

## **BASIC PHENOTYPIC MEASURES OF SERBIAN HOUND AND SERBIAN TRICOLOUR HOUND POPULATION IN BOSNIA AND HERZEGOVINA**

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### **ABSTRACT**

Along with indigenous hound breed Barak, a large number of hounds used in hunting in Bosnia and Herzegovina belongs to breeds Serbian Hound, Serbian Tricolour Hound and Posavatz Hound. So far, the population of these breeds in Bosnia and Herzegovina has not been the subject of research. The aim of this paper is to describe basic phenotypic parameters of Serbian Hound and Serbian Tricolour Hound from Bosnia and Herzegovina, to determine whether the obtained values meets the values defined by standards for these breeds, and is there any significant difference between the populations of dogs in Serbia and Bosnia and Herzegovina. The study was conducted on 38 dogs, including 20 Serbian Hounds (11 males and 9 females), and 18 Serbian Tricolour Hounds (10 males and 8 females). The following parameters were measured on each dog: the height at withers, the body length the length of head, the length of skull, the length of muzzle, the girth of chest. The measurements were performed using Litin rod, moving scale with nonius and the tape. Based on the results obtained from this research, it can be concluded that the Serbian Hound does not have large deviations from the values defined by standard, nor the differences between the populations of dogs in home country and Bosnia and Herzegovina. In the Serbian Hound, a significant statistical difference is observed between the genders in following parameters: the height at withers, the length of head and the length of skull. In the Serbian Tricolour Hound, the males observed to be higher than height interval from standard for this breed, while the females

remained in the values defined by standard. A very significant statistical differences between the genders were determined in all measured parameters for Serbian Tricolour Hound.

**KEY WORDS:** hounds, phenotypic measures, population, standard.

## **INTRODUCTION**

The name “Hounds” includes a group of hunting dogs that chase game following their scent trail. During the chase, these dogs sound out loud. According to Federation Cynologique Internationale (FCI) hound dogs are classified in:

<b>FCI group 6</b>	Scent hounds and related breeds
<b>Section 1</b>	Scent hounds
<b>Section 2</b>	Leash (scent) Hounds
<b>Subsection 1.1</b>	<i>Large-size Hounds</i>
<b>Subsection 1.2</b>	<i>Medium-size Hounds</i>
<b>Subsection 1.3</b>	<i>Small-size Hounds</i>
<b>Section 3</b>	Related breeds

(Federation Cynologique Internationale – FCI, 2019).

The Austrian Frank B. Laska (1905) conducted the first zootechnical examination on hounds from the territory of Serbia and Bosnia and Herzegovina. The measurements were performed on 1036 hounds. According to the author, the Balkans are the nursery of hounds, that is, the hounds from the Balkans were the basis for creation many breeds of hounds on the West. (Urosevic, 2006).

Hounds from the Balkans are medium-size hounds (section 2, subsection 1.2). The total of seven breeds from the Balkans are recognized by FCI: Bosnian Broken-haired Hound called Barak from From Bosnia and Herzegovina, Serbian Hound and Serbian Tricolour Hound from Serbia, Montenegrin Mountain Hound from Montenegro and from Croatia Istrian Short-haired Hound, Istrian Wire-haired Hound and Posavatz Hound. In addition to these standardized forms and officially recognized breeds in canine world, there is a population of dogs in Serbia, named Serbian Yellow Hound, that still has not been officially recognized by FCI. (Drobnjak, 2009). Along with indigenous hound breed Barak, a large number of hounds used in hunting in Bosnia and Herzegovina belongs to breeds Serbian Hound, Serbian Tricolour Hound and Posavatz Hound.

Serbian Hound is described by FCI-Standard N°150, and Serbian Tricolour Hound by FCI-Standard N°229. The standardization of these breeds began in 1924, when PhD Ivan Lovrencic in Ljubljana, Slovenia gave the first proposal of standard for the Balkan hound. The breed named the Balkans Scent Hound was recognized by Federation Cynologique Internationale (FCI) in 1948. Despite the suggestions to change the name of the breed, it was done just in 1996, since when the name of the breed is the Serbian Hound. Beside Serbian Hound, the Serbian Tricolour Hound is standardized in 1961, then called Yugoslav Tricolour Hound. (Urosevic, 2006). The current standard for the Serbian Hound states that the height at withers for males is 45-56 cm (ideal height 51-52 cm), while for females 44-54 cm (ideal height 48-49 cm). Important proportions suggests the length of body should exceed the height at withers by 10%, and the girth of chest should be 20% more than height at withers. The standard for the Serbian Tricolour Hound propose the height at withers for males range 45-55 cm (ideal 51 cm), while in females range from 44 to 54 cm (ideal 49 cm). The length of body should be 10% more than the height at withers and the length of head corresponds to 45% of height at withers.

The morphometric characteristics of Serbian Hound, Serbian Tricolour Hound and Serbian Yellow Hound has been the subject of research on several occasions in Serbia. Based on research in 1954, the first study of the Serbian Hound was published. Average height at withers for females was 47.29 cm. The length of body was 52.72 cm on average, and the length of head averages at 19.72 cm. Average height at withers for males was 50.16 cm, the length of body 56.18 cm, and the length of head 20.98 cm (Pavlovic, S. & Antic, S., 1954).

The next study of morphometric characteristics of Serbian Hound and Serbian Tricolour Hound was done in 1988. The study found that the average height of male Serbian Hound, then Balkans Hound, was 50.70 cm, the length of body 56.20 cm, and the length of head was 22,90 cm. For females, the average height at withers was 47.90 cm, the length of body 52.80 cm, and the length of head 21.60 cm. For the Serbian Tricolour Hound, average height at withers for males was 51,10 cm, the length of body 56.20 cm, while the length of head was 22.50 cm. Females of this breed had average height at withers at 48.60 cm, the length of body 53.70 cm, and the length of head 21.50 cm (Urosevic at al. 1988). These studies was used for the latest changes to the standard for the breeds in 2002 and 2003.

So far, the population of these breeds in Bosnia and Herzegovina has not been the subject of research. The aim of this paper is to describe basic morphometric parameters of Serbian Hound and Serbian Tricolour Hound from Bosnia and Herzegovina, to determine whether the

obtained values meets the values defined by Standards for these breeds, and is there any significant difference between the populations of dogs in Serbia and Bosnia and Herzegovina.

## **MATERIALS AND METHODS**

The study involved 38 dogs, including 20 Serbian Hounds (11 males and 9 females), and 18 Serbian Tricolour Hounds (10 males and 8 females). All dogs were aged one to six years, and had the pedigree issued by appropriate canine organization. The research was conducted on following locations: Banja Luka, Prijedor, Kotor Varos, Kljuc and Gradiska.

The following parameters were measured on each dog: the height at withers, the body length, the length of head, the length of skull, the length of muzzle, and the girth of chest. The measurements were performed using Litin rod, moving scale with nonius and the tape.

Descriptive statistic values were calculated: coefficient of variation (CV), standard error (Sg), standard deviation (SD), minimum value (MIN), maximum value (MAX) and mean ( $\bar{x}$ ). Using the t-test, the statistical significance of the difference was calculated in measured parameters between genders and between breeds. Software *Statistical Package for the Social Sciences (SPSS) for Windows Release 17.0.0* was used to process collected data.

The following relative ratios of body development – indices, were calculated: body format index (body length / height at withers  $\times$  100), head length index (head length / height at withers  $\times$  100), skull length index (skull length / head length  $\times$  100), muzzle length index (muzzle length / head length  $\times$  100), massiveness index (girth of chest / height at withers  $\times$  100) (Urosevic & Drobnjak, 2019).

## **RESULTS AND DISCUSSION**

In population of the Serbian Hound males in Bosnia and Herzegovina, the average height at withers is 50.36 cm with standard deviation of 2.19. The height of males varies from 47.00 to 53.50 cm. In Serbian Hound females, the average height is  $47.44 \pm 1.57$  cm and the variation interval is 45.00 to 50.00 cm. In both male and female of the Serbian Hound, the height variation interval is within standard values, and no variation in height were recorded in previous studies for this breed. A significant statistical difference ( $P < 0.001$ ) for this parameter is determined between males and females of the Serbian Hound. The male of Serbian Tricolour Hound has an average height of  $53.70 \pm 2.49$  cm, standard error 0.78, and variation interval from 49.00 to 57.00 cm. The females of this breed has the average height at withers of 48.88 cm with standard deviation of 2.24, and variation interval from 45.50 to

52.00 cm. It is noticeable that the examined males of Serbian Tricolour Hounds are higher than standard defined interval, while the females remain in standard values. A very significant statistical difference ( $P < 0.0001$ ) for this parameter is determined between males and females of the Serbian Tricolour Hound. Comparing the statistical difference of the height at withers between breeds in males, a significant statistical difference is observed ( $P < 0.001$ ), while in females there was no statistical difference in height between these two breeds.

Table 1. Descriptive statistical values of the Serbian Hound (SH) and Serbian Tricolour Hound (STH)

Parameter	Breed	Sex	N	$\bar{x} \pm SD$	CV	Sg	MIN	MAX	P ♂/♀	P SH/STH
Height at withers	SH	♂	11	50.36±2.19	4.35	0.66	47.00	53.50	0.0036**	0.0041**
		♀	9	47.44±1.57	3.31	0.52	45.00	50.00		
	STH	♂	10	53.70±2.49	4.65	0.78	49.00	57.00	0.0006***	0.1453 <sup>ns</sup>
		♀	8	48.88±2.24	4.60	0.79	45.50	52.00		
Body length	SH	♂	11	58.59±2.97	5.07	0.89	53.00	62.50	0.0606 <sup>ns</sup>	0.3689 <sup>ns</sup>
		♀	9	55.78±3.30	5.93	1.03	50.00	59.00		
	STH	♂	10	59.90±3.54	5.91	1.12	51.00	64.00	0.0325*	0.7957 <sup>ns</sup>
		♀	8	56.19±3.07	5.46	1.08	49.50	59.00		
Head length	SH	♂	11	23.18±1.47	6.35	0.44	21.00	25.00	0.0065**	0.0892 <sup>ns</sup>
		♀	9	21.33±1.14	5.37	0.38	19.50	23.00		
	STH	♂	10	24.40±1.64	6.75	0.52	21.00	27.00	0.0002***	0.7113 <sup>ns</sup>
		♀	8	21.13±1.12	5.33	0.39	20.00	23.00		
Skull length	SH	♂	11	12.73±0.90	7.11	0.27	11.00	14.00	0.0065**	0.2773 <sup>ns</sup>
		♀	9	11.56±0.76	6.65	0.25	10.00	12.50		
	STH	♂	10	13.20±1.03	7.82	0.32	11.00	15.00	0.0038**	0.5968 <sup>ns</sup>
		♀	8	11.75±0.70	6.02	0.25	11.00	13.00		
Muzzle length	SH	♂	11	10.45±0.82	7.85	0.24	9.00	12.00	0.0675 <sup>ns</sup>	0.0294*
		♀	9	9.77±0.71	7.28	0.23	9.00	11.00		
	STH	♂	10	11.30±0.82	7.29	0.26	10.00	12.00	0.0001***	0.2722 <sup>ns</sup>
		♀	8	9.37±0.74	7.94	0.26	8.00	10.00		
Girth of chest	SH	♂	11	60.09±4.01	6.68	1.20	54.00	68.00	0.0399 <sup>ns</sup>	0.2227 <sup>ns</sup>
		♀	9	56.67±2.55	4.50	0.84	52.00	60.00		
	STH	♂	10	62.20±3.61	5.81	1.14	53.00	66.00	0.0001***	0.0506 <sup>ns</sup>
		♀	8	54.00±2.61	4.85	0.92	50.00	58.00		

The body length of the Serbian Hound male is in the range from 53.00 to 62.50 cm. Average body length is 58.59 cm with standard deviation of 2.97 and coefficient of variation 5.07%. Body format index of male is from 112 to 116, which means that the body is 12-16% longer than height at withers. In Serbian Hound females, the average body length is  $55.78 \pm 3.30$  cm and the variation interval is 50.00 to 59.00 cm. Body format index of female is from 106 to 110, which means that the body is 6-10% longer than height at withers. Standard for this breed recommends the body should be 10% longer than height at withers. Females of the Serbian Hound in this population have a body within standard values. In males, the situation is somewhat different since there are individuals in the population whose body is 16% longer than the height at withers, which is not a characteristic of this breed. There is no statistically significant difference in body length between the genders of this breed. The body length of the Serbian Tricolour Hound male averages at  $59.90 \pm 3.54$  cm with variation interval from 51.00 to 64.00 cm. Females of this breed have the body length of 56.19 cm with standard deviation of 3.07. Variation interval for females is from 49.50 to 59.00 cm with coefficient of variation of 5.46%. Body format index for males is from 104 to 112, and for females 108 to 113. This breed also requires standard body length of 10% more than height at withers. It can be said that the dogs of this breed are in this interval, although there are males whose body is only 4% longer than height. Between the genders of this race, a statistical significance of body length is determined ( $P < 0.05$ ). When looking at statistical significance between the breeds by genders, there is no statistically significant differences in body length between the males nor females.

Males of Serbian Hound have a head length of 21.00 to 25.00 cm, with coefficient of variation of 6.35%. The average head length is 23.18 cm with standard deviation of 1.47, and it is higher than in studies from previous authors (Pavlovic & Antic, 1954; Urosevic et al. 1988). Females of this breed have the average head length of 21.33 cm with standard deviation of 1.14. Females also show slight increase in head length, just as males, compared to previous studies. A significant statistical difference in head length ( $P < 0.001$ ) was noted between the genders of this breed.

The index of length for males is from 44 to 46, and for females from 43 to 46. It means that males have head 44-46% of the height at withers, and females 43-46% of the height at withers. Although the slight increase in head length in both males and females is observed, it did not significantly affect body proportions, so the dogs of this breed remain in standard proportion of head length as 45% of height at withers. In the male population of Serbian

Tricolour Hound, the average head length is 24.40 cm with standard deviation of 1.64. Variation interval for males is 21-27 cm. Females of Serbian Tricolour Hound have the average head length of  $21.13 \pm 1.12$  and variation interval from 20.00 to 23.00 cm. The index of length for males of this breed is from 42 to 47, and for females from 43 to 44. The standard for Serbian Tricolour Hound suggests that the head length should be 45% of the height at withers. In males it is noticeable that the interval of head length index is quite large, which is not desirable feature. The situation is better at females, but one can see that the head length is slightly shorter than standard value. A very high statistical significance ( $P < 0.0001$ ) at head length was observed between the genders of Serbian Tricolour Hound. Comparing this parameter between the breeds, there was no statistically significant difference.

The average skull length for Serbian Hound males is 12.73 cm with standard deviation of 0.90. Variation interval for skull length is from 11.00 to 14.00 cm. For female individuals, the skull length varies from 10.00 to 12.50 cm with average at  $11.56 \pm 0.76$ . The average skull length for Serbian Tricolour Hound males is 13.20 cm with standard deviation of 1.03. Variation interval for skull length is from 11.00 to 15.00 cm. Females of Serbian Tricolour Hound have the skull length 11.75 cm on average with standard deviation of 0.70 and variation interval from 11.00 to 13.00 cm. There is a significant statistical difference ( $P < 0.001$ ) between the genders in both breeds.

The muzzle length for males of Serbian Hound varies from 9.00 to 12.00 cm with average length of 10.45 cm and standard deviation of 0.82. Females have the muzzle length  $9.77 \pm 0.71$  on average, with variation interval from 9.00 to 11.00 cm and coefficient of variation of 7.28%. The muzzle length for males of Serbian Tricolour Hound varies from 10.00 to 12.00 cm with average length of 11.30 cm and standard deviation of 0.82. Females have the muzzle length  $9.37 \pm 0.74$  on average, with variation interval from 8.00 to 10.00 cm and coefficient of variation of 7.94%. No statistically significant difference in muzzle length is observed between the genders of Serbian Hound, unlike the Serbian Tricolour Hound, where there is very significant statistical difference between the genders for this parameter. The skull length index for Serbian Hound is 54 for both males and females, while the muzzle length index is 45 for both genders as well. It means that the muzzle length is slightly shorter than the skull, which is in accordance with standard defined values for this breed. The ratio between cranial and facial part of the head for Serbian Tricolour Hound males is 54:46, and for females 55:45. Just like the Serbian Hound, the ratio of cranial and facial part of the head for Serbian Tricolour Hound is in standard proposed values. There is no statistical significance difference

in skull length between the breeds. There is a statistically significant difference ( $P < 0.05$ ) in muzzle length between the males of these two breeds, while there is no statistically significant difference in the length of muzzle between the females.

The girth of chest for Serbian Hound males is 60.09 cm on average, with standard deviation of 4.01. Minimum value of girth of chest for males is 54.00 cm, and maximum is 68.00 cm. For females, the minimum value is 52.00 cm, and maximum 60.00 cm, with average value of  $56.67 \pm 2.25$ . Average value of girth of chest for Serbian Tricolour Hound males is 62.20 cm with standard deviation of 3.61, and coefficient of variation 5.81%. Female individuals of Serbian Tricolour Hound have the girth of chest which varies from 50.00 cm to 58.00 cm, with average value of  $54.00 \pm 2.61$ . There was no statistically significant difference in girth of chest between the genders of Serbian Hound, while the statistical difference between the genders of Serbian Tricolour Hound was very significant ( $P < 0.0001$ ). The massiveness index of Serbian Hound is 119, for both males and females, which means that the girth of chest is 19% bigger than the height at withers. The standard for this breed propose that the girth of chest should be 20% bigger than height at withers, so it can be said that the individuals from this population are approximately in the standard values for this parameter. As for Serbian Tricolour Hound, the massiveness index is 115 for males, and 110 for females. There is no statistically significant difference for this parameter between the breeds.

## **CONCLUSIONS**

Based on the results obtained from this research, it can be concluded that the Serbian Hound does not have large deviations from the values defined by standard for this breed, nor the differences between the populations of dogs in home country and Bosnia and Herzegovina. In the Serbian Hound, a significant statistical difference is observed between the genders in the following parameters: the height at withers, the length of head and the length of skull. In the Serbian Tricolour Hound, the males observed to be higher than height interval from standard for this breed, while the females remained in the values defined by standard. A very significant statistical differences between the genders were determined in all measured parameters for Serbian Tricolour Hound. Statistical significance between the breeds were determined in two parameters, and only in male individuals.

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