ANIMAL SCIENCE AND FOOD TECHNOLOGY

Journal homepage: https://animalscience.com.ua/en
Animal Science and Food Technology, 16(2), 23-38
Received 16.01.2025 Revised 01.05.2025 Accepted 22.05.2025

UDC 636.32/.38
DOI: 10.31548/animal.2.2025.23

Growth and meat productivity of lambs depending on the genotype according to the A blood group system of their mothers

Serhii Luhovyi*
Doctor of Agricultural Sciences, Professor
Mykolaiv National Agrarian University
54008, 9 Georgiy Gongadze Str., Mykolaiv, Ukraine
https://orcid.org/0000-0001-6505-8105

Alla Bondar
PhD in Agricultural Sciences, Associate Professor
Mykolaiv National Agrarian University
54008, 9 Georgiy Gongadze Str., Mykolaiv, Ukraine
https://orcid.org/0000-0002-5546-0528

Halyna Danylchuk
PhD in Agricultural Sciences, Associate Professor
Mykolaiv National Agrarian University
54008, 9 Georgiy Gongadze Str., Mykolaiv, Ukraine
https://orcid.org/0000-0002-5647-4593

Liudmyla Onyshchenko
PhD in Agricultural Sciences, Senior Lecturer
Mykolaiv National Agrarian University
54008, 9 Georgiy Gongadze Str., Mykolaiv, Ukraine
https://orcid.org/0000-0003-2666-9813

Abstract. The Askaniy fine-wool breed of sheep is known for its high meat and wool productivity, as well as its adaptability to steppe conditions, making it a valuable subject for breeding research. This study aimed to investigate the relationship between maternal genotypic characteristics and key lamb productivity indicators to improve the efficiency of breeding programmes. The research

Suggested Citation:
Luhovyi, S., Bondar, A., Danylchuk, H., & Onyshchenko, L. (2025). Growth and meat productivity of lambs depending on the genotype according to the A blood group system of their mothers. *Animal Science and Food Technology*, 16(2), 23-38. doi: 10.31548/animal.2.2025.23.

*Corresponding author

was conducted from 2022 to 2024 at the Educational, Scientific and Practical Centre of Mykolaiv National Agrarian University (Ukraine). The sample comprised 60 clinically healthy Askaniy fine-wool ewes aged 2 to 5 years, all kept under uniform conditions, with minimal fertility variation and no hereditary pathologies. The most prevalent maternal genotype was A(-), associated with stable reproductive performance. The Ab genotype exhibited the highest milk yield and fertility, while Aa showed balanced characteristics. The Aab genotype was notable for high fertility and frequent multiple births. Lambs born to dams with the Ab genotype had the highest average birth weight (4.2 kg), daily weight gain (180 g), and weaning weight (18.2 kg). The lowest productivity indicators were observed in the A(-) group, although this group displayed strong adaptive traits. At seven months, lambs from Ab dams showed the highest slaughter weight (21.4 kg) and meat yield (53%), outperforming the Aa, A(-), and Aab groups. The maternal genotype also influenced fat content, bone ratio, and meat quality. These results confirmed that maternal genotype significantly affected lamb productivity, with the Ab genotype showing the greatest potential in terms of growth, milk production, and meat yield, highlighting its value for selective breeding programmes

Keywords: breeding; slaughter weight; fertility; milk production of sheep; Askaniy fine-wool breed

Introduction

The relevance of this study stems from the growing importance of livestock productivity in agriculture – particularly in sheep breeding, where traits such as growth rate, meat yield, and adaptive capacity are of key economic and practical significance. Breeding highly productive sheep breeds with enhanced growth and meat qualities is a strategic priority for meeting the demand for quality animal products, especially in steppe regions characterised by challenging climatic conditions. In this context, particular attention must be paid to the genetic factors influencing productivity, with blood groups playing a prominent role as potential productivity markers.

Research into the relationship between genetic characteristics – particularly phenogroups defined by blood group systems – and animal productivity represents a promising area of investigation. Blood groups can serve not only as markers of performance traits but also as influencing factors in growth, development, and both meat and wool productivity (Dossybayev *et al.*, 2024). Previous studies have demonstrated that phenotypic and genotypic traits are instrumental in determining both productivity and adaptability in sheep. For instance, I. Hladii (2022) focused on the biochemical blood parameters of young sheep from different genotypes, revealing significant differences influenced by genetic factors such as metabolism, resistance to environmental stressors, and physiological development. These findings underscore the critical role of genetic variability in assessing productivity and its potential for enhancing sheep breeding practices.

The applied value of such research is evident: the results can be directly implemented to improve breeding programmes and increase the economic efficiency of sheep production. This approach is further supported by S. Luhovyi *et al.* (2020), who emphasised the prospects of genomic selection methods in improving sheep production quality. Their work proposed molecular-genetic approaches, including the identification of productivity-associated markers for traits such as adaptability and disease resistance. These methods represent innovative solutions within the industry, promoting more effective use of genetic resources in breeding efforts (Ruban & Danshin, 2023). The relevance of this research is further

confirmed by international studies. For example, D. Karthik *et al.* (2021) examined the effects of different housing systems on the growth, productivity, and stress resistance of sheep. The study focused on physiological adaptation to environmental conditions, including temperature stress and feed variability, demonstrating the necessity of a comprehensive approach that integrates both genetic and environmental factors. Their findings reinforced the role of optimised management practices in enhancing the overall efficiency of sheep farming systems. Despite growing interest in this field, a key challenge remains the lack of sufficient data on the relationship between blood groups and sheep productivity, which limits the practical application of blood group systems in breeding. In addressing this gap, the study by E. Mukhtarov *et al.* (2022) analysed the dynamics of several blood parameters in sheep – specifically haemoglobin, erythrocyte, and leukocyte levels – which serve as important biomarkers for assessing health and productivity potential. These findings emphasise the role of physiological and biochemical monitoring in understanding metabolic processes and optimising husbandry conditions.

The study by F. Alshamiry *et al.* (2023) investigated the influence of various feeding regimes on the growth and meat productivity of lambs. The authors focused on analysing the fatty acid composition of meat, which serves as a key indicator of nutritional value. Their findings demonstrated that modifications in diet significantly affect not only growth performance but also the ratio of saturated to unsaturated fatty acids, offering practical insights into improving meat quality in line with modern consumer demands. In the work of V. Iovenko *et al.* (2021), a novel method was proposed for assessing and predicting meat productivity in sheep. This method integrates biological, genetic, and performance indicators, allowing the identification of potentially productive animals at early stages of development. Such a tool presents substantial value for enhancing selection processes within breeding programmes.

M. Gill *et al.* (2021) explored polymorphisms in genes related to protein and lipid metabolism in modern Ukrainian cattle breeds. Their research demonstrated that certain genetic markers may act as indicators of high productivity and environmental adaptability. This study contributed to the scientific discourse by highlighting the role of molecular genetic research in elucidating key mechanisms of metabolic regulation in livestock. Further, Y. Gritsienko *et al.* (2022) established a correlation between genetic markers and performance traits in dairy cattle breeds, underscoring the applicability of genetic indicators across various branches of animal husbandry. These findings can be adapted for use in meat-producing sheep breeds, reinforcing the potential of molecular genetic approaches in breeding strategies.

The purpose of the study was to determine the influence of maternal genetic characteristics, specifically within the A blood group system, on the productivity of lambs – focusing on their growth, development, and meat performance – in order to optimise breeding programmes and enhance the efficiency of selecting high-yielding sheep. Objectives of the study:

- to assess the influence of different maternal genotypes within the A blood group system on early lamb growth, particularly live weight gain and weaning weight;
- to investigate the relationship between maternal genetic characteristics and the meat productivity of lambs, specifically slaughter weight and meat yield;
- to determine statistical patterns in the influence of maternal phenogroups on the performance traits of offspring for their potential use in future breeding strategies.

Materials and Methods

The study was conducted from 2022 to 2024 at the Educational, Scientific and Practical Centre of Mykolaiv National Agrarian University

(Ukraine). The object of the research was sheep of the Askaniy fine-wool breed, known for its high meat and wool productivity as well as its adaptability to the climatic conditions of steppe regions. These characteristics make it a valuable breed for breeding and productivity studies. A sample of 60 clinically healthy ewes aged between 2 and 5 years was selected for the study. All animals were maintained under identical conditions in terms of housing, feeding, and care. The ewes were housed in rooms with a total area of 50 m^2, ensuring a minimum of 2 m^2 per animal. Environmental conditions were controlled, with a stable indoor temperature of 18-20°C and relative humidity maintained between 60-70%. The animals were grouped in flocks of 15, facilitating optimal social interaction. The feeding regime consisted of a balanced diet including 1.5 kg of hay and 0.5 kg of concentrated feed per ewe per day, along with unrestricted access to fresh water. Mineral supplements were added to ensure a full spectrum of essential nutrients. The sample included only ewes with minimal fertility (i.e. those having given birth to a single lamb), free from hereditary pathologies, and confirmed as belonging to the Askaniy fine-wool breed. Representativeness was ensured by selecting animals from different breeding lines and families to minimise the risk of inbreeding. Ewes with genetic abnormalities, chronic diseases, or those that did not meet the requirements of blood group testing were excluded from the sample.

To determine fertility and the frequency of multiple births, zootechnical records from the period 2020-2023 were used. Fertility was calculated as the average number of lambs born per ewe per year. Each litter was recorded, noting the number of viable lambs. The frequency of multiple births was calculated as the percentage of ewes that produced twins or triplets out of the total number of ewes that gave birth within each group. The data were averaged separately for each maternal genotype. Milk yield was assessed using an electronic lactograph (Waikato Milk Meter MK4, accuracy ±0.05 L). Measurements were carried out within the first seven days post-lambing, during which peak lactation occurs. Milk volume was automatically recorded during each milking session (twice daily at 06:00 and 18:00). The average daily milk yield was calculated by averaging the results of all 14 milking sessions for each ewe individually.

The blood group of each ewe was determined via an agglutination reaction using standard isohemagglutinins. The analysis was performed with the "Vet Agglu Test" reagent kit (Germany). Blood samples were collected from the jugular vein using sterile vacuum tubes containing K3 EDTA anticoagulant (USA). Laboratory tests were conducted using an Eppendorf 5702 centrifuge (Germany) and a Leica DM750 microscope (Switzerland). Agglutination reactions were incubated in a Memmert IN55 thermostat (Germany). Results were interpreted in accordance with the Ukrainian State Standard ISO 15189:2015 (2016).

The study included 158 lambs born to the sampled ewes. Lambs were divided into four groups based on the maternal phenogroup within the A blood group system: Group 1 – lambs from Aa phenogroup mothers; Group 2 – lambs from Ab phenogroup mothers; Group 3 – lambs from Aab phenogroup mothers; Group 4 – lambs from A(-) phenogroup mothers. This grouping allowed for the evaluation of the influence of different maternal phenogroups on the growth and development of offspring. Three main indicators were used to assess lamb growth: birth weight – recorded within the first 24 hours after birth; weekly live weight gains – measured from birth to three months of age; weaning weight – recorded at three months of age, a critical stage in lamb development. Weight measurements were performed using electronic scales "Kern PCB 1000-2" (Germany), providing high precision with an accuracy of up to 0.01 kg. The scales were calibrated prior to each measurement to ensure accuracy.

Additionally, calibration was carried out at least once per month, or following equipment transportation, in accordance with the manufacturer's instructions, to minimise potential errors and ensure the reliability of the results. All measurements were conducted in the morning, before feeding the animals, to eliminate the effect of digestive tract fill on body weight. The collected data were recorded in a measurement log, from which the weekly live weight gains for each lamb were subsequently calculated. To evaluate meat productivity at seven months of age, 40 lambs (10 from each maternal genotype group) were selected for slaughter. Prior to slaughter, the lambs were fasted for 24 hours, with free access to water, to ensure digestive tract emptying. After slaughter, slaughter weight was determined by weighing the paired carcass following removal of the internal organs.

For meat yield assessment, the carcasses were dissected to determine the mass of muscle tissue, adipose tissue, and bone. The ratio of these components was used to evaluate carcass quality and breeding efficiency. Meat quality was assessed through parameters including moisture content, colour, and pH value. Moisture content was measured by drying a muscle tissue sample to constant weight using a "Memmert UF55" drying cabinet (Germany). Meat pH – an important indicator of freshness and stress – was measured using a "Testo 205" portable pH meter (Germany), designed for food applications. Measurements were taken directly from the muscle tissue 45 minutes post-slaughter (pH_{45}) and after 24 hours of chilling at +4°C (pH_{24}). Meat colour was evaluated according to the international CIELAB standard (L*, a*, b*), allowing quantitative assessment of lightness, redness, and yellowness. Measurements were conducted with a "Konica Minolta CM-700d" spectrophotometer (Japan), ensuring high accuracy and standardised results. All assessments were conducted in the enterprise's laboratory in accordance with established protocols and standards for evaluating meat productivity, namely: DSTU ISO 2917:2001 (2003), DSTU ISO 1442:2005 (2008), DSTU 4673:2006 (2011). All results were entered into an electronic database for subsequent analysis and intergroup comparison. The study was conducted in accordance with international standards on the humane treatment of animals, including the European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes (1986), and the Law of Ukraine No. 3447-IV "On the Protection of Animals from Cruelty" (2006). All data were processed using "Statistica 12.0" software (StatSoft, USA). Intergroup comparisons of mean values were performed using Student's t-test (significance level $p \leqslant 0.05$), and correlations were assessed using Pearson's correlation coefficient. Ninety-five percent confidence intervals were calculated for all key indicators. All measurements were repeated three times to minimise experimental error.

Results

As a result of examining the genotypic structure of 60 Ascanian fine-wool ewes based on the A blood group system, four primary phenogroups were identified: Aa, Ab, Aab, and A(-). The distribution of these phenogroups was uneven, indicating a degree of genetic diversity within the studied population. The most prevalent group was A(-), accounting for 54% of the total, while the Ab group was the least represented, comprising only 8% (Fig. 1).

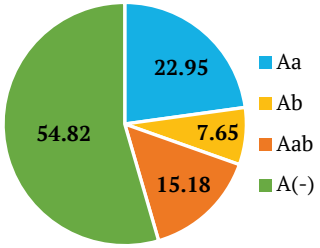

Figure 1. Distribution of ewes by genotype, %
Source: created by the authors

This disparity highlights the genetic diversity within the population and suggests a potential selective advantage of certain genotypes under specific management conditions. Detailed quantitative performance indicators for each group are presented in Table 1.

Table 1. *Performance indicators of the studied groups*

Genotype	Number of ewes (n)	Average fertility (lambs/ewe)	Milk yield (l/day)	Average weight gain of lambs (g/day)	Multiple pregnancy rate (%)
Aa	14	1.1 ± 0.2	1.2 ± 0.3	180 ± 20	5
Ab	5	1.8 ± 0.4	2.5 ± 0.5	250 ± 30	25
Aab	9	2.5 ± 0.6	0.9 ± 0.2	150 ± 25	65
A(-)	32	1 ± 0.3	0.8 ± 0.1	160 ± 15	8

Source: created by the authors

Ewes of the Aa genotype accounted for 23% of the studied sample. The average fertility in this group was 1.1 ± 0.2 lambs per ewe, with 95% of lambs being singletons. A milk yield of 1.2 ± 0.3 litres/day ensured a stable daily weight gain of lambs (180 ± 20 g), corresponding to the average indicators of the breed. Despite its small proportion (8%), the Ab group exhibited extreme performance indicators. The highest milk yield was recorded at 2.5 ± 0.5 litres/day (108% higher than in A(-)), which correlated with the highest weight gain of lambs (250 ± 30 g/day). Fertility (1.8 ± 0.4 lambs per ewe) exceeded the average population level by 64%, and the frequency of multiple births was 25% (mostly twins). These results suggest that the Ab genotype may be key for selection aimed at improving milk production, although its low prevalence warrants further analysis of its genetic potential.

The Aab group demonstrated a combination of characteristics: the highest frequency of multiple births – 65% (mostly twins and triplets), with an average fertility of 2.5 ± 0.6 lambs per ewe. However, milk yield was the lowest (0.9 ± 0.2 litres/day), which limited lamb weight gain (150 ± 25 g/day). This makes Aab valuable for regions with unstable climatic conditions, where offspring survival is a priority. The prevalence of the A(-) genotype (54%) is justified by its versatility. Stable fertility (1.0 ± 0.3 lambs per ewe) and a low frequency of multiple births (8%) ensured predictable litter sizes. Milk yield (0.8 ± 0.1 litres/day) was the lowest among the groups. Lamb weight gain (160 ± 15 g/day) remained stable even under stressful conditions, making this group optimal for farms with limited resources. These data underscore that each genotype possesses unique advantages that can be utilised for targeted breeding, depending on farm priorities (e.g., maximising flock size vs improving product quality). The results show that the most common genotype in the studied population of ewes is A(-), which may reflect its advantages in terms of the productivity of the Ascanian fine-wool breed. At the same time, each group exhibits specific characteristics that define the individual productivity and fertility traits of the animals.

The influence of maternal genotype on lamb growth is a key indicator of productivity and selection efficiency in sheep breeding. The assessment of live weight gain was carried out during the first three months of the lambs' lives – a critical developmental period during which the main parameters of physiological condition and viability are established. The average birth weight of lambs is a crucial determinant of their subsequent development and survival. It largely depends on the maternal genotype, which influences intrauterine development, metabolism, and postnatal lactation performance. The study analysed four genetic groups of dams. Dams in the Ab group gave birth to 48 lambs, with an average birth weight

of 4.2 kg. This was the highest value among all groups, indicating favourable intrauterine conditions and a high level of maternal milk production following lambing. Dams in the Aa group gave birth to 25 lambs with an average weight of 4.0 kg. Although slightly lower, this figure remained high and ensured good neonatal viability. Lambs born to dams of the Aab group had an average weight of 3.8 kg, with a total of 34 lambs in this group. The lower average weight compared to groups Ab and Aa may be attributed to the lower milk yield of the dams and possibly a higher frequency of multiple births (twins or triplets). The lowest average birth weight was observed in lambs from the A(-) group, which included 51 lambs with an average weight of 3.6 kg (Table 2). This may reflect a reduced nutrient supply during gestation and comparatively lower lactation performance of dams in this group.

Table 2. *Influence of maternal genotype on lamb growth*

Indicator	Group Ab (n = 27)	Group Aa (n = 15)	Group Aab (n = 18)	Group A(-) (n = 32)
Number of lambs	48	25	34	51
Average birth weight, kg	4.2	4	3.8	3.6
Average daily gain, g	180	160	155	150
Weight at weaning, kg	18.2	16.8	16	15.6

Note: all indicators were statistically significant ($p < 0.05$)
Source: created by the authors

The results obtained indicate that the genotype of the mothers plays an important role in determining the birth weight of lambs. The highest values observed in the Ab group correlate with elevated lactation levels and overall maternal productivity. Conversely, the lowest figures recorded in lambs from group A(-) mothers may be associated with certain energy limitations during gestation, which likely influenced foetal development. Therefore, selection aimed at increasing birth weight should take into account not only direct genetic factors, but also the physiological status of the mothers, their milk yield, and the level of nutrient provision during pregnancy.

Weekly live weight gains were highest among lambs born to mothers of the Ab group, with an average daily gain of 180 g. This reflects superior lactation performance in the mothers and optimal conditions for lamb development. Lambs from group Aa mothers demonstrated a slightly lower gain of 160 g per day, which may be attributed to moderate maternal milk yield – sufficient for stable, though slightly less intensive, growth. Lambs from Aab group mothers recorded a daily live weight gain of 155 g, lagging behind the Ab group, likely due to reduced lactation levels, especially in cases of twin or triplet births where competition among lambs for resources is higher. The lowest weight gains were observed in lambs from group A(-) mothers, at 150 g per day. All recorded growth rates were statistically significant ($p < 0.05$), indicating a direct effect of maternal genotype on offspring growth. Weaning weight at three months of age also varied depending on maternal genotype. Lambs from Ab group mothers achieved the highest weaning weight at 18.2 kg, reflecting the substantial influence of this genotype on rearing efficiency. Lambs from Aa group mothers had a slightly lower weaning weight of 16.8 kg, which nonetheless remained within the breed's standard range, indicating stable growth. The average weaning weight in the Aab group was 16.0 kg, lower than that of the Ab and Aa groups. The lowest weaning weights were found in lambs from group A(-) mothers, averaging 15.6 kg. Analysis of the data confirms that maternal genotype significantly affects lamb growth and development. Dams with the

Ab genotype provided the most favourable conditions for offspring growth, as reflected in the highest live weight gains and weaning weights. At the age of seven months, 40 lambs (10 from each group) were selected for the assessment of meat productivity. The results demonstrated that the slaughter weight of lambs was influenced by the genotype of their mothers, which strongly correlated with the average birth weight of the lambs and intrauterine development conditions. The highest slaughter weight was recorded in lambs from mothers of the Ab group, with an average of 21.4 kg. This result aligns with the highest average birth weight in this group (4.2 kg) and the superior milk yield of the mothers, which provided optimal conditions for offspring growth and development.

Lambs born to mothers of the Aa group exhibited an average slaughter weight of 20.1 kg. Although slightly lower than the Ab group, this value reflects balanced maternal milk yield and the lambs' capacity to accumulate muscle mass effectively. The relatively high average birth weight of 4.0 kg in this group also provided favourable initial conditions for subsequent development. The lowest average slaughter weight was observed in lambs from mothers of the Aab group, amounting to 19.3 kg. This outcome may be attributed to the group's lower average birth weight (3.8 kg) and a higher incidence of multiple births, which likely resulted in increased competition for milk during the early postnatal period. Reduced maternal milk yield further contributed to the decrease in slaughter weight within this group. Lambs from mothers in the A(-) group had an average slaughter weight of 19.8 kg – lower than that of the Ab and Aa groups but slightly higher than that of the Aab group. These results are consistent with the lowest birth weight observed in the A(-) group (3.6 kg), suggesting limited energy availability during gestation. Nevertheless, the stable fertility and resilience of the ewes in this group helped maintain conditions conducive to lamb development. The results obtained confirm that the genotype of the mothers has a direct influence on the meat productivity of lambs. The Ab genotype is associated with the most favourable slaughter characteristics, including high carcass yield and superior meat quality. Meanwhile, the Aa and A(-) groups demonstrated satisfactory results, making them suitable for use in farms with varying management conditions and production objectives.

Carcass quality, as determined by the ratio of meat, fat, and bone, varied significantly depending on maternal genotype. Lambs born to Ab group mothers exhibited the highest meat yield – 53% of slaughter weight – highlighting the superior muscle development promoted by this genotype, which is a critical factor in meat productivity. Lambs from Aa mothers showed a slightly lower meat yield of 51%, though still at a commendable level. The Aab group lambs had the lowest meat yield at 49%, likely influenced by the genotype's tendency for multiple births and lower milk production, which may affect muscle development. In contrast, lambs from A(-) mothers had a meat yield of 50%, outperforming the Aab group but falling short of Ab and Aa results. In terms of fat yield, the highest value was recorded in lambs from Aa mothers – 26%. This was followed by the Ab group at 24%, the A(-) group at 23%, and the Aab group at 22%, indicating a moderate but consistent variation in adipose tissue accumulation depending on maternal genotype. The bone yield remained relatively consistent across all groups, ranging from 23% to 25% of slaughter weight, suggesting that bone development was less affected by genetic factors in comparison to muscle and fat deposition.

An analysis of the ratios of meat, fat, and bone following carcass dismemberment confirmed that lambs born to Ab group mothers exhibited the highest meat productivity. The ratio of meat to fat and bone in this group was the most favourable among all those studied, indicating superior carcass quality. In Aa group lambs, the ratio was slightly less advantageous

due to a higher fat content, which somewhat reduced the proportion of lean meat. The Aab group showed the lowest meat-to-fat-and-bone ratio, primarily due to a reduced proportion of muscle tissue and a comparatively higher proportion of bone mass. Lambs of the A(-) group demonstrated a meat-to-fat-and-bone ratio exceeding that of Aab, but still lower than in the Ab and Aa groups, suggesting a moderate but noteworthy meat productivity potential. The quality of lamb meat, influenced by the maternal genotype, was assessed through parameters such as moisture content, pH, and colour. Lambs from Ab group mothers had the lowest moisture content (74.3%), which is a desirable trait, indicating better meat quality and reduced water loss during heat treatment. Aa group lambs had a moisture content of 76.1%, while Aab lambs showed the highest value at 77.4%, which may negatively affect texture and shelf-life. Lambs from A(-) group mothers had a moisture content of 75.5%, placing them between the Aa and Ab groups, and lower than Aab (Table 3). The pH values, which serve as indicators of meat freshness and post-mortem biochemical changes, also varied. The Ab group had the lowest pH (5.6), associated with optimal meat quality and good preservation characteristics. The Aa group had a pH of 5.8, the Aab group registered the highest at 6.0, while the A(-) group had a pH of 5.7, comparable to Ab. These findings suggest that lamb meat from A(-) group mothers, despite their lower productivity, possessed better organoleptic qualities than that from Aab group mothers. This highlights the importance of considering both quantitative and qualitative traits in breeding programmes.

Table 3. *Indicators of lamb meat productivity according to maternal genotype*

Indicator	Group Ab	Group Aa	Group Aab	Group A(-)
Average birth weight (kg)	4.2	4	3.8	3.6
Average slaughter weight (kg)	21.4	20.1	19.3	19.8
Meat yield (% of slaughter weight)	53	51	49	50
Fat yield (% of slaughter weight)	24	26	22	23
Bone yield (% of slaughter weight)	23	23	25	24
Meat moisture (%)	74.3	76.1	77.4	75.5
Meat pH	5.6	5.8	6	5.7

Source: created by the authors

The colour of the meat also varied between groups. Analysis based on the CIELAB standard (L*, a*, b*) showed that lambs from group Ab had meat with the most intense red colour (a* = 13.5). In lambs from group Aa, this indicator was 12.8; in group Aab – 12.1; and in group A(-) – 13.0. These results suggest that the meat from group A(-) lambs had a better visual appearance than that of group Aab, and was comparable in quality to that of group Ab. The most favourable indicators were consistently observed in lambs from Ab dams, confirming their potential for use in breeding programmes aimed at enhancing meat productivity. Lambs from A(-) dams demonstrated results that may be considered competitive, particularly with regard to their meat-to-fat ratio, as well as moisture and pH characteristics. Groups Aa and Aab may require further optimisation of housing and feeding conditions to achieve improved performance.

Discussion

Comparison of the results with previous studies allows for a comprehensive assessment of the importance of maternal genotype for lamb growth and meat production within the context of existing scientific literature. N. Bobokulov *et al.* (2021) established that maternal

genotype is a key factor influencing live weight gain and meat quality in lambs. Their study demonstrated a significant impact on average birth weight, daily weight gain, and weaning weight. The findings of the present study support these conclusions, particularly in showing that lambs born to dams of the Ab genotype exhibited the most favourable growth rates, which aligns with the positive influence of specific genotypes on offspring development noted by N. Bobokulov *et al.* (2021). Other researchers have also highlighted the combined role of genetic and nutritional factors in sustainable lamb production. E. Ponnampalam *et al.* (2020) observed that high maternal lactation levels contribute significantly to improved lamb weight gain. This study confirms that observation, as lambs from Ab dams exhibited the highest average daily gains, reflecting the influence of increased milk yield. Furthermore, this study shows that the maternal genotype has a substantial effect on meat performance: lambs of the Ab group displayed superior slaughter weights and meat quality, further affirming the role of genetic factors in meat production outcomes. These results are consistent with the findings of N. Luthfi *et al.* (2022), who examined the impact of feeding levels on growth and meat quality – research that complements genetic studies by underscoring environmental contributions.

J. Orzuna-Orzuna *et al.* (2021) similarly emphasised that both genetic and environmental variables significantly affect lamb growth and meat characteristics, findings that correspond closely with the results of this study, particularly the performance advantages seen in lambs of the Ab genotype. The study by P. Stapay *et al.* (2023), which explored the biological determinants of sheep meat productivity, also confirms the genetic influence on slaughter weight and meat yield. These conclusions are mirrored in the current findings, where maternal genotype – especially Ab – proved decisive in meat performance indicators. Finally, the article by S. Prache *et al.* (2022) identified genetics and environmental conditions as the principal determinants of meat productivity, particularly in relation to fat content and muscle development. The results of this study reinforce those findings, as the genotype of the dams significantly influenced lamb weight and meat quality traits such as fat and muscle yield. The Ab group again demonstrated the most favourable outcomes, supporting the conclusions drawn in the aforementioned research.

In the study conducted by S. Gallo *et al.* (2019), the effects of various methods of finishing lambs on performance and meat quality were examined. It was established that feeding systems and housing conditions can significantly influence meat characteristics. However, the results also demonstrated that the genotype of the dams plays an equally important role in ensuring optimal growth performance and meat quality in lambs – particularly in terms of higher live weight gain and superior meat traits observed in lambs from dams of the Ab group. This confirms that while feeding systems are crucial, genetic factors may exert an even greater influence on sheep productivity (Daribayeva *et al.*, 2025). In the work of T. Al-Thuwaini (2021), a comprehensive analysis of haematological parameters associated with adaptation and reproduction in sheep was conducted. The author concluded that the general health and physiological adaptation of sheep directly affect their performance. Although these factors were not directly examined in the present study, it is noteworthy that the health status and lactational capacity of the dams significantly influenced lamb growth outcomes. The high milk yield of Ab group dams could be indicative of an optimal physiological state, thereby reaffirming the role of maternal health in achieving high levels of meat productivity (Mukanova *et al.*, 2024). A. Moloney & M. McGee (2023) explored the factors influencing the growth of beef animals, including genetics, housing, and feeding systems. They emphasised the

interaction of these elements in attaining optimal growth and development rates. The findings of the present study support this integrated approach, demonstrating that the genotype of the dams is critical for achieving optimal growth and meat production outcomes – particularly evident in the superior performance of lambs from Ab dams across all major parameters. M. Redoy *et al.* (2020) investigated the effects of herbal supplements on growth, immunity, and meat quality in sheep. They found that such supplements positively impact animal health and productivity. Although the present study did not involve the use of dietary supplements, it is evident that the genetic makeup of the dams had a comparable influence, particularly in maintaining high productivity levels among lambs. This reinforces the importance of genetic factors, which can have an equivalent effect on performance as certain nutritional interventions (Sansyzbayeva *et al.*, 2024).

According to M. Benoit *et al.* (2019), economic and environmental optimisation in livestock production does not always align with the requirements of the meat industry. However, the current study demonstrated that the use of Ab group dams led to high meat yield and lamb productivity, which can simultaneously fulfil both economic and environmental objectives. This highlights the potential of integrating genetic selection strategies into intensive sheep farming systems (Verzhykhovsky & Nedosekov, 2024). Finally, the study by D. Cardoso *et al.* (2021) underscored the significance of nutrition in influencing live weight gain and carcass quality in lambs. The present findings complement this by illustrating the crucial role of dam genotype as an additional determinant. Lambs from Ab dams recorded the highest live weight gains, suggesting a synergistic relationship between nutrition and genetics in optimising lamb performance.

The current study confirms that maternal genotype exerts a significant influence on lamb performance. J. Galaviz-Rodríguez *et al.* (2014) indicated that lamb productivity is shaped not only by genotype but also by production systems. While this study primarily focused on maternal genotype, the results from the Aab group suggest that performance is also dependent on external factors, thereby validating the need to integrate management conditions into breeding strategies. Specifically, the recommendation to improve housing and feeding conditions for dams of the Aab genotype is in line with J. Galaviz-Rodríguez *et al*. (2014) findings on the importance of aligning management systems with genotype-specific requirements.

The study by J. Issakowicz *et al.* (2018) confirmed the effectiveness of crossbreeding in improving productivity. Although crossbreeding was not the focus of the present research, the findings regarding the breeding potential of the Ab genotype align with J. Issakowicz *et al*. (2018) premise that selecting optimal genotypes contributes to enhanced productivity. The high indicators of milk yield, birth weight, and slaughter weight observed in lambs born to Ab dams suggest that further selection based on this genotype may ensure a sustainable increase in productive traits. Early feeding intervention was explored in the study by Y. Paksoy *et al.* (2024), where the authors emphasised the role of early nutritional strategies in promoting lamb growth. Although the present study focused more specifically on maternal genotype, the findings indicate that optimising feeding for genotypes with moderate productivity levels – such as Aa and Aab – could enhance outcomes. In particular, the physiological condition of dams in these groups points to the need for targeted nutritional adjustments to increase their lactation potential. Overall, the findings of this study reaffirm the crucial role of genetic potential in improving sheep productivity, as supported by the cited literature. The Ab genotype emerges as the most promising for breeding programmes due to its consistent milk yield and high fertility, whereas other genotypes may yield improved outcomes under enhanced housing and feeding conditions.

Conclusions

The study of the genotypic structure of mothers according to the A blood group system revealed considerable diversity within the population of the Ascanian fine-wool breed. The most prevalent genotype was A(-), noted for its high adaptability and stable reproductive function. The Ab genotype exhibited the best indicators in terms of milk yield and fertility; the Aa group was characterised by balanced fertility, adaptability, and milk production, while the Aab genotype was marked by high fertility and frequent multiple births. The maternal genotype significantly influenced lamb birth weight, growth rates, daily live weight gains, and weaning weight. The highest productivity indicators were observed in lambs born to mothers of the Ab group, which achieved the greatest birth weight (4.2 kg), highest daily gain (180 g), and maximum weaning weight (18.2 kg). These findings reflect the strong lactation potential and favourable physiological status of dams in this group. Lambs from Aa and Aab dams showed slightly lower indicators, likely due to moderate lactation capacity and the prevalence of multiple births, respectively. In the A(-) group, lambs exhibited the lowest growth rates, although the resilience and adaptability of these dams may partially compensate for these limitations.

The evaluation of maternal genotype effects on meat productivity in lambs at seven months of age demonstrated a clear dependence on genotype group. The highest slaughter weight (21.4 kg) was recorded in lambs from Ab dams, aligning with their superior birth weight and maternal milk yield. Lambs from the Aa group (20.1 kg) also performed well, albeit below that of Ab. Groups A(-) (19.8 kg) and Aab (19.3 kg) yielded lower results, likely due to reduced birth weight, frequent multiple births, and constrained intrauterine development. Maternal genotype also affected meat, fat, and bone yields. The highest meat yield (53%) was observed in group Ab, supporting the notion of optimal muscle development. Group Aa followed with 51%, while groups A(-) and Aab showed 50% and 49%, respectively. The highest fat yield was noted in group Aa (26%), while the lowest was in group Aab (22%), indicating a greater fat accumulation capacity in group Aa. Overall, maternal genotype is a critical factor in determining lamb meat productivity. The Ab genotype emerges as the most promising for breeding purposes, whereas the Aa and A(-) genotypes produce favourable results under well-managed rearing conditions. The Aab genotype would benefit from improved husbandry practices to enhance productivity outcomes. A limitation of this study lies in the absence of long-term observations on how maternal genotype influences the subsequent productivity of lambs under varied rearing and feeding conditions. Furthermore, the study does not address the potential influence of epigenetic factors that may modulate the expression of genetic traits in future generations. Further research could incorporate environmental management systems and early interventions to optimise the productivity of different genotypes.

Acknowledgements

None.

Funding

None.

Conflict of Interest

The authors declare no conflict of interest.

References

[1] Alshamiry, F.A., Alharthi, A.S., Al-Baadani, H.H., Aljumaah, R.S., & Alhidary, I.A. (2023). Growth rates, carcass traits, meat yield, and fatty acid composition in growing lambs under different feeding regimes. *Life*, 13(2), article number 409. doi: 10.3390/life13020409.

[2] Al-Thuwaini, T.M. (2021). The relationship of hematological parameters with adaptation and reproduction in sheep: A review study. *Iraqi Journal of Veterinary Sciences*, 35(3), 575-580. doi: 10.33899/ijvs.2020.127253.1490.

[3] Benoit, M., Sabatier, R., Lasseur, J., Creighton, P., & Dumont, B. (2019). Optimising economic and environmental performances of sheep-meat farms does not fully fit with the meat industry demands. *Agronomy for Sustainable Development*, 39(4), article number 40. doi: 10.1007/s13593-019-0588-9.

[4] Bobokulov, N., Khatamov, A., Abduzoirova, D., Yusupov, A., Urimbetov, A., & Olmasov, B. (2021). Meat productivity of sheep in Uzbekistan and its relationship with different factors. *E3S Web of Conferences*, 258, article number 04020. doi: 10.1051/e3sconf/202125804020.

[5] Buzu, I., Evtodienko, S., & Lyutskanov, P. (2020). Genotypical particularities of the type of sheep Moldavian Karakul. *Scientific Papers. Series D. Animal Science*, 63(2), 56-69.

[6] Cardoso, D.B., *et al*. (2021). Growth performance, carcass traits and meat quality of lambs fed with increasing levels of spineless cactus. *Animal Feed Science and Technology*, 272, article number 114788. doi: 10.1016/j.anifeedsci.2020.114788.

[7] Daribayeva, A., Alina, G., Nurgaliyeva, A., Ukubassova, G., & Tursumbayeva, M. (2025). Kazakhstan's meat market: Analysis of production, consumption, and export. *Scientific Horizons*, 28(5), 90-101. doi: 10.48077/scihor5.2025.90.

[8] Dossybayev, K., Amandykova, M., Orakbayeva, A., Adylkanova, S., Kozhakhmet, A., Yergali, K., Kulboldin, T., Kulataev, B., & Torekhanov, A. (2024). Genome-wide association studies revealed several candidate genes of meat productivity in Saryarka fat-tailed coarse-wool sheep breed. *Genes*, 15(12), article number 1549. doi: 10.3390/genes15121549.

[9] DSTU 4673:2006. (2011). *Cattle for slaughter. Technical conditions*. Retrieved from https://online.budstandart.com/ua/catalog/doc-page.html?id_doc=91492.

[10] DSTU ISO 1442:2005. (2008). *Meat and meat products. Method for determination of moisture content (test method) (ISO 1442:1997, IDT). Amendment*. Retrieved from https://online.budstandart.com/ua/catalog/doc-page?id_doc=82535.

[11] DSTU ISO 15189:2015. (2016). *Medical laboratories. Quality and competence requirements*. Retrieved from https://online.budstandart.com/ua/catalog/doc-page.html?id_doc=66234.

[12] DSTU ISO 2917-2001. (2003). *Meat and meat products. Determination of pH (reference method) (ISO 2917:1974, IDT)*. Retrieved from https://online.budstandart.com/ua/catalog/doc-page.html?id_doc=89528.

[13] European Convention for the Protection of Vertebrate Animals used for Experimental and Other Scientific Purposes. (1986, March). Retrieved from https://rm.coe.int/168007a67b.

[14] Galaviz-Rodríguez, J.R., Ramírez-Bribiesca, J.E., Vargas-López, S., Zaragoza-Ramírez, J.L., Guerrero-Rodríguez, J.D., Mellado-Bosque, M., & Ramírez, R.G. (2014). Effect of three production systems of central Mexico on growth performance of five lamb genotypes. *Journal of Animal & Plant Sciences*, 24(5), 1303-1308.

[15] Gallo, S.B., Arrigoni, M.D., Lemos, A., Haguiwara, M.M., & Bezerra, H.V. (2019). Influence of lamb finishing system on animal performance and meat quality. *Acta Scientiarum. Animal Sciences*, 41, article number e44742.

[16] Gill, M., Gritsienko, Y.V., Denisyuk, L., & Gorbatenko, I.Y. (2021). Polymorphism of genes of the protein and lipid exchanges in modern Ukrainian breeds of cattle bred for dairy productivity. *Journal of Clinical Rheumatology*, 74(6), 373-380. doi: 10.2478/prolas-2020-0056.

[17] Gritsienko, Y., Gill, M., & Karatieieva, O. (2022). Connection between gene markers with milk production traits of Ukrainian dairy cows. *Online Journal of Animal and Feed Research*, 12(5), 302-313. doi: 10.51227/ojafr.2022.41.

[18] Hladii, I.A. (2022). The results of the blood biochemical indicators monitoring in the different genotypes young sheep. *Scientific Bulletin "Askania-Nova"*, 15, 6-17. doi: 10.33694/2617-0787-2022-1-15-6-17.

[19] Iovenko, V.M., Yakovchuk, H.O., Hladii, I.A., & Rukavnikova, H.I. (2021). Method for assessing and predicting the level of the sheep meat productivity development. *Scientific Bulletin "Askania-Nova"*, 14, 111-121. doi: 10.33694/2617-0787-2021-1-14-111-121.

[20] Issakowicz, J., Issakowicz, A.C., Bueno, M.S., Costa, R.L., Geraldo, A.T., Abdalla, A.L., McManus, C., & Louvandini, H. (2018). Crossbreeding locally adapted hair sheep to improve productivity and meat quality. *Scientia Agricola*, 75(4), 288-295. doi: 10.1590/1678-992X-2016-0505.

[21] Karthik, D., Suresh, J., Reddy, Y.R., Sharma, G.R., Ramana, J.V., Gangaraju, G., Yasaswini, D., Adegbeye, M.J., & Reddy, P.R. (2021). Farming systems in sheep rearing: Impact on growth and reproductive performance, nutrient digestibility, disease incidence and heat stress indices. *PloS One*, 16(1), article number e0244922. doi: 10.1371/journal.pone.0244922.

[22] Law of Ukraine No. 3447-IV "On the Protection of Animals from Cruelty". (2006, February). Retrieved from https://zakon.rada.gov.ua/laws/show/3447-15#Text.

[23] Luhovyi, S.I., Kramarenko, S.S., Kramarenko, O.S., Lykhach, V.Y., & Atamaniuk, I.P. (2020). *Introduction of genomic selection methods for improving the quality traits of pig and sheep meat: Production and practical recommendations*. Mykolaiv: Mykolaiv National Agrarian University.

[24] Luthfi, N., Adiwinarti, R., Purnomoadi, A., & Rianto, E. (2022). Effect of feeding level on growth rate, carcass characteristics and meat quality of thin tailed lambs. *Journal of the Indonesian Tropical Animal Agriculture*, 47(4), 290-300. doi: 10.14710/jitaa.47.4.290-300.

[25] Moloney, A.P., & McGee, M. (2023). Factors influencing the growth of meat animals. In F. Toldra (Ed.), *Lawrie's meat science* (pp. 21-49). London: Woodhead Publishing. doi: 10.1016/B978-0-323-85408-5.00006-6.

[26] Mukanova, L., Kırıkçı, K., Sadykulov, T., Baimazhi, Y., Zhumagaliyeva, G., & Adylkanova, S. (2024). Effect of DGAT1 gene polymorphisms in coarse-haired fat-tailed lambs of different genotypes. *Brazilian Journal of Biology*, 84, article number e285041. doi: 10.1590/1519-6984.285041.

[27] Mukhtarov, E.A., Bobokulovich, D.N., & Ishkuvvatovich, B.E. (2022). Dynamics of some indicators of sheep blood. *Journal of New Century Innovations*, 17(2), 36-42.

[28] Orzuna-Orzuna, J.F., Dorantes-Iturbide, G., Lara-Bueno, A., Mendoza-Martínez, G.D., Miranda-Romero, L.A., López-Ordaz, R., & Hernández-García, P.A. (2021). Productive performance, carcass traits, and meat quality in finishing lambs supplemented with a polyherbal mixture. *Agriculture*, 11(10), article number 942. doi: 10.3390/agriculture11100942.

[29] Paksoy, Y., Darcan, N.K., & Göncü, S. (2024). Potential benefits of early-life supplementation of feed additives on the growth and health of lambs. *South African Journal of Animal Science*, 54(6), 691-699. doi: 10.4314/sajas.v54i6.03.

[30] Ponnampalam, E.N., Knight, M.I., Moate, P.J., & Jacobs, J.L. (2020). An alternative approach for sustainable sheep meat production: Implications for food security. *Journal of Animal Science and Biotechnology*, 11(1), article number 83. doi: 10.1186/s40104-020-00472-z.

[31] Prache, S., Schreurs, N., & Guillier, L. (2022). Factors affecting sheep carcass and meat quality attributes. *Animal*, 16, article number 100330. doi: 10.1016/j.animal.2021.100330.
[32] Redoy, M.R., Shuvo, A.A., Cheng, L., & Al-Mamun, M. (2020). Effect of herbal supplementation on growth, immunity, rumen histology, serum antioxidants and meat quality of sheep. *Animal*, 14(11), 2433-2441. doi: 10.1017/S1751731120001196.
[33] Ruban, S., & Danshin, V. (2023). Perspectives for the use of genomic selection for genetic improvement of dairy cattle in Ukraine. *Ukrainian Black Sea Region Agrarian Science*, 27(1), 20-29. doi: 10.56407/bs.agrarian/1.2023.20.
[34] Sansyzbayeva, B., Adylkanova, S., Sadykulov, T., & Kırıkçı, K. (2024). Determination of CAST/MspI gene polymorphism and its effects on 180-day weight in meat production line of Kazakh Saryarka lambs. *Pakistan Journal of Zoology*, 56(6), 2977-2980. doi: 10.17582/journal.pjz/20230430130400.
[35] Stapay, P.V., Tiutiunnyk, O.S., Stakhiv, N.P., & Pakholkiv, N.I. (2023). Biological features of meat productivity formation in sheep. *Animal Biology*, 25(1), 46-53. doi: 10.15407/animbiol25.01.046.
[36] Verzhykhovsky, O., & Nedosekov, V. (2024). Key aspects of biosafety in modern animal husbandry. *Ukrainian Journal of Veterinary Sciences*, 15(3), 41-54. doi: 10.31548/veterinary3.2024.41.

Ріст і м'ясна продуктивність ягнят залежно від генотипу за показниками системи А груп крові їхніх матерів

Сергій Луговий

Доктор сільськогосподарських наук, професор
Миколаївський національний аграрний університет
54008, вул. Георгія Гонгадзе, 9, м. Миколаїв, Україна
https://orcid.org/0000-0001-6505-8105

Алла Бондар

Кандидат сільськогосподарських наук, доцент
Миколаївський національний аграрний університет
54008, вул. Георгія Гонгадзе, 9, м. Миколаїв, Україна
https://orcid.org/0000-0002-5546-0528

Галина Данильчук

Кандидат сільськогосподарських наук, доцент
Миколаївський національний аграрний університет
54008, вул. Георгія Гонгадзе, 9, м. Миколаїв, Україна
https://orcid.org/0000-0002-5647-4593

Людмила Онищенко

Кандидат сільськогосподарських наук, старший викладач
Миколаївський національний аграрний університет
54008, вул. Георгія Гонгадзе, 9, м. Миколаїв, Україна
https://orcid.org/0000-0003-2666-9813

Анотація. Асканійська тонкорунна порода овець є однією з порід, що поєднує високу м'ясну та вовнову продуктивність зі здатністю адаптуватися до умов степових районів, що робить

її перспективним об'єктом для селекційних досліджень. Метою роботи було встановлення залежності між генотиповими характеристиками матерів і основними показниками продуктивності ягнят для підвищення ефективності селекційної роботи. Дослідження проводилося впродовж 2022-2024 років на базі Навчально-науково-практичного центру Миколаївського національного аграрного університету (Україна). До вибірки включали 60 клінічно здорових маток овець асканійської тонкорунної породи віком від 2 до 5 років, які утримувалися в однакових умовах, з мінімальною плодючістю та відсутністю спадкових патологій. Виявлено, що найпоширенішим генотипом серед маток був A(-), який забезпечував стабільну репродуктивну функцію, тоді як генотип Ab продемонстрував найкращі результати молочності та плодючості. Генотип Aa мав збалансовані характеристики, а Aab вирізнявся високою плодючістю з багатоплідними окотами. Ягнята від маток групи Ab мали найвищу середню масу при народженні (4,2 кг), максимальний щоденний приріст (180 г) і найвищу масу при відлученні (18,2 кг). Найнижчі показники спостерігалися у групи A(-), проте ця група демонструвала високі адаптивні властивості. Дослідження м'ясної продуктивності в семимісячному віці показало, що ягнята від маток групи Ab мали найвищу забійну масу (21,4 кг) і максимальний вихід м'яса (53 %), тоді як групи Aa, A(-) та Aab поступалися цими показниками. Генотип матерів впливав також на вміст жиру, кісток і якість м'яса. Висновки підтвердили, що генотип матерів значною мірою визначає продуктивність ягнят, причому найвищі показники зростання, молочності та м'ясної продуктивності продемонстрував генотип Ab, що підтверджує його перспективність для селекційної роботи

Ключові слова: селекція; забійна маса; плодючість; молочність овець; асканійська тонкорунна порода