The developmental behaviour of foals and its relevance to husbandry, part 2: weaning

The veterinary team plays a key role in providing help and education to breeders. Weaning is a critical time in the foal's life and is likely to have a significant impact on their future behaviour and resilience to stress. This article is the second of two applying the research on foal behavioural development to good practice in the management and training of foals. This article examines the evidence surrounding weaning practices and provides a guide to best practice with the resources available to the veterinary team and the horse breeders they work with.

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Vets are highly regarded sources of reliable, evidence-based information and advice, the aim of which should be to summarise findings and practical applications of the most up-to-date research. Artificial weaning differs from that of free ranging, naturally living horses. Finding a balance between meeting the needs of the breeding operation and working with the natural adaptations of horses to safeguard their welfare is best guided by the available evidence base.

Weaning has been repeatedly found to cause large increases in stress in the new weanling, with negative impacts on their welfare, and a large panel of equine scientists and vets have deemed it the single most stressful intervention in a horse's life (McGreevy et al, 2018). With increasing recognition that horses' experiences impact their welfare status, when and how foals are weaned is important in order to protect their welfare. It is increasingly considered that the balance of the horse's experience should be weighted towards the individual having positive experiences and being able to successfully predict and overcome negative experiences (McGreevy et al, 2018).

Finding the best way to reduce the impact of weaning on mares and foals is the shared goal of vets, equine scientists and horse breeders. Most agree that artificial weaning is not natural, but that weaning is part of horse breeding operations. Understanding and weighing up the scientific evidence presented on how different weaning protocols affect mares and foals will allow the veterinary team to help breeders find the best practice for their stud and to successfully apply it.

Two key areas have emerged from the research on weaning in horses to date: the age at which the foal is weaned and how the foal is weaned.

Foal age at weaning

Free-ranging domesticated horses that have become feral or are kept under naturalistic free-range conditions stop being suckled by the age of approximately 10 months, unless their dam is not pregnant in which case suckling ceases later (Tyler, 1972; Crowell-Davis, 1985). Suckling behaviour is mostly initiated by the foal (Crowell-Davis, 1985). The duration of suckling bouts may or may not decrease as the foal gets older and the frequency of suckling bouts decreases (Crowell-Davis, 1985; King yet al, 2016). Milk quality and production also decreases after the first few months of the foal's life. The amount of suckling behaviour does not correlate with the amount or quality of milk produced by the mare (Cameron et al, 2008). The foal also tends to end most suckling bouts, but mares may do so by moving away, blocking the foal by flexing the hind leg or by behaving aggressively (Tyler, 1972; Crowell-Davis, 1985). Some mares may increase aggressive behaviour and end suckling bouts in the last month prior to natural weaning (Duncan et al, 1984). The mares in Tyler's (1972) study did not behave aggressively at this stage of lactation and Crowell-Davis (1985) recorded the most aggressive mare behaviour related to suckling around the 13th week of lactation (Crowell-Davis, 1985).

Research by Henry et al (2020) looked at weaning in 16 mare-foal pairs of naturally kept Icelandic horses and observed that most foals in their study stopped suckling spontaneously at 9–10 months of age (270–300 days) without apparent stress in either foal or dam, or rejection by the dams. In other observations of free-living horses, foals stopped suckling around the same time with the earliest documented natural weaning at 140 days (Duncan et al, 1984). This figure represented an outlier, other foals of multiparous mares in the study cohort stopped suckling between

245 and 280 days with the foals primiparous mares weaning 5 weeks before the next foal was born.

Boy and Duncan (1979) noted that in the last 10–12 weeks before weaning, foals spent much more time engaged in foraging behaviour, like the yearlings and 2-year-olds in their study cohort of free-ranging Camargue horses. Based on these clearly documented observations, Henry et al (2020) and the author advocate for delaying weaning until this later age. Identifying increased foraging time, like that of yearlings and 2-year-olds, could be a useful indicator of nutritional readiness for weaning.

While the foals in these studies ceased suckling spontaneously, there may be some less obvious and not yet investigated mechanism responsible for this. This could be related to gut biome changes or simply a further decline in milk quality as the mare invests her energy into the last trimester of the next pregnancy. Milk produced in the autumn (September, October, and November) is lower in energy, protein, fat, cholesterol and vitamin C (Markiewicz-Kęszycka et al, 2015). There has not been any research into any effect of even later lactation milk on the foal gut biome or on the composition of the milk of mares in the month before they are due to foal again. Milk itself is an important part of growing a foal; it is at its highest quality in terms of protein, fat, and sugar content during the first months of the foal's life and declines in quality and quantity past that point.

At 4–6 months of age, the typical time for artificial weaning, milk still plays an important role. Foals are susceptible to gastric ulceration. Feeding mares a high fibre diet, supplemented by fat rather than by cereals improves milk yield and also increases the presence of linoleic acid in the milk, which is thought to help protect the foal from gastric ulceration (Hoffman et al, 1998). Weaning foals at approximately 6 months of age was shown to result in a high proportion of foals experiencing gastric ulceration in the two weeks that followed (Hewetson et al, 2018). In comparison to 7 days before weaning, at 14 days after weaning the percentage of foals with clinically significant lesions increased from 8% to 82%, more had signs of less significant gut damage. At this age the foal's stomach lining is potentially not ready to go without milk and is very sensitive to the significant stress associated with weaning.

Means of weaning

Generally, foals are weaned abruptly or gradually, and there is a wide variation in techniques:

Abrupt weaning

Abrupt weaning normally means moving the mare away to a separate location, usually but not always out of ear shot of the foal. The foal may be left stabled, in a barn or at grass, with or without other foals, and/or without other familiar adult horses. There has not yet been a study published that shows that abrupt weaning is not stress free, just that some techniques are not as stressful as others. Weaning into groups on pasture already familiar with the foals and providing a fat and fibre diet, versus weaning them into an unfamiliar building and feeding a cereal-based diet (Nicol et al, 2005), also resulted in decreased incidence of crib-biting, weaving and box walking (Waters et al, 2002). Paddock weaning resulted in fewer of these repetitive, stereotypical behaviours associated with stress compared to weaning into a stable or barn.

Crib biting started at only 20 weeks of age, or 5 months, triggered by the stress created at weaning (Waters et al, 2002). Given that crib biting horses are at increased risk of epiploic foramen entrapment colic, of which survival rate is relatively poor compared to other types of colic (Archer et al, 2008), it is in the foal's best interests not to be exposed to a situation known to induce crib-biting.

In addition to keeping stress levels down, keeping youngsters in groups helps them to refine their social skills and set them up to be safe to keep in groups as adult horses, especially for stallions (Christensen et al, 2002), which under free-living conditions also receive more maternal investment in their social behaviour, readying them for the wider social network that free-living stallions find themselves in (Stanley and Schultz, 2012).

Typical behavioural responses to abrupt weaning are increased movement and vocalisation, and decreased eating behaviour. Colts are more likely to vocalise and defecate more frequently, but fillies have shown higher levels of the stress hormone cortisol post-weaning (Wulf et al, 2018). Aggressive behaviours may increase, and the physiological measures of stress include lack of weight gain, increased heart rate and increased cortisol (Wulf et al, 2018).

Gradual weaning

Gradual weaning can mean progressively getting mares and foals used to a duration of separation each day until weaning, and other means of separating the end of suckling from the end of all physical contact. It can also mean removing one or two mares a day from a group of mares and foals.

Mach et al (2017) took a group of 34 Welsh pony foals and split them into two groups. In the first group, progressive weaning, 17 7-month-old foals were separated from their dam by a steel gate across the stable door; foals were kept inside and mares outside in an adjoining enclosure where they could see, smell, and touch each other but not suckle for increasing time periods over 30 days. Starting with 5 minutes per day for a week and building up to 6 hours separated by a solid door a month later when the mares were permanently removed from their 8-month-old foals. The second group, abrupt weaning, involved removing the mares once the foals reached 8 months of age. Each group had two mares and foals per stable so that all the foals were weaned in the company of a second foal. The gut microbiota composition of the foals was recorded at 30 days before weaning (at the start of the progressive weaning protocol), on the day of weaning, and then at 3, 5, 7 and 30 days after weaning. The foals in the abrupt weaning protocol had a better adapted gut microbiota on the day of weaning, with more of the beneficial groups prevotella, parapreovotella and ruminococcus, compared to the progressive group. The actual weaning event was followed by marked shifts in the gut microbiota with foals ending up with one of three distinct gut biome types regardless of weaning method. The type 2 community is helpful in providing some resistance to the negative effects of stress. It is characterised by eubacterium, copracoccus, clastridium XI and blautra species and is associated with lower measures of stress: lower salivary cortisol, longer telomere length (telomeres shorten

in response to oxidative stress which can be induced by psychological stress, and can lead to cell death) and increased N-butyrate production. However, it is unclear how to promote this gut microbiome community in the weanling as it was not fully influenced by the weaning protocol.

When it came to the behavioural and physiological effects on each group, almost the same team of experimenters found that the foals in the progressive group fared better (Lansade et al, 2018) despite having less prepared gut biomes. Foals in the progressive group did call more during each of the separations, but nowhere near as much as when finally separated (Lansade et al, 2018). Once actually weaned, the foals of the progressive group neighed and trotted less than those weaned abruptly. Their cortisol levels were also lower. Over the 3 months that followed, the progressively weaned foals were also braver, more curious and less needy of their companions. The mares in the progressive group had lower cortisol levels on the day of weaning when they were transported to a familiar site 2km away. Once there they spent more time resting and eating than the mares in the abrupt weaning group. The progressive group mares also had longer telomere length (Lansade et al, 2018).

In other research ten 6-month-old Anglo Arab colts were weaned by placing the mares on the far side of a v-mesh fence through which the foals and mares could interact but not suckle (Bruschetta et al, 2017). Compared with another ten Anglo Arab colts of the same age that were completely separated, the ones with the mesh fence had lower stress responses, resulting in lower cortisol and other stress-related hormones (Bruschetta et al, 2017).

Experimental use of udder covers on the mare for 4 days before complete separation was largely effective at stopping nursing but not at reducing the stress induced by physical separation (Merkies et al, 2016).

In other examples, one or two mares per day have been removed from the group until only foals are left, with or without familiar adult horses. Erber et al (2012) examined the differences between groups of foals on pasture: when all the mares removed at once; where two mares were taken per day; and where all the mares were removed but two familiar but unrelated mares were left with the foals. All methods caused increased levels of cortisol, with cortisol levels remaining elevated in the second method until all mares had finally been removed. This suggests prolonged stress, which could be attributed to the lack of predictability about the disappearance of the remaining mares, and/or the social contagion created as the mares and foals yet to be weaned became stressed by the ones that had already been weaned and were calling to their absent dams (Briefer et al, 2017; Żelazna and Jezierski, 2018). In other studies, horses have been shown to react negatively to the separation of mares and foals (Żelazna and Jezierski, 2018), and to the calls of those that are stressed by separation (Briefer et al, 2017). In Erber et al's (2012) study, the foals moved and called when separated from the mares in all groups, but moved and called less in the latter group where two familiar mares remained. All three methods caused stress, but the third method caused the least amount of stress.

The most important thing about these results is that they build on the earlier work by Nicol et al (2005) who used sequential removal of mares in their paddock weaning method. This was judged to be less stressful because the foals looked less agitated, although no biological measures such as heart rate or cortisol production were taken, and so the study was incomplete. Future research would benefit from recording both behavioural and physiological measures to better understand the impact of weaning methods and determine how appropriate they are for use. The other important fact was that foals left with familiar adults had the least worst stress response. A result that has been repeated by Henry et al (2012) finding that foals weaned into a group with other foals and with adult horses had smaller stress responses and were also less aggressive to each other than foals weaned into a group consisting solely of other foals.

Conclusions

Based on the knowledge to date, artificial weaning has never been shown to be stress free, just that there are differing degrees of stress caused: for example, foals weaned at least before 7 months of age are at increased risk of gastric ulceration. Stress caused by sudden weaning causes crib-biting to begin in those animals genetically predisposed to it. Natural weaning occurs in the months just before when the next foal is due, when the foal at foot is 9–10 months of age, and there is no apparent stress, and aggressive behaviour from the mare to the foal only occurs in a limited proportion of mare-foal dyads. Weanlings adjust better when they are weaned into familiar environments, when there are familiar adults, when they are fed high fibre diets, and when they have spent the month beforehand gradually adjusting to short periods of time with the mare on the far side of a barrier through which she can be seen, smelled, and touched, but where suckling is not possible. EQ

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KEY POINTS

- Natural weaning happens spontaneously at around 9–10 months of age.
- No artificial weaning method has ever been found to be stress free.
- Foals weaned at the traditional time of around 5–6 months of age are at significant risk of gastric ulceration and crib-biting.
- Stress caused by weaning can be eliminated or reduced by:
  - Allowing natural weaning to occur.
  - Delaying weaning to past 9 months of age and using a progressive method where mares and foals are gradually familiarised with short separations where they can still see, smell and touch each other in the month leading up to weaning.
  - By weaning foals into a familiar environment in the company of familiar adult horses.
  - Feeding a high fibre diet and adding oil where additional energy is required before, during and after weaning.

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