

CHARACTERISTICS OF THE KARAKACHAN SHEEP BREED REARED UNDER DIFFERENT CONDITIONS

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Abstract

Subject of the study were 682 sheep of the Karakachan breed, reared in three flocks in the region of the Middle and Western Rhodopes in 2018. The aim of the study was to create a phenotypic characteristic of the main selection traits of Karakachan sheep, under different breeding conditions in a mountainous area. The live weight and fertility traits were studied at 2.5, 3.5 and 4.5 years. Body measurements of sheep were taken at 2.5 years. The indexes for stretching, chest, massiveness and compactness were calculated. It was found that the Karakachan sheep breed meets the productivity and body measurements standards defined in the breeding program. The average live weight in the studied flocks varied from 36.620 kg to 39.410 kg under different conditions and altitude. The highest live weight was reached by the animals from the Agricultural and Stockbreeding Experimental Station (ASES) Smolyan - 40.53 kg at 4.5 years of age. The biological fertility for the studied period varied from 92.2% in ASES - Smolyan up to 103% in the village of Smilyan. Body measurements and body indexes establish the indicator dynamics, within the norm, under different breeding conditions and confirm the authenticity of the breed type in the Karakachan sheep breed.

Key words: body indexes, body measurements, fertility, Karakachan sheep breed, live weight.

INTRODUCTION

The economic conditions in the field of agriculture have imposed the tendency of breeding animals with lower requirements for breeding and feeding in areas with poor natural resources in recent years. This determines the increased interest in the local breeds of sheep, respectively in the Karakachan sheep breed. These animals are characterized by high vitality and adaptability, good disease resistance; lower but stable productivity and unpretentiousness to breeding conditions and feed resources. The local breeds are most suitable for the extensive conditions in the mountainous and semi-mountainous regions of the country. They play an important role in our agriculture, both economically and socially, and ecologically. This topic has been very relevant in connection with new trends in healthy nutrition and safety of animal products in recent years. These animals are reared in the absence of technological stress in a clean environment. The products obtained from them are of high quality, unique taste and indisputable benefits for consumers' health.

The Karakachan sheep breed is a typical local breed, which originates from the ancient breed Tsakel and its ancestor the European Mouflon. It is widespread on the Balkan Peninsula and in our country, mainly in the mountainous regions of the country. The peculiarities, the productive indicators and the condition of the Karakachan sheep population, reared in our country are the subject of studies made by Aleksieva (1979); Odzhakova (1994); Kafedjiev (1997; 1998); Odzhakova et al. (2002; 2020); Genkowski (2002); Panayotov et al. (2003); Nedelchev (2004); Vuchkov (2020).

Live weight is the main productive trait of sheep, an indicator of their development and physiological status. The possibilities for realization of a certain level of productivity depend on its dynamics. It is determined by a number of factors, including breed, sex, age, year of birth and production, type of birth, breeding technology and more (Aleksieva, 1978; 1987; Aleksieva et al., 1989; Vuchkov et al., 2008; Staikova et al., 2009). Fertility, along with live weight and growth intensity, are essential for the economic results of sheep breeding. Popova et al. (2007; 2015),

Odzhakova et al. (2010) found that from 40% to 80% of the revenues in sheep breeding in the various productive areas come from lamb sales. The main income is generated from the sale of lambs for meat in indigenous sheep breeding and sheep breeding for meat production. Staykova (2005) found that 69.34% of the relative share of income on a farm with Karakachan sheep is derived from meat income. Hinkovski et al. (1984) reported that in native sheep breeds the body measurements are one of the main selection traits, along with the type and condition of the animals. The body measurements are directly related to the level of productivity of the animals (Raichev et al., 1992). The analysis of the productivity of the animals during certain periods of time gives significant information about the correct direction of the selection process and the establishment of the factors that influence the full manifestation of the genetic potential. This motivates our research.

The aim of the study was to create a phenotypic characteristic of the main selection traits of the Karakachan sheep breed, under different breeding conditions in a mountainous area.

MATERIALS AND METHODS

Subject of the study were 682 sheep of the Karakachan breed, reared in three flocks in the region of the Middle and Western Rhodopes. Two of them were in the Municipality of Smolyan - the flock of the Agricultural and Stockbreeding Experimental Station (ASES) Smolyan - Group I, the village of Smilyan - Group II and one in the Municipality of Borino, the village of Borino - Group III. The survey was conducted in 2018. The data were obtained according to the standard methods and instructions provided in the Instruction for breeding and preservation of local (aboriginal) breeds in Bulgaria (2003). The live weight and fertility traits were studied at 2.5, 3.5 and 4.5 years. Body measurements of ewes at 2.5 years were made. Withers height, Diagonal length of the body, depth and chest width were measured with a Lidtin rod. Chest girth, whistle scope and tail length were measured with tape. The indexes for stretching, chest, massiveness and compactness were calculated. Statistical data processing was performed using software version 20 of the SPSS program.

The farm of Agricultural and Stockbreeding Experimental Station-Smolyan is located at 1170 m above sea level. Pastures at an altitude of 1000-1200 m were used to feed the animals. The soil was brown forest type, highly rocky and had a clayey-sandy composition in the conditions of mountain-forest climate. The supply of humus was low. The reaction of the soil was acidic pH = 4. The grass composition of natural grasses consisted of 70% cereal grasses, about 9% legumes and 21% other grasses. The farm was well provided with concentrated feed for winter feeding.

The farm in the village of Smilyan used pastures from 950-1100 m above sea level, with predominantly brown forest type soils. In the composition of the grassland the highest was the percentage of cereal grasses - about 36%, followed by legumes - 35% and other grasses - 29%. The favourable ratio between the three grass classes was a prerequisite for good protein, energy and mineral supply of the nutritional needs of sheep.

The farm in the village of Borino is located at 1100m above sea level, used mountainous pastures located on brown forest and cinnamon forest type soils. The content of cereal grasses was about 64%, followed by legumes - 14% and other grasses - 22%.

RESULTS AND DISCUSSIONS

Data on live weight at different ages during the study are shown in Table 1. The highest live weight was represented by the sheep from the flock of ASES - Smolyan (Group I), which increased with age and reached a maximum of 40,530 kg at 4.5 years ($P < 0.001$). At 2.5 years of age we had a statistically significant difference of 1.58 kg between groups I and II and 1.39 kg between groups I and III. At 3.5 years the difference was 1.74 kg, between groups I and II and 3.07 between groups I and III. At 4.5 years of age, the same differences increased to 4.96 kg, and 4.29 kg ($P < 0.001$). The variation level within group I was low, 6.8% for live weight at 2.5 years to 9.2% at 3.5 years. Animals from the other two groups showed lower and close in values average live weight by age. The total average weight by flocks for the studied period was the highest in ASES -Smolyan - 39.410 kg ($P < 0.001$), which

was explained by the good conditions of breeding and feeding, ensuring the realization of the genetic potential of the breed on this trait. The results obtained by Kafedzhiev (1997) for live weight at 2.5 years (38.630 kg) for the same flock of the Karakachan breed were close to the values obtained by us. The established live weights at different ages in group II did not follow a certain trend. The variation of the trait was more significant at the end of the age period, which was probably due to environmental factors. The values of the trait in group III did not indicate significant differences in the weight of the different age groups. The low variability degree for groups I and III (less than 10%) was due to the long-

term selection in terms of own productivity. The data indicated good equalisation for the studied trait in the flocks of this breed. The obtained results for average live weight of the Karakachan breed from groups II and III were close to those reported by Hinkovski et al. (1984), Kafedzhiev et al. (1992), Genkovski (2002) and for the flock of group I the results were analogous to the study of Panayotov et al. (2003). The analysis of the data on live weight by ages in the three flocks of the Karakachan breed gave information about the condition of the breed and the phenotypic manifestation of the genetic potential of the animals reared under different conditions and altitude.

Table 1. Live weight of sheep from three flocks (kg)

Karakachan sheep breed	Age												Total average			
	Live weight at 2.5 years				Live weight at 3.5 years				Live weight at 4.5 years				n	\bar{x}	$\pm Sx$	C%
	n	\bar{x}	$\pm Sx$	C%	n	\bar{x}	$\pm Sx$	C%	n	\bar{x}	$\pm Sx$	C%				
ASES-Smolyan I group	103	38.45a	± 0.229	6.8	103	39.23a	± 0.327	9.2	33	40.53a	± 0.251	7.8	239	39.41a	± 0.201	8.8
Smilyan village II group	73	36.87b	± 0.264	8.7	73	37.49b	± 0.231	10.7	37	35.97b	± 0.414	17.5	183	36.78b	± 0.367	9.6
Borino village III group	144	37.06c	± 0.339	7.7	83	36.16c	± 0.356	8.9	33	36.64c	± 0.471	7.78	260	36.62c	± 0.219	6.8
*** Significance p<0.01		a: b***		a: b***		a: c***		a: b***		a: c***		a: b***		a: c***		
*** Significance p<0.001		a: c***		a: c***		b: c**		a: c***		a: c***		a: c***		a: c***		

Another important selection trait is fertility, which largely determines the economic effect of animal husbandry. Table 2 shows the biological fertility of sheep from the three age groups - at 2.5, 3.5 and 4.5 years. The results from group I for the obtained average number of lambs were close, respectively 0.922, 0.950 and 0.963 number of lambs per ewe. During the second lambing period, the mothers from group II gave 106% fertility compared to 2.5 years old and 101% compared to 4.5 years old. The values of the trait in group III followed the tendency to increase with age. The differences

of 5% between 2.5 and 3.5 years and 7.3% between 2.5 and 4.5 years had no statistical significance. In the analysis of the data for the biological fertility of the three groups of the Karakachan sheep breed, it was established that during the study period the animals from the village of Smilyan (group II) had the highest fertility. The variation coefficients ranged from 32 to 45%. Similar results were obtained by Staykova et al. (2015) for the Karakachan sheep breed, where the variation coefficients ranged from 26.36% to 39.61%.

Table 2. Fertility of sheep from three flocks

Karakachan sheep breed	Age											
	Biological fertility Number of lambs/sheep at 2.5 years				Biological fertility Number of lambs/sheep at 3.5 years				Biological fertility Number of lambs/sheep at 4.5 years			
	n	\bar{x}	$\pm Sx$	C%	n	\bar{x}	$\pm Sx$	C%	n	\bar{x}	$\pm Sx$	C%
ASES - Smolyan I group	103	0.922	± 0.036	38	103	0.950	± 0.031	32	33	0.963	± 0.107	27
Smilyan village II group	73	0.976	± 0.044	35	37	1.030	± 0.079	41	37	1.022	± 0.116	39
Borino village III group	144	0.931	± 0.112	41	83	0.980	± 0.105	45	33	1.004	± 0.121	34

In the case of aboriginal sheep breeds with local significance, the body measurements are an important indicator, embedded in our and foreign programs for conservation of genetic resources (Nedelchev et al., 2014). They largely characterize the bodily characteristics of

animals, the dynamics of change in individual parts of the body, as well as their abilities in terms of productivity. The body measurements are one of the main controlled traits, alongside the type and condition of the animals. The results of the three farms are shown in Table 3.

Table 3. Body measurements in a Karakachan sheep of different farms

Body measurements	Smolyan - I n - 103		Smilyan village - II n - 73		Borino village - III n - 144		Significance
	\bar{x}	$\pm S \bar{x}$	\bar{x}	$\pm S \bar{x}$	\bar{x}	$\pm S \bar{x}$	
Wither height, cm	55.24 a1	± 0.655	52.95 b1	± 0.444	54.69 c1	± 0.359	a1: b1 p<0.01 c1:b1 p<0.01
Diagonal length of the body	57.97 a2	± 0.663	56.14 b2	± 0.306	56.75 c2	± 0.689	a2: b2 p<0.01
Depth of the chest, cm	25.25 a3	± 0.163	24.43 b3	± 0.159	24.93 c3	± 0.167	a3: b3 p<0.001
Width of the chest, cm	17.60 a4	± 0.173	16.52 b4	± 0.195	16.38 c4	± 0.234	a4: b4 p<0.001 a4: c4p<0.001
Girth of the chest, cm	80.22 a5	± 0.825	69.76 b5	± 0.681	69.48 c5	± 0.306	a5: b5 p<0.001 a5: c5 p<0.001
Scope of the whistle, cm	8.29 a6	± 0.106	7.55 b6	± 0.207	7.84 c6	± 0.157	a6: b6 p<0.5
Tail length, cm	26.1 a7	± 0.347	24.59 b7	± 0.405	24.92 c7	± 0.303	a7: b7 p<0.001 a7: c7 p<0.001

The sheep from ASES - Smolyan were characterized by higher values for wither height, diagonal length of the body, depth and width of the chest. The wither height of the Karakachan sheep in groups I and III were close in value, respectively 55.24 and 54.69 cm, it was lower in group II - 52.95 cm (P<0.01). For the second indicator - diagonal body length, the sheep from group I were 1.83 cm longer than those from the village of Smilyan - group II (P<0.01) and 1.22 cm superior to the animals in the village of Borino - Group III. The same trend was maintained in the indicator for chest depth (P<0.001). In terms of chest girth, the highest average value was shown by the animals measured in ASES - Smolyan - I group (80.22 cm). This indicator was 14.1% higher than group II and 15.4% higher than group III (P<0.001). In terms of the whistle range, the difference between groups I and II was 0.74 cm in favour of the first (P<0.001). The average length of the tail in sheep in ASES - Smolyan (Group I) was 1.51 cm larger than Group II and 1.18 cm larger than Group III (P<0.001). The results obtained in our study for body measurements were close to the results obtained by Sedefchev et al. (2011) and indicate that the Karakachan sheep breed in the studied flocks is characterized by a well-preserved authentic breed type.

Body indexes reflect the relationship between two or more body measurements related anatomically or functionally and expressed in %. They characterize the proportions of the body and change during growth and development of animals. Through them the growth is controlled and the deviations from the norm are established. The body stretching index expresses the ratio between the length and height of the body. This index varies slightly with age. The results (Figure 1) show that most stretched were the animals from group II - 106%. The values are close in group I - 105% and group III - 103%.

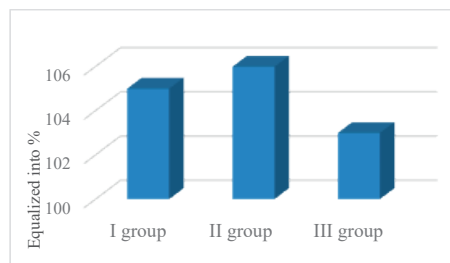


Figure 1. Stretching index

The chest index (Figure 2) shows the relative development of the chest, its width and shape. The results obtained for groups I, II and III are close, respectively 69%, 67% and 67%.

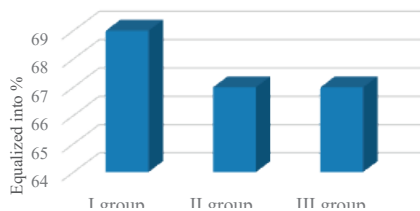


Figure 2. Chest index

The massiveness index (Figure 3) shows the relative development of the carcass. The Karakachan sheep from group I surpass by 9.8% those from group II and by 14.2% those from group III.

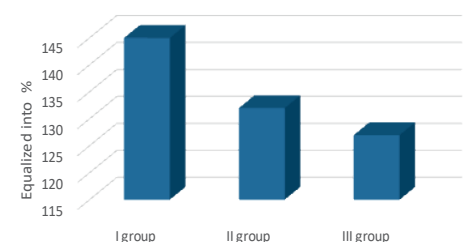


Figure 3. Index of massiveness

The compactness index (Figure 4) expresses the ratio between chest girth and body length. This index is related to body weight and characterizes the compactness of the body by supplementing the chest index. The lowest values are in group III 122%.

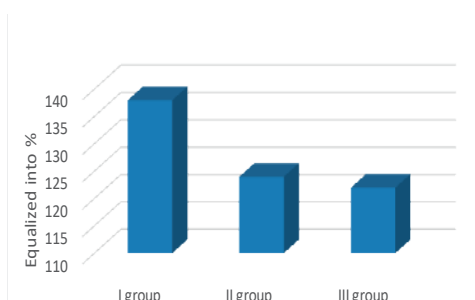


Figure 4. Index for compactness

The Karakachan sheep from group I are superior by 11.2% to the sheep from group II and by 13.1% to the sheep from group III according to this index. The results for the body

indexes reflect the differences in growth and development of body proportions due to the different environmental factors in the three farms. The calculated values of the indexes are within the normal range for the authentic type of Karakachan sheep breed, reported by Odzhakova et al. (2020).

CONCLUSIONS

The Karakachan sheep breed, reared under different conditions in a mountainous area, meets the productivity and body measurements standards defined in the breeding program. The average live weight in the studied flocks varied from 36,620 kg to 39,410 kg under different conditions and altitude. The highest live weight is reached by the animals from the flock of ASES Smolyan - 40.53 kg at 4.5 years. The biological fertility for the studied period varied from 92.2% in the flock of ASES-Smolyan to 103% in the village of Smilyan. Body measurements and body indexes showed the dynamics of the indicators, within the norm, under different conditions of breeding and confirm the authenticity of the breed type in the Karakachan sheep breed.

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