

# The Behavioral Repertoire of Cattle Used for Vaquejada Races Does Not Indicate Chronic Stress in Transport and Races

Raíssa Karolliny Salgueiro Cruz<sup>1</sup>, Carla Rayane dos Santos<sup>1</sup>, Isabella Cavalcante Costa<sup>1</sup>, Diego Barbosa de Freitas<sup>2</sup>, Muriel Magda Lustosa Pimentel<sup>1</sup>, César Fabiano Vilela<sup>3</sup>, Helena Emília Cavalcanti da Costa Cordeiro Manso<sup>4</sup>, José Dantas Ribeiro Filho<sup>5</sup>, Helio Cordeiro Manso Filho<sup>4</sup>

<sup>1</sup>Faculdade de Medicina Veterinária, Centro Universitário Cesmac, Maceió, AL, Brazil

<sup>2</sup>Private Veterinarian, Londrina, PR, Brazil

<sup>3</sup>Independent Researcher, Americana, SP, Brazil

<sup>4</sup>Núcleo de Pesquisa Equina, Universidade Federal Rural de Pernambuco (UFRPE), Recife, PE, Brazil

<sup>5</sup>Departamento de Medicina Veterinária, Universidade Federal de Viçosa, Viçosa, MG, Brazil

Email: helio.mansofo@ufrpe.br

**How to cite this paper:** Cruz, R.K.S., dos Santos, C.R., Costa, I.C., de Freitas, D.B., Pimentel, M.M.L., Vilela, C.F., Manso, H.E.C. da C.C., Ribeiro Filho, J.D. and Manso Filho, H.C. (2024) The Behavioral Repertoire of Cattle Used for Vaquejada Races Does Not Indicate Chronic Stress in Transport and Races. *Open Journal of Veterinary Medicine*, **14**, 305-319.

<https://doi.org/10.4236/ojvm.2024.1411019>

**Received:** October 9, 2024

**Accepted:** November 11, 2024

**Published:** November 14, 2024

Copyright © 2024 by author(s) and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

## Abstract

There is little information about the bovine behavior and welfare during transportation and vaquejada race competitions. To test the hypothesis that the transport and racing of bovines produce chronic stress during these events, a study was performed to evaluate the behavior of bovines used for vaquejada races. Evaluations of cattle (n = 80) occurred on transportation (before, immediately, and 8 hours after transportation), and three days at Vaquejada Park (1 hour before, immediately, and 1 hour after the vaquejada race). Evaluators used a behavioral repertoire based on an ethogram for bovines and were previously trained. They used an observational and noninvasive method for one hour and applied a visual scanning method at transportation and for three days at the races. The results for pre-transport had greater idleness (102.9%), head/tail movements (57.4%), and agitation (49.8%). After transport, idleness (69.7%) was reduced, and agitation (79.5%) increased. Eight hours after this, sodomy/mounting/dominance (118.1%) was higher, followed by head/tail movements (92.8%), lying down (63.3%), and fatigue (53.3%). The results of vaquejada races revealed high feeding rates before and after races on the three evaluation days (53.6% - 30.0%), followed by rumination (72.0% - 44.5%). On all the evaluation days at the races, agitation was higher immediately after the races (87.9% - 66.1%). In conclusion, it was observed that the animals increased the frequency of behaviors indicative of acute stress immediately after

transport and races but were able to recover the characteristic behavior a few hours after acute stress when transport and races followed the current official rules for both. Maintaining management standards for transport and vaquejada races, currently adopted, can reduce the impact on welfare and can be improved with regular scientific evaluations of the cattle involved to improve welfare through good practices.

## Keywords

Brazil, Transport, Stressors, Coleada Race

---

## 1. Introduction

Cattle are versatile species in different parts of the world, having been involved in various agricultural activities and sports [1]. On the American continent, both horses and cattle regularly participate in these activities, and in northeastern Brazil, vaquejada is the most widespread and popular sport involving horses and cattle [2]. Vaquejada races are used to test the athletic qualities of these animals and the cowboys, who are exposed to physical and metabolic challenges during the race [3]; however, few studies of cattle under the conditions present in this sport exist. Thus, better knowledge of the possible physical, metabolic, and behavioral changes experienced by cattle may help maximize the good management practices and the welfare of this species [1] [3].

The use of cattle in cultural practices and sports has prompted discussions about the need to preserve their integrity, health, and welfare [4]. Improvements in bovine welfare during vaquejada races can be reflected in the physical, metabolic, and behavioral adaptations of the Nellore cattle used in these activities [1].

In recent years, different methods have been used to evaluate animal welfare [4] [5]-[7]. However, currently, there is a push to use noninvasive objective methods; combined with other approaches, these methods aim to provide a more accurate evaluation system and thus assist in decision-making and the evaluation of animal welfare [5]-[9]. In this sense, behavioral assessment is a useful technique because it is noninvasive [10], can be applied quickly, and is practical for measuring the state of an individual concerning the environment they occupy [7] [11] [12].

The primary method for monitoring behavior as a qualitative and quantitative marker of animal welfare is observation [5] [7]. Observations can be performed directly or indirectly with a video [12]. The data can be evaluated quickly and practically using an ethogram [7] [8]. Internationally recognized evaluation models, which are based on the concept of the 5 domains (5D) and include animal-human-environment interactions, were applied [13] [14].

Therefore, to understand the effects of the transporter and vaquejada races on the behavior and welfare of cattle in vaquejada, an experiment was developed to test the hypothesis that transport and cattle racing can produce stress during these events and chronically impact the animals. The objective of this experiment was

to evaluate cattle ( $n = 80$ ) during transport (before, immediately, and 8 hours after transport) and on the three days of races in the Vaquejada Park (1 hour before, immediately, and 1 hour after the vaquejada race) through ethogram to evaluate the cattle by scanning methods. Therefore, these results can contribute to understanding cattle behavior under these conditions and improving management practices and their welfare.

## 2. Materials and Methods

This study was conducted after approval by the Committee on Ethics in the Use of Animals of the Centro Universitário Cesmac (CEUA/CESMAC) under protocol number 03A/2021. Importantly, the study was performed in a real vaquejada environment (*i.e.*, a farm and Vaquejada Park). The legal, normative, and regulatory provisions and precepts were followed. These included ensuring that animals had a tail protection harness and were run no more than three times a day and that when unbalanced, they fell into an area of very soft sand [15]-[18].

### 2.1. Animals and Breeding Systems

In the present study, 80 Nellore cattle, which were collectively housed on a farm in the municipality of Garanhuns, PE ( $8^{\circ}53'25''\text{S}$ ;  $36^{\circ}9'31''\text{W}$ ), were provided with *Brachiaria* grass (*Brachiaria decumbens*) and supplemented daily with silage of capiaçu grass (*Pennisetum purpureum* Schum, cultivar RNC 33503), which was available *ad libitum*. These cattle had free access to mineralized salt and water, which they received regularly. They had a mean age of 30 months and a mean weight of 540 kg, obtained by weighing them on an electronic scale before being transported to the Vaquejada Park. Parasitic, ectoparasitic, and endoparasitic disease control and vaccination (rabies, foot-and-mouth disease, and clostridial disease) were performed regularly as indicated by the manufacturers.

On the farm of origin, the cattle were randomly split into two homogeneous lots, each consisting of 40 animals, which were identified with green and yellow markers (Raidl-Maxi, RAIDEX GmbH, Dettingen/Erms, Germany) to prevent any animals from changing groups during the experiment and from being housed in the incorrect corrals.

On the following day, using a dedicated cattle truck, the animals embarked for the Vaquejada Park (**Figure 1**) located in the municipality of Paranatama, PE ( $8^{\circ}54'34''\text{S}$ ;  $36^{\circ}39'31''\text{W}$ ), approximately 25 km from the farm of origin. The cattle were transported without stops, with the journey lasting approximately 40 minutes. Trucks that are suitable for the transport of cattle and that have suitable capacity according to Brazilian laws were used [15].

After unloading, the cattle were housed in resting corrals in the same groups of 40 previously identified cattle; both corrals had a minimum capacity of 15 m<sup>2</sup>/animal, where cattle had free access to water and were supplemented with Capim-Açu (*P. purpureum* Schum, cultivar RNC 33503) silage and mineral salt. The silage offered at the competition site was the same as that on the farm and was

provided *ad libitum* three times a day (5:00 am, 1:00 pm, and 10:00 pm) through collective feeding areas. Both resting corrals were equipped with a sand floor, a water drinker, a salt, good drainage, and an area of approximately 50 m<sup>2</sup>, with artificial shading made of black screens (80% shade).



**Figure 1.** Aerial satellite photograph of the Vaquejada arena. Observations: lines with red arrows indicate the path of the cattle during and after the races; red and yellow dots indicate the positioning of the observers during the analysis of the cattle behavior in the resting corral. (Source: Apple Map 2024)

## 2.2. Vaquejada Races

Vaquejada races occurred following the official rules [15]–[18], *i.e.*, with a tail guard, which was placed before the races and removed immediately after. The animals ran a maximum of twice a day, and the animals were brought down in an area with soft sand that was 50 cm deep. The corral entry and exit practices also complied with good management practices for beef cattle. Details of transport and races are described in a previous publication [5] [6].

## 2.3. Behavioral Assessment

Evaluations of the behavior of the cattle were performed before the animals left the farm of origin when the animals were housed in the handling corrals for loading, and after transport to the corrals prior to the races. The phases of the cattle behavior evaluations are described in detail in **Table 1**. The evaluators were previously trained to use the behavioral repertoire adapted from Pes [19] (**Table 2**). These procedures were entirely observational and noninvasive and did not require individualized restraint of the cattle, minimizing environmental interference.

Each round of observation was performed via the scanning sampling method, with the evaluators taking their notes 5 minutes after entering the observation positions in the corrals without interfering with the animals. During the previously defined 1-hour scanning period, each evaluator took notes three times in

the following periods: 0, 30 and 60 minutes. The analytical period of each scan lasted 60 s for each evaluator. The results of the means of the three analyses were added together, and the frequency of expression of each item in the behavioral repertoire relative to the total number of cattle ( $n = 80$ ) was subsequently calculated.

**Table 1.** Description of the different evaluation stages of Nelore cattle.

Evaluation phase	Description
<b>Transport</b>	
Pre-shipment	The animals were kept in the handling corrals, 1 hour before loading onto the trucks.
Immediately after arriving	The animals arrived at the Vaquejada Park, with access to food, shade, and water.
8 hours after arriving	Resting corral, with access to food, shade, and water.
<b>Races</b>	
Prerace or 1 hour before the races	Animals were in the resting corral, with access food, shade, and water.
Immediately after the races	Immediately after the races, at the resting corral, with access to food, shade, and water.
Post races or 1 hour after races	After the races and at the resting corral, with access to food, shade, and water.

In addition to the ethogram, the animals were evaluated daily throughout the vaquejada period via the five-domain welfare evaluation system, which considers the positive and negative conditions for the ambiance, nutrition, health, behavior, and mental status domains [7] [13]. At the end of the event, the animals remained in the enclosure, awaiting commercialization.

### 3. Results

The frequencies of the different behaviors of Nelore cattle during transport and the vaquejada competitions are listed in **Table 1** and **Table 2**.

**Table 2.** Description of the behavioral repertoire characteristics of Nelore cattle.

Activity	Description
<b>Vocalization</b>	Mooing
<b>Food</b>	Feeding on forages and concentrates. Drinking
<b>Decubitus</b>	Lying down in sternal or lateral recumbency
<b>In season</b>	Standing, stationary
<b>Interaction</b>	Interacting with peers and the environment
<b>Rumination</b>	Ruminating while standing or in sternal recumbency
<b>Idle</b>	Not feeding, ruminating or interacting with other animals, but alert to the events around it

## Continued

<b>Sodomy/mounting/ domination</b>	One animal mounting another without exposing its penis
<b>Agitation</b>	Rapid movements around the corral; restlessness
<b>Head and tail movements or restlessness</b>	Frequent head and/or tail movement and restlessness without moving around the corral
<b>Tired</b>	Peripheral fatigue; no interaction with the environment or people; and diaphragmatic “fluttering” may occur after exercise

The frequencies of the behaviors in the behavioral repertoire were analyzed, and the results showed that the pre-transport period had greater idleness (102.9%), followed by head/tail movements (57.4%) and agitation (49.8%). Immediately after transport, there was a reduction in idleness (69.7%) and an increase in agitation (79.5%). Finally, eight hours after the animals arrived at the Vaquejada Park and were unloaded, the most frequent parameter was sodomy/mounting/dominance (118.1%), followed by head/tail movements (92.8%), lying down (63.3%), fatigue (53.3%), and interactions with peers (52.5%) (**Table 3**).

Before loading and after unloading the cattle at the Vaquejada Park, no injured or bleeding animals were observed, nor were they lame. A few hours after arriving at the park, the cattle were already feeding and drinking water, with rumination observed hours after feeding.

**Table 3.** Results of the frequency (%) of different behaviors of Nelore cattle (n = 80) subjected to transportation by truck in different periods (1 hour before, immediately after, and after 8 hours).

Behavior	Transport		
	-1 hour	Immediately after transport	+8 hours
<b>Feed</b>	0.0	42.4	37.5
<b>Rumination</b>	30.0	9.5	0.0
<b>Interaction with peers</b>	34.0	14.0	52.5
<b>Interaction with the environment</b>	0.0	0.4	13.3
<b>Lying down</b>	0.0	27.5	63.3
<b>Fatigue</b>	0.0	0.0	53.3
<b>Idleness</b>	102.9	69.5	51.1
<b>Agitation</b>	49.8	79.5	5.6
<b>Head and tail movements</b>	57.4	45.8	92.8
<b>Vocalization</b>	13.3	0.0	3.8
<b>Sodomy/mounting/ dominance</b>	2.0	4.9	118.1

The results of the evaluations of the behaviors during different phases of the vaquejada races revealed high feeding rates before and after the races on the three evaluation days, with rates between 53.6% and 30%, followed by rumination (72.0% - 44.5%) and idleness (83.5% - 48.3%). Sodomy/mounting/dominance accounted for less than 4.1% of the behaviors observed, head/tail movement accounted for 42.4%, and no tired animals were observed. On all the evaluation days, agitation was greater immediately after the races (87.9% - 66.1%) (**Table 4**).

No deaths were observed during the races. There was also no bleeding, lameness, or animals lying down and not eating after the races. Like what was observed in the evaluations during transport, the animals returned to eating and ruminating, indicating that they were healthy and regaining a positive mental state. Clinical inspection was performed throughout the days using the concepts of the 5 domains [7]. Invasive clinical evaluations or those that required restraint of the animals were not used so as not to interfere with the noninvasive evaluation systems.

**Table 4.** Result of the frequency (%) of the different behaviors of Nellore cattle (n = 80) subjected to races during three days in different phases (1 hour before the races, immediately after, and after 1 hour of the race).

Behavior (%)	Race period								
	1st day			2nd day			3rd day		
	C1	C2	C3	C1	C2	C3	C1	C2	C3
Feed	53.6	16.3	58.1	51.3	42.9	50.0	30.0	42.5	50.0
Rumination	63.8	37.4	64.1	44.5	44.5	62.4	71.0	59.5	62.4
Interaction with peers	22.0	38.6	19.5	15.4	13.6	14.9	12.8	17.5	14.9
Interaction with the environment	4.4	2.5	4.5	1.3	1.1	1.3	4.0	3.8	1.3
Lying down	21.6	13.8	48.8	67.5	25.0	48.8	48.3	20.0	48.8
Fatigue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Idleness	83.5	64.0	67.9	80.8	71.1	79.1	80.3	48.3	79.1
Agitation	41.6	87.9	23.6	24.9	66.1	26.3	38.3	79.5	26.3
Head and tail movements	17.9	42.4	7.0	10.4	29.0	15.0	10.8	27.5	15.0
Vocalization	0.4	0.0	0.8	0.0	0.4	0.0	0.0	0.0	0.0
Sodomy/mounting/dominance	2.4	2.8	3.8	3.3	4.1	2.0	2.5	1.3	2.0

**Observations:** C1: 1 hour before the race; C2: Immediately after the race; C3: 1 hour after the race.

#### 4. Discussion

Animal welfare can be assessed both through behavioral observations and by measuring physiological parameters [20]-[25]. In this study, the behavioral responses of Nellore cattle were assessed during two challenges, the first being transportation (pre-transportation, immediately after transportation, and 8 hours after transportation) and the second being vaquejada races (1 hour before, immediately after races, and 1 hour after a race), where each cattle runs once a day. In the

different phases of evaluation, *i.e.*, transportation and races, behavioral changes were observed in the cattle associated with the applied stressor, but with rapid recovery of the animals, corroborating an increase in positive indicators of well-being and mental health.

This article demonstrated that the behavioral changes that occurred after the application of the stressor was related to changes in the environment and the different management practices used for the animal and produced acute stress, without compromising the welfare of the animals in the long term or in a chronic manner, like other well-managed farms [21] [26]. It was thus demonstrated that cattle used in *vaquejada* that comply with official regulations and good management practices are used, and their welfare is positive.

Before transport, while still on the farm and in the corral, the most frequent behaviors were idleness, head and tail movements, agitation, and little interaction with the environment and peers. The idle time comprised the period in which the animal was awake and in a quadrupedal position but remained still [11] [12]. This parameter is essential for determining the degree of agitation and/or restlessness of an animal in the environment to which it is subjected [23] [24] [26]. Idleness was also the most commonly observed behavior in a study by Gonçalves *et al.* [23] in Girolando and Holstein cattle during corral management. According to Cecim [24], idleness is one of the three most frequently observed behaviors throughout the day for cattle, in addition to rumination and activity, with the animals dedicating approximately 8 hours a day to each behavior, although there are changes in their distribution throughout the day. This may be related to health, nutritional, or environmental issues [25] [26].

The impact of transport and interaction with a new environment has repercussions on the behavior of the animals and can be detected by examining agitation, idleness, and head and tail movements immediately after transport. According to Pereira and Lopes [27] and Nielsen *et al.* [28], transport is one of the activities that causes stress in cattle. However, this reaction was expected because cattle were adapting to new corrals after transport. Nevertheless, excessive agitation can compromise animal welfare and even affect the health of cattle, as individuals who exhibit constant episodes of agitation due to suboptimal management practices gain less weight and are more affected by diseases [29] [30], thus indicating that even immunological parameters are altered by stress.

Eight hours after arriving, the most frequently observed behavior is sodomy/mounting/dominance, with dominance in these groups being established through competition, *i.e.*, aggressive interactions between animals of the same group. Under natural conditions, males would separate into small groups of bachelors; thus, mounts are most likely related to the establishment of dominance and occurred upon regrouping immediately and 8 h after transport in the present experiment. This excessive mounting behavior has already been reported among young bulls housed in corrals with limited space and among steers kept in large groups in feedlots or similar situations [31] [32].

The role of social behavior in cattle welfare is associated with the environment in which the animals are found, with space, group size, and group instability playing important roles [33]. Thus, we believe that the high frequency of this behavior may be due to the change in the housing environment following transport, as mentioned by other authors [12] [34]. However, it should be noted that in the present experiment, the cattle were housed in resting corrals with ample space, protection from the weather, and regular supplementation with good-quality feed; nevertheless, these behaviors (sodomy/mounting/dominance) were expected due to the increase in management activities.

With respect to the indicators of animal welfare during transport, the best indices were observed immediately and 8 hours after transport. The results demonstrated that, despite having been displaced, not being on a regular feeding schedule, and being in climatic conditions similar to those in the northeastern region, the animals were able to quickly return to their baseline physiological states. This indicates that the management practices used during transport were appropriate, thus minimizing the situations that generated stress among the animals, like the reduction of rumination time [32]. Therefore, the adoption of good management practices during the transport of cattle is necessary to reduce risk to the animals and limit situations that could negatively affect the welfare of the animals [35] [36].

The evaluations of the behaviors of the cattle in the different phases of the vaquejada races revealed high feeding rates on the three days evaluated, followed by rumination, idleness, and recumbency. We did not analyze the body scores of all animals, but they are eating and keeping the rumen full, which is a significant indicator of animal welfare [32] [36] [37]. According to Paudyal [32], rumination is an indicator of the feeding and resting behavior in cattle, and this information can be used to guide the development of management practices that help in the detection and prevention of diseases [21] [22] [32] [37]. The cattle spent more time in recumbency on the second day of the test, before vaquejada races, and this behavior was a strong indicator of herd health and animal welfare.

We should also remember that the evaluations were performed at different times over the three days, and the results were similar, indicating that there was a standard behavior after the races, followed by a rapid recovery in the post-race phase. Thus, the results observed in the post-race phase were similar to the characteristics observed in the pre-race phase, indicating that the race management system used in this experiment followed the official rules and that the welfare of the animals was not impaired. However, there is no complete or perfect method for assessing animal welfare and therefore the combination of behavioral and physiological factors can contribute to a better understanding of this process and facilitate the positive impact of animal welfare in different farming systems [26] [33]-[35].

Agitation and head and tail movements were greater immediately after the vaquejada races, which was expected due to the physiological stress caused by

running 80 m on a sand track. Animals subjected to some type of stress may exhibit changes in their social interactions [36], digestive processes [37] and homeostasis [38]. However, when the stressor is removed, we expect that it recovers rapidly. Chronic stress situations that occur with some regularity can harm mental and behavioral health [38]. The rapid recovery of pre-race behaviors (*i.e.*, within 1 hour after the race) is a good indicator that the current rules minimize stress; thus, the animal can recover from positive patterns of welfare.

However, despite the agitation observed after exercise, no fatigue was observed in any animal. Thus, it is suggested that the walking and trotting behaviors that frequently occur on farms during different management practices serve to strengthen the muscles of the animals [39].

The animals vocalized little, with this behavior being more evident 1 hour after the race (C3) on the first day of the test. According to Boissy and Le Neindre [39] and Holm *et al.* [40], cattle are highly gregarious and form complex social relationships, with a strong motivation for continuous social contact. In addition, the isolation of individuals can result in physiological changes, such as increased vocalization, heart rate, cortisol levels, and eye and nasal temperatures [39] [41] however, these variables were not evaluated in the present study.

Studies have shown changes in physiological and biochemical biomarkers in cattle during vaquejada races; however, 4 hours after the vaquejada races, these values return to baseline levels [5] [6]. In this sense, these animals exhibit a significant number of behavioral characteristics, which are highly complex and interactive. Thus, a clear understanding of animal behavior, especially in an environment that is as close to natural as possible, learning, development, and consolidation processes, as well as the factors that directly and/or indirectly affect these processes, is necessary for the development of production systems that achieve the correct level of animal welfare [36] [42] [43].

Evaluations of the effects of transport of the vaquejada races were carried out for the five domains, and the results indicated that the environments were suitable from the movement of the animals to the corrals, to their loading at the farm, and finally their unloading and settling in stalls at the park. In addition, the stalls at the Vaquejada Park were spacious and had good flooring and drainage. Additionally, it has water troughs and sufficient resources for the number of animals housed per corral. Proper facilities ensure that animals have an adequate mental balance, leading to better health, the prevention of accidents, and tranquility among the animals [7] [8].

The artificial partial shading used in the corrals was satisfactory. The implementation of shading is highly important for reducing insolation and consequently preventing thermal stress and decreasing physiological and behavioral changes that can compromise the performance of these animals under different breeding systems [22] [36] [42] [43].

In the nutrition domain, the body scores of the animals were high compared with those of obese animals, and the former had free access to high-quality pasture and supplementation with grass silage on the farm. In the corrals of Vaquejada

Park, the water was of good quality, and there was a regular supply of forage (silage). According to Bertoni *et al.* [43], appropriate feeding is essential for performance and weight gain; however, little attention has been given to understanding the link between nutrition and animal welfare.

No sick or lame animals were observed in the health domain. The animals' feces were compatible with the type of feed and characteristics of cattle fed a diet rich in good-quality forages (silage). It should be noted that the quality of facilities, food, health care, and activities directly influence animal welfare [13] [14].

Finally, throughout the evaluation period during the vaquejada races, no impairment of welfare was observed, and the changes found were compatible with a positive mental domain. It is essential for a well-trained team that understands the species in question to oversee the management of these animals, and there is a need to perform behavioral studies to understand how the animals interact in their rearing environment. The results of such observations will prevent the development of negative situations that result in chronic stress and consequent economic losses.

Research that evaluates the welfare of cattle in environments where they are housed for a short period (less than five days), such as in the Vaquejada Park, with that of animals in transit (e.g., for transport or between corrals), may hinder our understanding of the welfare of these animals. As it is not possible to identify 80 cattle individually, these evaluations may have overestimated or underestimated some of the parameters analyzed, especially the evaluations related to transport. However, during races, as the animals adapted to the new environments, this limitation may have been lower because monitoring the cattle for three consecutive days and at different times may have reduced possible counting errors made by the evaluators.

There is also a need to conduct more evaluations throughout all phases of the study. However, as this was an equestrian event involving cattle and having a well-defined schedule, it was not possible to transform the entire event into a controlled experimental model; nevertheless, the results reflect what occurs in an event of this size.

## 5. Conclusion

In conclusion, it was observed that the frequency of behaviors indicative of acute stress increased immediately after transportation and racing in the cattle used in the current experiment. These same animals showed positive behavior characteristics of the species a few hours after the stressors were removed, due to good technical management practices, mainly related to environment and nutrition. Regular scientific evaluations of animals used in sports, such as cattle, can contribute to improving their well-being and contribute to improving the current management practices adopted.

## Acknowledgements

To the breeders and owners of Vaquejada Quarter Horses and the Brazilian

Quarter Horse Association for partial financial support; CAPES for the scholarships of the students involved in the research.

### Authors' Contribution

RKSC, CRS, ICC, DBF, CFV, and HCMF, contributed to the data collection and execution. RKSC, HCMF, JDRE, and HECCCM contributed to the data interpretation. RKSC, HCMF, HECCCM, CFV, and JDRE contributed to the study design, data interpretation, and manuscript preparation. All authors have read and agreed to the published version of the manuscript.

### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

### References

- [1] Caceres, S., Moreno, J., Crespo, B., Silvan, G. and Illera, J.C. (2023) Physiological Stress Responses in Cattle Used in the Spanish Rodeo. *Animals*, **13**, Article 2654. <https://doi.org/10.3390/ani13162654>
- [2] Torres, P.B., Santiago, J.M., Lucena, J.E.C., Lima, G.S., Melo, D.A.D.S., Moraes, A.V.M., *et al.* (2020) Characterizing the Vaquejada Horse Herd in the Brazilian State of Pernambuco. *Bioscience Journal*, **36**, 2133-2141. <https://doi.org/10.14393/bj-v36n6a2020-48845>
- [3] Lopes, K.R.F., Batista, J.S., Dias, R.V.D.C. and Soto-Blanco, B. (2009) Influência das Competições de Vaquejada Sobre os Parâmetros Indicadores de Estresse em Equinos. *Ciência Animal Brasileira/Brazilian Animal Science*, **10**, 538-543.
- [4] Pellegrini, M., Martire Pellegrini, C., Gallo, M.A., De Pádua Foz Filho, R. and Do Vale de Zoppa, A.L. (2017) Avaliação radiográfica da coluna cervical de bovinos que participaram de prova de laço em duplas. *Pubvet*, **11**, 538-645. <https://doi.org/10.22256/pubvet.v11n6.581-586>
- [5] Cruz, R.K.S., Ribeiro, M.L.A., Macedo, J.S., Ferreira, B.A., Silva, M.A., Neves Diniz, A.D., *et al.* (2021) Clinical and Radiographic Evaluation of Cattle Tail before and after the Vaquejada Race. *Open Journal of Veterinary Medicine*, **11**, 165-176. <https://doi.org/10.4236/ojvm.2021.116012>
- [6] Cruz, R.K.S., Vilela, C.F., de Freitas, D.B., Paixão, C.C., da Silva, C.J.F.L., Trindade, K.L.G., *et al.* (2021) Effort and Recovery in Nellore Oxen during Vaquejada Assessed with Ocular and Tail Infrared Thermography Superficial Temperature. *Open Journal of Veterinary Medicine*, **11**, 258-271. <https://doi.org/10.4236/ojvm.2021.117017>
- [7] Mellor, D. (2017) Operational Details of the Five Domains Model and Its Key Applications to the Assessment and Management of Animal Welfare. *Animals*, **7**, Article 60. <https://doi.org/10.3390/ani7080060>
- [8] Lesimple, C. (2020) Indicators of Horse Welfare: State-of-the-Art. *Animals*, **10**, Article 294. <https://doi.org/10.3390/ani10020294>
- [9] Filho, H.C.M., Trindade, K.L.G., Silva, C.J.F.L., Cruz, R.K.S., Vilela, C.F., Coelho, C.S., *et al.* (2024) The Welfare of Horses Competing in Three-Barrel Race Events Is Shown to Be Not Inhibited by Short Intervals between Starts. *Animals*, **14**, Article 583. <https://doi.org/10.3390/ani14040583>
- [10] Döpjan, S., Schön, P., Puppe, B., Tuchscherer, A. and Manteuffel, G. (2008) Differential

- Vocal Responses to Physical and Mental Stressors in Domestic Pigs (*Sus scrofa*). *Applied Animal Behaviour Science*, **114**, 105-115.  
<https://doi.org/10.1016/j.applanim.2007.12.005>
- [11] Broom, D.M. (1991) Animal Welfare: Concepts and Measurement. *Journal of Animal Science*, **69**, 4167-4175. <https://doi.org/10.2527/1991.69104167x>
- [12] Broom, D.M. and Fraser, A.F. (2010) Comportamento e Bem-Estar de Animais Domésticos. Manole.
- [13] Mellor, D. and Beausoleil, N. (2015) Extending the 'Five Domains' Model for Animal Welfare Assessment to Incorporate Positive Welfare States. *Animal Welfare*, **24**, 241-253. <https://doi.org/10.7120/09627286.24.3.241>
- [14] Ledger, R.A. and Mellor, D.J. (2018) Forensic Use of the Five Domains Model for Assessing Suffering in Cases of Animal Cruelty. *Animals*, **8**, Article 101. <https://doi.org/10.3390/ani8070101>
- [15] MAPA: Ministério da Agricultura, Pecuária e Abastecimento (2017) Portaria Nº 1.781, de 14 de Agosto de 2017. [https://www.gov.br/agricultura/pt-br/assuntos/inspecao/produtos-animal/avaliacao-de-inovacoes-tecnologicas/arquivos/in-sda-30\\_2017-anexo-dou\\_16-08-2017\\_pag-2.pdf](https://www.gov.br/agricultura/pt-br/assuntos/inspecao/produtos-animal/avaliacao-de-inovacoes-tecnologicas/arquivos/in-sda-30_2017-anexo-dou_16-08-2017_pag-2.pdf)
- [16] ABNT: Associação Brasileira de Normas Técnicas. (2020) Equipamentos Utilizados na Prática de Atividades Esportivas Equestres da Raça de Cavalos Quarto de Milha. Parte 5: Modalidade-Vaquejada. ABNT/DE Publicações.
- [17] ABQM: Associação Brasileira de Criadores de Cavalo Quarto de Milha (2020) Manual de Boas Práticas Para Bovinos Participantes de Atividades Esportivas Equestres. <https://abqm.com.br/app/webroot/documentos/manualdeboaspraticasembovinos-site.pdf>
- [18] ABVAQ: Associação Brasileira de Vaquejada. (2020) Manual Bem-Estar Animal. <https://drive.google.com/file/d/1bM1qpXZ6eredn5G1xSZR3qLhOYIn5Fn0/view>
- [19] Pes, T.S. (2018) Avaliação do Bem-Estar de Equinos, Submetidos a Confinamento em Feira Equestre, Através da Utilização de Etograma. Master's Thesis, Universidade Federal de Pelotas.
- [20] Nicolaisen, S., Langkabel, N., Thoene-Reineke, C. and Wiegard, M. (2023) Animal Welfare during Transport and Slaughter of Cattle: A Systematic Review of Studies in the European Legal Framework. *Animals*, **13**, Article 1974. <https://doi.org/10.3390/ani13121974>
- [21] Kaurivi, Y.B., Laven, R., Hickson, R., Parkinson, T. and Stafford, K. (2020) Developing an Animal Welfare Assessment Protocol for Cows in Extensive Beef Cow-Calf Systems in New Zealand. Part 1: Assessing the Feasibility of Identified Animal Welfare Assessment Measures. *Animals*, **10**, Article 1597. <https://doi.org/10.3390/ani10091597>
- [22] Burfeind, O., Sepúlveda, P., von Keyserlingk, M.A.G., Weary, D.M., Veira, D.M. and Heuwieser, W. (2010) Technical Note: Evaluation of a Scoring System for Rumen Fill in Dairy Cows. *Journal of Dairy Science*, **93**, 3635-3640. <https://doi.org/10.3168/jds.2009-3044>
- [23] Gonçalves, B.P., Schneid, U.S., Cardoso, J.B., Corrêa, T.I., Brauner, C.C., *et al.* (2023) Comportamento de Ruminação, Atividade e Ócio de Vacas Holandês e Girolando. 9ª Semana Integrada e XXV Encontro de Pós-Graduação da Universidade Federal de Pelotas. [https://cti.ufpel.edu.br/siepe/arquivos/2023/CA\\_05450.pdf](https://cti.ufpel.edu.br/siepe/arquivos/2023/CA_05450.pdf)
- [24] Cecim, M. (2018) Monitoramento Remoto de Saúde da Vaca em Transição. In:

- UFRGS, Ed., *V Simpósio da Vaca Leiteira*, UFRGS, 86-113.
- [25] Lawrence, A.B., Vigors, B. and Sandøe, P. (2019) What Is So Positive about Positive Animal Welfare?—A Critical Review of the Literature. *Animals*, **9**, Article 783. <https://doi.org/10.3390/ani9100783>
- [26] Romero, M.H., Barrero-Melendro, J. and Sanchez, J.A. (2023) Study of the Feasibility of Proposed Measures to Assess Animal Welfare for Zebu Beef Farms within Pasture-Based Systems under Tropical Conditions. *Animals*, **13**, Article 3659. <https://doi.org/10.3390/ani13233659>
- [27] Pereira, A.S.C. and Lopes, M.R.F. (2006) Manejo Pré-Abate e Qualidade da Carne. Programa de Carne Angus Certificada. Artigos Técnicos. Associação Brasileira de Angus.
- [28] Nielsen, B.L., Dybkjær, L. and Herskin, M.S. (2011) Road Transport of Farm Animals: Effects of Journey Duration on Animal Welfare. *Animal*, **5**, 415-427. <https://doi.org/10.1017/s1751731110001989>
- [29] Voisinet, B.D., Grandin, T., Tatum, J.D., O'Connor, S.F. and Struthers, J.J. (1997) Feedlot Cattle with Calm Temperaments Have Higher Average Daily Gains than Cattle with Excitable Temperaments. *Journal of Animal Science*, **75**, 892-896. <https://doi.org/10.2527/1997.754892x>
- [30] Fell, L.R., Colditz, I.G., Walker, K.H. and Watson, D.L. (1999) Associations between Temperament, Performance and Immune Function in Cattle Entering a Commercial Feedlot. *Australian Journal of Experimental Agriculture*, **39**, 795-802. <https://doi.org/10.1071/ea99027>
- [31] Brower, G.R. and Kiracofe, G.H. (1978) Factors Associated with the Buller-Steer Syndrome. *Journal of Animal Science*, **46**, 26-31. <https://doi.org/10.2527/jas1978.46126x>
- [32] Paudyal, S. (2021) Using Rumination Time to Manage Health and Reproduction in Dairy Cattle: A Review. *Veterinary Quarterly*, **41**, 292-300. <https://doi.org/10.1080/01652176.2021.1987581>
- [33] Jensen, M.B. (2018) The Role of Social Behavior in Cattle Welfare. In: Tucker, C.B., Ed., *Advances in Cattle Welfare*, Elsevier, 123-155. <https://doi.org/10.1016/b978-0-08-100938-3.00006-1>
- [34] Taylor, L., Booker, C., Jim, G. and Guichon, P. (1997) Epidemiological Investigation of the Buller Steer Syndrome (Riding Behaviour) in a Western Canadian Feedlot. *Australian Veterinary Journal*, **75**, 45-51. <https://doi.org/10.1111/j.1751-0813.1997.tb13830.x>
- [35] Silva, T.M.D., Brainer, M.M.D.A., Godoy, H.B.R.D., Paiva, S.C. and Fabino Neto, R. (2022) Influência do transporte no bem-estar e na qualidade da carne de Bovinos. In: *Open Science Research VI*, Editora Científica Digital, 2094-2112. <https://doi.org/10.37885/220910116>
- [36] Botreau, R., Bonde, M., Butterworth, A., Perny, P., Bracke, M.B.M., Capdeville, J., *et al.* (2007) Aggregation of Measures to Produce an Overall Assessment of Animal Welfare. Part 1: A Review of Existing Methods. *Animal*, **1**, 1179-1187. <https://doi.org/10.1017/s1751731107000535>
- [37] Higino, B.D.S.S. and Tarso, S.G.S.d. (2019) O rúmen como marcador de saúde: revisão de literatura. *Medicina Veterinária (UFRPE)*, **13**, 309-317. <https://doi.org/10.26605/medvet-v13n3-3287>
- [38] Rankins, E.M., Manso Filho, H.C., Malinowski, K. and McKeever, K.H. (2022) Muscular Tension as an Indicator of Acute Stress in Horses. *Physiological Reports*, **10**, e15220. <https://doi.org/10.14814/phy2.15220>

- [39] Boissy, A. and Le Neindre, P. (1997) Behavioral, Cardiac and Cortisol Responses to Brief Peer Separation and Reunion in Cattle. *Physiology & Behavior*, **61**, 693-699. [https://doi.org/10.1016/s0031-9384\(96\)00521-5](https://doi.org/10.1016/s0031-9384(96)00521-5)
- [40] Holm, L., Jensen, M.B. and Jeppesen, L.L. (2002) Calves' Motivation for Access to Two Different Types of Social Contact Measured by Operant Conditioning. *Applied Animal Behaviour Science*, **79**, 175-194. [https://doi.org/10.1016/s0168-1591\(02\)00137-5](https://doi.org/10.1016/s0168-1591(02)00137-5)
- [41] Gavojdian, D., Mincu, M., Lazebnik, T., Oren, A., Nicolae, I. and Zamansky, A. (2024) BovineTalk: Machine Learning for Vocalization Analysis of Dairy Cattle under the Negative Affective State of Isolation. *Frontiers in Veterinary Science*, **11**, Article 1357109. <https://doi.org/10.3389/fvets.2024.1357109>
- [42] Hernandez, A., Galina, C.S., Geffroy, M., Jung, J., Westin, R. and Berg, C. (2022) Cattle Welfare Aspects of Production Systems in the Tropics. *Animal Production Science*, **62**, 1203-1218. <https://doi.org/10.1071/an21230>
- [43] Bertoni, G., Grossi, P. and Trevisi, E. (2013) Use of Nutraceuticals for Improving Animal Health During the Transition Period of Dairy Cows in FAO. In: Makkar, H.P.S., Ed., *Enhancing Animal Welfare and Farmer Income through Strategic Animal Feeding—Some Case Studies*, FAO, 79-83.