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Morphometric Characterization of the Akbaş (Akbash) Turkish Shepherd Dog

Milivoje Urosevic[1,a], Darko Drobnjak[1,b], Petar Stojic[2,c], Yusuf Ziya Oğrak[3,d,*]

[1]*Center for preservation of indigenous breeds, Belgrade, Serbia*
[2]*Institute PKB Agroekonomik, Belgrade, Republic of Serbia*
[3]*Department of Animal Husbandry, Faculty of Veterinary Medicine, Sivas Cumhuriyet University, 58140 Sivas, Turkey*
[*]*Corresponding author*

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ABSTRACT

In this study, a morphometric investigation was carried out on the Akbash Turkish shepherd dog breed using 30 exterior parameters. The study consisted of 96 dogs (54 males and 42 females) ranging in age from 2 to 9 years. All dogs were bred in the West Anatolia region of Turkey, around the city of Eskisehir. The following exterior parameters were measured and their means were obtained: height at withers (65.22±3.99 cm), height at mid-back (62.24±4.24 cm), height at rump (64.97±4.16 cm), height at base of tail (58.2±5.01 cm), height to elbow (36.07±4.06 cm), height to knee (35.83±4.96 cm), height to hock (17.08±3.21 cm), height to tip of sternum (45.12±4.30 cm), body length (70.58±5.58 cm), chest depth (29.58±3.23 cm), chest width (21.02±3.18 cm), breast width (16.86±3.41 cm), chest circumference (77.86±7.05 cm), pastern circumference (13.27±1.67 cm), rump length (19.21±3.27 cm), pelvic width (8.65±2.18 cm), rump protuberance width (7.58±3.02 cm), head length (27.20±2.85 cm), skull length (16.58±1.92 cm), muzzle length (10.30±2.35 cm), skull width (14.06±1.96 cm), muzzle width (7.60±1.26 cm). According to the obtained morphological characteristics the dog has a rectangular body format, and the rump is somewhat higher than the height at the withers. According to its craniological characteristics it belongs to the group of mesaticephalic dogs. The width of the skull is smaller than its length. Angles of the hind legs are more open than angles of the front legs.

[a] *office@cepib.org.rs* *http://orcid.org/0000-0001-6248-3405*
[b] *drobnjakvet@yahoo.com* *http://orcid.org/0000-0002-5169-3375*
[c] *pstojic@sbb.rs* *http://orcid.org/0000-0001-9176-7335*
[d] *yograk@cumhuriyet.edu.tr* *http://orcid.org/0000-0002-3110-7826*

Introduction

Turkey has only one breed of dog that is internationally recognized (FCI: Fédération Cynologique Internationale). The Kangal shepherd dog has been accepted by the FCI as a separate breed since June 2018 (Oğrak et al., 2018). All shepherd dogs in Anatolia, and there are several breeds and varieties there, can be referred to as shepherd dogs of Anatolia. In 2007, with the foundation of the Cynology Federation of Turkey (KIF), deliberations started about the possibility of standardizing various autochthonous dog breeds in Turkey, one of them being the Akbash Turkish shepherd dog. Systematic cynological investigations aimed at classifying numerous shepherd dogs in the field soon began. By recognizing existing cynological and zootechnical principles, the selection and zootechnical processing of individual animals began.

Since data about the external characteristics of the Akbash are scarce in the literature, data about the Kangal, the Sharplanina Yugoslav shepherd dog, and the Tornjak, a shepherd dog native to Bosnia and Herzegovina and Croatia, as the closest relatives of the Kangal and dogs of the same performances, were used as the indicators for the constitution of shepherd dogs.

Available literature contains only one reference covering this topic. Atasoy et al. (2011) researched the exterior characteristics and constitution of the Akbash dogs. The established average height at withers was 64.42 cm, and body length was 66.13 cm. The comparison of sexes upon these authors state that the average height of females was 62.3 cm, and of males 66.36 cm. The body length of females was 64.98 cm, and of males 67.19 cm, on average; therefore, the dogs were square in outline, or negligibly elongated. According to general principles of the constitution of shepherd dogs, they must have an elongated body shape. In the same study, other average measurements of 98 dogs between 1 and 4 years of age, for males and females respectively, were: chest depth 27.34 cm and 26.26 cm; chest width 20.89 cm and 20.36 cm; chest circumference 82.62 cm and 80.41 cm; front cannon

circumference 13.91 cm and 12.92 cm; hind cannon circumference; 12.72 cm and 12.00 cm; head length 29.43 cm and 28.02 cm; and muzzle length 11.96 cm and 12.45 cm. It has been reported that differences between males and females were important for all variables except chest width and muzzle length.

External parameters for the head and the body of the Kangal Turkish shepherd dog have been published by Urošević et al. (2012a; 2012b; 2014b). The average height of male Kangals was 72.80 cm, and body length was 81.20 cm. The average height of females was 69.20 cm, and body length was 77.60 cm. The frame index was 111 in males, and in females 112. Differences in height at the withers between males and females was statistically significant ($P<0.05$), while the difference in body length between sexes was not statistically significant ($P>0.05$). On a sample of 126 Turkish Kangal shepherd dogs it was established that the body was rectangular, i.e. that body length was greater than the height at withers, by 11% in males, and 12% in females. This was fully in accordance with general principles of conformation for shepherd dogs. From obtained results it can be concluded that the average head length in the Kangal Turkish shepherd dog was 28.79 cm with a total range of 25.00 to 33.00 cm. The average skull length was 17.34 cm, and the length of the muzzle was 11.52 cm. The relationship between skull and muzzle length was 60:40. Average skull width was 16 cm, which was approximately 55% of head length. If the relationship between skull width and skull length is compared, it can be said that the skull of the Kangal was approximately square, and that the ratio was 60:55. Muzzle width was 8.35 cm, and muzzle depth was 10.37 cm. Statistical significance between sexes was highly significant ($P<0.001$) for mean values of all measured parameters except for muzzle length where the value was significant ($P<0.05$). Among index values there was just one case where there was no statistical significance ($P>0.05$) between sexes, namely for the value of the skull width index. Pelvis length in Kangal males was on the average 20.43 cm, and in females, it was 19.94 cm (Urošević et al., 2012a). The results obtained so far have been in accordance with values prescribed by the standard for this Turkish autochthonous breed.

Oğrak et al. (2018), who investigated Malaklı dog (one of the other Turkish shepherd dogs), reported the average height at withers as 80.75 cm, rump height as 78.5 cm, body length as 99.6 cm, head length as 35.2 cm and muzzle length as 15.4 cm.

On a sample of 67 dogs, Stankovic (1967) established that the average height at withers of Sharplanina dogs were 62.87, and 60.75 cm, for males and females, respectively. On average, the body lengths were 68.78 and 68.45 cm, the average head lengths were 25.02 and 24.35 cm, the skull lengths were 14.55 and 13.9 cm, for males and females, respectively. By measuring 75 dogs, Urošević and Latinović (1987) established that the average height at the withers was 60.9 cm, and body length 67.2 cm, and that the length of the head was approximately 41% of the height at withers.

Investigating the external characteristics of 30 Sharplanina dogs in Macedonia, Bozinovski (1984) established that the average height at withers were 67.7 and 60.4 cm, for males and females, respectively. Head length in the dogs measured was in accordance with proportions defined by the standard for this breed, and approximately 40% of the height at withers. Drozdovski and Keramicis (1987) stated that the average heights of Sharplanina dogs were 64 and 59 cm, the average body lengths were 68 and 63 cm and the average head lengths were 27.17 and 25.92 cm, for males and females, respectively. Simcic (1984) stated that, in Sharplanina dogs measured in Slovenia, average head length in males was 27 cm, and it was 25.6 cm in females. Skull and muzzle lengths in males and females, respectively, were 13.70 and 13.50 cm and 13.20 and 12.10 cm

Urošević and Drobnjak (2011) stated that the average height at withers of Sharplanina dogs bred in the vicinity of Belgrade was 66.89 cm, and body length was 73.84 cm. Urošević et al. (2017) stated that the average measurements of Sharplanina dogs of males and females, respectively, were 29.03 and 27.28 cm for head length, 17.32 and 16.69 cm for skull length, 14.59 and 13.60 cm for skull width, 11.78 and 10.59 cm for muzzle length, 8.49 and 7.76 cm for muzzle width and 10.73 and 10.09 cm for muzzle depth. All data in the literature clearly indicate that body length is greater than the height at withers.

When it comes to basic external parameters of the Tornjak, Salkic et al. (2000) state that the average heights at withers were 69 and 60.75 cm for males and females, respectively. Body length of males was 74.2 cm, while it was 65.5 cm for females. In this case the body length was also greater than the height at withers. By investigating the biostatistical model of the body of the Tornjak, Urošević et al. (2014a) established that the line of the back in the Tornjak was not straight, but slightly concave, the rump height exceeding the height at withers, which was typical for shepherd dogs. Body length was greater than the height at withers. Chest depth was never over 50% of the height at withers. The pelvis was longer than hock height. Both Tornjak males and females have a massive skull. The three main weight-bearing parts of the front assembly, the shoulder blade, upper and lower part of the front extremity, have approximately the same length, and the length of the upper and lower hind extremity was also the same. The angle of the neck should not exceed 30 degrees, and the angle formed by the rump was approximately the same. The angle at the shoulder and at the knee joint was approximately 120 degrees, while angles of the elbow and the hock joint were more open. The angle of the pastern was approximately 29 degrees.

The scientific data published on the Akbash dog breed are very limited and these studies describe only a few exterior features. This study aims to determine more of the exterior characteristics of Turkish Akbash dogs.

Materials and Methods

This investigation was a morphometric evaluation of 30 external parameters in 96 dogs of the Turkish Akbash shepherd dog breed. The studied population was consisted of 54 males and 42 females. The age of the dogs included in investigation was between 2 and 9 years. All the dogs were bred in Turkey, in the region of West Anatolia, around the city of Eskisehir.

The following morphometric parameters were measured: height at withers, height at mid-back, height at rump, height at base of tail, height to elbow, height to knee,

height to hock, height to tip of sternum, body length, chest depth, chest width, breast width, chest circumference, pastern circumference, rump length, pelvic width, rump protuberance width, head length, skull length, muzzle length, skull width, muzzle width, muzzle depth, muzzle circumference, ear length, shoulder joint angle, elbow joint angle, knee angle, hock angle, neck angle, and rump angle. Lengths, widths and depths were measured by use of which movable device for measuring, while muzzle circumference was measured using a zootechnical tape measure. Height was measured using a measuring stick for animals, and angles were measured with a protractor. Points for measurements were defined in accordance with zootechnical standards for these types of measurement.

Descriptive statistics calculated in this study were the arithmetic mean, standard deviation, range, standard error, and coefficient of variation. These statistics were separately calculated for all the male and female dogs. The *student t*-test was used to compare two groups. All statistical calculations and comparisons were done using the GraphPad Prism 5 program. Indexes of body development for certain parts of the body were also analyzed.

Results and Discussion

Average values for the exterior body measurements are presented in Table 1 and Table 2.

As shown in Table 1 and Table 2, two variables obtained from Akbash dogs, the average height at withers and the average height of the back, were found to be statistically different between the sexes ($P<0.05$ and $P<0.01$, respectively). For all other variables, the differences between males and females were statistically nonsignificant ($P>0.05$). While chest circumference in males had a broad variation interval, in females the variation interval was somewhat smaller.

Average values for the external head measurements are presented in Table 3.

None of the head measurements showed any significant difference between the sexes ($P>0.05$), except in case of head length, where significant difference between males and females ($P<0.05$) was established. Upon the calculated head length to height at withers ratio, the head length index in both sexes ranged from 37 to 43. Ear length measurements indicated more homogeneity in males, and was shorter than in females.

Average values of the various body angles are given in Table 4. As shown in Table 4, while a statistically significant difference between sexes was found for the elbow joint angle ($P<0.05$), no significance was found for the angles at other joints.

When the measured values in this research were evaluated, the Akbash dogs seemed to have significantly smaller body size compared to the other Turkish shepherd dogs: Kangal and Aksaray Malaklı (Oğrak et al., 2018; Urošević et al., 2012b)

In this study, body length was found to be 10% greater than height at the withers, while Atasoy et al. (2011) reported that these two variables were similar in the same breed. While the means of the height at withers and chest width in the current study were in accordance with Atasoy et al. (2011), the means of the body length and chest depth were high and the means of the chest circumference and muzzle length were low. Additionally, head length in these two studies was similar in male dogs but higher than given in Atasoy et al. (2011) for female dogs. These differences in some variables in the studies may be attributable to the measurement techniques as well as to variation in the animals included in the sample.

Table 1. Descriptive statistics for body heights (cm) in the Akbash shepherd dog.

Parameter	Sex	N	Min	Max	CV	$\bar{x} \pm SD$	P
Height at withers	M	54	60.00	73.00	5.79	66.79± 3.86	0.010^{*}
	F	42	57.00	68.00	5.16	63.15±3.25	
	Total	96	57.00	73.00	6.13	65.22±3.99	
Back height	M	54	59.00	70.00	5.22	64.36±3.35	0.006^{**}
	F	42	52.00	67.00	6.82	60.27± 4.11	
	Total	96	52.00	70.00	6.82	62.24±4.24	
Rump height	M	54	59.00	74.00	5.77	66.18±3.82	0.678^{ns}
	F	42	55.00	71.00	6.67	63.69±4.24	
	Total	96	55.00	74.00	6.41	64.97±4.16	
Base of tail height	M	54	51.00	69.00	8.45	59.56± 5.03	0.803^{ns}
	F	42	49.00	65.00	8.29	56.67± 4.69	
	Total	96	49.00	69.00	8.62	58.20±5.01	
Hock height	M	54	13.00	26.00	22.64	17.67±4.00	0.135^{ns}
	F	42	13.00	20.00	13.89	16.50±2.29	
	Total	96	13.00	26.00	18.84	17.08±3.21	
Elbow height	M	54	31.00	46.00	12.40	37.17±4.60	0.169^{ns}
	F	42	31.00	40.00	8.61	34.75±2.99	
	Total	96	31.00	46.00	11.26	36.07±4.06	
Knee height	M	54	28.00	47.00	14.72	36.92±5.43	0.295^{ns}
	F	42	28.00	44.00	12.70	34.75±4.41	
	Total	96	28.00	47.00	13.86	35.83±4.96	
Sternum tip height	M	54	39.00	55.00	10.16	45.38±4.61	0.756^{ns}
	F	42	38.00	51.00	9.23	44.85±4.14	
	Total	96	38.00	55.00	9.54	45.12±4.30	

ns : Not Significant ($P>0.05$), *$P<0.05$, **$P<0.01$,

Table 2. Descriptive statistics for other body measurements (cm) in the Akbash shepherd dog.

Parameter	Sex	N	Min	Max	CV	$\bar{x} \pm SD$	P
Body length	M	54	63.00	86.00	8.60	71.59±6.15	0.314^{ns}
	F	42	59.50	78.00	7.21	69.68±5.02	
	Total	96	59.50	86.00	7.92	70.58±5.58	
Chest depth	M	54	23.00	34.00	12.19	29.29±3.57	0.686^{ns}
	F	42	25.00	35.00	10.20	29.82±3.04	
	Total	96	23.00	35.00	10.95	29.58±3.23	
Chest width	M	54	15.00	26.00	15.84	20.96±3.32	0.920^{ns}
	F	42	16.50	27.00	15.10	21.10±3.18	
	Total	96	15.00	27.00	15.14	21.02±3.18	
Breast width	M	54	13.00	23.00	18.92	17.33±3.27	0.592^{ns}
	F	42	11.00	22.00	21.85	16.50±3.60	
	Total	96	11.00	23.00	20.23	16.86±3.41	
Chest circumference	M	54	61.00	92.00	10.43	78.58±8.19	0,517^{ns}
	F	42	69.00	88.00	7.22	77.00±5.56	
	Total	96	61.00	92.00	9.07	77.86±7.05	
Pastern circumference	M	54	11.00	16.00	13.86	13.50±1.87	0.479^{ns}
	F	42	11.00	15.00	12.16	13.00±1.58	
	Total	96	11.00	16.00	12.65	13.27±1.67	
Rump length	M	54	14.00	26.00	17.68	20.00±3.53	0.996^{ns}
	F	42	14.00	23.00	16.37	18.50±3.02	
	Total	96	14.00	26.00	17.05	19.21±3.27	
Pelvic width	M	54	5.50	13.00	28.62	8.90±2.54	0.561^{ns}
	F	42	6.00	10.00	18.68	8.25±1.54	
	Total	96	5.50	13.00	25.29	8.65±2.18	
Rump protuberance width	M	54	3.00	13.0	43.92	7.80±3.42	0.335^{ns}
	F	42	4.00	11.00	35.19	7.28±2.56	
	Total	96	3.00	13.00	39.82	7.58±3.02	

ns : Not Significant (P>0.05)

Table 3. Descriptive statistics for head measurements (cm) in the Akbash shepherd dog.

Parameter	Sex	N	Min	Max	CV	$\bar{x} \pm SD$	P
Head length	M	54	25.00	32.00	8.59	28.50±2.44	0.021*
	F	42	21.00	29.00	10.46	25.71±2.69	
	Total	96	21.00	32.00	10.51	27.20±2.85	
Skull length	M	54	14.00	20.00	12.71	17.00±2.16	0.876^{ns}
	F	42	14.00	18.00	9.88	16.00±1.58	
	Total	96	14.00	20.00	11.63	16.58±1.92	
Muzzle length	M	54	9.00	13.00	15.89	10.75±1.70	0.470^{ns}
	F	42	5.00	13.00	28.28	10.00±2.82	
	Total	96	5.00	13.00	22.91	10.30±2.35	
Skull width	M	54	12.10	17.00	11.27	14.49±1.63	0.870^{ns}
	F	42	10.50	17.00	16.73	13.63±2.28	
	Total	96	10.50	17.00	13.99	14.06±1.96	
Muzzle width	M	54	6.00	10.00	19.89	7.75±1.54	0.381^{ns}
	F	42	6.00	9.00	14.49	7.47±1.08	
	Total	96	6.00	10.00	16.63	7.60±1.26	
Muzzle depth	M	54	7.00	11.00	17.57	9.00±1.58	0.918^{ns}
	F	42	7.00	11.00	15.75	8.98±1.41	
	Total	96	7.00	11.00	15.73	8.99±1.41	
Ear length	M	54	11.00	14.00	10.33	12.50±1.29	0.592^{ns}
	F	42	11.00	15.00	10.14	12.99±1.31	
	Total	96	11.00	15.00	9.88	12.81±1.26	

ns : Not Significant (P>0.05), *P<0.05

Examining the differences in values for the rump height and the height at base of tail established in males and in females, the slope index in males varied from 98 to 101, and it ranged from 96 to 104 in females. This finding indicates that there are dogs with a downward-sloping line of the back in the population, which is very undesirable, but also dogs with the rump height that was 1% to 4% greater than the height at withers, which is typical for shepherd dogs. The established average height of the Akbash was smaller than the height of Kangal as described by (Urošević et al., 2012b). The pelvis length of the Akbash was approximately the same as the pelvis length of the Kangal (Urošević et al., 2012a).

Table 4. Descriptive statistics for body angels in the Akbash shepherd dogs.

Angels	Sex	N	Min	Max	CV	$\bar{x} \pm SD$	P
Shoulder joint	M	54	80.00	115.0	12.14	99.29±12.05	0.529^{ns}
	F	42	90.00	115.0	9.13	102.5±9.35	
	Total	96	80.00	115.0	10.50	100.8±10.58	
Elbow joint	M	54	110.0	140.0	8.00	122.6±9.80	0.013^{*}
	F	42	118.0	150.0	7.12	132.9±9.46	
	Total	96	110.0	150.0	8.44	128.0±10.80	
Knee	M	54	100.0	160.0	12.85	130.8±16.79	0.884^{ns}
	F	42	105.0	155.0	12.19	129.8±15.82	
	Total	96	100.0	160.0	12.34	130.4±16.09	
Hock	M	54	115.0	160.0	11.23	138.9±15.60	0.893^{ns}
	F	42	110.0	165.0	12.70	138.0±17.53	
	Total	96	110.0	165.0	11.73	138.5±16.23	
Neck	M	54	20.00	50.00	28.85	33.78±9.74	0.190^{ns}
	F	42	13.00	45.00	39.34	27.45±10.80	
	Total	96	13.00	50.00	34.90	30.30±10.57	
Rump	M	54	20.00	50.00	27.80	36.56±10.16	0.544^{ns}
	F	42	19.00	50.00	35.50	33.25±11.80	
	Total	96	19.00	50.00	30.71	35.00±2.60	

ns : Not Significant (P>0.05), *P<0.05,

On average, the head length corresponded to 40% of the height at withers, which was in accordance with established measure in other breeds of shepherd dogs (Stankovic, 1967; Urošević et al., 2012b; Urošević et al., 2014b). The average head length of males in this study was 2 cm longer than the head length in a study performed by Stankovic (1967), while in females the length was almost 3 cm greater.

The ratio of skull length to muzzle length was 64:36, indicating that the head of the Akbash belongs to the mesencephalic type, which is typical for shepherd dogs. The skull is not square, but elongated since its length is greater than its width.

While the angles established at elbow, hock and neck in this study were in accordance with those described by Urošević et al (2014a), the angle at shoulders was less open. The angle at shoulder joint in the Akbash was approximately 20 degrees less open than in the Tornjak (Salkic et al., 2000).

The body frame index (percentual ratio of the height at withers and body length) for males was in the range 105 to 117, while it was from 104 to 115 in females. These values for the frame index show that the Akbash has a rectangular body, with body length greater than the height at withers by 4% to 17%. It was also noticeable that the frame index varies greatly, which is not praised characteristics in the breed. The chest depth index in males ranged from 38 to 47, and in females from 44 to 51. This means that it ranged from 38% to 51% of the height at withers. A broad variation interval of the chest depth was also observed in this investigation.

The Turkish Akbash shepherd dog belongs to the group of shepherd dogs widespread in the territory of Turkey, in western Anatolia. It is primarily used to guard herds of domestic animals. According to its morphological characteristics it has a rectangular body format, and the rump is somewhat higher than the height at withers. According to its craniological characteristics it belongs to the group of mesaticephalic dogs, i.e. the muzzle is shorter than the skull. The width of the skull is smaller than its length. Angles of the hindlegs are more open then angles of the forelegs.

Having in mid that FCI has recognized one of the Turkish shepherd dog breeds, the Kangal, it is important to determine the standard for the other Turkish shepherd dog, the Akbash, in aim to achieve the international recognition of this important breed for Turkish agrobiodiversity and breeding tradition. The Akbash dog breeding will fulfill the demands for official recognition of the breed thanks to pedigree breeding in accordance with standards when morphometric characteristics of the population are defined. The data obtained in this investigation are huge contribution to the process.

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