



Body measures and indexes of the Holstein horses reared in Križevci

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ABSTRACT

Breeding of the Holstein horses in Križevci started in 1980 by importing initial breeding material from domicile area in Germany. The aim of these studies was to establish body measures and indexes of the Holstein horses bred in Križevci, separately for stallions and mares fully grown. The investigation was carried out on forty grown-up animals that were measured with standard aids. The body indexes were calculated on the basis of the obtained values which will serve as initial values for the future Holstein breed follow-up in Croatia and its impact on breeding of the Croatian sport horse.

(Keywords: body measures, body indexes, horse breeding, Holstein horse, stud-farm)

INTRODUCTION

Breeding of the Holstein horse in Croatia started in 1980 by importing animals from a domicile area in Germany. The horses were imported by the stud-farm of the Križevci Agricultural Institute which later developed into the Centre for Horse Breeding and Equestrian Sport. The breeding was immediately spread into the country production on the territory of Croatia and Slovenia. In 1985 the Association of the Holstein Horse Breeders in Croatia was established and today there are about 300 Holstein horses in private breeding. In the period of 22 years of the Križevci Holstein horse breeding programme three generations of animals were obtained out of the initially imported material. The aim of this paper is to analyse body characteristics of the Holstein horses reared in Križevci after becoming fully grown-up. *Rastia et al.* (2000) investigated the correlation of withers height, chest volume and cannon bone circumference among different age groups of these horses, aged up to three years. Here are presented the results of our research.

MATERIALS AND METHODS

The object of the research are the Holstein horses reared at the stud-farm in Križevci, aged four years. The investigated animals were measured with Lydtin's stick and cattle string, namely, withers height, trunk length, depth and width of the chest, chest volume and cannon bone circumference. The chest depth and width and trunk length were correlated with withers height. Based on the measurements, body indexes were calculated as follows: trunk size, compactness, rib cage and bony frame. The obtained results were analysed statistically. Forty animals in total were investigated and analysed: 14 stallions and 26 mares. A part of the investigated animals served as the basis for the research «IMPACT OF WITHERS HEIGHT, CHEST VOLUME AND CANNON BONE

CIRCUMFERENCE AFTER BIRTH ON DIFFERENT HOLSTEIN FOALS» (*Rastija et al., 2000*).
The body indexes were measured after the following formulas:

$$\text{Format indeks} = \frac{\text{trunk length}}{\text{withers height}} \times 100$$

$$\text{Trunk indeks} = \frac{\text{trunk length}}{\text{chest volume}} \times 100$$

$$\text{Compactness indeks} = \frac{\text{chest volume}}{\text{trunk length}} \times 100$$

(Eurosomy)

$$\text{Rib cage indeks} = \frac{\text{chest width}}{\text{chest depth}} \times 100$$

$$\text{Bony frame} = \frac{\text{cannon bone circumference}}{\text{chest volume}} \times 100$$

RESULTS AND DISCUSSION

Body measurements and body indexes of the Holstein horses reared at the stud-farm in Križevci have been analysed for the first time in a paper and can be considered as preliminary results. These results will serve for further follow-up of the Holstein horse breeding at the Križevci stud-farm and they can be used for comparison with other breeding investigations of the Holstein horse in Croatia. The following tables show the results for stallions and mares separately.

Table 1

Body measurements of the stallions

No.	Withers height		Chest depth			Chest width			Body length			Chest volume		Cannon bone circumference	
	x	x- \bar{x}	x	x- \bar{x}	%V.G.	x	x- \bar{x}	%V.G.	x	x- \bar{x}	%V.G.	x	x- \bar{x}	x	x- \bar{x}
1.	175	5	79	4.65	45.14	51	3.50	29.14	172	-1.14	98.28	202	6.58	23	1.22
2.	173	3	72	-2.35	41.61	45	-2.50	26.01	170	-3.14	98.26	200	4.58	22	0.22
3.	182	12	80	5.65	43.95	47	-0.50	25.82	182.5	9.86	100.27	202	6.58	22	0.22
4.	165	-5	71	-3.35	43.03	50	2.50	30.30	173	-0.14	104.84	190	-5.42	21	-0.78
5.	171	1	77	2.65	45.03	47	-0.50	27.48	163	-10.14	95.32	195	-0.42	21.5	-0.28
6.	172	2	72	-2.35	41.86	45.5	-2.00	26.45	184	10.86	106.97	194	-1.42	22	0.22
7.	167	-3	68	-6.35	40.71	50	2.50	29.94	172.5	0.14	103.29	189	-6.42	21	-0.78
8.	177	7	75	0.65	42.37	48	0.50	27.11	180	6.86	101.69	198	2.58	23	1.22
9.	171	1	79	4.65	46.19	47	-0.50	27.48	170	-3.14	99.41	200	4.58	22	0.22
10.	167	-3	70	-4.35	41.91	49	1.50	29.34	172	-1.14	102.99	190	-5.42	21	-0.78
11.	163	-7	77	-2.65	47.23	45	-2.50	27.60	169	-4.14	103.68	195	-0.42	21	-0.78
12.	166	-4	71	-3.35	42.77	46	-1.50	27.71	176	2.86	106.02	187	-8.42	22	0.22
13.	164	-6	68	-6.35	41.46	48	0.50	29.26	171	-2.14	104.26	189	-6.42	21	-0.78
14.	168	-2	82	7.65	48.80	46	-1.50	27.38	169	-4.14	100.59	205	9.58	22	0.22
	170.07		74.35			47.5			173.14			195.42		21.78	
s	5.41		4.64			1.94			5.77			5.82		0.69	

Table 2

Body indexes of the stallions

No.	Format index	Compactness index	Trunk index	Bony frame	Rib cage index
1.	98.28	117.44	85.14	11.38	64.55
2.	98.26	117.64	85.00	11.00	62.50
3.	100.27	110.68	90.34	10.89	58.75
4.	104.84	109.82	91.05	11.05	70.42
5.	95.32	119.63	83.58	11.02	61.03
6.	106.97	105.43	94.84	11.34	63.19
7.	103.29	109.56	91.26	11.11	73.52
8.	101.69	110.00	90.90	11.61	64.00
9.	99.41	117.64	85.00	11.00	59.49
10.	102.99	110.46	90.52	11.05	70.00
11.	103.68	115.38	86.66	10.76	58.44
12.	106.02	106.25	94.11	11.76	64.78
13.	104.26	110.52	90.47	11.11	70.58
14.	100.59	121.30	82.43	10.73	56.09
	101.84	112.98	88.66	11.12	64.09
m	95.32	106.25	82.43	10.73	56.09
M	104.84	121.30	94.11	11.76	73.52

Table 3

Body measurements of the mares

No.	Withers height		Chest depth			Chest width			Body length			Chest volume		Cannon bone circumference	
	x	x- \bar{x}	x	x- \bar{x}	%V.G.	x	x- \bar{x}	%V.G.	x	x- \bar{x}	%V.G.	x	x- \bar{x}	x	x- \bar{x}
1.	166	1.74	72	-1.50	43.37	55	7.24	33.13	170	-2.32	102.40	200	4.89	19	-1.96
2.	156	-8.26	71	-2.50	45.51	39.5	-8.26	25.32	171	-1.32	109.61	186	9.11	20	-0.96
3.	164	-0.26	74	0.50	45.12	41.5	-6.26	25.30	170	-2.32	103.65	193	-2.11	20	-0.96
4.	166.5	2.24	72.5	-1.00	43.54	50	2.24	30.03	176.5	4.18	106.00	198	2.89	21	0.04
5.	164	-0.26	72	-1.50	43.90	47	-0.76	28.65	177	4.68	107.92	190	-5.11	20	-0.96
6.	164	-0.26	71	-2.50	43.29	49	1.24	28.87	176.5	4.18	107.62	191	-4.11	21	0.04
7.	166	1.74	74.5	1.00	44.87	48	0.24	28.91	178	5.68	107.22	200	4.89	22	1.04
8.	166	1.74	74	0.50	44.57	52.5	4.74	31.62	164	-8.32	98.79	202	6.89	22	1.04
9.	160	-4.2	74	0.50	46.25	44	-3.76	27.50	162	-10.32	101.25	192	-3.11	19	-1.96
10.	169	4.74	73.5	0.0	43.49	49	1.24	28.99	178	5.68	105.32	200	4.89	21	0.04
11.	168	3.74	74	0.50	44.04	50	2.24	29.76	177	4.68	105.35	198	2.89	23	2.04
12.	164.5	0.24	74	0.50	44.98	56	8.24	34.04	170	-2.32	103.34	202	6.89	22	1.04
13.	159	-5.26	70	-3.50	44.02	44	-3.76	27.67	171	-1.32	107.54	193	-2.11	21	0.04
14.	156.5	-7.76	72	-1.50	46.00	47.5	-0.26	30.35	162	-10.32	103.51	192	-3.11	20	-0.96
15.	162	-2.26	75.5	2.00	47.00	61.5	13.74	38.00	177	4.68	109.25	200	4.89	21	0.04
16.	163	-1.26	71.5	-2.00	43.86	43.5	-4.26	26.68	174.5	2.18	107.05	192	-3.11	20.5	-0.46
17.	160	-4.26	72	-1.50	45.00	49	1.24	30.62	169	-3.32	105.62	195	-0.11	22	1.04
18.	165	0.74	70	-3.50	42.42	48	0.24	29.09	175	0.68	106.06	195	-0.11	22	1.04
19.	168.5	4.24	74	0.50	43.91	46	-1.76	27.29	181	8.68	107.41	190	-5.11	22	1.04
20.	167	2.74	76	2.50	45.50	40	-7.76	23.95	168	-4.32	100.59	183	-12.11	20	-0.96

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21.	170.5	6.24	78	4.50	45.74	46	-1.76	26.97	186	13.68	109.09	208	12.89	22	1.04
22.	160	-4.26	76	2.50	47.50	42	-5.76	26.25	154	-18.32	96.25	195	0.11	20.5	-0.46
23.	163	-1.26	73	-0.50	44.78	47	0.76	28.83	174	1.68	106.74	194	-1.11	21	0.04
24.	163	-1.26	77	3.50	47.23	43	-4.76	26.38	166	-6.32	101.84	198	2.89	20	-0.96
25.	167.5	3.24	73	-0.50	43.58	52	4.24	31.04	175	2.68	104.47	188	-7.11	20	-0.96
26.	170	5.74	74	0.50	43.52	47.5	-2.66	27.94	178	5.68	104.70	198	2.89	21.5	0.54
	164.26		73.5			47.76			172.32			195.11		20.96	
s	3.89		2.03			5.06			6.89			5.58		1.02	

Table 4

Body indexes of the mares

No.	Format index	Compactness index	Trunk index	Bony frame	Rib cage index
1.	102.40	117.64	85.00	9.50	76.38
2.	109.61	108.87	91.93	10.75	55.63
3.	103.65	113.52	88.08	10.36	56.08
4.	106.00	112.18	88.88	10.60	68.96
5.	107.92	107.34	93.15	10.52	65.27
6.	107.62	108.21	92.40	10.99	69.01
7.	107.22	112.35	89.00	11.00	64.42
8.	98.79	123.17	81.18	10.89	70.24
9.	101.25	118.51	84.37	9.89	59.45
10.	105.32	112.35	89.00	10.50	66.66
11.	105.35	111.86	89.39	11.61	67.56
12.	103.34	118.82	84.15	10.89	75.67
13.	107.54	112.86	88.60	10.88	62.85
14.	103.51	118.51	84.37	10.41	65.97
15.	109.25	112.99	88.50	10.50	81.45
16.	107.05	110.00	90.88	10.67	60.83
17.	105.62	115.38	86.66	11.28	68.00
18.	106.06	111.42	89.74	11.28	68.57
19.	107.00	104.00	95.00	11.57	62.16
20.	100.59	108.92	91.80	10.92	52.63
21.	109.09	118.82	89.42	10.57	58.97
22.	96.25	126.62	78.97	10.50	55.26
23.	106.74	111.49	89.69	10.82	64.38
24.	101.84	119.27	83.83	10.10	55.84
25.	104.47	107.42	93.05	10.63	71.23
26.	104.70	111.23	89.89	10.85	64.18
	104.93	113.60	88.34	10.71	64.93
m	96.25	99.47	78.97	9.50	52.63
M	113.25	126.62	100.52	11.61	81.45

A survey of relative measurements in relation to withers height

	Withers height	Chest depth	Chest width	Body length
Stallions - 14	170.07	74.35	43.71%	47.50
Mares - 26	164.26	73.50	44.73%	47.76
				27.93%
				28.96%
				173.14
				101.84%
				172.32
				104.94%

A survey of body indexes in stallions and mares

	Format index	Compactness index	Trunk index	Bony frame	Rib cage index
Stallions - 14	101,84	112,98	88,66	11,12	64,09
Mares - 26	104,93	113,60	88,34	10,71	64,93

By comparing the obtained results of the withers height in stallions reared in Križevci with the wither height of the licensed stallions in domicile breeding area in Germany we can see that the average withers height of the Križevci stallions is 170.07 and that of the original stallions 167.62. The difference is that German data are applied to withers height of stallions upon licence at the age between 2.5 and three years, while the Križevci stallions were measured following the age of four and later.

CONCLUSIONS

Preliminary results of the investigations of the body measures and body indexes of the Holstein horses reared at the stud-farm of the Centre for Horse Breeding and Equestrian Sport in Križevci make the basis for further investigations and analyses of the Holstein horse population in Croatia.

The obtained data are the result of 22 year long work with the Holstein horse breeding at the stud-farm in Križevci and they can serve for similar investigation of the Holstein horse population around Croatia, as the breeding has lasted for the same period of time.

Horse breeding at the stud-farm in Križevci served as the basis for several investigations and it will continue in the future. The stud-farm i serves as the education practicum for students at the College of Agriculture in Križevci.

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