

# Research Journal of Pharmaceutical, Biological and Chemical Sciences

## Postembryonic Development of the Skin of Young Ewes of the Romanov and Tushin Breeds in the Conditions of the Foothill Zone of the North Caucasus.

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### ABSTRACT

Studying the age features of the structure of the skin provides us with additional data on the adaptive peculiarities of animals in the new breeding conditions. The purpose of the research was to study the postembryonic changes in the skin of young ewes of the Romanov and the Tushin breeds in the first year of their life. Two groups of young ewes – of the Romanov and Tushin breeds - were formed in the foothill zone of the North Caucasus. The subjects were weighed at birth and at the age of 4, 8 and 12 months, and skin samples were taken for the study at the same age. The skin samples were taken with the help of a special device, the knife-sampler with a diameter of 2 cm, a cross-sectional area of 3.14 cm<sup>2</sup> that made it possible to select skin samples with the minimum labor costs and minimally injuring the animals. The design of the device allows changing the depth of cutting the knife into the skin, which makes it possible to take the skin sample from all animals, without exception, with any thickness of the skin. Preparation of the skin specimens and their study was carried out according to the method of N.A. Diomidova et al. The Romanov ewes in terms of their live weight, both at birth and in the following periods, significantly exceeded the Tushin coevals. The Romanov ewes at the age of 12 months exceeded the Tushin coevals by the thickness of the pilar layer by an average of 52.2%, and in terms of the total thickness of the skin - by 26.7%, yielding to the latter in the thickness of the epidermal layer by 5.1%, and by the thickness of the reticular layer - by 10.1%. The calculations showed that the Romanov ewes exceed the Tushin peers in relative thickness of the pilar layer, having yielded to them in a similar index of the epidermis and the reticular layer. The Romanov sheep at birth and at one-year-old age in terms of the thickness of the collagen fiber surpassed Tushin peers on average by 16.4-19.0% ( $P > 0.99$ ). At the age of 12 months, the Romanov ewes surpassed their coevals in the depth of occurrence of the primary follicles by an average of 52.8%, and in the depth of the secondary follicles and the width of the bulbs of the primary and secondary follicles, the experimental groups of ewes did not differ significantly. The Romanov ewes at the age of 12 months exceeded the Tushin coevals on the following parameters: by the depth of the sweat glands by 42.6%, by the width of the secretory units - by 65.8%, by the length of the sebaceous glands in 2.61 times, by their width - in 2.91 times. The analysis showed that according to the number of follicles in the hair follicle complex, Tushin ewes naturally, but statistically unreliably, surpass the Romanov's coevals. The total number of follicles in the hair complex almost does not change with age. This constancy of the number of follicles in the group is confirmed by the ratio of the number of secondary follicles to the number of primary follicles. According to the total number of all follicles per 1 mm<sup>2</sup> of the skin area, taking into account the reduction in their number with age, in all considered ages the Romanov ewes exceeded Tushin peers on average from 14.2% to 43.2%. In the group of the Romanov ewes, by the age of 8 months, 93.02% follicles were formed from the embryonic secondary follicles, for the Tushin ewes - 85.04%. Sheep breeding and development biology.

**Keywords:** young ewes, skin structure, epidermis, reticular layer, pilar layer, hair follicle.

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## INTRODUCTION

The skin of mammals is a multifunctional system that provides it with a polymorphic structure. It is a fairly well-studied object as an organ that produces hair. Most details about the histogenesis and structural organization of the skin and its layers of mammals are set forth in the works of Noback G. [1], Montagna W. [2], Potten C.S. [3], Pak I. [4], and Marai I. [5]. Hair follicles are the most important elements of the sheep skin coat. Variety of follicles determines the quality of the coat. The more is this variety, the more heterogeneous is the coat [6]. In the skin of sheep, there are two types of hair follicles - primary and secondary. The rough-coated sheep have primary follicles that produce ground hair and the coarsest transition (intermediate) hair. Secondary follicles produce down hair, and the fine-wool sheep have the thickest down hair that are formed from the primary follicles, while the secondary follicles form thinner hair [6, 7, 8, 9, 10, 11, 12, and 13].

At the present time, quite a large amount of factual material has been accumulated to determine the patterns of development of the skin and wool of sheep of different breeds during the embryonic and postembryonic periods [7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, and 20]. These researchers note the presence of pedigree and individual characteristics in the development of skin and wool connected both with genetic and external factors.

In the literature on the structure of the skin of the sheep of the Romanov breed available to us, there are papers devoted to the research of the skin structure at different ages. For example, the work of I.S. Vinogradov [21] touches upon the characteristics of the skin of the sheep of the Romanov breed at the age of eight months. Therefore, the study of regularities in the formation of the skin of the Romanov sheep in the foothill zone of the North Caucasus in comparison with the local native Tushin breed is topical.

The Romanov breed is a unique one not only for its economically useful traits, but also for a number of biological qualities. So, absolutely specific requirements are imposed to the wool coat of the sheep of this breed that are related to the structure of the skin. In addition, the study of the age features of the skin structure gives us additional data on the adaptive features of animals in the new breeding conditions, in our case - in the foothill zone of the North Caucasus.

N.A. Diomidova [14] notes that the skin favorably differs from internal organs in that it can be studied without slaughtering of the animal, using for this purpose the method of intra-vital sampling. In vivo observations carried out on the same animals, open the possibility of studying the properties of the skin in connection with changes occurring in the body under the influence of the environment.

Taking into account the above, we set **the purpose** to study postembryonic changes in the skin of young ewes of the Romanov and Tushin breeds during the first year of their life.

## MATERIALS AND METHODS

In order to achieve the goal, two groups of ewes - of the Romanov and Tushin breeds - were formed in "Iraf-Agro" LLC, Irafsky district of the North Ossetia-Alania. The subjects were weighed at birth and at the age of 4, 8 and 12 months, and skin samples were taken for the study at the same age. Sampling of the skin was carried out with the help of a special device designed and manufactured at the Department of Small Animal Husbandry of Gorski State Agrarian University under the guidance of Professor G.S. Avsadzhanov. The knife-sampler of the device with a diameter of 2 cm and a cross-sectional area of 3.14 cm<sup>2</sup> makes it possible, with the least labor cost, to select skin samples, minimally injuring the animal. The design of the device allows regulating the depth of cutting the knife into the skin, which makes it possible to take the skin samples from all animals, without exception, with any thickness of the skin. Preparation of skin specimens and their study was carried out according to the method of N.A. Diomidova et al [22].

## RESULTS AND DISCUSSION

The Table 1 shows the data of the live weight of the ewes, which show significant superiority of the Romanov ewes both at birth and in subsequent ages. So, at birth the advantage of the Romanov ewes was 6.7%. As a result of more intense weight-growth in the period from birth to 8-month age, the difference in favor of the Romanov ewes increased to 26.7%, which remained with some dropping (23.0%) at one year of age ( $P > 0.99$ ).

**Table 1. Live weight of the experimental ewes at birth, kg.**

Breed	Age	M ± m	σ	C
Romanov	At birth	3.2 ± 0.064	0.203	6.78
	4 months	21.7 ± 0.481	1.521	7.01
	8 months	32.7 ± 0.736	2.848	8.71
	12 months	35.3 ± 0.646	2.499	7.08
Tushin	At birth	3.0 ± 0.056	0.177	5.89
	4 months	19.7 ± 0.395	1.247	6.33
	8 months	25.8 ± 0.662	2.092	8.11
	12 months	28.7 ± 0.693	2.190	7.63

It is known that the thickness of the skin is composed of the sum of its parts - the epidermis, the pilar and reticular layers. The Table 2 presents data indicating that at birth, the ewes' origin had a certain effect on the thickness of the epidermis, which is confirmed by the Tushin coeval group's superiority by an average of 5.0%, and with age it persists.

**Table 2. Thickness of the test ewes' skin and its layers, μm.**

Layer of skin	Age	Breed	
		Romanov	Tushin
Epidermis	At birth	18.1 ± 0.447	19.0 ± 0.323
	4 months	18.9 ± 0.486	19.5 ± 0.475
	8 months	21.9 ± 0.482	22.1 ± 0.453
	12 months	21.6 ± 0.501	22.7 ± 0.353
Pilar layer	At birth	1282.6 ± 28.18	1043.9 ± 10.47
	4 months	1475.7 ± 41.75	1177.7 ± 37.28
	8 months	1716.1 ± 50.72	1199.1 ± 12.72
	12 months	1671.8 ± 48.78	1098.6 ± 10.81
Reticular layer	At birth	539.5 ± 9.00	589.4 ± 15.63
	4 months	607.6 ± 19.27	714.4 ± 10.89
	8 months	692.7 ± 21.13	743.7 ± 12.61
	12 months	701.8 ± 19.94	772.4 ± 15.32
The total thickness of the skin	At birth	1840.2 ± 32.78	1655.4 ± 24.34
	4 months	2102.2 ± 61.47	1914.8 ± 43.22
	8 months	2430.7 ± 69.31	1961.8 ± 40.14
	12 months	2395.2 ± 67.99	1890.5 ± 23.61

The origin of the experimental ewes had a significant effect on the thickness of the pilar layer of the skin, since the Romanov sheep at birth exceeded the Tushin peers by an average of 22.9% (P> 0.99).

In the period from birth to weaning, the thickness of the pilar layer increased in both groups, but its index was influenced by the origin. Thus, for the specified period, the thickness of the pilar layer in the Romanov group increased by 15.1%, while in their peers this index lost 2.3 pieces to them, as a result, the advantage of the first at the time of weaning increased to 25.3%.

In the next four months, the intensive growth of the pilar layer (the coefficient of growth of 1.163) was noted for the Romanov ewes, while their coevals had a small increase (the coefficient of growth is 1.018), which made outperformance of the first group equal to 43.1% at the age of 8 months.

In the winter stall period, which coincides with the period from 8 to 12 months of age and causes a natural decrease in the thickness of the pilar skin layer of the experimental ewes, the thinning of the pilar layer was observed for both groups of ewes. Thus, during the indicated period, the skin of the Romanov ewes was

made on average by 2.6% thinner, while of the Tushin peers – by 8.4%. As a result, the advantage of the first breed at the age of 12 months increased to 53.2% ( $P > 0.99$ ).

The data presented show that at birth, the Tushin ewes on the thickness of the reticular layer exceeded the Romanov coevals on average by 9.2%. During the suckling period, the thickness of the reticular layer increased by an average by 21.2% for the Tushin ewes and by 12.8% - for the Romanov ewes that resulted in an increase of the outperformance of the first group to 17.6% ( $P > 0.99$ ).

After weaning, the thickness of the reticular layer of the Romanov ewes increased at a higher rate (the coefficient of growth was 1.140) than had their peers (the coefficient of growth was 1.041). Despite this, at the age of 8 months the Romanov ewes lost to their coevals by 7.4%.

In the period from 8 to 12 months, a slight increase in the thickness of the reticular layer is observed in both groups. In connection with the fact that in the group of the Tushins ewes it grew by 3.9% (in the Romanov group – by 1.3%), at the age of one year they surpassed the coevals by 10.1% in the thickness of the reticular layer ( $P > 0.95$ ).

The calculations showed that the Romanov ewes on the relative thickness of the pilar layer surpassed the Tushin peers, yielding them on the similar index of the epidermis and the reticular layer. So, the share of the epidermis in the total thickness of the skin of the Tushin ewes was 1.02 - 1.20%, whereas their coevals of the Romanov breed had this parameter at the level of 0.89 - 0.98%. The share of the reticular layer of the Tushin breed was 35.60 - 40.86%, while that of the Romanov ewes was 28.90 - 29.32%. As for the pilar layer, its share was 69.80 - 70.60% for the Romanov ewes, and 58.11 - 63.06% - for the Tushin breed.

The total thickness of the skin depends on the thickness of its main layers - epidermal, pilar and reticular, so changes in the thickness of these layers in one or another direction cause similar changes and the overall thickness of the skin. Among the newborn ewes, the Romanov ewes are distinguished on the total thickness of the skin, surpassing the Tushin peers by an average of 11.2% ( $P > 0.99$ ).

The Table 2 shows data on the age-related changes in the total thickness of the skin of the ewes, which reflect a natural growth of the skin to 8 months of age, and its thinning in the period from 8 months to 1 year of age.

During the suckling period, the thickening of the skin of the Tushin ewes occurred at a higher rate (the coefficient of growth was 1.157) than in the group of the Romanov coevals (the coefficient of growth was 1.142) that contributed to reducing the difference between the groups in favor of the former to 9.8%.

The total skin thickness of the Romanov ewes increased by an average of 328.5  $\mu\text{m}$  (15.6%) during the period from the weaning to 8 months of age, whereas this indicator of the Tushin peers did not exceed 47.0  $\mu\text{m}$  (2.5%). This pattern contributed to an increase in the difference in favor of Romanov ewes to 23.9%. After 8 months of age, there was a slight decrease in the skin thickness of the young animals of both groups (1.5-3.4%), while the advantage of the Romanov ewes remained at the level of 26.7% ( $P > 0.99$ ).

According to the data obtained (Table 3), the Romanov ewes at birth by the thickness of the collagen fibers exceeded the Tushin peers by an average of 16.4% ( $P > 0.99$ ). In the suckling period, a small thickening of collagen fibers was observed for the Romanov breed (3.9%) and more intense – for the Tushin breed (13.6%) that reduced the advantages of the former to 6.4%.

**Table 3. Thickness of the tufts of the collagen fibers of the skin of the ewes, micron.**

Age	Breed			
	Romanov		Tushin	
	M ± m	C	M ± m	C
At birth	12.8 ± 0.53	9.22	11.0 ± 0.25	7.18
4 months	13.3 ± 0.50	8.43	12.5 ± 0.32	8.01
8 months	14.6 ± 0.58	8.91	13.5 ± 0.32	7.43
12 months	14.4 ± 0.51	7.99	12.1 ± 0.31	8.01

In the period from 8 to 12 months, the increase in the thickness of collagen fibers continued at a higher rate in the group of the Romanov ewes (growth ratio 1.098) than in the group of their peers (growth ratio 1.080).

In the final period from 8 to 12 months, there was a slight decrease in the thickness of the collagen fiber tufts of the Romanov ewes (0.2 μm), and more noticeable of the Tushin ewes (1.4 μm). As a result of this, at the age of 12 months the difference in favor of the former was 19.0% (P> 0.99).

In the skin of the experimental ewes, the hair follicles are located in two tiers, and the primary follicles lie more deeply. According to the Table 4, the experimental ewes do not practically differ in the depth of occurrence of both types of follicles. However, with age, with increasing thickness of the skin, there is an increase in the depth of occurrence of hair follicles, and this increase has some specificity in the types of follicles and the origin of ewes. Thus, during the period from birth to 4 months of age, the primary follicles in the skin of the ewes of the Romanov breed increased by an average of 37.1%, whereas in the Tushin ewes group this indicator was 12.3%. As a result of this, on the depth of occurrence of the primary follicles at the age of 4 months, the Romanov ewes surpassed the Tushin ewes by 24.9% (P> 0.99).

**Table 4. Depth of occurrence and width of the hair follicles of the experimental ewes, micron.**

Indicators		Age	Breed	
			Romanov	Tushin
Primary follicles	Depth of occurrence	At birth	1090.2 ± 43.12	1066.0 ± 30.52
		4 months	1495.0 ± 55.26	1197.0 ± 63.21
		8 months	1738.7 ± 71.49	1219.1 ± 43.01
		12 months	1693.2 ± 60.32	1108.1 ± 43.54
	Width of the bulbs	At birth	137.8 ± 6.02	130.5 ± 7.16
		4 months	141.2 ± 6.06	133.0 ± 4.75
		8 months	164.8 ± 6.58	156.1 ± 4.35
		12 months	172.4 ± 6.70	166.8 ± 5.29
Secondary follicles	Depth of occurrence	At birth	628.5 ± 27.38	627.9 ± 25.08
		4 months	946.9 ± 34.28	887.8 ± 31.07
		8 months	987.4 ± 42.05	933.2 ± 31.66
		12 months	952.4 ± 34.10	884.4 ± 30.78
	Width of the bulbs	At birth	64.1 ± 2.55	64.6 ± 3.63
		4 months	71.5 ± 2.79	84.1 ± 3.31
		8 months	88.1 ± 3.34	86.5 ± 3.51
		12 months	92.5 ± 3.59	88.0 ± 2.07

In the period from 4 to 8 months, the rate of deepening of the primary follicles in the skin of experimental ewes significantly decreased. In this period, relatively higher rates of deepening of the primary follicles demonstrated the Romanov ewes (growth ratio 1.163) than their Tushin peers (growth ratio 1.018) that contributed to the increase in the difference by 42.6% in favor of the former. In the period from 8 to 1 year old, the depth of occurrence of the primary follicles in the skin of the Romanov ewes decreased by 0.03% and in skin

of the Tushin ewes - by 9.1%, so at the age of 12 months the advantage of the former group increased to 52.8% ( $P > 0.99$ ).

As for the depth of occurrence of the secondary follicles, on the rates of their deepening they were much inferior to the primary follicles, and the Romanov ewes differ from their coevals on this indicator. Thus, in terms of the depth of the secondary follicles deepening, the difference between the groups of ewes is less noticeable (50.7% for the Romanov ewes group and 41.4% for the Tushin ewes group). Therefore at the age of 4 months, the advantage of the Romanov ewes does not exceed 6.7%. Also, a similar pattern exists in the next period, so at the age of 8 months the difference of 5.8% persists in favor of the Romanov ewes.

At the age of 12 months, an identical slight decrease in the depth of occurrence of the secondary follicles in both groups (3.5-5.2%) was noted, but the Romanov ewes retained an advantage of 7.7%. It should be pointed out that the superiority of the Romanov ewes on the depth of occurrence of the secondary follicles, in contrast to the depth of occurrence of the primary follicles, at these ages is not reliable.

The ratio of the depth of occurrence of the primary hair follicles to the analogous index of the secondary follicles indicates their fairly uniform deepening, while maintaining a certain difference between them, with fluctuations from 1.15 at birth to 1.76 at one-year-old age for the Romanov ewes, and 1.70 at birth to 1.31 at the age of 12 months for the Tushin ewes. The results of the research showed that the bulbs width increases regularly from birth to one-year-old age: in the primary follicles of the Romanov ewes - by 25.1%, in the Tushin ewes' follicles - by 27.8%, in the secondary ones – by 44.3% and 36.2% respectively. At the same time, the experimental subjects differ a little in the width of the bulbs, both in the primary follicles and in the secondary ones, and the advantage of the Romanov ewes does not exceed 6.2% in the primary, and 5.1% in the secondary follicles.

The index of wool balance along the thickness of the wool fibers can be determined by the ratio between the indices of the width of the varietal follicles. The smaller the results of this relationship, the wool is more equal in thinness. According to our data, the ratio of the width of the primary follicles to the width of the secondary follicles decreased approximately with age of the animals of both groups from 2.15 at birth to 1.86 at 12 months of age, while both groups of ewes had almost identical indices.

The glandular system of the skin is represented by the sebaceous and sweat glands, while the test subjects are significantly different from one another. As it can be seen from the data presented in the Table 4, on the depth of the sweat glands the Romanov ewes at birth exceeded the coevals on average by 26.6%, and by the width of the secretory units - by 39.8% ( $P > 0.99$ ).

**Table 5. The glandular system of the skin of experimental ewes, micron.**

Indicators		Age	Breed	
			Romanov	Tushin
Sweat glands	Depth of occurrence	At birth	1238.4 ± 56.06	977.9 ± 47.6
		4 months	1486.7 ± 64.78	1056.0 ± 12.0
		8 months	1789.3 ± 80.44	1239.1 ± 11.3
		12 months	1672.6 ± 61.68	1173.0 ± 14.9
	Width of the secretory units	At birth	80.1 ± 3.46	57.3 ± 3.52
		4 months	94.5 ± 3.82	66.7 ± 2.32
		8 months	96.9 ± 3.49	68.5 ± 1.81
		12 months	90.1 ± 3.08	62.8 ± 0.83
Sebaceous glands	Length	At birth	188.3 ± 7.24	77.0 ± 1.3
		4 months	216.6 ± 7.85	89.2 ± 2.2
		8 months	237.1 ± 7.92	84.3 ± 2.03
		12 months	201.5 ± 7.21	77.1 ± 3.01
	Width	At birth	59.1 ± 2.49	37.4 ± 0.92
		4 months	90.6 ± 3.34	46.3 ± 0.81
		8 months	101.5 ± 3.61	43.0 ± 0.93
		12 months	89.6 ± 3.21	30.8 ± 1.62

The size and depth of occurrence of the sweat glands varies with age. During the period from the moment of birth to the age of 8 months, the deepening of sweat glands of the Romanov ewes was 44.5%, and the Tushin ewes - 26.7%, and the width of secretory units was 21.0 and 19.5%, respectively. These indicators contributed to the superiority of the Romanov ewes at the age of 8 months on the depth of occurrence by 44.4 and the width of the secretory units - by 65.6% ( $P > 0.99$ ).

In the period from 8 to 12 months, the depth of occurrence of the sweat glands of the Romanov ewes decreased by 6.5%, and the width of the secretory units - by 7.0%, and of the Tushin ewes - by 5.3 and 8.3%, respectively. Thus, at the age of 12 months, the Romanov ewes exceeded their coevals on the depth of occurrence of the sweat glands by 42.6%, and on the width of the secretory units - 43.5% ( $P > 0.99$ ).

As our studies show, the secretion of the sebaceous glands is closely related to changes in their size. According to our data, at birth, the Romanov ewes by the length of the sebaceous glands are 2.44 times higher than similar indicator of the Tushin ewes. During the suckling period, the length of the sebaceous glands in both groups of ewes develops almost equally (15.0-15.8%), while the advantage of the Romanov ewes on this indicator by 2.43 times is preserved.

In the period from 4 to 8 months, the length of the sebaceous glands increased by an average of 9.5 for the sheep of the Romanov breed, and by 14.5% in the case of the Tushin ewes, and the advantage of the first group increased to 2.51 times. During the period of winter maintenance, the length of the sebaceous glands of the Romanov ewes decreased by 15.0%, and the Tushin ewes - by 8.2%. Thus, the Romanov ewes by the length of the sebaceous glands at the age of one year exceeded the Tushin peers by an average of 2.61 times ( $P > 0.99$ ). The Romanov ewes significantly exceed the Tushin coevals on the width of the sebaceous glands: at birth by 58.0%, with age the advantage increases, and at the age of 12 months it is 2.91 times ( $P > 0.99$ ).

As shown by most studies, hair follicles are laid during intrauterine life. By the time of birth, in the skin of the ewes, there are already all the structures characteristic for the skin of an adult sheep, but the differentiation of tissue does not stop. It continues in the postnatal period under the influence of new environmental conditions, which ensures further development of the trait.

Our research of the follicular fund of the experimental ewes is presented in the Tables 6-10. First of all, let us consider the quantitative composition of follicles in the hair group (skin complex).

**Table 6. Number of follicles in the skin complex of the experimental ewes, pcs.**

Indicators	Age	Breed	
		Romanov	Tushin
Number of follicles, total	At birth	15.7 ± 0.73	16.5 ± 0.33
	4 months	15.0 ± 0.68	16.2 ± 0.48
	8 months	14.9 ± 0.62	16.2 ± 0.41
	12 months	14.7 ± 0.63	15.7 ± 0.68
Including the primary follicles	At birth	1.9 ± 0.06	2.0 ± 0.06
	4 months	1.8 ± 0.05	1.9 ± 0.04
	8 months	1.8 ± 0.05	1.9 ± 0.06
	12 months	1.8 ± 0.05	1.9 ± 0.06
Secondary follicles	At birth	13.8 ± 0.63	14.5 ± 0.52
	4 months	13.2 ± 0.54	14.3 ± 0.67
	8 months	13.1 ± 0.55	14.3 ± 0.44
	12 months	12.9 ± 0.52	13.8 ± 0.50
Ratio of the secondary follicles to the primary follicles	At birth	7.26 ± 0.17	7.25 ± 0.19
	4 months	7.33 ± 0.20	7.53 ± 0.17
	8 months	7.28 ± 0.30	7.53 ± 0.27
	12 months	7.17 ± 0.25	7.26 ± 0.26

The hair group in the skin of sheep consists of the primary and secondary follicles. The results of their counting in the hair group are given in the Table 6, from which it follows that in the ages recorded, the number

of primary follicles in the skin of the ewes of the Tushin breed is 1.9-2.0 pieces; the Romanov coevals are inferior to them by an average of 5.3-5.6%. In terms of the number of the secondary follicles in different ages, the advantage reaches 9.2%; however, the differences obtained are not reliable.

On the total number of follicles in the hair group, the leading place belongs to the Tushin ewes with a difference of 5.1% at birth, and at other ages the advantage reaches 8.7%. Thus, according to the number of follicles in the hair group, the Tushin ewes have a legitimate advantage, but the differences are not mathematically reliable.

Analyzing the data in the Table 6, one can note the constancy of the number of follicles in the hair group, that is, the total number of follicles in the hair group with age hardly changes. This constancy of the number of follicles in the group is also confirmed by the ratio of the number of the secondary follicles to the number of the primary follicles. These facts indicate that the hair follicles are laid during intrauterine life. By the time of birth, in the skin of ewes, there are already all the structure characteristic for the skin of an adult sheep.

In our experiments, the task was set to follow the progress of the change in the number of developed and undeveloped (rudimentary) secondary follicles in the hair group of the skin of the experimental ewes. The data obtained (Table 7) show that the number of developed follicles in the hair group was the same at birth in the groups of the Romanov and Tushin ewes, but in relation to the total number of the secondary follicles, the Romanov ewes had 52.17% as developed that is by 2.51% more than in the skin of the Tushin peers.

In subsequent periods, the rudiments develop and begin to produce wool. However, it should be emphasized here that in the skin of the Romanov ewes this process was more intensive than in the skin of their coevals. Thus, at the age of 4 months, the number of the developed follicles in the skin of the Romanov ewes increased by 54.2% and reached 11.1 pieces, while in the group of the Tushin peers these figures were at the level of 40.3% and 10.1 pieces. As a result, in the hair group of the Romanov ewes developed were 84.09% follicles, which is 13.46 pieces more than in the Tushin ewes.

In the period from 4 to 8 months, the formation of the strands of wool of the Tushin ewes occurred at a higher rate (23.8%) than that of the Romanov ewes (10.8%). Despite this, at the age of 8 months, the latter had an advantage on the number of the developed secondary follicles on 6.48 pieces. At the age of 12 months, no embryonic follicles were found in the skin of the experimental ewes of both groups.

**Table 7. Formation of the strands of wool from the embryonic follicles in the hair group.**

Age	Indicator		Breed	
			Romanov	Tushin
At birth	Total of hair follicles	pcs.	13.8 ± 0.63	14.5 ± 0.38
	Developed	pcs.	7.2 ± 0.34	7.2 ± 0.26
		%	52.17	49.66
	Embryonic	pcs.	6.6 ± 0.27	7.3 ± 0.41
%		47.83	50.34	
4 months	Total of secondary follicles	pcs.	13.2 ± 0.54	14.3 ± 0.41
	Developed	pcs.	11.1 ± 0.50	10.1 ± 0.34
		%	84.09	70.63
	Embryonic	pcs.	2.1 ± 0.08	4.2 ± 0.13
%		15.91	29.37	
8 months	Total of secondary follicles	pcs.	13.1 ± 0.55	14.3 ± 0.51
	Developed	pcs.	12.3 ± 0.54	12.5 ± 0.6
		%	93.89	87.41
	Embryonic	pcs.	0.8 ± 0.03	1.8 ± 0.06
%		6.11	12.59	

12 months	Total of secondary follicles	pcs.	12.9 ± 0.52	13.8 ± 0.49
	Developed	pcs.	12.9 ± 0.56	13.8 ± 0.49
		%	100	100

The analysis of the number of hair follicles per 1 mm<sup>2</sup> of skin area (Table 8) shows that the newborns of both groups in terms of the number of the primary follicles per 1 mm<sup>2</sup> of skin area did not differ significantly.

During the suckling period, due to the weight growth of the ewes and the increase in the skin area, the number of the primary follicles in the group of the Romanov ewes decreased by 2.04 times, in the Tushin ewes group - by 1.49 times, as a result, the Tushin ewes at the age of 4 months showed 11.4 pcs of primary follicles per 1 mm<sup>2</sup> of the skin area that is 37.3% more than the respective number for the Romanov ewes group.

In the period from 4 to 8 months, in connection with a more intensive decrease in the number of the primary follicles in the Tushin ewes group (47.4% versus 34.9% in the Romanov group) both groups practically did not differ on this indicator. In the end, at the age of 12 months, on the number of the primary follicles per 1 mm<sup>2</sup> of the skin area, the Tushin ewes outpaced the coevals on average by 12.5% (P > 0.95).

**Table 8. Number of follicles per 1 mm<sup>2</sup> of the skin area of the experimental ewes.**

Indicator		Age	Breed	
			Romanov	Tushin
Total of follicles	pcs	At birth	138.3 ± 6.52	96.6 ± 2.31
		4 months	67.5 ± 3.37	59.1 ± 1.96
		8 months	44.1 ± 1.86	33.4 ± 1.12
		12 months	39.3 ± 1.68	30.4 ± 0.95
Including the primary follicles	pcs	At birth	16.9 ± 0.51	17.0 ± 0.39
		4 months	8.3 ± 0.25	11.4 ± 0.35
		8 months	5.4 ± 0.15	6.0 ± 0.16
		12 months	4.8 ± 0.15	5.4 ± 0.17
Secondary follicles	pcs	At birth	121.4 ± 5.53	79.6 ± 2.35
		4 months	59.2 ± 2.43	47.7 ± 1.57
		8 months	38.7 ± 1.62	27.4 ± 0.77
		12 months	34.5 ± 1.39	24.8 ± 0.66
Ratio of the secondary follicles to primary follicles		At birth	7.18 ± 0.22	4.68 ± 0.15
		4 months	7.13 ± 0.22	4.63 ± 0.12
		8 months	7.17 ± 0.19	4.57 ± 0.14
		12 months	7.19 ± 0.19	4.59 ± 0.13

The experimental ewes in terms of the number of the secondary follicles per 1 mm<sup>2</sup> of the skin area differed more clearly than in the number of the primary follicles. Thus, according to the Table 8, at birth, the Romanov ewes, in terms of the number of the secondary follicles, surpassed the Tushin peers on average by 52.5%. However, at the time of weaning, the advantage of the Romanov ewes decreased more than twofold (24.1%), since in the suckling period the Romanov ewes experienced a more intensive reduction of the secondary follicles (2.05 times) than the Tushin ewes (1.67 times).

After weaning, the number of the secondary follicles per 1 mm<sup>2</sup> of the skin area decreased by an average of 34.6 in the group of the Romanov ewes, and by 47.4% - in the Tushin ewes group. As a result, at the age of 8 months, the advantage of the first increased to 41.2%. Approximately the same difference (39.1%) preserved between the groups at one-year-old age (P > 0.99).

On the total number of all follicles per 1 mm<sup>2</sup> of the skin area, taking into account the reduction in their number with age in all the considered age groups, the Romanov ewes exceeded the Tushin peers on average from 14.2% to 43.2%. The process of forming wool from the embryonic follicles per 1 mm<sup>2</sup> of the skin area is of particular interest. The analysis of the data in the Table 9 shows that on 1 mm<sup>2</sup> of the area of the skin, 62.6 pcs of the developed follicles were found in the group of the newborn Romanov ewes that is 37.3% higher than the

respective indicator in the Tushin ewes group, but in terms of the level of formation of the strands of wool, the Tushin ewes took a priority with 57.29%.

**Table 9. Formation of the strands of wool from the embryonic follicles per 1 mm<sup>2</sup> of the skin area.**

Age	Indicator		Breed	
			Romanov	Tushin
At birth	Total of the secondary follicles	pcs	121.4 ± 5.53	79.6 ± 2.35
		Developed follicles	62.6 ± 2.44	45.6 ± 1.66
	Embryonic follicles	%	51.56	57.29
		pcs	58.8 ± 2.39	34.0 ± 1.17
4 months	Total of the secondary follicles	pcs	59.2 ± 2.43	47.7 ± 1.57
		Developed follicles	49.5 ± 2.23	30.3 ± 0.85
	Embryonic follicles	%	83.61	63.52
		pcs	9.7 ± 0.37	17.4 ± 0.58
8 months	Total of the secondary follicles	pcs	38.7 ± 1.62	27.4 ± 0.80
		Developed follicles	36.0 ± 1.59	23.3 ± 0.71
	Embryonic follicles	%	93.02	85.04
		pcs	2.7 ± 0.10	4.1 ± 0.14
12 months	Total of the secondary follicles	pcs	34.5 ± 1.39	24.8 ± 0.66
		Developed follicles	34.5 ± 1.39	24.8 ± 0.66
	Embryonic follicles	%	100	100
		pcs		

At the age of 4 months, due to the increase in the size of the skin, the number of the secondary follicles per 1 mm<sup>2</sup> of the skin area decreased sharply, but under these conditions, the number of the developed follicles increased to 49.5 pieces in the Romanov ewes group that is 63.4% higher than in the Tushin group. In relation to the total number of the secondary follicles, 83.61% of the follicles happened to be developed in the Romanov breed, whereas in the Tushin breed this indicator lagged by 20.09 pieces.

At the age of 8 months, of 38.7 pcs of the secondary follicles, 93.02% happened to be developed, while in the given period the Tushin peers lost on average by 8.0 pcs. Thus, in the Romanov breed, by the age of 8 months, the formation of hair from the embryonic follicles was almost completed, whereas in the Tushin breed this process lasted up to one-year-old age.

**CONCLUSION**

The data obtained by us allow drawing some conclusions:

- The Romanov ewes in terms of their live weight both at birth and in the following ages reliably exceeded the Tushin coevals;
- The Romanov ewes at the age of 12 months exceeded the Tushin coevals in the thickness of the pilar layer by an average of 52.2% and by the total thickness of the skin - by 26.7%, yielding to the latter in the thickness of the epidermal layer by 5.1%, and by the thickness of the reticular layer - by 10.1%. The calculations

showed that the Romanov ewes in the relative thickness of the pilar layer are superior to the Tushin coevals, having yielded to them by a similar index of the epidermis and the reticular layer;

- According to the data obtained, the Romanov ewes both at birth and at one-year age exceeded the Tushin coevals by an average of 16.4-19.0% ( $P > 0.99$ ) in terms of the thickness of the collagen fibers;

- At the age of 12 months, the Romanov ewes exceeded the coevals on the depth of occurrence of the primary follicles by an average of 52.8%, but on the depth of occurrence of the secondary follicles and the width of the bulbs of the primary and secondary follicles, the experimental groups of the ewes did not differ significantly;

- The Romanov ewes at the age of 12 months exceeded the Tushin ewes on the following parameters: the depth of occurrence of the sweat glands by 42.6%, the width of the secretory units - by 65.8%, the length of the sebaceous glands – in 2.61 times, in their width – in 2.91 times;

- The analysis showed that according to the number of follicles in the hair follicle complex, the Tushin ewes naturally, but statistically unreliably, surpass the Romanov ewes. With age, the total number of follicles in the hair complex almost does not change. This constancy of the number of follicles in the group is also confirmed by the ratio of the number of the secondary follicles to the number of the primary follicles;

- On the total number of all follicles per 1 mm<sup>2</sup> of the skin area, taking into account the reduction in their number with age, the Romanov ewes exceeded the Tushin coevals on average from 14.2% to 43.2% in all considered ages;

- By the age of 8 months, 93.02% of the embryonic secondary follicles happened to be developed in the Romanov breed, whereas in the Tushin breed this parameter was at the level of 85.04%.

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