The Effects of Weaning Related Stress on the Emotional Health of Horses

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Abstract

Domestic weaning processes have the potential to cause intense distress in both mares and foals particularly when the mare and foal are separated abruptly and isolated in a confined space. This distress can create patterns of emotional dysregulation that could have long-term welfare implications. In wild and semi-feral herds, the physical separation of foals from their mothers does not usually occur until they reach sexual maturity at 2-3 years old and go off to form their own herds. Physically separating foals from their mothers at 6 months old in domestic circumstances can cause a range of stress related behaviours such as stereotypies and increased vocalization and defecation during the weaning process. However, progressive separation, where mares and foals spend a brief time away from each other daily, can not only reduced the intense distress experienced by abrupt forms of separation but the health of the mares has shown to improve where progressive weaning separation appears to reduce the likelihood of mastitis. The aim of this thesis was to establish evidence to develop an equine weaning welfare assessment tool.

A narrative literature review was used to capture the background and current understanding of weaning and to establish what was being used for welfare assessment in weaning related research. The first phase literature review identified a lack of use of welfare assessment tools in equine weaning research. The most common assessment tool used in equine behaviour reasearch is an ethogram used largely to assess pain in ridden horses.

A scoping review was conducted to identify and collate the available evidence on the long-term effects and methods of weaning. Systematic searches were conducted in three scientific databases. 366 publications were identified; 22 were retained for inclusion and charting. 18 studies reported behavioural measures, four only reported physiological measures and 12/22 studies used a combination of both. 15 studies analysed foal behaviour only (15/22), six analysed foals with their dams and one analysed the mare only. Duration of most studies (19/22) was a maximum of 12 months post weaning; three studies continued measurements until the foal age was 3-4 years old.

Finally focus groups were conducted with professionals working in rescue organisations, managing mare/foal populations. This enabled the gathering of first-hand experience and insights from focus group participants. One organisation was into the second year of assessing welfare in relation to a new and progressive form of weaning separation. They had noticed more positive outcomes than the previous forms of abrupt and isolating separation that they had used in the past. Not only was there a reduction of acute and intense distress, but there was also a reduction in mastitis in the mares that had saved the charity money on medications. The organisations consistently reported that they weren’t using official welfare assessment tools however and were relying on caregiver observation of perceived positive or negative emotional states.

This combined approach to gathering data has highlighted that there is a gap for future research to create a welfare assessment tool specifically for weaning that could be used ongoingly throughout the horse's lifetime. The experience of industry professionals involved in the weaning of mares and foals agrees with the research that abrupt and isolating forms of weaning separation are likely to cause the most intense distress and therefore present a potential welfare issue.

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Chapter 1. Review of the Literature

1.1 Is Domestic Weaning Stressful?

The domestic weaning process is considered one of the most stressful events in the life of a young horse (Apter & Householder, 1996), and some researchers believe that stress at weaning is unavoidable (Delank *et al.,* 2023). The level of stress placed on the foal at weaning has the potential to create lifelong behavioural problems (Henry et al., 2020) and therefore presents a potential welfare issue (Waran et al., 2008). The process of weaning horses varies according to the environment they are born in to. Large commercial facilities such as racing studs may have a completely different approach to weaning for example than an individual owner who is breeding a foal for themselves from their own mare. Time constraints, finances, and facilities all influence the different approaches to weaning, and more research is needed to identify the factors that influence both good and compromised welfare in both the foal and the mare.

1.2 Weaning as nature intended

Models of measuring and assessing animal welfare have traditionally centred around the expression of ‘natural behaviours’ where possible, within the confines of domestic circumstances (Hothersall & Casey, 2011). Achieving good welfare requires a balance of the necessary restrictions of domestic life alongside the freedom to express naturally occurring behaviours (Goodwin, 1999). All activities involving animals are under the scrutiny of public opinion which is often referred to as the social license (Fiedler and Slater, 2024). Anything that the public perceives as a welfare issue can quickly come into

focus especially in the case of ridden horse deaths during racing or acts of abuse during training. This presents animal related industries with a challenge to operate ethically and increases the need and demand for evidence-based methods of husbandry and training (Hampton et al., 2020). Equine behaviour related research is incredibly sparse compared with other species such as dogs, cats, and farm animals and this presents both a challenge and an opportunity for anyone aiming to contribute to and grow the body of research. One of the growing areas of interest in Equine behaviour is early years experiences and how welfare standards can be improved during these formative periods (BHF, 2024). All young horses must go through many new experiences and adapt to environments and expectations that may contradict their natural tendency towards claustrophobia and neophobia (Carroll et al., 2022). Even horses that are not destined for a ridden career will, for example, to have their feet trimmed by a farrier for the first time and have health checks and vaccinations from a vet for the first time. If horses aren't introduced to these experiences with an understanding of how they learn and process new information, anything that may be taken for granted within the human environment has the potential to become a source of conflict between horse and handler (Carroll et al., 2022). It is important therefore, that the introduction of new experiences is done with awareness of how horses learn and process their environment. Horses born in natural conditions whether in wild or semi managed herds, tend to form close bonds with their parents that only end when the young horse reaches sexually maturity and is ready to go off and form their own herds (Mills & McDonnell, 2005). Both mares and stallions have active daily roles in the upbringing of

foals and young horses, and it appears that younger siblings also have a regulatory effect on the suckling behaviour of foals (Henry *et al*., 2020). A study conducted by Henry *et al*., (2020) observed a semi wild herd of Icelandic ponies and concluded that foals ceased sucking between the ages of 9 and 11 months old. All the mares in the herd gave birth to another foal during the observation period which limits the understanding of how foals might regulate their suckling behaviour in the absence of a new foal on the way. The close relationship with the mother didn't cease at the same time as suckling however and the study concluded that the foals remained very closely attached to their mothers until they left the social group at sexual maturity around 2 – 3 years old. This study offers insight into the close bonds that are formed between foals and their mothers beyond the need for nutrition. Interactions between foals and stallions have been shown to provide opportunities for foals to develop through play. In one study of semi feral Exmoor ponies, stallions were shown to receive more friendly interactions from foals than mares and appeared to be more tolerant and playful towards the foals than the mares were (Sandlova *et al.,* 2020)**.**

1.3 How are we weaning currently?

There are several ways that foals are weaned from their mothers in domestic situations. The most traditional method is to remove the mother from the stable and close the foal in on its own, this is known as the abrupt weaning method (Apter & Householder, 1996). Sometimes more than one foal is left in a single stable and there is also the group method where herds of foals are housed together in paddocks or barns after the removal of the mothers (Rogers et al.,

2004). Those methods that involve progressive separation where the mare and foal spend a short time apart during the day, building the time up slowly until the point they are totally weaned are becoming more popular in response to the growing body of research (Lansade *et al.,* 2018: Henry *et al.,* 2020).

A study by Heleski *et al*., (2002) found that weanlings that were group–housed in paddocks had more optimal welfare than weanlings single–housed in stalls. Welfare was measured through the observation of behaviours including aberrant or displacement behaviours and by measuring faecal cortisol levels in the two groups of foals. This study only used 12 weanlings, so the sample size was small. The researchers only took measures up to 56 days post weaning, so the long-term impacts weren't measured. Stall weaning of individual foals has shown to be less stressful than weaning pairs of foals in stalls where they tend to show aggression towards each other (Apter and Householder, 1999). This suggests that any group based weaning methods require open spaces to allow for the usual herd-based conflict and resolution dynamics. Normando *et al* (2022) concluded that pairs of 5-month-old foals were more stressed at weaning than 7-month-old foals in groups. Another important factor to consider is the presence of other adult horses during the early stages of the weaning process. A study conducted in 2012 looked at two groups of foals going through the weaning process. One group consisted of foals plus unrelated adult horses and the other, just a group of foals. The group with unrelated adults showed significantly less stress related behaviours such as wood chewing and vocalisation and displayed significantly less aggression toward their peers (Henry *et al.,* 2012). This study only measured stress

markers for one month post weaning so the long-term differences between the two weaning methods isn't clear. The sample size of 32 foals was also quite small. The results, however, suggest that optimal weaning should include the presence of adult horses once the mother has been removed. It has been shown that domesticated young horses not only benefit from the companionship of adult horses but that the ratio of adults to young horses in a group has a significant impact on regulating aggression and sustaining social cohesion. Instances of aggression decrease up to four times with more adults present (Bourjade et al., 2009). The process of mirroring calm behaviour to reduce arousal states has been shown to work from foals to mares too. A study conducted in 2012 used images of foals with neutral body language to regulate the arousal states of mares that had been momentarily separated from their foals for routine medical treatments. When the phantom foal was shown, stress levels remained almost at baseline levels, when no image was shown, the behaviour scores for 5 out of the 6 ethogram criteria which were agitated, fidgety, anxious, active, aggressive and uncomfortable were significantly higher (Rogers *et al.,* 2012). The sample size of this study was extremely small with only seven mares being observed. There were also intrusive measures used to create the separation with foals being anesthetised before being placed out of sight of the mares which could present a welfare issue. The results do, however, provide further evidence for the importance of having emotionally balanced conspecifics present during stressful experiences. The regulation of arousal states by the presence of adults isn't exclusive to horses. Young male elephants have been shown to come into musth/sexual maturity 10 years earlier than normal when older bull elephants are removed from their

herds for culling purposes. The young bulls have then gone on to demonstrate violent and fatal behaviour towards rhinoceros (Slotow & Van Dyk, 2001). The study of female elephants has produced similar results where the presence of older females leads to successful reproduction, improved behaviour and better decision making of young females (McComb et al., 2011: Lee *et al.,* 2016: Foley et al., 2008). Whilst studies on weaning related stress are consistently limited by sample size and duration, there is agreement across the research that abrupt and in particular isolating forms of weaning separation produce more stress indicators in mares and foals. As herd animals, isolation appears to cause the greatest level of distress and should be avoided where possible to prevent compromised welfare.

The bond between mares and their foals doesn't appear to be altered by domestic separation even after weeks and months have passed which supports the observation of the long-lasting bonds in wild herds (Lansade *et al.,* 2022). After five months separation, a group of colts and fillies were reintroduced to their natal group, and they all approached their dam first and spent longer sniffing her and looking at her. This behaviour was more pronounced in fillies both towards their own dams and the other adult females in the group (Lansade *et al.,* 2022). Gender based differences have been identified across several weaning based studies. Fillies tend to have greater overall stress responses to weaning than colts (Moons *et al.,* 2005: Wulf *et al.,* 2018) and there appears to be a difference in suckling behaviours with fillies suckling more frequently but mares producing more milk for colts (Crowell-

Davis, 1985). This suggests that the impact of abrupt, isolating or premature weaning could be greater on filly foals than colts.

Current research (Henry *et al*., 2020) suggests that foals shouldn't be weaned prior to ten months old and that weaning between four and seven months old in domestic situations should be considered too early. This may present a challenge, particularly to the flat racing industry where horses are sent into training at a year old. The premature weaning of foals may therefore be deemed necessary in this context and changes in husbandry more difficult to implement. The evidence that weaning foals is best done in groups with a proportion of adults, in open spaces may present challenges for individual horse owners or hobby breeders that don't have access to other horses or appropriate facilities.

1.4 Nutritional requirements

Besides the need for social connection and stabilised herd dynamics, there appears to be a continuing dietary need in the foal that may drive many of the ongoing attachment behaviours. A study conducted in 1996 discovered that foals fed with a high fat and high fibre diet were less stressed at weaning than foals fed a corn-based diet (Holland *et al.,* 1996). The duration of this study was very limited with measures only being taken up to 72 hours post weaning. The long-term impact on the foals is therefore unknown. The sample size of 44 foals was small but bigger than similar studies. Another study concluded that feeding concentrates after weaning was associated with a 4-fold increase in the incidence of crib biting (Waters *et al.,* 2010). This study was one of the

most reliable within the pool of equine weaning research. It was a four-year prospective study with a sample size of 225 young horses. This enabled the researchers to measure the long-term effects of weaning related stress and to correlate that with the presence of stereotypical behaviours. Increasing the fat content of a horse's diet and reducing the starch-sugar content has also been shown to reduce stress and reduce the startle response in adult horses (Redondo, Carranza and Trigo, 2009) and feeding grain has been shown to decrease the trainability of young horses (Black *et al.,* 2018). In the foal's case the most readily accessible source of fat is the dam's milk. If we are weaning foals earlier than they would naturally wean, careful diet management may not only reduce the stress associated with weaning but may also reduce the development of some stereotypies and support the foal's long-term wellbeing.

1.5 The development of stereotypies

Stereotypies or stereotypical behaviours are described as functionless repetitive behaviours that result from compromised welfare (Tatemoto *et al*., 2022. Although stereotypies are used in research as a measure of welfare, they are generally behaviours that continue to manifest after the original stressor has ceased. They can be considered chronic, post traumatic behaviours that aren't always indicative of current environmental influences. Research has demonstrated that diet and weaning method have an impact on the development of stereotypical behaviours and that the rate of development is highest during the first 9 months of a horses' life (Waters *et al.,* 2010). A four-year study on factors influencing the development of stereotypical and redirected behaviours concluded that foals weaned in stables or barns,

regardless of having companionship were more likely to develop redirected behaviours or stereotypies than those housed in paddocks (Waters *et al.,* 2010). This study also found that feeding concentrates after weaning was associated with a 4-fold increase in the incidence of crib biting and that the foals of high-ranking females were more likely to develop behavioural problems than foals of middle or low-ranking mares. This could be related to the stress of holding rank within a group. This study not only measured the effects of weaning over a four-year period, but the sample size was also 225 young horses. The sample size and duration of this study provides more reliable evidence than most of the similar studies.

1.6 Welfare Assessment Tools

There are several types of tools used for the purpose of assessing welfare in animals that rely on the observation of body language, facial expressions, and motor behaviours. In equine research, assessment tools are mostly used to measure either pain or the behaviour of ridden horses (Dyson, S. *et al.* 2018, Dyson, 2021). The use of assessment tools for measuring stress or behaviour outside the context of ridden work is limited. Tools are often used in conjunction with each other to achieve collaboration and to test the efficacy of emerging tools (Minero *et al,* 2018). Measuring behavioural markers of welfare is often done alongside measuring physiological markers such as blood cortisol levels and this can help to make sense of the results.

Observer training is important when developing welfare assessments. Dai *et al.,* (2020) concluded that 30 minutes of face-to-face training wasn't sufficient to teach an observer without existing horse experience to effectively apply the

horse grimace scale in a welfare assessment. The experience of the observer is important in creating accurate and consistent measurements. It is also important to measure how the presence of an observer impacts or influences the responsiveness of the subject. Torcivia and McDonnell (2020) concluded that caretaker visits to hospitalised horses interrupted discomfort behaviour which could lead to an under estimation of disability or pain. During video monitoring over a 24-hour period, the discomfort behaviours either reduced or stopped altogether when a caretaker approached or interacted with the horses. When they left, the behaviours resumed.

1.6.1 Ethogram

Ethograms are used in ethology to catalogue species – specific actions and behaviours in animals. The behaviours are treated as distinct from one another and are generally limited to the relevant area of research, for example behaviours that are demonstrated during transportation as opposed to feeding behaviours. Ethograms have been used in Equine research largely to measure pain (Dyson *et al.,* 2018: Dyson, 2021: Torcivia and McDonnell 2021) particularly in ridden horses but have shown to be lacking in accuracy as other influential factors such as faulty equipment, training levels of the horse and the skill of the rider have been omitted from these studies. The recommendation is a double-blinded study to address concerns raised (Ladewig *et al*., 2022).

1.6.2 Horse Grimace Scale

The horse grimace scale (HGS) is a tool used to assess pain in horses by independently scoring facial actions/expressions. It has been shown as a

reliable method of assessing pain in relation to castration operations (Dalla Costa *et al.,* 2014), chronic dental disorders (Marcantonio Coneglian, 2020) and during induced acute pain (Gleerup *et al.,* 2015). Another study measured whether emotional states affected the pain related HGS scores of horses and concluded that fear did affect results (Dalla Costa *et al.,* 2017) by creating additional tension in the chewing muscles and changes in ear posture. This suggests that further research is needed to determine whether emotional stress or pain is influencing behavioural indicators.

1.6.3 Human Approach Test

The human approach test (HA) is used to measure human-animal relationships and can be used to gauge the animal's response to a human approaching them or vice versa (Waiblinger *et al.,* 2003). The types of responses measured during the test are indifferent, interested, or aggressive (Sanmartin Sanchez *et al.,* 2020). One study using this test concluded that the way in which humans approach horses has an impact on how they respond with speed of approach being the most influential factor (Birke et al., 2011). Research using HA is more limited than other tools but still offers insight into an important aspect of assessing equine behaviour.

1.6.4 Avoidance Distance Test

The avoidance distance test (AD) measures the distance that an animal begins to withdraw from an approaching human. Research involving horses is extremely limited and tends to concentrate on farm animals (Mazurek et al., 2011: Mattiello et al., 2010) that often don't have the same level of handling

and interaction with humans that horses do. Avoidance based tests have been used to measure the horses' response to stimuli other than approaching humans and have been shown to accurately measure fear in relation to avoidance behaviours (Dalla Costa et al., 2015: Wiśniewska et al., 2021).

1.6.5 Qualitative Behaviour Assessment (QBA)

Qualitative behaviour assessment (QBA) is a method of measuring the emotional experiences of animals by assessing demeanour and body language. It has been used in various domestic animal species such as dogs and farm animals such as calves. Although the use of QBA is limited in equine research, it has shown positive results. Minero *et al,* (2018) researched the effectiveness of QBA in measuring equine behaviour by comparing the results with an avoidance distance test (AD) and a forced human approach test (FHA). There was a correlation between the three tests with horses showing relaxed/at ease in the QBA, showing less avoidance in the AD, and responding less aggressively/fearfully in the FHA. Three observers carried out the assessments across 355 sport and leisure horses. Their inter-observer reliability was initially tested on a live scoring of 95 horses, and they reached a good level of agreement prior to the on-farm assessments. The assessments were carried out across 40 different horse farms with differing management practises which may have influenced differences in the horses' behaviour.

Whilst some previous studies have measured indicators of stress in foals at weaning, such as vocalisation (Wulf *et al.,* 2018) and blood cortisol levels (Holland *et al.,*1996), there is no accepted scale for measuring equine weaning behaviours, and it appears that literature for the mare is virtually non-existent (Falomo *et al.,* 2020). Ethograms have been developed for the weaning behaviours of some species such as pigs and dairy cows (Rault et al., 2015; Neave et al., 2018) but Equine weaning is underrepresented in current research. Qualitative Behaviour Assessment (QBA) has been used in equine behaviour research, but largely alongside the grimace scale and ethograms to measure pain indicators in ridden horses, rather than for weaning or other forms of non-ridden welfare assessments.

1.7 Common Stress Indicators

The most common stress indicators evidenced in current equine research relate to vocalisation, defecation, oral behaviours such as chewing, ear movement, head and neck position, muscular tension, and stereotypies (Wilk and Janczarek, 2015: Lesimple, 2020: Rankins *et al.,* 2022). Time budgets are also used to measure stress (Gorecka-Bruzda *et al.,* 2015) and horses who spend a disproportionate amount of time doing a particular activity or behaviour could be demonstrating compromised welfare. As an example, horses that can freely move around pasture spend up to 18 hours a day foraging which represents 50-60% of their daily time, depending on seasons and weather (Auer et al., 2021). In many domestic situations however, this activity can be reduced to as little as 16% as they are stable kept and fed concentrates alongside forage supplements such as hay (Auer et al., 2021).

1.8 Summary

The aim of this research project is to determine if weaning related stress has a long-term impact on the emotional health and wellbeing of horses and how this is currently being measured. The next part of the project is a scoping review of the literature on equine weaning to determine if there is any existing evidence on the long-term effects. Focus groups have also been chosen to gain industry insights on the current methods of weaning being used and on the use of welfare assessment tools to measure stress. Questionnaires could have been sent out to commercial studs and owner/breeders to gain this type of information or observational visits to observe weaning practices. Due to the often-busy lifestyle of those working in the equestrian industry, a small number of welfare organisations with access to mare/foal groups were instead invited to share their insights through online meetings. This also gave an opportunity to trial the process of using a weaning assessment tool, by offering participants a behaviour chart alongside some video clips of mares and foals at point of separation. Not only were they able to share their own experiences of weaning methods and how mares and foals manage stress, but they were also able to feedback on the use of a new equine weaning assessment tool and how this may work within their organisations.

Chapter 2. Scoping Review

2.1 Abstract

The study presented in this chapter was published on 29/08/2024 Dwyer, J. *et al.* (2024) 'Effects of weaning-related stress on the emotional health of horses—a scoping review', *Equine Veterinary Journal* [Preprint]. doi:10.1111/evj.14412.

Weaning represents one of the most stressful events in the life of a horse. There are a range of weaning methods used and a lack of consensus on how stress and impact are measured.
This element of the study aimed to conduct a scoping review on effects and measures of weaning-related stress on the mare and foal.

Systematic searches were conducted in three scientific databases, and retrieved studies were reviewed against inclusion and exclusion criteria. Study and population characteristics and data relating to health and behavioural outcomes were extracted and charted.

A total of 366 publications were identified; 22 were retained for inclusion and charting. Eighteen studies reported behavioural measures, four only reported physiological measures and 12/22 studies used a combination of both. Fifteen studies analysed foal behaviour only (15/22), six analysed foals with their dams and one analysed the mare only. Duration of most studies (19/22) was a maximum of 12 months post weaning; three studies continued measurements until the foal age was 3-4 years old. There were a limited

number of studies and marked variation in methodologies used. Further research is needed in relation to the long-term consequences of the weaning related stress on both mare and foal.

2.2 Introduction

Equine behaviour is influenced by many social and environmental factors and the stress associated with weaning is considered unavoidable. Although limited, the research conducted on foal weaning has identified several relevant factors that can influence best practice and therefore may improve the welfare of both mares and foals in the immediate term. There is some agreement that colts are more resilient to weaning related stress than fillies (Moons *et al.,* 2005: Wulf *et al.,* 2018). The housing and social structure that foals are managed in post weaning is an important consideration. Studies generally agree that keeping foals in familiar groups with a balance of both young and adult horses, housed in paddocks is the least stressful way for foals to be managed after separation from the mare (Henry *et al,* 2012)

To the authors' knowledge, no systematic review, research syntheses or scoping reviews have yet been published on the impact of weaning related stress on the long-term emotional health of the horse. Therefore, decision making on methods for best practice remains challenging.

The aim of this study was to identify and chart the current evidence on the effects of the stress experienced by the horse at the point of weaning, and to highlight areas where knowledge is lacking.

2.3 Objectives

- conduct a systematic search of databases using published methodology to identify current literature on weaning horses.
- review and appraise the literature on the effects of weaning horses.
- chart and summarise evidence on associations between emotional development and behavioural problems in horses following weaning.
- chart study methodology from existing publications to identify knowledge gaps and construct recommendations for future studies to improve the evidence base.

2.4 Materials and methods

2.4.1 Protocol and registration

A search for scoping and systematic reviews on the impact on behaviour of foal weaning was conducted on VetSRev on 16th October 2023 (VetSRev, 2023) and no reviews were identified. A Preferred Reporting Items for Systemic reviews and Meta-Analyses Extension for Scoping Reviews was used for this scoping review. The scoping review protocol was developed before data extraction and was registered with the Open Science Framework. The project was reviewed and approved by the Ethics Committee, School of Veterinary Medicine and Science, University of Nottingham.

2.4.2 Search strategy

Primary literature searches were conducted on 26/03/2023 in three scientific databases; CAB Abstracts (1973–present), Medline (1996–present) and

Embase (1974–present). Search terms were developed and reviewed by a team of four people, including authors and a librarian (Appendix 4).

2.4.3 Study selection

The publications identified in the searches were exported into Rayaan. Duplicate records were identified and deleted. Retained publications were then assessed against the inclusion criteria (Appendix 5). A three-stage systematic review and exclusion process was completed independently by two researchers (JD and AR) involving 1) review of publication titles, 2) review of publication abstracts and 3) review of the full-text for the remaining publications. At title and abstract review, ambiguous publications were retained for the next stage of review. Publications where abstracts could not be identified were retained for full-text review. A study was excluded if English language full-text was not available from University of Nottingham libraries or e-libraries, from free online Open Access and legal deposit libraries, from online searches, or from direct contact with authors or journals.

2.4.4 Charting process

The remaining final full-text publications were read and assessed independently by two researchers to ensure eligibility for inclusion. Characteristics and relevant information were extracted and presented.

2.4.5 Data extraction

Following full text review, key information was extracted from each of the remaining 22 publications using a standardised form (Supplementary Material 3) and tabulated. Study characteristics extracted and charted were: author, publication year, study design, sample size, weaning method,

measurement points and duration and sample size (Table 1). Study population behavioural measures extracted and charted were: Defecation, vocalisation, locomotion, eating, lying, affiliative social interaction, agonistic social interaction, maladaptive behaviours (Table 2). This was carried out independently by one researcher.

2.4.6 Charting of the available evidence

There were four publications reporting on health outcomes only and these were not charted further. There were 18 publications that reported on the effects of weaning on stress related behaviours. These were charted according to the most reported impacts on behavioural outcomes: stress related behaviours, aggression, physiological and social behaviours and where measured/reported data was charted to include mare behaviour as well as foal behaviour.

2.5 Results

2.5.1 Study selection

The primary literature search identified 366 publications following the removal of duplicates. Of these, 230 were excluded on title review, 81 were excluded following abstract review and 33 were excluded on full-text review. Exclusions at full stage review included six studies that were not available in English, ten excluded for outcome, three for publication type, twelve for intervention and two for study population. Twenty-two publications remained for further assessment and charting.

2.5.2 Study characteristics

The final 22 papers were from studies conducted on horses in the USA (7/22), Europe (9/22), England (3/22), Canada (1/22), various or multiple countries (1/22) or location unknown (1/22) and published between 1984 and 2022 (Table 1). Seven of the 22 studies were prospective cohort studies, fourteen were quasi experimental studies and one was a randomised controlled trial (Table 1).

The emotional impact of weaning was frequently measured using behavioural indications of stress (18/22 studies) four studies only used physiological indicators of stress. Twelve of the studies used a combination of behavioural and physiological indicators of stress.

2.5.3 Study population characteristics

The majority of the studies involved analysis of foal behaviour only (15/22). Six analysed foals with their dams and 1/22 measured the effects of weaning on the mare only. A variety of weaning methods were used. The most used method was abrupt separation (12/22). Four studies used a combination of

abrupt and progressive separation methods, one used progressive separation only and 5/22 studies didn't state the method of separation used (Table 1). The most common housing system reported was that foals were kept in groups or pairs immediately after weaning (13/22), in 1/22 studies, the foals were individually housed. Most studies only measured indicators of stress in the short-term (up to a maximum of one year post weaning (19/22)). Only three of the 22 studies continued to measure indicators of stress into the foal's 3rd or 4th year of age (Table 1).

Table 1. Study characteristics of 22 publications that were identified in a scoping review of literature on the effects of weaning related stress on the emotional health of horses.

Author	Year	Study Design	Country	Weaning method and housing methods in the study	Measurement points and duration of measurements	Number of mare and foals
Araba and Crowell-Davis	1994	PC	US	Insufficient information on weaning method. Paddock housed mixed foal herd after weaning. Mares remained together in the paddock they occupied with the foals.	1 week old to post weaning	15 mares and 10 foals
Christensen, Beblein and Malmkvist	2020	PC	Denmark	Abrupt separation Housed in groups of five colt foals after weaning.	5 months old (pre weaning), 1 year (3 months post weaning), 3 years old.	25 colts/stallions
Dubcova, Bartosova, and Komarkova	2015	QE	Czech Republic	Abrupt separation Housed in mixed foal herds after weaning.	Up to 140 days after weaning.	56 foals
Erber et al	2012	QE	Germany	Combination of separation methods: all mares removed from group; broodmares removed from the group, but two nanny mares left behind; few mares removed from the group progressively. Foal groups all housed in large stables with straw.	The day before to 8 days after weaning.	17 foals
Falomo et al	2020	QE	Italy	Abrupt separation One group of mares' paddock housed together. The other group of mares initially individually stall housed for 2 days and then turned out into a paddock. Insufficient information on foal housing after weaning.	7 days pre weaning, day of weaning, 7 days post weaning and 30 days post weaning	22 mares
Gorecka-Bruzda et al	2015	QE	Poland	Abrupt separation Foals housed together in pens (5-8 foals in a pen) after weaning.	1-day pre weaning, day of weaning, 1 day post weaning	53 weanlings
Heleski et al	2002	QE	US	Abrupt separation.	Day of weaning then 2 days per week 6 hours per day for a total of 56 days	12 weanlings

				One group of foals housed individually in stalls. One group of foals housed in groups in paddocks.		
Henry et al	2012	QE	US and France	Abrupt separation. Foals group housed in paddocks. One group housed with the presence of two unrelated adults. One group was peers only	2 weeks prior to weaning through one month after	32 foals
Holland et al	1996	QE	US	Combination of separation methods: some abrupt, some gradual. Foals paddock housed after weaning.	Blood sampling 72 hours post weaning (exp 1) and 48 hours post weaning (exp 2). Behaviour measures 1 hour on weaning day and the next two days for both experiments.	44 foals
Houpt, Hintz and Butler	1984	QE	Unknown	Insufficient information on weaning method. Foals housed in singles and pairs in stalls after weaning	Focal samples just before and just after weaning, then 6 hours, 12 hours, 24 hours and one week post weaning. Blood samples after each observation period except the 12 hour one.	22 foals
Lansade et al	2018	QE	France	Combination of separation methods: one group abrupt, one group progressive. Foals stall housed in pairs. Mares housed in groups of 4 in loose boxes with straw bedding.	Four weeks pre weaning, the day of weaning, and 3 months post weaning.	34 foals and their dams
Malinkowski et al	1990	QE	US	Insufficient information on weaning method and housing after weaning. Foals grouped by non-weaned foals, foals weaned singularly, and foals weaned in pairs.	Just before weaning and then 4, 8, 16, 24, 32, 40, 48 hours after weaning for cortisol concentrates and just before weaning and then 4 and 28 hours after for lymphocytes.	20 mare and foal pairs.
McCall et al	1987	QE	US	Combination of separation methods: some abrupt, some progressive. Foals housed in wire mesh pens of 15m x 15m. Mares also kept in pens. Some groups were able to have	5 days pre weaning, 2 days and 9 days post weaning	21 foals

				fence line contact with the mares but one group wasn't.		
Merkies et al	2016	QE	Canada	Abrupt physical separation but one group had a reduction in nursing 4 days prior. Insufficient information on the housing of mares and foals after weaning.	Daily for 4 days after weaning.	17 mare/foal pairs
Moons, Laughlin and Zanella	2005	QE	US	Abrupt separation but one group had experienced micro separations leading up to weaning. Foals individually housed in box stalls.	Separation group 2, 4, 6, 8, 10 and 12 weeks old and then the day prior to weaning, weaning day and the day after weaning for both groups	10 mare/foal pairs
Nicol and Badnell-Waters	2005	PC	England	Insufficient information on weaning method. Groups of up to 12 foals housed in barns post weaning.	2 weeks pre weaning, and up to 4 years post weaning.	186 foals
Nicol and Badnell-Waters	2005	RCT	England	Abrupt separation. One group was paddock housed in peer groups, the other was barn housed in peer groups after weaning.	From age 2 weeks to age 40 weeks.	17 foals
Normando et al	2022	QE	Italy	Abrupt separation. One group weaned together stall housed in pairs, the other group 2 foals weaned weekly, again stall housed in pairs for 6 days, then paddock housed.	7 days prior, day of weaning, 7 days after and 30 days after weaning.	22 foals
Qureshi, Yaqoob and Enbergs	2013	PC	Germany	Abrupt separation. Insufficient information on housing after weaning.	2 days before weaning, 1 day before weaning, 1 day after weaning and 14 days after weaning	84 foals
Waters, Nicol and French	2002	PC	England	Insufficient information on weaning method. Foals housed either individually or in groups post weaning.	Up to 4 years post weaning.	225 foals/young horses
Weeks et al	2000	PC	US	Progressive separation. Group housed in paddocks after weaning.	From June to September (when the last foal was weaned). Weaned at 4 months old, observed up to 6 months old.	14 mare/foal pairs
Wulf et al	2018	PC	Germany	Abrupt separation. Foals then group housed with peers initially in a barn, then in a paddock.	2 days before weaning to 7 days after.	22 foals

Abbreviations: PC – prospective cohort, QE – Quasi Experimental, RCT – Randomised Control Trials.

Behavioural outcomes

Behavioural outcomes only were reported in eighteen of the 22 studies. Four studies only used physiological indicators of stress. **Table 2** shows the eight commonly reported behavioural outcomes that were impacted by the process of weaning: defaecation, locomotion, vocalisation, eating, lying down, affiliative social interactions, agonistic social interactions and maladaptive behaviours. The most commonly reported behaviour was vocalisation which was reported in 13/18 studies that measured behaviour. The least commonly reported behaviours were maladaptive or stereotypies (7/18). Two of the 18 studies reported data on all eight behavioural outcomes (Table 2).

Table 2. The behavioural outcomes that were assessed in a scoping review of the literature on the effects of weaning related stress on the emotional health of horses (behavioural outcomes measured in each study are shaded in green).

Paper	**Defecation** Frequency	**Vocalisation** Frequency	**Locomotion** Walking, trotting, cantering	**Eating** Time budget	**Lying** Time budget	**Affiliative social interaction** Grooming, suckling, touching, sniffing	**Agonistic social interaction** Kicking, biting, distancing away	**Maladaptive (Stereotypical) behaviours** Pacing, crib biting, windsucking
Araba and Crowell-Davis								
Christensen, Beblein and Malmkvist								
Erber et al								
Falomo et al								
Gorecka-Bruzda et al								
Heleski et al								
Henry et al								
Holland et al								
Houpt, Hintz and Butler								
Lansade et al								
Merkies et al								
Moons, Laughlin and Zanella								
Nicol and Badnell-Waters								
Nicol and Badnell-Waters								
Normando et al								
Waters, Nicol and French								
Weeks et al								
Wulf et al								

2.6 Discussion

This is the first scoping review that collates and describes the current literature on the effects of weaning related stress on the emotional health of horses. The review identifies a lack of evidence, with only 22 studies eligible for inclusion. Of those, only three measured the long-term effects of weaning on the foals. Only one study measured the effects of weaning related stress on mares, and this was limited to the immediate term post weaning. There were several issues identified with the existing literature, which included limited research on the impacts of weaning on mares, significant variations in study design and methodology, and a limited period of time that behaviour was assessed post weaning.

Ideally studies are designed prospectively, and subjects randomly allocated to study groups to reduce the risk of bias. The majority of studies in the scoping review were quasi experimental. This approach gives the flexibility to study weaning related behaviours in real time, but often doesn't account for the multifactorial nature of the process. These factors include the interactions between the weaning methods used, and the housing and social structures that mares and foals occupy pre, during and post weaning. The studies that were prospective cohort studies, mainly followed the study populations for a short period of time which limits the understanding of the long-term effects of weaning. The maximum study population for the prospective studies was 225 foals and most were studies of small groups – 14/22 studies had less than 30 foals. Study design, sample size, management style, and the length of the

observation period all affect study reliability and how the findings can be related to the general population of horses.

The method of weaning used can have a significant impact on the behaviours observed. The weaning of horses in the UK has traditionally been performed abruptly, meaning that mare and foal have no periods of separation from each other until the day of weaning (Lansade *et al*., 2018) with foals being housed individually in stables or stalls in the immediate term post weaning. There are more progressive approaches to weaning (McCall *et al.,* 1987) where mares and foals are given very short periods of time apart to begin with. Over several weeks and months, these periods of time are increased. This gives mares and foals time to assimilate the sense of being separated. Although progressive weaning methods have been recommended by researchers for several decades, the industry hasn't been quick to adopt them. There is growing agreement amongst researchers that abrupt weaning methods result in higher levels of stress related behaviours than more progressive and habituated approaches to separation (Lansade *et al.,* 2018; McCall et al., 1987) and group-based housing in an outdoor paddock causes the least amount of weaning related stress (Nicol *et al*., 2005; Heleski *et al.,* 2002). Most of the studies analysed in this evidence review didn't clearly describe both the method of weaning and the post weaning housing arrangements, and these two distinct processes were often merged or crossed over in the literature. A clear description and distinction between the weaning methods is essential to enable assessment of the impacts of different methods.

Five of the studies did not describe the weaning method used (Araba & Crowell-Davis, 1994; Houpt, Hintz and Butler 1984; Malinkowski *et al.,* 1990; Nicol and Badnell-Waters, 2005; Waters, Nicol and French, 2002). Further research is needed to identify the ways in which stress at weaning can be minimised to support horses through this critical time in their development. This evidence review highlights that studies related to weaning need to clearly define the methods being used, to enable robust evidence to be generated and consolidated to inform future best practice.

Research into weaning methods and how they impact the mares and foals are important. There is currently a suggestion that some maladaptive or stereotypical behaviours may be initially triggered by weaning (Nicol and Badnall-Waters 2005) so assessment of behavioural traits associated with weaning is of particular interest. Eighteen studies mapped behavioural changes during weaning. The most common behaviour traits impacted by weaning were those relating to stress and anxiety, and these could be divided into eight classifications of behaviours as reported in table 2. These behaviour classifications were reported reasonably consistently across the studies. However, most studies only focused on short term effects. Only three studies measured the effects of weaning up to 3-4 years of age. This scoping review highlights a need for further research in this area.

Most studies were focused on the foal, and there were limited studies that evaluated both mare and foal. This is important both because weaning can impact the welfare of both mare and foal, and because the mare/foal

interaction may be an important factor for future behaviour of the foals. One study reported that mares showing signs of dominance-based aggression and high social rank within their herds, their foals were more likely to continue this behaviour by rank amongst their peers' post weaning (Araba & Crowell-Davis, 1994). These more aggressive foals were more likely than lower ranking foals to develop maladaptive or stereotypical behaviours (Waters et al., 2002). However, the development of behaviour is complex and multifactorial. The impact of how foals are managed post weaning was reported to have more bearing on the manifestation of the behaviour, as the presence of unrelated adult horses appears to minimise the expression of aggression and stress related behaviour in foals (Erber *et al*., 2011; Henry *et al.,* 2012). The current evidence is limited by the diversity of the research, however it is clear that the impact of weaning may be affected by a number of factors including the behaviour and social ranking of the mare, the method of weaning used, the age and gender of the foal, the social grouping before and after weaning and the methods of housing before and after weaning. Future studies of weaning should be developed with these factors in mind, so that the methodologies and influencing factors are reported, and incorporated in data analysis.

The limitations of this scoping review are that the database searches were conducted in March 2023. Since that time, further studies may have become available. The search may not have identified all the available literature on the topic, the databases used were consistent with those reported as most suitable for the veterinary literature. However, the study did not include grey

literature, and publications that were not available in English. The major limitation was the challenge in comparing and consolidating the current evidence due to significant variation in methodology and reporting.

A scoping review was chosen for this project due to the broad question being asked. A scoping review does not allow for the analysis of literature relating to a specific question, or the reporting of findings in a way that may be expected from a systematic review, but this was not the aim of the study. Had a systematic review been undertaken for example, only the three studies that examined the long-term impact of weaning would have been included, and the variations in methodology and reporting weaning methods meant these could not be compared and consolidated.

Future studies that aim to examine the long-term effects of weaning related stress on horses, should clearly identify the method of weaning and post weaning management and continue to measure stress related behaviours into the young horses' ridden career. Other important factors that should be considered include the welfare of broodmares as they may produce several foals across their lifetime and risk being subjected to high levels of unnecessary trauma on a relatively regular basis. More research is also needed to determine whether there are differences between colts compared to fillies for the impact of weaning related stress, based on limited evidence documenting gender differences in two of the studies (Moons *et al.,* 2005: Wulf *et al.,* 2018).

Studies should be undertaken prospectively, with mares and foals randomly allocated to weaning groups in which weaning and housing methods are described, and consistent, and validated methods should be used to measure behaviour, including either direct behavioural observations or validated behaviour assessment tools. Consideration should also be given to the amount of time between the point of weaning and collecting behaviour measures to ensure that the long-term effects of weaning related stress are identified. Study population sizes should ensure that the minimum number of mares and foals needed for valid statistical analyses are recruited to the studies.

2.7 Conclusions

This scoping review identified and described the available literature relating to the effects of weaning related stress on the long-term emotional health of horses. Only three studies measured the long-term effects of weaning. The remaining 19 studies used such a variation of weaning and housing methods that it is extremely challenging to assess whether weaning related stress is unavoidable or indeed carried forward into the lifetime of the horse. Most studies were quasi experimental and varied in their methodologies, quality and means of categorising the management of horses which may have had a significant impact on the stress related behaviours observed in the studies.

The review has identified a lack of evidence to support the understanding of the long-term impact of weaning on horse behaviour and emotional resilience and in addition, has highlighted weaknesses in the existing studies because

of the lack of categorisation of weaning methods, management of mare and foals, the short duration of study designs, and the lack of mare specific research. Recommendations have been made on how to improve future study designs and reporting to generate a robust evidence base which can be used by veterinarians, behaviourists horse owners and carers, and other industry professionals when making decisions on weaning and early years management.

The literature and scoping review elements of this study have highlighted limitations in the understanding of the long-term impacts of equine weaning and the apparent absence of an official assessment tool to measure weaning related stress. The focus group stage of this project may help to gather insights on how the industry is currently measuring weaning related stress and whether there is any anecdotal evidence on long-term effects.

Chapter 3. Focus Groups

3.1 Abstract

Background: Equine welfare organisations are frequently involved in the management of mare/foal pairs when pregnant animals or those already with foals at foot, are admitted into their care. This presents an opportunity for these organisations to explore the range of different methods of weaning and the different styles of management systems during and post weaning.

Objective: To explore insights on best practises involved in the weaning process and to see how mares and foals are currently being managed in welfare organisations. To discuss current welfare assessment tools and how these may be applied to weaning related stress.

Methods: Trigger material was gathered in the form of short video clips of up to one minute in length showing a variety of mares and foals at the point of separation during different weaning methods. Participants viewed the trigger material and were then invited to join focus groups to discuss what they observed. Inductive coding was used during thematic analysis to generate the key themes from the discussions.

Results: The main themes generated were ‘culture’ ‘welfare indicators’ ‘methods of assessing welfare’ and ‘factors that influence the stress response’. There was a comparison with how the public are now educated on the importance of the early years experiences of puppies including their weaning method, introduction to novel stimuli, relationships with their mother

and other dogs and their exposure to social situations. The understanding and awareness of the horses' early years experiences in comparison doesn't appear to be a factor in deciding to purchase a horse. There was discussion about the limitations that some owners and breeders may face including the lack of facilities and other horses to provide the housing and social structure needed to navigate a healthy weaning process.

Conclusion: Participants were in unanimous agreement that abrupt and isolating forms of weaning separation not only compromised short term welfare of the mare and the foal but in some cases could cause long term psychological health issues. Education of the public was seen as one of the most important factors in creating cultural shifts in the industry. They felt that the demand for horses with good early years experiences is the most likely to elicit change.

3.2 Introduction

With little industry consensus and limited research on best practice in relation to the weaning of foals, it is important to grow the body of research and help horse breeders and owners to become better informed about the welfare of mares and foals during and post weaning. Weaning isn't just a dietary change, but the physical separation of closely bonded horses. There is the potential to cause emotional and psychological distress during weaning which could create a welfare issue.

The scoping review aspect of this project identified some agreement amongst researchers that methods of weaning involving the isolation of horses' during weaning separation, compromise welfare (Lansade *et al.,* 2018; McCall et al., 1987) and the age at which a foal is separated from its mother needs further consideration. Most foals in the UK are weaned between four and six months old but in wild herds the process of physical separation doesn't start until around a year old and can go on for two or three years (Henry *et al*., 2020).

3.3 Aims and Objectives

The aim of this study was to explore stakeholder's perceptions of the current approaches to weaning horses in the UK and to inform best practice guidance to weaning.

Objectives:

- To recruit stakeholders with experience of weaning and welfare assessments in the UK horse population.
- To discuss experiences of using current welfare assessment tools and how these may be further developed and applied to weaning related stress.
- To explore the opinions on best practises involved in the weaning process.
- To explore how the management of mares and foals is considered during weaning.

3.4 Methods

The Consolidated Criteria for Reporting Qualitative research (COREQ) guidelines (Tong et al., 2007) were used as a framework for this study. The project was reviewed and approved by the Ethics Committee, School of Veterinary Medicine and Science, University of Nottingham.

3.4.1 Study Design

Video footage was recorded by the primary researcher (Joanne Dwyer) showing mares and foals at the point of physical separation for the purpose of weaning. Horses were selected to include a range of different weaning methods although the methods were not disclosed to the participants viewing the footage. Permission to obtain the footage was granted from one stud owner known to the primary researcher, one welfare organisation known to the university and two individually owned mare/foal pairs. One owned by the

primary researcher and one by supervisor (Sarah Freeman). Associate professor (Zoo and Wildlife Medicine) Lisa Yon advised on the collation of trigger material for use in focus groups particularly in relation to the length of the video clips. Clips were up to one minute in length. This was to keep participants interested but also to show enough footage to enable them to assess what they saw. Participants reviewed the video footage alongside a chart of commonly used behavioural markers for assessing welfare as identified in the scoping review (Table 2). Two semi structured focus groups were then conducted on Microsoft teams and were used to collect data and analysed using thematic analysis.

Participant Selection

Purposive sampling was used to select participants with direct experience of weaning. Focus groups consisted of staff members from three equine welfare organisations and one regulatory body for equestrian activities in the UK as shown in table 3. Participants were sent an invitation email, participant information sheet (Appendix 1) and a behaviour chart (Table 2). Participation was voluntary. No financial incentives were offered, and all participants were at least 18 years old.

Table 3. Focus group participant roles and anonymised organisations

Organisation	Role
Centre A	Centre Manager
Centre B	Head of Research
Centre C	• Team Leader • Farm Manager
Centre D	Research Analyst

Setting

Focus groups were conducted in April 2024. The meetings were held online via Microsoft teams due to the time constraints and geographical spread of the organisations involved.

Data Collection

An interview schedule was developed (Appendix 5) which included open questions. The questions weren't necessarily asked in order but to facilitate the flow of the conversation between participants. A pilot focus group was carried out prior with a group of two postgraduate veterinary students from the University of Nottingham. The pilot was carried out on Microsoft Teams, and feedback was invited on both the interview schedule and the skills of the interviewer.

3.4.2 Researcher Reflexivity

Both focus groups were conducted and analysed by the primary researcher (Joanne Dwyer). An in-depth reflexivity statement for this researcher is available in appendix 6. There were no existing relationships with

participants prior to data collection for this project. Two participants were known to the researcher through the collection of trigger material at their organisation.

3.4.3 Data Analysis

Transcription

Transcripts and video recordings of the meetings were automatically recorded by Microsoft teams. The accuracy of the transcripts was limited with specific language related to horses being difficult for the software to interpret. The primary researcher watched the video recordings back and edited the transcript manually. This aided the analysis and interpretation of themes. Transcript content that would identify participants was removed.

Coding and theme generation

Transcripts were coded by the primary researcher (Joanne Dwyer). The primary researcher met with supervisors Mandy Roshier and Brad Hill to discuss and refine the codes. Codes that were related were grouped into themes. Ground Theory Method (GTM) (Glaser & Strauss, 2017: Williams and Moser 2019) was used to gradually narrow down and link similar codes into themes.

3.5 Results

3.5.1 Overview

14 people were invited to participate in focus groups. nine signed the consent form to view the trigger material and five continued to interview in the final focus group discussions. All participants were female. Some participants who reviewed the videos prior to the focus group meeting were male but they either couldn't attend the meeting or allocated the task to another member of the team. Participants represented a variety of roles within their organisations. Two focus group meetings were conducted and lasted between 30 and 45 minutes. Thematic analysis generated four main themes, 'culture', 'welfare indicators', 'methods of assessing welfare' and 'factors that influence the stress response' and each theme contained sub themes which are shown in table 4.

Table 4. Outcomes of thematic analysis from focus group transcripts

Theme	Culture	Welfare Indicators	Methods of Assessing Welfare	Factors that influence the stress response
Sub-Themes	• Public awareness drives change • Finances • Research limitations	• Trauma • Language • Distress	• Empathy • Emotional Expression • Lack of Formal Assessment	• Isolation • Gender based differences • Epigenetics

Topics that were spoken about the most during focus group discussions were the education of the public and the lack of changes within the industry

despite the research available. This generated the theme, ‘public awareness drives change’. Participants voiced frustration that despite a good enough body of research to support progressive weaning methods, lots of horses are still being admitted to their organisations with what they identify as weaning related separation anxiety even into their adult years. They have made this observation based on their historical experiences with abrupt weaning processes and can identify patterns of behaviour in these rescue cases that they witnessed in abruptly weaned foals. There was also discussion about how behaviour and welfare are measured in horses, often not in a quantifiable way but through the ‘instincts’ of their handlers which could be considered anthropomorphic by researchers. This generated the themes ‘empathy’ and ‘emotional expression’. Bringing human empathy and instinct into equine research however is important because it appears to be a dominant feature in equine welfare assessment.

3.5.2 Culture

The culture theme generated three subthemes which were finances, public awareness drives change and research limitations. The general culture surrounding equine weaning was described by participants as outdated. Despite a good enough body of research and anecdotal evidence, abrupt and isolating forms of weaning appear to be commonplace. Education of the public was seen to be the most likely catalyst for change, but participants also recognised that the research needs to move forward and that finances were an integral part of hastening weaning processes for breeders and buyers alike.

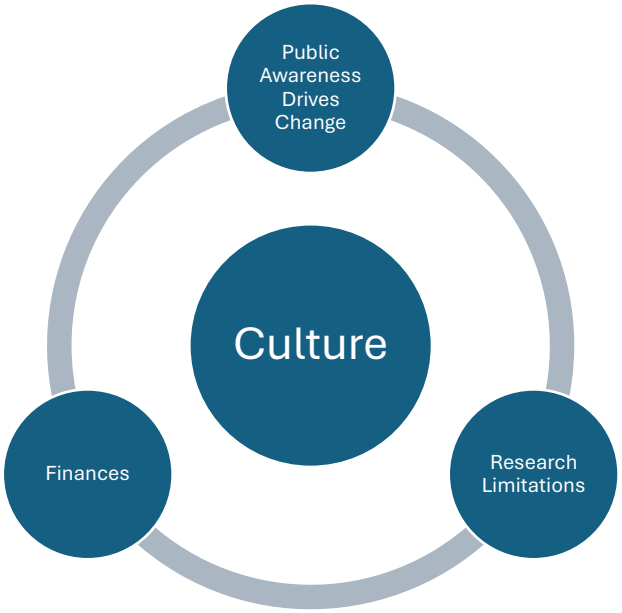

Figure 1.1 Image showing the theme 'culture' and sub themes from a qualitative study of focus groups with equine welfare professionals.

Public Awareness Drives Change

Participants were unanimous in the need to educate the public on issues around equine weaning in the same way that we have done in other species such as dogs. They discussed how this was potentially the biggest driver to industry change with the intention of reducing weaning processes that produce high and unnecessary levels of stress in the foal.

> *"Educating people who are buying these youngstock (is important). I wouldn't want one. They're going to be prone to gastric ulcers, stereotypies, separation anxiety and poor performance before you've even started"*
>
> -A, Centre Manager

They also described how their organisations were going to support the change needed to improve mare/foal welfare.

> *"And I know that the plan is for this year and responsible ownership from birth to death, and obviously weaning fits within that.*
> *So we're really keen to be able to deliver that to the general public as well to support them with weaning in the future".*
>
> -C, Farm Manager

> *"We have been working with different behaviourists to put together infographics about it. Noting behaviours that are showing subtle signs*

of pain or stress. I'm sure a lot of them will be facial expressions and body language the more detailed bits of what to look out for".

-D, Research Analyst

Finances

There was agreement by all participants that cost was a factor in the decision-making process of those seeking to buy foals or youngstock and that hurrying the process of developing a young horse may drive the short-term costs down and enable people to buy cheaper horses.

"There are those breeders that put the extra work in and then no one will pay their prices because they can get a cheap, just taken straight, abruptly weaned foal."

-B, Head of Research

Research Limitations

Participants discussed that the terminology currently used in weaning related research did not adequately capture the welfare issues that they observed in the video clips. They used language such as 'trauma' to describe the potential lifelong implications of intense experiences of acute stress. Some participants shared examples of where they have seen signs of weaning related trauma in later years. This suggests that future equine research could start to incorporate concepts of assessing and measuring welfare that include an up-to-date understanding of how trauma impacts the mammalian brain and nervous system. Trauma is discussed in the next theme.

“More people are talking about trauma and animals and animal behaviour… A mare who's been managed very holistically and very naturally, who goes through weaning probably experiences a different long-term impact than the mare, who's starting from a place of trauma, in my opinion I think mares who are well balanced and calm and holistically managed, raise foals who are the same. That resilience there that they just don’t have”

-B, Head of Research

“I can see how these behaviours relate and whereas before, like people were just curious, it's just being naughty. No, I actually don't think she is. I just think she's probably been abruptly weaned and it's bringing back trauma to her”

-C, Team Leader

3.5.3 Welfare Indicators

Trauma, distress and language were the three subthemes generated from welfare indicators. Participants were asked to use a chart to make simple assessments of the mares and foals they saw in the videos. The chart was made up of behaviours that are commonly used in weaning related research to assess welfare. Participants found that this list of behaviours limited their capacity to assess welfare in a timely manner and instead were drawn to what they described as “obvious stress” through posture and motor movements. When questioned further about the behaviours, they had noticed most of them in some of the mares and foals but due to what they described as intense and traumatic circumstances, their instinct was not to sit and watch, but to pull the horses out of that situation.

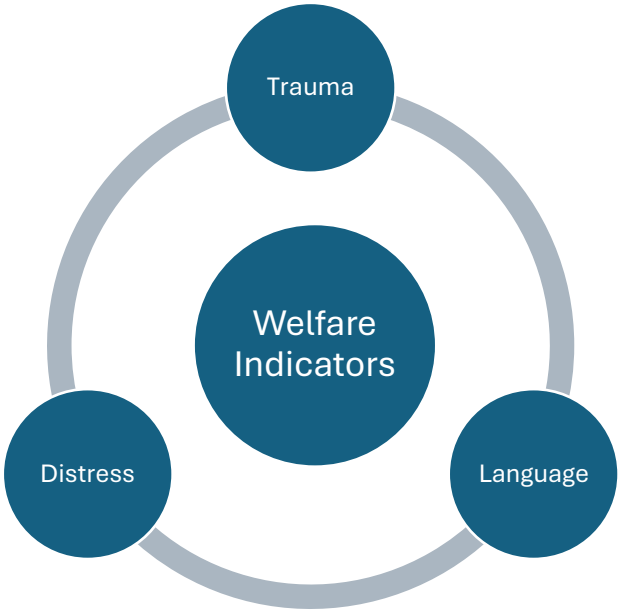

Figure 1.2 Image showing the theme ‘welfare indicators’ and sub themes from a qualitative study of focus groups with equine welfare professionals.

Language

The introduction of new language to describe the horses' experience of stress did encapsulate much of the existing understanding of assessing welfare but enabled the expansion of the measures used. During these focus groups, terms such as 'self-regulation' and 'trauma' were used frequently. Participants felt that current measures of welfare assessment in weaning related research were too limited to give comprehensive welfare assessments. They felt that the chart of behaviours that was uncovered by the scoping review (Table 2), was too basic and wanted to incorporate body language and facial expressions into their assessments.

"The first thing that struck me when I saw it is just how basic (the chart) is… I would already have instinctively, when measuring stress and looking at tiny things, the facial expression that an animal can have, quite soft posture and not have a really high energy, but that you see that furrowed brows and tight real tight, pinched muzzle"

-B, Head of research

"They could self-regulate… but almost they could see they could recognise, they noticed, but they felt that they had enough resilience within themselves and enough care around them from those other horses and all of the and steps that had obviously been put in place for that gradual weaning process"

-B, Head of research – Gradual weaning process

Trauma

Introducing the concept of trauma into the study is an important consideration for future research. Focus group participants were keen to move away from existing measures of welfare which were limited to a collection of individual behaviours that they felt didn't accurately capture the impact of what the mare and foal were experiencing.

"They gave the impression to me of animals that had just been separated quite abruptly and their reactions were as you would expect in that kind of traumatic situation"

-A, Centre manager – Abrupt weaning process

Distress

Stress was an obvious feature in many of the video clips according to the participants. An important consideration was the change from stress to distress. Stress is a natural part of life for animals and humans and a certain level of stress can be useful. When this becomes distress however, this is where it may start to become a welfare issue.

"Those animals all to me, looked obviously stressed, and that the vocalizations, posture, body language, the way they were moving and the whole thing to me just looked like extremely distressed animals"

-A, Centre manager

3.5.4 Methods of assessing welfare

Methods of assessing welfare identified lack of formal assessment, emotional expression and empathy. All participants agreed that they were measuring the welfare of the horses within their organisations, but they all said they weren't using any formal welfare assessment tools. The most common method of assessing welfare appeared to be through the observation of emotional expression in the horses and the participants experience of empathy. This was a challenging aspect of the research due to the potential association with the concept of anthropomorphism, however, there is emerging research on the emotional inter-play between horses and humans that needs further investigation.

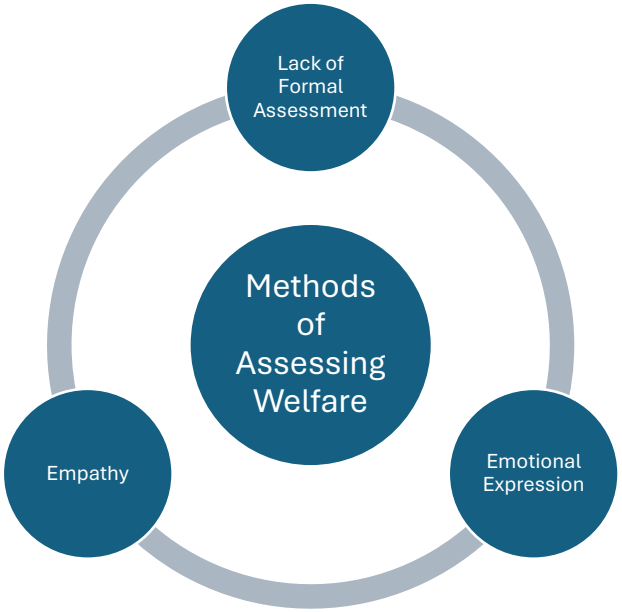

Figure 1.3 Image showing the theme 'methods of assessing welfare' and sub themes from a qualitative study of focus groups with equine welfare teams.

Lack of Formal Assessment

Focus group participants commonly reported that they didn't use formal tools within their organisations to assess any aspect of equine welfare. Instead, they used the experience and instincts of the staff teams.

"I would say for within our farms generally not and certainly not in a formal way. I think all our staff would be working along those lines, they'd be very quick to say that's not quite right, that dynamic is wrong and what we don't have within our farms is that proper structured formal process to follow"

-A, Centre manager

"so, it's not like an actual assessment that we go through, but I'm watching stress levels all the time"

-C, Team Leader

Emotional Expression

Although participants said they weren't using official welfare assessment tools, they said they were assessing welfare by observing the emotional expressions of the horses.

"I think most people could look at that and just go that foals really upset and that one's less upset or not upset… the footage of foals that have obviously been shut in versus the ones that are outside… I think subconsciously just seeing a foal inside on its own gives me some kind of response".

-B, Head of research

Empathy

Participants described the visceral stress that they experienced in their own bodies when they were watching the videos, particularly of those where the foals had been abruptly weaned and isolated. Feeling what the horse was feeling was a common theme throughout the group meetings.

“But I think we were quite well upset, weren't we? To watch some of the foals and the mothers calling out”

-C, Farm Manager

3.5.5 Factors that influence the stress response

Isolation, gender-based differences and epigenetics were identified as the key factors that influence how horses respond to stress. There was unanimous agreement that isolating a foal during intense periods of stress has the potential to cause the most long-term damage. Participants with direct experience of weaning all agreed that male and female foals respond differently to stress and that mares build relationships differently with female foals than they do with male foals. Some participants also believed that trauma or resilience could be passed on from mares to their foals.

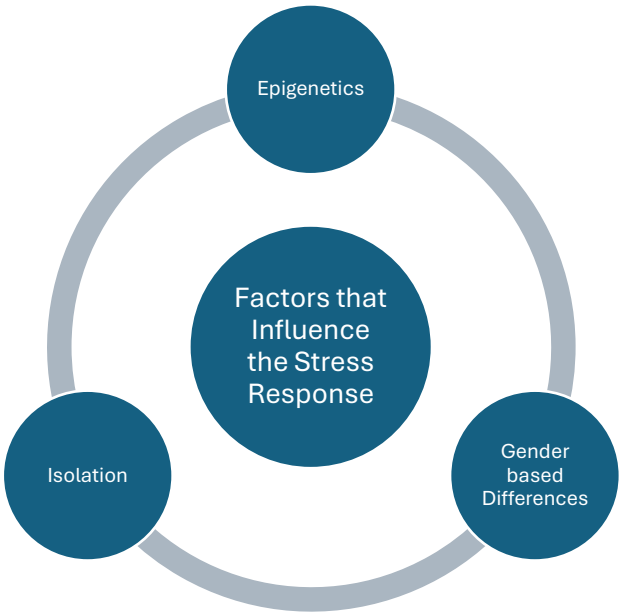

Figure 1.4 Image showing the theme 'factors that influence the stress response' and sub themes from a qualitative study of focus groups with equine welfare professionals.

Isolation

The various weaning methods used in the video footage that participants viewed was not disclosed. Despite this, during the group discussion it became apparent that participants accurately assumed the weaning method that caused the highest empathic stress response in them. The abruptly weaned foals showed many of the listed behavioural markers such as box walking and vocalisations as well as a range of facial expressions and body language markers that indicated acute traumatic stress. These foals also happened to be isolated in single stalls, unable to see or touch other horses.

"Some examples of what I saw that I thought is indicative of poor welfare certainly for the first clips… They gave the impression to me of animals that had just been separated quite abruptly and their reactions were as you would expect in that kind of traumatic situation"

-A, Centre Manager

"And while we definitely saw behaviours that we have seen previously at our organisation with the abrupt weaning method… we don't necessarily see those behaviours now, with the gradual weaning… it was things like calling for their mother, stress box walking and head very high. And just generally tense and unsure, without their mother there"

-C, Farm Manager

Gender based differences

The experience of weaning related stress according to foal gender, emerged during both the literature and scoping reviews. This was supported by the

first-hand experiences of the staff involved in caring for and managing mares and foals up to and including weaning. There was a general sense that mares form closer attachments with female foals and that male foals pose more of a physical and emotional challenge for the mares as they tend to clamber on and bite the mares more during rough play. Some participants agreed that weaning male foals earlier than females may be beneficial to the mare and have little impact on the foal. They also agreed that leaving female foals longer appears to be of benefit to both the mare and the foal.

“We don't obviously breed anything here in rescue, but lots of mares, especially semi feral mares, come in in foal or with tiny foals at foot and we always say in our team, those mares that have colts can't wait to see the back of them. They really can't by six or seven months… but mares love their fillies. We don't have an infinite amount of time, but I'm never in a hurry to take fillies until they're nine or ten months old. But colts behave differently as well. And when they’re young foals, you've only got to look across the field then you can pick out who's a filly, who's a colt. That's the physically teeth and feet and jumping all over them, which fillies just don't do”

-A, Centre Manager

“Colts… weren't as bothered as the fillies had been. They're off to the side of the field, not bothering”

-C, Team Leader

Epigenetics

There was some discussion on epigenetics and how traits may be passed on to foals, particularly if the mare had experienced trauma in their own weaning process.

“were these mares weaned like this themselves…. horses who have been abruptly weaned through a short performance career, in whichever sphere, and then retired for breeding, what is the impact on them… a mare who's been managed very holistically and very naturally, who goes through weaning probably experiences a different long-term impact than the mare, who's starting from a place of trauma… I think mares who are well balanced and calm and holistically managed, raise foals who are the same.”

-B, Head of research

3.6 Discussion

3.6.1 Summary

Focus groups were chosen for this aspect of the study to explore the insights and opinions of professionals involved in the decision making and day to day care of mares and foals in welfare and rescue organisations. Accurate interpretation and reporting of findings from qualitative studies can be challenging especially in relation to the interpretation of patterns and themes (Sandelowski & Barroso, 2002) however the primary researcher and two supervisors all reviewed the transcripts and collectively agreed on themes and subthemes.

Four major interconnected themes were generated ‘culture’, ‘welfare indicators’ ‘methods of assessing welfare’ and ‘factors that influence the stress response’. The study highlighted the need for practical welfare assessment tools that capture the broad range of behaviours, emotions and experiences associated with the weaning process. Similar tools have been developed for other species such as elephants (Yon, *et al.,* 2019) and welfare assessment tools such as ethograms are being used in other areas of equine research such as pain in relation to ridden work (Dyson *et al.,* 2018).

3.6.2 Limitations

Although there were mixed roles represented within the focus groups, private and commercial breeders, studs, and private horse owners didn’t take part. The aim of the study was to gather opinions on the trigger material and

existing welfare assessment tools. It was determined that established rescue organisations, caring for mare and foal groups were likely to have experience of different methods of weaning and assessing welfare and could contribute with less bias on a particular method. It was also determined that they may have experience on the longer-term impacts of weaning as they continue to work on the education of the foals after weaning to rehome them. There were only five participants that attended the final focus group discussion, which is a limited number, however, collectively they did offer some useful insights that agreed with the existing literature. Although this group didn't represent the general horse owning population, they do have the ability to influence policy and have an awareness of key welfare issues. Some participants were very comfortable with speaking in the group and others less so. This may have influenced how much feedback they felt able to share, although everyone was given the time and space to contribute.

3.6.3 Key Findings

The research to date appears to be stalled in both its use of language and in the way that studies are designed. The current literature, spanning back as far as 1984, describes a range of behaviours that may indicate that an animal is stressed. Focus group participants went into greater depth about welfare analysis and used language related to trauma. Concepts such as trauma and resilience simply don't exist in the body of research. The focus group participants added new dimensions to the current understanding and application of weaning related research and offered new insights and aspects to consider when weaning foals from their mothers. The existing

research doesn’t offer much information on how mares are affected by weaning although it is suggested that foals naturally adopt their mother’s rank within a herd situation and continue that rank within their peer groups beyond weaning. It is possible therefore that foals also pick up on stress and trauma in the mare and this is an area that needs consideration in future research.

Focus group participants found the existing measures of behaviour very limited. They touched on additional things such as body language (Ladewig, 2019) and facial expressions (Ask et al., 2024: Wathan *et al.,* 2015) as ways to assess welfare. The concept of being able to feel what the horse was feeling was also an important addition that may ordinarily be missed out due to the association with anthropomorphism. Mirroring emotions appears to be a facet of the mare/foal relationship that works both ways (Rogers *et al.,* 2012) and this process is also being measured in equine facilitated therapies where it is suggested that this emotional transfer/mirroring occurs between horses and humans (Scopa et al., 2019).

Chapter 4. Final Discussion

4.1 Overview

This research project is intended to form a basis from which to build a weaning assessment tool to support ethical weaning processes and management of mares and foals. The literature and scoping review aspects of the project identified a variety of different weaning methods and management styles but there was a lack of consensus and guidance on which methods supported optimal welfare. There was some agreement that isolating foals in stables was not ideal and that foals appeared to cope differently with stress according to their gender (Moons *et al*., 2005: Wulf *et al.,* 2018). There were also some dietary suggestions that feeding a high fat-based diet could reduce stress in foals (Holland *et al.,* 1996: Waters *et al.,* 2010). The scoping review further identified a consistent range of behavioural indicators of stress at point of weaning (Wilk and Janczarek, 2015: Lesimple, 2020: Rankins et al., 2022). This enabled the creation of a list of behavioural indicators that were used by focus group participants to generate discussion around weaning related stress. Participants used a range of measures to assess the positive and negative welfare of mares and foals during weaning. These included some behaviours from the chart plus body language (Ladewig, 2019), facial expressions (Ask *et al*., 2024: Wathan *et al.,* 2015) and social interaction (Torres Borda *et al*., 2023). Findings from the focus groups supported the literature and scoping reviews that isolating foals was the least optimal way to wean and presented a welfare issue although long term effects could not be determined from the assessments. Participants supported the view that mares form different relationships with

foals according to their gender which may influence the difference in resilience during stressful events. The focus groups identified the limitations of the current measures used to assess welfare at weaning and were keen to include body language, facial expressions and how foals were engaging in social groups. They also identified barriers to change and suggested that the general horse owning population needed to be more aware of the early year's experiences of horses and in some cases were actively engaged in campaigns to support this. Participants recognised that historical trauma may pass from mares to foals and were keen to end any practices that they deemed to be an obvious welfare issue. Overall, the focus group discussions offered insight into what is currently being done by the industry to address both the evidence and the limitations of the existing research to improve the welfare of mares and foals during and post weaning.

4.2 Methodology and Limitations

Mixed methods were used to conduct this project. Qualitative focus groups were used to gather industry related perspectives whilst quantitative reviews of the existing literature sought to gather more factual data. Focus groups are useful in gathering information on niche topics where other data measures are limited (Greenwood & Parsons, 2000) and were chosen in this case to stimulate organic discussion amongst industry professionals. Conducting the meetings via teams offered convenience and flexibility which allowed colleagues from some large organisations to contribute to the project where time constraints may have prevented them from attending. Online meetings can affect entitativity, (Blanchard & McBride, 2020) but this has

been shown to improve when focusing on shared documents which were a feature of these meetings. Data saturation (Mwita, 2022) wasn't quite reached as there were nuances in terminology still emerging during the second meeting. It is suggested that two – three focus groups may capture 80% of the topic themes but three – six may capture 90% (Guest *et al*., 2016). The size of the groups was also small with only two – three participants in each group. These are classed as mini focus groups and can be used where a small pool of participants may be difficult to reach, but typically have a high level of expertise (O.Nyumba *et al*., 2018).

Professionals involved in the care and management of mare/foal populations and those involved in informing equine policy were chosen for this project because gaining expert consensus on animal welfare issues can help to prioritise welfare needs (Rioja-Lang *et al.,* 2020). The attitude of stakeholders can also influence the implementation of welfare assessments in the equine industry (Horseman *et al*., 2017). Focus groups should have included horse owners and commercial breeders as the development of a weaning assessment tool would require a larger network of stakeholder input. Restrictions on time and funding however, limited the number of focus groups that could be facilitated. Organisations involved in the regulation of horse welfare or involved in the care of rescue horses were chosen to participate in the focus groups as it was determined that having access to large groups of mares and foals each year would offer valuable insights into current weaning practices. It was considered that being tasked with preparing and training foals for rehoming may also offer some insights into

the long-term effects of weaning. As a population of innovators, active in influencing policy, it was also determined that they may be able to initiate social change more quickly than other stakeholders (Murphy 2024).

4.3 Key Thesis Findings: Development of a Weaning Assessment Tool

4.3.1 Developing equine assessment tools.

The use of formalised welfare assessment tools in equine research is relatively new and is largely used to measure pain or performance in ridden horses (Dyson, S. *et al.* 2018, Dyson, 2021). The use of formalised tools in equine weaning based research appears to be non-existent although weaning assessment tools are being developed for other species such as dairy cows (Barry *et al.,* 2019).

Behaviour assessment tools are not well integrated within the industry although professionals do appear to be making some level of observational welfare assessments. Focus group participants believed that they were measuring equine welfare subjectively during stressful events such as weaning but none of the participating organisations recorded measures in an official tool. Some measures were used by one organization such as the observation of improvement in mastitis in mares who had undergone a progressive weaning process. They had also observed differences in how male and female foals respond to weaning related stress. Understanding whether there is a demand for the development of welfare assessment tools by professionals within the equine industry is unclear. There is a growing desire amongst animal welfare researchers however to develop tools that are scientifically reliable to improve welfare standards (Wemelsfelder and Mullan, 2014). Assessment tools are being developed in response to welfare concerns particularly in relation to captive elephants in Zoos (Yon, *et al.,* 2019). It is recognised that these tools must be reliable, simple and quick to

use and centre around expressed behaviours such as stereotypies, comfort behaviour, and social interactions (Yon, *et al.,* 2019). Similar efforts are going into the assessment of horses that are used for food production or work in settings where owners depend on them for an income. The Equid, Assessment and Scoping (EARS) tool was designed to expand the current equine welfare assessment methods to enable use in a variety of settings globally. This tool includes aspects of welfare such as geographic location, weather, and housing conditions, as well as behaviour, working conditions, body and skin condition. The tool also assesses harmful practices and end of life care (Raw et al., 2020). Welfare assessment tools are also being developed for use with farm animals such as sheep. These tools measure a range of welfare indicators such as stereotypies and vocalisations, that are similar to the development of the equine weaning tool, but also resource-based indicators such as stocking density and access to water (Richmond *et al.,* 2017) which are more relevant in a commercial farm environment.

4.3.2 Exploring the changes in terminology.

The scoping review identified a small but consistent body of research from which to explore the current understanding of weaning related stress. Focus group participants respected the body of research but also expressed frustration that valuable measures of behaviour and emotion were missing from weaning research that are used in other areas of equine welfare such as body language and facial expressions (Ask et al., 2024: Dalla Costa, E, *et al.* 2014). Participants introduced new terminology such as trauma and resilience. These terms are common in human related stress research and

trauma is measured through a range of physical, and behavioural indicators that include emotional dysregulation, cardiovascular issues and hyperarousal (Center for Substance Abuse Treatment, 2014). There appears to be a barrier in animal behaviour research linked to the concept of anthropomorphism. Challenging the concept of anthropomorphism is crucial, particularly in a world where we now accept that animal sentience (Browning & Birch, 2022) and emotion (Hall et al., 2018) are recognised and measurable. Although animal sentience is accepted within the research community progress into exploring the emotional connectedness between animals and humans appears to be cautious (Fiedler et al., 2024). Research has traditionally measured welfare indicators in isolation from human connection. Horses are often assessed in isolation or with conspecifics and the focus is typically on the occurrence or lack of ‘natural’ behaviours such as eating and social interactions. Human beings have a unique influence on the lives of animals however and it has been identified that human behaviour may be central to many animal welfare issues, particularly involving decision making on things such as veterinary intervention. This has led to the inclusion of human psychology research in animal sciences to improve welfare through human behaviour change (Lightfoot, 2021). Observer influence is an important factor to consider in animal research as the presence of a human has the potential to interrupt behaviours that express pain or discomfort (Torcivia and McDonnell, 2020).

Research suggests that horses can feel and respond to the emotions of other horses when they observe positive or negative interactions between conspecifics and humans (Trösch et al., 2020). It is also considered that emotional transfer and co-regulation between horse and human is a feature in equine facilitated therapy (Scopa et al., 2019). This area of research is of particular importance in exploring the relevance and significance of 'instinct' or empathy-based assessments of horse welfare by their handlers.

This is an aspect of the study that requires further investigation by using strategies such as Delphi studies (Barrett & Heale, 2020: Nasa et al., 2021) to identify the broader consensus on how we use emotion and language to describe and assess equine welfare. Implementation studies (Peters et al., 2014) may then help to measure the applicability and efficacy of equine/human emotional interplay during welfare assessments.

4.3.3 Sharing information with the public

Educating horse owners on early years experiences is important. It appears that the culture and habits around buying young horses is not as robust as it is when buying a puppy. It appears that the public are much more aware of the need for good weaning practices and other early years experiences of puppies. The university of Lincoln have produced best practice guidance in relation to developing resilience in dogs through training them to cope with life stressors. Exposure to certain lights and acoustics were shown to affect the decision-making ability of dogs and suggest that training to overcome the inherent response to this type of stimuli during the early years helps to build resilience (University of Lincoln, 2024). Horses are more complex in the

sense that they may be 3 or 4 years old by the time they are purchased by their future owner/rider and the young horse will have gone through many new experiences within that time frame such as halter training, hoof care, veterinary care, early ridden training and possibly transporting. How the foal was weaned is almost a distant memory at that point even though there is the potential for the young horse to be harbouring weaning related separation anxiety. The early years experiences of the young horse should hold as much importance as those of young dogs where campaigns by regulatory bodies have enabled the public to educate themselves on how to purchase healthy well-rounded animals (Kennel Club, 2024). Similar awareness building campaigns have been successfully circulated through equine welfare organisations such as the REACT now to beat colic campaign (BHS, 2024). There are several key organisations and charities that are well placed to share best practice guidance on equine weaning (World Horse Welfare 2022: Blue Cross 2024: Bransby Horses 2024) and to incorporate the information into existing curriculums (BHS, 2024: Pony Club 2024).

4.4 Next Steps

The key feature in creating any welfare assessment tool is ease of use. Industry professionals and organisations need something that meets their expectations and has an easy interface. In the digital age more day to day processes are moving to online platforms and an equine welfare assessment tool could work very efficiently in this format. Creating a record for each mare and each foal and spending 5-minutes a day updating the observations would be of minimal impact to the daily workload which is an important facet of user uptake of welfare assessment tools (Yon *et al*., 2019). This record could link into the horse's health record and a digital passport (equine register, 2024) and remain with the horse for life. It is important that mares are assessed separately although interactions between the mare and foal and other herd members could also form part of the welfare assessment (Rankins & Wickens, 2020).

Recommendations

Table 5. Recommendations for best practice during equine weaning

Recommendation	Source
Isolation during acute stress should be avoided	Literature Review, Scoping Review, Focus Groups
Integrate mare/foal into a herd structure prior to weaning	Literature Review, Scoping Review Focus Groups,
Micro-separations in the buildup can minimise distress at weaning	Focus Groups
Allow a minimum window of 12 months within which to wean	Literature Review
Female foals may take longer to wean	Literature Review, Scoping Review, Focus Groups
During weaning keep mare and foal with familiar herd members	Literature Review, Scoping Review
Minimise starch and increase fat and fibre in the diet	Literature Review

4.5 Thesis Conclusions

This study researched the current measures of assessing equine welfare during the weaning process. Existing measures include a range of behaviours such as vocalisation, defecation, and stereotypies. Future assessments need to include measures of distress such as posture and facial expressions. Welfare assessment tools need be accessible, quick and easy to perform to motivate horse owners and carers to adopt them.

Currently there are limited scientific measures being used to assess horse welfare during weaning with handler experience and assessment of the horses' emotions being the main tools. This study has unlocked many potential avenues for future research especially in relation to the horse-human emotional inter-play and how much we can rely on this in equine welfare assessments. Future studies on equine weaning should aim to set out very clear weaning methods and post weaning management practices and use larger sample sizes. It is also important when measuring the long-term impacts of weaning that foals are assessed for a longer period where possible.

For horses, domestic weaning is less about the dietary changes that occur when a young animal no longer requires milk. In domestic circumstances it can be the premature severance of a strong emotional bond with their mothers' which form as a necessity to live within a herd. The permanent severance of this formative attachment occurs in the life of a domestic horse at a very young age, but in a wild situation this process is much more

progressive and doesn't generally occur until the foal reaches sexual maturity. We have a challenge then to minimise the impact that severing this bond has on both the mare and the foal in domestic circumstances. It is important that domestic foals are provided with a balanced herd structure where they can learn to form bonds with horses beyond the maternal attachment that may continue beyond weaning.

This research has identified the deficits and issues with current welfare assessments of weaning in the horse. It has proposed a more holistic approach which considers the mare, foal and herd social interactions and impact, and includes facial expression, posture and body language as methods of assessing welfare.

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Appendix 1 Ethics Approval and Participant Consent Form

SCHOOL OF VETERINARY MEDICINE AND SCIENCE STATEMENT OF RESEARCH ETHICS - FOR DATA COLLECTION BY QUESTIONNAIRE, INTERVIEW OR FOCUS GROUP

Name: Brad Hill and Mandy Roshier

Title of proposed research project: Development of an equine weaning behavioural welfare assessment tool

✓ (COPY AND PASTE)

	Tick where appropriate
1. I am aware of the relevant sections of the EU General Data Protection Regulation (GDPR) and the UK Data Protection Act 2018: https://www.nottingham.ac.uk/governance/records-and-information-management/gdpr-overview.aspx http://www.legislation.gov.uk/ukpga/2018/12/section/1/enacted	✓
2. Data gathering activities involving schools and other organisations will be carried out only with the agreement of the head of school/organisation, or an authorised representative, and after adequate notice has been given.	✓
3. The purpose and procedures of the research, and the potential benefits and costs of participating (e.g. the amount of their time involved), will be fully explained to prospective research participants at the outset.	✓
4. My full identity will be revealed to potential participants.	✓
5. Prospective participants will be informed that data collected will be treated in the strictest confidence and will only be reported in anonymised form, but that I will be forced to consider disclosure of certain information where there are strong grounds for believing that not doing so will result in harm to research participants or others, or (the continuation of) illegal activity.	✓
6. All potential participants will be asked to give their explicit, *normally* written consent to participating in the research, and, where consent is given, separate copies of this will be retained by both researcher and participant.	✓
7. In addition to the consent of the individuals concerned, the signed consent of a parent, guardian or 'responsible other' will be required to sanction the participation of minors (i.e. persons under 16 years of age) or those whose 'intellectual capability or other vulnerable circumstance may limit the extent to which they can be expected to understand or agree voluntarily to undertake their role.	N/A
8. Undue pressure will not be placed on individuals or institutions to participate in research activities.	✓
9. The treatment of potential research participants will in no way be prejudiced if they choose not to participate in the project.	✓
10. I will provide participants with my contact details, in order that they are able to make contact in relation to any aspect of the research, should they wish to do so	✓
11. Participants will be made aware of their options to withdraw from the project at the beginning of data collection/enrollment.	✓

12. Research will be carried out with regard for mutually convenient times and negotiated in a way that seeks to minimise disruption to schedules and burdens on participants.	✓
13. At all times during the conduct of the research I will behave in an appropriate, professional manner and take steps to ensure that neither myself nor research participants are placed at risk.	✓
14. The dignity and interests of research participants will be respected at all times, and steps will be taken to ensure that no harm will result from participating in the research.	✓
17. The views of all participants in the research will be respected.	✓
18. Special efforts will be made to be sensitive to differences relating to age, culture, disability, race, sex, religion and sexual orientation, amongst research participants, when planning, conducting and reporting on the research.	✓
19. Data generated by the research (e.g. transcripts of research interviews) will be kept in a safe and secure location and will be used purely for the purposes of the research project (including dissemination of findings). No-one other than research colleagues or examiners will have access to any of the data collected.	✓
20. Research participants will have the right of access to any data kept on them. (Please note: If they have given information anonymously then this may not always be possible to retrieve.)	✓
21. All necessary steps will be taken to protect the privacy and ensure the anonymity and non-traceability of participants – e.g. by the use of pseudonyms, for both individual and institutional participants, in any written reports of the research and other forms of dissemination.	✓
22. Where possible, research participants will be provided with a summary of research findings and an opportunity for debriefing after taking part in the research.	✓

Please provide further information below in relation to any of the above statements which you have not been able to tick, explaining in each case why the suggested course of action is not appropriate (expand this box if necessary):

Please outline any areas of risk, which have not been referred to above, associated with your research, and how you intend to deal with these (expand this box if necessary):

Signed_____ Print Name___Brad Hill and Mandy Roshier_____ Date__22__J

Hello,

My name is Jo Dwyer and I am a student at the School of Veterinary Medicine and Science at the University of Nottingham. I would like to ask if you would be willing to participate in a focus group about the development of an equine weaning behavioural welfare assessment tool. Participation in all aspects of this research is entirely voluntary and there is no obligation to take part.

The focus group will be sent a link to a YouTube channel to view some footage of mares and foals who have been separated. You will also receive a behaviour chart to complete for each video. For those who wish to discuss their findings we will also conduct some online meetings via Microsoft teams and by completing this consent form you agree that the group meetings will be recorded and the recording used for research purposes.

This research study has been approved by the School of Veterinary Medicine and Science's ethics committee.

The information I collect may be used for publication and research presentations at conferences or meetings.

All responses will be anonymised and no contact details will be passed on to any other persons or third-party organisations.

All data will be securely stored by the researcher.

Your help is very important to the success of this study, so we would appreciate your time and interest.
Further information or queries about the study can be obtained by contacting me: joanne.dwyer@nottingham.ac.uk or my supervisors Sarah Freeman, School of Veterinary Medicine and Science, University of Nottingham sarah.freeman@nottingham.ac.uk or Mandy Roshier, School of Veterinary Medicine and Science, University of Nottingham mandy.roshier@nottingham.ac.uk, tel: 0115 95 16432

This consent form is a formal way of indicating that you agree to participate in this study and that you
understand that any information collected by the researchers:

- · will be used for a research study
- · may be written in a report for publication
- · may be presented at research conferences or meetings
- · will be anonymous and treated confidentially
- · will be securely stored and will only be accessed by research colleagues or examiners

As a participant in this study, you may:

- · request to see a copy/summary of the completed study
- · request to see any information written down/kept during the process of data collection

If you are willing to participate in this study, please complete the following consent section.

I have read and understood the relevant information regarding consent and agree to the terms laid out for my participation in this study. Yes/No
I confirm I am of 18 years of age or over. Yes/No

Signature:

Date:

Thank you very much for participating in this study.

Appendix 2 Risk Assessments

Business Unit:	**Location(s) of Activity:** **Travel from Derby to Longford**	**Risk Assessment Ref:**
Activity Title: Driving Own Vehicle		
Activity Outline: Driving to and from one location in order to capture video footage of mares and foals		
Those at risk / affected parties: Researcher, other road users		
Risk Assessor Name: Joanne Dwyer	Signature: J Dwyer	Date: 13/10/2022
Responsible person / Line Manager Name:	Signature:	Date:
Master Risk Assessment Reference where applicable:	**Related procedure references or links:**	
Review Period:		

What are the hazards?	**List the harm associated with the hazard**	**Risk Evaluation without controls in place** High/Med/Low	**What control measures are, or will be put, in place to control the risk?** List all elimination, substitution, engineering and/or administrative controls	**Risk Evaluation with controls in place** High/Med/Low
Vehicle Condition	Breakdowns, accidents due to tire and brake condition.	HIGH	Vehicle has current MOT and was serviced at the same time. Tire pressures regularly checked; oil level regularly checked.	LOW

Driving	Lack of insurance cover for specified use.	HIGH	Check with insurance company that use is permitted.	LOW
Weather Conditions	Increased risk of accidents in wet or poor visibility conditions	HIGH	Will cancel the journey in the event of extreme weather due to rural roads.	LOW
Traffic Conditions	Potential delays, increase journey time, tiredness	MED	Alternative routes, will cancel if delays add unnecessary travel times	LOW
Out of Hours working	Nature of the project may require early start or late finish.	MED	Aiming for working hours but will take extra breaks and food and drink in case of out of hours working due to the nature of the project.	MED

Business Unit:	**Location(s) of Activity: Middlebrook Stud**	**Risk Assessment Ref:**
Activity Title: Metting Off-Site		
Activity Outline: Meeting farmer/horse breeder to take video footage of mares and foals at point of weaning.		
Those at risk / affected parties: Researcher, farmer/stud owner		
Risk Assessor Name: Joanne Dwyer	Signature: J Dwyer	Date:13/10/2022
Responsible person / Line Manager Name:	Signature:	Date:
Master Risk Assessment Reference where applicable:	**Related procedure references or links:**	
Review Period:		

What are the hazards?	**List the harm associated with the hazard**	**Risk Evaluation without controls in place** High/Med/Low	**What control measures are, or will be put, in place to control the risk?** List all elimination, substitution, engineering and/or administrative controls	**Risk Evaluation with controls in place** High/Med/Low
Travelling	Vehicle issues, road conditions	High	Car serviced and MOT'd, route planned, cancel in the event of adverse weather.	Med
Attack from third party	Physical harm	Med	Meet with more than one person, raise alarm with emergency services.	Low

Adverse Weather	Road conditions, working outdoors	Med	Cancel the trip in the event of extreme weather.	Low
Working near Animals	Unpredictability of animals	High	Wear protective equipment, minimise direct contact with the animals	Med

Business Unit:	**Location(s) of Activity: Office**	**Risk Assessment Ref:**
Activity Title: Office work		
Activity Outline: Working within an office environment using and storing equipment such as computers.		
Those at risk / affected parties:		
Risk Assessor Name: Joanne Dwyer	Signature: J Dwyer	Date:13/10/2022
Responsible person / Line Manager Name:	Signature:	Date:
Master Risk Assessment Reference where applicable:	**Related procedure references or links:**	
Review Period:		

What are the hazards?	**List the harm associated with the hazard**	**Risk Evaluation without controls in place** High/Med/Low	**What control measures are, or will be put, in place to control the risk?** List all elimination, substitution, engineering and/or administrative controls	**Risk Evaluation with controls in place** High/Med/Low
Slips and Trips	Trips and Falls	High	• General good housekeeping • Areas well-lit including stairs • Offices cleaned frequently	Low

			• General walking areas to be kept clear and free of loose cables and general clutter.	
Manual Handling	Injury	High	• Trolley used to transport boxes awkward and heavy items. • High shelves for light objects only.	
Use of display screen equipment	Eye strain, musculoskeletal problems, repetitive strain	High	• Workers to contact DSE officer and have workstation assessed. • Reassessment if there is change to work features e.g. equipment or furniture. • Shared work stations assessed for all users. • Work planned to include regular breaks. • Lighting and temperature suitably controlled. • Eye tests provided for those who require them. • Lap top users advised of requirements to assess when using laptop away from office. • Workers should take breaks as advised by HSE to stretch and get up form work stations at intervals. • Workers should initially discuss with DSE advisor potential issues. • Workers are also advised to discuss issues with their GPs. • If issues cannot be resolved referral should be made to occupational health. • Workers should discuss issue with line manager and work patterns and breaks.	

			• Advisement for relevant eye tests provision of coupons for eye tests.	
Use of electrical appliances	Risk of shock, over heating		• All equipment should be operated according to manufacturer's guidelines. • Named equipment to serviced and maintained by contractors (i.e. copiers) • Portable equipment to assessed following SVMS PAT policy. • Sufficient sockets to be provided. • Cable to be kept tidy/out of way. • Damaged or faulty equipment to be taken out of service until fixed. • No toasters or heating element heaters to be used in offices.	
Storage	Falling objects, bumps, concussion, access and egress in an emergency		• Clear entry and egress from office to be maintained. • Exits to be kept clear and functional. • Objects to be stored securely. • Only light items to be secured above head height. • Step stools and steps ladders to be used to access high level storage areas. Step ladder used should be compliant with university ladder policy	
Access and egress in an emergency	Fire		• Exits clearly marked • Exits clear • Relevant inspections by Fire safety officer	

			• Reporting system for faults and repairs to safety related structures	
Lone Working	Increase problems associated if incident occurs when working alone.		• Out of hours activities to be risk assessed in line with the university policy on out of hours work. • Out of hours work to be approved by line managers.	

Business Unit:	**Location(s) of Activity:**	**Risk Assessment Ref:**
Activity Title: Participant Data Protection		
Activity Outline: Preservation of data offered by the participant for use in the research project.		
Those at risk / affected parties: Participant		
Risk Assessor Name: Joanne Dwyer	Signature: J Dwyer	Date:13/10/2022
Responsible person / Line Manager Name:	Signature:	Date:
Master Risk Assessment Reference where applicable:	**Related procedure references or links:**	
Review Period:		

What are the hazards?	**List the harm associated with the hazard**	**Risk Evaluation without controls in place** High/Med/Low	**What control measures are, or will be put, in place to control the risk?** List all elimination, substitution, engineering and/or administrative controls	**Risk Evaluation with controls in place** High/Med/Low
Confidentiality Breach	Reputation of the researcher and the University, Data protection breach	Med	• Review relevant sections of the *Data Protection Act* (1998): http://www.legislation.gov.uk/ukpga/1998/29/contents • Electronic data (e.g. spreadsheets, surveys) kept in password protected files. • Electronic data stored securely on a password protected computer. • All necessary steps will be taken to protect the privacy and ensure the anonymity and non-traceability of participants. • Participant information/data collected on paper will be given a subject code (names/addresses removed). • Informed consent will be collected if an organisation is to be named in any reporting. • When transferring data, this will be carried out using a pen drive/memory stick. • No-one other than research colleagues or examiners will have access to any of the data collected. • Care when sending group emails, ensure blind carbon copy selected when sending.	Low

Misunderstanding purpose of study/how their data will be used		Med	• Study and documentation reviewed by SVMS ethics committee. • Participants provided with study information and informed consent collected.	Low

Appendix 3 Gantt Planner

Week Commencing →	Oct 22	Nov 22	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023	June 2023	July 2023	Aug 2023	Sept 2023	Oct 2023	Nov 2023	Dec 2023	Jan 2024	Feb 2023	Mar 2024	Apr 2024	May 2024	June 2024	July 2024	Aug 2024	Sept 2024
Literature Review																								
Scoping Review																								
Preliminary footage of mares and foals at weaning.																								
Review Stakeholder involvement																								
Identify and contact stakeholders																								
Method/trigger material																								
Host workshops with stakeholders																								
Transcribe notes and recordings from workshops																								
Generate publication, submit abstract for ISES conference																								
Dissemination through industry and public media																								
Complete 20 credit taught elements																								
Thesis submission																								

Appendix 4 Search Terms

Search terms used in a scoping review designed to identify and chart the current evidence on the effect of weaning related stress on the emotional health of domestic horses.

(horse* or pony or ponies or mare* or dam or dams or broodmare or equus or equine*).mp.
(wean* or suckl* or postwean* or ((separat* or removal) adj3 mother*)).mp.
(weanling or foal*).mp. [mp=abstract, title, original title, broad terms, heading words, identifiers, cabicodes]
(emotion* or behaviour* or behavior* or welfare* or stress*).mp.

Appendix 5 Inclusion Criteria

Inclusion and exclusion criteria for a scoping review of the literature to identify and chart the current evidence on the effect of weaning related stress on the emotional health of horses.

CRITERIA	INCLUSION	EXCLUSION
PATIENT	Domesticated equines (mare and her foal)	Undomesticated equines Other species Other equids (Donkeys, mules, zebra, hybrids)
EXPOSURES	Mare and her single foal with no health issues in the foal	Papers relating to bone growth disorders or other health problems. Fostered / hand reared / orphan foals. Twin foals
INTERVENTION	Weaning and separation of mare from foal	Equines used for milk/dairy/meat farming Invasive management or handling of foals likely to affect behavioural responses
OUTCOME	Papers including independent assessments or measures of equine behaviour and/or stress during and/or after weaning. (Owner observations or survey of equine behaviour)	Studies of nursing behaviours only Studies of health outcomes only (including medical conditions, parasites, immunity) Student or owner opinions, perceptions or attitudes without behaviour observation or measure. Studies measuring individual temperament or manageability of foals only.
LANGUAGE	English or papers with translation available	Translation not available
STUDY DESIGN	Case series, cohort, case control, cross sectional	Individual case reports, qualitative studies Experimental studies of pharmaceutical or homeopathic interventions
PUBLICATION TYPE	Peer reviewed journals Conference proceedings	Narrative, textbook chapters, reviews Unable to obtain full study details (abstract or full text) Non-peer reviewed journals

Appendix 6 Researcher Reflexivity Statement

I am a white, female MRes student, aged 41, studying at the University of Nottingham School of Veterinary Medicine and Science.

I grew up in Derby and attended the University of Derby from 2019 for a BSc (hons) in Equine Science, Management and training as a mature student. I have had a 12-year career with Boots in various roles from Customer Advisor to Store Manager. I continue to work for Boots part time as a Pharmacy dispenser alongside my studies.

Growing up in a single parent family on an inner-city council estate was tough. I always remember being top of the class for spelling at primary school but after that, my academic abilities waned under the shadow of poverty. I was inspired to advocate for equine welfare when a leaflet from Redwings horse sanctuary came through the letterbox. There was a horse on the front called Laura and her ribs and spine were showing. I felt a powerful sense of righteousness, that I wanted to do something to stop this happening to other horses.

I left school with a couple of GCSEs and gained an apprenticeship at a riding school. I completed NVQ II and III in horse care and stable management and spent ten years as a groom. I moved out of the industry and took on the role as a customer advisor for Boots. I won awards for colleague and community care and was promoted into management roles. This gave me a good grasp of business practices and I had a specialism in colleague health and engagement. During that time, I went back to college to re-sit English and Maths GCSEs and improved my academic profile. Improving my academic profile enabled me to go into higher education and study for the BSc and subsequently for this MRes. I was keen to research weaning after having bred two of my own foals and based on my experiences as a groom where I had been responsible for caring for mares and foals.

My supervisory team consists of veterinary surgeons with equine specialisms, and a qualitative researcher from the animal behaviour setting. My personal experiences may have influenced interpretation of qualitative data collected. Gaining insight and advice from my supervisors added additional perspectives on theme generation, to create a more comprehensive analysis.

Appendix 7 Interview Schedule

Equine Professionals Focus Group Schedule
To begin:
• Introduce myself
• Explain what the research is about and why I want to hold focus group with the participants
• Emphasise I am interested in what they have to say and there are no right or wrong answers
• Explain set up, raise hands, respect others' views, each person will be given time to contribute
• Remind the participants the focus group should last around 60 minutes (but can be led by them and how much they want to share), say how many main questions will be asked.
• Participants can leave at any stage, and are free to return if the meeting is ongoing
• Responses will be kept anonymous, and they have the right to withdraw consent until data is analysed
• Confirm everyone was happy with consent form and pre work
• Start recording 1.
To start with, please could everyone introduce themselves, telling me a bit about your role as an Equine professional, and any other roles you have within the equine world?

- Did you observe behaviours in the video clips that could indicate either good or compromised welfare?
- Was the behaviour chart useful as a cross reference for assessing the welfare of the horses?
- Did you observe behaviours not listed on the chart that may indicate either good or compromised welfare?
- Did you notice differences across the videos?
- Do you currently use an assessment tool as part of managing mares and foals at your organisation?