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Morphometric evaluation in traction horses in the urban region of Maceió-AL

Avaliação morfométrica em equinos de tração na região urbana de Maceió-AL

Thamyres Valeriano Teixeira[1]*, Maria José de Holanda Leite[2], Isaac Ferreira de Lima Junior[3], José Jackson dos Santos[3], Tobyas Maia de Albuquerque Mariz[4], Pierre Barnabé Escodro[4]

ABSTRACT: The use of draught animals is still a reality in urban centers and has great economic and social relevance, serving as a driving force to capture recyclable materials or small freights and as a source of income for the population under vulnerability. The present research aimed to evaluate the morphometric parameters of horses used for traction in the urban region of Maceió, Alagoas, in order to identify the productive type and work capacity of the horses, based on their morphometric structure. A survey of the clinical register of 60 traction horses, from the Large Animal Release sector, was carried out at the Zoonoses Surveillance Unit (*Unidade de Vigilância de Zoonoses - UVZ*) of Maceió, Alagoas. The animals were submitted to zootechnical evaluation, with individual identification and measurement of morphometric measurements by the method of linear measurements and body circumferences. For this, a tape measure was used to measure the following variables: thoracic circumference (CTórax), body length (CCop.), withers height (ACern.), chest width (Lpeito) and cinnamon circumference (CCan.). From these measurements, the estimated weight was calculated and the morphometric indices were calculated: Body index (ICorp), compactness index 1 (Icomp.1), compactness index 2 (Icomp.2), conformation index (IConf) and the dactyl-thoracic index (TDI). In view of the results obtained, the aptitude of horses used in traction in the urban region of Maceió, Alagoas is for saddle, according to body indexes incompatible with what is characterized in the literature for traction activity.

KEYWORDS: Equine morphology; animal traction; load capacity.

RESUMO: O uso de animais de tração ainda é uma realidade em centros urbanos e possui grande relevância econômica e social, servindo como força motriz captação de materiais recicláveis ou pequenos fretes e como fonte de renda para a população sob vulnerabilidade. A presente pesquisa teve por objetivo avaliar os parâmetros morfométricos de cavalos utilizados para tração na região urbana de Maceió-AL, com o intuito de identificar o tipo produtivo e a capacidade de trabalho dos equinos, tomando por base sua estrutura morfométrica. Realizou-se o levantamento do cadastro clínico de 60 equídeos de tração, provenientes do setor de Liberação de Animais de Grande Porte, na Unidade de Vigilância de Zoonoses – UVZ de Maceió-AL. Os animais foram submetidos a avaliação zootécnica, com identificação individual e aferição das medidas morfométricas pelo método de medidas lineares e circunferências corporais. Para isso, utilizou-se fita métrica para mensuração das seguintes variáveis: circunferência torácica (CTórax), comprimento corporal (CCop.), altura da cernelha (ACern.), largura do peito (Lpeito) e circunferênca da canela (CCan.). A partir dessas medidas, foram calculados o peso estimado e calculados os índices morfométricos: índice corporal (ICorp), índice de compacidade 1 (Icomp.1), índice de compacidade 2 (Icomp.2), índice de conformação (IConf) e o índice dáctilo-torácico (IDT). Diante dos resultados obtidos, a aptidão de cavalos utilizados em tração na região urbana de Maceió-AL é para sela, conforme índices corporais incompatíveis com o que é caracterizado na literatura para atividade de tração.

PALAVRAS-CHAVE: Morfologia equina; tração animal; capacidade de carga.

[1] Programa de Pós-graduação em Ciência Animal, Campus de Engenharias e Ciências Agrárias/UFAL, Rio Largo/AL, Brasil
[2] Docente no Campus de Engenharias e Ciências Agrárias/UFAL, Rio Largo/AL, Brasil
[3] Unidade de Vigilância de Zoonoses, Maceió/AL, Brasil
[4] Grupo de Pesquisa e Extensão em Equídeos e Saúde Integrativa/UFAL, Rio Largo/AL, Brasil
*Corresponding author: thamyres.valeriano@hotmail.com
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INTRODUCTION

Horses, since their domestication, were used as a driving force in agriculture and as transportation, either in saddle or by the traction of carts, having their strength employed for the socioeconomic development of humanity (Segat *et al*., 2016). Currently the horses have been conquering new spaces, stand out in the social aspect, as in sport and leisure (Severo, 2019).

However, even in modern times, the exploitation of equidae for daily work in urban and rural centers is still observed (Rodrigues *et al*., 2019). Its functionality regarding the economic aspect is relevant in these environments, where it´s found the still significant use as an animal traction vehicle (VTA), in the search for recyclable materials and for the service of small freight, acting as a promoter of income and financial contribution to families under social and economic vulnerability (Segat *et al*., 2016). Despite the relevance of this activity, the welfare and sanity of these animals are still neglected.

For the horse to develop any type of activity, Costa *et al*. (1998) apud Santos e Silva (2018) state that there must be proportions between body parts, so that these linear and angular dimensions corroborate the translation of a balanced body conformation for locomotion dynamics. For a horse to properly perform its functions and locomotor affections to be minimized, it´s necessary to respect its conformation and that the maintenance of body balance occurs with good distribution of its mass (Rodrigues *et al*., 2019). Any imbalance in the bone structure can be severely aggravated due to the weight of the cart, the wagon driver and the load that the animal carries, in addition to the commands and speed of displacement.

The indices based on morphometric measurements are useful as to the classification of the function to which the animal can be inserted, being possible to determine its aptitude for a given job, respecting its ideal physical performance (Clark, 2017; Severo, 2019). The morphometric evaluation is done by analyzing each part of the individual's body that when observed together, allow to define the proportionality and determine the morphological type in which the animal can be classified: saddle, fast traction or heavy traction (Silva *et al*., 2020).

Aiming at the well-being and the full development of the traction activity by the horses, several authors have reported that, in some situations, the animal may be being demanded above its natural limits of work, being imposed on it that it travels long distances pulling weight above the supported, triggering as direct consequences affections in the locomotor system (Segat *et al*. 2016; Silva *et al*., 2020; Lima *et al*., 2020). In addition, the level of misinformation leads to inadequate nutritional management practices regarding the feeding and type of food that is offered to the animals, generating significant damages to their health such as fibrous osteodystrophy, colic syndrome, orthopedic developmental diseases (ODD), diarrhea and laminitis (Escodro *et al*., 2012; Cintra, 2016).

In order to mitigate the impacts generated on the well-being of equidae during the practice of various activities, it´s necessary that man understands the natural behavior of the species (Queiroz, 2020). In addition, it´s necessary that the wagon driver has knowledge about how to evaluate his animals through the five domains of animal welfare, proposed by Mellor and Reid (1994), a model that considers four domains that contemplate the internal or physical-functional states of the animal, being them "Nutrition" domain 1, "Environment" domain 2, "Health" domain 3 and "Behavior" domain 4, and that directly influence the associated affective experiences of the individual influencing in domain 5, the "Mental" domain.

The informal activity developed by the wagon drivers has its socioeconomic importance, on the other hand it becomes necessary an educational intervention for the implementation of animal welfare aimed at improving the sanitary and nutritional conditions and the work capacity of the animals involved in this activity (Segat *et al*. 2016).

The objective of this research was to evaluate morphometric parameters to determine the aptitudes of horses used in traction in the urban region of Maceió, Alagoas.

MATERIAL AND METHODS

Data collection and descriptive analysis of 60 files obtained from the files of the Zoonoses Surveillance Unit (UVZ) of traction horses seized and kept in the Large Animal Release sector of UVZ, Maceió, Alagoas, from 2018 to 2022, were carried out. The animals were submitted to zootechnical evaluation, being performed the identification of each individual, evaluation of its general condition, chipping and measurement of the morphometric measurements described by Torres and Jardim (1992): Thoracic circumference (CTórax), measured in the narrowest portion of the thorax, caudally to the withers, in the dorsal portion of the last thoracic vertebrae and ventrally in the caudal third of the sternum; body length (CCorp), distance that extends from the scapular-humeral joint to the ischial tuberosity; withers height (ACern), distance from the ground to the highest point of the withers, with the equine in season; breast width (LPeito), distance between the lateral edges of the right and left scapular-humeral joints; cinnamon circumference (CCan), measurement of the circumference in the median region of the shin of the right forelimb (Figure 1).

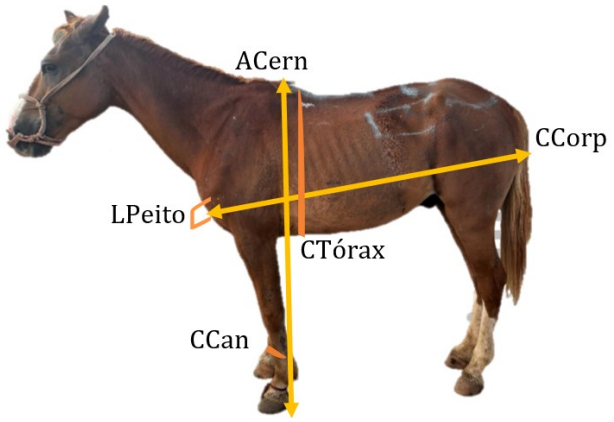
For inclusion in the research, forms were considered with full completion of all variables, through the measurement of linear morphometric measurements and body circumferences, using a tape measure obtained in a standardized way on the left antimer of the animal positioned in a forced station on a flat and regular floor.

The formula used to estimate weight, developed by Carroll and Huntington (1988), is indicated its measurement in adult horses in several breeds, being composed as follows: Estimated weight (PE) = ($CTórax^2$ * CCorp) /11900).

From these measurements obtained, the morphometric indices were evaluated as described by Torres and Jardim (1992), being the Body Index (ICorp), the relationship between body length, divided by thoracic circumference (IC=CCorp/CTórax); Compactness Index 1 (IComp[1]), ratio of estimated weight divided by withers height, with result divided by 100 (ICC1= (PE/ACern)/100); Compactness Index 2 (IComp[2]), estimated weight divided by the height of the withers subtracted from the value 1, dividing this result by 100 (IComp[2]= P/(ACern-1)/100); Conformation Index (IConf), chest circumference squared, with result being divided by withers height (IConf= CTórax²/ACen); Dactyl-Thoracic Index (IDT), relationship between shin circumference and thoracic circumference (CCan/CTórax); Load index 1 (IG1), thoracic circumference squared with the constant 56 divided by the height of the withers, the result of which indicates the weight in kilograms that the animal can bear without exaggerated effort on the back, at trot or gallop (IG1 = 56 * CTórax² / AC); Load index 2 (IG2), chest circumference squared with constant 96 divided by withers height (IG2= 96 * CTórax² / AC), whose result indicates the weight in kilograms that the animal can tolerate working at a pace.

The age was estimated from the dental chronology, since horses are hypsodont animals, that is, their teeth have continuous growth and wear during life, obtained through the observation of eruptions and wear of incisor teeth (Silva *et al.*, 2003). The body condition score (BCS) is defined through the inspection and palpation of some specific zootechnical points, such as the dorsal border of the neck, withers, ribs, posterior part of the scapula, lumbar spinous processes and area of the base of the tail, observing the deposition of fat and the visualization of the bone structure. According to Henneke *et al.* (1983), the body condition score can be measured through a scale that contains the visible and palpable characteristics of each structure, being classified from 1 to 9, in which 1, the animal is extremely thin and 9, the animal is extremely fat).

The variables obtained in this study were submitted to descriptive statistical analysis and processed in the Microsoft Office Excel® program, version 2013.



Source: Image adapted from Mariz *et al.* (2014).

Figure 1. Schematic design of morphometric measurements measured to assess the fitness of horses.

RESULTS AND DISCUSSION

According to the survey conducted in this research, 25 males and 35 females were counted, without defined racial pattern (SPRD), with an average age of 8.0 ± 4.3 years. Regarding the body condition score (BCS), these presented a mean BCS of 4.0 ± 1.48 according to the scale of Henneke *et al.* (1983) (Table 1).

Evaluations point to a moderately thin body condition, with a slightly thick neck, sharp withers, apparent ribs on palpation, and accentuated palettes. For the equine to maintain its performance it´s necessary to meet the nutritional requirements, which include, the maintenance requirements and the gain/activity requirements the type of work that the animal develops (Santos; Bragante; Chedid, 2020).

The estimated weight values presented in table 1, in which the animals evaluated presented an average of 268.96 Kg, classify them according to Astiz (2009) as small or hypometric animals, because they weigh less than 350 Kg. Proper nutrition of the mare at the stage of gestation is paramount for the proper development of foals, from the formation of the nervous system and tissues to bone formation. A poor diet can cause various problems, causing damage to the animal until adulthood. In addition, other problems that can be observed to justify the lower weight and height of these animals are dental problems, gastric ulcers, stress, previous diseases and access to food of low quality or insufficient quantity so that their size is not necessarily linked to racial characteristics, but to conditions of rearing and maintenance (Souza, 2006).

The thoracic circumference presented a mean value and standard deviation of 1.52 ± 0.11m, with results for males of 1.54 ± 0.11m and for females of 1.56 ± 0.11m (Table 2). However, it´s necessary that this parameter be evaluated in

Table 1. Classification of traction horses from the urban region of Maceió, Alagoas according to gender, age, body condition score (ECC) and weight (PE).

Gender	Total	Minimum and maximum age (years)	Age (mean and standard deviation)	ECC (mean and standard deviation)	PE Kg (mean and standard deviation)
Female	35	1.5 - 19	8.1 ± 4.7	3.6 ± 1.04	263.34 ± 50.83
Male	25	2 – 19	7.9 ± 3.6	4.2 ± 0.84	276.82 ± 55.34
Overall average	-	-	8.0 ± 4.3	4.0 ± 1.48	268.96 ± 53.17

conjunction with other parameters, such as withers height and body length, since the thoracic circumference alone is an irrelevant factor, not being able to determine whether the traction horses of the urban region of Maceió, Alagoas have adequate conformation to carry large loads.

Regarding body length, the animals presented mean and standard deviation of 1.36 ± 0.09m, with males with a mean of 1.38 ± 0.09m, and females with a mean of 1.35 ± 0.09m. Thus, the horses evaluated here had a longer body, which together with the thoracic circumference provide a more slender condition, making its use in traction activity inappropriate. One of the characteristics of the draft horse is to be heavy, with high stature and extremely muscular constitution (Severo, 2019).

The overall average height of the withers (1.37 ± 0.06) is below 1.50 m classifying the animals evaluated as small, a result similar to the traction horses evaluated by Tavares *et al.* (2015) in the city of Mossoró, and in males, the withers height observed was 1.38 ± 0.07 m and, in females, from 1.36 ± 0.06 m. According to Torres and Jardim (1992), animals that have a height of less than 1.50m are considered small animals, and do not suit the traction activity.

The measurements obtained for breast width presented an overall mean and standard deviation of 0.30 ± 0.03m, being 0.30 ± 0.04m for males and 0.29 ± 0.03m for females. The pectoral region should be wide and strong with good musculature, indicating that the lungs, chest and muscles are well developed. The very wide chest is a desirable feature in the draft horse, because when horses develop this activity, there is a greater demand for oxygen to the muscle cells (Silva *et al*, 2020).

In terms of cinnamon circumference, the traction horses of Maceió, Alagoas showed an average of 0.17 ± 0.01m, with an average of 0.18 ± 0.01m for males and 0.17 ± 0.01m for females. Santos e Silva (2018) analyzed draft animals from the municipality of Marechal Deodoro, Alagoas, and found means within the values found in this research with an average for CCan of 0.17m. This parameter is extremely important to evaluate the amount of weight that the animal can bear, without damaging its musculoskeletal system, and should be evaluated in conjunction with the measurements of: withers height, thoracic circumference and body length (Reginato *et al.*, 2022).

When evaluated in relation to gender, the animals did not present significant differences regarding morphometric measurements (Table 3).

The body indexes are relevant information for the evaluation of the fitness of the horses, being performed with the morphometric values applied to specific formulas (Torres; Jardim, 1992). The body index of traction horses in the urban region of Maceió, Alagoas presented an overall average of 0.90 ± 0.04m, and these animals are considered distant according to Torres and Jardim (1992). The average in males was 0.91 ± 0.09m, framing them as long-haired men who have characteristics of being lighter with a slender body and fit for saddle; on the other hand, the females had an average

Table 2. Maximum and minimum values of morphometric measurements of male and female traction horses in the urban region of Maceió, Alagoas.

Male	Parameters (m)				
	CTórax	CCorp	ACern	LPeito	CCan
Average	1.54 ± 0.11	1.38 ± 0.09	1.38 ± 0.07	0.30 ± 0.04	0.18 ± 0.01
Minimum	1.28	1.24	1.25	0.17	0.16
Maximum	1.77	1.58	1.60	0.45	0.20
Female	**Parameters (m)**				
	CTórax	CCorp	ACern	LPeito	CCan
Average	1.56 ± 0.11	1.35 ± 0.09	1.36 ± 0.06	0.29 ± 0.03	0.17 ± 0.01
Minimum	1.16	1.17	1.26	0.22	0.14
Maximum	1.73	1.54	1.48	0.35	0.20

Table 3. Total values of males and females of morphometric measurements of traction horses in the urban region of Maceió, Alagoas.

	Parameters (m)				
	CTórax	CCorp	ACern	LPeito	CCan
Males	1.54	1.38	1.38	0.30	0.18
Females	1.56	1.35	1.36	0.29	0.17
Overall mean and standard deviation	1.52 ± 0.11	1.36 ± 0.09	1.37 ± 0.06	0.30 ± 0.03	0.17 ± 0.01

Table 4. Mean and standard deviation of morphometric indices of male and female traction horses in the urban region of Maceió, Alagoas.

Indexes	Male	Female	Overall average
ICorp	0.91 ± 0.09	0.89 ± 0.04	0.89 ± 0.04
IComp1	2.11 ± 0.75	1.96 ± 0.28	2.03 ± 0.54
IComp2	7.28 ± 0.90	7.31 ± 1.00	7.30 ± 0.96
IConf	1.71 ± 0.19	1.68 ± 0.21	1.70 ± 0.21
IDT	0.116 ± 0.05	0.112 ± 0.01	0.114 ± 0.01
IG1	95.89 ± 10.99	94.23 ± 12.20	94.92 ± 11.74
IG2	164.35 ± 18.85	161.55 ± 20.92	162.71 ± 20.13

of 0.89 ± 0.04m, characterizing them as medioline animals (Torres; Jardim, 1992).

Indexes IComp1(2.03 ± 0.54), IComp2 (7.30 ± 0.96) and IConf (1.70 ± 0.21) demonstrate that the traction horses of the municipality of Maceió, Alagoas presented morphometric characteristics of saddle animals, being inappropriate for the use of heavy or light traction, according to the description of Torres and Jardim (1992).

Analyzing the TDI, the general mean 0.114 ± 0.01m, determines animals with aptitude for light traction however, if analyzed individually in relation to the values of TDI by gender, males presented mean and standard deviation of 0.116 ± 0.05m, and would be classified as heavy traction animals, and females with an average of 0.112 ± 0.01m, are light traction animals (Table 4) (Torres; Jardim, 1992). This was the only index that classified the animals as fit for traction, but it should be noted that the circumference of the shin is sensitive to the site of measurement (which may have variations in cm) and by affections of the locomotor system, in addition to being influenced by growth diseases.

Maranhão *et al.* (2006) stated that the most frequent affections of the locomotor system of traction equidae in the city of Belo Horizonte, Minas Gerais, were flexor tenosynovitis, superficial digital flexor tendon tendinitis (SDT), suspensory ligament dismissal and mixed tendinitis in the thoracic and pelvic limbs. The excessive effort and load much higher than what these animals can bear, causes the emergence of affections in their locomotor system such as injuries to the tendons and ligaments, because they do not have adequate proportions and good body conformation for good performance mainly in the traction activity (Díaz, 2014).

Analyzing the load indices 1 and 2, it was verified that the horses evaluated can withstand an average weight of 94.92 ± 11.74 Kg at trot or gallop and 162.71 ± 20.13 Kg at the pace, respectively. According to Santos e Silva (2018), the traction animals evaluated in their study presented an average of 99.11 Kg of load capacity working at trot or gallop and 168.13 Kg at the pace. Although the indexes are parameters used for comparison, referring to the carters, the animals transport part of the rubble originated from civil constructions or waste and household utensils, not being respected the minimum load, since, adding the weight of the wagon, the rubble and the wagon driver, this load can be much higher than the average weight that the horses evaluated can support (Segat *et al.*, 2016).

It´s necessary to implement morphometric analyses in traction horses in public policies of animal welfare intervention, allowing the definition of the maximum tractional load for animals working in urban areas, in addition to the creation of laws with the purpose of regulating the activity, animal care programs and educational programs in order to bring knowledge to the carters about the importance of welfare.

Under the aspect of animal welfare, the evaluation of morphometric measurements contribute to the identification of the fitness of the animals, so that it´s clear that saddle horses that are used for traction do not have the balance and body symmetry appropriate for this work (Queiroz, 2020). With this, the joint overload by the high demand to which these animals are submitted in this productive function, can result in several affections of the locomotor system (Escodro *et al.*, 2012), causing pain and discomfort to them.

Other measures should be introduced in public policies, since, under the socioeconomic aspect, the use of draught animals is a relevant activity for drivers who depend exclusively on this activity for the support of the family. Studies such as this one demonstrate the importance of the performance of qualified professionals to work in favor of public policies, adding animal welfare, control of zoonoses and training of drivers for their reintroduction into the labor market.

CONCLUSION

In view of the results obtained, the aptitude of horses used in traction in the urban region of Maceió, Alagoas is for saddle, and their body indexes are incompatible with what is expected of the body structure of an equine for use in the traction activity.

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