkeçi Goat Kids

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Cortisol hormone can be measured in animals from various biological matrices such as blood, saliva, urine, feces, and hair. Among these, blood serum or plasma has traditionally been the most widely used sample type. However, due to the circadian rhythm and pulsatile fluctuations of cortisol concentration in blood, as well as variations caused by handling stress associated with catching or restraining animals for sampling, alternative techniques utilizing matrices such as saliva, urine, feces, and hair have been developed. Among these biological matrices, hair has been described as an exciting novel matrix that is unaffected by circadian variations and enables long-term retrospective measurements of cumulative cortisol secretion. Depending on the species/breed-specific growth profile, the hair matrix has the potential to record glucocorticoid responses over several months, allowing retrospective determination of cortisol production during any given period without the necessity of collecting samples at the beginning of that period. This study aimed to determine the effects of macro-environmental factors such as sex, birth type, maternal age, and birth weight on the hair cortisol concentrations of newborn Akkeçi goat kids. For this purpose, hair samples were collected from 44 Akkeçi kids within the first 24 hours following birth. Cortisol analyses of the collected hair samples were conducted using the ELISA method in the Reproductive Biology and Animal Physiology Laboratory of the Department of Animal Science, Faculty of Agriculture, Ankara University. The statistical analysis revealed that sex, birth type, maternal age, and birth weight had no significant effect on the hair cortisol concentrations of kids ($p > 0.05$). Although not statistically significant, it was observed that males tended to have higher cortisol levels than females, kids born as twins or triplets had higher levels than singletons, and kids born from multiparous does had higher levels than those born from primiparous does. In conclusion, no relationship was found between hair cortisol concentrations and the investigated environmental factors in Akkeçi goat kids.

Keywords: Stress, neonatal, HCC, dairy goat

Determination of Crude Lanolin Content in Akkaraman Breed Sheep Under Different Environmental Conditions

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Lanolin, also called wool wax or wool oil, is a yellow waxy substance secreted by the sebaceous glands of wool-bearing animals. Most lanolin used by humans comes from domestic sheep breeds raised specifically for their wool. In this study, it was aimed to determine the crude fat (lanolin) rate in the Akkaraman breed, one of the most important sheep breeds raised in Turkey. The study was carried out in Aksaray (n=32), Ankara (n=43), Çankırı (n=38), Kayseri (n=52), Konya (n=52) and Niğde (n=43) within the scope of the "Public Sheep Breeding Project". Samples were taken from a total of 260 animals from enterprises in) provinces. Analyzes of fleece samples were carried out at UHAEM Fleece-Lint Laboratory and Gazi University Chemistry Laboratory. At this stage, all samples (n = 260) were used with the Soxhlet device (UHAEM Lab.) and three samples from each province (n = 18) were used with the SCC02 device (Gazi Lab.). In the analysis performed with the Soxhlet device, the lanolin rate was found to be 3.23%, and this value was found to be statistically different between provinces (P = 0.001). This value; In the provinces where the study was conducted, it was found to be 3.24%, 2.57%, 4.37%, 2.71%, 2.62% and 4.21%, respectively, as stated above. In the analyzes made with the SCC02 device, the lanolin rate was found to be 4.06%, 2.60%, 3.45%, 6.62%, 3.06% and 2.62% in the same order according to the provinces. Today, technological advances have reduced the demand for products obtained from sheep fleece. Therefore, lanolin may come to the fore among alternative evaluation methods for fleece. The fact that lanolin is relatively easy to obtain may encourage manufacturers to make products derived from it.

Keywords: Akkaraman sheep, fleece, raw wool wax

Machine Learning–Driven Discovery of Host Genetic Factors for Paratuberculosis (Johne's Disease) in Goats Within the One Health Framework

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Paratuberculosis, caused by *Mycobacterium avium* subsp. *paratuberculosis* (MAP), results in significant economic losses and zoonotic risks, highlighting its relevance to the One Health framework. Its latent progression, lack of effective treatments further complicate control efforts.

This study sampled 3,372 goats from seven breeds (Kıl, Honamlı, Tiftik, Kilis, Saanen, Maltız, and Damascus) across 11 provinces in Türkiye. Seroprevalence was assessed using indirect ELISA, revealing a prevalence ranging from 0% to 25.41% across breeds. Farm-level prevalence was alarmingly high at 95.55%.

A subgroup of 240 case-control matched pairs (n = 480) was genotyped using the ovine 50K SNP chip. Seven machine learning (ML) models—Random Forest (RF), Regularized Random Forest (RRF), Elastic Net (ENET), Gradient Boosting (GB), Regularized Ensemble (RE), Logistic Regression (LR), and Support Vector Machine (SVM)—were applied using Scikit-Learn in Python evironment. Hyperparameter optimization was performed using optuna library. Metrics including AUC, MCC, Sensitivity, Specificity, Recall, F1, Balanced Accuracy, ROC, and Cross-validation AUC were computed for training, validation, and test datasets. SNP importance scores were calculated, and the top 30 SNPs were identified for each model. Alongside consensus among the top 30 SNPs, model performance and overfitting were compared,

All ML models demonstrated excellent performance, with all metrics ranging from 0.912 to 1.00. The lowest top 30 SNP detection correlation was observed between GB and SVM at 40%, while the highest correlations were between ENET and LR at 94%. Overfitting analysis, based on the difference between training and validation metrics, showed no evidence of excessive learning in any of the ML models (Train-Validation Gap < 0.05).

Among the top 30 SNPs, 45 were identified, with 17 achieving 100% consensus across all models. The study concludes that ML algorithms provide a robust alternative to traditional single-locus and multi-locus GWAS models for identifying host genetic factors associated with diseases.

Genomic Breeding Value Estimations in Holstein Friesian and Simmental Cattle in Türkiye: Applications from 2017 to 2025

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The objective of this study was to present the outcomes of genomic estimated breeding values (GEBV) in Holstein Friesian (HF) and Simmental (SIM) cattle populations in Türkiye since 2017. Genomic evaluations for HF cattle have been carried out since 2017, and for SIM cattle since 2022, through the collaboration of HAYGEM, TAGEM, Ankara University, and TDSYMB. Pedigree, phenotypic (milk yield, milk quality, conformation traits, and reproductive performance), and SNP genotypes (54K and 100K) collected between 2017 and 2025 were used. Evaluations were conducted using the single-step genomic BLUP (ssGBLUP) method implemented in the BLUPF90 software family. The analyses revealed a gradual genetic improvement in milk production traits over the years. For conformation traits estimation results are provided. Although reproductive traits are characterized by low heritability, the inclusion of genomic information improved the accuracy of predictions. Differences were observed between HF and SIM in terms of genetic progress and prediction accuracies. Reference populations have been established, and national selection indices—the Türkiye Holstein Production Index (THPI) and the Türkiye Simmental Production Index (TSPI)—were developed by weighting production, conformation, and reproductive traits, and subsequently made available for breeders.

The implementation of genomic selection in Türkiye has increased the accuracy of breeding value estimations for both breeds and strengthened the foundation of sustainable breeding programs. These findings emphasize the importance of maintaining genomic selection at the national level.

Keywords: Holstein Friesian, Simmental, ssGBLUP, Genomic selection, Breeding value estimation

Effect of Herd Size on First Lactation Milk Yield Trends in Holstein and Simmental Cattle in Turkey

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Holstein Friesian (HF) and Simmental (SIM) cattle constitute the majority of Türkiye's dairy population. Understanding the dynamics of milk yield progress across farm sizes is essential for improving herd management and genetic selection strategies. This study aimed to evaluate the progress in first-lactation adjusted milk yield (LMY305) of HF and SIM cattle across different farm sizes between 2014 and 2023. First-lactation adjusted milk yield (LMY305) data from 2014 to 2023 were analyzed, covering 1,000,661 HF and 163,490 SIM cows from 64,115 farms. Farms were categorized by annual number of completed lactations as family (5–20), small (20–50), medium (50–100), large (100–250), and integrated (>250). A general linear model (GLM) was applied with breed, year, and farm size as fixed effects. LMY305 increased significantly with farm size ($p < 0.001$), with a moderate correlation between farm size and LMY305 ($r = 0.41$, $p < 0.001$). Mean LMY305 ranged from 5611.4 ± 5.08 kg/lac in family farms to 6127.9 ± 14.12 kg/lac in integrated farms. The highest annual progress was observed in integrated farms (120.00 ± 1.09 kg/year), followed by family farms (98.15 ± 0.89 kg/year). Overall, LMY305 increased by 88.99 ± 0.46 kg per year across all farms. Annual progress was greater in SIM (99.99 ± 1.40 kg/year) than HF (80.99 ± 0.58 kg/year; $p < 0.001$), although HF cows produced 649.73 ± 5.14 kg more milk on average than SIM ($p < 0.001$). Farm distribution shifted markedly, with integrated farms increasing by +16.80% and family farms declining by −20% over the study period. Milk yield progress in Türkiye was strongly influenced by farm size and breed. While SIM showed higher annual gains, HF maintained a higher overall production level. Structural changes in herd distribution, particularly the decline in family farms and the rise of integrated farms, highlight the ongoing transformation of the dairy sector.

Keywords: Holstein Friesian, Simmental, Farm size, First lactation, Milk yield

Genome-Wide Association Study for Binary Traits with Logistic Mixed Model Method: Simmental- Fleckvieh Conformation Traits

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Occurrence of the conformation defects were found to be important for both farming practices and culling decisions. In the present study, we opted to identify genomic regions that significantly effect on 3 selected traits which are, Loosey Shoulder (LS), Staged Udder (SU) and Rump Roof Shaped (RRS), defined in Fleckscore method, respectively. Variants' effects as the additive and dominant effects were also investigated. Total of 4605 Simmental cow were genotyped as a part of the Türkiye National Genomic Selection Project in Simmental Fleckvieh Cattle with 54k or 100k SNP arrays. The 54k SNP arrays were imputed and after the Quality and Control (QC) process total of 64588 variants were exceed the criteria. Thresholds of the logarithm base 10 of the P-Value ($-\log10P_i$) were selected as both Bonferroni Genome-Wide Corrected ($-\log10P_1=6$) and suggestive ($-\log10P_2=5$).

Investigating additive model, none of the variants were reached neither genome-wide nor suggestive levels of significance on RRS and LS. On the other hand, one variant on *Bos taurus* chromosome (BTA) 6 (*rs136013644*) was found to be significant at suggestive level on SU with the additive effect model. This variant was located on *RAP1GDS1* gene.

In dominance model, 4 variants and 12 variants were succeeding genome-wide and suggestive levels of significance for dominance effect model on RRS, respectively. The genome-wide level significant variants were located on BTA 29 (*PRMT3, rs41569702)*, BTA 24 (*KDSR, rs42052893)*, BTA 10 (*RPL10L, rs43622134)*, BTA 7 (*SPOCK1, rs109163147*) None of the variant were reached the threshold on LS and SU.

The results of the study enlighten our knowledge about genetic background of culling reasons in breeding system with respect to conformation malformations.

Keywords: Simmental, Conformation malformations, GWAS, Binary traits, Logistic mixed model

Comparative Evaluation of Machine Learning Models—LASSO and Elastic Net—for Genetic Association Mapping Using Simulated Phenotype Data

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Machine learning (ML) approaches provide flexible and powerful alternatives to classical statistical methods in genetic association studies, particularly when handling high-dimensional genomic data. In this study, two ML models—LASSO and Elastic Net—implemented in the GLMNET package, were evaluated. While these models originate from regularized regression in classical statistics, within ML they are applied for phenotype prediction and variable selection.

Genotype data were obtained from the Sheep HapMap consortium (Sheep 50K array), and phenotypes were simulated using Genome-wide Complex Trait Analysis (GCTA) under three heritability scenarios ($h^2 = 0.1, 0.3, 0.56$). The initial dataset included 46,925 SNPs and 2,819 individuals. After quality control with PLINK 1.9, genotype imputation with Beagle5, and linkage disequilibrium pruning (50 SNP window, 5 SNP step, $r^2 < 0.2$), 38,448 SNPs and 2,819 individuals were retained. Realised heritabilities were estimated as $h^2 = 0.11$, 0.26, and 0.60, respectively.

Model performance varied with heritability. At $h^2 = 0.1$, Elastic Net showed weak prediction ($R^2 = 0.079$ and correlation = 0.399), while LASSO performed similarly ($R^2 = 0.091$ and correlation = 0.421). At $h^2 = 0.3$, Elastic Net achieved $R^2 = 0.415$ and correlation = 0.71, whereas LASSO yielded $R^2 = 0.385$ and correlation = 0.686. At $h^2 = 0.6$, both models performed moderately well (Elastic Net: $R^2 = 0.672$ and correlation = 0.862; LASSO: $R^2 = 0.683$ and correlation = 0.866). Overlap in the top 50 SNPs identified by both models was high across scenarios: 84%, 90%, and 100%, respectively.

These findings demonstrate that LASSO and Elastic Net perform poorly in low-heritability contexts but show moderate-to-good performance at $h^2 \geq 0.3$, with strong concordance in top SNP detection. Although validation with empirical datasets is required, the results support the potential of ML models as effective tools for association mapping in high-dimensional genomic studies.

Evaluation of Reproductive and Growth Traits in Karya Sheep Breed based on Large-Scale Data

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The animal material for this study comprised a total of 94,681 Karya sheep and their lambs data from flocks participating in the “Karya Sheep Breeding” sub-projects, conducted in the provinces of Aydın and Denizli. The data covers the period between 2019 and 2024. The study evaluated fertility, lamb birth weights, and growth performance. The average number of lambs per ewe at lambing was 1.43, with values of 1.37 in Aydın and 1.49 in Denizli ($p < 0.001$). The rate of multiple lambing observed in the population, exceeding 40%, was considered noteworthy. The overall average lamb birth weight was 3.78 kg, with 3.44 kg in Aydın and 4.11 kg in Denizli ($p < 0.001$). Male lambs born as single had higher birth weights than those born as twins or triplets. When evaluation based on ewe ages, lamb birth weight increased up to 4 years of age and then showed a relative decline as the ewes aged further. Regarding growth performance, the average live weights were 10.92 kg at day 30, 18.16 kg at day 60, 27.40 kg at day 90, 33.21 kg at day 120, and 38.23 kg at day 150. The average daily gain values for these age intervals were 225.6, 231.2, 250.5, 244.2, and 226.6 g, respectively. Male lambs exhibited higher performance than females across all age groups ($p < 0.001$). Values obtained from elite herds were higher than those from base flocks, likely due to differences in husbandry practices and management. These results demonstrate that Karya sheep represent an important genetic resource for regional sheep farming, owing to their high multiple birth rate, superior birth weight, and rapid growth potential.

Keywords: Karya, breeding program, prolificacy, growth, sustainability

Comparative Growth Performances of Kıl Goats in Different Production Environments

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This study aimed to provide fundamental data on the growth performance of Kıl (hair) goats and to evaluate the effects of year, province, birth type, and sex on the trait in question. The animal material for the study comprised a total of 174,794 kids born between 2013 and 2024 as part of the "Hair Goat Breeding" projects conducted in the provinces of Aydın, Denizli, Isparta, and İzmir. The study evaluated birth weight (BW), live weight adjusted to 90 days of age (LW_{90}), and average daily gain (ADG_{90}) from birth to 90 days of age. The average values for BW, LW_{90}, and ADG_{90} were 3.05 kg, 17.76 kg, and 162.24 g/day, respectively. When evaluated by year, birth weight remained relatively stable, ranging from 2.97 to 3.15 kg; however, significant fluctuations were observed in growth performance. Specifically, in 2022, LW_{90} (20.01 kg) and ADG_{90} (187.51 g/day) reached their highest levels ($p < 0.001$). By province, the highest birth weight was recorded in Denizli (3.27 kg), while the lowest was in İzmir (2.89 kg). Kids raised in Isparta province exhibited the highest values for LW_{90} (19.06 kg) and ADG_{90} (175.80 g/day), whereas those raised in Aydın province had the lowest values ($p < 0.001$). Regarding birth type, single kids had higher birth weights, but twins showed superior growth performance until weaning. The sex factor was also found to be significant; males exhibited higher birth weight, LW_{90}, and ADG_{90} compared to females ($P < 0.001$). Consequently, year, province, birth type, and sex were shown to have significant effects on growth characteristics in Kıl goat kids. These findings indicate that the Hair goat exhibits considerable variation in the traits examined and that the data obtained can be effectively utilized in ongoing selection and breeding programs.

Keywords: Small ruminants, Kıl goat, Growth, Performance comparisons, Different environments

Environmental and Genetic Factors Affecting Growth Characteristics in Kıvırcık Sheep

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This study was conducted to evaluate the growth performance and genetic parameters of 7,076 lambs born between 2014 and 2023 as part of the Kıvırcık Sheep Breeding project in the province of Aydın. The traits assessed included birth weight (BW), live weight at approximately three months (LW), and average daily live weight gain (ADG). The mean values for BW, LW, and ADG were 3.95 kg, 25.77 kg, and 214.30 g/day, respectively. Significant differences were observed across years, with BW ranging from 3.71 to 4.47 kg, LW from 23.84 to 29.23 kg, and ADG from 200.78 to 253.22 g/day. The live weight (LW) and average daily gain (ADG) values obtained in the multiplier flocks were significantly higher than those in the base flocks ($p< 0.01$). Lamb performance improved with the age of the ewes, with lambs born to ewes aged 5–7 years or older achieving higher LW and ADG values. Single lambs outperformed multiple lambs in terms of birth weight (BW) and ADG ($p< 0.001$). Male lambs exhibited higher values than females across all growth traits ($p< 0.001$). Heritability estimates for LW and ADG were 0.47 and 0.45, respectively, indicating medium to high heritability for both traits. The genetic correlation between three-month LW and ADG was very high (0.917; $p< 0.001$), whereas the phenotypic correlation was moderate (0.510; $p < 0.001$). These findings indicate a strong genetic relationship among growth traits, suggesting that selection can be effectively applied. Consequently, curly lambs—with their wide variation, moderate to high heritability, and strong genetic correlations—represent a valuable resource for achieving genetic progress in breeding programs focused on growth traits. Notably, the study identified three-month live weight as a reliable selection criterion for breeding programs.

Keywords: heritability, correlation, breeding program, selection criteria

Assessment of DNA Damage in Long-Term Cryopreserved Bovine Ear Fibroblast Cells Using the Comet Assay

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This study aimed to investigate the effects of long-term freezing (more than 10 years) on DNA damage in ear fibroblast cells stored in a gene bank using the comet assay. A total of 60 mesenchymal (fibroblast) cell samples were obtained from mesenchymal cell lines derived from six indigenous cattle breeds to evaluate their post-thaw viability and genomic integrity under *in vitro* conditions. The breeds included Yerli Kara (YK), Boz Irk, Doğu Anadolu Kırmızısı (DAK), Güney Anadolu Kırmızısı (GAK), Yerli Güney Sarısı (YGS), and Zavot. Fresh samples were also collected as controls for comparison. Cryopreserved samples exhibited significantly elevated tail intensity (% tail DNA %) values, with Boz Irk (12.83), YGS (12.41), and DAK (12.36) showing the highest DNA damage. In contrast, controls averaged 5.63. Tail moment and tail length (μm) also varied by breed, with DAK and YGS exhibiting the highest tail moments (3.41 and 3.44, respectively). These findings confirm that extended cryopreservation produces significant differences in comet tail intensity when compared with non-frozen controls, emphasizing the impact of long-term storage on DNA integrity in gene bank materials. In addition, these findings highlight breed-specific differences in DNA stability after long-term cryopreservation, underscoring the relevance of genetic background in germplasm conservation protocols.

Keywords: Comet Assay, DNA Damage, Gene Bank, Indigenous Cattle Breeds

Cryoprotective Effects of Flavonoids on Freezing of Ram Semen

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Cryopreservation of semen is a widely used method in animal breeding; however, oxidative stress generated during the cooling and freezing processes causes severe structural and functional damage to spermatozoa. The present study aimed to evaluate the effects of selected flavonoids—capsaicin, baicalein, and syringic acid—supplemented into a Tris-based extender on the cryosurvival of ram spermatozoa. Semen samples were collected from six healthy Sönmez rams using an artificial vagina. Following macroscopic and microscopic evaluation, ejaculates were pooled and extended with experimental extenders containing different concentrations of flavonoids (0.5, 1, 2, and 4 mM). The diluted semen was loaded into 0.25 mL straws, equilibrated at +4 °C for 2 h, frozen in liquid nitrogen vapor (–120 °C), and stored at –196 °C. After thawing (37 °C, 30 s), sperm quality was assessed using computer-assisted sperm analysis for motility and velocity parameters, SYBR-14/PI for viability, FITC-PNA/PI for plasma membrane–acrosome integrity, JC-1 for mitochondrial activity, BODIPY/SYBR assays for oxidative stress, and single-cell gel electrophoresis for chromatin integrity. The results indicated that capsaicin had no significant protective effect on post-thaw motility, oxidative stress, or chromatin integrity. Conversely, 0.5 mM baicalein improved progressive motility and preserved chromatin integrity. More notably, syringic acid at 1 and 2 mM concentrations significantly enhanced both progressive and total motility while maintaining plasma membrane–acrosome integrity, mitochondrial activity, and chromatin stability. In conclusion, baicalein and syringic acid demonstrated promising cryoprotective properties against oxidative stress in ram spermatozoa, whereas capsaicin showed limited utility. The use of flavonoids as extender supplements may represent an effective strategy to improve post-thaw semen quality in rams, thereby contributing to enhanced fertility outcomes in small ruminant breeding programs.

Keywords: Flavonoids, cryopreservation, oxidative stress, ram semen, sperm integrity

Bovine Embryonic Stem Cell Derivation and Gastruloid Formation

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Stem cells represent a unique population of cells that can self-renew and also differentiate into many specialised cell types (Kuijk et al., 2011). They are classified by their ability to differentiate or by their origin. Embryonic stem cells (ESC) are derived from the inner cell mass of preimplantation embryos and are classified as pluripotent (PSCs) as they can differentiate into all three germ layers (i.e., ectoderm, mesoderm and endoderm (Biswas and Hutchins, 2007)). Livestock ESCs lend themselves to being genetically modified with agricultural and biomedical applications, with the promise of generating gametes *in vitro*, and additionally for understanding cell-fate decision during early embryo development (Soto and Ross, 2016). More recently, gastruloid formation has emerged as a model of differentiation into mesoderm and endoderm layers. Therefore, *in vitro* gastruloid generation allows us to understand the gastrulation process in terms of signalling, metabolic features and progression prior to organogenesis. To the best of our knowledge, no previous studies have successfully generated bovine gastruloids. The current study, therefore, sought to derive stable bovine stem cells from advanced blastocysts in defined media. This was undertaken to establish gastruloids to better understand developmental processes beyond the implantation stage. In this chapter Day 8 blastocysts (IETS Stage 7, 8 and 9) were generated from OPU-derived oocytes matured in the PVP-based serum free defined medium. Two donors were selected from the OPU study, and their blastocysts used to derive stem cells. Animals were 15 months old Holstein-Friesians. Their blastocysts were identified as male. Following stable stem-cell derivation, gastruloid formation was performed and the process repeated three times. In each replicate stem cells, pre-treated cells, 48h and 72h gastruloids were collected for gene expression and for immuno-staining. Also, the antero-posterior (A-P) axis of 48h and 72h gastruloids were observed. The ploidy status of stem cells was determined by Karyo-mapping (Tutt et al., 2021).

Keywords: Defined Media, antero-posterior axis, post-implantation embryo development

Sperm ProAKAP4 Concentration in Goats: Seasonal and Breed-Dependent Variations and Associations with Post-Thaw Motility and Kinematic Parameters

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The assessment of sperm proteins, particularly precursor A-kinase anchor protein 4 (proAKAP4), has gained considerable attention as a potential biomarker for semen quality evaluation across various mammalian species. This study was conducted to determine the seasonal variation in post-thaw proAKAP4 concentration and its effects on computer-assisted sperm analysis (CASA) parameters in Boer and Murcia-Granada goat breeds.

Semen samples were collected from seven adult goats (Boer, n = 3 and Murcia-Granada, n = 4) during the breeding and non-breeding seasons and cryopreserved using OptiXcell extender following a standardized freezing protocol (n = 4). Post-thaw proAKAP4 concentrations (ng/10^6 sperm) were quantified using enzyme-linked immunosorbent assay. Sperm motility parameters, including total and progressive motility percentages, and kinematic parameters, including average path velocity (VAP), straight-line velocity (VSL), and curvilinear velocity (VCL), were evaluated using a CASA system. Based on proAKAP4 concentrations, samples were stratified into low (< 40 ng/10^6 sperm) and high (≥ 40 ng/10^6 sperm) groups for comparative analysis. Correlation analyses were performed to examine relationships between proAKAP4 levels and all spermatological variables.

Motility percentage in the Boer breed was higher during the breeding season ($p < 0.05$). In the Murcia-Granada breed, all parameters were higher during the breeding season ($p < 0.05$). During the breeding season, all CASA parameters were similar between both breeds ($p > 0.05$). During the non-breeding season, VAP was higher in the Boer breed ($p < 0.05$). The overall post-thaw proAKAP4 concentration was 43.14 ± 4.70 ng/10^6 sperm. ProAKAP4 concentration did not differ between breeds in either season ($p > 0.05$); however, it was higher in the Murcia-Granada breed during the breeding season ($p < 0.05$). All parameters except VCL were significantly higher in the high proAKAP4 group ($p < 0.05$). Positive correlations were observed between proAKAP4 concentration and all CASA parameters except VCL ($p < 0.05$).

In conclusion, proAKAP4 represents a reliable molecular biomarker for assessing post-thaw semen quality in goats. The seasonal variations detected highlight the importance of considering reproductive seasonality. These results provide valuable insights for optimizing semen selection and artificial insemination outcomes in caprine breeding programs.

Keywords: Boer, Murcia-Granada, molecular biomarker, semen quality

The Effect of Selective COX-2 and Non-Specific Nonsteroidal Anti-İnflammatory Drug Applications on Pregnancy Rate in Central Anatolian Merino Ewes

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The study aimed to reduce embryonic deaths and consequently increase pregnancy rates in Central Anatolian Merino sheep by administering Carprofen and Diclofenac Sodium during the maternal acceptance period post-mating. Estrus was synchronized in these sheep at the beginning of the mating season (June-July).

The study material consisted of 210 Central Anatolian Merino sheep. For estrus synchronization, the sheep were administered a double dose of 1 ml PGF2α intramuscularly with 9-day interval. Estrus was detected using teaser rams at 06:00 and 16:00 in ewes. Detected estrus ewes were mated by hand (day 0). After mating, the animals were randomly divided into three groups. On the 11th day post-mating, Group I (n=70) received 1.4 mg/kg Carprofen subcutaneously, Group II (n=70) received 2.5 mg/kg Diclofenac Sodium intramuscularly, and Group III (n=70) received 1 ml physiological saline subcutaneously. Blood samples for progesterone analysis were taken from all groups on days 9, 11, 13, 15, and 17. Pregnancy examinations of the mated sheep were performed using USG on days 25 and 50 and compared with birth records.

On day 25, the pregnancy rates were 80%, 81%, and 76%, The birth rates were 77.1%, 78.6%, and 71.4%, the multiple birth rates were 46.3%, 40.0%, and 46.0%, fecundity was 1.13, 1.11, and 1.06, and litter size was 1.46, 1.42, and 1.48, in Groups I, II, and III respectively. No statistical differences were found between the groups in the evaluated parameters ($p>0.05$). Similarly, no statistical differences were found between the groups in the progesterone levels from blood samples taken on different days ($p>0.05$).

In conclusion, although Carprofen and Diclofenac Sodium application on the 11th day post-mating did not increase the conception rate in Central Anatolian Merino ewes, it increased the conception rate and the number of offspring numerically compared to the control group ($p>0.05$).

Keywords: Diclofenac sodium; Embryonic Mortality; Carprofen, Ewe; Progesterone;

Perceptions and Expectations of Farmers on Traditional Free-Ranging Cattle Farming in Aydın and Muğla Provinces

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This study aimed to explore the perceptions and expectations of farmers regarding the traditional free-range cattle farming system involving the Native Black Cattle breed in the Beşparmak Mountains (Latmos) ecosystem, located in the provinces of Aydın and Muğla. Face-to-face interviews were conducted with a total of 104 farmers across 23 villages in the districts of Koçarlı, Söke, Çine, and Karpuzlu in Aydın, as well as Milas and Yatağan in Muğla. The findings highlight several advantages of free-range cattle farming, including low feed and veterinary costs, ease of environmental adaptation, high economic returns in the sacrificial animal market, and the ability to utilize forest, maquis, and olive grove areas year-round. Additionally, this system provides important ecosystem services such as reducing fire risk, preserving biodiversity by suppressing competitive plant species, and generating organic fertilizer for olive groves. However, disadvantages were also identified, including the tendency of animals to become feral, risks of theft and accidents, lower slaughter value compared to cultivated breeds, limited access to public support, and insufficient public awareness. In conclusion, breeders' views on free-range cattle farming are largely positive, and this system has been adopted as a production model well-suited to regional conditions in terms of both economic sustainability and ecosystem conservation. Breeders also emphasized the need to develop public support and incentive mechanisms to ensure the long-term sustainability of free-range cattle farming.

Keywords: Native Black cattle, traditional production systems, environmental sustainability

How Should the Kilis Goat Breeding Project be Revised?

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The on-farm breeding project for Kilis goats was initiated in 2010. The project involved 39 breeders, managing approximately 6,000 does and 300 bucks. Among these, 25 herds were classified as base herds and 14 as elite herds. It was originally planned to establish a nucleus herd of 300 does, selected from the female and male goats within the breeders' herds. However, this objective could not be realized due to budgetary constraints and the breeders' reluctance to provide their superior animals.

Over the five-year period, data were collected from the herds (except in 2023, when records could not be obtained due to the earthquake) and evaluated using an index method. Based on these evaluations, breeding animals were identified for each herd and recommendations were provided to the breeders. Within this framework, the milk yield of elite herds ranged between 366.9 liters and 427.2 liters, while fertility varied from 113.7% to 114.2% during the same periods.

The primary breeding objective for the Kilis goat in this project is the improvement of milk yield. In calculating the selection index, several traits were considered, including kid birth and weaning weights, daily milk yield of dams at two different milking times, and type of birth. However, for more accurate selection in the future, it is recommended that the index be based exclusively on milk yield.

Furthermore, the best bucks should be subjected to progeny testing, and once genetically superior sires are identified, semen should be collected from them. The semen should subsequently be processed, frozen, and systematically distributed according to mating plans that specify which semen will be used with which does and on what dates. This approach would enable the implementation of an artificial insemination program. To support this process, the establishment of a regional research institute or breeding centre is also strongly recommended.

Key words: Kilis goat, Milk yield, İndex selection

Introduction

Over the past three decades, the global goat population has increased by approximately 60–70%. In contrast, Turkey's goat population, which stood at around 16 million heads in the early 1980s, has declined to approximately 10.5 million today. Of this population, 97% consists of Hair goats (*Kıl keçisi*) (FAO, 2024; TÜİK, 2024). As a significant component of Turkey's socio-economic and cultural heritage, Hair goats are widely distributed across almost all regions of the country. They are well-adapted to harsh environmental conditions; however, they are generally characterized by low productivity, particularly in terms of milk yield (87–146 kg per lactation) and fertility rates (65–100%) (Sönmez et al., 1973; Sönmez, 1974; Özcan et al., 1974; Şimşek et al., 2006).

Despite these relatively low performance parameters, Hair goats are still widely preferred by local farmers, especially under extensive farming systems that rely heavily on natural pastures. However, the potential negative impacts of such production systems on forested areas have frequently been raised as a concern. In light of both forest conservation efforts and the need to align with European Union (EU) production standards, it has been proposed to gradually reduce the number of Hair goats while increasing

the population of higher-yielding dairy genotypes.

In the 1969 Livestock Development Projection for Turkey, it was suggested that the national goat population should be reduced over time, while simultaneously enhancing the proportion of dairy breeds and crossbreeds within the remaining population. The report projected that by the year 2000, the total goat population would be reduced to approximately 3.6 million head, comprising 25% Hair goats, 15% Kilis goats, 5% Malta goats, and 55% dairy crossbreeds. Expected average milk yields for these groups were estimated at 100 kg, 350 kg, 400 kg, and 555 kg, respectively (Anon., 1969).

To achieve this proposed genetic composition, various crossbreeding programs were initiated in the 1960s, led by universities, research institutes, and the Provincial Directorates of the Ministry of Agriculture. As part of these programs, Swiss-origin Saanen bucks and German Noble Spotted bucks were used to improve the productivity of Hair goats. The resulting crossbreeds demonstrated promising results in terms of milk yield, fertility, and kid growth performance (Özcan, 1977; Güney et al., 1992).

As highlighted in the aforementioned projection study, the Kilis goat is considered a valuable genetic resource for the Turkish goat industry. Although not fully reflected in official statistics, the Kilis goat population is estimated to be around 500,000 head, primarily distributed across the provinces of Kilis, Adana, Gaziantep, and Hatay (Keskin et al., 2017).

Although less numerous than Hair goats, Kilis goats are distinguished by their superior productivity traits. They are often mistaken for Damascus or Aleppo goats but constitute a genetically distinct breed (Keskin et al., 1996; Keskin, 2000). Kilis goats are well-adapted to arid, tropical, and subtropical climates and represent an important local genetic resource.

Considering their adaptability and performance potential, it is crucial to document the breed's production characteristics through scientifically rigorous studies. This would support both conservation and sustainable utilization efforts. Within this framework, the "Genetic Improvement of Kilis Goats under Field Conditions" project has been implemented, aiming to improve milk and reproductive traits of the Kilis goat population through selection-based breeding programs.

Materials and Methods

The animal material of the project consisted of approximately 6,000 female goats and 300 bucks, totaling around 6,300 Kilis goats, including their kids and yearlings.

In the base herds, natural mating was performed annually during August and September. To synchronize estrus, bucks were separated from the females at least 45 days before the mating period. At birth, kids were individually tagged, and data were recorded including the identification numbers of both dam and kid, date of birth, litter size (birth type), and sex of the kids. To evaluate growth performance, kids were weighed at birth and again at 60 days of age. Due to the use of uncontrolled natural mating in these herds, pedigree records could not be maintained; however, dam-offspring records were collected.

In the elite herds, hand mating was applied, and pedigree records of all animals were kept. For each birth, the dam's identification number, litter size, birth date, and the ear tag numbers, sexes, and weights (at birth and at 60 days) of the kids were recorded.

In the elite herds, milk recording was conducted at 28-day intervals throughout the lactation period. Lactation traits were calculated using the ICAR-ATC (International Committee for Animal Recording – Alternative Test Control) method. In the base herds, two milk recordings were performed between April and June. These milk yield records, along with kid birth weights and weaning weights, were used for selecting breeding animals.

Selection of breeding stock was carried out using an index method based on the dam's milk yield, birth and weaning weights of the offspring, and birth types.

All data collected within the scope of the project were analyzed using basic statistical methods with the SPSS statistical software package

Results and Discussion

During the five-year period of the project (2020–2024), a total of 39 herds were included, comprising 25 base herds and 14 elite herds. Changes in performance traits over the years are presented in the table below. As can be seen from the data, the average birth weight of kids increased from 3.4 kg to 3.6 kg, while average weaning weight improved from 11.9 kg to 12.3 kg during this period.

Milk yield showed irregular fluctuations over the years. The 60-day suckling period, during which kids are born and nursed, generally coincides with favorable pasture conditions in the region. As a result, kid growth is relatively unaffected by seasonal changes. In contrast, lactation milk yields are directly influenced by pasture quality, with lower yields in dry years and higher yields in wetter seasons.

The milk yield traits recorded during this five-year project were consistent with the findings reported by Keskin et al. (2017), but higher than those reported by Tuncel et al. (1983) and Gül et al. (2016). These differences may be attributed to variations in year, herd, and regional conditions. Similarly, the average birth weights (3.4–3.5 kg) and weaning weights at 60 days (11.9–12.7 kg) were found to be in agreement with the findings of Aktepe (2009) and Keskin et al. (2017).

Table. Reproductive performance, kid growth, and milk yield characteristics of the project animals

Traits		Years			
		2021	2022	2023	2024
Number of does mated		5375	5625	eartquake	5995
Number of breeding bucks		276	289		309
Number of does kidding		5085	5306		5704
Number of kids born		5781	6058		6476
Kid birth weight (kg)	N	5599	6204		6234
	Min	1,6	2,0		2,1
	Max	6,3	6,1		4,83
	X±Sx	3,4±0,01	3,5±0,05		3,6±0,04
	CV (%)	14,5	12,3		10,32
Kid weaning weight (kg)	N	5599	5763		5282
	Min	8,0	7,0		7
	Max	18,6	23,8		19,6
	X±Sx	12,7±0,02	12,3±0,03		12,3±0,03
	Age	60. gün	60. gün		60. gün
	CV (%)	13,1	22,3		15,5
Elite flock milk yield (liters)		---	403,3±6,9		364,3±2,12
KPDK (%)		129,4	129,0		124,3
Selection differential (kg)		0,82	4,39		3,50
Survival rate at weaning (%)		100,0	92,7		84,7

KPDK, Kids per doe kidding; **Selection Differential**, Difference between selected males and average of male population; **Survival Rate**, Kid survival rate at weaning

Conclusion

The outcomes achieved thus far in this project can be summarized as follows:

Farmers have learned the importance of record-keeping and have started to maintain regular records.

Vaccination programs have been introduced and adopted by producers.

The significance and objectives of the project have become better understood, and stakeholders have begun to fulfill their roles more effectively.

Farmers have started to procure breeding stock from animals whose performance traits have been recorded and evaluated. As a result, they are no longer dependent on external sources or forced to purchase animals with unknown productivity.

In the elite herds, mating records have been verified through paternity testing. For this purpose, financial support was provided by the Scientific Research Projects Commission of Hatay Mustafa Kemal University. A total of 118 kids and 19 potential sires, randomly selected from elite herds, were analyzed. The results showed a paternity error rate of 3.4%. When broken down by herd, the incorrect sire-offspring match rate was 0.0% in two herds, 3.0% in one herd, 4.8% in another, and 7.4% in one more. These results indicate that elite herd breeders have been successful in managing controlled mating practices.

Animals raised under the project were transferred to new locations for broader use: 300 female and 25 male yearlings were sold to the Konya region as part of the Konya Plain Project, and 75 female and 3 male animals were sold to Dicle University Faculty of Agriculture in Diyarbakır. It was reported that these animals adapted well and were successfully raised in their new environments.

The scientific data obtained from Kilis goats will be shared nationally and internationally, serving as a first step toward promoting this valuable indigenous genetic resource on a global scale.

Within the framework of the “On-Farm Conservation and Genetic Improvement of Kilis Goats” project, average lactation duration and milk yield in elite herds were found to be 221.9 days and 347.0 liters, respectively. There is considerable variation in milk yield among animals.

To achieve better results from this project, subprojects aiming to increase milk yield by selection, such as those for Kilis goats, should exclude birth and weaning weights from the index value calculation.

To better utilize these traits, it is recommended to establish a Goat Research Institute in Kilis province. An elite herd should be established within the institute, and semen should be collected from qualified, progeny-tested bucks and used in artificial insemination programs countrywide.

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Reproductive Efficiency and Growth Dynamics of Esme Sheep under Different Environmental and Managemental Influences

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This research was conducted as part of the “Eşme Sheep Breeding” sub-project, supported by the General Directorate of Agricultural Research and Policies (TAGEM) of the Ministry of Agriculture and Forestry. The study focused on integrated and base flocks located in the Eşme district of Uşak province. The animal material consisted of 22,528 sheep and lambs whose performance records were taken between 2019 and 2024. The study investigated the number of lambs per lambing ewe, lamb birth weight, live weights at 30, 60, 90, 120, and 150 days, and the corresponding average daily gains (ADG). Statistical analyses were performed using the General Linear Model (GLM) procedure, with year, tiers, birth type, dam age, and sex included as fixed effects. The average number of lambs per lambing ewe was 1.45, with 1.40 in base flocks and 1.51 in integrated flocks ($p < 0.001$). The average lamb birth weight was 4.03 kg, with 4.14 kg in integrated flocks and 3.91 kg in base flocks ($p < 0.001$). Single-born lambs exhibited significantly higher birth weights than multiple-born ones, and male lambs weighed more at birth than females ($p < 0.001$). Live weight measurements revealed averages of 14.31, 21.30, 29.70, 35.24, and 39.66 kg at 30, 60, 90, 120, and 150 days of age, respectively. Average daily gain from birth to weaning ranged from 270 to 290 g/day. Differences observed between years and tiers were attributed to variations in management, feeding conditions, and husbandry practices. The findings indicate that the Eşme sheep population possesses significant advantages in both fertility and growth performance. Given these characteristics, Eşme sheep represent a strategic genetic resource for lamb meat production in Western Anatolia and hold high potential for sustainable production models and breeding programs in regional livestock farming.

Keywords: Western Anatolia, Eşme sheep, reproduction, growth, breeding strategies

Some Fertility Traits of Karacabey Merino Sheep in Rural Farms

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The aim of the presented study was to investigate the effects of age and environmental factors on some reproductive parameters and performance values of lambs between 2022 and 2024 within the scope of Balıkesir Province Karacabey Merino Sheep Breeding Project. In the study, 3-year reproductive performances of 6,000 Karacabey Merino Sheep, aged 2-7 years, in Balıkesir Province were evaluated. An extensive breeding system was applied to the herds, and no synchronization or superovulation programs were applied. The sheep were not fed any other than pasture and routine feeding. The first ram matings were carried out freely in March and April (off-season). Subsequent additions of rams were made in June-July and September-October (in-season). Rams were kept in the flocks for 45-60 days. Birth records of pregnant sheep were kept. At the end of the year, the number of animals that did not become pregnant or give birth was determined. The birth weight of the lambs, the 90-day live weight and the average daily live weight gain from birth to 90 days were recorded. Data were analyzed using the t-test, Duncan's test, and least squares. Differences in conception, lambing, and survival rates between years were found to be insignificant ($P > 0.05$). It was found to be significant between the years in terms of birth and 1st weighing weights ($p<0.001$). Maternal age was found to be a significant factor on birth weight ($p<0.001$). Gender had a significant effect on both birth and first weights ($p<0.001$). Birth type was found to have an effect on birth weight ($p<0.01$). The rates of multiple births in the entire herd were found to be singletons 46.9%, twins 52.2%, triplets 0.84%, and quadruplets 0.02%. As a result, it was observed that age and year of gestation did not affect pregnancy rate, while age and birth weight did. However, the multiple birth rates were found to be consistent with the characteristics of the Karacabey Merino breed.

Keywords: Balıkesir, Karacabey Merino Sheep, Reproductive Performance

Acknowledgement: This study was supported by TAGEM's “Public Breeding of the Karacabey Merino Sheep Breed Sub-Project (Project Code: 10 KBM 2021-03)” carried out in Balıkesir.

Multifactorial Influences on Growth and MLD Muscle Traits in Kıvırcık Sheep: Towards Sustainable Breeding Programs

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This study was conducted to examine the growth performance and carcass characteristics, as determined by ultrasound, in lambs raised under the “Kıvırcık Sheep Breeding Project” in the province of Aydın. A total of 241 Kıvırcık lambs, with an average age of 109 days, were included in the study. The animals were evaluated for birth weight (BW), live weight (LW), average daily live weight gain (ADG), and ultrasound measurements of backfat thickness (BFT), skin+fat thickness (SBFT), and muscle depth (MD) related to the M. longissimus lumborum (MLD) muscle. The average BW, LW, and ADG values were 4.23 kg, 27.17 kg, and 213.3 g/day, respectively; BFT, SBFT, and MD averaged 0.31 cm, 0.51 cm, and 1.91 cm, respectively. Statistically significant differences were observed between farms for all traits ($p < 0.001$). Lambs from Farm 1 exhibited the highest LW and ADG values, whereas lambs from Farm 5 had the highest BW and MD values. Single-born lambs showed higher BW and ADG compared to twins. Males demonstrated significantly greater BW, LW, and ADG than females ($p < 0.001$), while females had superior BFT and SBFT measurements. Regression analyses revealed strong and significant effects of BW on both LW and ADG ($p < 0.001$). Age positively influenced LW but negatively affected ADG. Phenotypic correlation coefficients indicated strong relationships between LW and MD (0.609) and between BFT and SBFT (0.917), whereas correlations between ADG and carcass traits were not statistically significant. These results suggest that farm conditions, birth type, and sex significantly impact growth performance and carcass characteristics.

Keywords: Environmental factors, Selection criteria, Breeding programs, Small ruminants

Determination of Growth Traits of Akkaraman Lambs Raised under Breeder Conditions in Nigde/Altunhisar District: II. Period**

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The aim of this study was carried out to determine the growth traits of Akkaraman lambs in Altunhisar district of Nigde province and the effects of non-genetic factors affecting these traits between 2021 to 2025. The research was conducted in 5 different locations and 24 farms with ewes number ranging from 100 to 650 heads. A total of 31905 lambs for birth weight and 31324 lambs for other growth traits were evaluated in the study. The least squares means of birth weight (DA), 90th day live weight (90CA), live weight gain from birth to 90 days (90CAA) and Kleiber ratio (KR) of Akkaraman lambs were determined as 3.85±0,01 kg, 23.30±0.06 kg, 216.1±0.62 g and 20.04±0.02, respectively. DA and 90CA were highest in single lambs, whereas 90CAA and KR were highest in twin lambs ($P<0.001$). A comparison of herd sizes in the study revealed that all growth characteristics examined for Akkaraman lambs were lowest in herds with 100 to 200 ewes ($P<0.001$). Effects of year of birth, sex and region among other non-genetic factors on all growth traits in Akkaraman lambs were found to be significant ($P<0.001$). As a result, all non-genetic factors discussed in the study have affected all growth traits evaluated in Akkaraman lambs. It was found that DA, 90CA and 90CAA of lambs were slightly lower than similar studies conducted in previous years under breeder conditions in Nigde province.

Key words: Akkaraman, Sheep, Growth performance, Kleiber rations

*: This research was supported by the Ministry of Agriculture and Forestry, General Directorate of Agricultural Research and Policy(TAGEM) with the title of "National Small Ruminant Breeding in Public Hands Project (Breeding of Akkaraman Sheep in Altunhisar District of Niğde Province: II. Term)" (Project no: 51AKK2016-05).

Effects of Intensive and Pasture Feeding on Milk and Colostrum in Anatolian Buffaloes

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The Anatolian water buffalo is one of Türkiye's most important genetic resources. Despite being fed low-quality forages, its productive capacity is remarkably high. In this study, milk yield, composition, and colostrum quality of Anatolian water buffalo were investigated when fed intensively and on pasture. For this purpose, intensively (n=12) and pasture (n=8) fed animals were monitored in Bartın. Milk measurement, milk quality analysis, lactation milk yield, colostrum quality, and Ig levels were analysed each month. Colostrum fat was found 13.10±1.21% and 22.96±0.71% ($p<0.05$), while solid-not-fat (SNF) was 22.26±0.17% and 21.23±0.64% ($p>0.05$) for intensively and pasture-fed animals, respectively. Regarding colostrum Ig, IgG was found to be the highest. In addition, IgG was determined to be higher in the pasture-fed group (21.61±1.33-14.87±2.16 mg/ml) ($p<0.05$). The average Ig distribution in colostrum in the study was found to be 69.07% IgG, 25.48% IgA, and 5.45% IgM. Lactation milk yield was 1177 L in intensively fed and 1673 L in pasture-fed ($p<0.05$) animals, and lactation length was 339.7-331.2 days ($p>0.05$). Milk fat was higher in the pasture-fed group in May, June, August, and November ($p<0.05$), similar in July, September, and October ($p>0.05$). SNF was found to be higher in the pasture group in July ($p<0.05$) and similar in the other months ($p>0.05$). It has been determined that Anatolian buffaloes are productive even under intensive conditions, but feeding on pasture significantly increases milk yield, milk quality, colostrum quality, and colostrum Ig levels.

Keywords: Anatolian buffalo, Milk yield, Colostrum, Ig

Acknowledgements: Author thanks to GDRAP (TAGEM) and Bartın Buffalo Breeder Association for support of the animal material. This project funded by Necmettin Erbakan University, Scientific Research Project Comission (23AB29001 project number). Authors thanks to Necmettin Erbakan University, Scientific Research Project Comission.

Effect of Artificial Insemination at Different Times on Pregnancy Rates in Nulliparous and Multiparous Anatolian Water Buffaloes during Ovulation Synchronization

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In Türkiye, the application of artificial insemination (AI) using frozen semen in Anatolian Water Buffalo (AWB) remains at a limited level, with natural mating still being the predominant breeding method. However, to accelerate genetic progress in the improvement of AWB and to establish an efficient breeding system based on pedigree records, the widespread adoption of AI is essential. In recent years, research and field applications of AI in AWB have become increasingly common in Turkiye. The present study aimed to investigate the effects of insemination timing performed either simultaneously with the final GnRH injection or 6-8 hours thereafter within the Ovsynch synchronization protocol on pregnancy rates in nulliparous and multiparous AWB of different ages and lactation stages. The animal material consisted of female AWB enrolled in the “Anatolian Water Buffalo Breeding Project in Farm” conducted in Çorum Province. The experimental animals comprised nulliparous and multiparous buffaloes in their 1st, 2nd, 3rd, 4th, 5th, and ≥6th lactations, maintained on different farms. Within the ovulation synchronization protocol, AI was carried out at the time of the second GnRH injection (0 hour) or 6-8 hours thereafter. AI was performed using frozen semen obtained from the AWB bull KARAHİSAR, commercially produced by the International Livestock Research and Training Center, with each 0.25 ml straw containing approximately $25X10^6$ spermatozoa. Pregnancy diagnosis was conducted on day 90 post-insemination via rectal ultrasonography. As a result, inseminations were performed on 14 nulliparous and 65 multiparous buffaloes, yielding an overall conception rate of 78.48%. According to insemination timing, pregnancy success was 71.42% at 0 hours and 86.49% at 6-8 hours after the second GnRH administration. In conclusion, for ovulation synchronization in AWB, it is recommended that AI be conducted 6-8 hours following the second GnRH injection to achieve higher conception rates and improved reproductive efficiency.

Keywords: Buffalo, semen, artificial insemination, ovulation, synchronization.

Effects of Maternal Lactation Order on the Growth Performance of Anatolian Water Buffalo Calves

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This study investigated the effects of dam lactation order on the postnatal development of Anatolian Water Buffalo calves. The dataset comprised females born after 2013 and their male and female offspring (n = 1231) born between 2017 and 2023 within the Muş Province Public Anatolian Water Buffalo Breeding Sub-Project. In addition to the dams' lactation data, the birth weight, six-month and twelve-month live weights, and average daily live weight gains of the calves were evaluated. The Shapiro–Wilk test was applied to assess the normality of the data. Non-parametric tests (Kruskal–Wallis H and Mann–Whitney U) were used to analyze data that did not meet normal distribution assumptions. Lactation order had a statistically significant effect on birth weight ($p < 0.001$). The mean birth weight was 29.91 ± 2.49 kg in the first lactation and 31.50 ± 2.48 kg in the fourth lactation, reflecting a 5.3% increase. However, no significant differences were observed among lactation orders in calf live weight at six months ($p = 0.561$) or twelve months ($p = 0.339$). A negative correlation was identified between birth weight and average daily gain from 0 to 6 months ($\rho = –0.234$, $p < 0.001$). Although calves of first-lactation dams were lighter at birth, they compensated for this difference by exhibiting accelerated growth up to six months of age. These findings indicate that young dams should not be excluded from production under appropriate care and feeding conditions. Moreover, future studies should re-evaluate these results on a national scale using more comprehensive data from the Anatolian Water Buffalo Breeding National Project.

Keywords: Anatolian Water Buffalo, Maternal Effect, Lactation Order, Live Weight Gain.

Evaluation of Machine Learning Techniques for Weaning Weight Estimation in Extensive Goat Farming Systems

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Goat farming holds considerable economic and social value in Türkiye, where Hair goats represent the dominant breed raised under extensive systems. Accurate live weight assessment is essential for feeding, breeding, and marketing decisions, yet direct weighing is often impractical for small-scale farmers. Machine learning techniques provide an effective alternative by enabling the early prediction of weaning live weight, thereby supporting improved decision-making in goat production.

This study aimed to evaluate the potential of limited herd records of Hair goats for predicting weaning weight. A total of 9,982 animal records were analysed using classical machine learning algorithms, including linear regression, decision tree, and support vector regression, as well as ensemble methods such as AdaBoost, random forest, ExtraTrees regressor, XGBoost, and CatBoost. The predictor variables included dam age (ranging from 1 to 9 years), sex, birth type (singleton, twin, or triplet), year (2024–2025), birth weight, and age at weighing.

The best predictive performance was obtained using the CatBoost, yielding an R^2 value of 0.421, an adjusted R^2 of 0.418, and a mean absolute error of 3.19. The overall prediction performance of the algorithms was lower than that observed in our previous study on Hair goats (Esener & Kal, 2025). This discrepancy is likely attributable to the absence of additional animal-related variables and, more importantly, environmental factors that were incorporated in the earlier work. Furthermore, the current dataset covered only a two-year period, which may have restricted model performance.

The findings demonstrate that, although machine learning algorithms can predict weaning weight from limited herd records, their accuracy is reduced compared to models incorporating richer datasets. This highlights the importance of integrating additional animal- and environment-related features to enhance prediction reliability. In particular, systematic recording of environmental variables is recommended, as such data are increasingly critical under the influence of global warming and its impacts on livestock production.

Keywords: Hair goats, Ensemble learning, Livestock, Predictive modelling.

Effects Of Genetic And Non-Genetic Factors On First Age Growth Traits in Karacabey Merino Sheep

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The aim of this study was to evaluate the influence of genetic and non-genetic factors on birth weight (W0), live weight at 30 (W30), 60 (W60), 90 (W90), 180 (W180), 270 (W270), and 365 d. (W365) of of 22,713 Karacabey Merino lambs with their sire (n=594) spanning 2001 to 2024. Six different models differentiated by including or excluding of direct animal, additive maternal genetic, covariance between direct and maternal effects, and maternal permanent environmental effects.

All the fixed effects (year of birth, season, age of dam, birth type and sex) were significant for the growth of lambs, except dam age and birth type for W365. Environmental and maternal perminent environmental correlations were all positive. Direct genetic and additive maternal genetic correlations were positive and of low to high value for the most of the traits, except for the W0 with W30 and W60 that have negative value indicated that lambs with higher birth weight born in Season 2 have great dependency on environmental factors in early life.

Changes of lamb's live weight during the study were significant, especially for W90 and W365. Environmental and genetic parameters are of great interest in Karacabey Merino sheep breeding programmes. Birth season have great impact on birth weights and corresponding to fixed effects of this factor on firt ages growth traits of lambs. Since the direct-maternal genetic covariances were found to be negative, attention should be made in making selection decisions. Estimates of genetic parameters and observed genetic trends show that selective breeding can lead to significant genetic improvement in Karacabey Merino sheep.

Keywords: Karacabey Merino, Growth, Environmental factors, Genetic trends, Phenotypic trends, Restricted selection index

Increasıng the Fertile Yield Of Central Anatolıan Merino Lamb by Usıng İn Breedıng at Early Ages

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The main aim of animal rearing is obtain maximum number of offspring per dam during its lifespan. Sheep could best utilize the unproductive pastures. The study was carried out in a sheep farm with 1,500 head of Central Anatolian Merino breed breeding animals in Karapınar district of Konya province and included in the breeding project. In Turkey, native breeds are mated at the age of about 16-18 months. Lambs were fed with lamb starter, lamb rearing feeds and creep feding method in addition to milk until weaning in this study. They were then fed alfalfa in addition to pasture. Sheep were subjected to flashing 21 days before mating season. Male lambs were used for breeding at the age of 7-9 months and 60% of their adult live weight. Birth rate of primaporius ewe (16-18 months old) is between 88-94% in Turkey. In the presented study, the birth rate was 76%. While there was no statistical difference in the multiple birth rate ($p \geq 0.05$), the birth rate was higher ($p \leq 0.05$) in the 16-18 month old animals.

In conclusion, although the birth rate was low, use of these lambs in breeding added economical value to the enterprise for one year as it met the operating costs were covered. The lambs of normal breeding animals remained as net profit to the enterprise. This application has made a significant economic contribution to the business

Key Words: Early, Age, Lamb, Breeding, Yield

Determination of Some Physical Properties of Coarse and Down Fibers Obtained from Mahalli Goats

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The study aimed to determine some physical properties of the coarse and down fibers obtained from Mahalli Goats in the Project of Protection and Sustainable Use of Animal Genetic Resources, and thus to reveal their usability in the textile industry. The animal material of the study consisted of does, 1, 2, and 3 parity goats found in breeders' herds in Diyarbakır province. Fineness, single fiber natural length, elongation rate, breaking strength, and clean washing yield properties were examined in the coarse and down fiber samples taken from the shoulder, leg, and rib regions of each goat. Average fineness, single fiber natural length, elongation rate, breaking strength, and clean washing yield in the coarse fibers of Mahalli Goats were determined as 67.81 µ, 18.52 cm, 27.12%, 17.25 g/den, and 93.05%, respectively. In down fiber samples, average fineness, elongation rate, breaking strength, and clean washing yield were determined as 16.14 µ, 17.58%, 9.09 cN/tex, and 88.73%, respectively. When the correlations between the coarse and down fiber properties were examined, the highest correlation in the coarse fibers was determined between fineness and breaking strength (0.692, $p<0.001$), and the lowest correlation was determined between single fiber natural length and clean washing yield (0.041). The highest and lowest correlations in down fibers samples were determined between elongation rate and breaking strength (0.481, $p<0.001$), fineness, and elongation rate (0.176), respectively. As a result, it can be said that the coarse fibers obtained from Mahalli Goats can be used in the production of goat hair products, and the fine down fibers can be used in the textile industry.

Recovery Of Silk Protein Sericin From Wastewater And Cocoon Residues İn Silk Production Facilities And Its Economic Evaluation

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This study was conducted on the cocoon residues called "çepez" and cocoon softening wastewater of the silk yarn production facility operating in Kulp District of Diyarbakır Province, which processes an average of 48 tons of wet cocoons; It was carried out to recover serine, one of the two very valuable silk proteins that are not produced in our country, and to determine the most appropriate recovery method.

Samples were taken from four different wastewater exit points of the silk spinning facility and their recovery was evaluated. From these four different exit points, it was observed that serine could be recovered only in the water discharged from the drafting unit section, but sericin could not be obtained from the other three sections. The cocoons, which are considered economically waste products, consist of cocoons that are not suitable for the silk spinning process. Sericin could be obtained from these, and much higher amounts of sericin were obtained compared to the sericin obtained from the drafting unit wastewater.

This study shows that microfiltration is not very effective in the recovery process, the recovery levels decrease as the samples are kept, the most suitable autoclaving process for wastewater is 121°C/30 min, 121°C/60 min for cherries, and the most obvious phase separation is 6000 rpm at +4 oC. It was determined that the most suitable chemical for the precipitation process was ethanol, that the lyophilization process was an important and effective method in obtaining powdered sericin, and that there was a significant increase in sericin concentrations in the samples with the dialysis process.

Keywords: Sericin, Recovery, Silk proteins

Body Weight and Some Body Measurements of Kangal Dog Raised in the Sheep Breeding Research Institute

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This study was conducted to determine the body weight and some body measurements (wither height, rump height, body length, chest depth, and chest circumference) of Kangal dogs raised at the Bandırma Sheep Breeding Research Institute at different age stages. The research was carried out on 21 heads of Kangal dogs raised within the institute. The correlation between body weight and other body measurements in different ages was examined in the study.

The mean body weights at 90, 180, 270, 360, 450, and 540 days were found to be 13.27 ± 1.64, 28.73 ± 0.71, 37.12 ± 1.68, 39.44 ± 0.96, 39.45 ± 1.79, and 40.22 ± 1.08, respectively. In age groups, withers height was found as 41.28 ± 1.95, 61.83 ± 0.58, 68.38 ± 1.27, 71.9 ± 0.76, 72.80 ± 1.35, 73.08 ± 0.93; rump height as 41.85 ± 1.99, 63.16 ± 0.61, 69.38 ± 1.17, 72.5 ± 0.75, 73.20 ± 1.39, 73.52 ± 0.88; body length as 44.57 ± 1.81, 65.16 ± 0.62, 71.03 ± 1.18, 73.54 ± 0.74, 74.30 ± 1.56, 74.76 ± 0.88; chest depth as 17.17 ± 0.75, 25.05 ± 0.29, 28.23 ± 0.42, 29.19 ± 0.36, 28.80 ± 0.66, 30.17 ± 0.42; and chest circumference as 55.10 ± 2.33, 75.25 ± 0.79, 80.53 ± 1.23, 82.35 ± 0.84, 82.40 ± 1.98, and 85.85 ± 1.02 cm, respectively.

High and positive correlation was found between body weight and all body measurements at 90 days ($r \approx 0.96–0.98$, $p<0.01$). In later ages, the correlation between body weight and body measurements decreased, but it remained high (mostly $r>0.70$). Chest circumference and body length were found to be the best indicators of body weight.

The study showed that Kangal dogs exhibit rapid growth particularly in the first 6 months, while growth slows down after 12 months.

Keywords: Kangal dog, Body weight, Body measurements, Corrrelation

Investigation of Biometric Index Values in Akkaraman Sheep Raised in Extensive Conditions of Central Anatolia

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In this study, some zoometric measurements and biometric index values of Akkaraman sheep raised grown in extensive conditions in the province of Çankırı in Central Anatolia. For this purpose, the measurements total of 634 including 3rd month (n=171), 6th month (n=163), 12th month (n=150) and 18th month (n=150) ages were evaluated. Also, the birth weights of the lambs were also taken. Measured zoometric characters are live weight (LW), withers height (WH), chest depth (CD), body length (BL) and chest girth (CG). Examined biometric indexes are Compact Index (CoI), Area Index (AI), Proportionality Index (PI) Thoracic Index (TI) Length Index (LI) Chest Depth Index (CDI) Conformation Index (CnI) and Thoracic Development Index (TDI). The statistical differences between values in all periods of the animals were generally found to be significant between sex and farm values, but mostly insignificant between the birth type and the birth season values. Maternal age values also were found to be insignificant in all features. Mostly of biometric index values (CoI, AI, PI, CDI, CnI, TDI) increased with 3 months to 18 months of the animals, while some of them (TI, LI) decreased. Among the biometric indices, the highest positive correlations were found between CoI-AI, CoI-CnI, AI-CnI and CnI-TDI, while the highest negative correlations values also were found between PI-TI, PI-LI, TI-CnI and TI-TDI. As a result, in all periods Akkaraman breed were generally determined in mediolineal type in terms of features such as length and thinness. This may be an indication that the animals are genetically well adapted for pasture and long walks. Also, it can be said that the meat type characteristics are not bad either.

Keywords: Biometric index, Akkaraman sheep, Zoometric measured

Investigation of Weaning Weights of Karacabey Merino Lambs by Season

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Karacabey Merino breed sheep are known for their ability to give birth in all seasons of the year. In this study, the 90-day weaning weights from the years 2021, 2022, 2023, and 2024 were examined by season in the Balıkesir Province Karacabey Merino In-Hand Breeding Project, which is a sub-project of the National In-Hand Small Ruminant Breeding Project conducted by TAGEM.

In this study, the material used in the Karacabey Merino In-Hand Breeding Project varied by year, but the 90-day weights of approximately 7,000 lambs per year were examined according to seasons. Although, as part of the TAGEM project in Balıkesir province, the birth period of Karacabey Merino is approximately 80% in September and October, it has been observed that 20% of the births occur between January and March.

In the study, the growth performance of lambs born in spring and reaching weaning weight was compared to those born in winter and reaching weaning weight.

Keywords: Balıkesir, breeding Karacabey Merino, Season, Weaning weight

Evaluation of Birth Weight, Growth Performance and Mohair Production in Ankara Goats

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In this study, the productivity, fertility criteria, survival rates and fleece yields of goat kids between 2022-2024 of the Ankara Goat II. Sub-Project carried out by the General Directorate of Agricultural Research and Policies were evaluated. The survival rates of kids were found to be 55%, 68% and 68%, respectively, according to the years (2022-2024). Birth weights were determined as 2.31 kg in 2022, 2.40 kg in 2023 and 2.32 kg in 2024. In addition, the birth weights of goat kids on the 90th day of the experiment between 2022-2024 were 10.62 kg, 12.11 kg and 12 kg, respectively. The greasy fleece weights of Ankara goats were measured as 1.85 kg, 1.92 kg and 1.87 kg, respectively, between 2022-2024. The study found statistically significant differences between the birth weight and 90-day weight of offspring across years. The year 2022 was found to be higher than the other years ($p<0.05$). When birth weights were examined according to goat age, it was determined that offspring from goats aged 2 (2.39) and 5 (2.39) had the highest birth weight. It was determined that greasy fleece weight varied across years, and mohair yield was highest in 2022. Annual fluctuations occurred in the birth weight, 90-day weight, and mohair yield of offspring in Ankara goat herds. These changes were influenced by the producer's management and nutrition, weather conditions at calving that year, the spread of the herds, and the breeder's knowledge and expertise.

Keywords: 90th day weight, Survival rates, Mohair yield

Productive and Growth Traits of Zom Sheep in On-Farm Conditions

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This study was aimed to determine growth characteristics of Zom sheep in farmer conditions using data spanning the year from 2023 to 2025, in Diyarbakır, Türkiye. Materials of this research was consisted of 10 597 lambs born in 33 flocks. Live weights of lambs were taken from birth to 120th day of age by every two months. The projects was suported by the General Directorate of Agricultural Researches and Politics (TAGEM).

The data were analyzed by *GLM* procedure in SAS (2017) and *Tukey* test was used for the comparison of subclass means of environmental factors. Birth, 30th, 60th, 90th and 120th day of age live weights in females and males were 3.50 and 3.70, 9.9 and 10.7, 16.03 and 17.70, 22.7 and 24.7 kg, respectively. Survival rate until weaning were 96%.

Birth, 30th, 60th, 90th and 120th day of age live weights were affected by flock, birth year, birth season, type of birth and sex of lamb ($P<0.001$). In addition, coefficients of regression of 30th, 60th, 90th day of age live weights on birth weight were 0.75±0.0350, 1.052±0.0290 and 1.32±0.0563 kg, respectively ($P<0.01$).

Keywords: Zom sheep, Growth, Survival, Farmer conditions

Growth and Development Characteristics of Karakaş Sheep Raised by Farmers

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This study aimed to investigate the growth and development characteristics of Karakaş sheep reared under farmer conditions in Diyarbakır, Turkey, using data collected between 2023 and 2025. The study included 16,761 lambs born in 70 flocks. Live weights were recorded from birth to 90 days of age at two-month intervals. The project was supported by the General Directorate of Agricultural Researches and Policies (TAGEM).

Data were analyzed using analysis of variance (ANOVA), and Duncan's multiple range test was applied to compare the means of environmental factors. The average live weights at birth, 60 days, and 90 days for both sexes were 4.04, 18.05, and 25.03 kg, respectively. The survival rate until weaning was 98%. Birth weight, 60th day weight, 60th day weight gain, 90th day weight, and 90th day weight gain were significantly affected ($P < 0.05$) by year, maternal age, gender, birth type, and birth month.

Keywords: Karakaş sheep, Growth, Survival

Growth And Development Characteristics Of Mahalli Goats Cubs Raised In Diyarbakır Rural Area*

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* This Project was supported by General Directorate of Agricultural Research and Policies and carried out by GAP International Agricultural Research and Training Center

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Based on data obtained from domestic goats, the mean and standard error of birth weights for kids in 2022, 2023, 2024, and 2025 were determined to be 3.11 + 0.01 kg, 3.07 + 0.01 kg, 2.95 + 0.01 kg, and 2.87 + 0.01 kg, respectively. The mean birth weight and standard error for female kids were 2.94 + 0.01 kg, and the mean birth weight and standard error for male kids were 3.07 + 0.01 kg.

Birth weights were 3.02 + 0.01 kg for single-born lambs and 2.89 + 0.01 kg for twin-born lambs. The mean 90th-day live weights were 13.22 + 0.06 kg and 14.52 + 0.03 kg, respectively, for twin and single-born lambs. Daily live weight gains for males and females on the 90th day were 120.24 + 0.41 grams and 131.82 + 0.46 grams, respectively. The daily live weight gains for goat kids on the 90th day were 110.61 + 0.35 grams, 131.1 + 0.43 grams, and 162.23 + 1.28 grams, respectively, based on the months of their birth: February, March, and April. Birth weight, 60th day weight, 60th day weight gain, 90th day weight, and 90th day weight gain were significantly affected ($P < 0.05$) by year, maternal age, gender, birth type, and birth month.

Key Words: Birth weight, Mahalli goat, Growth cub, Twin

Environmental Factors Affecting Birth Weight in Southern Anatolian Red Cattle Raised in Sason Districts

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The aim of this study is to investigate the effects of environmental factors such as village, sex, year of birth, and month of birth on birth weight, a growth trait, in Southern Anatolian Red cattle raised in villages in the Sason district of Batman province. In study, all environmental factors were found to have a statistically significant effect on birth weight ($p<0.001$). Male calves (15.3 ± 0.21 kg, n=607) had higher birth weights than females (14.6 ± 0.17 kg, n=638). Regarding birth year, calves born in 2024 (18.7 ± 0.10 kg, n=702) were significantly heavier compared to those born in 2025 (10.1 ± 0.03 kg, n=543). Differences among villages were also evident, with the highest birth weights observed in Yanıkkaya (16.8 ± 0.94 kg) and Topluca (16.8 ± 0.94 kg), and the lowest in Dağçatı Gürgenli (11.9 ± 1.40 kg). Birth month was another influential factor; the highest mean birth weight was recorded in February (16.3 ± 0.35 kg, n=128), while the lowest was in March (12.4 ± 0.52 kg, n=52). The overall mean birth weight was 14.9 ± 0.14 kg (n=1245). Data on growth traits, birth weight and statistically significant environmental factors obtained in this study will be useful in selection programs and breeding studies in Southern Anatolian Red cattle breeding and will shed light on future studies.The study was supported by the General Directorate of Agricultural Research and Policies (TAGEM).

Keywords: Growth traits, Calving season, Breeding programs

Effects of Year, Sex, Birth Type, and Dam Age on Lamb Performance Traits in Awassi Sheep under a Community-Based Breeding Program in Şanlıurfa

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This study aimed to evaluate the effects of year, sex, birth type, and dam age on lamb growth performance in Awassi sheep raised under the Community-Based Breeding Program in Şanlıurfa province between 2020 and 2024. A total of 15,192 lamb records were analyzed for birth weight (BW) and weaning weight (WW, SKA) using One-Way ANOVA and General Linear Models in Minitab 19. The results indicated that BW differed significantly among years ($P<0.001$), with the highest mean observed in 2023 (3030 g) and the lowest in 2021 (2919 g). WW was more strongly influenced by year ($P<0.001$), and lambs born in 2024 had the highest average value (28.9 kg). Sex had a significant effect on WW, with males being slightly lighter than females at weaning (24.6 vs. 24.9 kg), although BW was similar. Birth type showed contrasting effects: single-born lambs were heavier at birth (2982 g vs. 2765 g), whereas twins had higher WW (25.8 kg vs. 24.7 kg). Dam age also influenced performance, with lambs from 4-year-old ewes exhibiting the highest WW, while older ewes (6–7 years) produced lighter lambs. These findings highlight the importance of environmental and maternal factors in lamb growth and suggest that breeding and management strategies should account for year-to-year variation, parity, and birth type to optimize productivity in Awassi sheep.

Keywords: Awassi sheep, Community-based breeding, Birth weight, Weaning weight, Environmental factors

Reproductive Performance, Body Measurements of Ewes, and Growth Traıts of Lambs in Dağlıç Sheep

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This study was conducted within the scope of the "Sustainable Use of Domestic Animal Genetic Resources – Dağlıç Sheep" project carried out by the Bahri Dağdaş International Agricultural Research Institute, with the aim of determining reproductive performance, post-shearing live weight, body measurements, and growth characteristics of lambs in Dağlıç sheep. The research was carried out in Taşağıl (Bolvadin/Afyon) and Tatköy (Selçuklu/Konya) districts. In total, data were collected from 923 lambs (birth weights, live weights, and body measurements) and 271 sheep and rams (post-shearing live weights and body measurements).

In terms of reproductive parameters, the lambing rate, single birth rate, twinning rate, infertility rate, and survival rate at weaning (3rd month) in Taşağıl Dağlıç sheep were 98.4%, 87.18%, 12.8%, 1.61%, and 96.7%, respectively; while in Tatköy Dağlıç sheep, these values were 97.4%, 90.76%, 9.2%, 2.6%, and 97%, respectively. The mean live weights of Taşağıl Dağlıç lambs at birth and at 3 (weaning), 6, 9, 12, and 18 months were 3.42, 25.33, 35.02, 38.13, 40.32, and 42.63 kg, respectively. Their average body measurements (wither height, rump height, chest depth, body length, chest girth, and cannon bone circumference) were 65.46, 66.95, 25.25, 61.57, 80.02, and 10.63 cm, respectively. For Tatköy Dağlıç lambs, mean live weights at birth and at 3, 6, 9, 12, and 18 months were 3.19, 23.36, 28.96, 33.91, 38.57, and 40.85 kg, respectively, and their body measurements in the same order were 62.93, 64.92, 23.83, 60.45, 78.83, and 10.29 cm ($p < 0.05$).

The average post-shearing live weights and body measurements (wither height, back height, rump height, chest depth, body length, and chest girth) of Taşağıl Dağlıç rams and ewes were 60.65 kg, 70.47, 68.96, 71.52, 32.91, 69.73, and 95.63 cm, respectively; while in Tatköy Dağlıç sheep the corresponding values were 57.53 kg, 68.44, 67.12, 70.44, 30.58, 68.42, and 92.49 cm ($p < 0.05$). A 5% significance level was adopted, and differences between means were compared using Tukey's multiple comparison test. Statistical analyses were performed with SPSS software (Version 23).

In conclusion, the data obtained from Dağlıç sheep and lambs in both regions showed that the Taşağıl (Bolvadin/Afyon) Dağlıç population had higher values for the examined traits compared with the Tatköy (Selçuklu/Konya) Dağlıç population, and this difference was found to be statistically significant ($p < 0.05$). The results indicate that breeder interest, management and feeding practices, pasture conditions, and geographical factors of the regions play an important role in these differences.

Keywords: Dağlıç, sheep, Reproductive performance, Body measurements, Lamb, Growth traits

Growth Characteristics of Zom Sheep in Farmer Conditions

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This study was aimed to determine growth characteristics of Zom sheep in farmer conditions using data spanning the year from 2022 to 2025, in Diyarbakır, Türkiye. Materials of this research was consisted of 23 428 lambs born in 32 flocks. Live weights of lambs were taken from birth to 180th day of age by every two months. The projects was suported by the General Directorate of Agricultural Researches and Politics (TAGEM).

The data were analyzed by GLM procedure in SAS (2017) and Tukey test was used for the comparison of subclass means of environmental factors. Birth, 60th, 120th and 180th day of age live weights in females and males were 4.01 and 4.32, 15.23 and 16.57, 26.02 and 28.12, 36.98 and 40.15 kg, respectively. Survival rate until weaning were 98%.

Birth, 60th and 120th day of age live weights were affected by flock, birth year, birth season, type of birth and sex of lamb ($P<0.05$), while the live weight of 180-day of age lambs were affected by flock, birth year, type of birth and sex of lamb ($P<0.05$). In addition, coefficients of regression of 60th, 120th and 180th day of age live weights on birth weight were 0.785±0.0250, 1.012±0.0390 and 1.47±0.0863 kg, respectively ($P<0.01$).

Keywords: Live weight, Weaning survival, Birth type, Environmental factors, Regression analysis

Environmental Factors Affecting Lactation Milk Yield in Southern Anatolian Red Cattle Raised in Silvan District

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The aim of this study was to investigate the effects of environmental factors such as village, sex, year of birth and month of birth on lactation milk yield in Southern Anatolian Red cattle raised in the villages of Silvan district of Diyarbakır province. In the study, it was determined that all environmental factors except sex had a statistically significant effect on lactation milk yield ($p<0.001$). Lactation milk yield was found to be 332.86±80.61 kg in 2023 and 1059.47±51.19 kg in 2024. Altınkum village had the highest lactation milk yield with 908.55±66.35 kg, while Çatakköprü village had the lowest lactation milk yield with 504.35±64.38 kg. In terms of month of birth, cows giving birth in the 9th month had the highest with 1581.84±232.80 kg, while cows giving birth in the 4th month had the lowest with 156.23±108.10 kg.The statistically significant data on environmental factors affecting lactation milk yield obtained in this study will be useful in selection programs and breeding studies for Southern Anatolian Red cattle and will inform future research. The study was supported by the General Directorate of Agricultural Research and Policies (TAGEM).

Keywords: Southern Anatolian Red, Lactation milk yield, Breeding programs

Some Growth and Survival Characteristics of Koçeri Lambs Under Breeder Conditions

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This study was carried out to increase the productivity, growth, and development characteristics of Koceri Sheep, which were raised by the breeders in Batman Province, Türkiye, in the 2008 and 2022 seasons. The live weights of lambs in various periods and daily live weight gains were observed.

Based on the 2018, 2019, 2020, 2021, and 2022 seasons, the average fecundity ratio was determined as 1.15, 1.14, 1.20, 1.17, 1.10, and 1.16, respectively; while the survival rate of lambs up to weaning ratio was found to be 0.95, 0.96, 0.95, 0.98, 0.98, and 0.96, respectively. Regarding the live weight averages, from birth, 30th, 60th, and 90th-day live weights averages were found 4.10, 12.18, 19.56, and 27.46 kg in 2018; 3.58, 11.82, 19.49, and 27.84 kg in 2019; 3.09, 11.08, 18.80 and 26.74 kg in 2020; 2.93, 11.74, 19.66 and 26.83 kg in 2021; 3.07, 10.86, 18.10 and 26.38 kg in 2022; 3.35, 11.54, 19.12 and 26.93 kg on year's average, respectively.

The statistical differences across years, maternal age, gender, and birth month were significant ($p<0.05$, $P<0.001$), whereas birth weight was significant only for maternal age ($P<0.001$).

Keywords: Koceri Sheep, Fertility, Growth characteristics, Live weight

Some Mohair Characteristics of Angora Goats in Eskişehir TİGEM Farm

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In this study, some mohair yield and quality parameters of Angora goats in TİGEM farms in Eskişehir province were investigated. A total of 45 male and 90 female heads of 1, 2 and 3 years of age were used as material in the study. Mohair samples were taken from three different body parts, shoulder, rib and thigh, and analyses were carried out for yield, fineness, elasticity and strength. In addition, the post-shearing live weight and dirty mohair yield of the sampled materials were recorded. The average the efficiency, fineness, elasticity and strength parameters of 1, 2 and 3 year old males and females goats is 75,73%, 27,16 µ, 34,77 % and 24,64 Cn/Tex, respectively. Again, the post-shearing live weight and dirty mohair yield of the same materials were determined as 39,20 and 2,07 kg, respectively. As a result, it is seen that age, gender and sampling region are effective in terms of mohair yield and quality parameters of Angora goats in Eskişehir TİGEM enterprise.

Keywords: TİGEM, Angora Goat, Breeding, Mohair

On-Farm Growth Characteristics and Performance of Hamdani Sheep

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This study was aimed to determine growth characteristics of Hamdani sheep in farmer conditions using data spanning the year from 2023 to 2025, in Siirt, Türkiye. Materials of this research was consisted of 12 017 lambs born in 21 flocks. Live weights of lambs were taken from birth to 90th day of age by every one months. The projects was suported by the General Directorate of Agricultural Researches and Politics (TAGEM).

The data were analyzed by *GLM* procedure in SAS (2017) and *Tukey* test was used for the comparison of subclass means of environmental factors. Birth, 60th and 90th day of age live weights in females and males were 3.77 and 4.07, 15.64 and 16.25, 22.13 and 22.97 kg, respectively. Survival rate until weaning were 97%.

Birth, 60th and 90th day of age live weights were affected by flock, birth year, birth season, type of birth and sex of lamb ($P<0.05$).

Keywords: Hamdani sheep, Growth, Survival, Farmer conditions

Some Reproductive Characteristics of Akkaraman Sheep Bred in Konya Province Karakaya Village Conditions

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This study was conducted to examine the reproductive performance and lamb survival parameters of Akkaraman sheep under breeding conditions. The study was conducted under the General Directorate of Agricultural Research and Policies (TAGEM) and was carried out by the Bahri Dağdaş International Agricultural Research Institute within the scope of the "National Community-Based Small Ruminant Breeding Project" (TAGEM/42AKK2018-04). Data from 2024-2025 for 8 breeders participating in the project in Karakaya village, Karatay district, Konya, were used. Data from a total of 6,290 sheep were used in this study: data from 3,160 sheep in 2024 and 3,130 sheep in 2025 were used for fertility traits. For determining survival parameters of Akkaraman sheep following findings were examined: number of ewes per ram, number of ewes lambing, number of lambs born, number of ewes lambing twins, number of ewes lambing singles, number of lambs born as twins, lambing rate, single birth rate, twin birth rate, number of lambs per ram, number of lambs per ewe lambing, number of lambs surviving until weaning (120 days), weaning survival rate, and lamb yield parameters were examined. The 2024 data in the above order is as follows: 3160 heads, 2687 heads, 3551 heads, 864 heads, 1823 heads, 1728 heads, 81%, 69%, 31%, 1.1, 1.3, 3215 heads, 90%, and 107%; The 2025 data, again in the same order, has been calculated as follows: 3130 heads, 2682 heads, 3654 heads, 972 heads, 1710 heads, 1950 people, 84%, 65%, 35%, 1.1, 1.4, 3371 heads, 92%, and 114%.

Conclusion: An important finding obtained from this research is that the reproductive performance traits in 2025 were determined to be better than those in 2024. This significant result has highlighted the importance of care, nutrition, and management of lambs in terms of the productivity of the farms involved in the project.

Keywords: Akkaraman, sheep, Lamb, Reproductive performance, Viability, Lamb productivity

Acknowledgment: This study was prepared using the 2024–2025 data of the Akkaraman sheep breeding project carried out in Karakaya District, Karatay, Konya, within the scope of the "National Community-Based Small Ruminant Breeding Project t" (TAGEM/42AKK2018-04), supported by the General Directorate of Agricultural Research and Policies.

Analysis of Fibers Obtained From Small Ruminant Breeding: Some Studies Conducted In Türkiye and the World

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Fibers obtained from small ruminants constitute the primary source of natural fibers used in textile and industrial production. Fibers such as wool, mohair, cashmere, and hair, thanks to their keratin-based structure, high durability, flexibility, and moisture-holding capacity, have broad potential for use both in the traditional textile sector and in modern fields such as biomedical, nanotechnology, and composite material production. Therefore, analyzing fibers at the physical (length, fineness, strength, etc.), chemical (keratin and amino acid composition), genetic, and molecular levels is critical for quality control, breeding programs, and the development of industrial standards. This review examines some of the research conducted on fibers obtained from small ruminants in Türkiye and globally. In Türkiye, intensive studies have been conducted on mohair and wool, in particular, examining the fibers' quality parameters, morphological characteristics, and, in some studies, their genetic structure. Globally, studies on sheep wool, cashmere, and mohair, conducted at the molecular level using advanced analysis methods such as SEM, FTIR, DSC, and XRD, are attracting more attention. The findings reveal that Türkiye has significant potential in fiber production, but that to compete internationally, research into molecular analysis techniques and new areas of application needs to be increased.

Keywords: Small ruminant breeding, Animal fiber, Fiber analysis, Keratin

Impacts of Heat Stress on Growth Performance and Its Mitigation in Small Ruminants

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Heat stress is a significant environmental factor that negatively affects the productivity and welfare of small ruminants, particularly in regions with hot and dry climates. It disrupts thermoregulation and leads to a series of physiological and metabolic changes, including increased body temperature, reduced feed intake, hormonal imbalances, and lowered growth performance. Young animals are especially vulnerable during critical development periods, and prolonged exposure to high temperatures can result in permanent losses in weight gain and carcass quality. This review explores the physiological effects of heat stress on small ruminants and its impact on growth performance. It also highlights practical mitigation strategies such as improved housing and ventilation, access to clean water, nutritional supplementation, and the use of heat-tolerant local breeds. Emphasis is placed on examples from Türkiye, where climate conditions and breed-specific responses play an important role in managing thermal stress. Integrated and region-specific solutions are essential to reduce the negative impacts of heat stress and maintain sustainable small ruminant production. Adaptation strategies combining environmental, nutritional, and genetic approaches can help improve resilience in flocks exposed to rising temperatures. Understanding animal responses and implementing early interventions are key steps toward enhancing productivity and animal welfare under changing climate conditions.

Keywords: Heat stress, small ruminants, growth performance, climate adaptation

Effects of Dam Age, Sex, and Birth Type on Birth Weight and Live Weight Gain in Güney Karaman Lambs

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This study was conducted using the 2024 data from the Güney Karaman-4 project carried out in Mersin province within the scope of the "National Small Ruminant Improvement Project in Farmers' Conditions." The effects of dam age, sex, and birth type on birth weight, 90-day weaning weight, and daily live weight gain during this period were examined in a total of 7,061 lambs raised in 46 farms. The birth and 90-day weaning weights of the lambs, as well as their daily live weight gains during this period, were evaluated in the GLM model considering dam age (2–7+), sex (female, male), and birth type (single, twin) as factors. Accordingly, the average birth weight was determined as 3,032 g, the 90-day weaning weight as 25.7 kg, and the daily live weight gain as 252 g. It was found that dam age had significant effects ($P<0.05$) on birth weight, 90-day live weight, and daily live weight gain; sex significantly affected ($P<0.05$) birth weight and 90-day live weight but not daily live weight gain; while birth type significantly affected ($P<0.05$) only birth weight, but had no effect ($P>0.05$) on 90-day live weight or daily live weight gain. In conclusion, it was determined that in Güney Karaman lambs, dam age and sex had significant effects on birth weight and 90-day live weight gain, whereas birth type affected only birth weight.

Keywords: Güney Karaman, birth weight, weaning weight, dam age

Acknowledgement: This study was prepared using the 2024 data of the Güney Karaman-4 project in Mersin province, carried out within the scope of the "National Small Ruminant Improvement Project in Farmers' Conditions" conducted by the Ministry of Agriculture and Forestry of the Republic of Türkiye.

Growth Performance Characteristics of Angora Goat Kids: Ankara Province

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In this study, some growth parameters were investigated in kids born in Angora goat farms in the first sub-project within the scope of the 'National Small Ruminant Breeding Project' in Ankara province. The material of the study consisted of 3480 live-born kids found in Angora goat farms in Beypazarı and Nallıhan districts of Ankara Province in 2024. The average birth weight of Angora goat kids was 2.36 kg, and their 90th-day live weight was 11.22 kg. It was also determined that the kids gained 97 g of daily live weight. It was observed that mother age, sex and birth type had an effect on kids birth weight and growth parameters. In conclusion, kids growth parameters of Angora Goat raised in Ankara province are similar to those in the literature. The economic situation of Angora Goat farms can be improved with the implementation of breeding programs especially increasing growth traits.

Keywords: Ankara Province, Angora Goat, Breeding, Growth Characteristics

Evaluation of Environmental and Biological Factors Affecting Early Growth Performance in Angora Goats Under Farmer Conditions

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This study aimed to evaluate the effects of various biological and environmental factors on early growth traits in Angora goat kids raised under farmer conditions in Ankara Province, Türkiye. The research was conducted as part of the "National Small Ruminant Genetic Improvement Project Under Farmer Condition" and included a total of 6104 kids born in the same kidding season across 14 farms. Birth weights were recorded within 24 hours of parturition, and live weights at 3 months were measured using digital scales. Average daily gain (ADG) was calculated from birth to 3 months of age. The effects of sex, birth type, dam age, birth month, and district on birth weight, 3-month weight, and ADG were analyzed using ANOVA, with mean comparisons conducted via Tukey's test ($P<0.05$). The results showed that sex significantly affected 3-month weight and ADG, with male kids outperforming females. Birth type had a significant effect only on birth weight, where single-born kids were heavier. Dam age influenced all traits; kids from older dams (6+ years) had lower birth weights but higher postnatal growth rates. Kids born in April exhibited better growth performance than those born in March. Notable differences among districts were observed, with Çubuk showing the highest 3-month weights and ADG, while Polatlı had the lowest. These results highlight the importance of considering both genetic and environmental factors in breeding and management strategies to improve growth performance in Angora goats.

Keywords: Angora goat, Growth performance, Average daily gain, Environmental factors

Environmental Effects on Growth Performance and First-Year Mohair Yield of Ankara Goat Kids in Ankara Province

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The Angora goat is a native breed valued for high-quality mohair and adaptability to harsh environments. This study evaluated the effects of dam age, birth type, kid sex, year, and birth season on birth weight (BW), daily weight gain (DWG), weaning weight (WW), and first-year mohair yield (MY) using data from 38,458 kids across 30 farms in Ankara Province over five years (2020–2025). Year and dam age significantly affected all traits ($P < 0.001$), while birth season influenced DWG, WW, and MY ($P < 0.001$) but not BW ($P = 0.131$). BW, WW, and MY significantly increased with dam age ($P < 0.001$), although a decline was observed in dams older than five years. Birth season had a marked effect on WW, with performance progressively increasing from February-born kids (10.27 ± 0.25 kg) to May-born kids (12.56 ± 0.26 kg) at 90 days; March- and April-born kids showed intermediate values (10.98 ± 0.24 kg and 11.92 ± 0.24 kg, respectively), likely reflecting improved pasture quality and nutritional conditions during late spring and early summer. Year-to-year variation, including a 768 g reduction in 2022, suggests that management and feed availability may have been more limiting than thermal conditions. WW performance during the first 90 days was further assessed with climatic data, including average temperature, humidity, temperature-humidity index (THI), and minimum daily temperature. Although THI was statistically significant in the model ($P < 0.001$), actual stress levels remained within manageable ranges, with average THI values primarily in the comfort zone (60–72, range 45–80). Farm-level management and feeding practices also had considerable effects on growth performance. Overall, these findings indicate that optimizing growth and mohair production in Angora goats requires integrated farm management strategies, with management practices being a primary driver of performance beyond environmental constraints.

Keywords*:* Ankara goat, Growth performance, Mohair yield, Environmental factors

Effects Of Some Environmental Factors On The Daily Live Weight Gain Of Central Anatolian Merino Lambs: The Case Of Karaman Province

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This study was conducted within the framework of the National Small Ruminant Breeding Project, specifically the "Central Anatolian Merino Sheep Breeding-2" subproject (Project Code: 70OAM2012-02) implemented in Karaman Province. The aim was to determine the effects of certain environmental factors on the daily live weight gain (DLWG) of lambs reared on participating farms.

The animal material consisted of 40,815 lambs born between 2018 and 2024. A General Linear Model (GLM) was used to analyze the effects of year, dam age, sex, and birth type on DLWG up to 90 days of age. Least square means were used to estimate effect sizes.

Results indicated that all investigated environmental factors had a statistically significant effect on DLWG up to 90 days ($P<0.05$). The mean DLWG by birth type was 255 g for singles and 245 g for twins. Based on sex, males and females had mean values of 261 g and 241 g, respectively. The overall mean DLWG up to 90 days was 251 g, with annual averages ranging from 220 g (2020) to 285 g (2022). Lambs from 4-year-old dams exhibited the highest DLWG (255 g), while lambs from 6-year-old dams showed the lowest (245 g). No significant difference was found between lambs from dams aged 4 and ≥7 years.

In conclusion, improvements in management and feeding conditions are expected to result in increased DLWG and weaning weights of lambs. Despite ongoing breeding efforts, environmental factors continue to exert significant influences on DLWG across years.

Keywords: Dam age, Sex, Birth type, Year

Acknowledgement: The data used in this study were obtained from the subproject "Central Anatolian Merino-02" conducted in Karaman Province under the Ministry of Agriculture and Forestry (Project Code: 70OAM2012-02). The authors gratefully acknowledge the Ministry's support.

Towards Sustainable Breeding: Long-Term Trends in Fertility, Lamb Growth and Survival in Akkaraman Sheep Breed

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This study was conducted to determine the fertility, lamb birth weight, and survival rate of Akkaraman sheep until weaning, based on long-term data, and to evaluate the effects of genetic and environmental factors. The animal material for the study consisted of 71,153 sheep from multiplier and base flocks included in the “Akkaraman Sheep Breeding 1” project carried out in Aksaray Province between 2012 and 2024, as well as 83,582 lambs born from these sheep. Records of birth type, lamb birth weight, and vitality were evaluated. Variance analysis and Chi-square tests were conducted using the SAS software package (1999). The average number of lambs born was 1.18, with significant differences observed between years ($p< 0.001$). The highest value was recorded in 2013 (1.22), while the lowest was in 2022 (1.12). The lambing rate increased from 1.10 in two-year-old ewes to 1.21 in middle-aged ewes. Average values in multiplier flocks were higher than those in base flocks. The average lamb birth weight was 4.52 kg, ranging from 4.10 to 4.71 kg over the years ($p < 0.001$). Single-born lambs (4.87 kg) were heavier than multiple-born lambs (4.16 kg), and male lambs (4.67 kg) were heavier than female lambs (4.36 kg). The overall survival rate was 94.0%, with statistically significant differences observed between flocks and years ($p<0.001$).In conclusion, the study findings reveal that Akkaraman sheep possess significant potential as a local genetic resource, characterized by moderate fertility, satisfactory lamb birth weights, and a high survival rate. Based on these findings, strategies focused on balancing the age structure of flocks and increasing multiple lambing rates, while considering the relationship between birth weight and survival rate, will enhance the effectiveness of breeding programs.

Keywords: Genetic resources, Breeding, Small ruminants.

Acknowledgements: This study was prepared using the data for the years 2012-2024 within the scope of the "National Project for Breeding of Akkaraman Sheep by the Public (1)" carried out by the Ministry of Agriculture and Forestry of the Republic of Turkey in Aksaray province.

The Effect of Environmental Factors on Birth Weight and Survival Rate of Akkaraman Lambs: The Case of Aksaray Province

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In this study, birth weight and survival rate data of 36,214 lambs collected between 2018 and 2024 within the Akkaraman Sheep II sub-project (TAGEM/68AKK2012-02) of the National Small Ruminant Improvement Program in Aksaray province were used to research the effects of certain environmental factors thought to influence the birth weight and survival of Akkaraman lambs. A randomised complete block design analysis of variance (ANOVA) was applied to determine the effects of year, dam age, type of birth, and sex as environmental factors. The significance level was set at 5%, and Tukey's multiple comparison test was used to compare the differences among means. The findings revealed that the mean ± standard error of lambs' birth weight and survival rate were 4.34±0.007 kg and 84.6±0.26%, respectively. Year, dam age, type of birth, and sex were found to have statistically significant effects on both birth weight and survival rate of lambs ($P<0.05$). In conclusion, it was observed that year, dam age, type of birth, and sex were effective on birth weight and survival rate in Akkaraman lambs.

Keywords: Akkaraman Sheep, Statistics, Aksaray

Acknowledgements: This study was prepared using the data for the years 2018-2024 within the scope of the "National Project for Breeding of Akkaraman Sheep by the Public (2)" carried out by the Ministry of Agriculture and Forestry of the Republic of Turkey in Aksaray province.

Evaluation of Milk Yield and Reproductive Performance of Water Buffaloes in Yozgat Province

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Water buffalo farming in Yozgat Province is traditionally practiced in mountainous villages, where milk is mainly processed into yogurt and cream and marketed through local bazaars and shops. The Provincial Buffalo Breeders' Association has 102 members engaged in buffalo production across 58 villages in 13 districts. Except for Çandır, buffalo breeding is present in all districts, with the highest populations in Merkez, Sorgun, and Kadışehri. The enterprises are mostly small-scale family farms, with an average of six female buffaloes per farm, and rely predominantly on pasture-based feeding systems.

Water buffalo husbandry in Türkiye had declined in the past due to low rainfall, the effects of climate change, and comparatively lower milk yields than dairy cattle. However, in recent years, production supports and the National Buffalo Breeding Project in Farm Conditions, launched in 2011 by the Ministry of Agriculture and Forestry, have contributed to an increase in both population and productivity. Currently, Yozgat hosts about 3179 buffaloes, around 1339 of which are kept in 93 farms participating in the project. This study evaluates selected milk yield and reproductive performance traits of buffaloes raised under this scheme and discusses their contribution to the development of regional water buffalo breeding.

Keywords: Water buffalo breeding, Milk yield, Reproductive performance, On-farm breeding, Yozgat

Determination of Some Milk Yield Characteristics in Güney Karaman Sheep

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In this study, some milk yield traits were investigated in Güney Karaman sheep raised under extensive conditions. The animal material of the study consisted of ewes (n=1089) raised in seven different farms within the scope of the Güney Karaman Sheep Breeding Project in Mersin province. Mean lactation length, lactation milk yield, average daily milk yield, milking time and suckling duration of lambs were determined as 266.7±0.59 days, 125.4±0.38 liters, 567.9±1.09 milliliters, 122 days and 144.7±0.59 days, respectively. Additionally, lactation (milking) milk yield calculated using Trapez II (ICAR: International Committee for Animal Recording) and average daily milk yield were calculated as 69.46±0.13 liters and 569.3±1.08 milliliters, respectively. Among the calculated traits, the effects of age ($p<0.01$) and farm ($p<0.01$) on the average lactation length, lactation milk yield and suckling duration of lambs were found to be significant. In conclusion, based on the findings, it can be stated that the amount of milk produced from Güney Karaman ewes is satisfactory and has a significant potential in terms of milk yield.

Key words: Güney Karaman, Milk yield, Sheep

Effects of Sex and Flock on Growth Traits and Correlations Between Weaning Weight and Body Measurements in Zom and Karakaş Lambs Raised in Diyarbakır Region

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Zom and Karakaş sheep are two local breeds of Türkiye. In the current study was aimed to determine growth traits including birth weight (BW), weaning weight (WW), average daily weight gain (ADWG), and Kleiber ratio (KR), as well as the correlations between WW and body measurements [Body Length (BL), Witter height (WH), Heart girth (HG), Chest depth (CD), Rump height (RH), Rump width (RW), Head length (HL), Head width (HW), Chest width (CW), Cannon perimeter (CP)]. The study was conducted on 84 Zom and 88 Karakaş lambs, with each breed raised on three distinct farms in the Diyarbakır province. The lambs were weighed using an electronic scale with 50-gram precision. From 75 days of age until weaning (on day 90), water and feed were provided ad libitum. BW, WW, and ten body measurements were recorded, and ADWG and KR were calculated. Statistical analyses were conducted using SPSS 25.0, with GLM used to assess fixed effects and Pearson's correlation to evaluate relationships between WW and body traits. In Zom lambs, sex significantly affected only BW ($P<0.05$), while flock had a significant impact on all growth traits ($P<0.01$). In Karakaş lambs, males had significantly higher BW and WW ($P<0.001$) and ADWG ($P<0.05$), while flock influenced BW and KR ($P<0.001$). Correlation analysis showed that in Zom lambs, WW had weak and mostly non-significant correlations with body measurements, indicating limited predictive value. In contrast, Karakaş lambs exhibited strong and significant positive correlations between WW except for HW ($P<0.01$). These findings highlight the importance of flock management in lamb growth performance and suggest that body measurements can be used for early selection in Karakaş lambs, but are less useful in Zom lambs. The results provide valuable insights for breeding and management strategies aimed at improving growth traits in local sheep genotypes.

Keywords: Body measurements, Growth, Karakaş lamb, Weaning weight, Zom lamb

The Effect of Year, Age and Birth Type on Lactation Duration, Lactation Milk Yield and Daily Average Milk Yield in Hair Goats: The Example of Niğde Province

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This study used milk yield datas from 10,643 animals collected during the 2023-2024 period within the National Small Ruminant Improvement Project in Farmers' Conditions (TAGEM/51KIL2012-01) within the scope of the National Small Ruminant Improvement Project in Farmers' Conditions conducted in Niğde province to examine some environmental factors thought to affect the milk yield of purebred goats. To determine lactation period milk yield, three individual control milkings were performed every 30 days, and lactation milk yield was determined using the Trapeze II method. The variance analysis was applied to determine the effects of environmental factors such as year, age, and birth type on lactation length (LL), lactation milk yield (LMY), and daily average milk yield (DAMY) in a randomized plot design. The significance level was set at 5% and Tukey's multiple comparison test was used to compare the differences between the means. According to the findings, the means and standard errors of LS, LSV, and GOSV of Hair Goats were determined to be 159.4±0.35 days, 101.7±0.47 liters, and 0.635±0.0015 liters, respectively. The effects of year and age factors on LS were found to be statistically significant ($P<0.05$), while the effect of birth type factor was insignificant ($P>0.05$). The effects of year and birth type factors on LSV were found to be statistically significant ($P<0.05$), while the effect of the age factor was insignificant ($P>0.05$). The effect of the year factor on GOSV was found to be statistically significant ($P<0.05$), while the effects of age and birth type were found to be insignificant ($P>0.05$).

As a result, it was observed that the year factor affected LL, LMY, and DAMY in Hair Goats. It was concluded that breeders should compensate for the negative effects of the year factor with the farm factor in order to achieve higher milk yields.

Keywords: Hair Goat, Milk, Cheese, Statistics, Niğde

Acknowledgement: This study was prepared using the 2023-2024 data of the Hair Goat-1 project in Niğde province, carried out within the scope of the "National Small Ruminant Improvement Project in Farmers' Conditions" conducted by the Ministry of Agriculture and Forestry of the Republic of Türkiye.

Ankara Goat Colostrum: Composition, Quality, and Implications for Husbandry

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Colostrum is a physiological secretion critically important for the survival of newborns, the development of the immune system, and early growth performance. This specialized milk, secreted during the first hours after birth, contains not only essential nutrients but also biologically active components rich in immunological factors. In Ankara goats, the composition and quality characteristics of colostrum play a decisive role in newborn kids' survival, growth rates, and overall herd health. Particularly, its high levels of immunoglobulins, proteins, fats, vitamins, and minerals enable the transfer of passive immunity to newborn kids, thereby providing an effective protective mechanism against infections during the early postnatal period. The literature reports that colostrum quality is influenced by multiple factors. These include the dam's nutritional status during gestation, season of kidding, parity, breed characteristics, environmental stressors, and housing conditions. In Ankara goat husbandry, regular evaluation of colostrum quality and ensuring that newborn kids receive adequate colostrum during the first hours after birth contribute significantly to reducing kid mortality and improving herd productivity. In this context, elucidating the compositional characteristics of Ankara goat colostrum and identifying factors affecting its quality not only enriches scientific knowledge but also provides guidance for sustainable livestock production systems. This study addresses the compositional properties of Ankara goat colostrum, factors influencing its quality, and its role in husbandry practices, emphasizing its importance for sustainable production.

Keywords: Ankara goat, Colostrum, Colostrum quality, Passive immunity

Metabolic Profile Changes in Akkaraman Sheep According to Pasture Periods in Çorum Province

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This study was conducted to evaluate metabolic profile changes of Akkaraman sheep during different pasture periods in Çorum province, within the framework of the National Small Ruminant Breeding Program. The research material consisted of 185 Akkaraman ewes from 19 farms, each with two lambings recorded, grazing on seven different pastures located in the districts of Merkez, Sungurlu, İskilip, Uğurludağ, and Mecitözü.

Blood samples were collected from the ewes in March (pre-pasture period) and during the pasture periods in April, June, and August. Serum obtained from these samples was analyzed for Blood Urea Nitrogen (BUN), Total Protein (TP), Albumin (ALB), Triglyceride (TRG), Beta-Hydroxybutyric Acid (BHB), Non-Esterified Fatty Acids (NEFA), and Glucose.

The results revealed statistically significant differences ($P<0.05$) between periods for BHB, NEFA, BUN, TRG, TP, and ALB values. BHB concentrations were below normal limits in March and April but above normal in August. BUN values reached their highest level in April, which was attributed to the ruminal degradation of crude protein derived from fresh forage. While serum glucose levels did not change significantly across periods ($P>0.05$), NEFA values were highest in the early pasture period, coinciding with the onset of lactation. Serum triglyceride, total protein, and albumin levels were found to be within reference ranges and consistent with other studies. Cholesterol levels were higher in June compared to other periods.

In conclusion, this study demonstrated seasonal-based differences in the metabolic profiles of Akkaraman sheep. These findings emphasize the importance of developing management and feeding strategies tailored to regional rearing conditions to ensure optimal productivity and animal health.

Keywords: Akkaraman, Metabolic profile, Pasture, BUN, NEFA

Next-Generation Feeding Approaches in Livestock: Nutrigenomics And Omics Technologies

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Nutrigenomics is an interdisciplinary field of science that investigates the interactions between dietary components and genomic structure, thereby enabling a more comprehensive understanding of metabolic responses at both individual and species levels. In livestock production, nutrigenomic approaches offer significant potential for the development of genotype-specific feeding strategies, improvement of feed efficiency, enhancement of immune functions, and optimization of product quality. In recent years, the increasing use of gene expression profiling, multi-dimensional omics technologies such as transcriptomics, proteomics, and metabolomics, as well as bioinformatic analyses, has made it possible to elucidate the molecular effects of feed additives and bioactive compounds. Notably, reducing methane emissions in ruminants, optimizing growth performance and meat quality parameters in poultry, and modulating immune responses are among the prominent areas of application. When evaluated within the framework of sustainable livestock policies and animal welfare, nutrigenomics holds the potential to both increase the economic efficiency of production systems and mitigate environmental impacts. This review discusses the fundamental principles of nutrigenomics, its current applications, and future research perspectives.

Keywords: Nutrigenomics, Livestock, Feed efficiency, Omics technologies, Sustainability, Animal welfare

Modified Dried Vinasse as a Sustainable Alternative Protein Source for Poultry

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Livestock products are vital components of human nutrition, offering high-quality protein and essential nutrients with superior bioavailability. However, increasing concerns have emerged regarding the sustainability and efficiency of feed protein sources used in poultry, rabbit, and livestock production. The rising global demand for protein-rich feeds has encouraged the exploration of alternative and more sustainable protein sources, particularly those derived from industrial by-products. Utilizing such by-products not only reduces feed costs and environmental burdens but also lessens the dependence on arable land. Vinasse is a by-product obtained after the fermentation of molasses during baker's yeast production. It is typically rich in ash and potassium. When its potassium content is reduced to about 2% and the dry matter is increased to approximately 60%, the product is referred to as modified vinasse. The modified dried vinasse (MDV; Integro Food and Feed Manufacturing Company, İstanbul, Türkiye) used in feed formulations generally contains 45–60% modified vinasse combined with other components such as wheat bran, corn distillers dried grains with solubles (DDGS), sunflower meal, corn germ meal, vegetable oil, and glycerol. MDV supplies valuable nutrients including proteins, amino acids, betaine, vitamins, minerals, and organic acids, largely owing to the presence of yeast, yeast cell walls, and fermentation-derived microbial growth factors. These properties give MDV both probiotic and prebiotic potential, supporting a balanced gut microflora. Furthermore, its high total phenolic content and antioxidant capacity contribute to its nutritional and physiological significance. Due to differences in processing techniques, the composition and effects of vinasse products can vary among manufacturers. Moreover, even the same manufacturer may produce different vinasse-based products for various animal groups by applying distinct processing methods. Studies conducted in broilers, quails, and laying hens have shown that MDV can be effectively incorporated into poultry diets without adverse effects. In conclusion, modified dried vinasse represents a promising, cost-effective, and sustainable alternative to conventional protein sources such as soybean meal, thereby contributing to environmentally responsible poultry production.

Keywords: Modified dried vinasse, Alternative protein source, Poultry nutrition, By-product utilization, sustainability

Usage of Mulberry Pomace in Animal Nutrition

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An increase in food demand is expected due to the consequences of a growing world population and climate change. One of the most important food sources in human nutrition is animal food. Increasing animal food intake is possible by increasing the number of animals or increasing the yield per animal. Furthermore, using new alternative products in animal nutrition can address the harmful effects of climate change. For this purpose, agricultural waste, fruit and vegetable pulp, and industrial by-products can be easily used in animal feeding. One of these products is mulberry pulp. Studies are being carried out to utilize the remaining pulp of the mulberry, which is processed for juice and molasses, in animal nutrition. In Turkiye, 70,000 tons of mulberries are produced, resulting in approximately 1,000 tons of mulberry pulp. Utilizing this pulp as animal feed is important for both economic and waste management purposes. This review focuses on the potential uses of mulberry pulp in animal nutrition.

Keywords: Animal nutrition, Mulberry pomace, Ruminant

Antioxidant and Nanoparticle (2020-2025)

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The examination of semen collected from male animals, diluted under appropriate conditions, and frozen (cryopreservation) has enabled semen to be stored for long periods and thawed for use when needed. This process has significantly contributed to the widespread use of artificial insemination in the practice field. However, cold shock and crystallization occurring in sperm cells during freezing and thawing can cause irreversible damage to the cell membrane. This manifests itself through pH changes, disruption of enzymatic reactions, cellular dehydration, and changes in membrane permeability.

To minimize these negative effects, various cryoprotectants and antioxidant compounds are added to sperm diluents. Substances such as disaccharides (lactose, trehalose), trisaccharides (raffinose), polysaccharides, egg yolk, and glycerol in diluents play an important role in protecting spermatozoa from cryogenic damage during the cooling and freezing stages. Antioxidants contribute to the preservation of spermatozoa's vital functions by reducing oxidative stress, cold shock, and crystallization that may occur after thawing.

Recent developments in nanotechnology (2020–2025) have enabled the use of nanoparticles (NPs) in biotechnology and, in particular, in animal reproductive biology applications. Nanoparticles can penetrate cell membranes and interact with DNA molecules due to their high surface area and unique physicochemical properties. However, this property also carries the potential to cause spermatotoxic effects. Studies have shown that some metallic and non-metallic nanoparticles suppress sperm motility, inhibit chromatin decondensation, and can cause disruptions in DNA repair mechanisms.

Therefore, the effects of nanoparticles on sperm and germ cells must be carefully evaluated in terms of both biological safety and reproductive efficiency. While the protective roles of antioxidants in the sperm freezing process have been known for many years, the potential toxicity risks associated with the use of nanoparticles have not been fully elucidated. Future studies should aim to achieve higher freezing-thawing success by combining the antioxidant effects with the controlled and safe use of nanoparticles.

Keywords: Trehalose, Cryopreservation, Antioxidant, Nanoparticle, Spermatotoxicity

The Effects of Vitamins (A, C, D, E) and Selenium on Fertility in Cattle

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Fertility in cattle is a critical parameter directly affecting the productivity of milk and meat production. In modern dairy farming, low conception rates, embryonic losses, and extended calving intervals are common challenges. Vitamins (A, C, D, E) and selenium are essential micronutrients for maintaining reproductive health and enhancing fertility. Vitamin A and beta-carotene support follicular and luteal cell functions, increase progesterone production, and thereby improve ovulation and fertility. Vitamin C, as a potent antioxidant, neutralizes free radicals, preserves oocyte and embryo quality, and reduces stress-induced infertility. Vitamin D regulates calcium and phosphorus metabolism and contributes to maintaining uterus health; its deficiency negatively affects luteal function and oocyte development. Vitamin E (α-tocopherol) protects cell membranes from oxidative damage, reducing peripartum and postpartum complications; its effect is more pronounced when combined with selenium, lowering incidences of retained placenta, metritis, and mastitis. Selenium strengthens antioxidant defense via releated enzymes, protects oocytes and embryos from oxidative stress, and reduces embryonic losses. Proper dosage and form of vitamin and selenium supplementation during transition and postpartum periods can optimize reproductive performance and improve fertility. In conclusion, the synergistic effects of these micronutrients play a crucial role in preserving bovine reproductive health and enhancing herd productivity.

Keywords: Antioxidant, Ovulation, Embryo development, Luteal function, Postpartum complications

Effects of the Co-Synch Protocol on Reproductive Performance in Dairy Cows

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Fertility in dairy cows is a critical factor for the profitability and sustainability of the farms. However, problems such as irregular estrus cycles, silent estrus and inadequate ovulation monitoring during the postpartum period make it difficult to achieve desired pregnancy rates with natural mating or conventional artificial insemination methods. Therefore, hormonal protocols that synchronize ovulation have become an important tool in modern herd management. The Co-Synch protocol is based on the GnRH–PGF2α–GnRH application sequence and is used in conjunction with timed artificial insemination. This protocol stimulates follicle development with the first GnRH application, induces luteolysis with the PGF2α injection, and synchronizes ovulation with the second GnRH application. This allows artificial insemination to be performed on all cows in the herd at a specific time. Various studies have shown that the Co-Synch protocol increases pregnancy rates, improves the chances of success at first insemination, and shortens the service period. It provides a practical advantage by reducing labor, especially in large herds where estrus detection is difficult. However, the lactation period, body condition score, and metabolic status of cows can affect the success of the protocol. In conclusion, the Co-Synch protocol stands out as an effective, practical, and economically advantageous method for reproductive management in dairy cows. The herd-based application of this protocol contributes to improved pregnancy rates and, consequently, increases both calf production and milk yield.

Keywords: Dairy cow, Co-Synch protocol, Ovulation synchronization, Timed artificial insemination, Fertility

Effects of Lameness in Dairy Cows on Reproduction and Milk Yield

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Lameness in dairy cattle is a significant health issue that threatens animal welfare and economic sustainability. Lameness cases resulting from nail and foot diseases are not limited to walking disorders, but are systemic health problems that negatively affect the animal's overall physiology, behavior, and reproductive performance. Lameness, when evaluated in terms of milk yield, causes problems such as decreased feed intake due to pain, negative energy imbalance with insufficient rumination, and increased stress. The observed decrease in milk yield is not only due to energy deficiency, but also to inflammatory responses causing disruption in the functioning of the mammary glands and a decrease in milk yield. Lameness also negatively affects milking behavior, leading to a decrease in milking frequency. When evaluated in terms of reproduction, lameness causes a decrease in estrus behavior, a delay in insemination time, a longer insemination period, and a decrease in pregnancy rates. Some hormonal disorders that develop during this process cause serious disruptions in follicular development, ovulation, and embryo implantation, increasing the rate of early embryonic death. Lameness is a critical parameter affecting milk and meat production as well as fertility. Therefore, the costs resulting from the decline in fertility, milk yield, and meat yield caused by lameness demonstrate that lameness is of strategic importance not only for individual animal health but also for herd management and farm economics. Therefore, regular hoof care should be performed, housing conditions should be improved, genetic selection should be carried out, and the overall management system should be continuously developed.
Keywords: Lameness, Milk yield, Fertility, Animal welfare, Livestock economics.

Some Reproductive Performance Traits of Central Anatolian Merino Sheep Raised in Karaman Province

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This study was conducted within the scope of the "Nationwide Genetic Improvement of Small Ruminants in Farm Condition" under the project titled “Breeding of Central Anatolian Merino Sheep Breed in Karaman-I (70OAM2011-01)”. Reproductive performance traits were evaluated for a total of 9,975 sheep raised in 13 farms during the 2022 and 2023 lambing seasons. The traits examined included lambing rate, multiple birth rate, fecundity, fecundity at weaning, litter size and litter size at weaning. Overall, the average lambing rate was found to be 77.5%, the multiple birth rate was 27.58%, fecundity was 1.12, fecundity at weaning was 0.99, litter size was 1.28, and litter size at weaning was 1.17.

When evaluated by year in 2022 and 2023 respectively, the lambing rate was 81.4% and 73.9%, the multiple birth rate was 26.85% and 29.34%, fecundity was 1.03 and 0.95, fecundity at weaning was 0.95 and 0.87, litter size was 1.27 and 1.29 litter size at weaning was 1.17 and 1.18. Statistical analysis revealed that the year had a significant effect on lambing rate and fecundity ($P<0.01$).

In conclusion, it was determined that breeding programs in Central Anatolian Merino sheep may lead to improvements in reproductive performance over time, although certain traits are significantly influenced by yearly environmental factors.

Key Word: Breeder condition, Central Anatolian Merino, reproduction, ewe,

Comparison of Oocyte Yield, Quality, and In Vitro Embryo Development among Anatolian Water Buffalo Adult Female and Nulliparous

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The aim of this study is to determine the number and quality of oocytes obtained from the ovaries of Anatolian water buffalo adult female and nulliparous, as well as the *in vitro* embryo development of these oocytes under controlled conditions. For this aim, 84 ovaries from 42 nulliparous and 100 ovaries from 50 adult female, all collected from an abattoir, were utilized for in vitro embryo production. Modified TCM-199 oocyte was used for maturation; IVF was performed through the Brackett-Oliphant method. Embryos were cultured in CR1aa medium. Moreover, 143 oocytes were retrieved from nulliparous, while 150 oocytes were collected from the adult female. Frozen semen from commercially produced Anatolian water buffalo bulls was used for fertilization. As a result, the fertilization rate was 34.74% (41 out of 118) in nulliparous and 24.64% (52 out of 211) in adult female. On day 7, the blastocyst rate was 8.6% (10 out of 120) in nulliparous and 10.44% (19 out of 182) in adult female. Between days 8 and 9, the rate of hatched blastocysts was 3.33% (4 out of 120) in nulliparous and 4.40% (8 out of 182) in adult female. Significant differences were observed in the number of cultured and fertilized oocytes ($p<0.05$). However, there were no significant differences in other embryo development parameters. In addition, this is the first study that directly compares oocyte recovery, oocyte quality, and *in vitro* embryo development between Anatolian water buffalo adult female and nulliparous. While the productivity of Anatolian water buffaloes may not match that of cattle in terms of yield, their superior product quality suggests that the combined use of routine technologies and advanced biotechnological methods employed in cattle breeding could significantly enhance the breeding and development of this buffalo breed.

Keywords: Anatolian water buffalo, heifers, in vitro, fertilization, embryo culture.

Time-Lapse Assessment of Bovine Embryo Morphokinetics with Sex-Sorted vs. Unsorted Sperm

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The protocols used for flow-cytometric sex-sorting of sperm have been substantially improved over the last decade, yet blastocyst rates after *in vitro* fertilization (IVF) with sex-sorted sperm remain variable. To compare embryo morphokinetics of *in vitro* produced (IVP) bovine embryos generated with cryopreserved sex-sorted (SS) versus unsorted control (CON) sperm. Single ejaculates from one Jersey and three Holstein-Friesian bulls were split in two aliquots: The SS aliquot was flow-cytometrically enriched for X-bearing sperm (~90% purity; 4×10^6 sperm/0.25-ml straw); the CON aliquot was left unsorted. Both SS (16×10^6 sperm/mL) and CON (60×10^6 sperm/mL) straws were frozen at -196°C in liquid nitrogen. Cumulus-oocyte complexes from slaughterhouse ovaries were used for IVF with SS or CON sperm. A total of 120 presumptive zygotes were monitored every 10 min until day 9 with time-lapse imaging. We recorded the times of first (t1) and second (t2) cleavage, last cleavage before the lag-phase (t3), cleavage resumption after lag-phase (tRCl), onset of blastocyst expansion (tSB), and blastocyst hatching (tHB). The cleavage and blastocyst rates (expressed as % of initial oocyte number), and the hatching rate (expressed as % of blastocysts) were compared between groups with the Mann-Whitney U test. Group differences for embryo transitions between states were explored with multi-state Cox models. The SS treatment had numerically lower cleavage (87.2% vs 90.0%), blastocyst (35.6% vs 38.3%), and hatching (18.1% vs 24.8%) rates than CON, without statistical significance ($P > 0.05$ in all cases). In contrast, SS embryos required longer to reach t1, t2, t3, and tSB than the CON embryos (33.2 vs 29.8 h; 39.4 vs 35.1 h; 50.3 vs 48.7 h; 162.2 vs 151.8 h, respectively; all $P < 0.05$). In conclusion, use of sex-sorted sperm was associated with slower embryonic developmental timing despite similar cleavage, blastocyst, and hatching rates.

Key Wods: Time-lapse, Embryonic development, Bovine

Selection Criteria for Breeding Roosters: Ethical Concerns and Performance-Based Considerations

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The selection of breeder roosters is crucial for the production of fertile eggs and the future of laying hen flocks. Currently, performance criteria such as sperm parameters and physical characteristics are frequently used in this selection, often overlooking ethical principles and animal welfare. Concerns regarding the behavior and healty breding roosters from animal breeding programs may require a re-evalution of these practices.

Keywords: Breeder Roosters, Sperm Parameters, Physical charcteristics, Animal Welfare, Ethical Principles

Investigation of the Role and Effects of Egg Yolk and Soy Lecithin in the Cryopreservation of Honey Bee (Apis mellifera) Semen

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In Turkey, which hosts many bee species, storing honey bee semen is an effective way to conserve genetic diversity and control breeding programs.In recent years, many studies have been tried to develop long term storage of honey bee semen. Among them cryopreservation method has the highest successful rate in long term storage and preserving of drone semen. However, fertilazition in queen bees insaminated with bee sperm frozen with the method has not been achieved at a high rate. Therefore,improving of the semen extender used the cyropreservation method is higly important for better conservation of bee sperm quality and enhancing queen fertility. In the experiment, by modifying semen extender containing different proportions of egg yolk (10% and 20%) and soy lecithin (0.5%, 1%, 2% and 4%) will be investigated on sperm quality and queen fertility. Findings from this work will assist optimization of cyropreservation method for conserving and improving genetic diversity of honey bee.

Key words: Honey bees(*Apis mellifera*), Cryopreservation, Soybean Lecitin, Egg Yolk, Sperm viability

Biotechnological Potentials of the Rumen Microbiome

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The rumen is a specialized foregut structure in ruminant animals where microbial digestion occurs. Ruminants, thanks to the microorganisms present in their rumen, can degrade complex plant polysaccharides such as cellulose and hemicellulose, which are not utilized by other vertebrates including humans, and convert them into high-quality protein like meat and milk. Moreover, they possess the ability to detoxify plant secondary metabolites with toxic properties. Bacteria, archaea, protozoa, fungus and viruses make up the rumen microbiome. By means of meta-omic analyses, which enable the identification of microorganisms in a specific habitat, the organisms, their functions and activities in the environment can be identified without the need for a culture medium. In meta-omic analyses, following the isolation of genetic material, the identification of microorganisms present in the environment is carried out through either amplicon sequencing or shotgun sequencing approaches. The rumen microbiome has an excessive biotechnological potential. In today's world, the rumen microbiome is being utilized in various fields such as enzyme production, bioenergy (biofuel) production, volatile fatty acid production, biodegradation, detoxification, and feed additives. This study aims to provide a comprehensive overview of the rumen microbial ecosystem, its functions, and biotechnological applications, with a special focus on utilizing metagenomic data to identify rumen microorganisms and explore their potential for applications in biotechnology, including bioenergy production, enzyme discovery, and development of novel metabolites.

Keywords: Rumen microbiome, microbial genomics, metagenomics, biotechnology

Gut Microbiota in Farm Animals and Its Relationship with Animal Welfare

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In farm animals, gut microbiota refers to the microbial community colonizing the intestine and is influenced by various factors such as production system, age, mode of delivery, dietary regimen, and environmental conditions. Differences in microbial diversity and abundance are observed across intestinal regions, as well as among species and developmental stages. A broad and diverse microbial ecosystem plays a critical role not only in enabling newborn animals to adapt from intrauterine conditions to the external environment but also in supporting their growth and development. In recent years, studies conducted in various species, particularly in primates and laboratory animals, have suggested that gut microbiota plays a role in regulating social and emotional behaviors, and that it is associated with welfare, stress status, and productivity of animals. Although the mechanisms mediating communication between the gut microbiota and the central nervous system (CNS) have not been fully elucidated, numerous studies have demonstrated a complementary and bidirectional relationship between the two. It has been shown that gut microbiota interacts with the brain through the nervous, endocrine, and immune systems in order to regulate brain functions and behaviors. This regulatory system, known as the microbiota–gut–brain (MGB) axis, is linked to stress responses and behavioral reactions through hormonal, neural, and immunological interactions. In recent years, it has been proposed that the MGB axis may serve as a novel indicator for evaluating the health and welfare status of animals. In this context, the aim of this study is to evaluate the relationship between gut microbiota and animal welfare in farm animals.

Keywords: Stress, Welfare, Gut, Microbiota

The Importance of Foot Diseases and Lameness in Sheep and Goats

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One of the most significant problems in sheep and goat farming is foot diseases and the resulting lameness. Lameness is not a disease but rather a symptom that often results from various etiologies. Infectious foot diseases are among the most common causes of lameness in sheep and goats, leading to reduced meat and milk yields, labor costs, and significant economic losses due to treatment. Lameness is also defined as a syndrome that limits production due to reasons such as increased mortality of sheep and goats, poor performance, infertility, slow growth of lambs and kids, and early culling from the herd. However, the economic losses associated with lameness are not always quantifiable, and the true cost is often unknown. These losses include increased labor, treatment and control costs, and prophylactic measures to protect healthy sheep and goats from potential foot diseases. The economic costs of foot diseases and lameness appear to negatively impact the sustainability of sheep and goat farming and livestock production. Foot diseases and lameness are not just a financial problem. It is also a welfare issue for sheep and goats that are in pain. Lameness and the pain associated with lameness also negatively impact behavior in sheep and goats, including decreased appetite, a constant desire to lie down, and a reluctance to walk or stand. Lameness is also associated with negative effects on the welfare of animals and the overall profitability of their breeding. In conclusion, in addition to knowing the etiology and pathogenesis of lameness and foot diseases, which are the most important causes of lameness, focus should also be on diagnosis and treatment costs, health and welfare status, and the impact on herd management, the development of effective treatments for foot diseases, and the implementation of sustainable preventive measures.

Keywords: Animal welfare, Prophylaxis, Herd management.

Substances Derived from Some Farm Animals Used in Cosmetics

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The cosmetics industry today utilizes a wide range of substances derived from various animal sources. Farm animals constitute the primary source of many animal-derived ingredients used in cosmetic formulations. These substances are largely by-products of the meat and livestock industries and are mainly obtained from cattle, sheep, and poultry. Collagen, elastin, keratin, hyaluronic acid, and lanolin obtained from these animals are functional ingredients commonly used in cosmetic formulations. The cattle industry holds particular importance, as collagen is extracted from connective tissues, elastin from the aorta and spinal tissues, and keratin from horns, hooves, and hair. The sheep industry stands out in the production of lanolin, which is obtained during the wool-processing stage and is known for its moisturizing properties. The poultry industry, on the other hand, provides hyaluronic acid, which is primarily sourced from rooster combs and is widely used in moisturizing and anti-aging skincare products.". However, in recent years, the use of animal-derived substances has shown a declining trend due to ethical, hygienic, and environmental concerns. Growing awareness of sustainability, animal welfare, and consumer consciousness has encouraged the industry to shift toward plant-based and biotechnological alternatives. Nevertheless, existing literature indicates that these substances still hold a significant place in certain cosmetic products. The purpose of this review is to introduce some of the animal-derived substances obtained from farm animals used in the cosmetics industry and to highlight their functions and applications in cosmetic formulations.

Keywords: Cosmetics Industry, Animal Sources, Farm Animals

Mitigation Strategies for Enteric Methane Emissions in Ruminants

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Methane (CH_4), primarily produced through enteric fermentation in ruminant animals, is a short-lived but potent greenhouse gas (GHG) with a high global warming potential. Although its atmospheric lifetime is shorter than that of carbon dioxide, its warming effect is approximately 28 times greater. Agricultural activities—particularly ruminant livestock production—represent a major source of global methane emissions. This review summarizes the mechanisms of methane formation, measurement techniques, and mitigation strategies, and evaluates nutritional, managerial, and policy-based approaches.

1. Introduction

Climate change is one of the most critical environmental challenges of our time. Since the Industrial Revolution, rising concentrations of greenhouse gases have accelerated due to fossil fuel combustion, land-use changes, and intensive agricultural practices. Despite its short atmospheric lifetime, methane (CH_4) is about 28 times more potent than CO_2 in terms of global warming potential. The agricultural sector contributes roughly 40% of global methane emissions, with the majority originating from enteric fermentation in ruminants. Therefore, reducing enteric methane emissions is considered a short-term yet highly effective strategy for achieving global climate targets.

2. Methane Formation Mechanisms in Ruminants

Methane production in ruminants occurs through microbial fermentation within the rumen. Complex carbohydrates (cellulose, hemicellulose) are converted into volatile fatty acids (VFAs) by bacteria, releasing hydrogen (H_2) as a by-product. Methanogenic archaea then utilize hydrogen and carbon dioxide (CO_2) to produce methane. This process results in an energy loss of approximately 2–12% of the gross energy intake. Redirecting rumen microbial metabolism through nutritional strategies can help mitigate this loss.

Recent metagenomic studies have demonstrated that the rumen microbiota is modifiable. Probiotic supplementation and microbiome engineering hold promise for reducing methane production while improving feed efficiency.

3. Methane Measurement Techniques

Accurate quantification of livestock methane emissions is essential for both scientific research and policy development. The main measurement techniques include:

- Respiration Chambers: The gold standard; provides high precision at the individual animal level.
- SF_6 Tracer Technique: Applicable to grazing animals; practical but requires careful calibration.
- GreenFeed® and Spot Sampling: Suitable for farm conditions; non-invasive and automated methods.
- Laser-Based Systems: Portable, rapid, and contact-free measurements.

• IPCC Tier 1–3 Models: Standardized methodologies used in national GHG inventories; Tiers 2 and 3 enable country-specific estimations.

4. Methane Mitigation Strategies

Mitigation of enteric methane requires an integrated approach combining nutritional, managerial, and policy measures.

4.1. Nutrition-Based Strategies

• 3-Nitrooxypropanol (3-NOP): Inhibits key methanogenic enzymes, achieving 30–40% reduction in methane output.

• Seaweeds (Asparagopsis spp.): Contain bromoform, which can reduce methane emissions by over 50%; cost and safety aspects are under evaluation.

• Fat Supplementation: Diverts hydrogen from methanogenesis, resulting in 10–15% reduction.

• Tannins and Saponins: Suppress microbial activity, contributing an additional 5–20% reduction.

• Highly Digestible Feeds: Lead to lower methane yield and improved energy efficiency.

4.2. Management Strategies

• Genetic selection for high-efficiency, low-emission animals

• Improved grazing and pasture management

• Early slaughter and reduced production cycle length

• Manure management and biogas production for energy recovery

Although each practice alone provides moderate effects, combined application can reduce emission intensity per product by 40–50%.

4.3. Economic and Policy Mechanisms

The dissemination of methane mitigation technologies depends on financial incentives, credit mechanisms, and sustainability labeling schemes. According to FAO and IPCC reports, low-cost strategies can achieve up to 30% reduction in agricultural methane emissions.

5. Global and National Context

The Global Methane Pledge (GMP, 2021) aims to reduce methane emissions by 30% from 2020 levels by 2030. FAO's Low Emission Livestock program and the IPCC (2023) reports highlight feed-based interventions as the most effective mitigation options in the agricultural sector. The European Union's "Farm to Fork" Strategy has incorporated feed additives such as 3-NOP within its legal framework. In low-income countries, improving forage quality and pasture management are recommended as cost-effective approaches.

In Türkiye, approximately 13% of total GHG emissions originate from agriculture, and 57% of those from enteric fermentation. Türkiye ratified the Paris Agreement in 2021 and announced its Net-Zero by 2053 target. However, on-farm applications involving 3-NOP or seaweed feed additives remain limited. National priority actions include:

Improving feed quality,

Establishing Tier 2 measurement infrastructure,

Expanding biogas and low-carbon livestock systems,

Enhancing farmer education and climate finance mechanisms.

6. Conclusions

Reducing ruminant-derived methane emissions is strategically important for both environmental sustainability and production efficiency. Evidence shows that in the short term, feed additives such as 3-NOP and seaweeds offer highly effective solutions, while in the long term, microbiome engineering and genetic selection can ensure durable mitigation. Integrating nutritional and managerial interventions with policy incentives can reduce emission intensity per product by up to 50%. For Türkiye, methane mitigation should be regarded not only as an environmental necessity but also as a component of rural development and energy transition. Strengthening science–policy integration and developing a national methane action plan aligned with the 2053 Net-Zero target will be essential. Ultimately, methane reduction is not solely a technical process but a multi-stakeholder transformation requiring collaboration among government, private sector, academia and consumers.

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High protein conten
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Which Strategies?
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Animals & People
Sustainable Nutrition
Safety & Environment
Current Issues (Global SDG, Biotic Conflicts, Trade, Tariff)


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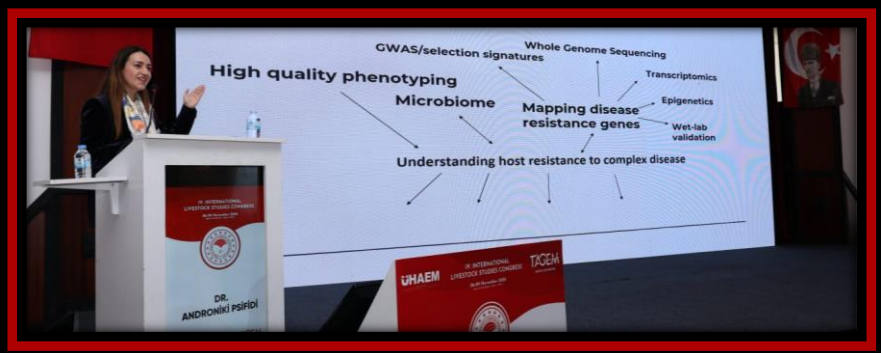
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Mapping disease resistance genes
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