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Climate Conditions Do Not Affect the Performance of Participating Horses of the Three Drum Race



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ABSTRACT

The objective of this research was to relate the performance of equine athletes participating in four stages of the three drums tests, which took place at different times of the year, according to the category of the test, sex, coat color, time elapsed along the route with environmental climatic conditions at the time of the tests. Data on age, sex, coat color, and a race time of the animals and the climatic conditions at the time of the tests of the four stages of the II EMS Cup, in Maringá, Paraná, south of Brazil. The data were analyzed using the Proc Genmod procedure. Climatic conditions, age, sex, and coat color of the animals did not affect the race time ($p>0.05$) and there was also no interaction between the variables studied. However, although there is no influence on the race time, the results showed differences ($p<0.05$) in the climatic characteristics between the four stages of the Cup. Based on the results obtained, consider that, as the sports practiced by athlete horses represent an important economic activity, this segment of the agribusiness of the horse employs management and training techniques that result in good conditioning and acclimatization of the animals, to that present good test times, regardless of weather conditions.

INTRODUCTION

Horses are, by nature, extraordinary athletes, being a characteristic of great importance arising from the speed to escape predators and the resistance to travel long distances in search of water and food for their survival (HINCHCLIFF et al., 2008). Therefore, due to this ability, in the last decades, there has been a reduction in the use of horses as a work tool and, at the same time, an increase in interest in equestrian sports.

This increase resulted in several studies, which are based on methods of prevention and monitoring of athletes, as is the case of blood determinations and assessments (CORRÊA et al. 2010), studies on the physiology of exercise (FERRAZ et al., 2007; SALES et al., 2013) and research on the various factors that can influence the horses' athletic performance, such as race, conformation, age, diet, fitness and physical condition, type of training and weather conditions (MADER et al., 2010; HODGSON et al., 2014).

To fully exploit an animal's athletic ability, it is necessary to understand the anatomy, physiology of exercise, and even how climate conditions can affect its performance. The climate represents an important environmental factor capable of affecting sports performance and studies have already shown a reduction in performance in exercise tests performed in hot and humid climates when compared to hot and dry climates or cold weather (McCUTCHEON; GEOR, 2007).

The thermoneutral zone of horses is around 25°C, and their body temperature is controlled through thermoregulation (SOUZA; BATISTA, 2012). At milder temperatures, animals dissipate sensitive heat through the skin, radiation, conduction, and convection, also, the heat exchange in the respiratory tract associated with these mechanisms improves the heat dissipation capacity in horses (SEABRA; DITTRICH, 2017). In warmer environments, if these mechanisms do not occur, heat stress develops, responsible, in part, for low animal productivity and, in the case of horses, poor performance in tests (McCUTCHEON; GEOR, 2007; HODGSON et al., 2014; REECE, 2017). However, temperatures below the thermoneutral zone also generate stress (SEABRA; DITTRICH, 2017).

In horses, heat dissipation is difficult when the environment is hot or hot and humid (SEABRA; DITTRICH, 2017), reducing their ability to exercise (FONSECA et al., 2015). In comparison with other animal species, the proportion of surface area about body mass area in horses is narrow, a fact that harms heat dissipation (HODGSON et al., 2014).

Other factors can also lead to thermal stress, for example, when the animal is not adequately conditioned for athletic activity (McCUTCHEON; GEOR, 2007; HODGSON et al., 2014) or is not physiologically adapted to the situation, that is, acclimatization process (FONSECA et al., 2015). Conditioning and acclimatization are measures that reduce the deleterious effects in the face of climatic adversities, also, in cold climates, it is important to increase the animal's heating time, heat the water for consumption and offer more energetic food, to increase energy consumption (MARLIN, 2007).

Considering the importance of the equine productive chain in Brazilian agribusiness, and that the country has continental dimensions, presenting a wide climatic variety depending on the different regions, and seeking to improve the understanding of the effects of climatic conditions and its influence on the sporting performance of athlete horses, The objective of this research was to relate the performance of equine athletes participating in four stages of the three drums tests, which took place at different times of the year, according to the category of the test, sex, coat color, time elapsed along the route with environmental climatic conditions at the time of the tests.

MATERIALS AND METHODS

This study took place between September 2018 to June 2019, and the data were collected in tests that took place in the covered arena in the Maringá, Paraná, south of Brazil (Latitude: -23.420861 Longitude: -51.902161).

Animal data were collected during the four stages of the II EMS Cup, which took place on September 22, 2018 (first stage), November 10, 2018 (second stage), February 02, 2019 (third stage), and June 7, 2019 (fourth stage). The EMS (Evidence Management System) Cup in Maringá is an equestrian championship in the modality of three drums, for animals of the Quarter Horse breed, and involves two categories: Junior Open, which includes animals aged 4 to 5 years, and Open Senior, for animals over 5 years old. The data collected at the time of the competitions were: age (years), to prove the category, sex, coat color of the animal, classified as light or dark and the race time (seconds).

The climatic conditions related to the day and time of the tests were collected on the website of the National Meteorological Institute (INMET, 2019). The data collected were air temperature (°C), relative humidity (%), atmospheric pressure (Hpa), wind speed (m/s), solar radiation (KJ/m²), and precipitation (mm).

The variables were analyzed by the PROC GENMOD procedure of the SAS statistical program (SAS, 2000), version 8.01, using Poisson distribution and identity link function. The means were analyzed by the Least Squares Means - LSM method using the Wald chi-square test.

RESULTS AND DISCUSSION

Climatic conditions, age, sex, and coat color of the animals did not affect the test time ($p > 0.05$) and there was also no interaction between the variables studied (Table 1). However, although there is no influence on the test time, the results showed differences ($p < 0.05$) in the climatic characteristics between the four stages of the Cup (Table 2).

Table No. 1: Performance of Quarter Mile Horse participating in the II EMS Cup - Three Drum Race, in Maringá, Paraná, southern Brazil, according to a category, sex, and coat color.

	Time (sec)	p value
Category		
Junior Open (M±SE)	17.7038 ± 0.29	0.8411
Open Senior (M±SE)	17.6103 ± 0.36	
Sex		
Male (M±SE)	17.6315 ± 0.30	0.9127
Female (M±SE)	17.6826 ± 0.35	
Coat color		
Light coat (M±SE)	17.6404 ± 0.46	0.9452
Dark coat (M±SE)	17.6047 ± 0.27	

M ± SE = mean more or less standard error of the mean.

The Three Drum equestrian event originated in the United States is a test of skill and speed, in which the set of horse and rider takes a determined course around three drums arranged in a triangular shape in the shortest time. This test allows the participation of children, youth, adults, professionals, and amateurs, so it has several categories and, therefore, it is considered a popular test, and, in Brazil, the shortest time is 16s446. Therefore, the time observed in this study, which is slightly above the lowest national time, proved to be as expected, regardless of the time of the race.

Table No. 2: Average race time and climatological characteristics in the time of the different stages of the II EMS Cup - Three Drum Race, in Maringá, Paraná, southern Brazil.

Parameter	Stage				p-value
	1	2	3	4	
Temperature (°C)	24.0 ± 0.42	22.31 ± 0.55	29.17 ± 0.74	22.64 ± 0.51	<.0001
Relative humidity (%)	65.68 ± 0.70	70.23 ± 0.98	48.24 ± 0.95	47.22 ± 0.74	<.0001
Pressure (Hpa)	952.93	950.52	952.73	957.91	
Wind speed (m/s)	1.18 ± 0.09	2.57 ± 0.19	0.65 ± 0.11	2.15 ± 0.16	<.0001
Radiation (KJ/ m²)	1468.66 ± 3.31	867.73 ± 3.45	1566.3 ± 5.44	2420.71 ± 5.27	<.0001
Precipitation (mm)	0.00	0.00	0.00	0.00	
Race time (sec) (M±SE)	17.84 ± 0.38	17.60 ± 0.50	17.43 ± 0.59	17.62 ± 0.47	0.9353

M ± SE = mean more or less standard error of the mean.

The fact that, despite climatic variations, the animals' performance in the tests was not affected ($p < 0.05$) revealed interesting data. In stage 2, the highest wind speed was observed, a fact that could have affected the animals' body temperature and performance, however, considering that the tests were carried out in a covered arena, perhaps this reason explains the absence of this influence. On the other hand, stage 3 happened in a situation of high temperature and low humidity and wind speed, being characterized as a negative condition for the performance of the animals and stage 4 happened with the lowest relative humidity. However, despite these differences, the climatological characteristics did not influence the test time in any of the evaluated stages. Therefore, it is believed that the animals that participated in this test were beneficially acclimatized and conditioned, therefore, the stressful climatic conditions did not impair their performance.

Exercising in thermally stressful environmental conditions due to heat and/or humidity requires acclimatization, which improves heat tolerance, enables greater exercise capacity, and reduces dehydration (MARLIN, 2007). Acclimatization is the long-lasting adaptive physiological adjustment, which results in increased tolerance for continuous or repetitive exposures to various climatic stressors and is usually produced under field conditions (SOUZA; BATISTA, 2012). Athletes' tolerance to heat tends to increase after several days of

exercise performed in exposure to hot climates. This is because the body adapts to the stress caused by the production of metabolic heat and the high temperatures of the environment (FONSECA et al., 2015).

Regarding conditioning, it is known that inadequate conditioning for athletic activity can negatively influence and lead to thermal stress. If the exercise continues when the heat dissipation mechanism is unable to monitor its production, the temperature can reach critical levels and cause deleterious systemic effects, in addition to impairing the animal's ability to exercise (McCUTCHEON; GEOR, 2007; HODGSON et al., 2014). Thus, it is believed that the animals in this research were adequately conditioned to carry out the evaluated tests.

Marlin (2007) stated that thermal stress at the time of exercise can be due to both cold and heat. The cold can cause deleterious effects on the horses' athletic performance, and in hot weather conditions, early fatigue, hyperthermia, dehydration due to intense sweating, negative effects on the gastrointestinal tract and dryness of the airways in dry weather conditions can be observed (REECE, 2017) that may result in lower animal performance. However, even though stage 3 took place in a high-temperature situation, this fact did not influence the performance of the animals in this study.

McCutcheon and Geor (2007) showed a reduction in the performance of horses submitted to exercise tests performed in hot and humid climates when compared to hot and dry climates or cold climates. In horses, heat dissipation is difficult when the environment is hot or hot and humid, increasing thermal stress during exercise. This is because evaporative cooling, which occurs through sweat and water from the respiratory tract, is compromised. In environments with high humidity, the vapor pressure gradient between the animal's body surface and the environment becomes smaller, affecting evaporation (SEABRA; DITTRICH, 2017). Therefore, considering that the high relative humidity of the air is a more detrimental factor to the body thermal control than the low humidity, it is attributed to this reason the fact that the climatic conditions of step 3 did not affect the performance of the animals, in addition to acclimatization and conditioning, already mentioned.

CONCLUSIONS

Based on the results obtained, it is concluded that the age, sex and coat color of the animals did not affect the race time and, despite the significant differences between the climatic conditions at the time of the various stages, these differences also did not influence the performance of animals.

Therefore, consider that, as the sports practiced by athlete horses represent an important economic activity, this segment invests in constant training, resulting in good conditioning and acclimatization of the animals, so that they present good race times, regardless of climate conditions.

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