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Short Communication

Observational Study of the Route's Characteristics of Tourism Carriage in a Tropical City

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ABSTRACT

The aim of this observational study was to describe the characteristics of circuits performed by horses used in carriage tourism in a tropical city and discuss their implications as a challenge for animal welfare. The tourism circuit of 33 Criollo horses (400 ± 50 kg) was followed by using the GPS from August 31 to December 2nd, 2018, in the rainfall summer season. The environmental temperature, humidity, and accumulated rainfall were obtained from a local meteorological station. The distance and number of trips, the number of people transported, and the time taken for working and resting activities were also registered to report descriptive statistics. A total of 69 trips were observed with a mean distance of 5 ± 0.5 km traveled in 47 ± 16 minutes, the number of trips performed by the horses being as maximum as six per day, and a continuous pulling activity of 4 hours and 42 minutes. The horses rested one day after two consecutive working days; resting within the same day lasted from one to 8 hours. The trips respected the carts' capacity of 6 people including the driver (~700 kg); mean daily temperature and relative humidity were 35.25 ± 1.54°C and 43.40 ± 6.58, respectively. No feed or water was offered during the carriage work. Considering that load-pulling capacity of light horses in low-friction surfaces can easily reach 2000 kg, carriage activity observed in the present study demand an under-maximum effort for horses. In addition, the length and intensity of workload does not imply a challenge for horse welfare. Nevertheless, watering practices could be improved and microweather conditions in warmer months should be monitored.

1. Introduction

Equestrian tourism can be stated as all activities where horses are the main motivation, that is, nature-based tourism or carriage where horses are used to pull a cart with passengers. Using horses in tourism is of social and economic relevance nowadays. In addition, in some countries such as France, it is considered an opportunity for bringing environmental education to people from cities promoting social cohesion between users, citizens, and horse owners [1]. Nevertheless, for people unfamiliar with horse-drawn carriages, this use of horses could seem as an intrinsic negative condition for their welfare. For example, lack of knowledge about the physical capacity of horses could lead one to think that pulling a cart as performed on a regulated tourism carriage involves an extraordinary effort beyond their natural capacities. Misinterpretations concerning welfare of horses can be exacerbated with an anthropocentric point of view or equating horses to pet dogs; both aspects characterize a lack of environmental education of contemporary' societies.

In tropical countries, the use of horses is often tolerated for societies when used for draught power and the welfare of the animal is respected. Nevertheless, their use for recreative purposes in traffic-saturated streets of cities exposing horses to accidents is at

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least questioned. In addition, high environmental temperatures and sun exposure in tropical latitudes is often used for arguing against carriage activity. Answering to this societal concern, universities [2], research centers, and animal welfare associations have been involved at long-term concerns on the study of aspects related to welfare of horses used in tourism—an activity that forms part of equitation science. The latter is prone to generate evidence-based enlightenment on horse welfare during activities such as dressage and training [3]. Despite these efforts, social networks still request for stopping use of horses in human activities, for example, the "current pandemic" of unwanted horses in carriage companies in South Carolina, USA [4]. The societal demand for stop carriage and other uses of horses in human activities is a trend that could also be present in other countries. This calls to generate more science-based evidence to state the challenge that carriage activity represents on horse's welfare. In consequence, the aim of this first part of the study was to describe the characteristics of circuits performed by horses used on carriage tourism in a tropical city and discuss their implications as a challenge for animal welfare.

2. Materials and Methods

2.1. Study Area and Experimental Period

The study was carried out in Mérida city, México (20° 58′12″ N, 89° 37′ 12″ W), a tropical subhumid region with 940 mm of mean annual rainfall mostly in the summer (AW_0), 27°C of mean annual temperature and 72% of mean annual relative humidity. Observations were performed from August 31 to December 2nd, 2018; the weather records of daily means of environmental temperature and moisture were obtained from a local meteorological station of the Water National Commission Institute (CONAGUA by its acronym in Spanish). The authors declare that all experimental procedures related to this study complied with ethical standards; the Bioethics Committee at the FMVZ-UADY approved the experimental protocol used (reference number CB-CCBA−M-2019-003).

2.2. Description of the Studied Horses

The study was performed in collaboration with the Driver's Union of Smallholders of Carriages of Yucatán which enabled the observation of their tourist routes covering the downtown of Mérida city. Horses used (stallions, females, and geldings included) are considered crossbreeds (Criollos) with a light morphology of speed type (400 ± 50 kg liveweight) (Figure 1) used for carriage during two consecutive days with the third day for resting.

2.3. Observations

Observations were performed at three points of the circuit: 1) at the start of the tour in the waiting point localized in the front of the cathedral at the heart of the Mérida city downtown; at this site, the horses remained standing, tied to their carriages, waiting for their turn; 2) during the carriage work in different points alongside of the avenue named "Paseo de Montejo"; and 3) at the end of the tour, when the horses get back to their waiting point. Observations were scheduled to observe the carriage work from 18h00 to 20h00 which is the day period with the highest demand for tours. Two persons, one placed at points 1 and 3 and another placed at the point 2, noted the observations in a logbook. Observers were communicated by telephone during the observations. All the drivers were interviewed using nonformal open interviews in which the topics concerned the management of horses during carriage and the duration of working journeys and the resting journeys of horses.

Fig. 1. Typical cart and carriage horse used in Mérida city by the "Unión de Conductores y Pequeños Propietarios de Carruajes de Yucatán".

2.4. Variables Observed and Data Analysis

The tourist route covered by 33 horses was followed by using the GPS to measure the distance traveled by horses during the circuits performed. The observed routes were described in terms of a) the time of the day at which they were deserved, b) duration of working journeys, c) duration to accomplish the touristic route, d) the number of trips performed by the horses, e) the distance covered in every trip, and f) the total distance traveled in the journey. In addition, the number of people transported per trip and the waiting time parked with the carriage were registered. The availability of water or feed during the working of carriage was also registered. The data were explored using descriptive statistics to inform means and standard deviation of the variables studied.

3. Results and Discussion

3.1. Pulling Activity During Circuits

In all cases of the present study, the trips respected the carts' capacity of 6 people (five passengers and the driver). These vehicles are constructed mainly of wood and disposed of pneumatic wheels resulting in an empty weight above 100 kg which at full capacity reaches around 700 kg to pull. Determining if carriage demands high physical efforts for horses is complex because many variables such as breed, horse weight, type of cart, resting periods, weather conditions, and so forth, must be considered. Although all horses could be used for carriage because they can pull more weight than they can carry, selected breeds (Percheron, Quarter Pony) are preferred because of their calm temperament. In addition, crosses obtained from more light draft breeds (Friesian, Cleveland Bay) are preferred for their easy drive. The "Criollo" horse, a mid-sized undefined breed, is also used for carriage. For this type of horse, pulling the carts observed in the present study at full capacity (700 kg) results to be lower than 900 kg that is recommended as the maximum weight ported for light horses [5]. Carriage observed in the present study can also be considered lower than the estimated load-pulling capacity of horses on low−friction coefficient surfaces (asphalt and cement) [6], which is between 4,000 and

5,000 kg for horses of 330 kg liveweight. Even when physical efforts performed by horses during carriage can modify their heart and respiratory rate, rectal temperature, and hematological and blood biochemistry parameters, all those physiological indicators recover their basal values after 10 minutes of resting from the carriage activity [7]. Furthermore, it is important to keep in mind that constant pull activity exerts a training effect, increasing the aerobic power capacity in the propulsion of hindlimb muscles [8]. That is why a regular physical exercise during slow tourism periods (working without passengers, pasture turns-out etc.) makes part of guideline recommendations issued by the American Association of Equine Practitioners [9].

3.2. Circuit Characteristics, Horse Management, and Weather Conditions

A total of 69 touristic travels (services) pulled by 33 Criollo horses were observed; nevertheless, owing to the observational nature of this work, a variable number of trips were performed by the horses. The main characteristics of the observed circuits and weather conditions are summarized in Table 1. During the waiting periods within services, the horses were not provided with water or food and most of them remained tied to the cart parked in a street area located in shaded zones with trees. In places with no natural shade, an umbrella was disposed to help the horses to cope with solar radiation. The animals received feed and water after finishing the working journey when returned to their enclosures located around Mérida city and only after the animals had been cooled and rested.

Concerning the global time in pulling activity (Table 1), this did not result in longer than the 4 hours of continuous work that can be performed by well-fed horses according to García Ospina [5]. The maximum number of trips per horse resulted to be similar to the four to six trips per day during five to six consecutive days followed by a resting period as reported by Kenneth [10]. The nonformal open interviews with the drivers enabled knowing that this limit on the number of trips by horses is determined by the horse carriage drivers' association, which determines strong economic punishment in case of nonaccomplishment. The daily duration that a cart was available for tourism service (Table 1) did not exceed the 10 hours of continuous work cited by Roser and Ardis [4]. Nevertheless, in the case of the present study, this duration does not consider the time of the travel between the housing system and the workplace. On other hand, carriage horses of Mérida were used only during two consecutive working days, a lower work intensity than the four days recommended by Márquez et al [10]. According to some interviewed drivers, the time spent by horses tied to the cart in the waiting points at low tourism periods can reach that of the full working day. It is important to notice that nonactivity can result negative for the comfort of horses [11], a species that on free conditions devote above 16 hours on search of feed and foraging activities. A recent study showed that maintaining horses tied with overchecks for more than 90 minutes can be considered a stressor; nevertheless, it seems that the latter can be reduced with an adaptation period [12]. Thus, long periods of horses on the waiting zones in Mérida carriages should be avoided.

Table 1
Circuit characteristics and weather conditions observed during carriage in Mérida city.

Daily time spent by cart available to tourism	8 hours
Duration of a circuit or service	47 ± 16 minutes
Mean distance of circuits	5 ± 0.5 km
Global time on pulling activity	4 hours and 42 minutes
Maximum number of travels by horse	6
Daily mean of environmental temperature	35.25 ± 1.54°C
Daily mean environmental humidity	43.40 ± 6.58%

Weather conditions observed in this study were a characteristic of tropical latitudes with 35°C and > 40% of environment moisture. Evaporation of sweat from the skin surface, the primary means of heat dissipation in horses, as well as respiratory heat loss by convection of the air expelled on breathing [13] could be compromised by the combination of high temperature and high environmental humidity [14].

Instead, thermoregulation mechanism enabled horses to cope with harsh weather conditions and even show acclimatization [15]. For example, training horses in sport activities such as galloping circles, spinning, and stopping under 30°C and 80% of relative humidity becomes efficient for maintaining heart rate and plasma lactate concentration after five days [16] of training. Nevertheless, heat stress in working horses can be present under extreme hot temperatures as 48°C as reported in Pakistan [17]. Tropical weather of Mérida city exposes carriage horses to a maximum of ~ 36°C during half of the year (from May to September) [18] and thermic sensation can reach 52°C for a few hours in the warmer month (May). In that season, a vigilance of microenvironment should be carried out to avoid physical activity of carriage horses in temperatures higher than 42°C + 80% of relative humidity.

Access to fresh water for animals seems logic under warm tropical conditions, advocating water to drink could alleviate dehydration resulting from exercise or thermal stress [17]. The latter must be carried out with caution because there is no consensus concerning watering practices. Water deprivation no longer than 4 hours had not been associated to colic presentation [19]; extreme water ingestion is negative for horses: i) a reduction in water ingested [20] but also the ingestion of water too cool [21] has been reported as risk factors for colic; ii) an increase in water consumption after exercise is a cause of primary gastric dilatation [22]. The latter seems to be the main reason for owners to not provide water to horses during carriage. In the aim to avoid colic, it could seem prudent that horses rest at least 2 hours after exercise to drink water or feed (as horses observed on the present studied were managed). Nevertheless, modern recommendations suggest providing water at frequent intervals (every 40 minutes) during a ride particularly in hot weather [23]. Thus, watering practice during carriage is a point that could be improved in this tropical city.

4. Conclusion

The observations of tourism carriage activity performed in the tropical conditions of Mérida suggest that the breed of horses used, the cart characteristics, as well as the distance and time in pulling activity do not imply a challenge for animal welfare of horses. Nevertheless, some recommendations include avoiding long periods in waiting zones when horses are tied to the cart and improving the current watering practice. Finally, further studies should be performed to analyze the effect of microweather conditions during warmer months on thermoregulation of horses.

CRediT authorship contribution statement

Armando de Jesús Tello-Pasos: Investigation, Writing - original draft. **Pedro Geraldo González-Pech:** Conceptualization, Methodology, Supervision, Writing - review & editing. **José Manuel Blanco-Molina:** Project administration.

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