

Optimising the welfare of equids on box rest: thinking outside the box

Restriction of equids to a stable for box rest is advisable for the management of acute physiological conditions. Confinement to a single stable is not an optimal environment for a horse and can create frustration and the expression of abnormal behaviours, which can indicate a reduced welfare state. Expression of aggression towards handlers or rebound behaviours when released from the stable can be a safety concern for handlers and gives the potential for reinjury. By reviewing the literature, we can consider what aspects of the environment can be adjusted to allow optimal expression of natural behaviour within the stable, subsequently reducing frustration and stress which will improve the welfare of the equine on box rest and potentially improve the safety of handlers.

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Restricting horses, mules and donkeys to box rest may be advised by veterinarians to manage acute physiological conditions and to facilitate diet restrictions. Restriction of movement is advised for wound healing, strained tendon recovery (Gillis, 1997) and is often used to manage acute laminitic episodes (Mitchell et al, 2015). Managing equines prone to laminitis frequently involves restricted forage intake (Mitchell et al, 2015) and this can result in inadvertent restriction of movement and social interactions. The long term recovery of the equine and its chance to return to previous levels of work is improved if the healing is optimised (Gillis, 1997), thereby protecting the horse's future.

Given the necessity to restrict horses for these reasons, it is important to consider the psychological impact of restriction to a stable on the horse, as well as the effect this can have on the behaviour of a horse on box rest. The author has reviewed the literature using the search engines Research Gate and Google Scholar. The initial search was for research related to management of equines in single housing, stereotypical occurrences related to management and effect of environment on equine behaviour. This initial review led to further searches into specific management factors that had been identified across multiple studies, which affected the occurrence of behaviours considered to be indicators of stress or poor welfare. Where a study had small numbers of study animals, further literature associated with that study area was sought to consider supporting or contradicting evidence. This contributed to identifying factors that can speed up recovery and improve the welfare of equids that are restricted during a period of treatment.

Behavioural and physiological indicators of stress have been recorded when horses have been confined to a stable and isolated from companions (Mal, 1991; Visser, 2008; Yarnell et al 2015). The behavioural outcomes of single housing can lead to increased difficulty in handling, reduced trainability and post-inhibitory rebound behaviours that compromise the safety of handlers and the safety and welfare of equids (Rivera et al, 2002; Freire et al, 2009; Yarnell, et al, 2015). The 'Five Freedoms' listed below are relevant to an equid on box rest, stating that an animal should be free and able to display natural behaviour.

- The freedom from hunger and thirst, equids have evolved to eat for 10-18 hours a day with small amounts of time between foraging bouts.
- The freedom from discomfort, a suitable shelter and bedding material to allow species-appropriate sleep and rest behaviour.
- The freedom from pain, injury and disease, ensure rapid treatment and ensure a suitable environment to reduce the opportunity for injury or disease.
- The freedom to display natural behaviour, allowing expression of natural behaviours and time budgets in a domestic environment with sufficient space and company of their own kind.
- The freedom from fear and distress, reduce the opportunity for mental distress through their environment and appropriate ethical training.

It can be argued that temporary box rest is enabling long term improved welfare for an injured animal and contributes to meeting the freedom, freedom from injury. However, longer term management in single stables should be avoided as this reduces the oppor-

tunity to express natural behaviour and the psychological welfare implications of this are significant. As Mellor's (2020) 'Five Domains Model' explores, we have to consider the positive emotions that our animals experience in life and recognise that it is more than an existence, but it must be a life worth living.

The natural behaviour of free living horses has been used as a reference point for behaviours which are considered important for equids to perform to promote good welfare (Yarnell et al, 2015). When domestic horses have the opportunity, they will display time budgets similarly to wild living horses (Heleski et al, 2002). Even stabled ponies with ad libitum forage will display similar time eating as wild living equids (Sweeting et al, 1985). Wild living equids forage for between 10 and 18 hours a day, dependant on group composition and other environmental factors such as weather (Duncan, 1980; Boyd et al, 1988; Baumgartner et al, 2020). Studies have shown near constant eating or a maximum gap in intake of 3 to 4 hours (Baumgartner et al, 2020). When horses display their maximum foraging time appears to be dependent on environmental conditions. While there are higher rates of foraging in winter, over summer, hot weather can result in higher levels of feeding overnight or increased dawn and dusk foraging bouts (Boyd et al, 1988; Berger et al, 1999). Beyond aspects of behaviour, there are direct health implications. Physiologically, the equids digestive system is designed to have near constant access to forage. Consequently, periods of over 6 hours without forage have been found to be related to ulcer formation (Luthersson et al, 2009).

Behavioural indicators of stress

Ruet (2019) considers there to be four behavioural indicators of poor welfare state in horses: stereotypic behaviour, aggression toward humans, withdrawn state and the expression of stress behaviours. Aggression towards humans has also been related to the expression of chronic pain and frustration (Mills and Nankervis, 1999; Fureix et al, 2010).

The social isolation and restriction of movement that is enforced with restriction to a stable, as on box rest, is considered to be a causative factor of stereotypy in horses (McGreevy et al, 1995; Bachmann et al, 2003), particularly when the restriction is of sudden onset or in young horses (Visser, 2008). Stereotypic behaviour is considered an indicator of poor welfare and wellbeing. There are contradicting studies in the stress levels displayed by horses displaying stereotypy and the current thinking is that stereotypy is an active coping mechanism that reduces the stress a horse feels during a period of poor welfare. Stereotypic behaviour should not be restricted by physical restraint, as that can contribute to the emotional motivation for the behaviour and cause a further decline in welfare (McBride and Cuddeford, 2001). Another complicating factor of stereotypic behaviour is that once developed it can be self-reinforcing and the behaviour can be shown even if welfare conditions are improved (Hemmings et al, 2004). Crib biting has been reduced by Naloxone, but this was believed to be a result of its sedative effect rather than a reduction in motivation, but weaving rates were not affected (McBride and Cuddeford, 2001).

By reducing the motivations that trigger these behaviours in the first instance, we can improve welfare at that point in time and in the future by reducing the opportunity for the behaviour to become

established for that individual. Attempting to restrict the behaviours physically, chemically or through training can mask the underlying problem.

Equines on box rest are prevented from achieving their goal of intrinsically motivated behaviours, including social interactions, foraging and moving. Their frustration can be expressed in the form of abnormal repetitive attempts (Mills, 2005) at trying to achieve the outcome they desire, which can develop in to stereotypy. Alternatively, this frustration can be expressed through aggression (Mills and Nankervis, 1999; Ruet et al, 2019) or undesirable behaviours including pawing, striking, kicking, biting, bolting, bucking and shying (Carroll et al, 2020). These behaviours can be a safety concern for handlers and also put horses at risk of reinjury.

Post-inhibitory rebound behaviour is considered to indicate a decrease in welfare as there is a restriction on maintenance behaviours (Freire et al, 2009). This is particularly relevant to horses on box rest, where the rebound behaviour related to movement can cause significant safety concerns for the owner and the equine. Common behaviours expressed when equines are allowed freedom after a period of confinement include trotting, cantering and bucking (Freire et al, 2009). Displaying this behaviour also carries the potential for reinjury, which could further extend box rest. Baumgartner et al's (2020) study indicated that if a horse's forage runs out overnight on a shavings bed then a rebound behaviour is shown, where the forage ration was eaten quicker than horses on a straw bed and with less interruptions to the meal. It was considered that this was as a result of having no opportunity to forage when bedded on shavings, resulting in reduced welfare for the horse.

The absence of these stress-related behaviours does not mean that the equine is not experiencing poor welfare and undue stress. Fureix et al (2012) describes an equine's withdrawn posture, with the head stretched out and the neck a similar level to the back, with eyes open but gazing at nothing. This was related to social, spatial and feeding restrictions, along with genetics and exercise type. Sweeting et al's (1985) study also described increased standing when view of neighbour was restricted. This state of anhedonia indicates poor welfare (Mellor et al, 2020). It is the author's belief that increased recognition of this by caregivers and owners has the potential to improve equine welfare.

The behavioural signs discussed are indicative of a sustained negative welfare state (Mills and Nankervis, 1999; Ruet, 2019). Behavioural signs of stress, including increased vigilance, defecation, pacing, ears flattened, flared nostrils have been identified in stabled horses on an increasing scale by Young et al (2012), similarly to Ruet's (2019) study of stress behaviours. Young et al's (2020) study had a variety of differing management factors and assessed them on acute stressors only. The scale can be useful to identify acute stress behaviours but did not identify the withdrawn posture reported by other studies (Hall et al, 2008; Ruet et al, 2019). This is likely reflective of the time that the horses were observed for within the stable. The withdrawn state was associated with age, but age reflected the amount of time the horses in Ruet's (2019) study had experienced the management of single house stabling. There are more subtle signs of equine stress including eye wrinkle angle (Hintze et al, 2016) which are also important to note, as responses to stimuli do not consistently reflect affective state (Squibb et al, 2018).

Caregiver identification and interpretation of behaviour is generally poor. (Dyson et al, 2018; Bell et al, 2019). Identifying caregivers' ability to recognise these indicators of stress can allow professionals to offer suitable resources to educate owners and motivate them to act on these signs. Simple adjustments to management can help meet behavioural motivations and reduce stressors, so the environment is more manageable for the equid (Cooper and Mason, 1998). This subsequently reduces the chance of an escalation of the stress-based behaviours that could become a safety concern for caregivers.

Effect of the environment

The environment of the horse on box rest will influence its welfare and can be adapted and enhanced in several ways to improve welfare. Enrichment of the environment is shown to decrease abnormal behaviour expression, improve learning, reduce anxiety and fearfulness and improve associations with humans (Lansade et al, 2014). The goal of environmental enrichment is to increase behavioural repertoire to align with wild living animal behaviour budgets. Baragli et al's (2009) study at a riding stable demonstrated that enrichment of the environment by modifying the stable structure to facilitate increased social interaction, provision of ad lib forage, plus 3 hours turnout per day with a companion, can work to reduce abnormal behaviours and optimise the expression of a time budget similar to that of the free-living horse. This was a study which had a small number of equids, but other studies support the findings of enrichment leading to time budgets closer to an equine's natural state (Winskill et al, 1996; Benhajali et al, 2009). By filling the time of a horse on box rest with opportunities to display natural behaviour, the opportunity to develop or display established stereotypy is reduced (Rochais et al, 2018).

By increasing the complexity of the stable environment, the whole 24 hour period can be positively affected with limited time requirements from humans. The environment can be further enriched with the addition of stable toys and sensory or cognitive stimulation. This can be effected by the caregiver's perception of the importance of the enrichment and the time available.

If a caregiver reports behavioural problems including aggression, difficulty handling or expressions of stereotypy during box rest, positive intervention by appropriately qualified professionals can support caregivers in making environmental changes that have the potential to improve safety and enhance equine wellbeing. Identifying the motivation for the behaviours and when they are triggered can assist in identifying aspects of the individual's physical environment and create management routine that can be adjusted to relieve the motivation and increase the behavioural repertoire, aligning it closer to free living equine time and thereby improving welfare.

Adaptation of the restricted environment and management to promote positive welfare

After reviewing the literature, the author identified four features of the environment which can be influenced by management to improve welfare:

- Physical features of the restricted environment and management
- Social opportunities
- Movement ability and opportunities
- Introduced activities for psychological stimulation.

These factors have the potential to protect the horse's psychological wellbeing when its needs cannot be met as a result of injury or illness. This has potential to reduce behaviours which carry the risk of injury to handlers.

Physical features of a restricted environment

The environment that the equid is restricted to and its surroundings play an important role for the equid on box rest. A common form of horse management is single stables with paddock turnout (Yarnell et al, 2015). Increased time spent in single housing was linked to increased expression of non-responsiveness to the environment (Ruet et al, 2019), indicating the importance of adaption of the space to allow for expression of natural behaviour time budgets and improve sensory stimulation and overall welfare. There are several features to consider when assessing the environment.

Physical Stable Environment

A large stable has been indicated to increase recumbency (glade, 1984; Raabymagle and Ladewig, 2006). Longer periods of lateral recumbency appear to indicate adequate rapid eye movement (REM) sleep (Pederson et al, 2004). It is unclear whether increased lying behaviour is an indicator of increased welfare in horses but it is considered that lying behaviour is affected by management (Chaplin and Gretgrix, 2010).

Allowing a view to the outside environment where horses could be seen was one of three factors that Ruet (2019) considered to be significant in terms of reducing behaviours that indicated poor welfare. McGreevy et al's (1995) study showed that abnormal behaviours increased in stables which minimised contact between neighbouring horses and Mills et al (2002) also saw a reduction in stereotypic weaving with the introduction of a mirror or grilled window to a neighbour. Adaptation of a stable to increase visual stimulation and ideally touch with other horses can increase welfare.

Bedding

The bedding choice is an influential factor of the stable environment, impacting upon several aspects of equid behaviour in a restricted environment. Adequate rest and sleep is important especially during box rest when pain may have an influence on a horse's decision to lie down. Pederson et al (2004) found that lateral recumbency time and length of recumbency is increased on a straw bed, compared to shavings. The use of straw has been shown to reduce the occurrence of stereotypical behaviour (McGreevy et al, 1995) and studies have shown reductions in aggression toward people (Ruet et al, 2019) when straw is available. It is thought that straw can encourage natural foraging behaviour and reduce time spent in the stable standing. Straw has been shown to be preferred by horses over shavings, straw pellets and paper bedding (Mills et al, 2000; Werhan et al, 2010).

Another common consideration for bedding is dust and air quality. Straw is poor at absorbing ammonia (Flemming et al, 2008) but good quality straw was shown to have lower levels of dust than shavings in a study by Vandenput et al (1997).

If straw is not a viable option as a full bed, then gradual introduction of straw to allow free foraging opportunities could contribute to the environmental complexity of the stable environment with

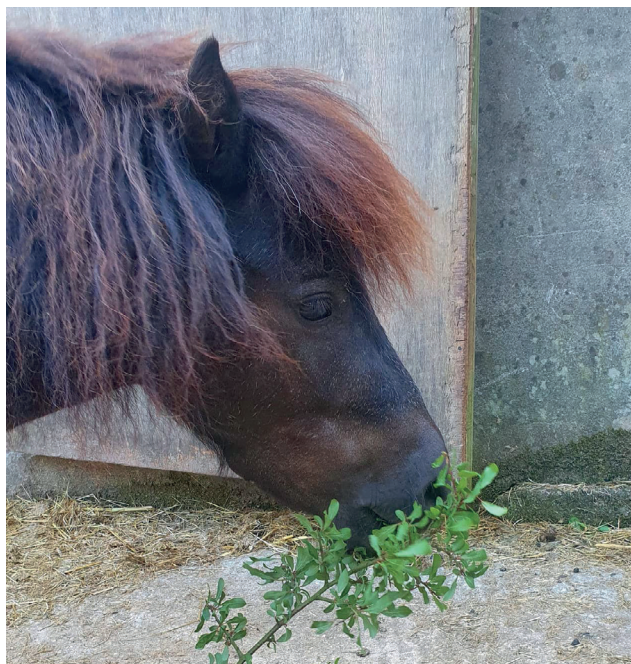


Figure 1. Introducing horse safe hedgerow plants or trees can increase forage type, foraging time and provide sensory enrichment including taste, texture and smell.

increased forage presentation and choice. Supplementing the diet with barley straw may be beneficial to increase forage allowance whilst reducing weight (Dosi et al, 2020). Sudden diet change can impact on the risk of colic so any change of bedding or diet should be introduced gradually where possible (Jennings et al, 2014).

Forage availability and presentation

Increasing the method of forage delivery and variety of forage adds choice and challenge to an environment (*Figure 1*), providing sensory enrichment and increasing the foraging time budget of the stabled horse (Goodwin et al, 2002; Rochais et al, 2018). Offering multiple types of forage across different locations allows horses to express natural foraging and exploratory behaviour whilst reducing bed eating behaviour (*Figure 2*) (Thorne et al, 2005; Goodwin et al, 2007). The increase of exploratory behaviour indicates a positive affective state, allowing an equine choice and control of when and where they eat forage and improving welfare. (Boissy et al, 2007; Mellor et al, 2020). Providing opportunities for positive emotional states is crucial to increase general mood and wellbeing (Mellor et al, 2020).

Reducing forage consumption rate with slow feeders is shown to be effective in extending time spent displaying foraging behaviour and reducing stereotypy displayed, but care should be taken as frustration behaviours can be shown (Rochais et al, 2018), indicating a negative affective state and a reduction in welfare (Mellor et al, 2020). Reduced concentrate has been indicated to reduce the expression of the four behavioural indicators of stress and oral stereotypy expression (Ruet, 2019).

Social opportunities

Social isolation is a significant welfare concern and facilitation of suitable company for the equine on box rest should be strongly en-



Figure 2. Here a proportion of the hay ration was mixed with straw to increase foraging behaviour and improve time spent with head and neck in a natural grazing position.

couraged. Increasing the ability of a horse to engage in social interactions, through stable windows or windows to the outside world, can decrease the chance of stereotypic behaviour and aggression (Ruet et al, 2019). Reducing a horse's ability to interact with a neighbour has been associated with increased levels of stereotypic behaviour (McGreavy et al, 1995) and increased non-alert standing (Sweeting et al, 1985). Allowing equines to access and view other equines can increase feeding behaviour (Sweeting et al, 1985), reduce stereotypic behaviour expression (Bachmann et al, 2003) and reduce rebound behaviour when allowed out of the stable (Mal, 1991). Increasing foraging opportunities in a group of horses allows for positive social interactions and reduced aggression between individuals (Benhajali et al, 2009). In the stable creating a space which allows movement away from the eyeline of other horses can provide sanctuary if the horse has lost encounters over resources in a previous experience or experiences aggressive behaviour from a neighbouring horse. This can also be achieved by specific windows for socialising with resources placed away from it. Allowing an area to move, away from the eyeline of other horses, can provide sanctuary if the horse has lost encounters over resources in a previous experience or has experienced feelings of fear from a neighbouring horse. Group living can allow for free social interactions and can be considered for some equines that are restricted, to allow for affiliative behaviours such as mutual grooming.

KEY POINTS

- Restricting an equid to a stable is advised to optimise physical wellbeing, but the stress of confinement can impact psychological wellbeing.
- The restriction of the stable reduces an equid’s ability to display naturally motivated behaviour, causing stress and frustration.
- Adaptation of the environment and introduced enrichment can provide complexity and challenge to the stable environment, allowing for behaviour expression to be closer to natural time budgets, subsequently improving equine welfare and the safety of caregivers.
- Assessment of the environment allows an individual approach to advising best management practises for horses on box rest, taking into consideration the environment available and physiological restraints to improve equine welfare and safety of handlers.

Movement ability and opportunities

Where movement is allowed, providing controlled exercise for an hour a day from the onset of box rest has the potential to reduce rebound behaviours shown (Houpt et al, 2001; Freire et al, 2009). The opportunity to experience social opportunities during this time

can also reduce rebound behaviour (Sweeting et al, 1985). This has the potential to improve safety for the handler and equid by reducing chance of reinjury (Bell et al, 2001). Provision of an outside area in front of the stable can offer an increase in choice for the equid, moving from inside to outside provides choice and further enhances the environment by increasing the amount of visual, auditory and olfactory stimulation. Where restriction is implemented to reduce dietary intake, the use of a track or area with no grass can encourage movement through spaced forage and resources and give an opportunity for social interactions. These factors alone allow for improved welfare benefits, by providing social opportunities and the ability to express natural foraging and movement behaviour.

Activities for psychological stimulation

Amending the environment by adding complexity and moving time budgets to a more natural state is already an improvement for the equine on box rest. Further elements of enrichment can be used to optimise welfare by providing cognitive challenge and sensory stimulation. Winskill et al’s (1996) study showed that the presence of a football encouraged a more natural time budget which is indicative of increased welfare. Introducing an enrichment toy, which the

Table 1. A selection of environmental enrichment opportunities and their benefits to equids

Enrichment Opportunities	Benefits
Logs and tree branches	Natural browsing behaviour opportunities, taste and smell stimulation
Hedgerow haynets	Increased forage choice in stable, taste and smell stimulations
Straw available	Alternative forage source, increases lying behaviour, preferred by equines, increases natural behaviour expression, reduces stereotypy expression
Multiple forage availability	Preferred by equines, increases natural movement patterns
Football or treatballs	Increases time spent displaying foraging behaviour
Hung swede, carrot, parsnip, apple	Sensory stimulation, taste, texture, occupies time
Forage boxes, puzzle feeders	Cognitive stimulation
Clicker training or grooming	Cognitive stimulation, potential for positive affective state. Watch for aversion to grooming and frustration with clicker training
Grazing in hand	Sensory enrichment, change of environment, choice, natural grazing opportunity, controlled movement
Social grazing (in hand)	Social contact reduces movement based rebound behaviour, choice of forage, controlled movement, sensory enrichment
Access to outdoor pen	Choice of environment and temperature regulation, access to sunshine, different substrate to walk on, restricted movement, social opportunities, visual and olfactory enrichment
Non-grass track system	Unrestricted movement, social contact
Time without rugs whilst with other horses can give opportunities for mutual grooming to occur	Social enrichment, mutual grooming has been shown to reduce heart rate (Feh and Mazieres, 1993)
A mirror in the stable	Potential for reduced stereotypy weaving (McAfee et al, 2002), social enrichment
Scatter feed concentrates on clean floor	Increases time foraging
Reduced concentrates	Reduces expression of four behaviour signs of reduced welfare (Ruet, 2019)
Slow feeders and hayballs	Increase time spent foraging which can reduce time to display stereotypy but can to be taken to ensure no frustration
Olfactory enrichment, lavender or scent trails including banana, herbs or spices.	Lavender shown to decrease stress hormones (Ferguson et al, 2013; Heitman et al, 2018)
Flavoured water or warm water	Sensory enrichment, increase fluid intake
Scratching post	Facilitates natural behaviour

horse can only lick, can have an effect on reducing crib biting in established crib biters (Whisher et al, 2011; Moore-Colyer et al, 2016). Our ability to enrich our equids' environment is only limited by our imagination and time, a selection of enrichment opportunities are summarised in *Table 1*. Where restriction to a stable is being used long-term for diet restriction, alternative methods of managing the equid could be explored, including turnout onto a non-grass track system to encourage movement and allow social interaction.

To support an equid on box rest, an assessment of the environment can be conducted to optimise the advice given to owners and caretakers. The assessment should take the equid's individual requirements into consideration, including their physical health, temperament, previous experiences and the environment they have access to. The four features of the environment can be used as part of an assessment by a vet or behaviour consultant, to better advise an owner on specific elements of the equid's environment and management that can be adjusted to allow it to better cope with restriction. Identifying an owner's ability to recognise equine stress, the time they have available and their motivation to make alterations for their equine can guide the provision of suitable educational resources.

Conclusions

The psychological impact of box rest on equids is significant, but it remains necessary during injuries or illnesses to protect the horse's long term welfare and quality of life. There are ways to adjust the stable environment to improve the equine's welfare, by optimising natural behaviour expression of time budgets. If psychological needs are met, the equid has a better chance of remaining calm whilst on box rest which will advance healing and improve the safety of handlers. It is clear that restriction to a stable cannot allow for natural behaviour expression as described in the 'Five Freedoms' and more recently the 'Five Domains Model' and, where not clinically necessary, long term stabling without turnout or with just limited turnout should be actively discouraged. **EQ**

Conflicts of interest

The author declares no conflicts of interest.

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