

## VARIABILITY OF BASIC MORPHOMETRIC PARAMETERS IN POSAVATZ HOUNDS IN SERBIA

UROŠEVIĆ Milivoje<sup>1</sup>, MATEJEVIĆ Milosava<sup>2\*</sup>, DROBNJAK Darko<sup>1</sup>

<sup>1</sup>Center for the Preservation of Indigenous Breeds, Belgrade, Serbia

<sup>2</sup>Faculty of Science, University of Novi Sad, Novi Sad, Serbia

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### Abstract:

*Introduction.* By the number of litters and puppies per year, the Posavatz hound is the second most common hound breed in Serbia. This hound is intensively used for hunting in Serbia, since these dogs show very good working characteristics. The aim of this study was to determine the extent to which the external characteristics of the population in Serbia meet the norms prescribed by the official standard for the breed.

*Materials and Methods.* A total of 251 Posavatz hounds, i.e. 134 adult males and 117 adult females, were included in a morphometric evaluation of the population sub-sample during 2017 and 2018. The basic parameters of height at the withers, body length, chest circumference and head length were measured. The variability of the results obtained was statistically analyzed by Student's t-test for distribution of the frequencies, while the heterogeneity/homogeneity of the evaluated morphometric parameters within the Posavatz breed was estimated by coefficient of variation.

*Results and Conclusions.* The results showed the studied Posavatz hounds in Serbia are characterized by a proper rectangular body shape. However, the average body height tended to be too low, i.e. more towards the lower limit of the prescribed height at the withers. The morphometric deviations established when comparing the Posavatz hound population in Serbia with the standard for the breed should enlighten the guidelines for sound selective breeding of the Posavatz hound by contributing to decision making by

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\*Corresponding author – e-mail: milosava@dgt.uns.ac.rs

breeders and expert commissions of canine organizations. Overall, this should allow healthy breeding and welfare maintenance throughout generations for this hound breed.

**Keywords:** body size, dog breed, hounds, morphometric, Posavatz hound

## INTRODUCTION

The Posavatz hound is an old breed of scent hound, and is a hunting breed that remains very popular among hunters in Serbia. In fact, research showed that the Posavatz hound is the second most common breed among hounds in Serbia (Matejevic, 2017). According to the Fédération Cynologique Internationale (FCI) Breed Standard (2014), this breed has a strong hound body and is medium sized with balanced movements. The coat is short, harsh, dense, shiny, lies close to the body and has a characteristic red-wheaten color that comes in all shades. Posavatz hounds have excellent strength, especially suited to hunting hare, fox and boar. According to the FCI, as one of the biggest global canine organizations, this breed descends from the type called Illirichen Hound of Red Colour. The Posavatz hound breed originated in Croatia. The latest valid official FCI standard was published in 2014 under number 154. In the available literature, there are few data on the morphological characteristics of the Posavatz hound.

The morphological characteristics of Serbian indigenous hounds were studied by Urošević et al. (1988). These studies have shown that the average withers height and body length of male and female Serbian hounds tends to be the ideal size as proposed by the official FCI standard. Later research on basic external body parameters of the Posavatz population in Serbia showed similar results (Drobnjak, Urošević, 2011). The same research also included a population subsample of Serbian tricolor hounds. The body size of the Serbian tricolor hound was very similar to the ideal size defined by standard. However, in the females, the average height at the withers tends to be more at the lower limit of the standard specified for height at the withers. For both these breeds, a low coefficient of variability was found for both sexes, indicating that the population is relatively stable in terms of these morphological characteristics. The Serbian yellow hound, a non-standardized Serbian hound breed, is very similar to the Posavatz hound in terms of coat color. Research on the Serbian yellow hound in Serbia showed this breed has a rectangular body shape. The average height at the withers of males is 44.50 cm, the body length is 55.00 cm and the head length is 22.00 cm. In female Serbian yellow hounds, the average height at the withers is 43.00 cm, the body length is 49.00 cm and the head length is 20.00 cm (Urošević et al., 2009). Urošević et al. (2014, 2014a) also studied the morphometric characteristics of the Bulgarian hound, which is a non-standardized Bulgarian hound breed.

The aim of this study was to determine the basic morphometric characteristics of a representative Posavatz hound population in Serbia, in order to find if and by how much the characteristics of this population deviate from those set by the official FCI

standard. The results of this research should give some important guidance for further breeding to all Posavatz hound breeders in Serbia and other countries.

## **MATERIALS AND METHODS**

A total of four morphometric parameters (height at the withers, body length, chest circumference and head length), following Urosevic et al. (1988), were measured in a population of 134 Posavatz male hounds and 117 Posavatz female hounds. All study dogs were registered in the breed book kept by the Kennel Association of the Republic of Serbia. These measurements were obtained during 2016 and 2017, in a completely random manner.

A Lydthin measurement stick was used to measure the height at the withers. For the other parameters, a tape measure was used. Conformation was based on the mean and standard deviation of the four morphometric parameters studied. Then, Student's t-test was applied to determine whether there were statistically significant differences among the individual characteristics and the sexes within the breed. Using coefficients of variation enabled the conformation variability of the study animals to be tested, to establish the degree of heterogeneity/homogeneity. Collected data were processed using the Statistical Package for Social Sciences (SPSS) for Windows Release 17.0.0 software.

## **RESULTS AND DISCUSSION**

The official FCI standard (FCI, 2014) prepared by Croatia prescribes the preferred height at the withers for Posavatz hounds of 50 cm to 56 cm in males, and in females of 47 cm to 53 cm, with tolerances of 2 cm above and below the preferred height. However, the standard notes that a difference of 2 cm above and below the prescribed height can be tolerated only in individuals with other body characteristics that are of excellent quality. Table 1 shows the frequency distributions of the height at the withers in males and females.

The results in Table 1 show that in the observed male population, 21.64% of hounds were below the preferred height. The majority of Posavatz hound males (78.35%) conformed to the desired height determined by the official standard. Only 2.98% of the male hound population did not satisfy the minimum height standard. The official standard (FCI, 2014) requires that the minimum height at the withers in females is 47.00 cm. Altogether, 20 females (17.1%) in our sub-population were below this preferred height standard. The upper height limit for females prescribed by the standard is 53 cm. In the observed population of 117 females, only one female was of maximum preferred height, and three females (2.61%) were above the maximum prescribed height. Most females (80.33%) conformed to the height determined by the official standard (47 cm to 53 cm). If the tolerance level of +/- 2 cm is considered, then the

situation is considerably more favorable. However, the body's structural harmony can be perceived only when body length is determined.

**Table 1.** Height at the withers and body length frequencies in Posavatz hounds in Serbia

Height at the withers – male (cm)			Height at the withers – female (cm)			Body length – male (cm)			Body length – female (cm)		
n	%		n	%		n	%		n	%	
2	1.49	46	3	2.56	44	1	0.75	50	1	0.85	48
2	1.49	47	1	0.87	45	4	2.98	51	4	3.42	49
14	10.45	48	16	13.67	46	6	4.48	52	6	5.13	50
11	8.21	49	18	15.38	47	8	5.97	53	9	7.69	51
32	23.88	50	26	22.22	48	18	13.43	54	17	14.53	52
24	17.91	51	14	11.96	49	19	14.18	55	19	16.24	53
24	17.91	52	27	23.08	50	23	17.16	56	22	18.80	54
13	9.70	53	4	3.42	51	24	17.91	57	19	16.24	55
3	2.24	54	4	3.42	52	12	8.95	58	11	9.40	56
4	2.98	55	1	0.87	53	6	4.48	59	3	2.56	57
5	3.73	56	1	0.87	55	7	5.22	60	1	0.85	58
			1	0.87	56	1	0.75	61	1	0.85	59
			1	0.87	59	2	0.74	62	2	1.71	60
						3	2.23	63	1	0.85	61

All hound breeds have an elongated body, which means the length of the body is greater than the height at the withers. The results in Table 1 clearly show the majority of males (71.63%) had body lengths of 54 to 58 cm. The body length of female hounds in the studied population varied widely. The majority of females (75.21%) had body lengths of 52 cm to 56 cm. Only 7.67% of females had a body length greater than 56 cm.

Chest circumference is a very significant external parameter. The frequency distribution of chest circumference in our sub-population of Posavatz hounds is given in Table 2.

The chest circumference, in addition to the genetic disposition, largely depends on the conditions in which dogs develop from their earliest days. A large interval for the chest circumference can be the result of insufficient care during the development of young dogs. However, despite a wide range of chest circumferences in our Posavatz hounds, the results could still be grouped. Thus, it is noticeable that the majority of males (67.91%) had a chest circumference of 58.00 cm to 62.00 cm. Similar results were found for females, which also showed a wide variation of chest circumference, indicating uneven and insufficiently high quality breeding conditions. However, genetic predisposition has an important influence on the shape and depth of the chest.

**Table 2.** Chest circumference frequencies in Posavatz hounds in Serbia

Chest circumference – males (cm)	n	%	Chest circumference – females (cm)	n	%
49	1	0.75	48	1	0.85
53	1	0.75	49	1	0.85
54	1	0.75	50	2	1.71
55	2	1.49	51	2	1.71
56	3	2.24	52	2	1.71
57	3	2.24	53	3	2.56
58	25	18.66	54	10	8.55
59	14	10.45	55	7	5.98
60	31	23.13	56	12	10.26
61	8	5.97	57	13	11.11
62	13	9.70	58	23	19.66
63	3	2.24	59	9	7.69
64	15	11.19	60	10	8.55
65	6	4.48	61	6	5.13
66	3	2.24			
67	3	2.24			
69	1	0.75			
72	1	0.75			

One of the basic characteristics of a particular dog breed is the head. When evaluating the exterior of every dog, including Posavatz hounds, special attention must be paid to evaluating the head.

**Table 3.** Head length frequencies in Posavatz hounds in Serbia

Head length – males (cm)	n	%	Head length – females (cm)	n	%
20	3	2.24	18	4	3.42
21	17	12.69	19	3	2.56
22	42	31.34	20	15	12.82
23	39	29.10	21	29	24.78
24	30	22.39	22	34	29.06
25	2	1.49	23	20	17.09
26	1	0.75	24	11	9.40
			25	1	0.85

Table 3 shows that only 2.24% of our male sub-population hounds had a rather small head length of 20 cm, and the same percentage (2.24%) had a head length greater than 24 cm, so slightly longer. In the female Posavatz hounds, head length ranged from 18 cm to 25 cm, so the females had a slightly shorter heads than males. Among female Posavatz hounds, 3.42% had the smallest head length (18 cm), and the most frequent head length was 22 cm (in 29.06% of female hounds).

After analyzing the absolute values of the basic external parameters, a complete exterior image can be considered only after further statistical analysis of the observed parameters.

**Table 4.** Descriptive statistics for morphometric variables in male and female Posavatz hounds

Morphometric parameters	Sex	n	Min	Max	CV	Sg	± SD	T
Height at the withers	Male	134	46.00	56.00	4.08	0.18	50.90±2.07	0.0001***
	Female	116	44.00	54.00	4.65	0.20	48.54±2.25	
Body length	Male	134	50.00	67.00	4.80	0.23	56.06±2.69	0.0001***
	Female	116	48.00	64.00	4.72	0.23	53.65±2.53	
Chest circumference	Male	134	49.00	72.00	5.28	0.27	60.55±3.19	0.0001***
	Female	116	48.00	67.00	6.02	0.32	57.66±3.47	
Head length	Male	134	20.00	26.00	4.95	0.09	22.64±1.12	0.0001***
	Female	116	18.00	25.00	6.68	0.13	21.68±1.44	

\*\*\* Very high statistical significance

An average-sized male among our studied Posavatz hounds in Serbia was 50.9 cm high at the withers with body length of 56.06 cm, and chest circumference of 60.55 cm. Average head length in males was 22.64 cm. These results show there is a problem in achieving the breeding goals in the population of this breed in Serbia. The males were at the extreme lower limit of desirable height (i.e. height at the withers), which breeders should keep in mind when planning future litters. Compared to other hound breeds from the region (Urošević et al., 1988; Drobnjak, Urošević, 2011), a significant percentage (20%) of Posavatz hounds had a height at the withers below the preferred standard value. The females were, on average, also slightly shorter than the prescribed standard, which is also characteristic of female Serbian tricolor hounds (Drobnjak, Urošević, 2011). About 16% of the female Posavatz hounds were below the desirable height and about 2% were above it. An average-sized female among our studied Posavatz hounds in Serbia was 48.54 cm high at the withers, with body length of 53.65 cm and chest circumference of 57.66 cm. Average head length in females was 21.68 cm.

Based on t-test results (Table 5), there is a very high degree of statistical significance of differences among the observed basic morphometric parameters, between males and females. This confirms that the expected sexual dimorphism is distinctly expressed. In

addition, the coefficient of variation (CV) is at a relatively low level, which shows the observed morphological parameters in the observed sub-population were uniform.

**Table 5.** Correlations

		Height at the withers (male)	Body length (male)	Chest circumference (male)	Head length (male)
Height at the withers (male)	Pearson Correlation	1	.855**	.623**	.494**
	Sig. (2-tailed)		.000	.000	.000
	N	134	134	134	134
Body length (male)	Pearson Correlation	.855**	1	.590**	.332**
	Sig. (2-tailed)	.000		.000	.000
	N	134	134	134	134
Chest circumference (male)	Pearson Correlation	.623**	.590**	1	.423**
	Sig. (2-tailed)	.000	.000		.000
	N	134	134	134	134
Head length (male)	Pearson Correlation	.494**	.332**	.423**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	134	134	134	134

\*\* . Correlation is significant at the 0.01 level (2-tailed).

		Height at the withers (female)	Body length (female)	Chest circumference (female)	Head length (female)
Height at the withers (female)	Pearson Correlation	1	.822**	.587**	.312**
	Sig. (2-tailed)		.000	.000	.001
	N	116	116	116	116
Body length (female)	Pearson Correlation	.822**	1	.524**	.292**
	Sig. (2-tailed)	.000		.000	.001
	N	116	116	116	116
Chest circumference (female)	Pearson Correlation	.587**	.524**	1	.345**
	Sig. (2-tailed)	.000	.000		.000
	N	116	116	116	116
Head length (female)	Pearson Correlation	.312**	.292**	.345**	1
	Sig. (2-tailed)	.001	.001	.000	
	N	116	116	116	116

\*\* . Correlation is significant at the 0.01 level (2-tailed).

The results in Table 6 show the frame index satisfies the basic biostatic characteristics. The body length in both males and females was greater than the height at the withers. However, individuals with large differences between body length and height at the withers were observed. Among these individual hounds, some males had a frame

index of 119, and that of some females was 118. In practice, this means the body was 19% and 18% longer than it was high, in males and females, respectively.

**Table 6.** Basic conformation indexes in Posavatz hounds in Serbia

Parameter	Male		Female			
	Min	Max	Min	Max		
Frame index	110	108	119	110	108	118
Mass index	118	106	128	119	109	124
Head index	44	43	46	44	40	46

## CONCLUSION

All hounds must have a body in the form of a rectangle – the body length is greater than the height at the withers. This is a basic biostatic model that allows a proper biokinetic effect during movement. The movement of hounds is at a uniform pace and must be durable. The reach is substantial with a strong drive. As the official standard points out, the movement has to be harmonious, and during movement, the back is preferably steady, while the limbs must not cross over.

This research has shown Posavatz hounds in Serbia are characterized by a proper rectangular body shape. However, the results show both male and female Posavatz hounds are, by height, at the lower limit of the preferred standard height. Posavatz hound breeders in Serbia must make special efforts to produce standard dogs. Height at the withers has proven to be the biggest problem for males, and breeders need to work systematically in order to improve this. Body length and body format generally correspond to current average heights. These results should be important guidelines for cytological workers, dog judges and Posavatz hound breeders in Serbia. Determining the current status of the hound population and setting realistic breeding objectives is required to improve the characteristics of the Posavatz hound population throughout the country.

### Author contribution

The authors UM and DD were engaged in measuring exterior parameters in all individuals (the height at the withers, the body length, the chest circumference and the length of the head). MM and UM were engaged in data processing, statistical data analysis, interpretation of results etc.

### Competing interest

The authors declare no competing interests (financial, general or institutional competing interests). The corresponding author confirms on behalf of all authors



that there have been no involvements that might raise the question of bias in the work reported or in conclusions, implications, or opinions stated.

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## MORFOMETRIJSKE KARAKTERISTIKE POPULACIJE POSAVSKIH GONIČA U SRBIJI

UROŠEVIĆ Milivoje, MATEJEVIĆ Milosava, DROBNJAK Darko

### Kratka sadržaj

*Uvod.* Po broju registrovanih legla i štenadi na godišnjem nivou posavski gonič predstavlja drugu rasu među goničima u Srbiji. Intenzivno se koristi u lovu u Srbiji, s obzirom da psi ove rase imaju vrlo dobre radne osobine. Cilj ovog rada je utvrditi u kojoj meri eksterijerne karakteristike populacije u Srbiji ispunjavaju norme propisane zvaničnim standardom pasmine.

*Materijal i metode.* U okviru ovog istraživanja, na uzorku od 251 posavskih goniča (134 odraslih mužjaka i 117 odraslih ženki) izvršeno je merenje morfometrijskih parametara, tokom 2017. i 2018. godine. Izmereni su osnovni parametri: visina grebena, dužina tela, obim grudi i dužina glave. Varijabilnost dobijenih rezultata statistički je analizirana

T-testom, dok je heterogenost ili homogenost merenih morfometrijskih parametara procenjena na osnovu koeficijenta varijacije.

*Rezultati i zaključak.* Rezultati su pokazali da populaciju posavskog goniča u Srbiji karakteriše pravilan pravougaoni oblik tela. Međutim, prosečna visina grebena je na donjoj granici intervala vrednosti visine grebena koji je predviđen zvaničnim standardom rase. Morfometrijska odstupanja koja su utvrđena ovim istraživanjem mogu uticati na uzgoj posavskog goniča u Srbiji i aktivnosti odgajivača i kinoloških organizacija koje bi doprinele uzgoj zdravih jedinki i održavanju dobrobiti svih generacija ove pasmine.

**Ključne reči:** veličina tela, rasa pasa, goniči, morfometrijski parametri, posavski gonič