

Horses' welfare during transport

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ABSTRACT

Objective: To review the literature related to horses' welfare during transport.

Approach: Transporting horses is a common practice in the equine industry and obeys to different reasons and activities. Therefore, understanding the factors that intervene during transport and management of the horses is critical.

Limitations on study/implications: Horses are the most transported animals globally, this being a very stressful event. Different factors affect their welfare during this process, such as the type of vehicle, the driver's expertise, the length of the trip, the orientation of the animal in the vehicle, lesions and diseases.

Conclusions: The factors involved in horses' transport should be known and taken into account, to ensure the horses' welfare.

Keywords: horses' transport, horses' welfare, stress.

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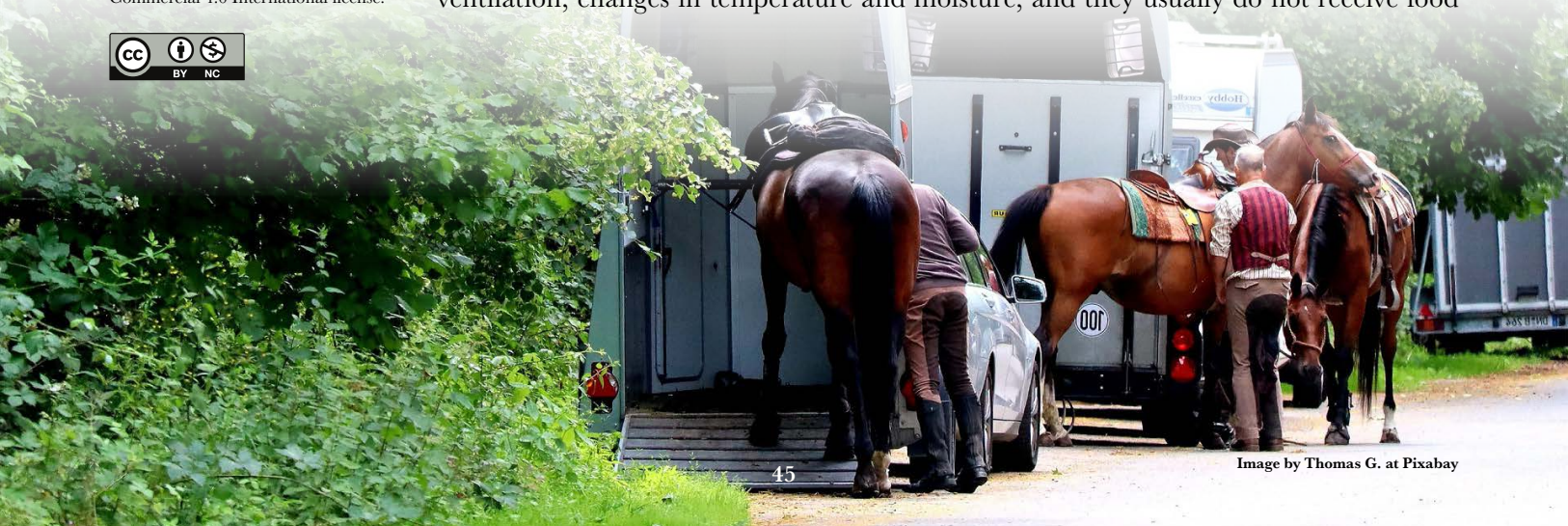
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INTRODUCTION

Horses are transported more than any other type of livestock, for different reasons: races, exhibitions, breeding, sale, or sacrifice (Riely *et al.*, 2022). It is a stressful event that implies the separation from their familiar environment and mixing with unknown animals. Mixing can cause aggressions between the animals (Hartmann *et al.*, 2009). The groups ought to be limited and from the same place, mares with offspring should be kept together with added space, and the studs ought to be separated from other males (Roy, 2014). During transport, horses are exposed to confinement, vibrations, inadequate ventilation, changes in temperature and moisture, and they usually do not receive food



and water (Wara, 1993; Dai *et al.*, 2021). Transport is among the main causes of lesions during loading, transport and disembarking; the physical stressors include movement of the vehicle, characteristics of the floor, environmental moisture, temperature, and restricted space (Giovagnoli *et al.*, 2002). The animals can be transported by ship, train, truck or plane and this depends on the destination and objective, for example, for competition, reproduction or sacrifice.

Horses began to be transported 3500 years ago. Xerxes moved his cavalries in Ancient Greece. Hannibal transported his horses through the Rhone River in 218 BC. During the 14th century, the horse trade between England and the rest of Europe increased, and at that time the horses were transported primarily by ship. In the 18th century transport was primarily by land and in the 19th century the horses were transported by train (Friend, 2001; Warran *et al.*, 2007). Currently the most common means of transportation is by land and air for long distances.

Many countries regulate horses' transport. Europe has the EC Regulation No 1/2005 for animal protection during transport (EPRS, 2018). In the United Kingdom, there is regulation for the welfare of animals during transport, especially of horses, ponies and other domestic equids (Defra, 2006). In USA, eleven states have laws that regulate horses' transport prohibiting the use of two-story trailers (Wish, 2014). There is also a practice code for their transport in Australia (Department of Agriculture, 2003).

Factors that influence the welfare of horses during transport

Different factors affect horses' welfare. The preparation of the horse and the vehicle can generate stress, affecting the horse's health and causing economic losses (Oikawa *et al.*, 2004; Padalino *et al.*, 2017b). Social isolation, age, sex, familiarity with the other animals that travel, the driver's expertise, duration of the trip, state of hydration, ventilation, air quality, temperature and moisture, prior experiences with transport, medications, the animal's temperament, restraint methods, as well as the place where the horse travels, in the front or back of the vehicle, and the road conditions, can affect horses' welfare (McGreevy, 2012; Nivelles *et al.*, 2020). Stress can favor lesions and fractures (Ferguson and Rosale-Ruiz, 2001; Mansmann and Woodie, 1995), as well as respiratory (Austin *et al.*, 1995) or gastrointestinal infections (McClintock and Begg, 1990).

Loading tends to be one of the most stressful events during transport, since by nature horses are neophobic (Dai *et al.*, 2021) and they present fear in face of new experiences. Most of the lesions in extremities at the time of loading are associated to the ramp (Dai *et al.*, 2021), so it is important accustom the horses to loading when they are foals to prevent behavior problems. During transport, horses tend to be restrained. In this regard, it is important for the distance of the cord between the tying point and the halter to be enough for the horses to lower their head freely. Restraining the horse without allowing it to keep its head low is associated with the increase in respiratory infections (Stull and Rodiek, 2002). During transport, the horses try to gain balance in the presence of changes in speed and direction, moving their head and legs quickly, which can cause leg wounds as they lose their balance when the vehicle stops, turns or accelerates abruptly; the noise and other factors also stress them, so it is very important to have an adequate

design of the vehicles, since it is one of the highest risks (Colborne *et al.*, 2021; Riley *et al.*, 2018; Giovagnoli *et al.*, 2002).

The dynamics of the vehicle will depend on the driver, road conditions, climate and other factors during the route (Riley *et al.*, 2016), and in the effort to adjust their posture horses can record muscular and emotional stress (Warran, 1993; Padalino, 2015b). The correction in the horse's posture can be insufficient to avoid lesions or distress, which will depend on the physical and emotional ability of each animal to respond to the stressful factors (Colborne *et al.*, 2021). The physical and behavioral problems are also affected by the driver's behavior, the inability of the horse to face unexpected movements of the vehicle, and the lack of outfitting of the vehicles taking into account the horses' welfare (Padalino *et al.*, 2018; Riley *et al.*, 2018).

Type of vehicle

Horses destined to sports and to reproduction are frequently transported by air, although transport by road is often used. In a study carried out with six horses (five castrated males of Dutch Warmblood race and a Belgian Warmblood female, of approximately 9.2 ± 2.1 years) that were transported by land and air, they showed variations in heart rate. The trip consisted of 24 h of rest in the stable, 4.5 h of travel by road, then 5.5 h of wait in a stable and, then, 11 h of travel by plane. The heart rate was significantly higher during air transport than during rest in the stable (Ohmura *et al.*, 2012), reaching the conclusion is that air transport caused a slight increase in the heart rate than the transport by road (Munsters *et al.*, 2015).

Duration of the trip

Sometimes horses are transported for long distances, exposing them to health and welfare problems (Marlin *et al.*, 2011). In a study with 180 horses transported between Sydney and Perth (4000 km), 97.2% of the horses arrived without signs of disease or lesions. The animals that presented health problems were diagnosed with respiratory problems (27%), gastrointestinal problems (27%), pyrexia (19%), traumatic lesions (15%) and death (12%). The duration of the trip and the season have a significant effect. During the spring and in trips of more than 20 h, respiratory problems and deaths increased ($p < 0.05$). Long trips increase the health problems and compromise the horse's welfare (Paladino *et al.*, 2015a).

Some physiological parameters were studied in horses between 4 and 10 years old transported in Poland. Blood samples were taken 8 h before transport and 24 h after having disembarked. The values of urea, cholesterol, creatinine, magnesium and alkaline phosphatase were similar. The albumin, total protein, aminotransferase alanine, aminotransferase aspartate, total bilirubin, kinase creatinine, and triglycerides were different as a result of transport. The metabolic response was lower in horses that exercised moderately or were transported for 24 h (Niedzwiedz *et al.*, 2012).

In two different trips with distances of 50 and 200 km with duration of 1 and 3 h, respectively, the blood of 12 Standardbred horses was analyzed, at rest, during the loading and disembarking, and 2 and 4 h after returning from the trips. The following were analyzed:

mean cell volume, cortisol, transaminase aspartate, transaminase alanine, creatinine, glucose, triglycerides, cholesterol, ureic nitrogen in blood, calcium, phosphorus, chlorine, total proteins, albumin, and alkaline phosphatase. The heart rate, respiratory frequency and body temperature were also measured. The loading always increased the respiratory frequency and the mean cell volume. In both cases, the distance of the trip increased the glucose, cortisol, mean cell volume and heart rate, while the kinase creatinine increased two hours after the return from the trip of 200 km. The water intake was higher in horses that travelled 200 km compared to those that travelled 50 km.

The adaptation to a new stable was easier when food and water were offered after arriving, and one of the conclusions of this study was that horses should arrive at least four hours at their destination before they start physical activity (Tateo *et al.*, 2012).

Stress is associated with long trips and the increase in the time of transport; however, it can also increase in short trips. Fazio *et al.* (2008) measured the ACTH hormone, β endorphin and cortisol in studs travelling different distances (100, 200 and 300 km). The β endorphin increased ($P < 0.01$) after 100 km, the ACTH increased ($P < 0.001$) after transport of 100 and 200 km, and the levels of cortisol were higher ($P < 0.001$) after 100, 200 and 300 km of transport by road. Wessely-Szponder *et al.* (2015) observed the physiological, immunological and metabolic changes that are produced in young and older horses during short and long distance trips. The study was carried out in 24 mares divided into four groups. Six female colts of 12-18 months and six mares of 6-12 years were transported 500 km. Blood samples were taken before, immediately after transport and during sacrifice.

The samples were analyzed to determine fibrinogen, malondialdehyde (MDA), aminotransferase aspartate, and kinase creatinine. The fibrinogen increased especially in the female colts after the long-distance transport, reaching the maximum level during sacrifice. Changes in the muscular enzymes were produced and the level of MDA also increased; the parameters of oxidative stress and the muscular lesions were related to the age and the distances in transport.

Seven castrated males and seven females, 5 to 15 years old, with the same body condition were studied in a trip of 4000 km. The heart and respiratory rate, rectal temperature, number of neutrophils, serum albumin and antioxidant state of the plasma increased. The results showed that long distances favor the induced response mediated by deteriorated cells (Padalino *et al.*, 2017a).

Horses have been given vitamin C to reduce the stress. Although horses can synthesize it from glucose or galactose, it cannot be stored in large quantities and it is used in prolonged stressful situations such as transport, which can favor the presence of diseases such as shipping fever. Ralston and Stives (2012) supplemented weaned colts with vitamin C during 5 and 10 days after 50 h of transport, and they found that supplementation with this vitamin for five days was adequate yet prolonged supplementation is not advisable.

Orientation of the horse in the vehicle

Gibbs and Friend (1999) researched the preferred orientation of the horses transported by road. The horses were tied to the left side of the trailer, to the right, or unleashed. The

horses tied to the right spent 59% of the time looking forward, the horses tied to the left 52% of the time looking backward, and unleashed horses 57% of the time looking forward and 35% looking backward. However, there was great variation between the horses.

Kusunose and Turikai (1996) studied the behavior and orientation of the horses that travelled unleashed. They observed that while the vehicle was in movement, the horses reduced food consumption and spent more time standing than when the vehicle was parked, in addition to increasing the frequency of animals looking backward. Smith *et al.* (1994) studied four horses that were left unleashed in the vehicle during transport, allowing them to choose the orientation; the results showed that they spent significantly more time looking to the back during a trip of 32 km by road. Horses can prefer three positions: looking forward, looking backward or at an angle (Colborne *et al.*, 2021). Different studies have attempted to determine the effect of the orientation on the ability of the horses to maintain their balance during transport and the results are contradictory due to the differences in the vehicle's design and performing simultaneous comparisons (Toscano and Friend, 2001). The orientation in which the horses travel does not significantly affect the ability of the horses to keep their balance (Fried, 2001), although it seems that travelling with their back to the direction of the trip offers allows them to maintain their balance better (Clark *et al.*, 1993).

Lesions and diseases

Some diseases, such as equine herpes virus, salmonellosis and pneumonia can increase during transport (Mc Greevy, 2012); in addition, lesions such as fractures, swelling, abrasions and hematomas. Roy *et al.* (2019) evaluated the hematomas ante-mortem after transport to a slaughterhouse using digital infrared thermography and they observed a significant percentage of horses with lesions on the skin, although this methodology had a modest sensitivity for the detection of hematomas.

Dehydration is also frequent, due to the lower intake of water and because it is rarely offered during transport and has been related to acute laminitis and colon impacting. Friend (2000) evaluated the effects of transport on the hydration status of the horses and found that the horses transported for 30 h showed a dehydration status higher than 10%; the study indicated that transport longer than 24 h causes a marked state of dehydration and extreme dehydration after 28 h of travelling with temperatures of 24 to 37 °C and relative humidity conditions of 32 to 94.

The horses subjected to trips for more than 24 h face higher risk of developing serious diseases or even dying (Padalino *et al.*, 2017). Sometimes they supply electrolyte solutions to avoid gastrointestinal impact, yet it is important to supply electrolytes directly into the animal's mouth and not in the water. Two or three percent dehydration can affect the yield during the competitions. The water supply during transport, especially when it is warm, prevents dehydration and stress (Mc Greevy, 2012).

It is important to keep the horses adequately hydrated so it is recommended to offer water at least every two hours of travel, and preferably from the place of origin, so there should always be water deposits. The restriction both of food and water during transport can trigger negative emotional responses (Roy, 2014).

Respiratory diseases are related to transport (Oikawa *et al.*, 2004); prior sub-clinical respiratory diseases and restraining with the position of the head upwards, which prevents the mechanisms of pulmonary cleaning, can favor these diseases. The stress that affects the immune system, the presence of toxic gases, the high concentrations of dust and bacteria in the air, the orientation of the animal during transport, the duration of the trip, and the body status can also cause the disease.

Oikawa *et al.* (2005) studied the orientation of the head (to the front or to the back), the periods of rest (30 min or 2 h per 4 h of travel, or 1 h every 5 h of travel), and the state of cleanliness of the truck used for horses' transport along 1500 km; in two seasons of the year, April and August. The results showed that the increase in rest time and cleanliness inside the truck were the main factors to prevent respiratory diseases.

Horses' transport destined to sacrifice

The commercial transport conditions of horses for meat jeopardize their welfare and lesions are frequently generated, causing both physiological and behavioral disorders (Marlin *et al.*, 2011; Roy *et al.*, 2015a). Globally, 50% of the horses transported for sacrifice suffer lesions (Roy, 2014). The conditions of management and transport cannot be compared with the horses that are transported with the purpose of sports and leisure; however, in these animals the transport also generates negative conditions in their health and yield (Leadon, 1994). In many countries, horse meat is a common food. In France, Italy, Germany, Austria, Belgium, Netherlands, Iceland, Norway, Sweden, Poland, Ukraine, Russia, Hungary, Bulgaria and Slovenia its consumption is common. In the United Kingdom, the sacrifice and consumption are not prohibited, although it is infrequent since the 1930s. Nowadays, horses are protected from their export for sacrifice (Warran, 1993). Horse meat is also consumed in many countries of Asia (China, Japan, Indonesia, South Korea, Kazakhstan, Kyrgyzstan and Mongolia). Although in most countries horse meat is not consumed, in Canada horses are sacrificed to obtain meat. In the United States, this meat is not used for human consumption, and plants to sacrifice horses are prohibited since 2007 (Roy and Cockram, 2015). However, the horses are sent to Canada and Mexico to be sacrificed (Stull, 2012). Mexico is one of the main producers of horse meat; it is exported but not consumed. Since 1960, Mexico is characterized for remaining in the first places as producer of this meat (Jastrzębska *et al.*, 2019; FAOSTAT, 2020). In South America, it is the main source of meat for indigenous peoples of Chile; and Argentina is producer and exporter, although the meat is not consumed.

The annual consumption of horse meat is 500,000 t on average (Belaunzaran, 2015). However, it has increased to 700,000 t annually due to the increase in production in Asia and Europe. Horse meat represents 0.25% of the total meat consumed in the world. Asia is the main producer of horse meat (46%), followed by America 30%, Europe 18%, Oceania 4% and Africa 2% (Belaunzaran *et al.*, 2015). It is estimated that 800,000 horses are sacrificed globally each year (Padalino and Riley, 2020).

The largest transporter and producer of horse meat in the world is China; others are Kazakhstan, Mexico, Russia and Argentina, which represent 58% of the world production of horse meat. The main consumers are Mongolia, Kazakhstan, Switzerland, Italy and

Russia. The composition of horse meat is similar to that of beef; it is composed of 68-70% water, 22% protein, 0.5-6% fat, and around 1.5% minerals (Venegas and Gutiérrez, 2016). Some factors that affect its quality are race, age, sex, live weight, months to weaning, diet and months of fattening (Belaunzaran *et al.*, 2015).

Sometimes, horses that will be sacrificed travel unleashed in the vehicles towards the slaughterhouse; in addition, the number of animals transported is variable. In this case, horses can suffer falls during the trip and end up hurt or dead, or there can be aggressive interactions between the horses. It is frequent for them to have to travel long distances without food and water, which causes adverse results in relation to the welfare, such as excessive dehydration, thirst, hunger and fatigue (Roy and Cockram, 2015).

In a study carried out by Stull (1999) in horses transported to slaughterhouses for long distances (96 to 2496 km), an average weight loss of 4% was observed in two types of commercial trailers (trailers with straight cover or livestock trailer). The type of trailer used affected the percentage of horses hurt. The percentage was higher ($P < 0.05$) in the case of the livestock trailers (29.2%) than in those with straight cover (8%).

The stress, indicated by the level of cortisol and the *neutrophil:lymphocyte* rate, as well as the rectal temperature were higher ($P < 0.05$) in a surface of 1.14 to 1.31 m² per animal than in those of 1.40 to 1.54 m². The physiological responses, such as the recount of white blood cells, the total concentration of proteins, and the *neutrophil:lymphocyte* rate were lower in horses with a greater surface per animal.

Nivelle *et al.* (2020) observed the conditions of the horses transported for sacrifice in Argentina and Uruguay. The horses were transported during 294 ± 153 min at a distance of 295 ± 250 Km, with a surface of 1.40 ± 0.33 m² per horse.

The study included 23 horse transports from loading to the slaughterhouse with 596 mestizo horses during one year. The results showed that loading and disembarking were carried out without problems. However, they found that it is necessary to improve the training of drivers. The soil surface should also be levelled with the loading ramp, to avoid confusion in the horses. They found that often animals were transported during the warmest hours of the day and that animals of different ages were not separated. The conclusion was reached that the degree of aggressiveness was not associated to the characteristics of the environment or transport, but rather to the animals loaded in the back or front spaces. It is very important to also consider that the behavior of the drivers towards the animals during loading, travelling and disembarking is affected by the payment they receive for the transport (Broom, 2007).

Transportation affects the horses' welfare, as seen in a study conducted in Iceland. The horses travelled between 0.33 and 3.10 h; the animals were healthy and no wounds were seen before transport. However, after transport, 1.6% of the horses presented superficial bleeding wounds, they were stressed and the respiratory frequency and blood lactate were high, which decreased the blood glucose. Of the adult horses, 45% and 17% of the colts presented contusions. The horses also showed a slight dehydration. These observations suggest that the manipulation, transport and stabling were inadequate and should be improved (Roy *et al.*, 2015b). There is evidence of the scarce welfare of horses transported for sacrifice, which show dehydration, severe lameness, lesions and even death, in addition

to the grave lack of compliance of the EC no. 1/2005 about the protection of animals during transport (Marlin *et al.*, 2011).

CONCLUSIONS

Transport is a stressful activity for horses where different factors intervene. Therefore, there should be suitable management of the animals during the different stages of transport, ideal vehicles in excellent conditions, and training and adequate salary for the drivers.

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