

Phenotype variability and basic morphological characteristics of the Aksaray Malakli dog population in Turkey



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Abstract

The Turkish Mastiff or Aksaray Malakli Dog is a Turkish dog breed not yet officially recognized by the world canine organization - *Fédération Cynologique Internationale* (FCI). To achieve recognition, more research and analysis of the morphometric parameters of this breed are required. Previous research on this breed presented the average values of certain morphological parameters. Measurement results of 20 morphometric

parameters showed that there are statistically significant differences in body structure between males and females. Such results are significant for setting the official breed standard in which the proportions of the body characteristic of this breed should be emphasized.

Key words: *Turkish Mastiff; Aksaray Malakli; dog breeds; morphometry; morphological traits; guarding dogs*

Introduction

The Turkish Mastiff or Aksaray Malakli Dog is a native Anatolian breed raised in the Aksaray region. This Turkish dog breed has not yet been officially recognized by the world canine organization - *Fédération Cynologique Internationale* (FCI). According to the FCI, mastiffs belong to Group 2, section (2) molossian type (2.1. mastiff type) (<http://fci.be/en/nomenclature/2-Pinscher-and-Schnauzer-Molossoid-and-Swiss-Mountain-and-Cattledogs.html>).

In order to be recognized, more research and analysis of the morphometric parameters of this breed are required. These are guard dogs, strong, with courageous and aggressive characteristics (Kocakaya and Atasoy, 2019). Aksaray Malakli dogs have large body size and weight, large body and head, droopy eyelids, cheeks and lips, large ears, short hair and uncurled tail (Atasoy et al., 2014; Oğrak et al., 2018). Coat colour is usually grey on the body

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Figure 1. Turkish Mastiff in the natural environment



Figure 2. Head profile of Turkish Mastiff

and black and yellow on the head (Büyükleblebici, 2019).

Previous research on this breed reported the average values of certain morphological parameters. Atasoy et al. (2014) indicated that Aksaray Malakli dogs have a strong body structure, with an average height at the withers of 78.36 ± 0.31 cm in males, and 72.98 ± 0.49 cm in females. They also reported a mean height at the rump of 78.65 ± 0.34 cm in males and 72.87 ± 0.53 cm in females. Females had an average body length of 79.02 ± 0.62 cm, males 82.68 ± 0.60 cm. Others parameters were: chest girth circumference 84.47 ± 0.71 cm in females and 89.89 ± 0.76 cm in males; chest depth 30.86 ± 0.26 cm in females and 33.73 ± 0.44 cm in males; chest width 24.76 ± 0.35 cm in

females and 26.68 ± 0.20 cm in males; front cannon bone circumference 14.71 ± 0.12 cm in females and 15.76 ± 0.08 cm in males; hind cannon bone circumference 13.90 ± 0.16 cm in females and 14.76 ± 0.08 cm in males; tail length 51.36 ± 0.83 cm in females and 54.76 ± 0.45 cm in males. Atasoy et al. (2014) also measured parameters on the head of Aksaray Malakli dogs: head length 30.92 ± 0.24 cm in females and 32.98 ± 0.18 cm in males; face length 11.80 ± 0.15 cm in females and 12.55 ± 0.09 cm in males; ear length 16.73 ± 0.26 cm in females and 17.67 ± 0.17 cm in males; ear width 13.96 ± 0.26 cm in females and 14.78 ± 0.18 cm in males. Oğrak et al. (2018) examined the genotypes of the Aksaray Malakli dog breed on a small sample of 10 dogs, and they presented somewhat different results of morphometric trait measurements: wither height mean 80.75 cm (male 80.10, female 71.40), height at the rump 71.45 cm (male 78.90, female 71.45), body length 99.60 cm (male 95.40, female 87.10), girth circumference cm 104.20 (male 101.80, female 96.40), front corpus circumference 19.00 cm (male 19.40, female 16.90), head length 35.20 cm (male 36.50, female 31.50), muzzle length 15.40 cm (male 14.50, female 13.90), body index 123.63 (male 119.06, female 121.71).

The aim of this study was to conduct a detailed analysis of all morphometric parameters that are significant for setting the official breed standard. This paper presents the measurement results of 20 morphometric parameters and their differences by gender and age. It may be an important guideline for breeders, canine organizations and expert commissions, dog judges and other canine workers.

Materials and Methods

Morphological parameters were measured on a total 44 individuals (22 males and 22 females) representing a population sample of the Turkish mastiff

breed. All dogs in this sample were bred in Turkey. All measurements were conducted in 2016 in Turkey (Cappadocia region). The following exterior parameters were measured in all dogs: withers height (WH), height of the back (HB), height at rump (HR), height of the tail root (HTR), height of the hock (HH), elbow height (EH), body length (BL), chest depth (CD), chest width (CW), chest circumference (CC), pastern circumference (PC), pelvis length (PL), rump width (RW), rump protuberance width, head length (HL), skull length (SL), head width (HW), muzzle width (MW), muzzle length (ML),

ear length (EL). These measurements do not have an invasive character and in no way endanger animal health. All Turkish mastiff dogs were between the ages of 1 and 9 years.

To measure height at the withers, the Lydthin measurement stick was used (Urošević and Drobnjak 2019). For all other parameters, a tape measure was used. All measurements were in centimetres and in accordance with zootechnical standards. Conformation characterization was based on the mean value (M) and standard deviation (SD) of the variables. The T-test was applied

Table 1. Descriptive statistics for morphometric variables in Turkish mastiff (cm)

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
withers height (WH)	44	72.00	83.00	77.34	2.74	7.53
height of the back (HB)	44	70.00	81.00	74.60	2.58	6.66
height at rump (HR)	44	69.50	83.00	78.83	2.66	7.09
height of the tail root (HTR)	44	60.00	79.00	71.86	3.32	11.05
height of the hock (HH)	44	19.00	24.00	21.61	1.20	1.45
elbow height (EH)	44	37.00	52.00	41.20	3.05	9.33
body length (BL)	44	76.00	91.00	82.02	3.90	15.18
chest depth (CD)	44	32.00	40.00	35.08	1.67	2.79
chest width (CW)	44	21.00	30.00	23.92	1.73	2.98
chest circumference (CC)	44	87.00	107.00	94.30	5.55	30.77
pastern circumference (PC)	44	15.00	19.00	16.80	1.32	1.74
pelvis length (RL)	44	17.00	27.00	19.36	1.75	3.07
rump width (RW)	44	7.00	9.00	8.27	0.61	0.38
rump protuberance width (RPW)	44	6.00	9.00	7.35	0.61	0.37
head length (HL)	44	29.00	35.00	31.23	1.54	2.37
skull length (SL)	44	15.50	23.00	18.69	2.37	5.60
head width (HW)	44	16.00	22.00	18.50	1.25	1.57
muzzle width (MW)	44	7.00	12.00	8.44	1.20	1.43
muzzle length (ML)	44	9.50	14.00	11.00	1.10	1.22
ear length (EL)	44	15.00	18.00	16.52	1.07	1.14
Valid N (listwise)	0					

Table 2. Descriptive statistic for morphometric variables by sex

	Sex	N	Mean	Std. Deviation	Std. Error Mean
head length (HL)	male	22	32.41	1.14	0.24
	female	22	30.05	0.79	0.17
skull length (SL)	male	22	20.64	1.68	0.36
	female	22	16.75	0.86	0.18
head width (HW)	male	22	19.09	1.23	0.26
	female	22	17.91	0.98	0.21
muzzle width (MW)	male	22	9.14	1.13	0.24
	female	22	7.75	0.81	0.17
muzzle length (ML)	male	22	11.18	1.14	0.24
	female	22	10.82	1.06	0.23
ear length (EL)	male	22	17.05	1.00	0.21
	female	22	16.00	0.87	0.19
withers height (WH)	male	22	79.41	1.70	0.36
	female	22	75.27	1.88	0.40
height of the back (HB)	male	22	76.23	2.18	0.46
	female	22	72.98	1.83	0.39
height at rump (HR)	male	22	80.36	1.59	0.34
	female	22	77.30	2.66	0.57
height of the tail root (HTR)	male	22	73.77	2.79	0.60
	female	22	69.95	2.68	0.57
height of the hock (HH)	male	22	21.77	1.19	0.25
	female	22	21.45	1.22	0.26
elbow height (EH)	male	22	43.41	2.74	0.58
	female	22	39.00	1.20	0.25
body length (BL)	male	22	85.09	2.27	0.48
	female	22	78.95	2.50	0.53
chest depth (CD)	male	22	35.98	1.65	0.35
	female	22	34.18	1.14	0.24
chest width (CW)	male	22	24.52	1.82	0.39
	female	22	23.32	1.43	0.30
chest circumference (CC)	male	22	99.00	3.35	0.71
	female	22	89.59	2.32	0.50
pastern circumference (PC)	male	22	17.73	1.03	0.22
	female	22	15.86	0.83	0.18
pelvis length (RL)	male	22	19.55	2.22	0.47
	female	22	19.1	1.14	0.24
rump width (RW)	male	22	8.14	0.71	0.15
	female	22	8.41	0.48	0.10
rump protuberance width (RPW)	male	22	7.31	0.65	0.14
	female	22	7.39	0.58	0.12

to determine statistically significant differences among individual traits of females and males. The results are presented with the t-value (t), degrees of freedom value (df) and significance value (sig).

For the further analysis, the frame (body) index in this population was analysed. According to Urošević and Drobnjak (2019), the body index in dogs is the ratio of body length to height at the withers, calculated by the formula: $(\text{body length} / \text{height of the withers}) \times 100$. For breeds of square body, the index is 100, and if the body index is greater than 100, then it is a more or less elongated body. As Urošević and Drobnjak (2019) indicate, if the body index is less than 100, this means that the height of the withers is greater than the length of the body, which occurs in a small number of breeds.

Croup index represents the ratio of croup height and withers height. If this index has a value of 100, this means that the height of the withers and height of croup are at the same level. If the croup index is greater than 100, the croup is higher than the withers. The dog has a falling backline when the croup index is less than 100. The croup index is calculated using the formula: $\text{croup height} / \text{withers height} \times 100$ (Urošević and Drobnjak, 2019).

For further analysis, the skull length index in this population, as the ratio of skull length to head length, was analysed according to Urošević and Drobnjak (2019), which determines head type. The lowest index (40–50) is in the dolichocephalic head type. Moderate index values (50–60) indicate a mesaticephalic head type, while the highest index is obtained for the brachycephalic head type (over 60). The skull length index is calculated using the formula: $\text{skull length} / \text{head length} \times 100$.

An analysis of variance (ANOVA) was conducted to determine differences in the

values of measured parameters between age groups in the observed population, where P was set at 0.05. Collected data were processed using the Statistical Package for Social Sciences software (SPSS for Windows Release 23.0.0).

Results

Official standards of dog breeds recognized by the FCI include a wide range of morphometric traits. The most important are withers height, body length and chest circumference. However, standards should include more detailed information about the dog breed in order to be useful for breeders, dog judges and other parties. This study included a large number of morphometric variables. The descriptive statistics for the 20 variables used here are shown in Tables 1 and 2.

The results show that the mean height at the withers was 77.34 cm (SD = 2.74), which is similar to previous reports (Atasoy et al., 2014). The mean value of body length was 82.02 cm (SD = 3.90, variance = 15.19).

The variables with the lowest coefficients of variation were: rump protuberance width (M=7.35, SD=0.61), rump width (M=8.27, SD=0.61), ear length (M=16.52, SD=1.07), muzzle length (M=11.00, SD=1.10), and muzzle width (M=8.44, SD=1.20). The greatest variability was found for chest circumference (M=94.30, SD=5.55). Significant variability was also shown in body length (M=82.02, SD=3.90) and height of the tail root (M=71.86, SD=3.32).

Table 2 shows the differences in the average values of the basic morphometric parameters between males and females. Based on the results obtained with the t-test, it could be concluded that most of the observed basic morphometric parameters showed statistically significant differences by sex, with the exception of muzzle length, height of the hock, pelvis length, rump

Table 3. Body format index

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Body format index	44	98.72	113.75	106.07	3.83	14.63
Valid N (listwise)	44					

Table 4. Body format index in males and females

	sex	N	Mean	Std. Deviation	Std. Error Mean
Body format index	male	22	107.20	3.55	0.76
	female	22	104.94	3.83	0.82

Table 5. Croup index

	N	Minimum	Maximum	Mean	Std. Deviation
Croup index	44	96.53	106.58	101.95	2.10
Valid N (listwise)	44				

Table 6. Croup index in males and females

	sex	N	Mean	Std. Deviation	Std. Error Mean
Croup index	male	22	101.23	2.13	0.45
	female	22	102.67	1.84	0.39

width, and rump protuberance width. T-test showed statistically significant difference between males and females for the following morphometric variables: head length ($t = 8.01$, $df = 42$, $sig = 0.00$), skull length ($t = 9.68$, $df = 42$, $sig = 0.00$), head width ($t = 3.52$, $df = 42$, $sig = 0.01$), muzzle width ($t = 4.68$, $df = 42$, $sig = 0.00$), chest circumference ($t = 10.82$, $df = 42$, $sig = 0.00$), body length ($t = 8.54$, $df = 42$, $sig = 0.00$), elbow height ($t = 6.92$, $df = 28.73$, $sig = 0.00$), height at rump ($t = 4.65$, $df = 42$, $sig = 0.00$), height of the back ($t = 5.36$, $df = 42$, $sig = 0.00$), withers height ($t = 7.63$, $df = 34.33$, $sig = 0.00$), chest width ($t = 2.45$, $df = 42$, $sig = 0.02$), chest depth ($t = 4.20$, $df = 42$, $sig =$

0.00), tail root height ($t = 4.63$, $df = 42$, $sig = 0.00$), pastern circumference ($t = 6.59$, $df = 42$, $sig = 0.00$) and ears length ($t = 3.70$, $df = 42$, $sig = 0.01$). This means that sexual dimorphism is distinctly expressed, and the values of these traits were higher in males than in females.

The format index in dogs is the ratio of body length to height at the withers (Urosevic and Drobniak, 2019). Consider only the mean values of withers height and body length for the total observed sample of Turkish mastiffs, it can be seen that this population has an elongated body (Table 3). The format index for each individual dog was also calculated, and ranged from 98.72 to 113.75. Only 2.3%

Table 7. Skull length index

	N	Minimum	Maximum	Mean	Std. Deviation
Skull length index	44	53.33	74.19	59.74	5.89
Valid N (listwise)	44				

Table 8. Skull length index in males and females

	sex	N	Mean	Std. Deviation	Std. Error Mean
Skull length index	male	22	63.76	5.84	1.25
	female	22	55.72	1.72	0.37

of the sample had a format index less than 100. Thus, the observed population generally has a rectangular body format and there are no varieties with extremely shorter bodies relative to the height of the withers.

When looking at the format index separately by gender (Table 4), males were observed to have a longer average format index than females, indicating that females have a slightly shorter body than males ($t = 2.03$, $df = 42$, $sig = 0.05$). However, these results further support that the population of Turkish mastiffs is characterized by a proper rectangular body shape.

This population of Turkish mastiffs, generally, is higher at the croup than at the withers (Table 5), with the croup index in the observed sample ranging from 96.53 to 106.58. However, only 4.5% of the sample had croup index equal to 100, and 11.4% has croup index less than 100. The T test showed that there was a statistically significant difference in the croup index between males and females, with a more pronounced difference in the height of the croup and the withers in females than in males ($t = 2.41$, $df = 42$, $sig = 0.02$) (Table 6).

The skull length index for each individual dog was also calculated (Table 7). The mean value of this index

shows that the breed is characterized by a mesaticephalic head type. However, 65.9% of dogs in the sample had a skull length index between 50 and 60, while in others the skull length index value was greater than 60.

The T-test showed that there was a significant statistical difference between the skull length index of males and females ($t = 6.193$, $df = 42$, $sig = 0.000$) (Table 8). Accordingly, females have a mesaticephalic head type, while males have a more brachycephalic head type.

Discussion and Conclusions

In order to obtain the most accurate breed information possible that would be useful to Aksaray Malakli breeders, regular research is required to facilitate establishment of the official breed standard. Recognition as a breed by the FCI is of the utmost importance for the protection of native Turkish mastiff population. The analysis of morphometric parameters requires the measurement of as many traits as possible, to allow for a detailed standard. Little research has been conducted on Turkish mastiffs, with differing results. In order to contribute to and enrich the current knowledge about the Aksaray Malakli breed, this study included the measurement of a larger

number of morphometric traits than in previous studies.

This study has found that Aksaray Malakli dogs are of rectangular body format, with no varieties in other body proportions. Females have a shorter body, which is contrary to the report of Oğrak et al. (2018) on a sample of 10 dogs. The obtained results for withers height, body length, height at rump, chest depth, chest width, hind cannon bone circumference, muzzle length, ear length reported here also differed from previous studies (Atasoy et al., 2014; Oğrak et al., 2018). Sexual dimorphism was confirmed. Males have a taller and longer body, larger chest circumference and longer and wider head, with a stronger muzzle. There was a statistically significant difference in the skull length index between males and females. Since the population of Turkish mastiffs in Turkey is heterogeneous, it is important that morphometric research on this breed should be conducted on a large number of individuals. It is also important to determine whether

the breeding aim will be for dogs with a mesaticephalic or brachycephalic head type, bearing in mind the breathing problems that could occur.

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Fenotipska varijabilnost i osnovne morfološke karakteristike populacije pasa aksaray malakli u Turskoj

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Turski mastif ili aksaray malakli je turska pasmina pasa koju Svjetska kinološka organizacija - *Fédération Cynologique Internationale* (FCI) još nije službeno priznala. Kako bi ova pasmina bila priznata, potrebna su brojna istraživanja i analiza morfometrijskih parametara ove pasmine. Prethodno istraživanje na ovoj aksaray malakli pasmini pokazalo je prosječne vrijednosti nekih morfoloških parametara. Mjerenje rezultata

20 morfometrijskih parametara pokazalo je da postoje statistički značajne razlike u tjelesnoj strukturi između mužjaka i ženki. Takvi rezultati su značajni za postavljanje službenog standarda pasmine u kojem bi trebalo naglasiti proporcije tjelesnih karakteristika ove pasmine.

Ključne riječi: turski mastif, aksaray malakli, pasmine pasa, morfometrija, morfološka obilježja, psi čuvari