# THE AVERAGE VALUES AND THE VARIABILITY OF VARIOUS MORPHOLOGICAL CHARACTERS IN ADULT MARES THROUGHOUT GENEALOGICAL LINES OF THE HUTSUL BREED

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***Abstract***

*Knowing the phenotype and genotype parameters in the horse breed from Lucina horse farm represents a current problem if we take into account that such studies are few and the scientific foundation of genetic selection and improvement has to be based on the analysis of average values and the variability of morphological characters in this horse population. The present paper aims to study the phenotype parameters in the present-day type of the Hutsul horse. The study was conducted on a batch of 96 breeding mares which belong to the following genealogical lines: Hroby – 27, Goral – 21, Pietrosu – 24, Ouşor – 19, Prislop – 5. These mares were measured and the resulting data were analyzed statistically. Following the comparison of the variability degree of the analyzed characteristics it can be conferred that these have a low variability, the mare batches being uniform and with a good homogeneity on all the analyzed levels.*

**Key words:** Hutsul breed, measurements, mares, morphological characters.

## MATERIAL AND METHODS

The research has been conducted on the equine stock extant at Lucina horse farm, the biological material being studied from the perspective of genealogic structure and body development. The data which resulted from body measurements have been interpreted statistically calculating the statistical estimates for different morphological characters.

In order to define morphologically the Hutsul breed body measurements were done. The measurements were done using the regular zootechnical instruments: horse measuring stick, compasses and measure tape with the animal in the zootechnical position, standing on four feet.

## RESULTS AND DISCUSSIONS

Further on there are described the general morphological traits, the structural ones, those of size, of uprightness and gait.

In Tables 1 and 2 there are shown the different values of the morphological traits of adult mares from the five genealogical lines of the Hutsul breed.

The height at withers showcases the fact that throughout time this size has varied considerably, the variation being influenced by the applied growth

method. The research on this size characteristic has revealed the following outcomes: the Hroby strain mares display the average of this dimension of 138,850 ± 0,320 with variability limits ranging from 137 to 142 cm.

*Table 1*

Average values and variability of main body dimensions in breeding mares from Hutsul breed

| **Specification** | **N** | $\bar{X}$ | $s^2$ | **s** | $s_{\bar{X}}$ | **V%** |
|---|---|---|---|---|---|---|
| **Breeding mares** | | | | | | |
| Size | 96 | 138.920 | 2.037 | 1.427 | 0.145 | 1.026 |
| Croup height | 96 | 140.656 | 2.985 | 1.727 | 0.176 | 1.227 |
| Sloping length of the body | 96 | 146.552 | 3.049 | 1.746 | 0.178 | 1.191 |
| Head length | 96 | 55.468 | 2.776 | 1.666 | 0.170 | 3.000 |
| Neck length | 96 | 54.520 | 15.957 | 3.994 | 0.407 | 7.325 |
| Chest perimeter | 96 | 172.281 | 11.958 | 3.458 | 0.352 | 6.940 |
| Shinbone perimeter | 96 | 18.125 | 0.162 | 0.403 | 0.041 | 2.223 |
| Chest depth | 96 | 62.968 | 2.378 | 1.542 | 0.157 | 2.448 |
| Length of croup at hip point | 96 | 48.885 | 2.312 | 1.520 | 0.177 | 3.109 |
| Length of rear shinbone | 96 | 25.093 | 2.043 | 1.429 | 0.145 | 5.694 |
| Sub-sternal vaccum | 96 | 75.958 | 2.830 | 1.682 | 0.171 | 2.214 |
| Height at pisiform bone | 96 | 40.062 | 2.268 | 1.506 | 0.153 | 3.759 |
| Height at articulation | 96 | 51.947 | 2.184 | 1.478 | 0.950 | 2.845 |
| Croup length | 96 | 47.062 | 1.500 | 1.224 | 0.124 | 2.600 |

*Table 2*

Medium values and variability of the figure on genealogical lines in Hutsul horses

| **Nr crt.** | **Linia** | **N** | $\bar{X}$ | $s^2$ | **s** | $\pm s_x$ | **V%** |
|---|---|---|---|---|---|---|---|
| 1 | Hroby | 27 | 138,850 | 2,899 | 1,702 | 0,320 | 1,225 |
| 2 | Goral | 21 | 138,857 | 1,628 | 1,275 | 0,278 | 0,918 |
| 3 | Pietrosu | 24 | 139,291 | 1,519 | 1,232 | 0,251 | 0,884 |
| 4 | Ousor | 19 | 138,684 | 2,214 | 1,488 | 0,341 | 0,072 |
| 5 | Prislop | 5 | 138,800 | 1,200 | 1,095 | 0,489 | 0,788 |

Mares of the Goral line have a withers average height of 138,857 ± 0,251 cm with variability limits ranging from 136 to 142 cm.

The Prislop line has a size of 138,800 ± 0,489 cm with variability limits ranging from 137 to 142 cm.

The height at croup marks a decrease during the 1926-1927 followed by a steady and considerable increase. My personal research situates the average croup height at 140,656 ± 0,176 cm with variability limits ranging from 137 to 145 cm. In comparison to the withers height, the croup height is 1.636 bigger. The croup height analyzed along breed lines displays the following values:

*Table 3*

Medium values and variability of croup height

| Nr crt. | Linia | N | $\bar{X}$ | $s^2$ | s | $\pm s_x$ | V% |
|---|---|---|---|---|---|---|---|
| 1 | Hroby | 27 | 140,333 | 4,615 | 2,148 | 0,413 | 1,530 |
| 2 | Goral | 21 | 141,095 | 2,190 | 1,480 | 0,401 | 1,048 |
| 3 | Pietrosu | 24 | 141,041 | 2,475 | 1,573 | 0,321 | 1,115 |
| 4 | Ousor | 19 | 140,263 | 2,204 | 1,484 | 0,340 | 1,058 |
| 5 | Prislop | 5 | 140,200 | 2,200 | 1,483 | 0,663 | 1,057 |

The Hroby line has the average size of 140,333±0,413 cm with variability limits ranging between 137-145 cm.
The Goral line haa the average croup height of 141,095±0,401 cm, with variability limits ranging between 139-144 cm.
The Pietrosu line has the average croup height of 141,041±0,321 cm, with variability lines ranging between 138-144 cm.
The mares from the Ouşor line display for this dimension the average of 140,263±0,340 cm, with variability limits ranging between 136-142 cm.
The Prislop line has got the value of 140,200±0,663 cm, with variability lines ranging from 138-140 cm. Table 3 below shows that the highest value for the croup belongs to the Goral line and the lowest to the Prislop line.
The diagonal length of the body in breeding mares which was statistically interpreted is shown in table 1. By looking at tables 1 and 4 it can be noticed that the average of this dimension is of 146,552±0,178 cm with varibility limits ranging from 142 to 150 cm.
The biggest body length value belongs to the Pietrosu individuals (146,833±0,402 cm) and the smallest value comes from the Goral line individuals.
The length of the body varies the most with Hroby individuals, V%=2,053, and the least with individuals from the Prislop line (V%=0,778).
The croup length which was statistically analyzed is presented in Table 5. It can be seen from the table that the highest value belongs to the Goral line (47,190±0,286 cm) and the lowest to the Ouşor individuals (46,947±0,247 cm). For the Hroby, Pietrosu and Prislop lines it varies around 47 cm. The highest variation value belongs to the Pietrosu line, 3,410%, and the lowest to the Prislop line, 1,504%. In terms of breed line, the croup length has a value of 47,062±0,124 cm, with variability limits ranging from 46 to 52 cm (cf. Table 1).

*Table 4*

Medium values and variability of the oblique length of the body

| Linia | N | $\bar{X}$ | $s^2$ | s | $\pm s_x$ | V% |
|---|---|---|---|---|---|---|
| Hroby | 27 | 146,703 | 4,216 | 2,053 | 0,395 | 1,399 |
| Goral | 21 | 146,238 | 2,389 | 1,545 | 0,337 | 1,056 |
| Pietrosu | 24 | 146,833 | 1,833 | 1,970 | 0,402 | 1,341 |
| Ousor | 19 | 146,368 | 1,904 | 1,379 | 0,316 | 0,942 |
| Prislop | 5 | 146,400 | 1,300 | 1,140 | 0,509 | 0,778 |

*Table 5*

Medium values and variability of the croup length

| Nr crt. | Linia | N | $\bar{X}$ | $s^2$ | s | $\pm s_x$ | V% |
|---|---|---|---|---|---|---|---|
| 1 | Hroby | 27 | 47,000 | 1,307 | 1,143 | 0,219 | 2,431 |
| 2 | Goral | 21 | 47,190 | 1,724 | 1,313 | 0,286 | 2,782 |
| 3 | Pietrosu | 24 | 47,125 | 2,585 | 1,607 | 0,328 | 3,410 |
| 4 | Ousor | 19 | 46,947 | 1,162 | 1,078 | 0,247 | 2,296 |
| 5 | Prislop | 5 | 47,000 | 0,500 | 0,707 | 0,316 | 1,504 |

The head length was measured in 1903 by A. Osowicki and had an average value of 58.20 cm the variation limits ranging from 55 to 61 cm. During the 1926-1927, *C. Wendling* found out the average of 53.60 cm with variability limits starting from 51 to 56.5 cm. Thus a decrease of 4.6 is recorded over a 25-year period.

Between 1950-1953, that is after another 25 years, this dimension increases with 1.4 cm, I. Radilescu finding the average of 55 cm with variability limits ranging from 51 to 58 cm. On the stock of mare which I analyzed in 2006, the average of the head length is of 55,468±0,170 cm, with variability limits ranging from 51 to 58 cm (cf. Table 1).

By comparison with studs, the mares have got a longer head with 0.326 cm. Looking at Table 6 one can notice that the longest value for the head size is to be found in the Ouşor line individuals (56,315±0,261 cm) and Prislop (56,200±0,411 cm), and the smallest value of this dimension belongs to the Goral individuals (54,142±0,325 cm).

*Table 6*

Medium values and variability of the of the head length

| Nr crt. | Linia | N | $\bar{X}$ | $s^2$ | s | $\pm s_x$ | V% |
|---|---|---|---|---|---|---|---|
| 1 | Hroby | 27 | 56,000 | 2,768 | 1,664 | 0,320 | 2,971 |
| 2 | Goral | 21 | 54,142 | 2,228 | 1,492 | 0,325 | 2,755 |
| 3 | Pietrosu | 24 | 55,208 | 2,519 | 1,587 | 0,324 | 2,874 |
| 4 | Ousor | 19 | 56,315 | 1,338 | 1,557 | 0,265 | 2,054 |
| 5 | Prislop | 5 | 56,200 | 0,850 | 0,921 | 0,411 | 1,638 |

The neck length has an average of 54,520±0,407 cm, with variability limits ranging from 47 to 63 cm. Analyzing Table 1, it can be noticed that the neck length is smaller with 0,948 cm than the head length.

*Table 7*

**Average values and variability of the neck length**

| Nr crt. | Linia | N | $\bar{X}$ | $s^2$ | s | $\pm s_x$ | V% |
|---|---|---|---|---|---|---|---|
| 1 | Hroby | 27 | 54,555 | 21,871 | 4,676 | 0,899 | 8,571 |
| 2 | Goral | 21 | 54,666 | 18,550 | 4,307 | 0,929 | 7,878 |
| 3 | Pietrosu | 24 | 54,708 | 14,128 | 3,758 | 0,767 | 6,869 |
| 4 | Ousor | 19 | 54,263 | 12,204 | 3,492 | 0,801 | 6,437 |
| 5 | Prislop | 5 | 53,800 | 5,200 | 2,280 | 1,019 | 4,237 |

Table 7 shows that the highest value of the neck length belongs to the Pietrosu line individuals (54,708±0,766 cm), while the lowest neck length belongs to the Prislop line individuals (53,800±1,019 cm). The variation value is very high, 7.325%, by comparison with the variation of the other body dimensions.

The chest perimeter value kept on increasing steadily starting from 166 cm in 1903 and reached 172, 281 cm in 2006. Only in 1926-1927 a visible decrease was recorded due to the infusion of Arab blood. The chest perimeter is shown statistically in Table 8. By studying the table it can be noticed that the highest chest perimeter value belongs to the Goral line (173±0,152 cm), and the lowest value belongs to the Prislop individuals (170±1,516 cm). The highest variation value belongs to the Goral line.

*Table 8*

Medium values and variability of the thorax perimeter

| Nr crt. | Linia | N | $\bar{X}$ | $s^2$ | s | $\pm s_x$ | V% |
|---|---|---|---|---|---|---|---|
| 1 | Hroby | 27 | 172,740 | 12,967 | 3,600 | 0,693 | 2,084 |
| 2 | Goral | 21 | 173,000 | 15,250 | 3,905 | 0,852 | 2,257 |
| 3 | Pietrosu | 24 | 171,625 | 8,591 | 2,931 | 0,598 | 1,707 |
| 4 | Ousor | 19 | 172,263 | 11,003 | 3,317 | 0,761 | 1,925 |
| 5 | Prislop | 5 | 170,000 | 11,500 | 3,391 | 1,526 | 1,994 |

The shinbone perimeter has continuously grown up to the present. It grew from 16.81 cm in 1903 to 18.125 cm in 2006.

The shinbone perimeter is statistically analyzed in Table 6.1. The average of this size is 18,125±0,041 cm, with variability limits going from 17 to 19 cm. By analyzing Table 9 one can notice that the largest perimeter belongs to the Ouşor line (18,236±0,078 cm) being followed by the Goral line (18,190±0,106 cm). The smallest value is present in the Prislop line (17,700±0,220 cm), which displays however the highest variation value (2,790 %).

The depth of the chest has an average of 62,968±0,157 cm with variability lines between 58 and 65 cm. Table 10 shows the statistical elements of the variability of chest depth. The Ouşor line has the highest value for chest depth (63,526±0,279 cm), being followed by the Goral line (63,476±0,124 cm). The lowest value for the chest depth is to be found in the Hroby line (62,259±0,381 cm), however this line displays the highest variation value (3,180%).

The width of the croup is presented statistically presented in Table 6.1. The analysis of the table shows that the croup width is larger than the croup length and varies around 49 cm. The highest variation value belongs to the Pietrosu line. The croup of the Hutsul horse resembles a square croup which is specific to the draft horse.

*Table 9*

Medium values and variability of the tibia perimeter

| Nr crt. | Linia | N | $\bar{X}$ | $s^2$ | s | $\pm s_x$ | V% |
|---|---|---|---|---|---|---|---|
| 1 | Hroby | 27 | 18,166 | 0,167 | 0,409 | 0,078 | 2,251 |
| 2 | Goral | 21 | 18,190 | 0,236 | 0,486 | 0,106 | 2,671 |
| 3 | Pietrosu | 24 | 17,958 | 0,084 | 0,290 | 0,069 | 1,614 |
| 4 | Ousor | 19 | 18,230 | 0,116 | 0,340 | 0,078 | 1,864 |
| 5 | Prislop | 5 | 17,700 | 0,245 | 0,494 | 0,220 | 2,790 |

*Table 10*

Medium values and variability of the thorax depth

| Nr crt. | Linia | N | $\bar{X}$ | $s^2$ | s | $\pm s_x$ | V% |
|---|---|---|---|---|---|---|---|
| 1 | Hroby | 27 | 62,259 | 3,921 | 1,980 | 0,381 | 3,180 |
| 2 | Goral | 21 | 63,476 | 1,061 | 1,030 | 0,224 | 1,622 |
| 3 | Pietrosu | 24 | 62,958 | 1,693 | 1,301 | 0,265 | 2,066 |
| 4 | Ousor | 19 | 63,526 | 1,484 | 1,218 | 0,279 | 1,917 |
| 5 | Prislop | 5 | 62,600 | 3,300 | 1,816 | 0,812 | 2,900 |

*Table 11*

Medium values and variability of the croup breadth

| Nr crt. | Linia | N | $\bar{X}$ | $s^2$ | s | $\pm s_x$ | V% |
|---|---|---|---|---|---|---|---|
| 1 | Hroby | 27 | 49,074 | 1,918 | 1,385 | 0,266 | 2,822 |
| 2 | Goral | 21 | 48,857 | 1,865 | 1,365 | 0,297 | 2,793 |
| 3 | Pietrosu | 24 | 49,000 | 3,826 | 1,956 | 0,399 | 3,991 |
| 4 | Ousor | 19 | 48,578 | 1,812 | 1,346 | 0,308 | 2,770 |
| 5 | Prislop | 5 | 48,600 | 2,300 | 1,516 | 0,677 | 3,119 |

The length of the rear shinbone has an average value of 25,093 ± 0,145 cm, with variation limits between 22 and 28 cm. Table 12 presents the statistical analysis of this size on genealogical lines.

The height at pisiforme bone has an average of 40,062±0,153 with variation limits ranging between 37 and 44 cm. Table 13 demonstrates that the Pietrosu line has the highest height value at the pisiforme bone (40,415±0,275 cm), and the lowest value belongs to the Ouşor line (39,789±0,363 cm). The highest variation value belongs to the Hroby line (4,497%).

The height at hind leg articulation point can be observed in Table 14. The analysis of the table demonstrates that the highest value for this size belongs to the Pietrosu line (52,250±0,283 cm), while the lowest value is to be found in the Prislop line. The biggest variation value belongs to the Hroby line (3,220%), and the smallest to the Prislop line (1,602%).

*Table 12*

Medium values and variability of the leght of the anterior tibia

| Nr crt. | Linia | N | $\bar{X}$ | $s^2$ | s | $\pm s_x$ | V% |
|---|---|---|---|---|---|---|---|
| 1 | Hroby | 27 | 25,222 | 2,640 | 1,624 | 0,312 | 6,438 |
| 2 | Goral | 21 | 25,142 | 1,865 | 1,365 | 0,323 | 5,429 |
| 3 | Pietrosu | 24 | 25,083 | 1,730 | 1,315 | 0,268 | 5,242 |
| 4 | Ousor | 19 | 24,947 | 2,162 | 1,470 | 0,337 | 5,892 |
| 5 | Prislop | 5 | 24,800 | 1,700 | 1,303 | 0,582 | 5,254 |

*Table 13*

Medium values and variability of the heigth of the pisiform

| Nr crt. | Linia | N | $\bar{X}$ | $s^2$ | s | $\pm s_x$ | V% |
|---|---|---|---|---|---|---|---|
| 1 | Hroby | 27 | 40,111 | 3,256 | 1,804 | 0,347 | 4,497 |
| 2 | Goral | 21 | 40,047 | 2,047 | 1,430 | 0,312 | 3,570 |
| 3 | Pietrosu | 24 | 40,416 | 1,818 | 1,348 | 0,275 | 3,335 |
| 4 | Ousor | 19 | 39,789 | 2,508 | 1,583 | 0,363 | 3,978 |
| 5 | Prislop | 5 | 40,000 | 1,500 | 1,224 | 0,547 | 3,060 |

*Tabelul 14*

Medium values and variability of the hock height

| Nr crt. | Linia | N | $\bar{X}$ | $s^2$ | s | $\pm s_x$ | V% |
|---|---|---|---|---|---|---|---|
| 1 | Hroby | 27 | 51,888 | 2,794 | 1,671 | 0,321 | 3,220 |
| 2 | Goral | 21 | 51,857 | 2,028 | 1,424 | 0,310 | 2,746 |
| 3 | Pietrosu | 24 | 52,250 | 1,934 | 1,390 | 0,283 | 2,660 |
| 4 | Ousor | 19 | 51,894 | 2,323 | 1,523 | 0,349 | 2,934 |
| 5 | Prislop | 5 | 51,800 | 0,690 | 0,830 | 0,371 | 1,602 |

The substernal void has a value of 75,958 ± 0,170 cm, with variation limits ranging from 71 to 80 cm. An analysis of Table 15 shows that the greatest substernal value belongs to the Hroby line (76,592 ± 0,366 cm), meaning that this line will have the least deep chest.

*Table 15*

Medium values and variability of the substernal void

| Nr crt. | Linia | N | $\bar{X}$ | $s^2$ | s | $\pm s_x$ | V% |
|---|---|---|---|---|---|---|---|
| 1 | Hroby | 27 | 76,592 | 3,634 | 1,906 | 0,366 | 2,488 |
| 2 | Goral | 21 | 75,380 | 1,147 | 1,071 | 0,233 | 1,420 |
| 3 | Pietrosu | 24 | 76,333 | 2,057 | 1,434 | 0,292 | 1,878 |
| 4 | Ousor | 19 | 75,157 | 3,149 | 1,774 | 0,407 | 2,360 |
| 5 | Prislop | 5 | 76,200 | 3,700 | 1,923 | 0,860 | 2,523 |

Following the comparison of the variability degree of analyzed characters it can be noticed that these have a smaller variability value, the mare bathches being uniform and displaying a good homogeneity in all researched lines.

**CONCLUSIONS**

1. The Hutsul horse from Lucina horse farm has been and continues to be reared as a clean breed, the only amelioration methods which are emplyed being the selection and guidance of mating for the purpose of body massification and to avoid consanguinity.
2. The main objective of the amelioration work, which was pursued since the establishment of the Lucina horse farm, has been and continues to be the massification of the Hutsul horse without losing its valuable traits of adjusting to the charactersitic life-conditions of the arid mountanous regions. This work of massification has been achieved within the permitted limits of hereditary conservation so common to the breed.
3. The biological material belonging to the Hutsul breed is being reared to a great extent under the influence of the natural conditions of the environment – height altitudes ranging between 800 and 1600 m characterized by low temperatures, heavy rain and prolonged cold seasons.
4. The natural environment conditions and the rearing system have conferred to the Hutsul breed a particular resistance to averse natural conditions and diseases, unpretensiousness in terms of feeding and up-keeping, increased

capacity for capitalizing on the fibrous plants and pastures, phisiological indicators with values which allow the animals to achieve superior production indicators in particular orographic conditions.

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