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Morphological Characteristics of Pacing Horses and Examination of Breeding Conditions*

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Abstract

The purpose of this study was to examine the morphological characteristics and breeding conditions of pacing horses in the Afyonkarahisar province. A total of 117 head of pacing horses, as well as farm operations and opinions of horse owners, were evaluated. The overall means of height at wither, body length, rump length, chest depth, chest circumference, head length, and forehead width were measured: 142.42, 145.15, 49.77, 55.43, 161.44, 51.94, and 21.52 cm respectively. It was determined that horses with Turkish native genotypes and 1-3 elder horses had the lowest body measurements. It was determined that the pacing horses had the bay, chestnut, gray, black, and chestnut paint coat colors. It has been determined that, in the choosing of pacing horses, horse owners pay great attention to the parent information (71.1%), the temperament (71.1%), body condition (68.9%), and the foot-nail structure (62.2%) of horses. As a result, it was concluded that the pacing horses with native genotypes in the Afyonkarahisar province were smaller than those who were crossbred and of foreign origin. Also, it was determined that the horses examined were of the bay, chestnut, gray, and black coat colors. In addition, it was concluded that the breeding conditions of pacing horses should be improved, and the horse owners should be informed about horse training and exercising.

Keywords: Body measurements, breeding, coat colors and marking, pacing horse

Introduction

Horses have been used in the past as labor force and are currently being breeding for various competitions, mostly sports, and they are still used in agriculture in operations in the highlands in some countries (Özbeyaz and Akçapınar, 2005). The number of horses in the world decreased after the Second World War, and according to the FAO (Food and Agriculture Organization of the United Nations) data from 2017, there are a total of 60 566 601 heads in the world. The number of horses in Turkey has decreased similarly to the rest of the world, and there were 120 040 heads in 2017 (FAO, 2019). In Turkey, a significant portion of the horse presence constitutes Thoroughbred, Arabian horses, and native horses. Thoroughbred and Arabian horses are used in racing, while native horses are used in traditional horse sports such as pacing and javelin.

The pacing is characterized by the limbs moving together on the same side, and when two feet on one side rise at the same time, the two feet on the other side are on the ground (Arpacık, 1999). For 2, 3, 4, and 5-year-old foals, pacing runs in Turkey are performed on a 10-meter-wide track (Anonymous, 2017d). In a study conducted on pacing horses, Andersson et al. (2012) named the DMRT3-Ser 301 STOP mutation as having an essential relationship with pacing. Özbeyaz et al. (2016) found the DMRT3 mutant allele frequency in the pacing hors-

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es in Turkey at 90.7%, 98.40%, 95.80%, and 96.40%, in native, Iranian, Afghanistan, and Bulgaria origins, respectively. Yüceer et al. (2016a) reported that the pacing horses in Turkey did not differ significantly from the region regarding genotypically and that they were considerably different from the Arabian horses and Thoroughbred and that the allele variety of the pacing horses was much higher than the Arabian horses and Thoroughbred. In a study carried out by Çağlayan et al. (2010) on pacing horses in Turkey, the overall means for the height at wither, height at rump, body length, chest depth, chest circumference, cannon bone circumference, and head length were found 139.21, 138.28, 141.60, 58.38, 155.30, 17.69, and 56.49 cm, respectively. In another study carried out by Yüceer et al. (2016b), on the Turkish native pacing horses, the means for the height at wither, height at rump, body length, chest depth, chest circumference, cannon bone circumference, and head length were found to be 138.92, 139.67, 145.51, 61.91, 156.45, 17.06, and 52.53 cm, respectively . In the studies carried out on Turkish native horses in the Van and Kars provinces in Turkey; the gray, bay, chestnut, black, isabelline, and buckskin coat colors were identified (Bayram et al., 2005; Kırmızıbayrak et al., 2004).

This study was conducted to examine some body measurements of pacing horses, determination of coat colors and white markings, breeding conditions in operations, training, and choosing of pacing horses.

Materials and Methods

Materials

This study included 117 heads of Turkish native, crossbred, and foreign origin pacing male and female horses at different ages in the Afyonkarahisar province in 2016 and 2017, Turkey. Moreover, in this study, the breeding, feeding, and barn conditions of 41 operations and the practices of 45 horse owners regarding pacing horse training and choosing were evaluated. The measurements, detection and notifications were recorded in the form. The genotype of the horses used in the study was based on the declaration of the horse owners. Also, the age of horses was established by determining the age, as well as the declaration of the horse owners. This study was conducted according to the ethical principles with the letter dated 06/14/2016 and numbered 49533702/105 of the Local Ethics Committee of Animal Experiments at Afyon Kocatepe University.

Methods

The height at wither, height at rump, body length, back length, rump length, chest circumference, chest depth, cannon bone circumference, head length, and forehead width were determined with the horse standing on a flat surface using the measuring stick (Hauptner) and tape (Arpacık, 1999). The training of pacing horses, coat colors and white markings, housing type, feeding, grooming and frequency, farrier supply, horseshoe, saddle and bit type, training obtained from face-to-face interviews with horse owners, training frequency and duration, the importance of choosing of pacing horses, and frequently encountered injuries were recorded in the form. In the creation of this form, Yıldırım and Yıldız (2013) notifications were used.

Statistical analysis

For the statistical analysis of the obtained body measurements, the $Y_{ijkl} = \mu + G_i + S_j + A_k + e_{ijkl}$ model was used in the variance analysis. In this model, Y_{ijk} was the observation value, μ is the overall mean value, G_i is the effect of genotype ($_i$=native, crossbred, and foreign), S_j is the effect of gender ($_j$= male and female), A_k is the effect of age ($_k$=1-3, 4-6, and 7≤), and e_{ijkl} represents the random error. In each subgroup, the means was compared with the Duncan's Multiple tests. Information about the management, feeding, training, and choosing preferences of horse owners in operations is given in as a proportion (%). The PASW Statistics 18.0 program was used in calculations.

Results

Morphological characteristics of pacing horses

The values of body measurements of pacing horses in the province of Afyonkarahisar are presented in Table 1. In these pacing horses, the height at wither, height at rump, body length, chest depth, chest circumference, cannon bone circumference, head length, and the forehead width for overall means were detected as 142.42±0.83, 142.50±0.81, 145.15±1.06, 55.43±0.56, 161.44±1.39, 17.58±0.16, 51.94±0.33, and 21.52±0.16 cm, respectively. The effects of the genotype (native, crossbred, and foreign origin), gender (male and female), and age (1-3, 4-6, and 7≤ years) on some body measurements were found to be statistically significant ($p<0.05$, $p<0.01$, $p<0.001$). According to genotype, the lowest body size values were determined in Turkish native pacing horses. In this study, it was determined that pacing horses were of the bay (53.0%), chestnut (23.1%), gray (18.8%), black (4.2%) and chestnut paint (0.9%) coat colors. In addition, 43.6% of these horses had white facial markings, and 34.2% of these horses had white leg markings.

Breeding conditions, management, and feeding

In this study, breeding conditions, housing, management, and feeding information were examined in the operations visited. It was found that the barns were tie stall (75.6%) and box stall (24.4%) housing. A total of 3 to 5 kg/day roughage (hay, fodder, alfalfa, vetch) and 3 to 6 kg/day concentrated feed (barley, vetch, and oats ration) were reported to be given to horses in operations. Also, the proportion of giving vitamin-mineral mixtures (powder, injectable, and licking block), raisins, and carrots were found to be 73.17% in operations. It has been stated that 92.7% of the visited operations were grooming, and 68.3% of them were providing farrier from outside the operations. In addition, it was determined that the horseshoe type on pacing horses was usually closed, and an imported saddle and a port bit were used.

Table 1. Least-squares means and standard errors for body measurements in pacing horses

	n	Height at wither $\bar{X} \pm S_{\bar{x}}$	Height at rump $\bar{X} \pm S_{\bar{x}}$	Body length $\bar{X} \pm S_{\bar{x}}$	Back length $\bar{X} \pm S_{\bar{x}}$	Rump length $\bar{X} \pm S_{\bar{x}}$	Chest depth $\bar{X} \pm S_{\bar{x}}$	Chest circumference $\bar{X} \pm S_{\bar{x}}$	Cannon bone circumference $\bar{X} \pm S_{\bar{x}}$	Head length $\bar{X} \pm S_{\bar{x}}$	Forehead width $\bar{X} \pm S_{\bar{x}}$
μ	117	142.42±0.83	142.50±0.81	145.15±1.06	55.40±0.71	49.77±0.44	55.43±0.56	161.44±1.39	17.58±0.16	51.94±0.33	21.52±0.16
Genotype		***	***	**	***	-	-	-	-	**	*
Turkish Native	97	138.81±0.56^{b}	138.95±0.55^{b}	142.98±0.72^{b}	53.05±0.48^{b}	49.09±0.30	54.76±0.38	158.32±0.94	17.69±0.11	51.09±0.22^{b}	21.20±0.11^{b}
Crossbred	11	140.70±1.65^{b}	139.91±1.61^{b}	141.59±2.11^{b}	53.37±1.41^{b}	49.93±0.88	54.21±1.11	161.24±2.78	17.36±0.33	51.15±0.66^{b}	21.17±0.32^{b}
Foreign origin	9	147.75±1.78^{a}	148.63±1.74^{a}	150.87±2.29^{a}	59.77±1.53^{a}	50.28±0.95	57.34±1.20	164.77±3.00	17.69±0.35	53.57±0.71^{a}	22.20±0.35^{a}
Gender		-	-	*	*	-	***	***	**	-	-
Male	78	142.41±0.88	142.33±0.86	143.73±1.12^{b}	54.48±0.75^{b}	49.41±0.47	54.06±0.59^{b}	158.38±1.48^{b}	17.85±0.17^{a}	52.03±0.35	21.49±0.17
Female	39	142.43±1.08	142.67±1.05	146.56±1.38^{a}	56.31±0.92^{a}	50.12±0.57	56.81±0.72^{a}	164.50±1.81^{a}	17.31±0.21^{b}	51.85±0.43	21.56±0.21
Age		***	***	***	***	***	***	***	***	***	***
1-3	38	139.41±1.06^{b}	139.73±1.04^{b}	140.32±1.37^{b}	52.78±0.91^{c}	48.03±0.57^{b}	53.25±0.72^{b}	155.23±1.79^{c}	16.67±0.21^{b}	50.37±0.43^{b}	20.66±0.21^{b}
4-6	39	143.77±1.13^{a}	143.83±1.11^{a}	147.17±1.45^{a}	56.01±0.97^{b}	50.69±0.60^{a}	56.26±0.76^{a}	162.47±1.90^{b}	17.95±0.22^{a}	52.45±0.45^{a}	21.86±0.22^{a}
7≤	40	144.08±1.05^{a}	143.94±1.03^{a}	147.96±1.35^{a}	57.32±0.90^{a}	50.58±0.56^{a}	56.80±0.71^{a}	166.62±1.77^{a}	18.12±0.21^{a}	52.99±0.42^{a}	22.04±0.21^{a}

μ: The over all mean; $\bar{X} \pm S_{\bar{x}}$: Least-squares mean±standard error of mean
-: Not significant (p>0.05); *: p<0.05; **:p< 0.01; ***:p< 0.001
^{a,b,c}: Different superscript letters differ significantly in each subgroup in the same column (p<0.05)

During the meetings with the pacing horse owners, only 14 owners said they were interested in pacing horse training. On the other hand, they expressed the age of horse training as 18, 24, and 25 months. It was said that the horses were given training for 60-120 minutes per day, and the experience of the trainers was over 5 years. It was stated that the training of pacing foals was continued by attaching chains to the foal's foot after the training of the bridle and saddle. During the meetings with horse owners, 31 breeders stated that they exercise their horses regularly. The duration of exercising is 30-120 minutes, and the majority of the horses have 60-120 minutes of exercising. When determining the injuries, the breeders stated that they are mostly encountering, pastern, tarsus, bridle, and saddle injuries in horses. Table 2 presents the findings regarding the issues that horse owners pay attention when choosing a pacing horse. It was determined that horse owners pay more attention to the parent information (71.1%), temperament (71.1%), body condition (68.9%), and foot-nail structure (62.2%) when choosing pacing horses.

Discussion

Morphological characteristics of pacing horses

The least-squares means and standard errors for body measurements presented in Table 1 showed that the Turkish native pacing horses were generally lower than those that were crossbred and foreign origin. Regarding age, the lowest body measurement values were found in horses 1-3 years old. The height at wither, height at rump, rump length, chest circumference, and head length were 138.81, 138.95, 49.09, 158.32, and 51.09 cm for Turkish native pacing horses; 140.70, 139.91, 49.93, 161.24, and 51.15 cm for crossbred pacing horses; and 147.75, 148.63, 50.28, 164.77, and 53.57 cm for foreign origin pacing horses, respectively. Similar to the statements by Yüceer et al. (2016b), this situation shows that Turkish native pacing horses were smaller than other pacing horse genotypes. The body measurements of pacing horses in the province of Afyonkarahisar, such as the height at wither, height at rump, body length and chest circumference overall means, were higher than the values reported by Çağlayan et al. (2010) for pacing horses. In this study, the height at wither, height at rump, and body length averages for Turkish native pacing horses were higher than those reported in the studies on Turkish native horses in the Van and Kars provinces (Bayram et al., 2005; Kırmızıbayrak et al., 2004). On the other hand, the values reported by Yüceer et al. (2016b) for Turkish native pacing horses and the values reported for Arabian horses in Turkey (Gücüyener Hacan and Akçapınar, 2011) were lower. This may be due to factors such as genotype, breeding conditions, and feeding. Also, it was found that the height at wither of the pacing horses in this study was in the range 133-142 cm reported for the

Table 2. Preferences of horse owners in the pacing horse choosing

	Important		Not important		No idea	
		%		%		%
Parent information	32	71.1	-	-	13	28.9
Coat colors	9	20.0	22	48.9	14	31.1
White markings	8	17.8	23	51.1	14	31.1
Foot-nail structure	28	62.2	3	6.7	14	31.1
Temperament	32	71.1	1	2.2	12	26.7
Body condition	31	68.9	-	-	14	31.1

Paso Fino horse and higher than Icelandic horse (Anonymous, 2017a; Anonymous, 2017b). The length of the back and rump values was the lowest for the native pacing horses. The forehead width is similar to the native and crossbred genotypes and is lower than for foreign origin pacing horses.

In this study, it was found that pacing horses were of the bay (53.0%), chestnut (23.1%), gray (18.8%), black (4.2%), and chestnut paint (0.9%) coat colors. Also, in 43.6% and 34.2%, White facial and leg markings were detected, respectively. Some researchers reported that American Saddlebred, Ayvacık pony, and Canik horses were of the bay, black, gray, chestnut, and chestnutpaint coat colors, and Arabian horses in Turkey were of the chestnut, gray, and bay coat colors (Anonymous, 2017c; Arıtürk, 1956; Gücüyener Hacan and Akçapınar, 2012; Güleç, 1995). The presence of the chestnut, bay, and gray colors in the native horses in the Kars region is mentioned, in addition to these colors in the horses in the Van region, the presence of the black, gray, buckskin, and isabelline coat colors has also been reported (Bayram et al., 2005; Kırmızıbayrak et al., 2004).

Breeding conditions, management, and feeding

It was determined that the pacing horse barns in the province of Afyonkarahisar are tie stall (75.6%) and box stall (24.4%) housing. For horses in the tie stall housing, the possibility of movement is restricted, which is considered to be a disadvantage regarding the horse performance. In addition, according to observations and determinations made during the research, housing measures and ventilation facilities concerning housing conditions are thought to be improved. While 92.7% of the operations stated that they were grooming regularly, 68.3% said they were bringing the farrier from the outside. Grooming in horse operations is an affirmative situation. The saddle used in pacing horses is usually imported (European origin), and the port bit is used. It is considered preferable because the imported saddle is robust, and the port bit gives the rider an advantage in horse control. On the other hand, almost half (41.5%) of the operations used the closed type horseshoe on four feet, and 36.5% stated that they used closed horseshoe on the front legs only or the hind legs only. The closed type horseshoe is considered to be preferred because of the protection it provides on the racecourse. It was stated that horses were given 3 to 5 kg/day roughage, 3 to 6 kg/day concentrated, and 73.17% of the operations were given vitamin-mineral mix (powder, injectable, and licking block), raisins, and carrots. It is a positive situation to use vitamin-mineral mixtures to feed horses in an essential part of operations and to pay attention to nutrition.

In the meetings held with the owners of pacing horses, it was determined that only 14 of them were interested in pacing horse training. These breeders expressed that the age of the horses to start training was 18, 24, and 25 months. Also, it was also determined that after the bridle and saddle training, the horse continued with the chain attached to the foot. This practice is thought to be performed to ensure that the limbs on the same side move together. During the meetings with the horse owners, 31 (68.9%) stated that they regularly exercise their horses, 14 (31.1%) did not exercise them, but only rode a horse intermittently. The training and the exercising schedule applied to the horses needs to be developed. In the determination of injuries in horses, 36 of the breeders did not encounter injuries, and 9 of them said that pastern-, tarsus-, bridle-, and saddle-related injuries were the most frequent. Such situations can occur during the use of horses, so this makes the bridle, saddle, and foot problems even more prominent. Horse owners stated that they paid more attention to the parent information (71.1%), temperament (71.1%), body condition (68.9 %), and the foot-nail structure (62.2%) when choosing the pacing horses.

As a result, it was found that the Turkish native pacing horses in the province of Afyonkarahisar were smaller than those that were crossbred and foreign origin and that the bay, chestnut, gray, and black coat colors were found frequently. The effects of genotype, age and gender on body measurements were found to be statistically significant. In addition, it was concluded that the breeding conditions of pacing horses should be improved and that the owners should be informed about horse training and exercising.

Ethics Committee Approval: Ethics committee approval was received for this study from the local ethics committee of animal experiments at Afyon Kocatepe University (Approval number: 49533702/105, date: 06/14/2016).

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