



Thermographic assessment of saddles used in Mangalarga Marchador horses

[Avaliação termográfica de selas utilizadas em cavalos da raça Mangalarga Marchador]

F.T.D.R. Dantas¹, M.A. Duarte¹, J.C.B. Marins², B.P.A. Fonseca²

¹ Aluno de pós graduação – Universidade Federal de Viçosa - Viçosa, MG

² Universidade Federal de Viçosa - Viçosa, MG

ABSTRACT

Poor saddle-fitting is one of the main causes of back pain in horses. Mangalarga Marchador is a popular breed in Brazil, being used mainly for pleasure riding and sports. This study aimed to thermographically assess saddles used in horses of this breed. Thermographic images were obtained from 18 saddles of animals from different categories during a Mangalarga Marchador National Exposition. The evaluation was based on three parameters: contact area symmetry, dorsal midline interaction and total skin contact area (25%, 50%, 75% or 100%). Contact area asymmetry was observed in 83.3% of saddles. Dorsal midline interaction was observed with the same frequency. Only 22.2% of saddles assessed in the present study had panels with contact areas greater than 50%. Based on the results of this essay it can be concluded that thermography is a useful tool for the evaluation of saddle contact area with the back of horses and that there is a high frequency of fitting unconformities in saddles used in Mangalarga Marchador horses.

Keywords: equine, back pain, gait, saddle fit, thermography

RESUMO

O ajuste inadequado da sela é um dos principais causadores de lombalgias em equinos. A raça Mangalarga Marchador está entre as mais populares do Brasil, sendo muito utilizada para cavalgadas e prática de esportes. O presente estudo teve como objetivo avaliar termograficamente as selas utilizadas em cavalos dessa raça. Para tal, foram realizadas imagens termográficas de 18 selas de animais de diversas categorias durante uma Exposição Nacional do Cavalo Mangalarga Marchador. A avaliação foi realizada baseando-se em três parâmetros: simetria da área de contato, interação com a linha média dorsal e área total de contato com a pele (25%, 50%, 75% ou 100%). Em 83,3% das selas avaliadas foi observada assimetria da área de contato. A interação com a linha média dorsal foi observada com a mesma frequência. Apenas 22,2% das selas avaliadas no presente estudo tinham suadouros com área de contato maior que 50%. Com base nos resultados obtidos neste trabalho, conclui-se que a termografia é uma ferramenta útil na avaliação do contato das selas com o dorso dos cavalos e que existe alta frequência de inconformidades no ajuste de selas utilizadas na raça Mangalarga Marchador.

Palavras-chave: equino, dor lombar, marcha, ajuste de sela, termografia

INTRODUCTION

Every athlete needs adequate equipment to perform in the best manner. For many years the equestrian industry did not give saddles, girths and other essential riding equipment their true value. Nevertheless, it is well known nowadays

that harmony between saddle, horse and rider is imperative (Harman, 1999).

Poor saddle fitting is one of the main factors known to trigger back pain in horses. The outcome of these injuries might go from intermittent lameness to permanent incapacity to be ridden and early retirement of horses (Harman, 1999; Alves *et al.*, 2004). Thereby, the awareness about saddle fitting and related issues

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E-mail: nandadelrey@hotmail.com

has grown along with the employment of new technologies to better assess the interaction between saddles, horses and riders (Greve and Dyson, 2013).

In this sense, pressure pads and thermography rose as useful auxiliary tools to assess forces distributed along the back of saddled horses. Pressure pads are fragile, expensive and specific for saddle fit assessment, thus they have been used mostly in experiments (Turner, 2007). On the other hand, thermography has many applications in veterinary medicine, especially concerning the diagnosis of orthopedic injuries like lower back problems, navicular disease, stress fractures and laminitis (Jones, 1998; Soroko *et al.*, 2013; Gomes and Gomes, 2014).

Some researchers have already employed this technology in the assessment of saddle fit in horses (De La Corte and Mikail, 2003; Fruehwirth *et al.*, 2004; De Cocq *et al.*, 2006; Arruda *et al.*, 2011). However, none of them evaluated Mangalarga Marchador horses, a very popular Brazilian breed that is characterized by a particular gait (*marcha*). The aim of this study was to thermographically assess saddles used in Mangalarga Marchador horses.

MATERIALS AND METHODS

This essay was approved by the Ethics Committee of the Veterinary Department of the Universidade Federal de Viçosa (Process no.65/2017) in accordance with Veterinary Professional Ethics Code, Ethical Principles for Animal Research established by the Brazilian College for Animal Experimentation and current Brazilian legislation.

The study was performed at the Mangalarga Marchador National Exposition with saddles used in horses of varied categories. Saddles were assessed according to personal interest of animals' owners. The only inclusion criteria was the availability to ride the horse for 20 minutes before the evaluation, as recommended by Turner (2007).

The assessment was performed in 18 saddles of different brands. Each saddle was used for one animal; there was no saddle or animal duplicity in this study. Before the exercise, riders were inquired about a number of aspects regarding

saddles and its usage through a standardized questionnaire. The number of horses who were ridden using the same saddle, saddle utilization time and the number of riders using each saddle were some of these aspects.

The exercise consisted of horses being ridden in a straight line for 20 minutes in their characteristic gait (*marcha*). Immediately after the exercise, horses' weight was estimated based on the thoracic perimeter with adequate tape and a thermographic image of the saddle was acquired through a thermographic camera (FLIR ThermoCam E40, FLIR Sytems Brasil, Brasil). The equipment emissivity (ϵ) was set at 0.99 and medium temperature scale between $19.5 \pm 4.7^\circ\text{C}$ and $31.9 \pm 2.3^\circ\text{C}$. For image acquisition, saddles were disposed against a wall with their panels facing up and the camera was positioned one meter away from the saddle in a 90° angle. All images were taken in a closed environment and protected from wind and sun.

Thermographic images were later analyzed using the open source software NIH ImageJ 1.48r (US National Institute of Health, available at <http://rsb.info.nih.gov/ij/>) based on three parameters: contact area symmetry, interaction with dorsal midline and total contact area with skin (25%, 50%, 75% or 100%). Images were analyzed by two of the authors in order to have a more reliable assessment. Contact area symmetry was assessed comparing the heat pattern in the right with the left side of the saddle. Interaction with dorsal midline was evidenced by hot spots in the gullet area. Total contact area was evaluated based on a grid dividing the thermographic image in four squares, each of them representing 25% of the total area of the saddle. Data collected were compiled in Epi Info (Centers of Disease Control and Prevention, USA, 2013). Descriptive statistical analysis was employed.

RESULTS AND DISCUSSION

Contact area asymmetry between saddles and the back of animals was observed in 83.3% of saddles assessed. This is the most important criteria in the assessment of saddle fit, since it indicates irregular pressure distribution in the dorsal region of horses (Turner, 2007). This situation leads to overloaded areas that generate

painful lesions and epaxial muscular atrophy (Greve and Dyson, 2013).

The pressure exerted in the back of horses when ridden results from the interaction and force distribution between horse and rider (De Cocq *et al.*, 2009). Pressure sores depend on an inverse relation between pressure applied and its duration – if applied for a long enough period, even a small amount of pressure might generate a lesion that is equivalent to one produced by a large amount of pressure that lasts a short period of time (Kosiak, 1959; Reswick and Rogers, 1976). Therefore, even small differences in saddle distribution forces can lead to injuries over long periods of time.

Arruda *et al.* (2011), working with jumping horses, observed that 62.8% of saddles assessed had contact area asymmetry. Thereby, they suggested that the vast majority of saddles used in animals of that equestrian modality are not well adjusted. However, one must have in mind that physical or postural asymmetries of the rider might as well result in asymmetrical force distribution from the saddle to the horse, demanding a thorough assessment of the problem (Greve and Dyson, 2013). It is also valuable to point out that irregularities in both animals' back and saddle can lead to differences in force distribution and, consequently, back pain in both horse and rider (Greve and Dyson, 2014). For this reason, a full assessment of both is required. The influence of the rider or horses' back anatomy was not evaluated in the present study.

The symmetry in force distribution is directly related to how much of the saddle is in contact

with horse's back: the greater the contact area, the better the force distribution. Only 22.2% of the saddles evaluated in the present study had panels with contact area greater than 50% (Figures 1 and 2). This is a very disquieting observation since, as mentioned before, uneven force distribution in the thoracolumbar region leads to overwhelmed spots that can provoke serious injury in the back of animals.

Evidence of contact with dorsal midline was observed in 83.3% of saddles assessed. This is a meaningful observation since one of the main concerns in saddle fit is to free the dorsal midline of any pressure focus (Turner, 2007; Dyson *et al.*, 2015). Inadequate tree width is a common cause of pressure irregularity and possible outcomes range from soft tissue injuries, such as supraspinous ligament desmitis, to osseous abnormalities, such as kissing spines (Haussler, 1999; Turner, 2007). Arruda *et al.* (2011) observed that 37.2% of saddles assessed in their study showed evidence of dorsal midline contact. The high incidence evidenced in the present study is possibly related to the lack of knowledge regarding saddle fit between Mangalarga Marchador's riders. The adjustment of saddle morphology to horse's anatomy is rarely a matter of concern. On the other hand, between other equestrian sports practitioners the knowledge concerning saddle adjustments is more widespread, contributing to the use of more adequate saddles and reducing the risk of injuries. The impression that the saddle must fit the rider and not the horse was also very evident in this study. Table 1 shows the number of animals ridden with the same saddle.

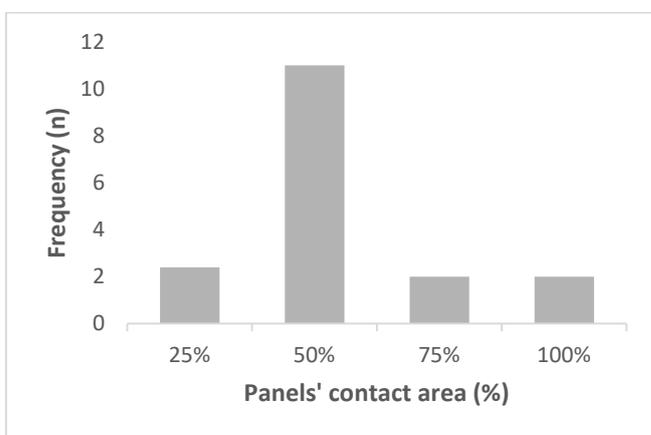


Figure 1. Panels' contact area (%) with the dorsal region of animals.

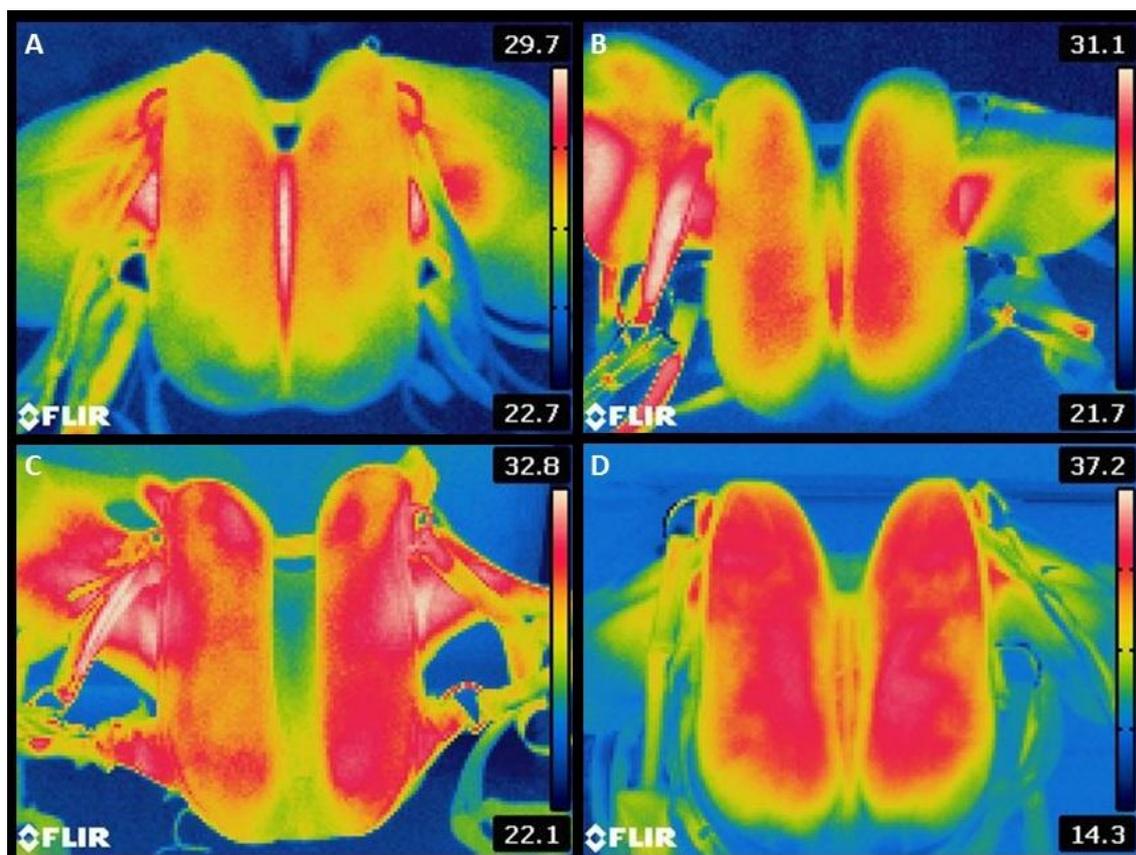


Figure 2. Thermographic images demonstrating the classification according to saddles' total contact area with the dorsal region of horses: A) 25%; B) 50%; C) 75%; D) 100%.

Table 1. Number of horses (H) ridden with the each saddle (number of saddles= n) according to riders

H	n	%
1 a 5	2	11.1
6 a 10	7	38.9
11 a 15	6	33.3
20	1	5.6
30	1	5.6
50	1	5.6
Total	18	100

Confronting these data with Table 2, that exposes the number of riders using each saddle, one can verify that most frequently saddles are of the riders' preference, disregarding what is better for the horse. While a single saddle is used in up to 50 animals, 72.2% of saddles are used for only one rider. It should be emphasized that this study was performed enquiring riders about saddles and animals that are considered the best in Brazil and, even in this context, the present data

suggests that saddle fit was neglected most of the time.

Table 2. Number of riders that use a single saddle

Number of riders per saddle	n	%
1	13	72.2
2	4	22.2
3	1	5.6
Total	18	100

The utilization time of saddles assessed was variable. However, 50% of saddles had been used for six months or less. The newest saddle had two weeks of usage and the oldest, 84 months (Table 3). Arruda *et al.* (2011) reported that saddles were used for 4.5 ± 4.3 years in 4.6 ± 3.7 horses for 2.1 ± 1.0 different riders. Data from this same essay showed that, as utilization

time and the number of horses using the same saddle grew, the frequency of asymmetric contact also increased. This observation was predicted, since older saddles and those applied in different shaped backs tend to be more “malleable”, succumbing easily to riders’ weight.

Table 3. Saddle utilization time in months

Utilization time (in months)	n	%
0 – 6	9	50
6 a 12	2	11.1
13 a 18	3	16.7
18 – 24	2	11.1
36	1	5.6
84	1	5.6
Total	18	100

Greve and Dyson (2014) reported that 78% of inquired riders employed their saddles in only one animal. A very different reality was observed in the present study and in Arruda *et al.* (2011). This discrepancy might be a result of cultural factors, insofar as the last two essays were carried out in Brazil, and Greve and Dyson (2014), in England.

Despite the fact that The Society of Master Saddlers (Thermography..., 2013) does not recommend the employment of thermography to assess saddle fit, the present study exposes data to disagree with that. In an essay performed with six animals, they reported thermograms were misleading and that without a professional saddle fitter their interpretation would be erroneous. Also, a block in heat conduction from the body of animals to the saddle caused by saddle pads is mentioned, what would preclude thermographic evaluation of saddles when pads are used. These results ought to be interpreted with caution. The methodology of the study failed in a number of aspects, especially concerning the number of animals and the exercise period. Regarding the blockage of heat caused by saddle pads, in the present study this was not observed. All animals assessed had pads under their saddles. Still, thermograms clearly showed heat conduction from the back of horses to saddle panels.

CONCLUSION

Thermography has proven to be a useful tool in assessing saddle fit, evidencing asymmetry in saddle contact with the back of horses. In addition, interaction between the saddle and dorsal midline of animals was well depicted with this imaging technique. Saddle fit appears to be a neglected field between Mangalarga Marchador horse riders.

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