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A review: Today's practices about the fitness for travel on land of horses toward the slaughterhouse

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ABSTRACT

Worldwide, millions of horses are transported toward slaughterhouses each year. The fitness for travel of those horses before they go onto transport has a major effect on the welfare of the horses during the loading, transportation, unloading, and slaughter process. In addition, a physically fit horse is more capable to handle stress than an unfit horse. Therefore, many legal regulations were introduced by governments to define the meaning and condition of a physically fit horse before going on transportation. The fact that fitness for travel is included in those horse transport codes demonstrates its importance. However, there is still no convention about some fitness for travel aspects, which is demonstrated by the differences in several regulations. Therefore, the main goal of this article is to discuss and highlight all critical issues about the fitness for travel of horses that will be transported to the slaughterhouse. In addition, the current legal regulations are described and potential deficiencies in those regulations are pointed out for further investigation. In short, this article illustrates the need for worldwide legislation, based on scientific research, to provide minimal requirements regarding fitness for travel that a horse should meet before being allowed on transportation. Such legislation would leave no room for interpretation of regulations or discussion about the fitness for travel of horses.

Introduction

Today, there is a decreasing trend in the number of horses being slaughtered in the western world (USA, Australia, and Europe). For example, in 2001, a total of 21,390 horses were slaughtered in Belgium, whereas in 2016, only 6,054 horses were slaughtered (BESTAT, 2017). China slaughtered the most horses in the world in 2014, about 160,000, according to data from the Food and Agriculture Organization of the United Nations (FAOSTAT, 2014). Although the production of horse meat is generally decreasing, worldwide, about 4.8 million horses are still transported to slaughterhouses on an annual basis (FAOSTAT, 2014). In addition, horses are still transported for long distances, possibly due to insufficient national production and the high demand for live horses rather than carcasses (Marlin et al., 2011). During loading, transportation, and unloading, a complex set of physiological factors, including the clinical condition of the horses, and physical factors, such as the outside temperature during transport, influence the comfort of the horses (Grandin, 1997; Roy et al., 2015). Therefore, all physiological and physical factors should be taken into account for animal welfare considerations during those 3 phases preceding the slaughter process (Padalino et al., 2012; Padalino, 2015).

Off all those elements, one of the most important horse transportation issues, for the transporters and for animal welfare, is having a physically fit horse before going to transport (World Organisation for Animal Health (OIE), European Regulation 1/2005). The transportation of a physically fit horse reduces disease transmission, avoids suffering of the horse during transportation, and avoids penalties such as financial losses or even withdrawal of the driver's certificate of competence (Practical Guidelines to Assess Fitness for Transport of Equidae, 2015). For example, Mansmann and Woodie (1995) showed that the state of fitness for travel of the horse relative to the duration of the journey is an important

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factor influencing the risk on transport laminitis. To reduce this risk, the horse should be in a physically good condition and the level of carbohydrate intake should be reduced before and during transportation (Mansmann and Woodie, 1995). It is in everyone's interest to only transport fit horses.

Requirements to ensure a horse is fit for travel are described in many legal regulations by different governments on different continents. Although many codes about the assessment of the fitness for travel exist, a single, uniform guideline is still lacking. At least, a minimum of legal regulations should be uniform across countries. For example, the US banned horse slaughtering, resulting in American horses having to cross the borders of Canada or Mexico to be slaughtered there. However, there is still no joint regulation between those 3 countries. Also, although there are similar agreements about transporting gestating mares, the determination of the pregnancy is still a difficulty (EFSA, 2017).

We first describe why horses can experience stress during the loading, transportation, and unloading procedure. Then, we define a physically fit horse and emphasize that horses need to be physically fit before going onto transport to reduce supplementary stress. Third, we present some of the legal regulations about the fitness for travel, emphasizing inconsistencies. In this way, critical issues about the fitness for travel will be highlighted and can be further investigated to work toward one scientifically based and globally consistent regulation.

Loading, transportation, unloading, and slaughter process

Loading, transportation, and unloading are stressful procedures for horses. Stress can affect the welfare of the animal, which comprises good health, expression of behavior, comfort, and the ability to be free from fear (Grandin, 1997; Waran et al., 2007; Driessen, 2015; Vermeulen et al., 2015).

An animal might experience stress, if the animal can neither cope with changes in its environment and management nor can adapt to those changes (Sterling, 2004; Mason and Mendl, 1993; Grandin, 2007). Research indicates that loading horses on a truck is considered the most stressful procedure for both naïve and for experienced horses (Waran and Cuddeford, 1995; Friend et al., 1998; Casamassima et al., 2008). Waran and Cuddeford (1995) recorded a significant higher heart rate of horses during loading. This can be partly caused by the physical effort that horses need to perform during loading. However, the fact that horses are instinctively fearful of entering dark, enclosed spaces and have difficulties with the steep angle of the ramp to enter the truck are indicators that the elevated heart rate might also be caused by stress (Cregier, 1982; Trunkfield and Broom, 1990; Tateo et al., 2012).

Furthermore, road transport, itself, includes various potential stressors including motion of the vehicle and orientation of the horse within the vehicle (Leadon et al., 2008). There is a high incidence of slipping and falling during transport, lack of drinking water, and the absence or presence of a tarpaulin, which all may affect the horse's welfare (Quality Transport and Control Post, 2014).

All such factors increase salivary cortisol and blood glucose concentration of horses during the journey (Roy et al., 2015; Schmidt et al., 2010a,b; Stull and Rodiek, 2000). An increased heart rate during transportation has been reported by multiple authors (Waran and Cuddeford, 1995; Schmidt et al., 2010a,b; Roy et al., 2015). Schmidt et al. (2010a,b) noted that such changes are unlikely due to activity because only little physical activity was requested of the horses during transportation, so the more likely explanation for the heart rate changes was the need to adapt to the transportation process. This conclusion is supported by the finding that 1 day after transport exceeding 3.5 hours, fecal cortisol metabolite concentration was significantly increased (Schmidt et al., 2010a,b). The extent of heart rate and salivary cortisol increase is related to the duration of transport (Schmidt et al., 2010a,b). Behavior of horses can also be affected during transportation (Waran and Cuddeford, 1995). Changes in the behavior might be an indicator of stress and according to Leiner and Fendt (2011) can be a response to fear. During transportation, horses in general have difficulty maintaining their balance, may become injured and dehydrated, can develop motion sickness, colic, shipping fever, and ambient conditions (Mansmann and Woodie, 1995; Grandin, 2007; Padalino, 2015). These are all worsened by stress and/or may be the cause of (additional) stress (Grandin and Shivley, 2015).

After arrival at the slaughterhouse, the unloading procedure can again affect the stress level and physical condition of the horses. During unloading and at arrival in lairage, horses are subjected to a new environment, sound, smell, other animals, etc., which again might elicit/contribute to stress (Grandin, 2007).

The final step is the slaughtering process itself. Horses have to be led in a one by one passageway and finally into the stunning box, where they get stunned individually. The fact that horses, which are herd animals, have to go one by one after each other might induce further stress because herd animals become fearful and agitated when they get separated (Grandin, 1999). The horses are showered during this process, which makes the passageway more slippery and may be unfamiliar to the horse. All aspects of this process can lead to panic reactions that may harm the horse (Grandin, 2014). Horses are considered aware and sentient beings (Grandin, 2014). The use of electric prods, beating, poking on sensitive areas, slamming gates on horses, etc., are forbidden (Grandin, 2012), but farm and slaughterhouse management staff must still educate their employees about good handling practices and to work toward a high animal welfare standard (Grandin, 2012).

As described in the OIE (World Organisation for Animal Health, European Regulation 1/2005), an animal is at particular risk of suffering due to poor welfare conditions during loading, transportation, unloading, and slaughtering when it is large, obese, very young or very old, excitable, aggressive, or has unhealed wounds from recent surgical procedures. Also, a risk occurs when the animal develops motion sickness, has little contact with humans, or has a history of exposure to stressors or pathogenic agents before transport. In addition, females in late pregnancy or early lactation, and dam and offspring pairs, have an increased risk for reduced welfare during loading, transportation, unloading, and slaughtering.

Importance of fitness for travel

Research showed that an elevated risk of transport-related muscular problems was observed when pretransport health checks were lacking (Padalino et al., 2016b). In addition, transport-associated exacerbation in infectious diseases is common in horses and other species (Blecha et al, 1984; Dalin et al., 1993, Padalino et al., 2016a; b). Transportation of horses has been associated with respiratory diseases, diarrhea, colic, equine gastric ulcer syndrome, laminitis, and rhabdomyolysis (Oikawa et al., 1994; Andrews et al., 2005; Padalino, 2015). While the exacerbation phenomenon can be explained partly by the exposure of individuals to unfamiliar pathogens during the transport process, there is also an interference of certain modes and durations of transport with protective immune responses. This immunological impairment may be a result of transport-associated metabolic derangements (Stull and Rodiek, 2002) or arise from the direct effect of stress-invoked soluble mediators on immunological effectors (Murata and Hirose, 1991). Cortisol has been implicated as a mediator of stress-

associated immune suppression (Stull et al., 2004). Several studies in horses have observed increases in cortisol concentration, total leucocyte counts, and neutrophil to lymphocyte ratio after 24-hour journeys by road, with the levels usually returning to normal within 12 to 24 hours (Stull and Rodiek 2000; Stull et al., 2004).

To cope better with all stressful aspects during transportation and thus to withstand the variety of environmental impacts associated with transportation, a horse should be in a good physical condition. Therefore, legal regulations were developed to judge whether a horse is physically fit before going onto transport.

Legal regulations about the fitness for travel

Different legal regulations about the fitness for travel of horses for land transport to the slaughterhouse exist (Table 1). Every legal regulation presented in this article describes that before loading, each horse must be inspected and assessed by a person in charge (animal handler, veterinarian) (World Organisation for Animal Health (OIE), European Regulation 1/2005, Australian Animal Welfare standard and guidelines, U.S. Transport Quality Assurance); Equine Canada, 2018; Transport within New Zealand, 2016. This person in charge should evaluate if there are injured, weak, or sick horses and asses the circumstances, such as the weather and the transport distance, in which the horse will be transported. In case doubt exists about the fitness for travel of the horse, a veterinarian should inspect the animal (European Regulation 1/2005, Australian Animal Welfare standard and guidelines). Horses assessed as unfit for travel should not be loaded onto a vehicle, except for transport necessary to receive veterinary care.

Although an evaluation process is described in legal regulations, some requirements in those regulations leave room for interpretation. In the next section, the legal regulations concerning a general assessment and a specific assessment for foals and gestating mares will be discussed, and the descriptions that leave room for interpretation will be highlighted.

General assessments

Table 1 presents a comparison between the requirements for the fitness for travel of the OIE, the European Regulation 1/2005, the Australian Animal Welfare standard and guideline, the U.S. Transport Quality Assurance, the equine transport regulation of Canada, and the transport code within New Zealand. All legal regulations describe that sick, injured, weak, disabled, or fatigued animals cannot be transported. Animals that are unable to stand unaided and that are unable to bear weight on each leg and hence are unable to walk without suffering are forbidden to be transported according to all prescriptions. In the Australian standard, it is specified that it is not allowed to transport horses if it is likely that the transportation will cause increased pain or distress and/or (?) if the general body condition is lower than 2 (Carroll and Huntington, 1988; Australian guideline). The EU also describes that horses with a condition that might cause increased pain or distress during transport cannot be transported. The OIE added a more precise description namely that it is not allowed to transport animals if it is likely that the body condition would result in poor welfare because of the expected climatic conditions during the transport. The Equine Canada regulation specifies transporting horses with prolapse is forbidden, and in New Zealand, horses cannot be transported within 7 days after castration. Horses that are bilaterally blind are prohibited from transportation in all legal regulations except the European Regulation 1/2005 and the transport code within New Zealand.

After evaluating these general assessments in all mentioned legal regulations, several conclusions can be drawn. First, the requirements from different legal entities do not entirely match each other. Second, there is room for interpretation when implementing the current requirements in practice. Weak or injured horses are not defined. How deep should a scratch be before the horse is assessed as injured? Horses that limp may be considered as fit for travel because the inspector might believe the welfare of the horse will not be harmed during transport. Third, some countries like those in Europe, the fitness for travel of slaughter horses can easily be assessed because, in general, horses are handled, loaded, and transported individually. However, this is not true for other continents where horses are transported in groups (Grandin, 2014; Quality Transport and Control Post, 2014).

There is debate about when transport is acceptable. The reason for a horse to be slaughtered might be the fact that it is limping. To relieve a horse from its suffering condition, the owner might decide to slaughter the animal. However, going on a transport journey might harm the welfare as well. There is also a relationship between the condition of the horse and the maximum travel distance (Stull, 1999). Regulations should provide a more detailed description that defines how to deal with such situations and to exclude subjective interpretations as much as possible.

Specific assessment: Foals

In addition to the latter general assessments, specific requirements about foals are incorporated in the legal regulations, because, as described by Tischner and Niezqoda (2000), transportation of young foals, accompanied by the mare, induces stress in the foals. Therefore, foals with an unhealed navel cannot be transported according to the OIE and the European Regulation 1/2005. The Equine Transport regulation of Canada prohibits transport of very young foals. The U.S. Transport Quality Assurance doesn't allow animals younger than 6 months on transport and in New Zealand it is forbidden to transport foals younger than 4 months.

Specific assessment: gestating mares

Tischner and Niezqoda (2000) showed that transportation was an even stronger stress-causing factor for the mares than for their foals (Tischner and Niezqoda, 2000). According to the OIE and the equine transport regulation of Canada, mares cannot be transported without their foals within 2 days after birth. The European and the Australian regulations prohibit transport of mares without foals within 7 days after giving birth. The remaining regulations do not mention anything about transporting mares after birth.

Restrictions about the transportation of gestating mares in the final 10% (final 33 days before birth) of their gestation at the time of unloading exist in the OIE and the EU regulation 1/2005. The Australian standard limits the moment for transporting gestating mares at 2 weeks before giving birth; and the U.S. Transport Quality Assurance, the equine transport regulation of Canada, and the transport code within New Zealand state that only heavily gestating mares, which are likely to give birth, are not allowed to be transported. Those regulations are introduced because, as mentioned before, transportation may cause fatigue in horses and is associated with stress even in experienced horses (Grandin, 1997; Waran and Cuddeford, 1995). Stress results in an increased cortisol level (Baucus et al., 1990; Schmidt et al., 2010a,b), and an increased cortisol level in the last 3 to 2 weeks of gestation can induce labor (Baucus et al., 1990). Gestating mares giving birth during transportation are a violation of good animal welfare practices and could result in the loss of the mare and the foal, so gestating mares should

Table 1
Comparison of requirements about the unfitness (X) of horses for the intended transport to slaughterhouse

Assessment parameters	World Organisation for Animal Health	EU Regulation 1/2005	Australian Animal Welfare standard and guidelines	U.S. Transport Quality Assurance	Equine Canada, 2018	Transport within New Zealand, 2016
General assessments						
1. Sick, injured, weak, disabled, or fatigued[d]	X	Open wounds, prolapse	Severe emaciated, injured or distressed, visibly dehydrated	X	X, prolapse	X, within 7 d being castrated
2. Unable to stand unaided and unable to bear weight evenly on all limbs to walk without suffering, move with pain	X	X	X	X	X	X
3. Condition that is likely to cause increased pain or distress during transport	/	X	X, body condition <2[c]	/	X	X
4. Body condition would result in poor welfare because of expected climatic conditions during transport	X	/	/	/	?	/
5. Blind in both eyes	X	/	X	X	X	/
Assessments for foals and their mares						
1. Newborns with an unhealed navel	X	X[a]	/	/	?	/
2. Younger than × mo		/	/	X = 6	Very young	X = 4[f]
Assessments for gestating mares						
1. Mares that have given birth without a foal	Within 2 d after birth	Within 7 d after birth	Within 7 d after birth[d]	/	Within 2 d after birth	/
2. Gestating mares	In the final 10% of their gestation period at time of unloading (final ± 33 d)	In the final 10% of their gestation period (final ± 33 d)	Within 2 wk before giving birth[b]	Heavily gestating, likely to give birth[e]	Likely to give birth, labor breathing[e]	Likely to give birth, in the last third of their gestation

[a] Exception: if the transport is required to ensure the health and the welfare of the newborn. In the latter case, the mother and newborn have to be transported together while constantly being accompanied by an animal care taker.
[b] Exception: if time off water and journey is less than 4 h.
[c] Sunken rump, cavity under tail, ribs clearly visible, prominent backbone and pelvis, and ewe neck narrow and slack or worse. Adapted from Carroll and Huntington (1988). Body condition scoring estimation of horses. Equine Veterinary Journal 20 (1): 41–45.
[d] Exception: when under veterinary advice.
[e] No time range given, only described that the horse seems likely to give birth.
[f] Exception: with their mare.

not be transported at the end of gestation. The stage of gestation in mares can be determined by clinical examination. Visual determination is only possible a few days before parturition, by clear yellow and sticky drops that may drip from the udder (Campbell et al., 2003). However, because in general slaughter horses are extensively bred, it has to be emphasized that the fertilization date is usually unknown and that it is difficult to perform clinical assessment. It is also impossible to compare the condition of the gestating horse during all stages of gestation, when extensively bred.

Furthermore, as described previously, there are inconsistencies between regulations on gestating mares and difficulties in assessing the stage of gestation. Research should address one uniform standard.

Environmental aspects in the slaughterhouse may affect the welfare of a gestating mare (Baucus et al., 1990). Once a late-gestating mare arrives at the slaughterhouse, questions rise about slaughtering the mare instantly or waiting until after the horse has given birth. There are ethical considerations in slaughtering a late-gestation mare. Some studies have determined that the sensation of pain and suffering is a cortical phenomenon (Mellor and Beausoleil, 2015). A fetus, which is not in an awake state and which lacks appropriate cortex participation, has not started to breathe yet. As long as the breathing process has not started, a fetus is thought to have no ability of perception and sensation (Mellor, 2010; Campbell et al., 2014). Therefore, the American Veterinary Medical Association recommended to keep fetuses in the unopened uterus for 15 to 20 minutes after the mare is slaughtered (Terrestrial Animal Health Code of the OIE, 2008). According to the American Veterinary Medical Association, if it is ethically permissible to kill a horse for food, it is also ethical to allow the fetus of the slaughtered mare to die by leaving it in the uterus. This perspective argues that the only reason not to slaughter a gestating mare would be purely sentimental (Terrestrial Animal Health Code of the OIE, 2008). If conscious perception of pain stimuli is subcortically based and thus takes place in the brain stem (Merker, 2007; Bellieni and Buonocore, 2012), pain sensation is present in the fetus during the last third of gestation, so it would not be ethical to kill a gestating mare and the fetus in this period (Merker, 2007; Bellieni and Buonocore, 2012). When considering this research, slaughtering a gestating mare and a fetus would only be allowed before the last third of gestation (Merker, 2007; Bellieni and Buonocore, 2012). However, if a gestating mare and a fetus would be slaughtered, the gestating mare should be separated during the preslaughter process (OIE). During the slaughtering process, the fetus should be prevented from breathing air. If there is any doubt about the consciousness of the fetus, it should be killed with a captive bolt of appropriate size or by a suitable blunt instrument (OIE). Rescuing the fetus at this stage may lead to health complications due to the lack of oxygen during the rescue procedure and the lack of colostrum afterward.

The European Regulation on the protection of animals at slaughter does not include any regulations to prevent the slaughter of pregnant mares and to prevent suffering of an unborn animal (EC No 1099/2099). This might be due to the assumption that slaughtering gestating livestock occurs only in exceptional cases, which was made by the Scientific Committee on Veterinary Measure (1999) relating to public health. However, recent studies, performed in the EU, indicate that slaughtering gestating animals is not an isolated phenomenon and occurs on a regular basis (Riehn et al., 2010; Maurer et al., 2016).

In general, it can be concluded that there is still no consensus about slaughtering late-gestating mares probably because of the difficult ethics of the topic of slaughtering fetuses and the risk of prolonged fetal suffering. To avoid fetal suffering during the slaughtering process, a scientific study should be addressed in which the relationship between stress, management, and fetal health, and the effect of the timing of a fetal insult on the postnatal welfare should be excessively investigated (Campbell et al., 2015). In this way, legislation about the protection of the welfare of prenatal animals can be developed.

Conclusion

Although there are similarities between different current regulations, worldwide requirements about the fitness for travel of slaughter horses are not consistent and leave room for interpretation (World Organisation for Animal health (OIE), European Regulation 1/2005, Australian Animal Welfare standard and guidelines, U.S. Transport Quality Assurance, Equine Canada, 2018, Transport code within New Zealand, 2016). There is an urgent need for a consensus on an international level about all parameters to ensure only physically fit horses are transported. To accomplish this consensus and to improve practical guidelines, additional research needs to be performed on whether the horse's fitness for transportation is affected by transport time and environmental effects. In this way, transport conditions can be included in regulations concerning the fitness for travel. Furthermore, legal regulation should provide a solution for injured horses, which are actually not fit for travel but have to be slaughtered to reduce additional suffering. Currently, management practices may not be compliant with recommendations for transportation (Padalino et al., 2016a). Thus, sensitization of people involved with the handling of horses is necessary.

An understandable and clear regulation can make the owner more attentive and might encourage the owner of the horses to treat them correctly. Once the legal regulation enters into force, raising the awareness of the staff who are involved in loading, transporting, unloading, and slaughtering horses, and training the staff, will be the next challenge (Grandin, 1994). A practical training can substantially improve the general attitude of all people involved in handling horses (Grandin, 1994).

In conclusion, a general and practically applicable legal regulation should be designed to provide clear and helpful advice on the fitness for travel of horses and to refine existing policies and practices in horse transportation.

Ethical considerations

No animal experiments were performed to write this article. Thus, compliance with regulations on the ethical treatment of animals is met.

Conflict of interest

The authors have no competing interests to declare.

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