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Biometric hoof evaluation of athletic horses of show jumping, barrel, long rope and polo modalities

Avaliação biométrica do casco de cavalos de esporte das modalidades hipismo, tambor, laço comprido e pólo

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SUMMARY

This study aimed to evaluate, through biometry, the forelimb hoof of horses participating in show jumping, barrel, long rope and polo competitions. Thirty subjects were assessed in relation to each competition (total of 120 animals). The linear measurements (cm) included the dorsal length of the toe; medial and lateral lengths of the quarter; medial and lateral heights of the quarter; lateral and medial lengths of the heel; medial and lateral heights of the heel; hoof length; hoof width; frog length; and frog width. The following angles (°) were measured: toe angle, pastern angle, heel angle and shoulder palette. The length of the horseshoe, coronet circumference and body weight were also assessed. With the use of hoof biometric evaluation was possible to identify the imbalances of forelimb in athletic horses and the most common were broken-backward hoof angle, with 96.7% of the animals showing this in the right forelimb (RFL) and 95.8% in the left forelimb (LFL); and contracted heels, with 95.0% in the RFL and 87.6% in the LFL. The competition type in which greatest numbers of hoof balance abnormalities were shown was the long rope, followed by the barrel. There were high frequencies of medial/lateral imbalance in all the sports. We conclude that animals used in functional tests have a high incidence of hoof balance abnormalities in the forelimbs.

Keywords: equine, hoof measurements, podiatry

RESUMO

Objetivou-se avaliar, através da biometria, os cascos dos membros anteriores de equinos participantes de provas de Hipismo Clássico, Tambor, Laço Comprido e Pólo. Em cada modalidade foram avaliados 30 indivíduos totalizando 120 animais. As mensurações lineares (cm) incluíram o comprimento dorsal da pinça, comprimentos lateral e medial dos quartos, altura medial e lateral dos quartos, comprimento lateral e medial dos talões, alturas lateral e medial dos talões, comprimento do casco, largura do casco, comprimento da ranilha, largura da ranilha, e as angulares (graus) foram relativas ao ângulo do casco medido pela pinça (podogoniometria), ângulo da quartela, ângulo dos talões, ângulo das paletas. O comprimento da ferradura, circunferência da coroa do casco e peso corporal também foram avaliados. Através da biometria do casco foi possível avaliar os desequilíbrios do membro anterior de animais atletas e os mais comuns foram: quebra do eixo podal, com

96,7% dos animais apresentando essa alteração no membro torácico direito (MTD) e 95,8% no membro torácico esquerdo (MTE); talões contraídos com 95,0% no MTD e 87,6% no MTE. A modalidade com os maiores desequilíbrios foi a de Laço Comprido, seguida pelos animais de Tambor. Foi encontrada uma alta frequência de desequilíbrio médio lateral em todas as modalidades desportivas. Conclui-se que animais utilizados em provas funcionais apresentam uma alta incidência de desequilíbrios podal nos membros torácicos.

Palavras-chave: equilíbrio podal, equino, podologia

INTRODUCTION

Hoof balance is a major factor in the health of the locomotor apparatus in horses and refers to the uniformity of weight distribution around the center of gravity of the hoof (BUTLER, 1994). Incorrect trimming and shoeing are closely related to foot imbalance, which along with conformational defects are among the main causes of lameness in horses (MELO et al., 2006). The poor conformation and imbalance in forelimbs has the most importance since 60% of weight is supported on them.

The most important disorders of foot balance in horses are broken hoof axes, underrun heels, contracted heels, sheared heels, mismatched hoof angles and small feet (TURNER, 1992). These changes include dorsal/palmar-plantar imbalances and medial/lateral imbalances, which when ignored can impair the athletic performance of horses.

Lack of theoretical knowledge and inadequate techniques for trimming and shoeing contribute towards high rates of foot imbalance. In practice, hoof balance is still considered to be a subjective assessment and the evaluation criteria may differ among professionals. Furthermore, the farrier's handedness, i.e. the side with greater ability, seems to interfere if objective biometric evaluation is not performed (RONCHETTI et al., 2011).

Biometric measurements are considered to be an easy process and enable objective assessment of hoof balance (TURNER, 1992). They also provide guidelines for correction of any imbalances found (MARANHÃO et al., 2007). Another factor that can be minimized is the difference between consecutive trimmings and shoeings. This is observed both when the farrier is changed and between two consecutive shoeings done by the same farrier (KUMMER et al., 2009).

Some horse sports shows similarity to farm daily work and in the region where this study was performed, the most common competitions are long rope and barrel. Comparing to show jumping and polo horses, there is still little investment in caring of long rope horses, which can fail in detection, prevention and correction of hoof imbalances, as well as lack of knowledge of modern technics for trimming and farriery.

This research aimed to make a biometric and unbalance incidence survey in the forelimb hooves of athletic horses, trying to establish which abnormalities are most prevalent among the different types of functional events.

MATERIAL AND METHODS

The horses in this study participated in equestrian competitions held in the region of Campo Grande, state of Mato Grosso do Sul, Brazil. A total of 30 animals in each sport (show jumping, barrel, long rope and polo) were evaluated, thus totaling 120 animals. The horses were included in one of the

following breed groups: Quarter Horse (n=58) and undefined breed (n=62).
Linear measurements of length, width, height and circumference, as well angular measurements, are shown in Figure 1 that schematically illustrates the procedure for measurement of all the variables.

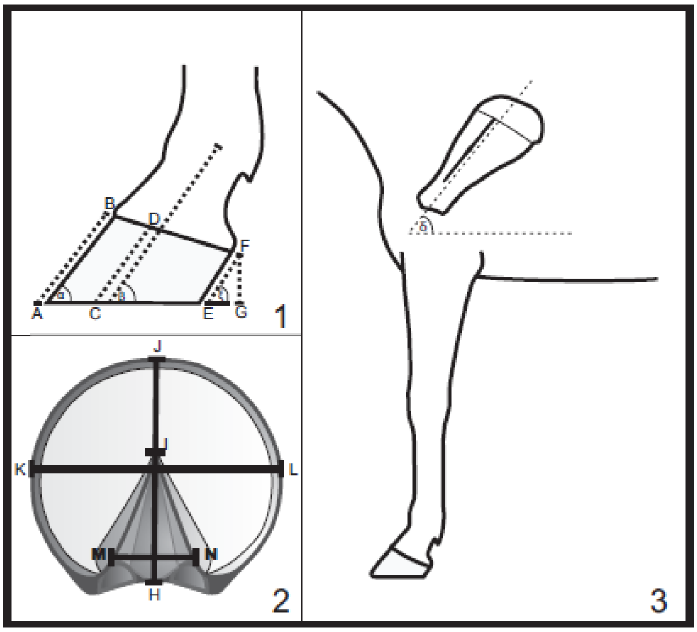

Figure 1. Biometric linear and angular measurements of equine forelimb. 1) AB = toe length; CD = quarters lengths; EF = heels lengths; GF = heels heights; α = toe angle; β = pastern angle, ξ = heel angle. 2) HJ = hoof length, HI = frog length; KL = hoof width; MN = frog width. 3) δ = shoulder angle

The forelimbs were analyzed regarding their conformation, and linear measurements (cm) were obtained with the aid of a flexible ruler. The toe angle was measured with a hoof gauge, and the shoulder and pastern angles were measured using a protractor. To determine the pastern angle, an imaginary line was taken, beginning on the lateral side of the fetlock joint and running laterally to the pastern, thus dividing it into two halves going toward the ground. For the shoulder angle, the reference used was the crest of the scapula, and a level was used to keep the base of the protractor/bevel parallel to the ground. Among the animals participating in the long rope competition, the shoulder angle was not measured. The heel angles were obtained from the sine, which was calculated by dividing the bead height by its length.
To estimate body weight (kg), a weighing tape was used. The weight was subsequently transformed into pounds in order to calculate the weight distribution in relation to the foot area. For this calculation, the coronet circumference measurement was also

transformed from centimeters to inches, and was used in the following formula: weight of horse in pounds x 12.56 / (coronet circumference in inches)^2. The value obtained reflects the pressure, in pounds, applied to each square inch of the foot.

All the dependent variables were subjected to analysis of variance, taking into consideration the fixed effect of the sport modality and breed adopting the randomized block design, using the GLM procedure of the SAS software. The means were compared using Student's t test at a significance level of 5% (SAMPAIO, 2007). The dependent variables of heel height, heel length, quarter height and quarter length on the left and right forelimbs were subjected to analysis of variance, taking into consideration the fixed effect of the sport modality and the side (medial or lateral). The dependent variables of hoof length, frog length, hoof width, frog width, toe length, quarter length (medial and lateral), heel length (medial and lateral), quarter height (medial and lateral), heel height (medial and lateral), hoof size, toe, pastern, shoulder angle and heel angle were subjected to analysis of variance, taking into considering the fixed effect of the sport modality and the limb (left or right), both adopting the randomized block design.

RESULTS AND DISCUSSION

The mean ± standard deviation of body weight was 427.13 ± 47.68kg. When all the animals were taken into consideration, there was no breed effect, no interaction between breed and modalities, as well as no difference between the means ($p > 0.05$) for all measurements made on the lateral and medial sides of the same limb, or between contralateral limbs.

Regarding forelimb conformation, 69.2% of the animals showed some type of abnormality. Among these, the commonest was a divergent toe, in 30.8%. The sport with the highest rate of conformational defects was long rope, in which 76.7% of the animals showed some type of abnormality. Coincidentally, this sport modality is the most practiced in the region where this study where performed and it is the closest of the work performed in farms. It probably shows that the early detection of forelimb conformational defects has been procrastinated, since some imbalance faults can be corrected in young age (O´GRADY & DRYDEN, 2012). 36.7% of the animals participating in long rope competitions presented a divergent toe. 34.5% of the horses in barrel and polo presented regular limbs, and 31% in show jumping (Table 1).

The poor conformation, as well imbalance, can be a clue for hoof disease. In static and dynamic evaluation, the conformational defects must be observed and with other exams, like hoof measurement, the clinic and farrier can choose the better treatment for healing or preventing injuries. Differences in normal conformation change the wall angle and thickness (EGGLESTON, 2012) with intertubular horn reorganization and tubular bending according to the shear forces within the stratum medium (LANCASTER et al., 2013). These modifications can move the center or pressure (PARKS, 2012), which lead to injuries of musculoskeletal system due to the ground reaction forces in the landing phase of stride (ELIASHAR, 2012).

Table 1. Frequency distribution of conformational defects in the forelimbs of horses participating in show jumping, barrel, long rope and polo competitions

Conformational abnormalities of the forelimbs	Type of competition				
	Show jumping (%)	Long rope (%)	Barrel (%)	Polo (%)	Total (%)
Convergent toes	13.8	13.3	6.9	0.0	8.5
Convergent right toe	0.0	3.3	0.0	3.4	1.7
Convergent left toe	6.9	6.7	3.4	6.9	6.0
Divergent toes	27.6	36.7	34.5	24.1	30.8
Divergent right toe	10.3	3.3	13.8	27.6	13.7
Divergent left toe	10.3	13.3	6.9	3.4	8.5
Regular conformation	31.0	23.3	34.5	34.5	30.8

Table 2 shows the biometric comparison of forelimb hooves between the animals in the four sports. Show jumping horses showed hoof lengths that were significantly longer than among the horses in long rope and barrel, but similar to the lengths among polo horses. Regarding hoof width, show jumping and polo horses did not differ, but showed higher values ($p < 0.05$) than among barrel and long rope horses. Barrel animals showed significantly narrower hoof width than among long rope horses.

Table 2. Hoof biometry among horses (mean ± standard deviation) participating in show jumping, barrel, long rope and polo competitions

Variables	Type of competition			
	Show jumping (n=30)	Barrel (n=30)	Long rope (n=30)	Polo (n=30)
Hoof length (cm)	12.7 ± 0.9^{a}	12.3 ± 0.9^{b}	12.3 ± 0.8^{b}	12.5 ± 1.0^{ab}
Hoof weight (cm)	12.5 ± 0.8^{a}	11.3 ± 0.8^{c}	12.1 ± 1.0^{b}	12.3 ± 1.2^{ab}
Frog length (cm)	8.3 ± 0.8^{a}	7.8 ± 0.7^{b}	8.0 ± 0.6^{b}	7.9 ± 0.7^{b}
Frog weight (cm)	4.3 ± 0.6^{ab}	4.0 ± 1.0^{c}	4.6 ± 0.8^{a}	4.1 ± 0.8^{bc}
Toe length (cm)	8.9 ± 0.8^{a}	8.7 ± 0.7^{a}	8.7 ± 0.6^{a}	8.4 ± 0.7^{b}
Medial heel length (cm)	4.9 ± 0.9^{b}	5.1 ± 1.0^{b}	5.5 ± 0.7^{a}	4.3 ± 0.6^{c}
Lateral heel length (cm)	4.9 ± 0.8^{b}	5.1 ± 1.0^{b}	5.5 ± 0.7^{a}	4.4 ± 0.6^{c}
Medial heel height (cm)	3.6 ± 0.9^{a}	3.6 ± 0.9^{a}	3.9 ± 0.8^{a}	3.1 ± 0.6^{b}
Lateral heel height (cm)	3.5 ± 0.8^{b}	3.7 ± 0.9^{ab}	3.8 ± 0.7^{a}	3.1 ± 0.6^{c}
Foot size (lb/in²)	67.0 ± 6.4^{b}	71.3 ± 7.8^{a}	72.2 ± 8.5^{a}	59.9 ± 5.4^{c}
Shoulder angle (°)	66.3 ± 5.7^{a}	65.0 ± 4.1^{a}	---	64.2 ± 4.7^{a}
Pastern angle (°)	63.8 ± 5.0^{ab}	65.5 ± 4.2^{a}	63.6 ± 5.1^{b}	65.3 ± 5.5^{ab}
Toe angle (°)	52.8 ± 4.1^{a}	49.2 ± 3.2^{b}	52.5 ± 4.0^{a}	53.3 ± 3.5^{a}

Different letters indicate significant difference on the line according to Student's t test at 5%.

This result was expected in these two modalities, since most of these animals were Quarter Horses or mixed with this breed (OVNICEK et al., 2003); similar findings were descripted by Melo et al. (2011). The difference in hoof width between these types of sport may reflect a predisposition towards clubbed feet, mishandling of hooves or high heels. The club feet approach is different when treating young or adult horses. In mild cases of young horses, the chances of success are greater and the treatment involves the correction of nutritional status, restricting exercise and correcting trimming. The heels should be lowered and the bars thinned or removed. The heels adjacent to the sulci should be angled do 45° to promote spreading. In severe cases, chirurgical approach must be considered combined with therapeutic farriery. The adult horse trimming should be done reducing weight bearing in the toe, reestablishing the weight bearing in the entire sole (O´GRADY & DRYDEN, 2012).

Australian wild horses show higher measurements in foot width when compared to foot length, which was not observed in this study. The foot morphology seems to be determined by hoof and surface environment (HAMPSON et al., 2013) and it can explain foot particularities observed in different breeds. These measures are useful for comparison between contralateral limbs, serving as a guideline for equal hoof size in both sides (TURNER, 1992). Polo horses showed shorter toe lengths than those found in show jumping, barrel and long rope horses. A shorter toe length theoretically accelerates the limb dynamics, which may be beneficial for that type of sport, but it also can be related with wall fragility or excessive trimming resulting in corium, frog and sole traumas (MELO et al, 2011).

Some horses may show excessive toe length in relation to their body weight (BALCH, 1991). This kind of problem leads to a change in the dynamics of movement, which increases the leverage force and delays limb elevation. It also concentrates the impact on the toe at the moment of limb landing (O'GRADY & POUPARD, 2001). In this study, the horses of all sports studied did not show long toe according with Balch (1991) guidelines. Among polo horses, 56.7% were not using horseshoes, which causes greater wear on the hoof. In those horses, there is a tendency for farriers leave the hooves with smaller dimensions, considering that there is no requirement to put nails in the hoof wall. The values found in this type of sport were similar to those reported by Melo et al. (2011), among vaquejada horses: most of the individuals analyzed were not using horseshoes and were Quarter Horse or mixed with this breed.

The frog length was greater in show jumping animals and did not differ among the other types of sport. The frog width of long rope horses was similar to that of show jumping horse and greater than among polo and barrel animals. Show jumping horses are larger than the horses in the other types of sport studied, which thus explains the higher values for hoof and frog lengths. However, in comparing the mean frog length and frog width of show jumping horses found in this study with the means from vaquejada horses obtained by Melo et al. (2011), the mean values observed among show jumping horses were lower than those found in vaquejada participants (8.3 ± 0.8 vs. 8.59 + 0.80 for frog length; and 4.3 ± 0.6 vs. 5.40 + 0.90 for frog width, respectively). The relation between frog and hoof expansion is still not clear and remains as cause of discussion by researchers. Pressure in the frog is not a key point for hoof expansion and in some cases, without a hoof angle change, it can cause contraction rather than expansion (MELO et al, 2011).

The heel was longest in long rope horses, followed by show jumping and barrel horses, which in turn showed higher values than in polo horses. The height of the medial heel in show jumping, long rope and barrel horses were not different, but were greater than those found in polo horses. On the lateral side, there was difference between the types of sport: in long rope horses, the height was greater than in show jumping horses, which in turn was greater than in barrel horses. The polo horses did not differ from the long rope and show jumping animals. High heels must be evaluated with caution, if no flexural abnormalities are observed; the trimming must be done in a pattern that does not promote this problem. Sometimes this problem can be found as mismatched feet, in these cases a radiographic exam should be executed and each hoof must be treated individually, for minimize articular commitment (O'GRADY & DRYDEN, 2012).

The heels are considered imbalanced when the difference in lengths between the medial and lateral faces is ≥ 0.5cm (TURNER, 1992). Thus, when individually evaluated, 37.5% of the horses showed medial-lateral imbalance in the left forelimb (LFL), 34.1% showed medial-lateral imbalance in the right forelimb (RFL) and 19.2% had this abnormality in both limbs. The values found in this study were higher than those reported by Melo et al. (2011) and Maranhão et al. (2007). This abnormality can lead to hoof distortion with excessive growth of the wall and heels. The frog tends to be contracted and the energy of impact is transferred from the wall to bones without passing by soft tissues structures, resulting in lameness, toe cracks, hoof-wall separation, white-line disease, and chronic laminitis (O'GRADY & DRYDEN, 2012). Lateral-medial imbalance can move de center of pressure causing compressive stress in the hoof and overload lateral or medial ligaments (PARKS, 2012). A difference between heel angles in the same limb is also considered to represent medial-lateral imbalance. When the heel angle is 5° less than the toe angle, this is considered to be an underrun heel. This imbalance is found in 28% of horses, even in those with regular limbs (TURNER, 1992). In the present study, we observed that 45.0% of the heels in the LFL had unequal angles and 52.5% in the RFL. The medial-lateral imbalance causes a change in the pattern of movement by displacing the weight-bearing point between the hoof and the ground. The change in locomotion appears to present lower interference when the displacement occurs towards the lateral side, but when it occurs towards the medial side, the horse presents less adaptation and therefore greater change in locomotion dynamics (WILSON et al., 1998).

Underrun heel imbalance was found in the medial and lateral faces of the LFL in 65.0% and 60.3% of the animals, respectively. In the RFL, this abnormality was detected in 56.4% of the animals on the medial side and 57.6% on the lateral side. The dispersion frequencies of combinations of underrun heels varied significantly ($p < 0.0001$) in both limbs (Table 3). According to the literature, this abnormality was found in 52% of the animals with normal athletic performance, but when the animals presented lameness, this imbalance was observed in 77%. In horses showing conformational abnormalities, the incidence was 1.5 times higher (TURNER, 2008).

The values found in the present study were higher than previously reported, which demonstrates that there is a need for veterinary monitoring, to help farriers in detecting static imbalances of the limbs. A decreased heel angle causes greater tension in the superficial digital flexor tendon, which can alter the dynamic equilibrium (LAWSON et al., 2007). The aim of the treatment in the abnormality is to arrest the condition, minimize the ongoing damage and prevent or eliminate the lameness. The goal is using trimming to reestablish normal angles and facilitate the regrowth and reorientation of the heels. Special shoes must be used, objecting the dissipation of the weight load over a larger area, these shoes can be wider, offering more support for the heel, straight bar shoes, heart bar shoes, onion shoes, roller motion shoes, heel plates, or other wide-webbed heel devices have been used with success. It should be empathized that the treatment for this imbalance takes a long period (HUNT, 2012).

Table 3. Frequency distribution of underrun heels in the forelimbs of horses participating in show jumping, barrel, long rope and polo competitions

Face of underrun heels	Left forelimb (%)	Right forelimb (%)
None	23.00	31.62
Medial heel	10.62	27.64
Lateral heel	16.81	11.98
Both heels	49.57	46.16

Contracted heels occur when the width of the frog is less than 67% of its length, and thus prevent complete dissipation of the pressure on the hoof (TURNER, 1992). The frequency of contracted heels was 88% in the LFL and 95% in the RFL. Canto et al. (2006) reported that this imbalance occurred in 87.62% of Crioulo horses, while Maranhão et al. (2007) found that 73% of lightweight traction horses presented contracted heels. Melo et al. (2011) found this imbalance in 64% of vaquejada horses. These studies reported that this problem was due to the toe length, which was greater than the values proposed by Turner (1992). In this study, 80.5% of the animals showed toe lengths within the range considered normal for their weight class, which indicates that the rate of contracted high heels found is related to other factors such as genetic factors or improper trimming and shoeing. The barrel, long rope and polo horses were Quarter Horse or mixed with this breed, which may have interfered with the values found, since horses of this breed have high incidence of contracted heels (OVNICEK et al., 2003).

The hoof is considered to be small when the ratio of body weight to hoof area is greater than 78pounds/inch^2. This type of problem is common in the Quarter Horse breed and may have an influence regarding lameness. The show jumping and polo horses did not have small hooves and had a good hoof size and weight ratio (Table 4). Among long rope horses, 26.7% and 30.0% of the horses had small hooves in the left and right forelimbs respectively. In barrel horses, the frequency of small hooves was 23.3% for both sides. In cases of navicular syndrome, the prognosis is poor if the animal has small hooves (TURNER, 1992), and when the ratio is greater than 83pounds/inch^2, the probability of resolving the lameness is very low (TURNER, 2008). Small feet affect 2% of sport horses, according to Turner (2008). However, in this study, this imbalance was found in 15% of the animals. Among the animals that had small hooves, 30% had a ratio exceeding 83 pounds/inch², and therefore among these animals, clinical assistance is even more important.

Table 4. Frequency distribution of contracted heels in the forelimb hooves of horses participating in show jumping, barrel, long rope and polo competitions

Type of sport	Left forelimb (%)	Right forelimb (%)
Show jumping (n = 30)	96.7	100.0
Barrel (n = 30)	86.7	93.3
Long rope (n = 30)	80.0	86.7
Polo (n = 30)	86.7	96.7

The foot axis reflects the relationship between the toe and pastern angles, and the breaking axis results from the difference between these angles. When the toe angle is smaller than the pastern angle, it is considered to be a broken-backward hoof axis, while when the toe angle is greater than the pastern angle, it is considered to be a broken-forward hoof axis. Normal hoof axes have the same angle between pastern and toe. Broken-backward axes were observed in 95.8% and 96.7% of the LFL and RFL, respectively, while broken-forward axes were found in 3.3% of the LFL and 1.7% of the RFL. In general, all types of sport presented cases with a broken-backward axis, but this was found in greater numbers of barrel horses. This type of abnormality causes higher tension in the deep digital flexor tendon (BALCH et al., 1998) and may predispose towards navicular syndrome (TURNER, 1992).

The toe angles found in barrel horses were smaller than in the other types of sport and were outside of the range recommended by Balch et al. (1991), which ranges from 50 to 54°. However, in terms of the Turner (1992) recommendation (ranging from 48 to 55°), those animals showed normal balance on the dorsal-palmar axis. The toe angles found in show jumping, barrel and polo horses were similar to those reported by Melo et al. (2011) among vaquejada horses, while barrel animals showed similar values to those described by Maranhão et al. (2007) among lightweight traction horses. The study with feral horses showed 52.8 ± 2.6° (HAMPSON et al., 2013) which was also similar to show jumping, barrel and polo horses values. The toe abnormality can be related to dorso-palmar imbalance and can lead to lameness due to soft tissues, articular or bone injuries (CANTO et al, 2006). The shoulder angle is also related to the pastern and hoof angles, and it is desirable to have the same measurement. In the present study, there was no difference between the shoulder and pastern angles among horses in the same sport, or between the sports (Table 5). However, the pastern and shoulder angles presented a difference in relation to the toe angle, such that the latter had lower values.

In the Crioulo breed, horses showing variation of 2 to 4° between the shoulder and hoof angles were considered to be better in gait tests, and were classified as being more balanced than those with differences greater than 4° (PAGANELA et al., 2008). This type of conformational alteration can lead to a modification in the trajectory of the gait arc, such that the parabola apex occurs before the passage through the contralateral limb (BALCH et al. 1991), thereby concentrating the impact in the toe, which in turn can cause injuries to epidermal lamellae (O'GRADY & POUPARD, 2001). Correction of hoof balance promotes comfort for the horse and prevents future injuries (OVNICEK et al., 2003).

Table 5. Shoulder, pastern and toe angles (mean ± standard deviation) of the forelimbs of horses participating in show jumping, barrel, long rope and polo competitions

Left forelimb			
Sport	Shoulder angle (°)	Pastern angle (°)	Toe angle (°)
Show jumping	65.55 ± 6.42^{Aa}	63.60 ± 5.08^{Aa}	52.93 ± 3.66^{Ab}
Long rope	-	63.83 ± 5.21^{Aa}	52.23 ± 3.83^{Ab}
Barrel	64.60 ± 4.43^{Aa}	65.40 ± 4.58^{Aa}	49.00 ± 2.90^{Bb}
Polo	65.27 ± 4.47^{Aa}	65.63 ± 5.74^{Aa}	53.30 ± 3.76^{Ab}
Right forelimb			
Sport	Shoulder angle (°)	Pastern angle (°)	Toe angle (°)
Show jumping	67.00 ± 5.15^{Aa}	63.93 ± 4.97^{Aa}	52.67 ± 4.47^{Ab}
Long rope	-	63.40 ± 5.12^{Ab}	52.83 ± 4.06^{Aa}
Barrel	65.20 ± 3.73^{Aa}	65.50 ± 3.84^{Aa}	49.47 ± 3.49^{Bb}
Polo	63.20 ± 4.70^{Aa}	64.97 ± 5.39^{Aa}	53.27 ± 3.30^{Ab}

Different capital letters in the columns indicate differences according to Student's t test at 5% (comparisons made in the same sport modality).
Different small letters in the lines indicate differences according to Student's t test at 5%.

The clinical evaluation of the veterinary combined with expertise and skills of the farrier are extremely necessary for a successful outcome for horse and owner. Based on that, communication between farrier and veterinary must be present for treating when there is the presence of injuries and for maintain and preserve the hoof health (WERNER, 2012).

With the use of hoof biometric evaluation was possible to identify the imbalances of forelimb in athletic horses of four different modalities. The most common imbalances were broken-back hoof axis, followed by contracted heels and underrun heels. According to the results from this study, it was observed that the greatest number of animals showing foot imbalances was in the long rope sport, followed by barrel horses. Furthermore, a high frequency of medial-lateral imbalance of hooves was found in all the sports, which may lead to low performance and lameness. It also suggests that the trimming and farriery must be reviewed. The adoption of objective measurement by biometrics and a better veterinary and farrier communication must also be considered intending to discuss better strategies for achieving the hoof balance. Researches should be made aiming to find the causes of these imbalances as well as trimming and farrierry strategies for the hoof problems.

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