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Letícia Santos Maurício

Knowledge, beliefs and attitudes of equine practitioners and enthusiasts about behaviors, emotions and welfare in horses

Florianópolis
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Àqueles que não podem se comunicar verbalmente com os humanos, que sejamos suas vozes.

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RESUMO

No primeiro capítulo desta tese, são descritos métodos utilizados para avaliar o estado emocional dos cavalos. Tais como: potenciais indicadores que auxiliam a compreender a valência emocional nesta espécie; novas metodologias que utilizam o conhecimento adquirido sobre vieses cognitivos e sua relação com estados emocionais; e conhecimento atual sobre empatia e contágio emocional em cavalos. Um dos indicadores de estados emocionais negativos que tem sido também objeto de debate é o comportamento estereotipado. Alguns autores argumentam que esses comportamentos indicam emoções negativas em cavalos. Enquanto outros argumentam que o comportamento indica que o cavalo está submetido a condições inadequadas de criação e/ou manejo. De qualquer forma, esse comportamento está associado a condições de vida subótimas. O segundo capítulo explora como os comportamentos estereotipados surgem de uma complexa interação entre a composição genética dos cavalos e os fatores ambientais a que estão expostos. Examina também como a seleção de raças equinas específicas e personalidades individuais de cavalos para vários propósitos de trabalho se entrelaçam com práticas distintas de moradia, alimentação e manejo, acabando por influenciar a manifestação de comportamentos estereotipados. O terceiro capítulo explora as crenças, conhecimentos e atitudes de praticantes e entusiastas do meio equestre sobre bem-estar em cavalos; as normas sociais subjacentes a práticas utilizadas neste meio, a percepção de diferentes significados sobre "deixar o cavalo ser cavalo" de acordo com o cavalo, seu valor e propósito; e as barreiras que impedem ou dificultam as pessoas de empregarem práticas de bem-estar que consideram benéficas aos cavalos. Uma dessas práticas diz respeito ao manejo alimentar que comumente consiste no fornecimento de grande quantidade de alimento concentrado e pequena quantidade de volumoso em poucas refeições diárias. Este manejo alimentar pode desencadear a expressão de comportamentos anormais e antecipatórios. A partir disso, o quarto capítulo da tese explora crenças, conhecimentos e atitudes de praticantes e entusiastas do meio equestre sobre emoções e comportamentos relacionados ao comportamento antecipatório a uma recompensa alimentar em cavalos, tendo em vista o debate atual no meio científico sobre as emoções vivenciadas por cavalos e outros animais durante a expressão de comportamento antecipatório.

Palavras-chave: bem-estar animal; comportamento antecipatório; comportamento estereotipado; estados afetivos.

ABSTRACT

In the first chapter of this thesis, methods used to evaluate the emotional state of horses are described: the potential indicators that help to understand the emotional valence in this species, the new methodologies that use the acquired knowledge about cognitive biases and their relationship with emotional states and the current knowledge about empathy and emotional contagion in horses. One of the indicators of negative emotional states that has also been the subject of debate is stereotypic behavior. Some authors argue that these behaviors indicate negative emotions in horses, while others argue that the behavior indicates that the horse has suffered poor welfare in the past or that the horse has been successful in facing a challenging environment in the past, but that it is not necessarily suffering in the present. In any case, this behavior is associated with suboptimal living conditions. The second chapter explores how stereotypic behaviors arise from a complex interaction between the genetic composition of horses and the environmental factors to which they are exposed, and examines how the selection of specific equine breeds and individual horse personalities for various working purposes intertwine with different practices of housing, feeding and management, eventually influencing the manifestation of stereotypic behaviors. The third chapter presents beliefs, knowledge and attitudes of practitioners and enthusiasts of the equestrian environment about welfare in horses, the social norms underlying the practices used in the equestrian environment, the perception of different meanings about "letting the horse be a horse" according to the horse, its value and purpose and barriers that prevent or impede people from employing welfare practices that they consider beneficial to horses. One of these practices concerns feeding management, which commonly consists of providing a large amount of feed and a small amount of roughage in a few daily meals. This dietary management can trigger the expression of abnormal and anticipatory behaviors. The fourth chapter of the thesis presents beliefs, knowledge and attitudes of practitioners and enthusiasts of the equestrian environment about emotions and behaviors related to the anticipatory behavior of a food reward in horses, in view of the current debate in the scientific community about the emotions experienced by horses and others. animals during the expression of anticipatory behavior.

Keywords: affective states; animal welfare; anticipatory behavior; stereotypic behavior.

RESUMO EXPANDIDO

Introdução

Cavalos soltos passam o dia pastando, alertas e expressando comportamentos sociais; no entanto, por meio da domesticação do cavalo, que se supõe ter ocorrido no Neolítico, Eneolítico ou início da Idade do Bronze, o homem impôs aos cavalos um manejo alimentar completamente distinto do que ocorria em vida livre, impedindo-os de expressarem comportamentos naturais (MILLS; MCDONNELL, 2005). A domesticação dos cavalos foi acompanhada de práticas de manejo que reduzem o acesso dos cavalos à área externa e restringem o contato entre eles, além de sujeitá-los ao desmame precoce, rotinas previsíveis, falta de estímulos, trabalho exaustivo e dietas inadequadas (LEME et al., 2014; MCGREEVY et al., 1995b). Essa diferença na vida de cavalos soltos e estabulados pode explicar por que problemas comportamentais, como comportamentos estereotipados, são observados de forma geral apenas no ambiente cativo (MILLS; MCDONNELL, 2005)

Embora os cavalos estabulados estejam sujeitos a muitas restrições, é possível melhorar seu bem-estar. Por exemplo, ao soltar os animais em piquetes por algumas horas do dia, proporcionando oportunidades de liberdade para se movimentar e pastarem no piquete durante o dia, com a possibilidade de expressar comportamentos naturais e ter contato com outros cavalos (BACHMANN; AUDIGÉ; STAUFFACHER, 2010; RIVERA et al., 2002). O bem-estar animal é entendido como um estado dinâmico (ARNDT; GOERLICH; VAN DER STAAY, 2022) e compreende componentes-chave como naturalidade, estados mentais/afetivos, saúde (FRASER et al., 1997), nutrição, espaço físico e interações comportamentais (MELLOR et al., 2020). Hoje, o foco do bem-estar dos animais de fazenda é oferecer oportunidades para que eles experimentem estados mentais positivos (ARNDT; GOERLICH; VAN DER STAAY, 2022), como felicidade (WEBB et al., 2019), sendo capazes de se adaptar e reagir ao ambiente natural ou humano/ambiente controlado (OHL; VAN DER STAAY, 2012) por meio de comportamentos naturais (ARNDT; GOERLICH; VAN DER STAAY, 2022) e ter "poder de escolha" sobre suas vidas e experiências (WEARY; VENTURA; KEYSERLINGK, 2016). Além disso, as experiências subjetivas do indivíduo afetam sua qualidade de vida, que é um conceito importante do ponto de vista ético (YEATES, 2016). O bem-estar animal também pode ser abordado de uma forma mais ampla, como a One Welfare Systemic Approach (PINILLOS et al., 2016), incluindo além dos animais, o ambiente em que estão inseridos e suas relação com os humanos, (LUKE; RAWLUK; MCADIE, 2022).

Toda essa discussão sobre o bem-estar dos animais de produção e fazenda não se restringe ao meio científico (FRASER, 1999). O conceito de bem-estar muda com a sociedade (BOCK AND BULLER, 2013), pois é baseado na ciência e cultura (FRASER, 2008), valores morais e sociais (OHL; VAN DER STAAY, 2012). A percepção e os valores morais do bem-estar animal influenciam as atitudes das pessoas, como a decisão de compra de produtos de origem animal, por exemplo (SCHNETTLER et al., 2009) e a forma como o público reage a esportes equestres (DOUGLAS; OWERS; CAMPBELL, 2022). A maioria das partes interessadas acredita que o manejo inadequado é uma preocupação para o bem-estar dos animais de produção (HELESKI; MERTIG; ZANELLA, 2006). Contudo, produtores e consumidores expressam crenças diferentes sobre o estado de bem-estar desses animais (TE VELDE; AARTS; VAN WOERKUM, 2002). Influenciar as crenças das pessoas sobre práticas nocivas aos animais é necessário para que elas mudem atitudes (HÖTZEL; SNEDDON, 2013). Isso pode ser alcançado por meio da educação (HELESKI; MERTIG; ZANELLA, 2006). No caso de equinos, principalmente por meio de programas de educação

desenvolvidos em torno de profissionais como veterinários e ferradores que são fontes de informação para entusiastas do hipismo (VISSER; VAN WIJK-JANSEN, 2012). Mudanças de atitude também podem ser desencadeadas pela pressão pública sobre os estabelecimentos e competições equestres, por meio da licença social para operar (DOUGLAS et al., 2012).

A sociedade ainda precisa avançar muito para garantir o bem-estar dos cavalos estabulados. O atual sistema de alojamento de cavalos baseado em estábulos usado em grande parte do mundo não possibilita que esses animais expressem seus comportamentos naturais da espécie. Isso resulta em problemas comportamentais, como comportamentos agressivos e estereotipados (SARRAFCHI; BLOKHUIS, 2013; SEABRA; DITTRICH; VALE, 2021). Outros tipos de comportamento, como os antecipatórios, não são considerados problemas comportamentais, sendo inclusive considerados normais no meio equestre. No entanto, existe uma lacuna no conhecimento sobre a valência da emoção associada à expressão do comportamento antecipatório em cavalos (PETERS; BLEIJENBERGC; DIERENDONCKA, 2012; RICCI-BONOT; MILLS, 2023; ZUPAN; ŠTUHEC; JORDAN, 2020). Esta tese, portanto, pretende contribuir para o entendimento de conhecimentos, crenças e atitudes de praticantes e entusiastas equestres sobre comportamento, emoções e bem-estar em cavalos. Não basta propor mudanças baseadas apenas em estudos científicos. Temos que entender quais são as barreiras que limitam ou impedem as pessoas de empregar melhores práticas de manejo que promovam o bem-estar animal. Por isso é de fundamental importância investigar se elas estão dispostas a implementar essas mudanças (WEARY; VENTURA; KEYSERLINGK, 2016).

Objetivos

- Explorar conhecimentos, crenças e atitudes de praticantes e entusiastas equestres sobre bem-estar de cavalos e identificar as barreiras que os impedem de empregar melhores práticas de manejo consideradas essenciais para promoção do bem-estar dos cavalos;
- Investigar conhecimentos, crenças e atitudes de praticantes e entusiastas equestres sobre comportamentos e emoções associados ao comportamento antecipatório em cavalos estabulados e como isso influencia nas suas decisões de manejo.

Metodologia

Os estudos qualitativos desta tese foram aprovados pelo Comitê de Ética em Pesquisa com Seres Humanos da Universidade Federal de Santa Catarina (CEPSH/UFSC), protocolo n. 5.092.727. Nos dois capítulos que envolveram pesquisas qualitativas, foram entrevistados 31 entusiastas e praticantes equestres, que eram pessoas diretamente envolvidas no meio equestre e que possuíam contato com cavalos. As entrevistas semi-estruturadas em profundidade ocorreram de fevereiro a maio de 2022 pessoalmente ou por videochamada.

Os primeiros participantes foram recrutados a partir da rede de contato da autora. Em seguida, foi utilizado o método de amostragem bola de neve, por meio do qual os participantes eram requisitados a recomendar participantes adicionais para o estudo (ROLLER; LAVRAKAS, 2015). Antes das entrevistas, todos os participantes receberam e assinaram um Termo de Livre Consentimento e Esclarecimento.

Os entusiastas e praticantes equestres responderam questões sobre bem-estar de cavalos, barreiras que impedem o emprego de melhores práticas para o bem-estar de cavalos e questões referentes à expressão do comportamento antecipatório a uma recompensa alimentar em cavalos em uma única entrevista. As respostas foram categorizadas em códigos para discussão por meio da análise temática, seguindo a metodologia de BRAUN; CLARKE (2006, 2019). Os códigos que possuíam um conceito organizador central comum foram

agrupados em temas (BRAUN V., CLARKE V., HAYFIELD N., TERRY G., 2019) para a interpretação de crenças, conhecimentos e atitudes dos entusiastas e praticantes equestres sobre comportamentos, emoções e bem-estar em cavalos.

Resultados

As entrevistas do primeiro estudo qualitativo exploraram crenças, conhecimentos e atitudes de praticantes e entusiastas equestres sobre bem-estar em cavalos e as maiores barreiras ao emprego de melhores práticas promotoras de bem-estar aos cavalos. Os participantes demonstraram ter conhecimento sobre aspectos relacionados ao bem-estar, como saúde, estados mentais e interações humano-animal, e muitos associaram o conceito de bem-estar à ideia de uso do cavalo de acordo com a sua natureza. Entretanto assumiram que não empregavam as melhores práticas que poderiam promover o bem-estar dos cavalos. As barreiras percebidas pelos participantes para justificar isso foram falta de recursos, como recursos financeiros, espaço físico, mão-de-obra qualificada, tempo, ferramentas e conhecimento e primazia dos objetivos pessoais humanos sobre o bem-estar do cavalo. Também foi apontada a necessidade de isolamento de cavalos com personalidade mais excitável, cavalos de esporte, exposição e garanhões como justificativa para evitar brigas, lesões, estragos na pelagem e melhoria no desempenho. Outra barreira ao emprego de melhores práticas apontada pelos participantes foram as normas sociais do grupo. Isso foi relatado por meio de termos como "como todo mundo faz" e "como sempre foi feito". Alguns participantes expressaram a crença de que práticas culturais estão sendo modificadas, outros contestaram algumas normas sociais, porém somente poucos relataram o abandono de determinadas normas sociais.

As entrevistas do segundo estudo qualitativo exploraram crenças, conhecimentos e atitudes de praticantes e entusiastas equestres sobre comportamento antecipatório em cavalos. A maioria dos participantes associou o comportamento antecipatório a uma emoção de valência negativa, como ansiedade. O aumento na ocorrência de comportamentos agressivos e estereotipados e vocalizações foi usado para justificar essa associação. Menos participantes associaram o comportamento antecipatório a uma emoção de valência positiva. Os participantes que expressaram essa crença interpretaram o comportamento antecipatório como um sinal de brincadeira, apetite ou alegria por receber comida. Muitos participantes defenderam a necessidade de rotina para o bem-estar dos cavalos, ainda que atribuíssem a causa do comportamento antecipatório nos cavalos à rotina altamente previsível, à fome gerada pelos longos intervalos entre o fornecimento das refeições e ao fornecimento de alimentos concentrados que deixam os cavalos com muita energia e ansiosos. Na percepção de alguns participantes, os cavalos apresentam intensidades diferentes na expressão do comportamento antecipatório, mesmo vivendo em uma mesma rotina, devido à personalidade. De acordo com alguns participantes, cavalos socialmente dominantes ou ansiosos expressam mais comportamento antecipatório.

Discussão

Muitos praticantes e entusiastas equestres orientaram suas práticas de acordo com o valor econômico do cavalo. A falta de recursos foi considerada como barreira intransponível para a implantação de práticas para melhoria do bem-estar no caso de cavalos de baixo valor econômico. Enquanto que a agregação efetiva de algum valor econômico foi a barreira apontada para aplicação de práticas que promovam o bem-estar de cavalos de valor econômico mais elevado. Dessa forma, o significado de “deixar o cavalo ser cavalo” foi percebido de forma diferente de acordo com o cavalo, seu valor e propósito. As barreiras

econômicas e a pressão cultural não foram suficientes para mudar as crenças e atitudes dos participantes. Os resultados sugerem que os participantes não possuem intenção de mudar as práticas ou desafiar a cultura e o status quo da produção equina.

A maioria dos participantes associou o comportamento antecipatório a uma emoção de valência negativa devido à alta ocorrência de vocalizações, comportamentos estereotipados e agressivos antes do fornecimento do alimento aos cavalos. Os participantes defenderam a rotina como benéfica para o bem-estar dos cavalos, mesmo considerando a rotina, práticas de manejo e condições de alojamento empregados como um gatilho para a expressão de comportamentos antecipatórios, agressivos e estereotipados. Mesmo reconhecendo esses comportamentos como associados a emoções negativas, os participantes não demonstraram pretensão em mudar a rotina, as práticas de manejo e as condições de alojamento.

Considerações finais

O meio equestre é caracterizado por práticas de manejo pautadas na tradição, preservadas por normas sociais do grupo e pouco contestadas, inclusive no manejo alimentar inadequado que resulta em comportamentos antecipatórios. A mudança dessas práticas será possível quando a observação de manifestações de emoções negativas em cavalos ou pensamentos dissonantes dos praticantes e entusiastas equestres gerarem desconforto suficiente para que valores morais sobre o bem-estar dos cavalos se sobressaiam sobre objetivos pessoais. Por fim, mudanças ocorrerão se barreiras percebidas como intransponíveis e crenças equivocadas forem ressignificadas.

Palavras-chave: bem-estar animal; comportamento antecipatório; comportamento estereotipado; estados afetivos.

FIGURE LIST

TABLE LIST

SUMÁRIO

1. INTRODUCTION

Free ranging horses spend the day grazing, alert and expressing social behaviors; however, due to the domestication of the horse, which is supposed to have occurred at the Neolithic, Eneolithic or early Bronze Age, man imposed a feeding management completely different from what occurred in the wild, preventing horses from expressing natural behaviors, such as feeding, sexual and social dominance behaviors (MILLS; MCDONNELL, 2005). Moreover, the domestication of horses was accompanied by management practices that reduce horse access to the outdoor areas and restrict social contact with other horses. In addition, horses are subjected to early weaning, predictable routines, lack of stimuli, exhausting work and inappropriate diets (LEME et al., 2014; MCGREEVY et al., 1995b). This difference in the lives of free-ranging and stabled horses may explain why behavioral problems, such as stereotypic behaviors, are observed when we keep these animals in a strict confinement system. (COOPER; ALBENTOSA, 2005; FREYMOND et al., 2020; MILLS; MCDONNELL, 2005; NICOL et al., 2002).

Although stabled horses are subject to many restrictions, it is possible to improve their welfare by providing opportunities for freedom to move and graze in a paddock during the day. Allowing the expression of natural behaviors and having contact with other horses (BACHMANN et al., 2003; RIVERA et al., 2002) and thus improving their welfare. Animal welfare is understood as a dynamic state (ARNDT; GOERLICH; VAN DER STAAY, 2022) and comprises key components such as naturalness, mental/affective states, health (FRASER et al., 1997), nutrition, physical space and behavioral interactions (MELLOR et al., 2020). Today, the focus of farm animal welfare is on providing opportunities for animals to experience positive mental states (ARNDT; GOERLICH; VAN DER STAAY, 2022), like happiness (WEBB et al., 2019). To enable them to be able to adapt and respond to the environment, whether natural or controlled by humans (OHL; VAN DER STAAY, 2012). And have "power of choice" over their lives and experiences (WEARY; VENTURA; KEYSERLINGK, 2016). Furthermore, the subjective experiences of the individual affect their quality of life, which is an important concept from an ethical point of view (YEATES, 2016). Animal welfare can also be approached in a broader way, such as the One Welfare Systemic Approach (PINILLOS et al., 2016), including beyond the animals, the environment in which they are inserted and their relationship with humans (LUKE; RAWLUK; MCADIE, 2022).

All this discussion about the welfare of farmed animals is not restricted to the academic environment (FRASER, 1999). The concept of welfare changes with society

(BOCK AND BULLER, 2013), as it is based on science and culture (FRASER, 2008), moral and social values (OHL; VAN DER STAAY, 2012). The perception and moral values of animal welfare influence people's attitudes, such as the decision to purchase animal products, for example (SCHNETTLER et al., 2009) and the way the public reacts to equestrian sports (DOUGLAS; OWERS; CAMPBELL, 2022). Although most stakeholders believe that poor management is a concern for the welfare of farmed animals (HELESKI; MERTIG; ZANELLA, 2006), farmers and consumers express different beliefs about the welfare state of farmed animals (TE VELDE; AARTS; VAN WOERKUM, 2002). Influencing people's beliefs about practices harmful to animals is key for changing attitudes (HÖTZEL; SNEDDON, 2013), which can come through education (HELESKI; MERTIG; ZANELLA, 2006), mainly education programs developed by professionals such as veterinarians and farriers who are sources of information for equestrian enthusiasts (VISSER; VAN WIJK-JANSEN, 2012). Attitude changes can also be triggered by public pressure on equestrian establishments and competitions, through the social license to operate (DOUGLAS et al., 2012).

This issue involving stabled horses, welfare and owners' attitudes will be addressed in four chapters. This thesis consists of four chapters that aim to understand the behavior of horses and people in order to improve horses' welfare, relating them to positive and negative emotions that can be triggered by management practices. The first chapter presents the article entitled “How to understand them? A review of emotional indicators in horses”, published in the Journal of Equine Veterinary Science, which describes emotional indicators in horses and how they can be used to investigate the existence of emotional contagion in horses. In the second chapter, the article “The vicious circle of stereotypic behavior in horses” explores how stereotypic behaviors arise from a complex interplay between the genetic composition (genotype) of horses and the environmental factors they are exposed to. This chapter examines how the selection of specific equine breeds and individual horse personalities for various work purposes intertwines with distinct housing, feeding, and management practices. Ultimately, it could influence the manifestation of stereotypic behaviors. In the third chapter, beliefs, knowledge and attitudes of practitioners and enthusiasts of the equestrian environment about the welfare of horses are explored, as well as barriers that prevent people from applying best practices. Finally, the fourth and final chapter explores beliefs, knowledge and attitudes of equestrian practitioners and enthusiasts about emotions and behaviors related to anticipatory behavior towards a food reward in horses.

Society still needs to advance a lot to ensure the welfare of stabled horses. The current stall-based horse housing system used in much of the world prevents natural behaviors of the

species and triggers behavioral problems such as aggressive and stereotypic behaviors (SARRAFCHI; BLOKHUIS, 2013; SEABRA; DITTRICH; VALE, 2021). Anticipatory behaviors are not considered behavioral problems and are even considered normal in the equestrian environment. However, there is a gap in knowledge about the valence of emotion associated with the expression of this behavior in horses (PETERS; BLEIJENBERGC; DIERENDONCKA, 2012; RICCI-BONOT; MILLS, 2023; ZUPAN; ŠTUHEC; JORDAN, 2020). Knowing how to recognize signs of discomfort, frustration, negative emotional states, and poor welfare in horses can lead people to employ changes in harmful management practices. This thesis intends to contribute to the understanding of knowledge, beliefs and attitudes of equine practitioners and enthusiasts about behavior, emotions, and welfare in horses.Understanding the conception of horse welfare, the social norms underlying perceived barriers that limit or prevent people from employing better management practices, and the understanding of the emotions associated with equine behaviors from people's point of view can be one more step in the process of making people aware of the use of practices that promote horse welfare.

OBJECTIVES

General objective

To explore knowledge, beliefs and attitudes of equine practitioners and enthusiasts about behaviors, emotions and welfare in horses through a qualitative approach.

Specific objectives

1. To present a brief history of the study of emotions; models that explain emotions from a scientific point of view; the physiological bases and functions of emotions; to review and discuss the indicators developed to assess emotions in horses; and to show how these indicators have been used to investigate if there is emotional contagion in horses.
2. To discuss how stereotypic behaviors, as well as other behaviors, arise from a complex interplay between those factors, such as horse genotype and the environmental factors and management factors they are exposed to; specifically, to examine how the selection of specific horse breeds for different type of work intertwines with distinct

environmental factors and management practices, ultimately influencing the manifestation of stereotypic behaviors; and to highlight the effects of horse usage on the development of stereotypic behavior.

3. To investigate the knowledge, beliefs, and attitudes of equine practitioners and enthusiasts regarding behaviors and emotions associated with anticipatory behavior in stabled horses and how this influences their management decisions.
4. To explore knowledge, beliefs, and attitudes of equine practitioners and enthusiasts about horse welfare and to identify the barriers that prevent them from employing better management practices considered essential to promote welfare in horses.

2 HOW TO UNDERSTAND THEM? A REVIEW OF EMOTIONAL INDICATORS IN HORSES

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Abstract

Stabled horses often experience negative emotions due to the inappropriate living conditions imposed by humans. However, identifying what emotions horses experience and what can trigger positive and negative emotions in stabled horses can be challenging. In this article we present a brief history of the study of emotions and models that explain emotions from a scientific point of view and the physiological bases and functions of emotions. We then review and discuss physiological and behavioral indicators and cognitive bias tests developed to assess emotions in horses. Hormone concentrations, body temperature, the position of the ears, facial expressions and behaviors, such as approach and avoidance behaviors, can provide valuable information about emotional states in horses. The cognitive bias paradigm is a recent and robust tool to assess emotions in horses. Knowing how to evaluate the intensity and frequency of an individual's emotions can guide horse owners and caretakers to identify practices and activities that should be stimulated, avoided or even banned from the individual's life, in favor of a life worth living. The development and validation of novel indicators of emotions considering positive and negative contexts can help in these actions.

Keywords: Affective states. Cognitive bias tests. Emotional contagion. Horse welfare. Stereotypic behavior. Umwelt.

2.1 Introduction

The interest in emotions of non-human animals is an ever-present subject, which even deserved the title of a book by Charles Darwin (The Expression of the Emotions in Man and Animal, 1872). However, the theme was ignored by the scientific community until recently, when the evaluation of animal welfare was considered incomplete if it did not consider the emotional state of animals (BOISSY et al., 2007; DÉSIRÉ; BOISSY; VEISSIER, 2002). Furthermore, as an impediment to the advancement of the understanding of emotions in non-human animals we can mention the scarce literature on pathologies and diagnoses of mental and psychological health in veterinary medicine (OVERALL, 2005; PISA; LEME, 2022). Emotions are defined as brief duration intense affective responses (Boissy et al., 2007, Désiré et al., 2002) to an internal or external stimulus or event that animals will work to acquire or avoid (Mendl et al., 2010; Paul and Mendl, 2018). The stimuli that animals strive to acquire are called rewards and those they avoid are called punishments (PAUL; MENDL, 2018). Therefore, emotions can be understood as states triggered by cognitive processes that evaluate stimuli as rewards or punishments (ROLLS, 2000). Furthermore, emotions have behavioral, subjective, cognitive, neural, and physiological dimensions - that is, emotions trigger physiological and behavioral responses in the body (PAUL; HARDING; MENDL, 2005). Mood, in turn, can be understood as a long-term emotional state that reflects short-term emotional experiences and shows an individual's past experiences (MENDL; BURMAN; PAUL, 2010). Considering the definition of the term emotion explained above, that a vocabulary is still under construction and that researchers use other different terminologies such as emotional and affective states as similar concepts (LEDOUX, 2012; NEETHIRAJAN; REIMERT; KEMP, 2021), we will use the terms emotion, affective states and emotional states as synonyms in this review.

Studying emotions is important because it is directly related to animal welfare. Animal welfare, defined as “an individual's state as regards its attempts to cope with its environment” (BROOM, 1991), reflects the balance between the frequency of positive and negative physical experiences, and also considers emotional states (SPRUIJT; VAN DEN BOS; PIJLMAN, 2001). As a result, animal welfare can vary on a scale from "very good" to "very bad" (BROOM, 1991). For example, good welfare results from a higher frequency of positive states than negative experiences or emotional states (BOISSY et al., 2007; MELLOR, 2016). In fact, the focus on positive emotional states is being increasingly highlighted in the conception of animal welfare (ARNDT; GOERLICH; VAN DER STAAY, 2022). Using part

of the concept of human happiness, Webb et al. (2019), conceptualized happiness in non-human animals as "how an animal feels most of the time", which coincides with the conception of animal welfare. Therefore, good animal welfare includes positive physical and mental experiences and positive affective states, which can be provided by adequate living conditions (BOISSY et al., 2007; BRAMBELL; TECHNICAL COMMITTEE TO ENQUIRE INTO THE WELFARE OF ANIMALS KEPT UNDER INTENSIVE LIVESTOCK HUSBANDRY SYSTEMS, 1965; DAWKINS, 2006, 2008; FRASER, 1993).

A greater understanding of emotions in horses, including their causes and ways to to assess them, may ultimately help humans involved with horses to choose best practices and improve human-horse relationships. The use of practices that are perceived as harmful to the emotional states of horses and, consequently, to their welfare, may undermine public support for equestrian activities and the “social license to operate” (DOUGLAS; OWERS; CAMPBELL, 2022; DUNCAN; GRAHAM; MCMANUS, 2018; FIEDLER; MCGREEVY, 2016; LADEWIG et al., 2022; MARTIN; WILLIAMS, 2011). In everyday life, welfare may be impaired in stabled horses through social and spatial restrictions (e.g., LEME et al., 2014). Other challenges for the welfare of horses are inadequate diets with too much concentrate, large amounts of cereals, little fiber and reduced frequency of meals (e.g., MCGREEVY et al., 1995), and working conditions (e.g., HENRGY et al., 2017). Such restrictions can prevent highly motivated behaviors in horses, listed in 3Fs framework (forage, friend and freedom) (WADHAM et al., 2022), such as foraging, social contact and wallowing, and reduce opportunities of occurrence of positive physical and mental experiences (LÖCKENER et al., 2015). Therefore, understanding emotions in horses may help to answer the question “how to provide good opportunities and avoid bad practices, based on the horse's affective states, in order to achieve a good level of well-being?”. To answer this question, it is first necessary to identify what emotional states horses experience in terms of valence (positive or negative) (e.g., BRIEFER FREYMOND et al., 2015) and behavioral (e.g., LANSADE et al., 2018) indicators. In addition, there are other indicators of affective states, such as the cognitive bias paradigm (PAUL; HARDING; MENDL, 2005) that can indicate a more lasting affective state, i.e., a mood state, different from an instantaneous behavior or physiological change in response to an isolated event.

In this article we will present a brief history of the study of emotions; models that explain emotions from a scientific point of view; the physiological bases and functions of emotions; review and discuss the indicators developed to assess emotions in horses; and show how these indicators have been used to investigate if there is emotional contagion in horses.

2.2 Understanding emotions: history, models, physiological bases and functions

In order to understand and find indicators of affective states and which factors affect emotions in horses, it is necessary to understand emotions more deeply. Throughout history, several authors have suggested different emotions that animals can theoretically experience. For example, in his book "The Expression of Emotions in Man and Animals", Darwin argued that animals could experience six basic feelings: surprise, happiness, sadness, disgust, anger, and fear (DARWIN, 1872) and described emotions that can be shared by different species such as anxiety, grief, joy, anger, guilt, helplessness, fear, and shame. Similarly, Ekman (EKMAN, 1970) proposed six basic emotions similar to the basic feelings proposed by Darwin: fear, anger, happiness, sadness, disgust, and surprise. More recently, Panksepp (PANKSEPP, 2005) proposed seven primary emotional systems or basic emotions, which are seeking/expectation, fear, rage, care, panic and play. Panksepp (PANKSEPP, 2007) also suggested three biological processes related to emotions: primary processes, which are instinctive, unconditioned and related to subcortical brain structures; secondary processes, which are involved with emotional learning and reflection capacity; and tertiary processes, which is the complex cognitive-affective process with involvement of the neocortex and limbic structures and greater awareness. In this theory, secondary and tertiary processes result from neuropsychological interactions of primary process emotions and their cortical-cognitive regulations (PANKSEPP, 2005). Therefore, basic emotions, such as fear, may occur only in the primary process, as they do not involve learning related to secondary processes, nor cognition, judgment and values of tertiary processes (PANKSEPP; WATT, 2011). Many studies have characterized emotions based on dimensional models (RUSSELL; BARRETT, 1999; SMITH; ELLSWORTH, 1985) in which one dimension refers to the valence (positive or negative) and other dimension refers to the arousal (high or low). In these models, long-term moods and short-term emotional states can be evaluated within a two-dimensional space (central affect) in which discrete emotions are located in the affective core and classified according to levels of valence and arousal. In this case, a positive emotion can be of high arousal, such as joy, or low arousal, such as contentment; and a negative emotion may be of high arousal, such as fear, or low arousal, such as depression (RUSSELL; BARRETT, 1999; WATSON et al., 1999).

Studies focusing on the valence of emotions are common in many species including equines. Researchers attribute the valence of the emotions according to the context or

stimulus used in the study. For example, a veterinary manipulation (negative context) and grooming (positive context) (TRÖSCH et al., 2020), or standard grooming (negative context) and gentle grooming (positive context) (LANSADE et al., 2018), or harmful living conditions such as being raised in stalls and social isolation (negative context) and beneficial conditions such as living in groups, loose in the pasture (positive context) (HINTZE et al., 2017). However, many studies do not actually describe what those emotions are, but only the valence of an undescribed emotion. This may be due to the difficulty in describing emotions in non-verbal animals in a scientific way.

To describe emotions, it may be useful to first understand the physiological bases of emotions. The physiological bases of emotions comprise sensory, autonomic and motor mechanisms related to the organism's homeostasis. Emotions are processed in the brain, more specifically in the somatosensory cortices, in the upper nuclei of the brainstem and midbrain (DAMASIO et al., 2000) and are regulated by limbic structures such as the amygdala and hippocampus. The brain stem is related to emotional states, the amygdala to response and attention functions, and the hippocampus to spatial memory (TUCKER; DERRYBERRY; EMOTION, 2000). Cells from the amygdala and the hypothalamus are also involved in general motivational states, for example, leading to fight or flight behaviors, regulation of analgesia and heart rate variability (BANDLER; SHIPLEY, 1994; DAMASIO et al., 2000). Finally, anatomical structures such as brainstem and spinal cord cells control muscles and peripheral organs, specific behaviors, such as facial expressions due to cranial nerves, the activity of the sympathetic and parasympathetic nervous system and autonomic reflexes (HOLSTEGE, 1991; TUCKER; DERRYBERRY; EMOTION, 2000; VAN BOCKSTAELE; PIERIBONE; ASTON-JONES, 1989).

Thanks to these anatomical structures, emotions present multiple important and adaptive functions (DARWIN, 1872; EKMAN et al., 1992; PAUL et al., 2020), such as the activation of autonomous, endocrine and motor responses and flexibility, changes and direction of behavioral responses (BLAIR, 2003; DAMASIO et al., 2000; DARWIN, 1872; EKMAN et al., 1992; ROLLS, 2000). Taking that into account, emotions are essential to life because they guide quick and appropriate individuals' responses to external or internal stimuli and lead individuals to exhibit behaviors resulting from decision making regarding the expectation of a positive (rewarding) or negative (aversive) stimulus (MENDL; BURMAN; PAUL, 2010). Therefore, emotions can be unpleasant for an individual if they are negative and lead to suffering; however, considering emotions as adaptive processes, they can lead to an increase in the animal's aptitude, preparing them to fight or flee (DAWKINS, 2000). The

big issue here is that emotions can benefit an individual due to these adaptive processes. These processes lead to physiological changes that trigger fight-or-flight responses, and these responses increase the likelihood of his survival. So, under conditions of acute stress when there is a threat, the individual's fitness can increase. However, if the conditions are persistent and result in chronic stress, the individual can be driven to exhaustion which leads to a poor state of well-being. This exhaustion occurs, for example, in situations of high levels of stress over a prolonged period, such as horses in a hostile environment where there is a high risk of predation or when horses are transported under suboptimal conditions. The adaptive characteristic of emotions, according to Darwin (DARWIN, 1872), can be observed in the similarity between behaviors expressed by different species through the use of the same anatomical structures, controlled by the direct action of the nervous system resulting from the same emotion. Despite this anatomical similarity regarding the expression of emotions, animals of different species can also present different indicators of emotions, such as postures and vocalizations. Therefore, it is essential to investigate indicators of emotions for each species, especially for prey species such as horses, in order to understand what emotions individuals are experiencing in different contexts.

2.3 Indicators of emotions in horses: How can we recognize the valence of emotional states in horses in different contexts?

2.3.1 Physiological indicators of emotions in horses

As seen in the previous section, emotions consist of several dimensions, among them the physiological (PAUL; HARDING; MENDL, 2005). Physiological changes in response to emotions can include regulatory responses and suppression of physiological functions (BROOM, 1988) and may involve diverse neuromodulatory systems, cortical and subcortical parts of the brain (BURGDORF; PANKSEPP, 2006; MENDL; BURMAN; PAUL, 2010; PANKSEPP; LAHVIS, 2011; SPRUIJT; VAN DEN BOS; PIJLMAN, 2001).

The autonomic nervous system that regulates heart rate is one of the most studied systems involved in physiological responses to emotions (BOISSY et al., 2007). The sympathetic nervous system is the main division of the autonomic nervous system involved in controlling heart rate. The activation of the sympathetic nerves stimulates the force of cardiac contraction. The parasympathetic nervous system, including the vagus nerves of the heart, also controls heart rate, albeit to a lesser extent, reducing it (GUYTON & HALL, 1997;

OBRIST, 1976). Heart rate can fluctuate due to stimuli that influence the balance between sympathetic or parasympathetic systems (SGOIFO et al., 1999) that control blood circulation. The parasympathetic system decreases heart rate and is involved in passive responses associated with rest, while the sympathetic nervous system increases heart rate and is involved in active stress avoidance responses associated with arousal (GUYTON & HALL, 1997; OBRIST, 1976). Because it is regulated by the autonomous systems and, therefore, it is involuntary, and not necessarily accompanied by a change in the behavioral response (CHRISTENSEN; KEELING; NIELSEN, 2005; SAFRYGHIN; HEBESBERGER; WASCHER, 2019), heart rate is a frequently used indicator of emotions in horses. Heart rate has been used as an indicator of pain in clinical practice and scientific research (GLEERUP et al., 2015; GRAUBNER et al., 2011; PRICE et al., 2002; PRITCHETT et al., 2003; VAN LOON; VAN DIERENDONCK, 2015); of stress by social restriction (REID et al., 2017; SGOIFO et al., 1999; VISSER et al., 2008); of stress caused by training (CHRISTENSEN et al., 2012) and of fear (SAFRYGHIN; HEBESBERGER; WASCHER, 2019).

Heart rate variability (HRV) is considered a reliable, non-invasive tool to provide a "snapshot" measure of stress (GONTIJO et al., 2018; NUÑEZ et al., 2014; PEETERS et al., 2010) and welfare (PACE-SCHOTT et al., 2019), better than heart rate. HRV can also be used to assess the temperament of horses (GARDELA et al., 2020), since this measure varies between individuals (NUÑEZ et al., 2014). HRV represents short-term heart rate fluctuations between beats. Therefore, it is a quantitative measure that shows responses of the autonomic nervous system, formed by the sympathetic and parasympathetic/vagal nervous systems, to different stimuli and conditions. Thus, this measure shows the balance between the sympathetic and parasympathetic/vagal nervous systems through the relationship between low and high HRV frequencies. This dynamic can occur as a result of sympathetic or parasympathetic activation or by reducing one or the other or activation of both (PACE-SCHOTT et al., 2019). In general, sympathetic influence increases heart rate and the HRV low/high rate ratio and reduces HRV, as, for example, in individuals practicing physical activity, and the parasympathetic reduces the heart rate, as, for example, in individuals at rest. Furthermore, sympathetic regulation influences low frequency HRV and long-term changes in HRV, whereas parasympathetic (vagal) regulation influences high frequency HRV (FUREIX et al., 2012; PACE-SCHOTT et al., 2019). Transport stress increases heart rate, reduces HRV (GARDELA et al., 2020) and reduces vagal tone in horses (NUÑEZ et al., 2014). This can be perceived through quantitative measures such as the decrease in the standard deviation of beat-to-beat intervals and the root mean square of successive differences beat-to-beat that

indicate sympathetic dominance (GARDELA et al., 2020). Like stress, pain can be assessed through HRV related to certain situations. Pain leads to a reduction in high frequency and an increase in the low frequency/high frequency ratio of HRV, reflecting sympathetic dominance (GONTIJO et al., 2018; PACE-SCHOTT et al., 2019).

The sympathoadrenomedullary system and the hypothalamic-pituitary-adrenocortical axis are frequently studied in horses in relation to responses to emotions (GONTIJO et al., 2018; NUÑEZ et al., 2014; PEETERS et al., 2010). These systems are responsible for the synthesis and secretion of the hormones cortisol (GUYTON & HALL, 1997), adrenaline and noradrenaline (PACE-SCHOTT et al., 2019). Cortisol can be measured in blood (PRITCHETT et al., 2003), saliva (PEETERS et al., 2010), fecal (NUÑEZ et al., 2014) and hair samples (GARDELA et al., 2020). It can be altered in horses due to pain resulting from surgery (PRITCHETT et al., 2003), depressive-like states (FUREIX et al., 2012) and stress due to transport (CAVALLONE et al., 2002; FAZIO et al., 2008a), aversive stimuli such as loud sounds, sudden movements (VALENCHON et al., 2013), social isolation (YOUNG et al., 2012), and physical exercise (FERLAZZO et al., 2012; STRZELEC; KANKOFER; PIETRZAK, 2011; WITKOWSKA-PIŁASZEWICZ et al., 2021). It is important to highlight that physical exercises are not always considered negative in horses and result in an increase in cortisol concentration. Proper physical exercise is beneficial to the welfare of horses (HAUSBERGER et al., 2020). Unlike what occurs in acute stressful events, plasma cortisol concentration may decrease in horses that experience depression-like states (PAWLUSKI et al., 2017). That is, after a stressful event, cortisol concentration can increase rapidly (FAZIO et al., 2008a), but different physiological systems of the organism will act to maintain the internal balance, called homeostasis. However, if the long-term living condition leads the individual to a state of chronic stress, homeostasis may be affected and, consequently, the cortisol concentration may be reduced due to the physiological adaptation process in response to stressful events, known as allostasis. In the case of horses that experience a depression-like state, the adaptation process may be physiologically harmful, being called allostatic loading (MCEWEN, 1998). We suggest that the constant challenge of stressful environments in captivity leads horses to develop this adaptive process, which negatively impacts emotions in the long term, as described for humans (PACE-SCHOTT et al., 2019). It is important to be careful with the use of cortisol as an indicator of stress, given that cortisol concentration may vary due to other factors. For example, it can increase in moments such as courtship and mating (BROOM, 1988), thus indicating an high arousal positive emotional state, or decrease

after a certain period of time following a stressful event, or even vary due to the circadian rhythm (BROOM, 1988; GONTIJO et al., 2018; LEAL et al., 2011).

In addition to heart rate and cortisol, other physiological indicators of affective states in horses are concentrations of catecholamines (such as adrenaline and noradrenaline), beta-endorphin, adrenocorticotropic hormone vasopressin and serotonin. All of these physiological measures increase in concentration in response to stress (catecholamines: (HADA et al., 2003; SNOW et al., 1992); beta-endorphin: (FAZIO et al., 2008b; FERLAZZO et al., 2012; MCCARTHY; JEFFCOTT; CLARKE, 1993); adrenocorticotropic hormone: (HADA et al., 2003); vasopressin: (HADA et al., 2003); serotonin: (BRUSCHETTA et al., 2014). Some studies show that the concentration of plasma beta-endorphin is a potential indicator of stress and acute pain in horses subjected to different stressful situations, such as colic, air transport (MCCARTHY; JEFFCOTT; CLARKE, 1993), short-distance transport (FAZIO et al., 2008b) and jumping physical exercise (FERLAZZO et al., 2012). ACTH is a potential indicator of stress, exercise and short-distance transport and vasopressin is a potential indicator of stress caused by new environmental stimuli and exercise (HADA et al., 2003). Serotonin concentration increases after prolonged physical exercise, as a response to the stress of exercise on the vascular system of horses (BRUSCHETTA et al., 2014). Finally, lower concentrations of basal oxytocin have been related to a better state of well-being (LANSADE et al., 2018).

More recently used methods for stress assessment in horses are the measurement of body, eye and crown temperatures and the individual electroencephalography (EEG) power profiles. Body, eye and hoof crown temperatures are obtained through infrared thermography (REDAELLI et al., 2019; SQUIBB et al., 2018). The eye temperature obtained from the tear caruncle proved to be useful as an indicator of fear (DAI et al., 2014) and acute stress resulting from physical exercise (REDAELLI et al., 2019; VALERA et al., 2012) and coincides with increased levels of cortisol (VALERA et al., 2012) and heart rate. In turn, EEG profile analysis has been suggested as a potential way to assess attention states (ROCHAIS et al., 2018) and chronic pain in horses (STOMP et al., 2020).

2.3.2 Behavioral indicators of emotions in horses

To understand emotional valence, researchers have assessed behavioral indicators such as the body positions (e.g., FUREIX et al., 2011), facial expressions (e.g., DALLA COSTA et al., 2017; LANSADE et al., 2018), behavioral disorders (e.g., TRÖSCH et al., 2019),

vocalizations (e.g., STOMP et al., 2018) and lateralizations (e.g., D'INGEO et al., 2019) in horses in conditions of good and poor welfare or positive and negative situations. In Table 1 we summarize some behaviors that have been tested and used as indicators of emotions in horses.

Table 1 - Indicators of positive and negative emotions in horses.

Indicators of positive emotions in horses	**Indicators of negative emotions in horses**	**Authors**
High/ moderately raised neck	Low/elevated neck	Graubner et al., 2011; Fureix et al., 2011; Gleerup et al., 2015; van Loon et al., 2015; Lansade et al., 2018
Ears directed backwards almost aligned with the nose	Ears pointing backward	Graubner et al., 2011; Gleerup et al., 2015; van Loon et al., 2015; Pritchett et al., 2003; Sankey et al., 2010; Lesimple et al., 2016; Henry et al., 2017a; Lansade et al., 2018; Rashid et al., 2020
	Tail swishing	Keiper, Berger, 1982; Goodwin et al., 2005
Semi-closed eyes and outstretched lips	Opened eyes and lips compressed	Graubner et al., 2011; Lansade et al., 2018; Dalla Costa et al., 2014, 2017; Gleerup et al., 2015; van Loon et al., 2015; Wathan et al., 2015; Rashid et al., 2020
More blinking, no contraction of the upper eyelids	Less blinking and twisting of the upper eyelids	Merkies et al., 2019; Rashid et al., 2020
No "worry wrinkles"	"Worry wrinkles"	Hintze et al., 2016

	Vigilant and "withdrawn" posture	Le Scolan et al., 1997; Seaman et al., 2002; Benhajali et al., 2009; Fureix et al., 2012; Lansade et al., 2014; Ruet et al., 2020
Snorts		Visser et al., 2008, 2009; Lemasson et al., 2009; Briefer et al., 2017; Stomp et al., 2018, 2020
Use of both eyes to approach a stimulus Right head orientation for humans	Use of left eye (right hemisphere) to approach a stimulus	Des Roches et al., 2008; Sankey et al., 2010; Austin, Rogers, 2014; d'Ingeo et al., 2019
Natural, affiliative, approach behaviors	Abnormal, stereotypic, aggressive and avoidance behaviors	Feh, Mazières, 1993; Christensen et al., 2002; Bachmann et al., 2003; Christie et al., 2006; Benhajali et al., 2008, 2009; Visser et al., 2008; Fureix et al., 2009, 2010, 2012; Hausberger et al., 2009; Peters et al., 2012; Leme et al., 2014; Henry et al., 2017; Roberts et al., 2017; Lansade et al., 2018; Schork et al., 2018; Ruet et al., 2020

One of the most used measures to assess the emotions of horses is the position of the ears and neck. One study found that in a positive situation horses have a moderately raised neck, while in a negative situation they have an elevated neck (LANSADE et al., 2018). However, the use of neck position to assess emotional valence in horses should be done in conjunction with other indicators and cautiously (FUREIX et al., 2011). Research shows that horses in states similar to depression and despair may exhibit a "withdrawn" posture (RUET et al., 2020) which is characterized by an elongated neck (at an angle of approximately 180 degrees between the nape, withers and back), fixed head and ears (FUREIX et al., 2012) and

horses with pain present low position of the head and arched back (GLEERUP et al., 2015; GRAUBNER et al., 2011; VAN LOON; VAN DIERENDONCK, 2015).

On the other hand, the position of the ears is one of the most reliable indicators of emotional valence in horses and people involved with horses, as owners and keepers, recognize them in their horses (HÖTZEL; VIEIRA; LEME, 2019). Asymmetrical positioning and ears pointing backwards are indicators of negative emotions (GLEERUP et al., 2015; GRAUBNER et al., 2011; VAN LOON; VAN DIERENDONCK, 2015); however, horses can show asymmetrical ears toward a sound source. The laid back position of the ears may indicate negative valence related to pain, discomfort (PRITCHETT et al., 2003; RASHID et al., 2020; SANKEY et al., 2010), vertebral problems (HENRY et al., 2017), or inadequate handling such as rearing in individual stalls (LESIMPLE; POISSONNET; HAUSBERGER, 2016). On the other hand, ears pointing backwards almost aligned with the nose occur more frequently in response to positive emotions (LANSADE et al., 2018). Therefore, this measurement, when observed together with other behavior indicators, may help us in the interpretation of emotional valence in horses. For example, horses with a high neck and exhibiting a tail swishing is likely experiencing a negative emotion, since tail swishing indicates discomfort (insect harassment: (KEIPER; BERGER, 1982); bitted bridle: (QUICK; WARREN-SMITH, 2009); riding: (VON BORSTEL et al., 2009).

Facial expressions have been used in recent years as indicators of affective states in horses, to assess positive and negative states such as acute, postoperative pain, irritation and stress (LANSADE et al., 2018, 2022; WATHAN et al., 2015) and emotional states resulting from different types of grooming (LANSADE et al., 2018). Some methodologies used to assess affective states in horses associate facial expressions to different contexts, such as the Equine Facial Action Coding System (EquiFACS) (WATHAN et al., 2015), the Horse Grimace Scale (HGS) (COSTA et al., 2014) and Pain Face (GLEERUP et al., 2015). Through these and other different methodologies, facial expressions such as angled, retracted and/or tense eyes, dilation of the nostrils, tight facial muscles, including chin and cheek lips, movement of the lower part of the face, chewing behavior, open eyes with exposure of the white part of the eyes, tight lips, less blink, half blinking, upper eyelids twist and "concern wrinkles" generated by the contraction of some facial muscles were related to negative emotions (COSTA et al., 2014; GLEERUP et al., 2015; GOODWIN, 2007; GRAUBNER et al., 2011; HINTZE et al., 2017; LANSADE et al., 2018; MERKIES et al., 2019; RASHID et al., 2020). On the other hand, half-closed eyes, extended lips and more blink without increasing eyelid contractions were related to positive emotions (COSTA et al., 2014;

LANSADE et al., 2018, 2022; MERKIES et al., 2019). Similar to observing neck height with ear guidance and tail swishing, facial expressions along with blink rates and "concern wrinkles" observed in the same individual can provide useful information about their emotional state. For example, horses exhibiting half-closed eyes, extended lips, more blinks and no "concern wrinkles" must be experiencing a positive valence emotion.

Horses' vocalizations, such as snorts and whinnies, can also indicate emotions. Horses produce more snorts in positive and more comfortable situations, such as social contacts and when released in the pasture (STOMP et al., 2018). On the other hand, horses use whinnies in positive contexts, such as social communication (BRIEFER et al., 2017; LEMASSON et al., 2009) and negative contexts, such as separation (BRIEFER et al., 2017).

An interesting finding is the visual lateralized way in which horses process positive or negative valence stimuli, i.e., horses can approach a stimulus with the left or right eye according to their valence. This shows the lateralized emotional processing and this lateralization can indicate emotional and attention state (AUSTIN; ROGERS, 2012; DE BOYER DES ROCHES et al., 2008). Lateralization occurs because horses, like other large animals, have 80-90% decussation of optical fibers, i.e., the nerve fibers on one side are directed to the other side of the body reflecting an asymmetry of brain function. In this way, visual information observed through the horse's left eye is processed mainly in the right hemisphere of the brain and vice versa (BROOKS, 2002). The left hemisphere of the brain appears to process information related to the approach, language, learning about routine/normal action, new information and categorization of stimuli; the right hemisphere, in contrast, appears to process information related to avoidance responses and negative emotions, threatening situations and unexpected stimuli (MACNEILAGE; ROGERS; VALLORTIGARA, 2009). This right-brain preference processing for threatening situations can be observed by the greater flight distance in horses approached from the left side than approached from the right side when faced with a threatening object (AUSTIN; ROGERS, 2007). In addition, horses show biases on the left side related to aggression and reactivity behaviors (AUSTIN; ROGERS, 2012). Horses can also present lateralization in relation to an object or to people. For example, horses preferentially used the right eye to observe a new object (DE BOYER DES ROCHES et al., 2008) and the left eye to assess people, even if they had been trained by riders on both sides (FARMER; KRUEGER; BYRNE, 2010).

Besides visual lateralization, horses have olfactory and auditory lateralization. Olfactory lateralization is the preferred use of a nostril to sniff objects (DE BOYER DES ROCHES et al., 2008) or other stimuli, such as the feces of other horses (MCGREEVY;

ROGERS, 2005). They show a slight trend to preferentially use the right nose to olfactory research, for the first time, a negative valence object (DE BOYER DES ROCHES et al., 2008). Another type of lateralization related to emotional value found in the equine species is the auditory lateralization. Horses orient the right side of the head more towards a loudspeaker that emits human voices they know from previous positive experiences and less when the voices are of people who caused them frustration (D'INGEO et al., 2019). But there is still no evidence on the relationship between auditory laterality and emotional value in relation to conspecifics. However, there seems to be a relationship between this type of laterality and social value, as horses primarily use the right ear to process vocalizations of known horses (BASILE et al., 2009).

Finally, some types of specific behaviors can indicate emotions in horses. For example, horses in good health and with positive emotions have a high occurrence of natural behaviors (RUET et al., 2020), approach behavior (FEH; DE MAZIÈRES, 1993; LANSADE et al., 2018), positive social interactions (BENHAJALI et al., 2008; RUET et al., 2020) and grooming behavior (FEH; DE MAZIÈRES, 1993). On the other hand, horses in poor welfare and with negative emotions have a high occurrence of aggressive behaviors, which reflect the perception of horses about negative experiences with humans (FUREIX et al., 2009), discomfort (BENHAJALI et al., 2008) or chronic pain (FUREIX; MENGUY; HAUSBERGER, 2010); avoidance behaviors and escape attempts that are related to fear (LANSADE et al., 2018). In addition to these behaviors, abnormal behaviors, such as coprophagy, also indicate negative emotions and may the result from the use of the horse (LEME et al., 2014), from social and physical restrictions (BACHMANN; AUDIGÉ; STAUFFACHER, 2003; MCGREEVY et al., 1995; RIVERA et al., 2002), or restricted time to forage (BACHMANN; AUDIGÉ; STAUFFACHER, 2003; BENHAJALI et al., 2009; MCGREEVY et al., 1995), which is much lower than time to forage in nature (GOODWIN, 2007).

Among the abnormal and unnatural behaviors most commonly observed in stabled horses are stereotypic behaviors, which can occupy 65% of their time in the stalls (BACHMANN; AUDIGÉ; STAUFFACHER, 2003). Stereotypic behaviors in horses are related to management practices related to poor welfare and to the type of work (HAUSBERGER et al., 2009; HENRY et al., 2017), the number of hours worked (CHRISTIE et al., 2006), feeding (MCGREEVY et al., 1995; NICOL et al., 2002; ROBERTS et al., 2017; SCHORK; DE AZEVEDO; YOUNG, 2018) and housing conditions (COOPER; MCDONALD; MILLS, 2000; MCBRIDE; PARKER, 2015; MCGREEVY et al., 1995;

NORMANDO et al., 2011; SCHORK; DE AZEVEDO; YOUNG, 2018; VISSER et al., 2008). Stereotypic behaviors are defined as repetitive and unvarying behaviors patterns without clear variation, purpose and function that are observed in non-human animals kept in suboptimal living conditions (MASON, 1991). Besides, stereotypic behaviors result from structural and/or physiological dysfunctions of the Central Nervous System, more specifically by sensitizing the basal ganglia, and are related to dysfunctions in dopamine physiology and stress responsiveness (LATHAM; MASON, 2010; MASON et al., 2007; MCBRIDE; HEMMINGS, 2009). The causes of stereotypic behavior are still discussed, but researchers suggest that they are related to frustration after many failed attempts to cope in an impoverished environment and suboptimal conditions (MASON, 1991). Some authors argue that stereotypic behaviors may reflect a welfare problem suffered in the past and indicate the animal's success in coping with a stressful and impoverished environment (TATEMOTO; BROOM; ZANELLA, 2022). In this sense, stereotypic behaviors would be forms of coping that have a calming effect on animals, reducing chronic stress. In conclusion, stereotypic behaviors could be considered ways to relieve stress or coping in adverse environments (MASON, 2006; MASON et al., 2007; MASON; LATHAM, 2004). However, if they are irreversible behaviors, they could be considered chronic and negative problems for horses (HAUSBERGER et al., 2009; LESIMPLE et al., 2019).

Therefore, stereotypic behavior and other types of behaviors, such as aggressive and abnormal behavior, as well as body positions, facial expressions, vocalizations and lateralizations can be useful in understanding affective states in horses. Like physiological indicators, behavioral indicators are very useful in evaluating emotions in horses, but must be observed in conjunction with other indicators and considering the context in which they are evaluated. For example, neck position needs to be analyzed in conjunction with eye and lip expression and ear position (LANSADE et al., 2022).

2.3.3 Cognitive bias as indicators of emotions in horses

The cognitive bias paradigm is used to infer the valence of emotions in non-human animals. This paradigm, first used in studies with humans (PAUL; HARDING; MENDL, 2005), started to be used to assist in the understanding of animal emotions (HARDING; PAUL; MENDL, 2004; LÖCKENER et al., 2016; RUET et al., 2020), including horses (e.g., (HENRY et al., 2017).The cognitive bias paradigm consists of attention, memory and judgment biases. Attention bias can be understood as bias that leads individuals to focus

attention on threats (PAUL; HARDING; MENDL, 2005) and indicate anxiety (LEE et al., 2016, 2018; MILLS et al., 2014). Studies using the attention bias paradigm show that some animals (sheep: (LEE et al., 2016, 2018); cattle: (LEE et al., 2018)) show more vigilant and threat-oriented behaviors and postures when administered with doses of pharmacological anxiogenics compared to individuals treated with anxiolytics. Therefore, the use of attention biases as a measure of emotional states in different species, including horses, is well accepted. For example, horses in poor welfare show attention bias and present less interest in environmental stimuli (BURN; DENNISON; WHAY, 2010; ROCHAIS et al., 2016a, 2016b). Horses in depressed or withdrawn states show less attention to the environment (ROCHAIS et al., 2016a) and to tactile stimuli, present more extreme responses to new objects (FUREIX et al., 2012; ROCHAIS et al., 2016b), and do not make eye contact with conspecifics or humans (FUREIX et al., 2012).

In judgment bias tasks, individuals are trained to recognize one cue as indicative of a positive consequence (optimistic expectation) and a different cue as indicative of a negative consequence (pessimistic expectation) (BATESON; MATHESON, 2007; BATESON; NETTLE, 2015; LÖCKENER et al., 2016; OLIVEIRA et al., 2016). Different types of cues have been used in these tests, depending on the biology of the species and the methodological conditions of each study, including coloured objects (BATESON; MATHESON, 2007), colors on a computer monitor (DAROS et al., 2014), position of a food bowl (BURANI; PELOSI; VALSECCHI, 2022; WICHMAN; KEELING; FORKMAN, 2012), surface texture (BARKER et al., 2017; NOVAK et al., 2016), odor (BOLEIJ et al., 2012), auditory tones (JONES et al., 2018). However, visual and spatial cues are the main ones used in this type of test. In addition, there are two types of tasks in which tested animals can be trained: Go/Go and Go/No-Go, with the second option used in most studies that use judgment bias tasks to assess emotions in animals (LAGISZ et al., 2020). In Go/Go tasks, also known as active choice tasks, given that the individual's response is always active (MURPHY; NORDQUIST; VAN DER STAAY, 2013; NOVAK et al., 2016), animals are conditioned to express a behavior (such as approaching one location) in response to a cue (such as a positive sign) to obtain a reward (such as food) and to express other behavior (such as approaching a second location) in response to a different cue (such as a negative sign) to avoid an event negative (such as an aversive noise). In the Go/No-Go, tasks the response is active (such as approaching a location) to the reward/positive consequence (such as food), but the individual must suppress the response (such as not approaching a location) to the negative consequence (like an aversive noise). In this case, the response is evaluated within a predetermined time for the

individual to go (active response to the positive consequence) or not go (suppressed response to avoid the negative consequence) (LAGISZ et al., 2020)). In both types of tasks, the individual must discriminate between a rewarded and an unrewarded consequence (WICHMAN; KEELING; FORKMAN, 2012) or a favorable/immediate/large reward and a less favorable/delayed/small reward (MURPHY; NORDQUIST; VAN DER STAAY, 2013) or a consequence with positive or negative valence (BURANI; PELOSI; VALSECCHI, 2022; DOUGLAS et al., 2012; DOYLE et al., 2010; JONES et al., 2018).

The test itself is performed after training, when individuals are presented with an ambiguous cue, which individuals evaluate positively or negatively. At the time of testing, in response to the ambiguous cue, whether the individual exhibits a higher proportion of positive (such as approaching the rewarded location) than negative consequence-related responses (such as approaching the unrewarded location or suppressing their response) or lower latency to present a positive response in relation to the latency to present the negative response, this response indicates that the individual assumes that there is reward associated with ambiguous cue. Thus, this indicates that the individual evaluated the ambiguous cue positively, presenting an increased expectation of reward, which reflects his positive/optimistic emotional state. The opposite reflects a reduction in the expectation of a positive event or anticipation of a negative event and a negative emotion or a “pessimistic” decision (LAGISZ et al., 2020; LÖCKENER et al., 2016; OLIVEIRA et al., 2016).

In horses, judgment bias tests have been used, for example, to show that riding school horses have a pessimistic bias and behavioral indicators of poor welfare, while horses of more naturalistic conditions have an optimistic bias and behavioral indicators of good welfare (HENRY et al., 2017). Similarly, horses used to live in isolated stalls, show a positive judgment bias when released in the pasture for a few days with the company of other horses, even after a short period of time released in the pasture (LÖCKENER et al., 2016).

The memory bias paradigm suggests that affective states can affect memory, in the sense that negative memories are more easily retrieved when individuals experience a state of depression (MATT; VÁZQUEZ; CAMPBELL, 1992) and that memories of events with valenced emotional states may also be better remembered than neutral events (HAMANN et al., 1999). In rats, the memory bias task appears to be a potential indicator of emotions (BURMAN; MENDL, 2018). However, studies in humans have not presented consistent evidence that anxious individuals have this type of bias (RADOMSKY; RACHMAN, 1999; RAPEE et al., 1994). Furthermore, it is not known to us that this type of study has already been carried out in the equine species.

We suggest that memory biases may occur as a result of emotional states, but also as a result of the individual's perceptual world/"Umwelt". This concept was proposed by Uexküll (UEXKÜLL, 1909), who argued that each individual perceives their own world, resulting from their life history and lived experiences that include aspects significant to them. In this case, threatening stimuli may be cognitively processed in different ways in individuals according to the experiences lived and the way they perceived those experiences.

2.3.4 Using emotional indicators in the search for evidence about the existence of emotional contagion in horses

The indicators of emotions in horses described so far in this review may be useful in the investigation of topics that are not yet entirely understood. An example of a topic that is under discussion and needs investigation is the existence of emotional contagion in the equine species. De Waal (2008) defines emotional contagion as a highly adaptive reflex in which an individual's emotional response causes a similar emotional reaction in another individual and can result in social learning, such as the transmission of social and emotional information from mares to foals (KARENINA; GILJOV; MALASHICHEV, 2018). The ability to use some information from other animals can be observed in horses (WATHAN et al., 2015). For example, in the presence of calmer individuals, horses have less fear-related reactions (CHRISTENSEN et al., 2008) and calmer emotional responses in stressful situations (RØRVANG; CHRISTENSEN; AHRENDT, 2015; RØRVANG et al., 2018).

Some authors argue that there is a lack of clear evidence indicating emotional contagion (BRIEFER et al., 2017) and social learning (KRUEGER; FLAUGER, 2007; LEFEBVRE; PALAMETA; HATCH, 1996; RØRVANG et al., 2018) in horses. However, there are several studies showing some type of transmission of emotional information and emotional recognition, even at the beginning of a horse's life. For example, foals of mares that had a positive treatment, through gentle brushing and manual feeding, showed more positive and less fearful behavioral reactions towards humans compared to foals from mares that did not receive this treatment (HENRY et al., 2005).

In addition to recognizing emotions of conspecifics present in the same environment, horses seem to be able to interpret the emotional valence of other horses in video (TRÖSCH et al., 2020), in photographs (WATHAN et al., 2016) and from recorded vocalizations (BRIEFER et al., 2017; LEMASSON et al., 2015). When observing a conspecific in a negative situation in a video, horses show behavioral indicators of negative emotion, such as

orienting their ears forward, lifting their necks and showing the whites of their eyes; in contrast, when observing a horse in a positive situation they show behavioral indicators of positive emotions (TRÖSCH et al., 2020). Additionally, horses can discriminate emotions from unknown conspecifics through photographs and, when exposed to a photo of horses in a positive context, they show behavioral indicators of positive emotions, such as approaching behavior and low heart rate; in contrast, when exposed to photos of a horse in a negative context, they show negative emotion indicators, such as avoidance behavior and high heart rate (WATHAN et al., 2016). Some authors argue that these behavioral and physiological changes indicate emotional contagion (TRÖSCH et al., 2020; WATHAN et al., 2015). However, it is difficult to speak about emotional contagion in these experiments because the use of images is not as real as evaluating a "live" face (SCOPA et al., 2019). Horses are also able to perceive the calm of stallions through the vocalization features of these animals (LEMASSON et al., 2015). Also, when interpreting both images and conspecific vocalizations, horses seem to perceive when the emotional valence of vocalization does not match that of the image (TRÖSCH et al., 2019). This mechanism, called cross-modal recognition and expectation paradigm violation, occurs when there is an incongruous combination of images and sounds (PROOPS; MCCOMB; REBY, 2009).

Although some studies show that horses present similar emotional responses to other horses, it is difficult to confirm whether there is emotional transmission in this species. Rather than emotional transmission, horses may simply be experiencing the same emotion as others because they are living in the same conditions. Or perceiving anxious states of other horses may generate a state of anxiety in horses, in anticipation of a negative event. Yet, considering the similar emotional response that horses show when observing other horses in photos and videos or through vocalizations, it is difficult to argue that there was no emotional transmission as observed in rats and mice (KEYSERS et al., 2022). Therefore, through the examples cited in this section, we can see how the known emotion indicators in horses can show us that horses recognize the emotions of other individuals, conspecific or not, and that there is strong evidence that there is emotional transmission in the equine species. Thus, we emphasize the need for more scientific evidence that types of emotional transmission, such as emotional contagion and empathy, occur in horses.

2.4 Summary and conclusions

Emotions are still a relatively recent topic of scientific study and insufficiently understood both in human and non-human animals, although it is attracting increasing interest in recent years. Much of what is known about emotions in non-human animals, such as the areas of the brain responsible for cognitive processing and memory related to emotion-laden events, are extrapolations from studies in humans to non-human species. In this paper we reviewed indicators of emotions which have been developed to help us infer what emotions horses may feel in different contexts. This includes physiological (e.g., heart rate, hormone concentrations and body, eye and crown temperatures), and behavioral indicators (e.g., direction of ears, blinking frequency, "worry wrinkles", vocalizations) and the response to cognitive bias tests (e.g., the behavioral response at judgment bias test). A few issues must be considered when interpreting emotional indicators to infer about emotions of horses: 1) the evolutionary history of the species and, when possible, the "Umwelt" of the horse must be considered, because each horse perceives the context individually and all the experiences lived by the individual influence its perceptual world, or Umwelt; 2) the questions must be relevant from the horses' point of view and, therefore, care must be taken to avoid classifying contexts or stimuli as positive or negative from an anthropomorphic lens; 3) within a given context, it is essential to be able to identify to which specific stimulus the horse is responding to (e.g., food, stall security, an unfamiliar person) and, finally, 4) several indicators should be used simultaneously in a given context, because it is difficult to interpret emotional states in horses using only one indicator, especially their valence. Another relevant fact that needs to be considered is that, during the training process, horses may need to learn to suppress some behavioral responses that humans consider undesirable, such as fear or pain, which may limit our ability to evaluate and study emotions in the species. In a continuous scenario, after several unsuccessful attempts to react and being punished for reacting, some horses may develop learned helplessness, which may be displayed with signs of apathy or depression. Taking these precautions when interpreting emotional indicators of horses, we suggest that future research looks for new indicators that help in the understanding of highly relevant issues related to the biology and ethology of horses. Understanding the impact of management practices (e.g., predictable routines, early weaning and development of the foal away from the dam, and long periods of confinement in isolated stalls) and horse use (e.g., equine-assisted therapy, equestrian sports, or reproduction) on the emotional state of the horse is important to aid in the assessment of the welfare of horses that are in daily contact with humans in equestrian centers and farms.

In addition, the growing interest in interpreting and discovering new indicators of emotions in horses is leading people involved with the equestrian environment to recognize emotions in horses. Training horse owners and caretakers to identify emotional indicators in their animals in a simple and accessible way, especially indicators based on behaviors and facial expressions and postures, may help improve the horse-human relationship. The evaluation of the intensity and frequency of an individual's emotions can guide horse owners and caretakers to identify practices and activities that should be stimulated, avoided or even banned from the individual's life, in favor of a life worth living.

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3 THE VICIOUS CIRCLE OF STEREOTYPIC BEHAVIORS IN HORSES

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Abstract

Stereotypic behavior is defined as repetitive behaviors without clear variation, purpose and function. Stereotypic behaviors can be associated with stress, boredom and pain resulting from environmental factors associated with management practices. We discussed how stereotypic behaviors, as well as other behaviors, arise from a complex interplay between those factors, such as horse genotype and the environmental factors and management factors they are exposed to. Specifically, we examine how the selection of specific horse breeds for different type of work intertwines with distinct environmental factors and management practices, ultimately influencing the manifestation of stereotypic behaviors. We highlight the effects of horse usage on the development of stereotypic behavior. Ample evidence indicates that management practices predispose horses to the development of stereotypic behaviors. However new empirical evidence supports the involvement of other factors, such as personality and genotype. The little evidence that exists on the role of personality indicates that more reactive, aggressive, but also more hardworking, intelligent, playful horses may be predisposed to the development of stereotypic behaviors. In relation to the role of genotype, alterations in the gut microbiota and the central nervous system can result in an increased state of motivation, ultimately triggering the expression of stereotypic behaviors. This knowledge could help us to improve horses' welfare.

Highlights

- A vicious cycle involving the selection of breed and personality and management practices increases the risk of horses developing stereotypic behaviors.
- Management practices are defined according to the use of the horse, influencing the manifestation of stereotypic behavior.
- Breed and personality are hereditary traits that interact with harmful handling practices and poor welfare for horses.
- Alterations in the microbiota and the central nervous system play a role in the

development of stereotypic behaviors.

- The cause-consequence relationship between personality and coping styles on the expression of stereotypic behavior is a field to be further studied.

Keywords: animal welfare; coping styles; crib-biting; equine; personality; microbiota.

3.1 INTRODUCTION

Stereotypic behaviors are defined as repetitive behaviors, without a defined and clear purpose or function (MASON, 1991). These behaviors are observed in different animals, from smaller species such as rats (LI et al., 2020) to larger species, such as humans (FERREIRA et al., 2018; LYDON et al., 2017) and horses (BACHMANN et al., 2003; BACHMANN; AUDIGÉ; STAUFFACHER, 2003a; HAUSBERGER et al., 2009; LESIMPLE et al., 2019; WATERS; NICOL; FRENCH, 2010). While free horses generally do not exhibit stereotypic behaviors (COOPER; ALBENTOSA, 2005; HOTHERSALL; NICOL, 2009), stabled horses may engage in such behaviors up to 65% of the time (BACHMANN; AUDIGÉ; STAUFFACHER, 2003a), with the majority occurring inside the stall (NORMANDO et al., 2002).

Stereotypic behaviors of horses are classified as oral or locomotor (HOUPT; MCDONNELL, 1993). Crib-biting and wind-sucking are some of the most frequently observed oral stereotypic behaviors in horses (HOUPT; MCDONNELL, 1993; KÁDÁR et al., 2023; MCBRIDE; HEMMINGS, 2009). Crib-biting consists of gripping an object or surface with the incisor teeth and drawing air into the esophagus, resulting in a grunting sound and neck bending (MCGREEVY et al., 1995b). Wind-sucking consists of drawing air into the esophagus and bending the neck with a grunting sound, but without drawing air. Common stereotypic oral behaviors also include repetitive movements of the tongue, mouth, or jaw on non-food items, such as sham-chewing and tooth-grinding, and licking non-food items repeatedly, mainly in a single location such as a stall wall. Certain facial expressions, such as lip curling and teeth baring, are considered stereotypic behaviors, but are less well understood (COOPER; MCGREEVY, 2006). The most common locomotor stereotypic behaviors in horses are weaving, box-walking, and nodding. Weaving involves repeatedly shifting weight

from side to side, alternating between one of its forelimbs (COOPER; MCDONALD; MILLS, 2000; KÁDÁR et al., 2023; MCBRIDE; HEMMINGS, 2009). Box-walking involves repetitive pacing in circular patterns around a stall (MCBRIDE; HEMMINGS, 2009). Finally, nodding is the swing of a horse's head up and down (COOPER; MCDONALD; MILLS, 2000).

It is hypothesized that stereotypic behavior may be related to frustration resulting from the expression of highly motivated behaviors with unsuccessful attempts to cope with a suboptimal environment (FREYMOND et al., 2020; HOUPT; MCDONNELL, 1993; MASON, 1991; MCBRIDE; HEMMINGS, 2005). For instance, unsuccessful attempts to escape a confined environment of small stalls that restrict natural behaviors can result in repetitive movements such as running in circles and pacing along fences (HOUPT; MCDONNELL, 1993). It is also hypothesized that stereotypic behaviors may be an attempt to alleviate physiological discomfort caused by stomach acidity. This occurs because horses that express oral stereotypic behavior tend to have more ulcers and inflammation than horses without (NICOL et al., 2002). Moreover, some stereotypic behaviors occur primarily after meals or in the absence of food (COOPER; ALBENTOSA, 2005). Stereotypic behaviors can also be associated with boredom, stress and/or pain resulting from management practices (CHRISTIE et al., 2006; MCBRIDE; HEMMINGS, 2009; MILLS; RIEZEBOS, 2005; SEABRA; DITTRICH; VALE, 2021). Therefore, some authors have argued that stereotypic behavior indicates poor animal welfare in horses (CHRISTIE et al., 2006; HAUSBERGER et al., 2009; LESIMPLE, 2020; LESIMPLE et al., 2019; WILLIAMS; RANDLE, 2017).

Other authors have argued that the expression of stereotypic behaviors is a coping mechanism aimed at reducing stress (BRIEFER FREYMOND et al., 2015; LUNDBLAD et al., 2021). The expression of stereotypic behavior could result from coping with a stressful environment (KRUEGER et al., 2021; TATEMOTO; BROOM; ZANELLA, 2022), with these behaviors having a calming effect (MASON, 2006; MASON; LATHAM, 2004). Animals that express stereotypic behaviors exhibit changes in brain structure and neurophysiology (MCBRIDE; HEMMINGS, 2005). It is suggested that those changes may reflect allostatic processes associated with pleasure-seeking and self-stimulation as a form of coping (HEMMINGS et al., 2018). Assuming that stereotypic behaviors are a coping mechanism, horses with stereotypic behavior would be expected to exhibit physiological responses indicating lower levels of stress than those without such behaviors. However, studies comparing physiological variables in horses with and without stereotypic behavior, such as cortisol (BRIEFER FREYMOND et al., 2015; CLEGG et al., 2008; FEJSÁKOVÁ et al.,

2014; FREYMOND et al., 2020; FUREIX et al., 2013; LESIMPLE, 2020; MCBRIDE; CUDDEFORD, 2001; MCGREEVY; NICOL, 1998; PELL; MCGREEVY, 1999), heart rate (BACHMANN et al., 2003; LEBELT; ZANELLA; UNSHELM, 1998; MCGREEVY; NICOL, 1998; MINERO et al., 1999), serotonin (LEBELT; ZANELLA; UNSHELM, 1998; OMIDI et al., 2018) and β-endorphin (GILLHAM et al., 1994; LEBELT; ZANELLA; UNSHELM, 1998; MCGREEVY; NICOL, 1998; PELL; MCGREEVY, 1999) have presented inconsistent or conflicting results.

The scientific understanding of stereotypic behavior is incomplete and controversial in a general way. Specifically for horses, the gaps in understanding include the identification of triggering factors and the reasons why some horses exhibit the behavior while others living in the same semi-optimal environment do not. A recent systematic review (SEABRA; DITTRICH; VALE, 2021) discussed the main factors that may be involved in the development of stereotypic behavior in horses and the research conducted on these factors in recent years. The authors concluded that stereotypic behaviors can develop due to several intrinsic and environmental factors, mainly an inadequate diet. Here we discussed how stereotypic behaviors, as well as other behaviors, arise from a complex interplay between those factors, such as horse genotype and the environmental factors and management factors they are exposed to. Specifically, we examine how the selection of specific horse breeds for different type of work intertwines with distinct environmental factors and management practices, ultimately influencing the manifestation of stereotypic behaviors. We highlight the effects of horse usage on the development of stereotypic behavior.

3.2 INTRINSIC FACTORS THAT CAN AFFECT THE DEVELOPMENT OF STEREOTYPIC BEHAVIOR

Individual factors that may be associated with the development of stereotypic behaviors in horses are personality (SEABRA et al., 2021), heredity (HEMMANN et al., 2014), genotype (MCBRIDE; HEMMINGS, 2009), breed, sex, and age (SEABRA et al., 2021). Some researchers suggest that horse personality may be linked to an increased risk of developing stereotypic behavior (CHRISTIE et al., 2006; JOLIVALD et al., 2022; NORMANDO et al., 2002). The term personality refers to interindividuals' behavioral and physiological tendencies that are "consistent over time and contexts"; other terms such as temperament and coping styles have been used by different authors to refer to these tendencies (FINKEMEIER; LANGBEIN; PUPPE, 2018; GOSLING, 2001; RÉALE et al.,

2007; SIH, 2011; STAMPS; GROOTHUIS, 2010a, 2010b). In this article, we use the term personality, firstly, because we understand that it encompasses the concept of temperament, given that personality can be understood as the result of the effects of the environment on temperament (FEAVER; MENDL; BATESON, 1986), including the effects of experience on temperament (FINKEMEIER; LANGBEIN; PUPPE, 2018); secondly, because this term has been most commonly used in studies related to horses. However, at times we will use the term temperament to maintain fidelity to the original author's quote.

Personality exhibits a certain degree of plasticity, allowing individuals to display varied behavioral responses that are adapted to different threats and external variables (LANSADE et al., 2014; LIEHRMANN et al., 2022; NOGUEIRA et al., 2021; RÉALE et al., 2007). For instance, personality can manifest as an animal's coping style in response to a stressful environment, which can be observed through individual behavioral, physiological, and neuroendocrine reactions that remain consistent over time (BUDZYŃSKA, 2014; KOOLHAAS, 2008; KOOLHAAS et al., 1999). Animals can be classified into two coping styles: proactive/active and reactive/passive. Proactive/active animals respond to stressful stimuli with active behaviors, such as fleeing or fighting, trying to remove the threat or escape from it; reactive/passive animals, in contrast, respond with behaviors such as immobility and freezing (BUDZYŃSKA, 2014; KOOLHAAS, 2008; KOOLHAAS et al., 1999; SEAMAN; DAVIDSON; WARAN, 2002). Animals classified as proactive seem to be more aggressive than reactive animals (KOOLHAAS et al., 1999), while animals classified as passive seem to be less anxious (NAGY et al., 2010). These responses indicate the ability of individuals to deal with and control threats and stressful environments; Proactive and reactive animals exhibit successful coping strategies depending on the type of environment they encounter; proactive animals are more successful in coping with a stable environment, while reactive animals do better in a more unstable environment; Coping styles also reflect an animal's susceptibility to disease, due to involvement of the autonomic nervous system (KOOLHAAS et al., 1999). Animals with reactive coping styles have been found to exhibit greater activation of the parasympathetic and hypothalamic-pituitary-adrenal (HPA) axis in response to stressors, and to be more adaptive and flexible (KOOLHAAS, 2008; KOOLHAAS et al., 1999). In contrast, animals with proactive coping styles display greater activation of the sympathetic nervous system and a more moderate response of the HPA axis to stressors (KOOLHAAS, 2008).

Few studies have focused on the role of personality on the emergence of stereotypic behaviors. One study (SCHORK; DE AZEVEDO; YOUNG, 2018) suggests that some types

of stereotypic behaviors can be associated with personality traits defined by the authors, such as licking is associated with a hardworking personality; lip-twisting with a reliable personality; pawing with a cooperative personality; locomotor stereotypic behaviors with an intelligent personality; licking, lip-smacking, and stomp with an aggressive, insecure, and irritable personality; kicking with a curious personality; crib-biting with a playful personality; and head-shaking with a playful, stubborn, intelligent, and hard-working personality (SCHORK; DE AZEVEDO; YOUNG, 2018). However, the most common dimensions used to describe temperament and personality are shyness-boldness, exploration-avoidance, activity, aggressiveness, sociability (Réale et al., 2007). It has also been shown that horses that express crib-biting appear to be less anxious (NAGY et al., 2010), more playful, and more curious (SCHORK; DE AZEVEDO; YOUNG, 2018). Horses with stereotypic behavior appear to be more reactive, sensitive to stress, and less flexible than horses without them (BACHMANN et al., 2003). Furthermore, according to owners, horses that present multiple types of undesirable behaviors, including stereotypic behavior, are more aggressive (SACKMAN; HOUPT, 2019). It has been hypothesized that horses classified as proactive are more prone to developing stereotypic behaviors (IJICHI; COLLINS; ELWOOD, 2013) because proactive individuals should actively avoid stressors (KOOLHAAS et al., 1999; SEAMAN; DAVIDSON; WARAN, 2002) while reactive individuals should present a docile behavioral trait that is slower and more self-controlled (ROBERTS et al., 2016). However, BRIEFER FREYMOND et al. (2015) did not find a difference in activity levels of horses with and without stereotypic behaviors.

Heritable traits may increase the risk of horses developing stereotypic behaviors (HEMMANN et al., 2014). For example, cribbing, weaving, and stall-walking occur ten times more frequently in family groups than in unfamiliar groups (VECCHIOTTI, GALANTI, 1986). Foals of dominant mares are at greater risk of developing stereotypic behavior (WATERS; NICOL; FRENCH, 2010). Moreover, both male and female foals tend to exhibit behaviors similar to those of their half-siblings in emotional tests but differ from non-related horses (WOLFF; HAUSBERGER; LE SCOLAN, 1997). Genotypes may increase individual susceptibility to stress and the way horses respond to the environment (MCBRIDE; HEMMINGS, 2009; WICKENS; BROOKS, 2020). Genotypes predisposed can be associated with chronic stress, leading to a highly motivated and enhanced state, arising from the altered neurophysiology of the dopamine in the basal ganglia of the central nervous system (HEMMINGS et al., 2018; MCBRIDE; HEMMINGS, 2009). Dopamine, a neurotransmitter associated with the motivation to seek rewards (BERKE, 2018; IKEMOTO; PANKSEPP,

1999; SIPPY; TRITSCH, 2023; WISE, 2004), participates in triggering behavioral responses aimed at approaching, searching, and investigating stimuli or rewards (IKEMOTO; PANKSEPP, 1999; SALOMONE et al., 2007). The association between predisposed genotypes, chronic stress, higher dopamine receptor densities in the nucleus accumbens (MCBRIDE; HEMMINGS, 2005), higher motivation to get a reward (MOGENSON; JONES; YIM, 1980), appetitive behavior, and frustration (IJICHI; COLLINS; ELWOOD, 2013) can trigger stereotypic behavior in horses (HEMMINGS et al., 2018; IJICHI; COLLINS; ELWOOD, 2013; MCBRIDE; HEMMINGS, 2009).

There is some evidence of predisposition in developing stereotypic behaviors in some breeds. For example, a study carried out on Finnhorses found a high heritability of crib biting (HEMMANN et al., 2014). Thoroughbreds may be more sensitive to stress, which may explain the high prevalence of stereotypic behavior in the breed (ALBRIGHT et al., 2009). Other breeds that are represented by horses with a high occurrence of stereotypic behavior are Arab, Welsh ponies (LLOYD et al., 2008), Norwegian trotter cold blood (OLSEN; KLEMETSDAL, 2017) and Chilean horse (MUÑOZ et al., 2021).

Another intrinsic factor influencing the manifestation of stereotypic behavior is sex. Mares present greater propensity to develop locomotor stereotypic behavior than males (BENHAJALI et al., 2010; LUESCHER; MCKEOWN; DEAN, 1998), and males present greater propensity to develop oral stereotypic behaviors (LUESCHER et al., 1991; MUÑOZ et al., 2021). Furthermore, the occurrence of stereotypic behaviors is associated with the reproductive status of females, with a higher occurrence of stall-walking and weaving observed in foaling mares than in non-foaling mares. This might be explained by the presence of foals and the variation of hormone concentration (BENHAJALI et al., 2010).

Finally, opinions within the scientific community vary regarding the relationship between stereotypic behavior and age in horses. While some authors found that crib biting, weaving, and stall walking may increase with age (CHRISTIE et al., 2006; LUESCHER et al., 1991), others found no effect of age on stereotypic behavior (BENHAJALI et al., 2010). We suggest that inadequate experiences and management practices imposed on the horses can lead them to exhibit a greater occurrence of stereotypic behaviors with increasing age. Alternatively, horses may develop stereotypic behavior through learned helplessness.

3.3 ENVIRONMENTAL FACTORS AND MANAGEMENT PRACTICES THAT CAN AFFECT THE DEVELOPMENT OF STEREOTYPIC BEHAVIOR

Stereotypic behavior may be triggered by management practices such as early weaning (PARKER et al., 2008; PETERS; BLEIJENBERGC; DIERENDONCKA, 2012; SEABRA; DITTRICH; VALE, 2021; WATERS; NICOL; FRENCH, 2010), weaning in confinement and concentrate feeding after weaning (WATERS; NICOL; FRENCH, 2010), social isolation (Christie et al., 2006; Cooper et al., 2000; DAI et al., 2023; Hemmann et al., 2014; Kádár et al., 2023; Mills and Riezebos, 2005; Borda et al., 2023), individual confinement, physical and visual restriction (BACHMANN; AUDIGÉ; STAUFFACHER, 2003a; BRADSHAW-WILEY; RANDLE, 2023; CHRISTIE et al., 2006; COOPER; MCDONALD; MILLS, 2000; DAI et al., 2023; HANIS et al., 2020; KÁDÁR et al., 2023; MCBRIDE; PARKER, 2015; MCGREEVY et al., 1995b; NINOMIYA; SATO; SUGAWARA, 2007; NORMANDO et al., 2002, 2011; SARRAFCHI; BLOKHUIS, 2013; SCHORK; DE AZEVEDO; YOUNG, 2018), bedding type other than straw (CHRISTIE et al., 2006; HOCKENHULL; CREIGHTON, 2014), inadequate diets, rich in concentrate and poor in forage and hay, and inadequate frequency of meals that result in unnatural time budget (BACHMANN; AUDIGÉ; STAUFFACHER, 2003a; COOPER; MCDONALD; MILLS, 2000; ERMERS et al., 2023; HEMMANN et al., 2014; HOMER et al., 2023; HOTHERSALL; NICOL, 2009; KÁDÁR et al., 2023; MCGREEVY et al., 1995b; SARRAFCHI; BLOKHUIS, 2013; SCHORK; DE AZEVEDO; YOUNG, 2018), or rest and sleep restrictions (LESIMPLE, 2020).

Housing horses in stalls with physical and social isolation are main causes of stereotypic behavior (CHRISTIE et al., 2006; KÁDÁR et al., 2023; SEABRA; DITTRICH; VALE, 2021), whereas outdoor group housing such as "Parcours" reduces their occurrence (DAI et al., 2023). The occurrence of stereotypic behaviors in horses housed in conditions of physical and social isolation can be reduced with the introduction of an image of another horse's face in the stable (MILLS; RIEZEBOS, 2005), mirrors (MILLS; DAVENPORT, 2002), windows (COOPER; MCDONALD; MILLS, 2000), and limited outdoor access (BRADSHAW-WILEY; RANDLE, 2023). Social isolation also appears to be alleviated by the presence of animals of other species. For example, a recent study showed that oral and locomotor stereotypic behaviors such as crib-biting objects and box walking were reduced in the presence of goats (YILDIRIM et al., 2023).

Feeding practices commonly observed in horse husbandry, such as providing large amounts of concentrate and limited roughage, along with infrequent meals and prolonged

periods without meals, act as triggers for oral and locomotor stereotypic behaviors in horses (COOPER; MCDONALD; MILLS, 2000; HANIS et al., 2020; NICOL et al., 2002; NINOMIYA; SATO; SUGAWARA, 2007; SEABRA; DITTRICH; VALE, 2021; WICKENS; HELESKI, 2010). The manifestation of these behaviors is notably pronounced prior to and following concentrated meals. Pre-meal stereotypic behaviors are often linked to anticipation of food reward, influenced by cues from the food delivery environment (BACHMANN; AUDIGÉ; STAUFFACHER, 2003a; COOPER; ALBENTOSA, 2005; HANIS et al., 2020), whereas the high frequency of stereotypic behavior after a concentrated meal (HEMMANN et al., 2014) may be due to stomach acidity (NICOL et al., 2002). The elevated frequency of stereotypic behaviors in the pre- and post-feeding periods suggests a potential association between the development of oral stereotypic behaviors and hormones involved in satiety signaling, such as leptin (BLUNDELL; GOODSON; HALFORD, 2001), and hormones that act in the brain reward system (JERLHAG et al., 2006) and protect the gastric mucosa (ADAMI et al., 2010), such as ghrelin. Horses with oral stereotypic behaviors exhibit lower plasma leptin and higher plasma ghrelin concentrations than those without stereotypic behaviors (HEMMANN et al., 2012, 2013). Furthermore, the inclusion of adequate dietary fiber has been shown to reduce stereotypic behaviors and increase plasma leptin levels (HANIS et al., 2023). Therefore, horses with stereotypic behaviors may experience gastric discomfort and altered postprandial satiety.

In addition to causing stomach acidity (NICOL et al., 2002), inadequate diet and food management can also alter the microbiota in horses (BULMER et al., 2019; DESTREZ et al., 2015; DESTREZ; GRIMM; JULLIAND, 2019; MILINOVICH et al., 2006), and their behavioral responses (DESTREZ et al., 2015; HOMER et al., 2023), making them present more reactive behaviors (BULMER et al., 2019) and anxious (DESTREZ; GRIMM; JULLIAND, 2019). Evidence suggests that the microbiota plays a crucial role in modulating behavior across various species (CAIRO et al., 2021; BRUCKNER et al., 2022; JOHNSON; FOSTER, 2018). Symbionts within the microbiota have been proposed to induce behavioral changes aimed at host adaptation (MACH et al., 2020; YUVAL, 2017). Moreover, studies have demonstrated the influence of the microbiota on the central nervous system, impacting conditions such as depression in rats (KELLY et al., 2016), social behaviors in zebrafish (BRUCKNER et al., 2022), and the regulation of stereotypic behaviors in mice (LUCZYNSKI et al., 2016). In the context of horses, it has been suggested that dysregulation of the gut microbiota, in combination with other stressors, can contribute to the development of stereotypic behavior (MCBRIDE; HEMMINGS, 2009) through the gut-brain axis

involving the nervous, endocrine, and immune systems (MACH et al., 2020). Further investigation is required in this field (MACH et al., 2021), but substantial evidence indicates that the microbiota's influence on the control of stereotypic behaviors observed in mice (LUCZYNSKI et al., 2016) may also occur in horses, as specific bacterial taxa are associated with the microbiota of horses displaying stereotypic behaviors through modulation of neurotransmitters (MACH et al., 2020).

3.4 HOW THE VICIOUS CIRCLE IS FORMED

In the selection of breeds, in addition to characteristics such as height, speed and strength, personality was also selected for certain uses of the horse and the combination of intrinsic factors of the individual and environmental factors along with inappropriate management practices can lead to the expression of stereotypic behaviors.

Type of work appears to be associated with the development of stereotypic behavior in horses. For example, a survey conducted in small equestrian centers in Brazil found that 56% of the horses in these locations had some type of behavioral problem, with the type of behavior being associated with the use of the horse (LEME et al., 2014). In that study, rodeo horses showed stereotypic behaviors such as wind sucking and weaving, while reining horses showed licking. Other studies showed that endurance horses have a higher incidence of stereotypic behavior than patrol, leisure, polo, and equestrian work (HANIS et al., 2020, 2021), and that dressage and high-school horses are more likely to display stereotypic behaviors, especially cribbing and wind sucking, than jumping, eventing, advanced-riding-school, and voltige horses; horses used for jumping, eventing, or instruction are more prone to licking or biting, whereas voltige horses exhibit mostly tongue movements and have a lower incidence of stereotypic behaviors (HAUSBERGER et al., 2009). The occurrence of stereotypic behaviors in horses employed in certain types of work can be attributed to multiple factors.

The occurrence of stereotypic behaviors in horses employed in certain types of work can be attributed to multiple factors. Firstly, several management factors that are associated to the occurrence of stereotypic behaviors are the type of accommodation and duration of confinement (LEME et al., 2014), the time worked (CHRISTIE et al., 2006; HANIS et al., 2020; NORMANDO et al., 2002), riding technique (HAUSBERGER et al., 2019; LESIMPLE; POISSONNET; HAUSBERGER, 2016), riding style (NORMANDO et al., 2002, 2011), the number of people riding a horse (NORMANDO et al., 2002), the type of

establishment, such as racing stables and riding schools (MCBRIDE; LONG, 2001) and the feeding management employed (HANIS et al., 2020; NORMANDO et al., 2002). Secondly, specific work-related factors contribute to the development of stereotypic behaviors, such as stressful living and working conditions (HAUSBERGER et al., 2008; HENRY et al., 2017), training that restricts movements and emotions, the use of equipment like bits, hand-to-bit contact, and other devices (HAUSBERGER et al., 2009; NORMANDO et al., 2002). Additionally, the selection of horses with suitable personalities for specific types of work may contribute to higher frequencies of stereotypic behaviors in those horses. For instance, dressage horses tend to be more reactive and exhibit an anxious personality trait and a higher frequency of stereotypic behavior, and voltige horses present a calmer temperament and lower prevalence of stereotypic behavior (HAUSBERGER et al., 2009; HAUSBERGER; MULLER; LUNEL, 2011).

Finally, it has been proposed that horses may learn stereotypic behaviors by observing individuals housed together displaying the same behaviors (HOUPT; MCDONNELL, 1993). NAGY et al. (2008) suggest that constant movement or sound from stereotypic horses may induce susceptible horses to express similar behaviors. MCBRIDE and LONG (2001) found through a telephone survey that owners commonly believe in horses learning or imitating stereotypic behavior from others, a belief also held by laypeople without experience (LITVA; ROBINSON; ARCHER, 2010). However, ALBRIGHT et al. (2009) and CLEGG et al. (2008) provide evidence contradicting the observational learning hypothesis, suggesting instead that shared stress-inducing conditions, such as inadequate diet and social restrictions, contribute to the development of stereotypic behaviors in horses (MCGREEVY ET AL., 2018; BROOM; KENNEDY, 1993). We suggest that horses that are housed together most likely share, besides the housing and feeding routines, other common features such as breed and type of work that, as we discuss here, predispose to the development of stereotypic behaviors. This would explain why horses that live in the same environment with inadequate conditions do not present the same types of stereotypic behaviors or why not all of them present these behaviors, without considering the hypothesis of social learning among horses.

The association between the type of work and the development of stereotypic behavior can be explained by the choice of horses that will be used in these activities, the management and housing used, or a combination of both (VISSER et al., 2003). Therefore, a vicious circle is formed: horses with genetic predisposition (breed, heredity, sex) or personalities associated with a higher risk of developing stereotypic behaviors, as they are “suitable” for certain types of work, are subject to specific handling practices, such as isolated housing, lack of exercise

or intense exercise, use of bits and inadequate food that leads to alteration of the microbiota. All of these factors in combination can be the trigger for the expression of stereotypic behaviors.

3.4 FINAL CONSIDERATIONS

In this review, we presented ample evidence indicating that inappropriate management practices predispose horses to the development of stereotypic behaviors. Empirical evidence reviewed in this paper indicates the involvement of personality in the emergence of stereotypic behaviors in equines. More reactive (in terms of reactivity), aggressive, intelligent, playful, cooperative, reliable and hardworking horse personalities are identified as more likely to develop stereotypic behavior. Conversely, we might expect that a horse willing to work would be one that has its needs met. So, the number of studies establishing a robust and definitive relationship between personality and the emergence of stereotypic behavior remains limited, indicating the need for further empirical studies to support this hypothesis.

The housing and management conditions of horses are often defined by the type of work they are assigned to and we have shown evidence that some types of work are associated with the development of stereotypic behaviors. This increased risk may be due, firstly, to the type of management employed such as use of bits, long hours worked or greater isolation, concentrate feed management for horses employed in jobs that require more energy and that can be associated with alterations in microbiota. These factors are seconded by the selection of horses with personalities better suited for these specific types of work. Studies are needed to elucidate whether the alteration in the microbiota is a cause or consequence of the development of stereotypic behavior. Also, there is evidence that genotype may play a significant role in the development of stereotypic behaviors via increased susceptibility to stress, which can lead to alterations in the central nervous system, particularly in the mesoaccumbens dopamine pathway. These alterations can result in an increased state of motivation, ultimately triggering the expression of stereotypic behaviors.

Therefore, the most effective treatment approaches to prevent and reduce stereotypic behaviors would involve improving the environmental conditions and mitigating the stressors that trigger the stereotypic behavior (MCBRIDE; HEMMINGS, 2009; NAGY et al., 2008; BROOM; KENNEDY, 1993). There are other forms of preventing and reducing stereotypic behaviors in horses, such as physically prevent the horse from expressing it, isolating the horse that express stereotypic behavior (MCBRIDE; LONG, 2001) or treating the horse

through via pharmacological (CARROLL et al., 2023; MCBRIDE; CUDDEFORD, 2001). However, these forms of treatments do not act on the possible causes related to the environmental conditions and do not improve horses' welfare.

4 THE EASIEST BECOMES THE NORM: BELIEFS, KNOWLEDGE AND ATTITUDES OF EQUINE PRACTITIONERS AND ENTHUSIASTS REGARDING HORSE WELFARE

Letícia Santos Maurício; Denise Pereira Leme; Maria José Hötzel

Highlights

- Equine practitioners and enthusiasts recognized several practices that promote horse welfare
- "Letting the horse be a horse" was a common belief to explain horses' welfare and had different meanings, according to the horse, its value and purpose
- Equine practitioners and enthusiasts guided their practices according to the value and purpose of the horse
- Social practices that harm horses' welfare but that are easy to employ become the norm

ABSTRACT

To consider that a horse is living a life worth living, it must be able to forage, socialize and express itself freely and subjectively perceive these experiences as positive. The objectives of this study were to explore beliefs, knowledge and attitudes of equine practitioners and enthusiasts about horse welfare and to identify the barriers that prevent them from employing better management practices considered essential to promote welfare in horses. Equine practitioners and enthusiasts' perceptions about horse welfare were in line with aspects related to the welfare of horses discussed in the scientific literature, focusing on the basic needs of horses. The main barriers perceived by practitioners and enthusiasts of the equestrian world to the use of management practices that may benefit the welfare of the horses were lack of financial resources, physical space, qualified labor, time, tools and knowledge. Important obstacles to changing practices related to the welfare of horses were social norms of the group and social and cultural practices. There is a contradiction between the belief that horse welfare is tied to the idea of letting the "horse be a horse," and the practice of not allowing the "horse to be a horse" in the way participants described. This contradiction is even greater for horses used in equestrian competitions, showing a distinction between economically lower valued

horses, for which the phrase "let the horse be a horse" carries meaning, and higher economic value horses, which would be a different type of horse.

Keywords: animal behavior; management practices; social practice; sport horses; telos.

4.1 INTRODUCTION

Animal welfare describes the state of an individual when facing the challenges of the environment (BROOM, 1991) and how they subjectively perceive experiences (MELLOR et al., 2020). This state includes physical and mental aspects, including the feelings of that individual (BROOM, 2011). In captive bred horses, welfare can be impaired due to inadequate management conditions (VIKSTEN et al., 2017), such as housing conditions that prevent them from socializing with other horses (LEME et al., 2014), express natural behavior (LÖCKENER et al., 2015) and forage *ad libitum* throughout the day, as would be the nature of the species (MCGREEVY et al., 1995).

The welfare state can be assessed based on physiological and behavioral measures (MELLOR et al., 2020), on the resources available, and the quality of handling and management (VIKSTEN et al., 2017, 2016). Animal welfare varies from very good to very poor (BROOM, 1991) depending on the balance between the occurrence of positive and negative experiences (MELLOR, 2016), which is called net welfare (BROOM, 2023; BROWNING; VEIT, 2023). But it is important to consider that not always good welfare "can counterbalance poor welfare", as some negative experiences can be more impactful than positive ones (BROOM, 2023). Focusing on the promotion of positive well-being, i.e, a context of greater occurrence of positive experiences, some concepts discussed are Quality of Life (YEATES, 2016) or "a life worth living" (WEBSTER, 2016). Specifically in the case of horses, the latter should consider the 3Fs framework (forage, friend and freedom) (WADHAM et al., 2022). For instance, to consider that a horse is living a life worth living, he must be able to forage, socialize and express itself freely and subjectively perceive these experiences as positive.

Studying public perception plays a vital role in comprehending individuals' viewpoints and the underlying factors that drive their choices regarding the adoption or avoidance of specific practices (e.g. pigs: (ALBERNAZ-GONÇALVES et al., 2021), cattle: (BASSI et al., 2019; CARDOSO et al., 2017; HÖTZEL; SNEDDON, 2013; YUNES et al., 2021)). These investigations provide valuable insights into people's perspectives, shedding light on their

motivations and decision-making processes. Equine practitioners and enthusiasts are included in different sectors of the equestrian community and seem to understand what harms the welfare of horses; however, many still employ harmful practices (MCBRIDE; LONG, 2001; VISSER; VAN WIJK-JANSEN, 2012). In the present study, we explored beliefs, knowledge and attitudes of equine practitioners and enthusiasts about horse welfare and identified the barriers that prevent them from employing better management practices considered essential to promote welfare in horses.

4.2 MATERIAL AND METHODS

This study is part of the research project "Knowledge, beliefs and attitudes of equine practitioners and enthusiasts about behaviors, emotions and welfare in horses" approved by the Ethics Committee in Research with Human Beings of the Federal University of Santa Catarina (CEPSH/UFSC), opinion n. 5,092,727.

4.2.1 Participant recruitment

A qualitative study was conducted with 31 individuals directly involved in the equestrian environment, focusing on horse welfare. Equine practitioners and enthusiasts were considered to be those who had some form of contact with horses, such as equestrian athletes and instructors, horse owners, trainers, veterinarians, animal scientists, military personnel, university and equestrian center teaching staff, and researchers with specialized knowledge in the equestrian field. The study consisted of in-depth semi-structured interviews, conducted from February to May 2022, by the same interviewer in Brazilian Portuguese. The initial three participants were recruited through the authors' network of contacts, followed by the snowball sampling method, where participants were requested to recommend additional participants for the study (ROLLER; LAVRAKAS, 2015). The initial contact with the participants was made through text messages, and in the case of agreeing to participate in the research, the interview was scheduled to be conducted in person (1 interview) or via video call (the remaining 30). Initially, 14 interviews were conducted. Subsequently, the responses were analyzed, and an additional 17 interviews were conducted. After analyzing the interviews from participants 15 to 31 in their entirety, it was found that no new themes or information were mentioned by the participants. The interviews lasted 30 minutes on average.

Before the interview, all participants received and signed an Informed Consent Form.

4.2.2 Interview script

The interview started with 6x closed questions regarding sociodemographic information, than participants were asked 2 open-ended questions: 1) what they understood about the welfare of horses and 2) the perceived obstacles that prevent people from taking actions that they believe are beneficial to horse's welfare. The interview was categorized into sociodemographic information and knowledge, beliefs, and attitudes about welfare in horses (Appendix A). Participants were asked about their conception of horse welfare and the greatest barriers that prevent people from employing practices indicated to improve the welfare of horses. The responses were based on participants' personal experiences with their own horses or through personal observation in other establishments. At all moments participants were given the freedom to express their opinions, beliefs, and share stories that served as examples to illustrate their opinions and experiences.

4.2.3 Data analysis

The interviews were transcribed with participant identification using numbers. This ensured anonymity, as only the first author transcribed the interviews and had direct access to the participants. The responses were categorized into thematic topics for discussion through thematic analysis (BRAUN; CLARKE, 2019, 2006; BRAUN et al., 2019). A data-driven deductive approach was employed, in which the authors were responsible for creating themes based on the raw interpretation of the data and the identification of less evident patterns through subjective analysis of factors that could be influencing the participants' responses. To analyze these less evident patterns, a latent analysis was conducted to uncover implicit meanings beneath the participants' superficial speech. This was done after the initial semantic analysis, as it revealed participants' opinions, perspectives, and beliefs that were not explicitly stated, including moral reflections about themselves and others.

The interviews were thoroughly, repeatedly, and carefully read for coding and theme development. Codes were inserted using the "Comment" feature in Google Docs throughout the document, corresponding to each quote from the transcribed interviews. Each quote was interpreted as a meaningful fragment. We sought to understand the participants' perspectives, opinions, and experiences based on their narratives, considering the participants' life context and searching for patterns in the data that would inform how they perceived horse welfare.

Codes were created for fragments of the narratives that were deemed significant during the initial analysis or after recognizing recurring ideas among participants' responses. Throughout the process, reflective notes and mind maps were made to capture ideas and topics related to the participants' statements. Fragments of the narratives that were deemed significant for more than one theme were coded under different themes.

The codes were discussed among the authors to identify patterns and group the codes into themes, considering different perspectives and commonalities in the participants' responses. Excerpts from the interviews were used to exemplify participants' statements related to the developed themes, after analyzing the data in the co-creation of themes, avoiding paraphrasing the participants' words. We aimed to include quotes that showcased the participants' different opinions and viewpoints, while maintaining the original idea expressed by the participants. Finally, the qualitative and quantitative responses were organized into a table.

4.3 RESULTS

4.3.1 Description of participants

The study participants had diverse professional roles and extensive experience with horses. The pool of participants encompassed various other roles such as handlers, veterinarians, agronomists, teachers, researchers, equine therapists, police officers, and athletes, with many participants identifying themselves as horse owners or trainers, coming from families with a rich history of horse ownership. Their involvement with horses varied, with some participants having contact with as few as 2 horses per week, while others were regularly engaged with up to 1000 horses per week. These interactions encompassed a wide range of activities including handling, sports, breeding, police work, leisure, horseback riding, equine therapy, teaching, and research (Table 2).

Table 2: Demographics of participants

Demography	**n**	**%**
Sex		
Female	9	28%
Male	22	69%
Time of experience with horses		
Until 5 years	3	9%
6 to 10 years	3	9%
11 to 15 years	3	9%
16 to 20 years	3	9%
More than 20 years	7	22%
Since childhood	12	38%
Level of education		
Elementary school	1	3%
High school	7	23%
University education	21	70%

Source: Author

4.3.2 Equine practitioners and enthusiasts perception about horses' welfare

Beliefs, knowledge and attitudes of equine practitioners and enthusiasts about the welfare of horses were divided into three themes. In the first, “Let the horse be a horse”, all participants showed knowledge about aspects related to welfare and focused on the nature of the equine species. The second theme, "Social norms" addressed the social norms that influenced the practices of the participants that promoted or were harmful to the welfare of the horses. The third theme, “Beyond utopia: how and why horses are managed the way they are”, explained barriers that were perceived as an impediment to the use of best practices for the welfare of horses.

4.3.2.1 Let the horse be a horse

Some participants demonstrated difficulty in conceptualizing the welfare of horses ("*Ah, this question is complex! This question is very tenuous.*" - P2) and tried to explain horses' welfare by referring to basic needs and to the respect of the nature of the species, frequently using the expression "let the horse be a horse" ("*It's letting the horse be a horse. As natural as possible…Let the horse be a horse. Of course, today the natural habitat of the horse doesn’t exist, there are few places where you can leave a horse without the presence of a person*." - P21; "*The horse being a horse, respecting he as prey, its limits, understanding how they feel, how they think, all this is very important*." - P24; "*A well-treated horse, with very fractional meals, several times a day, a horse that has the time to be a horse, because we can't let him be a horse all the time. The time to be a horse is to be released, in the field, that's being a horse*." - P6; "*...understanding he as an animal, a living being, which has its peculiarities, its needs… And having its needs met*" - P23). The idea behind “letting the horse be a horse" seemed to involve physical and mental aspects of the horse. Participants described many aspects of the biology, physiology and behavior of the horse that they associated with a horse being well. Many used health as a measure to verify a good state of welfare in horses ("*I see that they have good welfare if they are in good health.*" - P31; "*In addition to food, health care through vaccines.*" - P28; "*I think that a horse that you can say is healthy, well handled, is going through a process where there is good welfare. He will gain weight, he will have a beautiful coat... he will be fed with will, he will drink a lot of water*." - P25), with some expressing concern about the occurrence of diseases in horses associated with management

("*A stabled horse will possibly go through a colic process, a disease process.*" - P12; "*Colic is a proven fact, the horse in the wild has much lower chances of having a colic than that animal that is confined*." – P30). Feeding was a frequently cited element associated with good welfare ("*The horse's stomach is small and it fills up very quickly. That's why we see him eating all the time..."* - P16; "*They can't stay a long time without eating, it gives them gastritis.*" - P5). Participants also mentioned social behavior ("*...the horse is a social animal, he needs to be with others.*" - P5; "*... having a friend will also generate good welfare*". - P24; "*It's no use releasing a horse into a round on its own, because if he doesn't have the company of others, even if it's visual from the companion on the side, he doesn't have good welfare."* - P16). Many talked about the importance of freedom for the horses' wellbeing ("*More time enjoying freedom"* - P5; "*The freer, the happier.*" - P18).

"Letting the horse be a horse" had different meanings, according to the horse, its value and purpose ("*Because when you ride, or in a certain way use a snaffle, you, in a certain way, I believe that it is not good welfare, but this is the reason why we keep the horses*." - P19; "*There are horses that are super delicate to be released in the paddock, because they really hurt themselves, a lot of energy, a lot of euphoria, stallions mainly, right... they really end up being deprived of a lot of things, because they hurt themselves or hurt other horses or people.*" - P27; "*Some horses we need to release separately, because they fight, there are some more troublemakers. But this separation is harmful for the animal, because he has this collective need right*." - P9; "*You can't let the younger ones go all together, they fight a lot... There's not much to do. If you let them go, it's worse, because they fight, they get hurt easier*." - P13). Specifically in the case of sport horses, "being a horse" involved social isolation justified by the value and use of the horse ("*These horses (referring to sport horses) are animals that often eat a lot, they are very vigorous sports, so sometimes they end up not having some privileges because they get hurt*." - P26) or maintain the expected performance ("*Athletic horses, like humans, go through stress, to be able to maintain weight, not to wear out the musculature at the wrong time. So a horse, to be prepared for sport or for handling, is a horse that will have to be confined*." - P2; "*My horses are a little free in the pasture, a little in stalls. Because they are sport animals, they need to be prepared for sport, to compete*." - P5; "*Sometimes it's difficult to fully respect their welfare, let's put it that way. I think it's a necessary evil for anyone who wants to compete*." - P26).

The aesthetic value of the horses that participated in exhibitions was also presented as a justification for isolating horses in stalls ("*How are you going to have a stallion that goes to exhibitions to be released in the field? There's no way. He's going to be ugly. He can throw*

himself on a fence." - P5; "*We bring him to the stables to leave him with the most beautiful coat, shoed hoof, leave him with the conditions to be presented. A beautiful horse*." - P7; "*But when it comes to the competition part, then you think about the part of morphology, or the functional part. Whether you like it or not, you deprive him of what would be ideal welfare*." - P25).

Although less frequently, some participants discussed the mental state as part of their understanding of horse welfare ("*He should not show pain, irritation… Understanding how they feel, how they think, all of this is very important*." - P24; "*Second place, mental welfare*." - P18; "*I see his happiness… he likes to be with us… and he has to be very happy in what he does*" - P23). Participants showed concern about the stress resulting from management practices ("*They are housed as free as possible, not in these dark stalls. You see many horses that keep biting the door, swallowing air, aerophagia, all of that is stress.*" - P19; "*Always bring the horse conditions that he likes to be in, an environment he likes. It's no use for us to do it if he doesn't like what he's doing, right... That's what welfare is, looking at the animal and seeing what conditions he adapts to the environment and from that, dosing the ways to treat him according to his particularity*."- P29). Mental welfare was also described as dependent on the people in charge of the horses ("*Management by competent, capable people who only work with positive feelings, otherwise the horse will be permanently stressed*." - P16).

Participants expressed their love for the horses, describing it in terms of friendship ("*They say that a dog is man's best friend, but the horse is*." - P4; "*When you have a friendship between a man and a horse, it is much deeper than with a dog*." - P21). Two different views of the horse-human relationship were perceived in the participants' conversations: an affective view and an utilitarian view. Participants expressed the horse-human relationship through terms such as "passion" and "love" ("*Gauchos and southerners are passionate about horses... I am passionate about equestrian sports, I am passionate about horses, I chose to become a veterinarian because of the horse.*" - P2; "*Love is what you do, it's the important thing*." - P20; "*There's a horse that is her love (referring to a friend).*" - P28) and with sympathetic speeches ("*...the cart horses, it's a pity.*" - P4; "*I keep putting myself in his situation, if I was hungry... It's distressing, seeing the animals hitting, asking for food, my God, what should I do?*" - P20; "*I'm dying of pity, I don't even look. Because it's no use, I won't be able to fight with that... you see their sad expression, very sad, it's heartbreaking, so I try not to be close*." - P24). In addition, participants made referednce to the communication and understanding of horses by humans ("*Perceiving the signals they give,*

understanding this, welcoming what they bring to us." - P20; "*The main secret of the horse is that you can understand what he's telling you. They talk all the time… I think that's the main thing, people have to listen to horses. You have to learn to think like a horse and not like a person*." - P21). In contrast, some participants associated welfare with the usefulness and economic value of the horse ("*No one is going to hurt a R$ 70,000 horse, they are going to take good care of a horse like that. The equine therapy people are not going to mistreat their main therapist. But there are still a lot of carters that view that the horse is there to serve you...*" - P22; "*A horse that people pay the price of a car to have a financial return is an animal that .. is an investment, so the staff is very careful with it. They work with welfare very aligned*." - P2).

4.3.2.2 Social norms

Social norms and culture-based knowledge explained practices carried out by participants on a daily basis, which were generally accepted without substantial contestation. Participants used terms such as "as everyone does it" and "as it has always been done" to justify their motivation for using these practices ("*Some reasons, first convenience. You get out of a situation that everyone has been doing for many years*." - P16; "*Ah, culture. Culture! … The human from the countryside in general… he has the smarts of everyday life, but he has a certain ignorance and that culture is very strong, ingrained in him, the traditions, how it has always been don*e." - P19; "*Some don't do it [better management practices] out of stubbornness, beliefs*." - P17). However, for some, cultural practices have undergone changes ("*I believe that it is more cultural, of not respecting, going beyond what the horse can go. But I haven't seen that much anymore*." - P23).

Some participants evaluated practices carried out by others and contested some social norms ("*So there's also this part that I see that high-performance people lack a little to realize this. Having a touch at prioritizing the animal's emotions, because it interferes a lot too*."- P24; "*But if today the horse feels that leg, he [owner] asks his veterinarian to block that pain for the test. This is a tremendous evil for the horse, but due to the greed of the human being in wanting a result, he ends up doing it many times*." - P30; "*He [horse] knows he did that and he felt pain, and nobody did anything to ease it, he won't want to do it anymore*." - P27). The concern for the welfare of sport horses led only three participants to take more radical measures. These participants, who withdrew from equestrian competitions that they

considered harmful to the horse, cited their experiences to explain why they "gave up on the system" ("*But I've seen horses that, when leaving the starter, rear up, it takes a lot of work, they don't position themselves, they bend their whole body... I do horseback riding, but I don't go to races anymore, because I started to observe it in horses*." - P24; "*Today I'm seeing the consequences, that she's very anxious, so much so that I've stopped for a while, I'm not even taking her to the competition anymore*." - P25; "*That's why I stopped competing in that modality, because it required much more training and the pursuit of perfection is a factor that gets in the way, it doesn't just depend on you, much on the animal you're riding*." - P28).

4.3.2.3 Beyond utopia: how and why horses are managed the way they are

Participants demonstrated knowledge of management practices that can improve or harm the welfare of the horses. However, many explained that they are unable to apply such practices on a daily basis ("*Because we can't let him be a horse all the time. The moment to be a horse is to be released, in the field, that's being a horse*." - P7). According to participants, horses were raised mostly in mixed stalls and paddocks/pasture systems, where horses were kept most of the time in stalls and released into paddocks/pastures in small groups at specific times of the day. These housing conditions resulted in a large supply of concentrated food and little forage distributed in a small frequency of daily meals and little socialization among the horses.

There was some consensus among participants that horses loose in the pasture with *ad libitum* feeding have better welfare. However, main justifications presented for negative attitudes towards these practices were the lack of financial resources, physical space, qualified labor, time, tools and knowledge. Lack of financial resources was highly mentioned by the participants ("*Sometimes people don't have money. You see here, sometimes I have lunch, but I don't have dinner, so I can pay the bills for the horses and dogs... If you don't have money, don't have it*."- P22; "*The money factor today is what most influences*."- P28). It was mentioned that the COVID-19 pandemic exacerbated the lack of financial resources ("*During the pandemic, he stayed at a friend of mine's farm, I couldn't keep two horses... But we reduced work at the time of the pandemic and started to work with him later. There weren't so many practitioners.*" - P23; "*Today: 80 students, 19 horses... Before the pandemic there were 150 students and 49 horses.*" - P29). Participants associated the lack of financial resources with the impossibility of acquiring large physical spaces ("*The public that consumes horses today cannot afford 1 hectare per horse... People know and don't do it because they can't.*" -

P18; "*But having more horses is a very high cost, so it's very difficult for you to have that... but you have to give the space*." - P21; "*It's difficult to have paddocks at ease, that can release the horses every day*."- P27). Some participants mentioned attempts to improve housing conditions in smaller spaces ("*I made my stables for study, reading, studying... My animals at home are very calm, accommodated, they can be whatever stallion they are. It's all open, they can see each other*." - P1).

The lack of qualified labor was another aspect frequently mentioned as a barrier to the use of best practices ("*The handler is that guy who often earns the minimum wage and takes care of a horse worth thousands of reais... labor is certainly the biggest problem we have and the barrier that people have in wanting to qualify their labor… But the owner is the first to bar this qualification of labor*." – P16"; "*And everyone must say, labor in this area is very, very difficult*." - P24). Participants also cited lack of time and adequate tools ("*So, for us keepers, I think it's sad, right. But there's the issue of time. I've worked in a space where they had 30 animals, so I didn't manage to offer everything that I believe is right. The second point that was important for me, as a horse professional, was the tools that the center offers me. If the hay my boss gives me is X and for him it is ok, if the ration is finished and he says, solve it. So, my hands are tied*." - P20; "*Some say, my management doesn't allow it. And sometimes it doesn't allow it. Because of the routine, they can only treat the horses 2 times a day, they cannot insert a third unless it is midnight*." - P16). Lack of knowledge was also cited ("*I think the first thing is lack of knowledge*." - P21; "*Trainers are often much less educated and cultured people than us, they don't understand that*." - P27). However, some handlers and trainers reported professional training and qualifications ("*So, I learned this at Universidade do Cavalo. I took a course and learned it there*." - P7; "*I even participated in a course where the teacher was explaining it to me.*" - P24).

4.4 DISCUSSION

Equine practitioners and enthusiasts perceptions about horse welfare were in line with aspects related to the welfare of horses discussed in the scientific literature, focusing on the basic needs of horses and the three categories - freedom, forage and friends - that constitute the 3Fs Framework (WADHAM et al., 2022). Some elements that participants believed to be associated with a good state of welfare related to the horses' basic needs included rearing them in groups on pasture, fractioning meals throughout the day, providing with hay, water *ad libitum*, and practices aimed at promoting positive and reducing negative experiences and

emotional states, such as stress and pain, particularly in sport horses. We showed a disconnection between what participants considered positive or essential for good welfare and the management practices they employed. The main barriers perceived by practitioners and enthusiasts of the equestrian world to the use of management practices that may benefit the welfare of the horses were lack of financial resources, physical space, qualified labor, time, tools and knowledge. Important obstacles to changing practices related to the welfare of horses were social norms of the group and social and cultural practices. These norms, together with the perception of different meanings about "letting the horse be a horse" according to the horse, its value and purpose, especially sports horses and stallions, made participants perceive barriers as almost insurmountable.

Participants cited several ethical concerns about animal welfare discussed by different scholars, such as the nature of the species (*telos*) (ROLLIN, 2007), concern about horses as sentient animals and their health (FRASER et al., 1997), as well as human-horse interactions (MELLOR et al., 2020) and basic needs (KRUEGER et al., 2021). Other researchers also identified animal users' concerns about natural life (PRICKETT et al., 2010; SCHUPPLI et al., 2023), physical space and freedom (CARDOSO et al., 2016; PRICKETT et al., 2010), health (SCHUPPLI et al., 2023; VANHONACKER et al., 2008), affective states (SCHUPPLI et al., 2023), feeding and human-animal relationship (VANHONACKER et al., 2008) as valuable elements of the welfare concept. The shared common belief that the well-being of horses is basically associated with the idea of letting "the horse be a horse" suggests that participants shared the teleological conception that humans can make use of animals while respecting the biological nature of the species (ROLLIN, 2007). Yet, this idea was not applied in practice, as many participants kept the horses in isolated stalls, despite recognizing them as social animals. Participants' focus on the affective states of animals is in line with the consideration of the mental aspect of the animals in the assessment of animal welfare (MELLOR et al., 2020). Considering that equestrian users are able to identify different emotions of their horses (HÖTZEL et al., 2019) and that, as shown here, they know how to differentiate management practices that are beneficial or harmful for the horse, the greatest challenge is to encourage people to promote positive events and environments aiming to please horses and not just provide the essential elements to meet their basic needs. However, the failure to meet basic needs will logically lead to poor horse welfare and result in negative emotions.

Concern for negative emotions often does not extend to health issues, such as recognizing pain. Lay people and even professionals struggle to identify pain in horses, which

is a clinical but often subtle sign of diseases like gastritis in horses kept in stalls. Another factor associated with animal welfare highlighted by participants was the quality of the human-horse relationship. Handlers' work and their relationship with animals has a big impact over animal welfare (HEMSWORTH, 2003). This relationship is formed based on successive experiences (RAULT et al., 2020), so it is imperative that people responsible for the care of horses focus on maximizing the experiences that horses perceive as positive or negative (HAUSBERGER et al., 2008).

The generalized use of stall housing reported in this study has been reported by others (LEME et al., 2014; VISSER; VAN WIJK-JANSEN, 2012). Previous research has also identified the same factors as in this study as obstacles to implementing better practices for welfare, including financial limitations (DOCKÈS; KLING-EVEILLARD, 2006; GOTTARDO et al., 2011; HORSEMAN et al., 2016; VISSER; VAN WIJK-JANSEN, 2012), lack of physical space, labor (VISSER; VAN WIJK-JANSEN, 2012), time (GOTTARDO et al., 2011) lack of knowledge (CARDOSO et al., 2016; HORSEMAN et al., 2016). We suggest that the barriers to the use of best practices cited in our study are not real, but perceived (AJZEN, 2011). Participants had choices such as, for example, keeping the horses isolated in stalls or even stop breeding horses, as was the choice of participants who considered these obstacles insurmountable and their moral values led them to change practices. However, many participants accommodated their dissonant attitudes and opinions with arguments lacking technical or scientific basis. Participants justified the practice of keeping the horses isolated due to the mistaken perception that the more excitable personality of some horses can lead them to fights, when in fact what can lead the horses to express aggressive behavior is the supply of concentrate that provides excess energy to an animal trapped in a stall.

Some participants showed sympathy or pity for the horses, but did not actually experience the negative emotions of the horses in a sensory way so that we could say that they felt empathy (SINGER et al., 2004), nor did they implement efforts aimed at alleviating the suffering of animals. Sympathetic attitudes and recognition of horses as sentient individuals were frequent but not enough for participants to support or adopt practices that meet the horses' behavioral needs, promoting their welfare. Interestingly, in the case of low-value horses, the main claims to defend practices such as stall housing and concentrated feeding were related to high costs involved in addition in space or labor, while for high-value horses used in performance and aesthetics, the arguments shifted to potential benefits for the horses themselves. Differences in the use of management practices according to the economic value of the horse also reported by Leme et al. (2014). In the present study, participants drew on

their personal experiences and took more ownership of practices in relation to practical and economic barriers for high-value horses than for low-value horses, but tended to refer to “others” to describe poor management of lower valued horses. This suggests that they felt more comfortable with the decision when it could be justified “for the horses’ benefit”.

The big question is, if people claim to love horses, why don't they treat them with better practices that align with this sentiment? There is a contradiction between the belief that horse welfare is tied to the idea of letting the "horse be a horse," and the practice of not allowing the "horse to be a horse" in the way participants described, with freedom to graze, express natural behaviors, and socialize with other horses. This contradiction is even greater for horses used in equestrian competitions, showing a distinction between economically lower valued horses, for which the phrase "let the horse be a horse" carries meaning, and higher economic value horses, such as sport horses, often referred to by participants as "athlete horses," which would be a different type of horse. Therefore, the expression "let the horse be a horse" for sport horses implies different practices aimed at making the "horse be a horse," since the purpose of this specific category of horse would be a special case, as it has another purpose for humans - to win equestrian competitions - and, according to participants, this type of horse would have different needs. This belief that the sport horse has a different purpose justifies participants imposing restrictions on the horse, as they isolate horses with the aim of making the horse an athlete horse. On the other hand, for economically lower valued horses, the idea of letting the "horse be a horse" and express its purpose is utopian, as it is not possible to care for this horse, to let the "horse be a horse," with few resources and effort. Therefore, there is a contradiction between the beliefs, knowledge, and attitudes of practitioners and equestrian enthusiasts, but the daily practices are accepted because they are widely accepted and preserved in the equestrian community of the study participants. This wide acceptance did not extend to all participants. Some reported disagreeing with such practices but prioritized the "horse being a horse." These participants do not seem to distinguish between economically lower valued horses and higher value horses such as sport horses. Therefore, these individuals chose not to participate in this type of horse use because they agree that the available resources do not allow the horse to "be a horse."

Culture and traditions are related to the long experience with horses that many reported having. Due to their widespread adoption within the equestrian community, participants may overlook the problematic nature of certain practices that pose harm to horse welfare. Being part of a group that considers these practices acceptable can make people feel comfortable, move away from the problem, and shift responsibility to other members of the

group. The Theory of Social Practice (SHOVE et al., 2012) explains that everyday practices, called "social practices", represent values and beliefs of a social system that can be preserved over time or transformed by people. Social practices result from three factors that are interrelated: materials, meanings and skills (SHOVE et al., 2012). In this study, some materials identified are the financial resources, space, skilled labor, time and tools; meanings are the culture of using the horse, and skills are the knowledge about horse welfare and the practices that can be used to manage horses. The result of the interconnection between these three elements can explain why some practices are preserved over so many years in the equestrian environment, configuring barriers that prevent the transformation of values into action (SHOVE et al., 2012).

Practices based on specific use of the horse, tradition and culture can impede changes to promote animal welfare (BASSI et al., 2019). Even so, some study participants improved housing conditions to improve horses' welfare, for example making changes to the stall architecture to enable horses to see their neighbors. In fact, allowing horses to view neighboring horses improves their welfare (LESIMPLE et al., 2019). However, Hausberger et al. (2021) criticize some forms of environmental enrichment in horse stables, arguing that they do not provide better conditions for the horses, they only compensate for inadequate conditions and divert "the owner's awareness of the real welfare problems".

The evolution of social practices can happen in response to public pressure. For example, the practice of blocking horse pain, often mentioned in our study, may be related to the influence of the media on impaired welfare problems in these animals (HORSEMAN et al., 2016), as the media can have an influence on public opinion on animal related issues (RADMANN et al., 2021). The public has growing influence on the decisions and practices employed by large organizations (DOUGLAS et al., 2022; DUNCAN et al., 2018; MCMANUS, 2022). Today there is much discussion about the social license to operate, a concept that explains an unofficial contract or license whereby the public attributes legitimacy to the operation of an organization or activity (HELESKI, 2023; MCGREEVY; MCMANUS, 2017). Public awareness, media coverage and public pressure together can be drivers of change leading to regulatory norms to protect animals.

Since the barriers to the use of best management practices that may be beneficial to the welfare of stabled horses are multiple and at the same time interrelated, the actions to overcome them also need to be interrelated. Considering lack of resources, some actions can be increase awareness of owners about the importance of training handlers; automatize food management, which can allow automatic night feeding of forage without involving extra

labor; define goals for handlers to improve practices and financial incentives to achieve these goals; give incentives for establishments that demonstrate the application of good management practices and train handlers by offering short courses with accessible language. Some examples regarding social practices are short courses focusing on re-signify traditions and demystify erroneous beliefs and encourage discussions between participants in the equestrian environment to exchange experiences and shift the paradigm regarding the use of better welfare practices. Finally, it is urgent to educate people about the effects of improved welfare on performance and the harm of blocking pain in sport horses, including considering the effects of doping on the outcome of equestrian competitions and ethical perspectives, to improve the disbalance between the primacy of personal goals over the welfare of horses.

Changes in management practices that promote the well-being of horses are urgent, but the participants did not demonstrate this intention to change. They provided explanations for the practices they use and partly justified the incongruity between what they describe as utopian, ideal, and natural for the horse, and what they actually do and will continue to do. Thus, the withdrawal of the two participants who stopped using accepted but harmful practices reinforces the mistaken belief that the way horses are managed is the only one that exists. Utopia is a theoretical argument, in practice the participants only see one option: the norm that is easy and widely used.

4.5 CONCLUSIONS AND IMPLICATIONS

This study showed beliefs, knowledge and attitudes of equestrian practitioners and enthusiasts about the conception of welfare of horses, perceived barriers to promote better practices for horses welfare and the social norms of the group that influence their practices. Participants oriented their practices according to the economic value of the horse and many showed no intention of changing them or challenging the culture and status quo of equine production. They demonstrated knowledge about the welfare of the horse and the factors that harm it; however, this knowledge was not enough to motivate them to have the intention of changing the way they raise horses. Even if participants showed knowledge about better practices to favor horse welfare, the group's social norms had an important weight on how they evaluated the barriers. From an ethical point of view, ideally people should not have horses when it is not possible to keep them with a guarantee of their well-being. However, social norms keep people in a modus operandi following a pattern of traditional daily practices harmful to horses ready and preserved over long periods of time and across

generations. Discussing factors that promote the well-being of horses, their nature and basic needs can lead some people who maintain traditional social practices to leave their comfort zone, which demands energy and disposition. Therefore, even people who declared sympathy actually showed selective sympathy, considering what would be possible to do to improve the welfare of the horses under their care. The appeal to culture also seems to take place in a selective manner in which culturally accepted and repeated management practices are maintained. Barriers were mostly perceived and not questioned, proof of which is that some participants made significant changes and improved the welfare of the horses. Cultural pressure was not enough to change the participants' beliefs and attitudes, with the exception of those who contested social norms and failed to follow them, such as, for example, withdrawing from competitions. The withdrawal of few participants reflects how keeping horses in optimal condition is not an easy task and how the system is preserved and requires a great effort to keep horses in optimal condition, basic needs met and chances to provide opportunities to experience positive emotions. Because of this difficulty, people want to have horses, but since it is not possible, they attribute the responsibility to equestrian centers where horses are cared for by others.

Public pressure and social license play a role in these changes, as social norms that are not consistent with what the public expects, especially in the case of the sport horse, appear in the media and are subject to social scrutiny. The change will come with the breaking of the cultural idea that the welfare problems of horses exist but are acceptable and when the cognitive dissonance between the ideal and the real and the feeling of guilt represent a great degree of discomfort. This study has shown that equine practitioners and enthusiasts do not intend to change; based on this result, future studies can investigate how to motivate them to change these practices.

5 BELIEFS, KNOWLEDGE AND ATTITUDES OF EQUINE PRACTITIONERS AND ENTHUSIASTS ABOUT ANTICIPATORY BEHAVIOR IN HORSES

Letícia Santos Maurício; Denise Pereira Leme; Maria José Hötzel

Abstract

Stabled horses receive few meals/day. This can lead them to express anticipatory behavior, in the form of an increase in activity before food delivery. There is no scientific consensus about the valence of emotional state that horses experience when expressing anticipatory behavior to a food reward. This study aimed to investigate the knowledge, beliefs, and attitudes of equine practitioners and enthusiasts about behaviors and emotions related to anticipatory behavior to provision of food in stabled horses and how this influences their management decisions. We interviewed 31 equine practitioners and enthusiasts through face-to-face interviews. Data were transcribed and submitted to thematic analysis. Three main themes capture participants' knowledge and views on anticipatory behavior. In theme 1, "valence of anticipatory behavior", many participants described that the provision of highly palatable food is usually followed by an increase in vocalizations, agitation, aggressive and stereotypic behaviors, and emotions of negative valence, such as anxiety. Theme 2, "management influences anticipatory behavior": participants discussed how the strict feeding routine triggers the anticipatory behavior. Yet, most also believed that maintaining the feeding routine is necessary or beneficial or needed for horses' welfare. Theme 3, "horse factors influencing anticipatory behavior": in the participants' perception, horses that are socially dominant or anxious express more anticipatory behavior. In conclusion, the opinion of experienced equine practitioners and enthusiasts supports the hypothesis that anticipatory behavior to a food reward triggers negative valence emotions in stabled horses. However, most participants maintained and believed that the food management triggers such emotions in the equines.

Highlights

- Two distinct views on the emotional valence of anticipatory behavior were identified: negative valence related to anxiety and positive valence associated with reward attainment.

- Horse factors, such as temperament and social dominance, and the strict feeding routine were associated with the expression of anticipatory behavior.
- The opinion of experienced equine practitioners and enthusiasts supports the hypothesis that anticipatory behavior to a food reward triggers negative valence emotions in stabled horses.

Keywords: affective states; animal welfare; equus caballus; routine; personality.

5.1 INTRODUCTION

Foraging constitutes 60% of the behavioral budget of horses. However, stabled horses are often provided meals at limited, fixed times (BACHMANN; AUDIGÉ; STAUFFACHER, 2003b; BENHAJALI et al., 2009), which conflicts with their natural foraging behavior (GOODWIN, 2007). In barren housing environments, routine predictability is often accompanied by environmental cues that signal an imminent reward delivery, triggering increased activity in horses prior to the arrival of food (PETERS et al., 2012; ZUPAN; ŠTUHEC; JORDAN, 2020). This behavior, known as anticipatory behavior (SPRUIJT; VAN DEN BOS; PIJLMAN, 2001), is acquired by associative learning, through Pavlovian (VINKE; BOS; SPRUIJT, 2004) and operant (BALSAM et al., 2009) conditioning. In this process, animals learn to recognize environmental cues that indicate the forthcoming delivery of a reward (MOE et al., 2006, 2009). Thus, anticipatory behavior is exhibited between cue and reward delivery (BOISSY; TERLOUW; NEINDRE, 1998; SPRUIJT; VAN DEN BOS; PIJLMAN, 2001) In horses, the behavior exhibited when anticipating a food reward is characterized by an increase in the number of behavioral transitions, heart rate frequency, and the expression of behaviors such as pawing the ground and looking towards the door (PETERS et al., 2012; ZUPAN; ŠTUHEC; JORDAN, 2020). Other behavioral changes include an increase in the frequency and duration of locomotion (BENHAJALI et al., 2009), excitement and investigation, increased standing, as well as a reduced duration of maintenance behaviors such as foraging and resting compared to baseline levels (PETERS et al., 2012).

Anticipatory behavior is considered a valuable indicator of an animal's perception of specific stimuli as rewarding or aversive (TUCKER; DERRYBERRY; EMOTION, 2000) and events as pleasurable or unpleasant (BASSETT; BUCHANAN-SMITH, 2007). This

interpretation is made by reward centers in the brain, such as the hippocampus and amygdala, that trigger anticipatory behavior (SPRUIJT; VAN DEN BOS; PIJLMAN, 2001). Some authors argue that animals may experience negative emotions associated with the expression of anticipatory behavior. For instance, rats housed in non-enriched cages exhibit a stronger anticipatory behavior compared to those housed in enriched cages, which is interpreted as an indicator of higher levels of stress in the former (VAN DER HARST; BAARS; SPRUIJT, 2003). Cows display reduced intensity of anticipatory behavior when they have access to pasture, compared to being housed in enclosed environments, which could be an indication of positive emotional states in the better living conditions (CRUMP et al., 2021). Dolphins that exhibit a higher frequency of anticipatory behaviors tend to display more pessimistic outcomes in cognitive bias tests compared to dolphins with a lower frequency of anticipatory behaviors (CLEGG; DELFOUR, 2018). On the other hand, other authors suggest that anticipatory behaviors related to positive events reflect a good state of animal welfare (SPRUIJT; VAN DEN BOS; PIJLMAN, 2001) and that the emotional valence associated with the expression of anticipatory behavior is positive (BOISSY et al., 2007; MAIGROT et al., 2017; RICCI-BONOT; MILLS, 2023). Therefore, there is a lack of consensus among researchers regarding the valence of emotional states experienced by horses and other animals when expressing anticipatory behavior. Soliciting the viewpoints of equine practitioners and enthusiasts about the valence of anticipatory behavior may provide valuable insights into this matter. As a result of their frequent and intimate interactions with horses, these individuals may possess an extensive understanding of equine behavior, offering a potential contribution to the comprehension of the emotional valence associated with anticipatory behavior in horses. Gaining an understanding of the beliefs, knowledge and attitudes of experienced equine practitioners and enthusiasts may enable the identification and investigation of pertinent management issues that can be addressed to promote the welfare of horses. Therefore, the present study aimed to investigate the knowledge, beliefs, and attitudes of equine practitioners and enthusiasts concerning the behaviors and emotions associated with anticipatory behavior in stabled horses, as well as how these factors influence their decision-making processes pertaining to horse management.

5.2 MATERIAL AND METHODS

5.2.1 Participant recruitment

This study is part of the research project "Behavior, emotional states and welfare in horses" approved by the Ethics Committee in Research with Human Beings of the Federal University of Santa Catarina (CEPSH/UFSC), opinion n. 5,092,727.

Participants were recruited as described in Chapter 3. Participants that were interviewed in this study were the same that participated in the qualitative study described in Chapter 3.

5.2.2 Interview script

The interview was categorized into the following sections: type of management practices used and knowledge, beliefs, and attitudes about anticipatory behavior in horses (Appendix B). Questions about horse management were tailored based on each participant's relationship with horses. Initially, participants were explained what anticipatory behavior is and asked if they had ever observed this behavior in their own horses or in horses belonging to others. Subsequently, the interviewer encouraged the participant to express their opinions and attitudes regarding this behavior in horses. Questions were asked about the possible causes of anticipatory behaviors, the specific behaviors horses exhibited when anticipating food delivery, the emotion they believed horses experienced when expressing this behavior, and whether temperament, personality, or other individual characteristics of horses could affect the expression of anticipatory behavior. Participants were asked about the relationship between anticipatory behavior and horse welfare. Participants who owned horses were asked about the types of housing (stalls with or without side openings, paddocks), the type of feed provided (grain, oats, hay, forage), and the daily frequency of meals provided to the horses. Owners, handlers, trainers, riders, and anyone who interacts with horses on a daily basis were questioned about the type of housing in which the horses lived and the feeding frequency. Athletes were asked if they had observed anticipatory behavior in the different sports they participated in, such as jumping, barrel racing, and riding. When the responses regarding "emotions experienced by horses during the expression of anticipatory behavior" were vague, participants were asked to provide examples of observed behaviors in horses and discuss well-known indicators of the observed emotions.

5.2.3 Data analysis

Data analysis followed the methodology mentioned in Chapter 3.

5.3 RESULTS

5.3.1 Description of horse management

Many equine practitioners and enthusiasts in this study reported keeping the horses under their care in stalls or pastures, with only a minority housing them exclusively in stalls or in pastures. A few participants mentioned that their stalls were designed to allow visual contact between the horses. While many participants said they offered their horses up to three daily meals, the frequency of meals varied from 2 to 6 meals per day (Table 3).

Table 3: Description of the housing conditions and frequency of daily meals where horses were raised according to participants

Demographic characterisation of the environments where horses were raised.	**n**	**%**
Housing conditions		
Only stall	1	4%
Only paddock/pasture	4	17%
Stall and paddock/pasture	19	79%
Frequency of daily meals		
2	5	24%
3	6	29%
4	1	5%
5	4	19%
6	1	5%
Variable	4	19%

Source: Author

5.3.2 Equine practitioners and enthusiasts perception about anticipatory behavior and emotions in horses

All participants have observed anticipatory behavior in horses. Their knowledge and perspectives on anticipatory behavior centered around three central themes presented below: "Valence of emotion associated with anticipatory behavior", "Management influences anticipatory behavior" and "Horse factors influencing anticipatory behavior".

5.3.2.1 Valence of emotion associated with anticipatory behavior

When asked about the valence of emotion associated with anticipatory behavior some participants said they believed that the emotions associated with the expression of anticipatory behavior were not entirely negative or positive ("*I think it's positive, yes, I don't see anything bad. But I see that between happiness and anxiety, I think it is more anxiety. And also happiness*". - participant 19), others associated anticipatory behavior just with emotions of negative valence, such as anxiety. And there were also participants who associated anticipatory behavior only with a positive valence emotion, perceiving it as a sign of playfulness, appetite, or joy in anticipation of receiving food.

The belief that anticipatory behavior is associated with negative emotions was prevalent among participants, with nearly unanimous agreement that it is specifically associated with anxiety ("*This anxiety for food to arrive".* - participant 9; "*They get anxious, a lot of agitation, anxiety, excitement*". - participant 10; "*Pure anxiety, thirst to eat, fear of not having it. It's now or never, despair. My perception, just anxiety".* - participant 16; "*I think he tends to be more anxious, because then he doesn't know when he's going to win and it turns out that any bucket bump or little noise that reminds him of a concentrate, can already be a reason for "I'm going to win, I'm going to win", then it turns into euphoria, anxiety".* - participant 26; "*Anxiety. Who doesn't feel anxious for food, right? (laughter)".* - participant 13). However, anxiety was not viewed by all as a negative emotion ("*Of course, at that moment when they are running back to eat the feed, I think it is anxiety. I think it's a form of anxiety, but not that negative anxiety".* - participant 14).

Many participants explained that the high occurrence of stereotypic behaviors, which many considered negative for horses, supported their belief that anticipatory behavior is associated with negative emotions. Therefore, the occurrence of stereotypic behaviors was

cited as an argument to justify this belief. Several participants also noted that the provision of food often triggers an increase in stereotypic behaviors, vocalizations, agitation, and even aggressive behaviors ("*They stomp their feet when they see others being "handled*". - participant 3; "*Knock on the door, do that bear dance, rocking in the stable. eat your own dung".* - participant 6; "*Stabled horse, I can see... they like to hit the trough with their hand, there are some who hit the stall wall, right there with their elbow... I've seen a horse that learns to swallow air, the dance of the bear".* - participant 25; "*They dig, they stamp their paws on the ground".* - participant 5; "*Whinny, slam the hand on the door".* - participant 29; "*He neighs and keeps banging his knee on the door, banging, banging, until he gives him his kibble".* - participant 31; "*Neighing before food [delivery], going around the stall*" - participant 3; "*Making noise, neighing".* - participant 7; "*Some clap their hands, others neigh... others do the bear step, others kick and fight with the horse next to them*". - participant 9). Participants also associated prolonged periods without meals with anticipatory and stereotypic behaviors and negative emotions ("*At the moment they are there in fasting, it's a little more distressing, 'I'm hungry, oh'".* - participant 19"; "*He is calmer, I reduced the concentrate, but I increased the hay, he has more volume at night".* - participant 23; "*So the periods are very strict here, at 6 am we have the first meal, then at 1 pm and then at 7 pm. When it's around these times, it's common for them to neigh*". - participant 30).

The word cloud (Fig. 1) highlights the words most frequent cited by participants when describing anticipatory behavior in horses. Whinny was the term most cited by participants, followed by kick and dig.

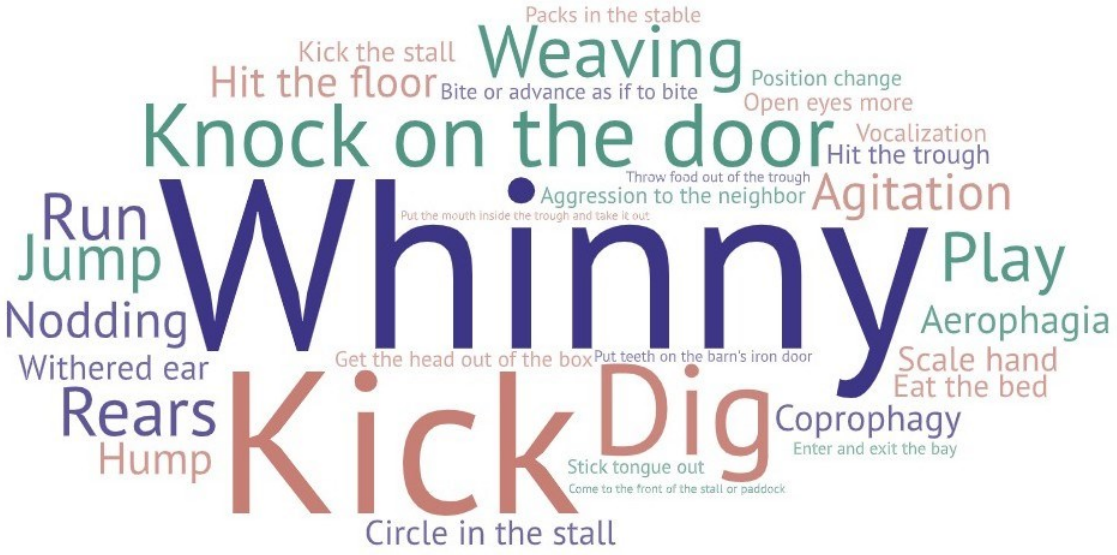

Fig. 1: Cloud of words with the most frequent words used by participants to describe anticipatory behavior in horses.

Few participants believed that horses experience a positive emotion while exhibiting anticipatory behavior. These individuals associated such behavior with positive valence emotions, often describing the horses as playful ("*Jump, play, kick... I want to believe it's positive*". - participant 1), joyful (*"It's not a sign of stress... many times also with joy. I've seen joy from receiving the food*". - participant 21) or content ("*Maybe it's like a puppy when you get home, he gets excited too, he's euphoric. I would say it would be a positive feeling for the animal. I will get food that I like*". - participant 9). Some participants described anticipatory behavior as an indicator of good horse's welfare ("*My horses here are agitated to receive food, if at the time of treatment I see that they are a little quiet, I already know that there is something bothering them, there is something pain, something like that*" - participant 31). Interestingly, some participants who argued that anticipatory behaviors are associated with positive valence emotions provided examples that contradicted their own conclusions ("*He was super agitated in the stable, withered ear like angry, ... neighing a little bit, very normal, very routine… But I judge a positive action, it's very positive for them ... I think they get anxious, for sure, that's a fact. Anxiety for something. Anxious waiting a lot for that to be done at once*". - participant 1; "*I think they're happy. Unless the two are together in the same place, then mine hits the other, doesn't let him get close. We see it as if it were jealousy or to protect his food... But it's not a big deal either*". - participant 14).

5.3.2.2 Management influences anticipatory behavior

Participants, explained that the type of management a horse receives and the subsequent stress he experiences are the primary factors that influence whether a horse will exhibit anticipatory behavior ("*There are horses that really stress themselves out a lot, there are horses that kick wall, they keep trying to bite the partner next to them and they can't reach it, so for the horses it's a very stressful time. This is also very much linked to handling… I think it depends a lot on proper handling".* - participant 27; "*Nothing, no stress. I'm sure it's due to my treatment of the 5 fractional daily meals, and the stall, the first sees the last*" - participant 7).

Participants acknowledged that the strict feeding routine used in the farms could trigger anticipatory behavior in horses. However, most of them also believed that maintaining a strict feeding routine could help prevent colic and that it is necessary, beneficial, or even essential for the welfare of horses ("*The ideal is to have a routine".* - participant 3; "*Shed that is well organized, that he obeys that part of the routine, the animals tend to wait for that calmer moment".* - participant 26; "*I think horses like routine... Doing this deal religiously at the same time and in the same order of horses. The first one knows that he will eat first and the last one knows that he will eat last*". - participant 18; "*Do you want to make the horse happier, in better condition? You have to have a routine. And routine presupposes anticipation".* - participant 16).

Some participants associated anticipatory behavior to hunger ("*Only when they're hungry".* - participant 3) and to types of feed ("*Usually, before feed and oats. It is not so much in bulky*". - participant 9; "*I think that they do more agitation for feed, oats, more than roughage".* - participant 10), especially those that provided excessive energy ("*It's corn, alfalfa gives a lot of energy and I think it doesn't increase the agitation much, but it increases the energy, if you don't work, they get anxious, they have a lot of energy in the stable, agitated, right?*" - participant 11). Despite being aware that concentrated feed provides more energy and can make horses agitated, all participants who owned or managed horses reported providing concentrated feed in at least one daily meal. Some participants noted that the high palatability of the concentrate compared to the forage could impact the expression of anticipatory behavior, by making horses more anxious ("*But whenever the concentrate arrives, the anxiety is much greater than for the roughage (...) It is a sign that the concentrate is more palatable".* - participant 15; "*The horses that were grazing, even eating all day, when the concentrate arrived, they were anxious".* - participant 15; "*The smell, even concentrates*

that contain molasses, which are sweeter, have grains. They are more anxious, euphoric, to receive the concentrate than the roughage". - participant 26; "*Yes, but for concentrate more, because they love the concentrate*" - participant 28).

For some participants, anticipatory behavior was associated with stressful housing conditions ("*Before being released into the paddock, they do a little [anticipatory behavior]. Some do more. Then it is already related to the stress in the stall, being confined".* - participant 10; "*I think it's bad management of the stable, this agitation... I think this is a management failure, not an addiction or anxiety".* - participant 19; "*Then I always offer the hay first to the horses in the pits, who are more anxious, and then I'll offer it to the others who are in the paddocks, who are already calmer. Anxiety is less".* - participant 21). Some participants mentioned that in more open housing environments, such as paddocks and pastures, horses exhibit less anticipatory behavior ("*Those in the paddocks are much calmer, and those in the stall, they already call, asking, more anxious and everything".* - participant 20.

When asked about the changes they made to mitigate the anticipatory behavior, the participants mentioned: feeding the horses at night ("*We replace the hay at the end of the day so that they spend the night eating, until the end of the day there is left over*." - participant 29); feeding the horse with stereotypic behaviors first ("*Before changing the stall from the filly that is agitated to the first stall, she was more agitated. Now there is no time for her to be so agitated. She would jump if another horse came close at the time. She was making a circle in her stall, she kicked, jumping, playing, extremely agitated, really joking. Now she's much calmer, because food arrives first for her. But she gets anxious, no doubt, anxious, agitated*." - participant 1) or with abnormal behavior first ("*I have a mare here, I have to treat her first, otherwise she breaks everything*." - participant 8).

5.3.2.3 Horse factors influencing anticipatory behavior

Participants frequently discussed the individuality of horses, specifically mentioning how temperament and personality relates to the expression of anticipatory behavior. All participants agreed that horses possess unique personalities, but the terminology used in the horse world to describe these characteristics, such as personality, temperament, spirit, or hot-bloodedness, might have caused some confusion. Some noticed the impact of a horse's personality on anticipatory behavior through changes in their behavior and many said that horses that are anxious express more anticipatory behavior ("*This agitation depends more on*

the personality… there are horses that stay quiet and wait". - participant 31; "*Usually these horses that do this behavior… noise… they hit the wall… they behave differently to receive food, they are animals with different temperaments".* - participant 7; "*The most restless [horses], if they don't work for a long time, they want to eat".* - participant 14;"*It has some peculiarities. There's a horse over there that's a little more annoying, and he arrives on time, if he's a little late, he stays at the door there, neighs and bangs his knee on the door, banging, banging, until he gives him his feed*". - participant 30). Others argued that socially dominant horses express more anticipatory behavior ("*Usually the dominant ones there are more agitated, and those who are submissive in the herd, tend to wait. Whenever you're arriving with food, the leader neighs "look I'm here". It's not a sign of stress, it's a sign of who is the leader".* - participant 21).

5.4 DISCUSSION

All participants in this study were familiar with anticipatory behavior towards a food reward and reported observing this behavior in horses under their care, showing how commonly anticipatory behavior is observed in horses. Most of them believed that anticipatory behavior is associated with negative valence emotions in horses and justified this view based on their observation of various behaviors that they believed to be associated with negative emotions, as part of anticipatory behavior. These included stereotypic and aggressive behaviors, as well as vocalizations. On the other hand, some participants expressed the belief that anticipatory behavior is associated with positive emotions. The lack of consensus on the valence of emotion associated with the expression of anticipatory behavior both in the scientific literature and among experienced equine practitioners and enthusiasts reflects the difficulty of deciphering emotions in non-verbal animals. This difficulty comes from the lack of systematic evaluation of stimuli associated with anticipatory behavior. For instance, emotions can be positive or negative valence and high and low arousal according to the stimulus. Therefore, future studies should be carried out using indicators of emotional states to validate the valence of emotion associated with the expression of anticipatory behavior.

The most mentioned behaviors displayed during anticipation of food in horses by participants were vocalizations, aggressive and stereotypic behaviors. Whinnies, which were frequently cited by participants in anticipation of food, can be expressed in both positive and negative situations (BRIEFER et al., 2017; LEMASSON et al., 2009). In the study of WAITT and BUCHANAN-SMITH (2001), a delay in supplying food to burrow-tailed monkeys

resulted in an increase/intensification of occurrence of stress-related behaviors, including vocalization. Other studies also reported aggressive behaviors as part of anticipatory behavior in several species (horses: HINTZE et al., 2017; PANNEWITZ; LOFTUS, 2023; baboons: WASSERMAN; CRUIKSHANK, 1983; stump-tailed macaque: WAITT; BUCHANAN-SMITH, 2001; calves: JOHANNESSON; LADEWIG, 2000) and stereotypic behavior (horses: RICCI-BONOT; MILLS, 2023; ZUPAN; ŠTUHEC; JORDAN, 2020). The occurrence of stereotypic behaviors may have led the participants to classify the emotion associated with the anticipatory behavior as negative, as they classified the stereotypic behavior as negative for the horses. Indeed, stereotypic and aggressive behaviors are cited in the scientific literature as indicators of negative emotions (MAURÍCIO; LEME; HÖTZEL, 2023). SPRUIJT et al. (2001) suggest that due to the self-rewarding nature of both anticipatory and stereotypic behaviors, anticipatory behaviors can "replace consummatory acts and evolve into stereotypic behavior". The majority of participants reported providing concentrated feed to the horses 2 or 3 times a day, and keeping them in stalls or stables for long periods of time. This could potentially account for the high frequency of stereotypic behavior cited. For example, the natural behavior of a horse is spending 16h/day eating through free grazing, which is completely different from a stable life. In the stalls, the horse is fed 2 to 3 times a day, often in a trough that is built at an inappropriate height that interferes with feeding behavior and digestion. These inappropriate conditions can lead to the development of oral stereotypic behaviors. Oral stereotypic behaviors are hypothesized to be attempts by horses to increase saliva production, thus reducing gastrointestinal acidity (NICOL, 1999); stomach acidity can also be induced by prolonged intervals between meals and inadequate diets with limited forage content (MCGREEVY et al., 1995b). Some participants expressed concern about the long periods without meals that horses experience, particularly at night, that may explain the high occurrence of vocalizations, stereotypic and aggressive behaviors. This concern shows how participants linked vocalizations, stereotypic and aggressive behaviors to negative emotions and poor welfare.

The frequent observation of stereotypic behaviors in horses may explain why manyt participants considered anticipatory behavior to be associated with a negative valence emotion, such as frustration. Indeed, the occurrence of stereotypic behaviors during the expression of anticipatory behavior in horses suggests that anticipatory behavior is associated with frustration (COOPER et al., 2005; COOPER; MCDONALD; MILLS, 2000; NINOMIYA et al., 2004; SARRAFCHI; BLOKHUIS, 2013) and chronic stress (LUESCHER et al., 1991; MCGREEVY et al., 1995b). Animals may exhibit increased activity and

investigative behavior when anticipating a pleasant experience and reduced activity when anticipating an aversive experience (SPRUIJT; VAN DEN BOS; PIJLMAN, 2001). This behavioral response reflects if an animal enjoys a reward or not, because it precedes the reward (SPRUIJT; VAN DEN BOS; PIJLMAN, 2001; VINKE; BOS; SPRUIJT, 2004) and the animal's motivation for obtaining the resource (SPRUIJT; VAN DEN BOS; PIJLMAN, 2001). Some authors suggest that anticipation is associated with a negative emotion related to frustration if the reward expected is delivered with some delay. The positive expectation of the reward is replaced by a negative state, such as frustration, due to feeding expectations not being fulfilled (ANDERSON et al., 2020; PETERS; BLEIJENBERGC; DIERENDONCKA, 2012; ZUPAN; ŠTUHEC; JORDAN, 2020). Frustration may be observed in the form of stereotypic behaviors (PANNEWITZ; LOFTUS, 2023), short-term behaviours (PETERS; BLEIJENBERGC; DIERENDONCKA, 2012; ZUPAN; ŠTUHEC; JORDAN, 2020), increased locomotion, muscle tension (PANNEWITZ; LOFTUS, 2023), facial expressions such as eye white increase and lateral, and caudal rotation of the ears (RICCI-BONOT; MILLS, 2023).

Participants that believed that the emotion associated with the expression of anticipatory behavior in horses was of positive valence cited stereotypic and aggressive behaviors as examples. In addition, some considered these behaviors normal. We suggest that these participants may not have considered anticipatory behaviors to be associated with a negative emotion, because they similarly did not associate other abnormal behaviors with negative emotions. Play behavior, cited by the participants as justification for the belief that anticipatory behaviors would be associated with a positive valence emotion is considered an expression of good welfare (BOISSY et al., 2007; FRANCHI et al., 2023; HELD; ŠPINKA, 2011). Play behavior can be considered a way to release chronic stress (BLOIS-HEULIN et al., 2015; HAUSBERGER; LESIMPLE; HENRY, 2021).

Anticipatory behavior related to food delivery has been widely studied in animals living on a predictable feeding schedule and routine (BASSETT; BUCHANAN-SMITH, 2007; CHINCARINI et al., 2018; EDWARDS et al., 2019; PETERS et al., 2012). Participants held a common belief that having a routine is essential for the welfare of the horses. However, predictable routines can be detrimental to animals bred in captivity due to lack of motivation and inactivity (NOGUEIRA; NOGUEIRA-FILHO, 2018) and may result in increased abnormal behavior before feeding (BLOOMSMITH; LAMBETH, 1995) and indicate negative emotional states in some cases associated to boredom-like, for instance (FUREIX; MEAGHER, 2015). On the other hand, they may be beneficial for providing security against

predators and food (NOGUEIRA; NOGUEIRA-FILHO, 2018) and for not being so stressful (ULYAN et al., 2006) and less potential of generating frustration in these animals (JOHANNESSON; LADEWIG, 2000) as unpredictable routines. ZUPAN et al. (2020) suggested that since unpredictable routines lead to the loss of temporal predictability and to behaviors related to anticipation and frustration in horses, routine should be predictable for the species. Study participants also highlighted predictable routines as positive for horse welfare, however routines can serve as triggers for anticipatory behavior, as horses develop high expectations of food in response to consistent patterns; this can be particularly challenging for horses that lack control over their environment. Giving opportunities for horses to express highly motivated behavior, for example through environmental enrichmet, can improve their welfare even if they are living in a predictable routine.

The recognition of negative behaviors and emotions associated with predictable routines and inadequate housing and feeding was not a driving force behind changes in the routine and practices of the participants. For example, on one hand participants expressed the belief that the emotion associated with anticipatory behavior is negative and that routine triggers the expression of this behavior, but on the other hand they argued that the routine would be beneficial for horses. On the contrary, we identified a strong normalization of anticipatory behavior on the part of the participants. This type of normalization of detrimental aspects of farm animal welfare by humans is not uncommon (ALBERNAZ-GONÇALVES; OLMOS; HÖTZEL, 2021). It is possible that contradictions in the participants' statements may have emerged because the interview was their first opportunity to contemplate the practices they employ in horse handling in relation with anticipatory behavior. This assessment may have generated psychological discomfort, in the form of cognitive dissonance (FESTINGER, 1962). This discomfort may have also led some participants to employ better practices, such as providing food during the night to reduce the interval between meals, as reported during the interviews.

Feeding horses overnight is a measure that can improve the welfare of horses that spend long periods fasting. However, humans may not be aware of this need for horses at night (HAUSBERGER; LESIMPLE; HENRY, 2021), since the physiology of humans and horses with regard to the frequency of feed intake is completely different (MILLS; MCDONNELL, 2005). Another change cited by participants was feeding the horse with stereotypic and abnormal behaviors first. This is a change that can be successful, as it can "remove anticipation and frustration", as quoted in the work of MCBRIDE and LONG (2001).

The role of intrinsic individual factors, such as personality and social dominance, in

triggering anticipatory behavior in horses was discussed by many participants. RICCI-BONOT and MILLS (2023) suggest that there must be differences in the individual responses of horses to anticipation, although in the experimental study of PETERS et al. (2012) no such differences were observed. Future studies could investigate whether practices mentioned by participants, such as respecting social hierarchy or providing food first to the horse considered dominant, mitigate the anticipatory behavior of horses. The influence of personality on the expression of anticipatory behavior in horses can also be studied, for example through behavioral and physiological responses, such as measurement of dopamine levels and spontaneous blink rate, which reflects personality traits such as anxiety (ROBERTS et al., 2016). In this study, we did not ask participants about their understanding of anxiety and whether they considered it a positive or negative emotional state. We suggest that future studies investigate what people involved with horses understand by anxiety and the valence of the emotional state.

5.5 CONCLUSIONS

The opinion of experienced equine practitioners and enthusiasts interviewed in our study supports the hypothesis that anticipatory behavior to a food reward triggers negative valence emotions in stabled horses. Most people were aware of anticipatory behavior towards a food reward and were able to easily recognize it in the horses under their care. They also recognized behaviors associated with negative emotions, such as aggressive and stereotypic behavior. The way horses were handled, housed and fed by participants was consistent with the occurrence of anticipatory behaviors. However, despite recognizing these managements and emotions as negative for the animals, the participants considered that maintaining the routine is essential for good welfare and, most importantly, they did not intend to change.

The lack of consensus regarding the valence of emotion associated with anticipatory behavior in horses identified among equine practitioners and enthusiasts is shared by scientists, reflecting the difficulty in assessing emotions in animals. New empirical studies could shed light into this question. However, perhaps more important than determining the emotional valence of this behavior is to understand how to change attitudes and behaviors of people towards practices that they recognize as harmful to horses. Therefore, the challenge is to understand why caretakers do not implement changes in equine management practices that they recognize as detrimental to the welfare of the animals.

6. GENERAL DISCUSSION

In this thesis, I explored the knowledge, beliefs, and attitudes of practitioners and equine enthusiasts towards horse behavior, emotions, and welfare. While these individuals possessed knowledge about practices that promote or harm horse welfare, perceived barriers, mainly financial and social, hinder the transition to better practices. Common practices, such as isolating horses in stalls and providing few daily meals with excessive concentrate and limited roughage, may lead to anticipatory behaviors in horses. These behaviors are considered associated with negative emotions, but people showed little intention to change such practices.

Researchers of emotions in horses and other animals continue to make significant discoveries, based on the understanding of emotion biology and physiology in humans (PAUL et al., 2020). Though it is challenging to identify emotions in non-verbal species, various physiological (SAFRYGHIN; HEBESBERGER; WASCHER, 2019), behavioral (STOMP et al., 2018) and cognitive biases (JONES et al., 2018; MENDL et al., 2009) indicators are available to measure emotional valence. Technology has aided this field, with the use of electrocardiograms (ROCHAIS et al., 2018), biochemical analyses (GONTIJO et al., 2018) and thermographic measures (REDAELLI et al., 2019). There is also evidence that emotional contagion in horses, assessed using these indicators (TRÖSCH et al., 2020), is a step toward understanding animal empathy, a challenging aspect to prove (DE WAAL, 2008). Interpretation of emotional indicators in horses requires careful consideration of evolutionary history of the species, the individual's "Umwelt," the horse's perspective on context and valence of the stimuli, as well as identifying the actual stimulus triggering the response, the simultaneous use of multiple indicators to assess horse emotional states, and considering whether the horse is suppressing behavioral responses due to training. Negative emotional indicators, such as aggressive and stereotypic behaviors, are recognized by equine practitioners and enthusiasts in their daily practices, revealing their awareness of the impact of management practices and horse use on horses' welfare. Unfortunately, this understanding has led just a few individuals to change practices, as shown in this thesis.

An important welfare indicator in horses is stereotypic behavior. These behaviors are associated with impoverished and suboptimal housing and management conditions (MCBRIDE; HEMMINGS, 2005). Several factors contribute to stereotypic behavior development (SARRAFCHI; BLOKHUIS, 2013; SEABRA et al., 2021), and a combination of these factors, such as feeding (NICOL et al., 2002) and inadequate housing conditions

(DAI et al., 2023), as well as different stress-inducing work types (HAUSBERGER et al., 2009), and individual aspects like stress-sensitive breeds (OLSEN; KLEMETSDAL, 2017), can trigger it. Stereotypic behaviors serve as indicators that the management use of the horse is wrong. Considering the causes of stereotypic behaviors as multifactorial is not sufficient help in raising people's awareness and motivate them to implement changes in management practices. Studying this behavioral problem as if it were a complex interplay between intrinsic factors of the horse and external factors related to management, rather than trying to isolate causal factors, may help advance change. Considering all the factors involved in this vicious circle, there will never be solutions to such a huge problem; but considering the Five Domains (MELLOR et al., 2020), small steps can include providing adequate diet, housing conditions where the horses are free to move around, keeping them free from diseases, allowing them to express natural behaviors such as wallowing and socializing with other horses, and promoting positive experiences that benefit positive states of mind, humans can promote the welfare of horses. It is up to humans to interrupt this cycle at its different points, abandoning management practices already condemned from the point of view of animal welfare and which are known to be associated with the development of stereotypic behaviors.

The results from this thesis suggests that practitioners and enthusiasts in the equestrian world can be divided into at least four groups: individuals who maintain practices and have no intention of changing; individuals who had not considered the effects of management practices but started evaluating them during qualitative interviews; individuals who feel the need to change but have not yet taken action; and individuals who have evaluated harmful management practices and have either altered them or abandoned the system. From this vision of the 4 groups, this work serves to base future studies with a larger number of participants that can confirm this and better understand these groups, with the hope of being able to propose interventions. The study participants demonstrated knowledge about aspects related to horse welfare, such as health, mental states, and human-horse interaction (FRASER, 2008; MELLOR et al., 2020) with a particular focus on ROLLIN's teleological conception (2007) which considers respecting the nature of the horse in its use.

Many common habits shared by the equestrian community are based on tradition and passed down through generations, representing social practices that are rooted in values and beliefs of a social system (SHOVE; PANTZAR; WATSON, 2012). The outcome of the interplay between resources, the culture of horse use, and knowledge regarding practices that promote or harm horse welfare can explain why some practices persist over many years in the equestrian field while others evolve. Awareness among stakeholders, media coverage

(RADMANN; HEDENBORG; BROMS, 2021), public pressure, and social license to operate (HELESKI, 2023), can collectively serve as drivers for change.

Even with this knowledge, most participants were not motivated to change management practices that harm horse welfare. Perceived barriers to implementing better practices were associated with a lack of resources (financial, physical space, qualified labor, time, tools, and knowledge), as indicated by other studies (CARDOSO; VON KEYSERLINGK; HÖTZEL, 2016; PRICKETT; NORWOOD; LUSK, 2010; SCHUPPLI; SPOONER; KEYSERLINGK, 2023; VANHONACKER et al., 2008), and the primacy of human's personal goals over the welfare of the horse. The participants justified their practices based on the value of the horse. The perceived barriers by the participants were considered insurmountable by the vast majority, especially when related to horses of low economic value. The perceived barriers regarding horses of higher economic value, such as breeding, sports, and exhibition horses, were attributed to potential benefits for the horse itself, but still reflected the primacy of human's personal goals over the welfare of the horse. Except for two participants who expressed that their moral values led them to change their attitude, such as leaving the equestrian competition system, the other participants accommodated dissonant attitudes and opinions. Some contradictions among people may reflect discomfort between opinions and attitudes, leading them to change.

The lack of consensus on the valence of emotion associated with anticipatory behavior in horses reflects the difficulty in assessing emotions in animals, which is shared by lay people and scientists. Qualitative research about knowledge, beliefs and attitudes of equine practitioners and enthusiasts help us to understand people's reasons for preserve practices that can harm animals' welfare (e.g. pigs: ALBERNAZ-GONÇALVES; OLMOS; HÖTZEL, 2021, cattle: BASSI; GODDARD; PARKINS, 2019; CARDOSO; VON KEYSERLINGK; HÖTZEL, 2017; HÖTZEL; SNEDDON, 2013; YUNES et al., 2021).

It is crucial to continue discussing the impact of management practices and the use of horses on their welfare. There are no longer any excuses for not implementing significant changes in our relationship with these animals. The transformation of practices will occur when humans challenge the common sense that the welfare issues horses face are acceptable.

7. CONCLUSIONS

Harmful practices for the welfare of horses are recognised as such but preserved due to perceived barriers involving lack of resources or primacy personal goals of humans over

welfare of horses, and group social norms that embrace beliefs that such practices are a necessary evil accepted within equestrian culture, especially if they are related to the preparation of higher value horses, such as those used in sport and breeding.

The isolation of horses in stalls and the provision of an inadequate diet through a few daily meals are practices recognized as being associated with the expression of anticipatory behavior. Although normalized in the equestrian environment, this behavior is a clear sign of impoverished animal welfare, but one that people do not intend to change.

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APPENDIX A - SCRIPT INTERVIEW ABOUT HORSE WELFARE

Supplementary material - Beliefs, knowledge and attitudes of equine practitioners and enthusiasts regarding horse welfare

- Demographic information:

1) Level of education

Elementary school
University education
Post graduate

2) Sex

Feminine
Masculine

3) Time of experience with horses

Between 1 and 5 years
Between 6 and 10 years
Between 11 and 20 years
More than 20 years

4) Type of contact with the horse

Owner
Handler
Veterinarian
Zootechnist
Student
Researcher
Equestrian athlete

Trainer

5) Number of horses you have contact with

Between 1 and 5 horses
Between 6 and 10 horses
Between 11 and 20 horses
More than 20 horses

6) Type of work your horses are employed in

Horsemanship
Resarcher
Mounted police
Tour
Rural/adventure tourism

- Knowledge, beliefs and attitudes about anticipatory behavior in horses:

1) What do you understand about the welfare of horses?

2) What obstacles prevent people from taking actions that they believe are beneficial to horse's welfare?

APPENDIX B - SCRIPT INTERVIEW ABOUT ANTICIPATORY BEHAVIOR IN HORSES

Supplementary material - Beliefs, knowledge and attitudes of equine practitioners and enthusiasts about anticipatory behavior in horses

Script interview:

- Type of management used:

1) How is the horse bred?

Stall
Pasture
Paddock

2) How is the architecture of the stall/stable?

All concrete
There are windows between the stalls that allow visual contact between the horses

3) How many meals does the horse receive per day?

3
4
5
6

4) Is the horse fed with commercial concentrate?

Yes
No

- Knowledge, beliefs and attitudes about anticipatory behavior in horses:

1) Have you observed anticipatory behaviors in the horses?

Yes
No

2) What kind of emotion do you believe the horse is feeling when it expresses anticipatory behaviors?

Positive
Negative

3) If you believe that anticipatory behaviors are related to a negative emotion, what could be done to promote a positive emotion?

4) What behaviors or signs do you observe during the expression of anticipatory behaviors in the horse?

5) What makes horses express anticipatory behaviors?

6) Do horses feel anxiety?

Yes
No

7) Do anticipatory behaviors in horses occur more frequently at certain times of the day or on specific days?

Yes
No

8) If so, at what times?

9) Can any handling practices be related to the expression of anticipatory behaviors?

Yes
No

10) If so, which management practices may be related to the expression of anticipatory behaviors?

11) What do you understand about the welfare of horses?

12) Do you believe that anticipatory behaviors can affect the welfare of horses?

13) Do horses have different personalities?

Yes
No

14) If so, does the personality of the horses influence the way they express anticipatory behaviors?

Yes
No