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PRESERVATION AND THERMOREGULATION PECULIARITIES OF LAMBS OF DIFFERENT TYPES OF BIRTH AND BODY WEIGHT

Ivan Pomitun, Doctor of Agricultural Sciences, Professor,
<https://orcid.org/0000-0002-7743-3600>,

Ihor Korkh, PhD in Agricultural Sciences, Senior Researcher,
<https://orcid.org/0000-0002-8077-895X>,

Liubov Pankiv, PhD in Agricultural Sciences, Senior Researcher,
<https://orcid.org/0000-0002-3295-2132>,

Natalia Boyko, PhD in Agricultural Sciences, Senior Researcher,
<https://orcid.org/0000-0001-6742-8456>,

Nadiia Kosova, PhD in Agricultural Sciences, Senior Researcher,
<https://orcid.org/0000-0001-7353-1994>,

Livestock Farming Institute of NAAS, Kharkiv, Ukraine

The research was carried out on 1421 lambs of different genders and types of birth (singles, twins and triplets) of the Kharkiv intrabreed type of the Precos breed, as well as the aboriginal Sokolska breed (19 heads). It had lasted for two adjacent years, while ewes were lambing in January-February at the experimental farm of the institute "Hontarivka" in the Kharkiv oblast, the following parameters were measured: the body weight of the lambs (BW), their type of birth (TB) and the character of the hair cover (HC), the age on the mortality date (MA), rectal body temperature (RT), body surface temperature in the chest area (ST), temperature (T) and air humidity (H) and other indicators of the microclimate in the premises. Research has established that the year of birth is an influential factor in relation to (BW) and homogeneity of lambs. The average (BW) of all newborn lambs differed by 6.2% in the compared years for a statistically highly probable difference. There were more than 12% of differences in this trait among single lambs. The indicators of the phenotypic variation of this trait in the herd also differed significantly by year. In general, the level (MA) of lambs in the period from birth to weaning was 6.2-7.9%, and the lambs that died had lower body weight than the average of the sample for the years of evaluation, from 7.7% to 14.2% ($p < 0.001$ in both cases). Although most lambs (from 20 to 38%) died in the first three days after birth, research has not established the probable repeatability of the structure (MA) of lambs in adjacent years, $r \pm mrs = +0.714 \pm 0.350$ ($p > 0.5$). It is more natural that the total number of lambs that died falls on the first 30 days of their life – 39% (2020) and 57.5% (2021). Studies of changes (ST) during the first hour of life of lambs revealed features related to the type of their birth. Twins and triplets had a relatively greater decrease (ST), namely 3.9 °C (14.2%, $p < 0.01$) in twins and 3.7 °C (13.1%, $p < 0.001$) in triplets, while in singles it was only 1.1 °C (4.1%). The change in body temperature during the first hour of life has a correlation of +0.445 with (BW) of lambs. At the age of 20-25 days, lambs of the Precos breed with a typical merino type of wool cover prevailed in (BW) from 4.3% to 13.7% with an improbable difference and in (ST) 11.6% and 16.7% ($p < 0.001$ in ram lambs and ($p < 0.01$ in ewe lambs) over the peers, who had a wool cover of the "doghair" type.

The obtained results of this work are important for the further selection of sheep regarding the increase of body weight at the birth of lambs and the homogeneity of the wool cover.



Key words: *body weight, mortality, rectal temperature, body surface temperature, type of birth, lambs.*

ЗБЕРЕЖЕНІСТЬ ТА ОСОБЛИВОСТІ ТЕРМОРЕГУЛЯЦІЇ ЯГНЯТ ЗА РІЗНОГО ТИПУ НАРОДЖЕННЯ І ЖИВОЇ МАСИ

Помітун Іван, д. с.-г. н., професор, <https://orcid.org/0000-0002-7743-3600>,

Корх Ігор, к. с.-г. н., с. н. с., <https://orcid.org/0000-0002-8077-895X>,

Паньків Любов, к. с.-г. н., с. н. с., <https://orcid.org/0000-0002-3295-2132>,

Бойко Наталія, к. с.-г. н., с. н. с., <https://orcid.org/0000-0001-6742-8456>

Косова Надія, к. с.-г. н., с. н. с., <https://orcid.org/0000-0001-7353-1994>,

Інститут тваринництва НААН, м. Харків, Україна

Дослідження здійснено на 1421 головах ягнят різної статі та типу народження (одинаки, двійні та трійні) Харківського внутрішньопородного типу породи прекос, а також аборигенної сокільської смушкової породи (19 голів). Оцінювалися у два суміжні роки за ягніння овець в січні-лютому в умовах експериментальної бази інституту – дослідного господарства «Гонтарівка» Харківської області показники живої маси ягнят (ЖМ), тип їх народження (ТН) і характер волосяного покриву (ВП), вік на дату падіжу (ВДП), температура тіла ректальна (РТ), температура на поверхні тіла в області грудей (ТП), температура (Т) та вологість повітря (В) та інші показники мікроклімату у приміщенні. Дослідженнями встановлено, що рік народження являється впливовим фактором щодо (ЖМ) та однорідності ягнят. Середня (ЖМ) усіх новонароджених ягнят відрізнялася на 6,2 % у порівнювані роки за статистично високівірогідно різниці. Більш ніж на 12 % виявилися розбіжності за цією ознакою серед ягнят – однаків. Істотно відрізнялися за роками також показники фенотипової варіації цієї ознаки у стаді. В цілому рівень (ВДП) молодняку овець в період від народження до відлучення від матерів складав 6,2-7,9 %, а ягнята, які пали мали нижчі, ніж середні по вибірці за роками оцінки показники живої маси від 7,7 % до 14,2 % ($p < 0,001$ в обох випадках). І хоч найбільше (від 20 до 38%) ягнят гинуло у перші три доби після народження, дослідженнями не встановлено вірогідної повторюваності структури (ВДП) ягнят у суміжні роки, $r \pm mrs = +0,714 \pm 0,350$ ($p > 0,5$). Більш закономірним є те, що сумарна чисельність ягнят які пали припадає на перші 30 діб їх життя - 39 % (2020 р.) та 57,5 % (2021 р.). Дослідженнями змін (ТП) у продовж першої години життя ягнят виявлено особливості, пов'язані з типом їх народження. У двійнят та трійнят відзначалося відносно більше зниження (ТП). Воно склало 3,9о С (14,2 %, $p < 0,01$) у двійнят та 3,7о С (13,1%, $p < 0,001$) у трійнят, тоді як у однаків - лише 1,1о С (4,1%). Зміна температури тіла за першу годину життя має кореляцію +0,445 з (ЖМ) ягнят. У 20-25 – добовому віці ягнят породи прекос з характерним для мериносів типом вовнового покриву переважили за (ЖМ) від 4,3 % до 13,7 % за невіррогідної різниці та за (ТП) 11,6 % та 16,7 % ($p < 0,001$ у баранців та ($p < 0,01$ у ярок) над ровсениками, що мали вовновий покрив типу «песига».

Одержані результати цієї роботи важливі для подальшої селекції овець щодо збільшення живої маси при народженні ягнят та типовості за вовновим покривом.

Ключові слова: *жива маса, падіж, температура ректальна, температура на поверхні тіла, тип народження, ягнята.*



Introduction. Indicators of the fertility of ewes and the preservation of lambs play a significant role in increasing the production of sheep farming goods. Therefore, in modern economic conditions, sheep breeds with high fertility are becoming widespread among manufacturers of sheep farming products, and selection and technological measures are being taken to increase it in local breeds. This is evidenced by the transformation of the breed composition of sheep in Ukraine, which has been observed in recent years (Romanova O. V., et al., 2018; Zhukorskyi O. M. et al., 2023). There has been an increased interest in breeding sheep of the meat direction (Doper and Merinolandschaf breeds), milk direction (Lacon breed) and Romanov sheep breed of the fur direction, which are characterized by high fertility.

However, an increase in the fertility of ewes is usually accompanied by a decrease in the level of lamb preservation. Moreover, the highest mortality occurs from birth to weaning from ewes. The reasons for this are factors of both genetic nature and environmental influence.

Mellor D.J., Stafford K.J., 2004, studying the causes of neonatal mortality and morbidity of newborn lambs, goats and offspring of other animal species, note that the main causes may be hypothermia due to significant body heat loss, hypoxia, starvation, and other causes that lead to impaired thermoregulation. At an older age, during the dairy growing period, the reasons for the death of lambs be the loss of contact between the mother and the offspring, infections, injuries, and poor-quality feed.

Knowing the factors affecting the viability of young livestock, as well as the features of their manifestation, is important for assessing the health of newborns and identifying those that require personnel intrusion to minimize long-term neonatal morbidity and animal death (Bienboire-Frosini C., Muns R., Marcet-Rius M., et al., 2023).

In this regard, a significant part of research considers the study of the influence of the dams' body on the development of the body weight of the offspring and the peculiarities of thermoregulation at birth, as well as the identification of the connection of these signs with the subsequent viability of the lambs.

Thus, research by De Barbieri I., Montossi F., Vinales C. et al., 2018 proves that lambs born from ewes sheared on the 70-80th day of pregnancy were heavier ($p < 0.05$) and had better viability ($p < 0.05$) than peers whose dams were shorn after lambing. The specified feature of lambs did not depend on the type of their birth (number in offspring) and was due to better development of the placenta, and therefore better nutrition of the fetus. According to the results of research of Labeur L., Villiers G., Small A.H. et al., (2017), shearing ewes on the 125th day of pregnancy had a positive effect on the formation of thermoregulatory processes in their offspring after birth due to an increase in fat tissue deposits in their body. In general, offspring from such ewes better maintained body surface temperature than lambs whose dams were not shorn.

Urun, S. and Şirin, E., 2023. indicate a positive correlation between body weight of newborn lambs and body weight of ewes before insemination (+0.147), but almost similar in values, and only a negative correlation with maternal age (-0.119). Development of placenta and lamb birth type had significantly higher, positive values: +0.604 and +0.643, respectively. However, Oldham C. M. et al. (2011) found that the birth weight and survival of Merino lambs can be predicted by the profile of the dam's body weight changes during pregnancy.

Furthermore, according to Gibb M.J., Treacher T.T., 1980, not only the body weight of ewes before insemination, but also the state of their fattening affects the development of offspring and the overall increase in body weight of lambs in the first two months of their rearing. Similar results are demonstrated by the research of Hein-



zen B. C. (2023), regarding assessment of ewes with different fatness, in particular after lambing.

Santiago R., Martínez-Burnes J., Mayagoitia A.L. et al. (2019) found that a relatively lower body surface temperature of piglets at birth by 1-2 °C (assessed using an infrared thermographic camera) is associated with their low viability.

According to our research, it was found that lambs born with a higher body weight by 5.1 and 9.9% with a higher metabolic rate of 1.0378 and with a higher pulse rate by 5.0-14.9% are more viable and breathing rate by 4.7 and 27.7% compared to peers with lower body weight. This is evidence of more effective thermoregulation in them (I. Korkh et al, 2024).

Research by Schreurs N.M., Kenyon P.R., Mulvaney F.J., et al., 2010, shows that low body weight is one of the causes of mortality among lambs born as twins. Moreover, among the evaluated pairs, the individual with a lower body weight died most often.

In fact, despite the greater body weight of newborn ram lambs above the ewe lambs, the latter had better preservation until weaning. Twins of both genders, according to this indicator, were inferior to lambs born single (Mullaney P. D., 1969). According to his data, offspring from ewes that lambed for the first time had a lower body weight and level of preservation than lambs from older ewes. In addition, lambs of the Australian Merino breed, which had a body weight 4.5 kg at birth, had a higher viability, while this indicator was 5.0 kg and 3.6 kg, respectively, for the Coridel and Polvars breeds. Thus, the breed factor is crucial for the optimal body weight of lambs at birth, which provides them with the best viability.

Sykes A. R., Griffiths R. G. and Slee J. (1976) point out significant differences between sheep with different types of wool covering in relation to the ability of the body of lambs to hypothermia. According to their data, Cheviot, Scottish Blackface, and Soay lambs maintained homeothermy during the cold season, while Tasmanian Merino and Finnish Landrace lambs of the same body weight significantly lowered their body temperature already within the first 20 minutes after birth, and did not restore it in next hour. The lowest viability in these conditions among the compared breeds was distinguished by the offspring with hair covering of Merinos.

Lambs with low body weight at birth had lower rectal temperature than lambs of the same age with high body weight ($p < 0.01$). Thus, lambs of the Suffolk breed of the meat sector were likely to be inferior to lambs of the local Blackface breed. Better thermoregulation during the first three days was shown by lambs that consumed colostrum exactly after birth (Dwyer C. M. and Morgan C. A., 2006).

According to Schmidek, A. et al. (2013), reduced body weight at birth is the main reason for low viability of young cattle. This is the reason for reducing the availability of glycogen in the liver and skeletal muscles by 70-85%. The amount of available lipids in newborn piglets and lambs with low body weight is also only 10% compared to animals with adequate body weight. Together, this can affect the offspring's body's ability to generate the energy needed to stand up quickly and consume colostrum. The low degree of heritability of the indicator of viability of calves before weaning is evidence of a significant influence of environmental factors on this trait compared to the genotype of the animals.

Considering age-related mortality of lambs, Vatankhah M., Talebi M.A. (2009) note that from birth to the age of one this indicator was almost 23%. Thus, the period up to 3 months of age accounts for 6.14%, and from 3 to 6 months – 12.8%, and as it increases, this indicator significantly decreased. Maternal age had no significant relationship with lamb mortality. The type of birth as a factor affecting viability was significant



in the period before the lambs were weaned. Twins had a higher death rate. Ram lambs had a higher risk of mortality than ewe lambs and their body weight at birth had a highly significant ($p \leq 0.01$) effect on their mortality at all ages. The established level of heritability of lamb survival rate was very low, ranging from 0.01 to 0.13.

Compared to twins, lambs born in triplets are less physiologically mature and have a lower body weight and body temperature at birth. In this regard, they receive less colostrum later, which is one of the reasons for their reduced viability and body weight when weaned from ewes (Kenyon P. R. et al., 2019).

Aleksiev Y. et al. (2007) on lambs of four breeds found that rectal temperature decreased in them in the first 12 hours after birth, followed by an increase up to 24 hours of life. The gender of the lamb did not have a significant effect on the rate of decrease in body temperature, and singles had higher indicators both one hour and 12 hours after birth, compared to twins. The researchers did not note cases of hypothermia in lambs of all breeds at indoor temperatures from 0° to $+8^{\circ}$ C.

In general, the body surface temperature of lambs after their birth had a less pronounced relationship with body weight and rectal temperature than with the temperature and temperature-humidity index of the room (Vicente-Pérez R. et al., 2019).

So, judging by the above studies, the relevance of a comprehensive study of the problem of preserving young livestock is obvious. In this regard, **the purpose of this study** was to research the relationship between the preservation of lambs and the type of their birth and development, as well as the peculiarities of their thermoregulation in the neonatal and milk periods of life.

Research materials and methods. Lambs of different types of birth (singles, twins and triplets) of the Kharkiv inbred type of the Precos breed, as well as the aboriginal Sokolska breed, were the object of research. The assessment was carried out in two adjacent years for sheep lambing in January-February at the experimental research farm "Hontarivka" in the Kharkiv oblast. The parameters of body weight of lambs (BW) and their type of birth (TB) and hair cover (HC), age on the date of mortality (MA), rectal body temperature (RT), body surface temperature in the chest area (ST) were taken into account, as well as temperature (T) and humidity in the room (H). The mean values of trait scores and error values, the level of phenotypic variability, correlations and regression values were calculated. Body weight of lambs was calculated with an accuracy of 0.1 kg using electronic scales, rectal body temperature – with an accuracy of 0.1° C with a mercury thermometer, temperature on the body surface and in the premises, as well as humidity and the content of carbon dioxide, hydrogen sulphide, and ammonia were determined by using a non-contact device-analyzer.

Research results. During the research period, sheep were kept on deep straw bedding in a brick room with an insulated attic. The temperature and humidity of the air outside the premises during the period of observation (last week of January ÷ first week of February) ranged from -9.3° to -18.1° C and 63-72%, respectively. Similar indicators inside the sheepfold were plus $10.5 \pm 0.88^{\circ}$ C with fluctuations over the years at different times of the day from $+7.5^{\circ}$ to $+13.2^{\circ}$ C and $78.4 \pm 1.65\%$ with fluctuations from 63% to 83%. The content of carbon dioxide, hydrogen sulphide and ammonia, measured at the height of the animals, was within the permissible limits for sheep farms.

Research has established that body weight indicators of lambs at birth depend on the year of assessment. Thus, the data in Table 1 show that the average body weight of all newborn lambs was lower in 2021 compared to the previous year by 240 g or 6.2% for a statistically highly probable difference ($td=5.37$). In fact, the significantly higher average body weight of lambs in 2020 was of a significant advantage (by 12.1%) in single lambs over peers born in 2021 and due to significant heterogeneity of offspring,



which can be traced to a higher indicator of phenotypic variation of this trait. Moreover, a significant contribution to the increase in the diversity of offspring by body weight in 2020 was due to the increase in the difference between the indicators of singles and their peers born as twins and triplets. That year, singles outnumbered twins by 25.9% and triplets by 62.2%, compared to only 10.4% and 21.7%, respectively, in the previous year. Thus, the share of twins and triplets among the offspring of 2021 was higher by almost 6%, and their body weight was higher by 1.8% and 18.9% compared to peers of the corresponding type of birth in the previous year.

Table 1

Body weight and its variability in lambs of different genders and types of birth and the percentage of mortality in adjacent years of assessment

Gender and type of birth	Indicators by years of assessment							
	2020				2021			
	num ber	body weight		mor- tality, %	num ber	body weight		mor- tali- ty,%
M±m, kg		Cv, %	M±m, kg			Cv, %		
Lambs in total	658	3.88±0.04*	25.3	7.9	763	3.64±0.02	15.2	6.2
Including - rams	315	4.03±0.06*	26.6	3.3	374	3.77±0.03	15.2	3.8
- ewes	343	3.76±0.05*	23.4	4.6	389	3.50±0.03	14.1	2.4
Type of birth								
- single	374	4.28±0.05*	22.0	3.7	389	3.82±0.03	14.6	2.9
- twins	270	3.40±0.05	22.7	4.0	356	3.46±0.03	13.8	2.9
- triplets	15	2.64±0.10	13.8	0.2	18	3.14±0.09*	11.9	0.4

p<0.001 (in all cases for groups of lambs by years)

In general, the mortality level of lambs in the period before weaning in the compared assessment years was not significant. So, it can be argued that there is no relationship between the year of assessment and the percentage of lambs of a certain gender that have died. If in 2020 more ewe lambs died, then in the adjacent year, on the contrary, the number of ram lambs that died was higher. As for the type of birth, there is a tendency to increase the number of lambs born as twins and triplets. So, if the death rate among singles was almost the same – 6.4% and 5.7%, then among twins and triplets it was much higher, and in the compared years it exceeded 10-16% of the number of peers of the same birth type.

Detailed characteristics according to the body weight index of the lambs that died are given in Table 2.



Table 2

Body weight of newborn lambs of different genders and types of birth that died

Gender and type of birth	Years					
	2020			2021		
	num ber	body weight		num ber	body weight	
M±m, kg		Cv, %	M±m, kg		Cv, %	
Number of lambs that died	52	3.33±0.13	27.9	47	3.36±0.08	16.0
Including - ram lambs	22	3.68±0.23	29.6	29	3.49±0.09	13.9
- ewe lambs	30	3.06±0.13	22.7	18	3.14±0.13	17.9
Type of birth:						
- singles	24	3.45±0.22	31.6	22	3.35±0.12	17.2
- twins	27	3.24±0.15	23.8	22	3.45±0.10	14.1
- triplets	1	2,5	-	3	2.60±0.12	7.7

In general, the lambs that died, had lower than the average body weight of the sample for the years of assessment by 14.2% and 7.7%, respectively ($p < 0.001$ in both cases). Thus, the body weight of ram lambs was lower than the average for this gender group by 8.7% and 7.4%, but the difference was significant only in 2021 ($p < 0.01$). The ewe lambs that died were also inferior to the average values for this gender group by 18.6% and 10.3%, respectively ($p < 0.001$, 2020 and $p < 0.01$, 2021). Considering the relationship between body weight and the type of birth of lambs, it can be outlined that its decrease is typical only for single lambs – by 19.4% and 12.3% in the compared years of assessment. In both cases, the difference between the average indicators of the lambs that died and their peers of the same birth type turned out to be significant, $p < 0.001$. The triplets that died were also smaller, while no similar feature was found for the twins.

Considering the indicators of body weight in lambs that died during the milk period of their growth, it should be noted that a significant decrease in this indicator is noted only in individuals that died in the first three days of the neonatal period (Table 3).

Table 3

Body weight of lambs that died during the period from birth to weaning

Lambs died by age	Years					
	202.			2021		
	Num- ber	body weight		Num- ber	body weight	
M±m, kg		Cv, %	M±m, kg		Cv, %	
from 0 to 3 days	20	2.69±0.13	21.7	9	2.72±0.17	18.6
from 3 to 10 days	13	3.55±0.17	17.6	6	3.35±0.28	20.5
from 11 to 30 days	6	3.70±0.41	26.9	12	3.62±0.15	14.8
from 31 to 60 days	1	3.8		6	3.40±0.09	6.4
from 61 to 90 days	6	4.03±0.63	38.1	8	3.45±0.13	10.6
from 91 to 120 days	6	3.8±0.24	15.7	6	3.57±0.12	8.3

The body weight of these lambs is probably lower (almost by 19% in both years, $p < 0.001$) than in the general group of the same age groups regarding mortality. In addi-



tion, this age group of lambs is also characterized by the lowest body weight among other compared age groups, which indicates their possible physiological immaturity.

Typically, the group of lambs that died in the first three days of life is the largest in 2020 and significant in the adjacent year (Fig. 1).

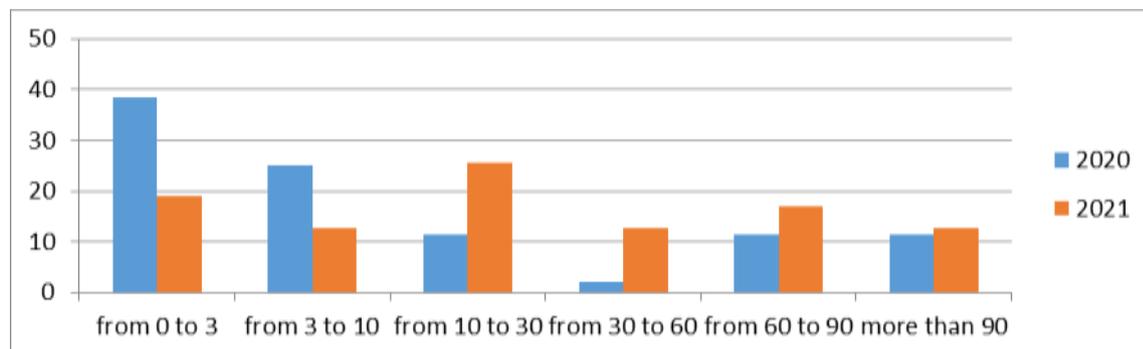


Fig. 1. The structure (vertical, %) of the number of lambs that died by age.

Over the years, it has been assessed that 20-38% of lambs died in the first three days after birth. However, there is no trace of any prevalence of this phenomenon. If in 2020 the maximum mortality was on the first three days, then in 2021 there is no clearly defined numerical extremum of the lamb preservation in connection with their age. Studies of the rank correlation (repeatability of the structure) of lambs mortality of the considered age periods in adjacent years established an improbable indicator, $r_{\pm mrs} = +0.714 \pm 0.350$ ($p > 0.5$). The dispersion analysis of the influence of the year of birth on the distribution of lambs that died by age established the power of influence (η_x^2) of this factor at the level of 0.552. Nevertheless, this influence was also unlikely. It is more natural that the maximum number of lambs that died on the first 30 days of their life is 39% (2020) and 57% (2021).

Considering differences in body weight among lambs of different types of birth, we studied the peculiarities of thermoregulation in them. Body weight, rectal temperature and temperature on the body surface were assessed. The results of the research are given in Table 4.

Table 4

Body temperature changes in lambs of different birth types (M±m)

Birth type of lambs	number	Body weight kg	Temperature on the body surface, °C		Rectal temperature °C
			at birth	in 1 hour	
singles	15	4.48±0.15	26.7±0.55	25.6±1.20	39.5±0.27
twins	18	3.92±0.18	27.4±0.61	23.5±0.78	39.6±0.37
triplets	3	2.87±0.15	28.2±0.40	24.5±0.18	39.2±0.03

At relatively lower body weight, lambs born as twins and triplets had higher body surface temperatures both immediately after birth and one hour later. Considering the fact that the body temperature of the lambs of all groups was at the normal level for young animals, it can be determined that they were physiologically mature at birth. But a quite obvious feature of the response of the body of lambs, namely a decrease in the temperature on the surface of their body, among multiple offspring to the influence of an environmental temperature lower than that of the dam's body was much more than



that of single lambs. It was 3.9° C (14.2%, $p < 0.01$) in twins and 3.7° C (13.1%, $p < 0.001$) in triplets, while in singles it was only 1.1° C (4.1%). Between the change in body temperature during the first hour of life of the lambs and their body weight, an average correlation of +0.445 was established, as well as a dependence described by the following linear regression equation:

$$Y = 8.235 - 1.325X \quad (1)$$

Where:

X is body weight of the lamb at birth, kg;

Y is temperature on the body surface (°C) 1 hour after the birth of the lamb.

During the first day of life of lambs, the temperature on the body surface has certain fluctuations, which are characterized, as mentioned above, by a decrease during the first hour and a subsequent recovery until the first day after birth. The features of these changes can be traced according to the data in Table 5.

Table 5

Temperature changes on the body surface of lambs during the first day of their life

Time after birth, hours	number	Body weight, kg	Temperature on the body surface, °C
0	36	3.81±0.19	27.4±0.39
1	36	3.81±0.19	24.4±0.52
10	17	4.06±0.19	25.6±0.51
24	26	4.42±0.19	27.3±0.38

During the first hour after birth, the temperature on the body surface of the lambs decreased by 10.9% ($p < 0.001$) and gradually increased by 4.9% up to 10 hours and by 6.6% from 10 to 24 hours of life.

The temperature on the body surface of 20-day-old lambs at an indoor air temperature of +13.3 °C and a humidity of 82% was stable and ranged from 18 to 20 °C. Moreover, no significant differences due to the gender of lambs were observed (Table 6). However, the differences due to the breed and type of wool cover of lambs are clearly visible.

Table 6

Body weight and temperature on the body surface of lambs of different breeds, genders and types of wool cover at the age of 20-25 days

Breed and type of wool cover	Gender	Number	Body weight, kg	Temperature on the body surface, °C
Precos (in total)	rams	91	9.14±0.20	20.9±0.23
	ewes	99	8.81±0.18	20.8±0.22
Including: - with wool cover like Merinos	rams	82	9.26±0.21	21.1±0.25
	ewes	91	8.89±0.19	21.0±0.22
- with wool cover like doghair	rams	5	8.88±1.11	18.9±0.35
	ewes	6	7.82±0.71	18.0±0.93
Sokolska	rams	13	9.88±0.18	18.1±0.63
	ewes	6	8.45±0.66	17.3±0.77



Thus, comparing the indicators of lambs of the Kharkiv inbred type of the Precos breed, it can be stated that both ram lambs and ewe lambs, with a wool cover like Merinos, had not only a higher body weight, but also a higher temperature on the surface of the body than peers who were covered with "doghair". Accordingly, the advantage in terms of body weight was 4.3% in ram lambs and 13.7% in ewe lambs with an improbable difference, and in body surface temperature by 11.6% and 16.7%, respectively ($p < 0.001$ in ram lambs and $p < 0.01$ in ewe lambs). That is, lambs with wool cover of the "doghair" type lost heat from the body surface more intensively than their peers with wool cover like Merinos (more thick).

It is worth mentioning that the lambs of the Sokolska breed with coarse non-homogeneous wool, although they did not have a probable difference with their peers of the Precos breed with wool cover like Merinos, in terms of body weight, were still inferior to the latter in terms of body surface temperature by 16.5-21.4% ($p < 0.001$ for animals of both genders). That is, the looser wool cover of both Sokolska and Precos breeds with wool like "doghair" is accompanied by a more intense loss of heat from the body surface, and therefore requires more energy expenditure for the body's thermoregulation process.

Discussion. Increasing the level of preservation of lambs is important for stable, economically profitable production of sheep farming products. Shiels D., et al., (2022) report that 1% reduction in lamb mortality generates €3 million in additional revenue for Irish sheep producers.

In connection with the great importance of this problem for the economy of the industry, as well as the fact that, for various reasons, the loss of lambs is constantly present in herds with different production technologies and when breeding sheep of different breeds, the research of ways to increase the level of preservation of lambs is among the prior tasks solved by many researchers and practitioners. Kopp K., et al., (2020) note that according to published statistical data, the mortality rate of lambs in Australia under the pasture system of their housing is from 20 to 25%. However, when surveying farmers, up to 50% of respondents noted that only up to 10% of lambs die in the period from birth to tagging. Significant differences between herds according to this indicator are due to different frequency of vaccination against clostridium and the spread of the practice of feeding ewes before lambing.

According to the data of Belay B. and Haile A. (2011), the values of the parameters of the lambs for the period from their birth to the yearling age are variable. Thus, in the first 60 days of life, they amounted to 11%, while during the period from birth to 120 days, they increased to almost 19%. After weaning to the age of one year, the number of lambs left increased to 50%. The season of birth of lambs and the region likely influenced their preservation rates. The data we obtained are significantly different from the above indicators and indicate that with a stable technology of housing ewes during the lambing period and rearing lambs in the winter period of birth with the use of the regime-contact method in the premises, the level of their mortality is significantly lower (6.2-7.9 %) and is comparable to the results of studies by Vatankhah M., Talebi M.A. (2009), where about 6.0% of the total number of lambs died from birth to 3 months old. In the conditions of our experiment, a feature different from that of Belay B. and Haile A. (2011) is also noted as the number of lambs aged from birth to 60 days is greater, with certain fluctuations in preferences for the first or second half of this period, due to the year of their birth.

Gaur P., Malik Z.S., Bangar Y.C. et al., (2022) considered two mathematical models for forecasting the possible mortality of lambs, which took into account such fixed factors as year of birth, gender of lambs, body weight at birth, body weight and



age of the ewe while lambing According to their data, the lambs' preservation rate before weaning was 86.8% and 91.6%, respectively (mortality – 13.2% and 8.4%). Therefore, one of the forecasting models is close to the actual values obtained in our research and research Vatankhah M., Talebi M.A. (2009).

Comparing the frequency of mortality of lambs regarding their gender, most research results indicate its presence. Meanwhile, researchers outline that ram lambs are more prone to death than ewe lambs (Mullaney P.D., 1969; Gaur P., Malik Z.S., Bangar Y. C. et al., 2022; Habtegiorgis K. et al., 2022).

Moreover, Belay B. and Haile A. (2011) clarify that the greater mortality of ram lambs appears at an age older than 120 days.

We did not establish a connection between the gender of the lambs and their death during the milk growing period, while the type of birth had such a connection. If the death rate among singles was 5.7-6.4%, then among twins and triplets it exceeded 10-16% of the number of peers of the same birth type in the compared years.

Habtegiorgis K. et al. (2022) point out the low chances of survival of lambs born in triplets and quadruplets, specifying despite the fact that they had a body weight below 2.0 kg at birth. Vatankhah M., Talebi M.A. (2009) also linked the decline in lamb viability to the type of birth, recording higher twin deaths. However, Belay B. and Haile A. (2011) in their research do not confirm a probable connection between the type of birth of lambs and their viability.

Considering the parameters of body weight of lambs that died, we found a probable decrease of this indicator by 7.7-14.2% over the years compared to the entire sample of same-gender peers. This feature of lambs with reduced body weight can also be traced to the works of Dwyer C. M. and Morgan C. A., 2006; Schmeidek, A. et al., 2013; Kenyon P.R. et al., 2019.

Therefore, we found that lambs died in the first three days after birth, whose body weight was probably 19% lower, compared to the average for the entire sample of peers, which was about 2.7 kg.

Our studies prove that lambs from the number of twins and triplets, in addition to having a lower body weight, have a higher body surface temperature both immediately after birth and one hour later. The decrease in temperature per hour of observation was 3.9°C (14.2%, $p < 0.01$) in twins and 3.7°C (13.1%, $p < 0.001$) in triplets, while in singles it was only 1.1 C (4.1%), which is evidence of better thermoregulation in the latter.

Similar results were obtained in the works of Sykes A. R., Griffiths R. G. and Slee J., 1976; Dwyer C. M. and Morgan C. A., 2006; Aleksiev Y. et al. , 2007, as a result of studies of changes in rectal temperature of lambs. In addition, Vicente-Pérez R. et al., 2019, note that the relationship between the body weight of lambs and the temperature on their body surface at birth is less close than with the environmental temperature indicator.

In addition, in 20-25-day-old lambs of the Precos breed with a typical Merino type of wool cover, we found an advantage in body weight of 4.3% in ram lambs and 13.7% in ewe lambs, with an improbable difference, and in terms of surface temperature bodies, respectively, by 11.6% and 16.7% ($p < 0.001$ in ram lambs and $p < 0.01$ in ewe lambs) over peers who had a wool cover of the "doghair" type. Thus, lambs with a wool cover of the "doghair" type lose heat more intensively from the body surface than their peers with a thicker wool cover.



Conclusions.

1. The year of birth of lambs is an influential factor in terms of their body weight. Thus, newborn single lambs of the Precos breed (regardless of their gender) exceed twins and triplets in this respect.
2. Under the established parameters of the fluctuation of body weight indicators at birth in the compared years and the stable technology of obtaining and growing lambs before weaning in the winter period, their death rate is within the limits of close to 7%.
3. No correlation was found between lamb mortality and gender of lambs, while type of birth was found to be an influential factor. From the number of singles, 5.7-6.4% of lambs died, and among twins and triplets in the compared years, this indicator was 10-16%.
4. Over the years, 20-38% of lambs died in the first three days after birth. Typically, lambs with body weight up to 2.7 kg died during this period, which is probably lower than the average for the sample of peers.
5. Lambs from twins and triplets have a higher temperature on the body surface and are characterized by a greater decrease in temperature during the first hour of life than single lambs, which is an indicator of better thermoregulation in the latter.
6. Lambs of the Precos breed with a "doghair" cover at the age of 20-25 days lose heat more intensively from the body surface than their peers with a thicker wool cover like Merinos.

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