Artykuł przeglądowy *Review*

Role of environmental enrichment during box rest in mitigating stereotypic and other behavioural disturbances in horses

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Summary

Box rest is commonly used in the treatment and rehabilitation of horses, but the associated restriction of locomotion, foraging and social contact may negatively affect their welfare and contribute to stereotypic and other undesirable behaviours. The review covered literature published between 1986 and 2026 and examined the role of environmental enrichment in mitigating the behavioural consequences of box rest, with particular emphasis on feeding, social and cognitive needs. Appropriate feeding enrichment may prolong foraging and reduce the expression of some stereotypies, whereas social enrichment may help alleviate the effects of isolation. When permitted by the horse's clinical condition, controlled locomotion may complement management during box rest. Environmental enrichment should be individually adapted to the horse's clinical condition, temperament and locomotor restrictions so that behavioural needs can be supported without compromising treatment and recovery.

Keywords: environmental enrichment, box rest, horse, welfare

Horses evolved as herbivorous steppe animals leading a herd lifestyle and adapted to constant movement in search of food (61). Foraging for around 15 hours a day, along with the many hours of movement required freedom of movement and constant access to food (78). Due to their need for a sense of security and a strong social instinct, horses prefer open spaces and living in groups of their own species. Thus, prolonged foraging, locomotion and social contact constitute key components of the species-specific behavioural repertoire of horses. Unfortunately, intensive breeding practices and the way horses are used today often significantly restrict their ability to express natural behaviours (69).

Changes in the use of horses have also been accompanied by changes in their living conditions (45). Human-controlled environments may restrict horses' freedom of choice regarding movement, food, shelter and social interaction (43). Consequently, horses are entirely dependent on the environment created by humans, which significantly affects their behaviour and physiology (36). Individual stall housing is particularly relevant in this context because it may considerably restrict natural physical activity and the expression of species-specific behaviours (72). Based on observations of warmblood horses kept under various systems, these animals cover 0.17 km in their stalls, amounting to 578 steps per day (78). According to Hampson et al. (29), wild horses cover an average of 17.9 km per day. Furthermore, providing large quantities of hay in one place may reduce physical activity, the need to actively forage for food, and the motivation to explore the surroundings (40, 44). Inappropriate husbandry conditions, such as limited access to exercise, social contact or environmental stimuli, have a negative impact on the physical and mental condition of horses. Their health effects may include, among others, abnormal bone development (4) and susceptibility to respiratory tract inflammation (32). Behavioural disorders, on the other hand, often result from chronic stress or monotony associated with the inability to engage in natural species-specific behaviours (42). This conflict

becomes particularly important when stall confinement is required for therapeutic reasons. Although box rest may be necessary to facilitate recovery from injuries or other clinical conditions, the associated restriction of movement, foraging and social contact may negatively affect psychological welfare (60). Therefore, management strategies are needed that support physical recovery while minimising the behavioural and welfare consequences of confinement and maintaining the safety of both horses and handlers (57).

The aim of this study was to review the role of environmental enrichment in mitigating the behavioural consequences of box rest in horses, with particular emphasis on factors associated with the development and expression of stereotypic behaviours. The review focused on restrictions in feeding, locomotor and social behaviour and on the potential of appropriately selected environmental enrichment to compensate for these limitations during box rest without interfering with therapeutic requirements.

Material and methods

A review of the scientific literature was carried out using databases and search engines, such as PubMed, Google Scholar, ScienceDirect and ResearchGate. The search was based on the following keywords in both English and Polish: horse behaviour, equine welfare, horse management, stereotypic behaviour in horses, box rest horses, stall confinement, social behaviour in horses, feeding behaviour in horses, and environmental enrichment in horses. The publications included in the review were published between 1986 and 2026 and comprised both fundamental and recent scientific reports. Particular attention was paid to empirical and review studies describing the impact of environmental enrichment on the behaviour of horses kept in conditions that limit their ability to express natural behavioural patterns, including studies addressing stereotypic behaviours and the behavioural consequences of box rest.

Species-specific behavioural pattern

Despite domestication, horses retain species-specific behavioural needs, particularly those related to feeding, social interaction and locomotion, which are closely interrelated (78). Horses are a social species which, under natural conditions, live in small herds with a stable, structured hierarchy (70). The need to function within a group is a fundamental behavioural characteristic of this species. Studies have shown that the motivation to return to or remain within the herd is sufficiently strong to reduce horses' sensitivity to fear-inducing stimuli. This phenomenon suggests that the need for interaction with conspecifics may weaken the instinctive response to danger (35). This is related to the fact that the presence of, or interaction with, familiar individuals reduces stress responses (31). Therefore, maintaining social contact is an important element of horse welfare and a prerequisite for proper psychological functioning.

Feeding behaviour in horses is closely associated with their social functioning (16). As herd-living herbivores, horses are adapted to slow, almost continuous grazing throughout the day. Under natural conditions, this activity may occupy 16-20 hours daily. This results from the specific structure of the equine digestive system, as horses are non-ruminant ungulates. The stomach continuously secretes hydrochloric acid, which is buffered by saliva produced during mastication, particularly while chewing forage (53, 65). Therefore, for biological reasons, restricting chewing and access to fibrous feed can result not only in impaired well-being, but also in the development of stomach ulcers (55). Horses forage within so-called "feeding stations". This involves feeding in one location until the quantity or availability of vegetation decreases, after which the animal moves several steps to another feeding site. However, when food resources within a given area become depleted, the herd relocates to a new area (5, 59).

Feeding and locomotor behaviours are closely interrelated, as under natural conditions horses regularly move in search of food, water and resting areas. During grazing, horses spend approximately 60% of the day slowly moving forward. The predominant gait is walk, whereas trot and gallop occur mainly during play, conflicts or escape situations (58). The expression of social and comfort behaviours in horses kept outdoors may also vary depending on environmental conditions (37). Consequently, housing conditions that restrict social contact, prolonged foraging and locomotion may interfere with the expression of key species-specific behaviours and should be considered when assessing the behavioural consequences of box rest.

Horse welfare in the context of housing conditions

Animal welfare is a complex concept referring to the physical, psychological and social condition of an animal. It may be defined as a state of health and comfort enabling normal functioning (8). It also reflects the animal's ability to cope with its environment and includes its subjective experiences and emotional state (2, 11). Fundamental to the definition of welfare are the Five Freedoms, which specify the basic needs that should be ensured for all animals kept by humans (49, 52). In the context of horse housing, particularly relevant are freedom to express natural behaviour and freedom from fear and distress, as both may be compromised when opportunities for locomotion, foraging and social contact are restricted (Polish Horse Breeders Association, 2026, Polish Horse Breeders Association: https://www.pzhk.pl/wp-content/uploads/dobre-praktyki-pzhk.pdf, accessed: 19 May 2026).

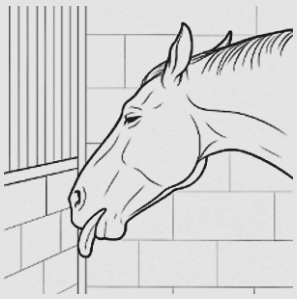
Furthermore, inadequate opportunities for social contact with other horses may negatively affect their welfare. Housing conditions are therefore an important determinant of equine welfare, particularly when they

limit access to forage, locomotion and social contact (13). For this reason, Arndt et al. (2) extend the definition of welfare to include "a state perceived by the animal as positive and associated with positive emotions". Contemporary approaches to animal welfare therefore emphasise not only the avoidance of negative states, but also opportunities for positive experiences (50). The inability to satisfy species-specific needs constitutes one of the major stress-inducing factors in animals. Stress may be defined as experiences, contexts or stimuli disrupting the homeostasis of the organism, manifested through various indicators. When horses are unable to avoid or cope effectively with persistent stressors, prolonged welfare impairment may result in more complex behavioural responses. The occurrence of stereotypies is commonly recognised as an indicator of reduced welfare in farm animals. Such behaviours result from disturbances in psychological processes caused by chronic stress, nervous system overload or the absence of appropriate environmental stimuli (8). In horses, stereotypies are also a consequence of inappropriate housing conditions, feeding practices and restrictions on the expression of natural behaviours (61).

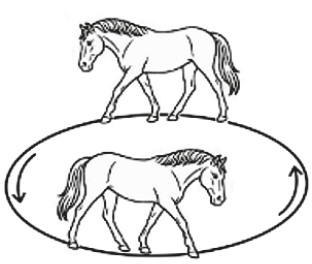
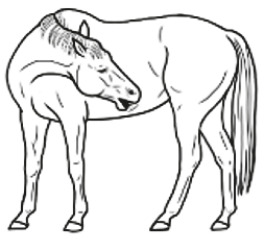
Stereotypic behaviours: aetiology and characteristics

Kowalski (41) defines stereotypies as simple, ritualised, rhythmically repeated activities lacking an apparent purpose and not leading to the fulfilment of the organism's physiological needs. Cooper and McGreevy (19) distinguish oral and motor stereotypies, examples of which are presented in Table 1. Stereotypies are repetitive behaviours associated with suboptimal environmental conditions and may develop when opportunities to perform highly motivated species-specific behaviours are restricted (65, 68). The development of stereotypic behaviours in horses is closely associated with environmental and management conditions, particularly restrictions on feeding, locomotion and social contact (48, 65). It has been demonstrated that unavoidable stress or fear, as well as sensory deprivation, significantly increase

Tab. 1. Oral and motor stereotypies

Illustration	Description	References
	**CRIB-BITING** The horse grasps a fixed object (e.g., a feed trough, fence or stall edge) with its incisors, flexes its neck and draws air into the oesophagus, often producing a characteristic grunting sound.	1, 19, 23, 48, 61, 69
	**TEETH-RUBBING** Teeth grinding on objects. Mechanical grinding or gnawing of the teeth against hard objects, such as wooden structures or metal bars.	19, 69
	**WIND-SUCKING** The horse flexes its neck and draws air into the oesophagus without grasping or anchoring its incisors on a fixed object.	19, 48
	**WALL-LICKING** Repetitive licking of stall walls or other surfaces within the stall.	19, 69
	**WOOD-CHEWING** Repetitive chewing and gnawing of wooden structures or stable fixtures.	23, 61
	**WEAVING** Rhythmic swaying of the horse from side to side, accompanied by repetitive movements of the head and neck.	1, 19, 23, 48, 61, 69

Tab. 1. (cont.) Oral and motor stereotypies

Illustration	Description	References
	**BOX-WALKING** Repetitive walking around the stall along a fixed or stereotyped route.	19, 23, 48, 69
	**WEIGHT-SHIFTING** Frequent shifting of weight from one limb to another without forward movement.	69
	**CIRCLING** Repetitive walking in circles, following the same circular path.	19, 23, 48
	**NODDING** Repetitive movements of the head in the vertical or horizontal plane, including repeated tossing, bobbing, or swaying motions.	23
	**SELF-BITING** Biting one's own body, particularly the flanks and limbs.	23, 48, 61, 69

Source: author's own work; original illustrations

the risk of stereotypy development (66). Nutritional management is particularly relevant, as reduced forage availability and low feeding frequency shorten foraging time and may increase boredom and frustration (33, 61). Another contributing factor is the restriction of movement resulting from keeping horses in small stalls without the possibility of free locomotion (17). Horses spending more than 21 hours per day in stables are considerably more prone to the development of behavioural disturbances, particularly oral stereotypies (30). These risk factors are particularly relevant during box rest, when restrictions on movement, social interaction and foraging may occur simultaneously. Such conditions may promote frustration and abnormal repetitive behaviours, especially when confinement is introduced abruptly (60). Movement and interaction with conspecifics are natural physiological and behavioural needs of horses. Therefore, isolation from other horses and the inability to establish social contact may lead to stress and the development of stereotypies. Monotonous environments with limited stimulation may further contribute to boredom and the development of abnormal behaviours. Providing appropriate environmental stimulation may therefore be particularly important when management or therapeutic requirements restrict opportunities to perform species-specific behaviours (48). Prevention and reduction of stereotypic behaviours are also clinically relevant because persistent or severe stereotypies may be associated with tooth wear, digestive and musculoskeletal problems, weight loss and reduced time available for feeding and resting (19, 65).

The importance of box rest and its behavioural consequences

A particularly challenging situation in horse management, in which ensuring the full expression of species-specific needs becomes difficult, is so-called box rest. The term "box rest" may be defined simply as a therapeutic management method that restricts a horse's freedom of movement by confining it to an individual stall during treatment or convalescence. It is frequently recommended as a treatment for acute clinical conditions (60). Based on this definition, indications for such immobilisation may include, among others, orthopaedic injuries (e.g., fractures) or soft-tissue injuries. This form of restricting locomotor activity is also useful during the course of laminitis. In addition, box rest is applied after surgical procedures, such as arthroscopy, surgery for intestinal obstruction or surgical wound management (e.g. skin grafting) (73). Thus,

although box rest is prescribed primarily to facilitate physical recovery, its implementation represents a broader clinical management challenge. Behavioural responses associated with confinement and social isolation may increase difficulty in handling and contribute to post-inhibitory rebound, potentially compromising handler safety and increasing the risk of reinjury (60). Despite its therapeutic importance, box rest may negatively affect horses' psychological welfare when the associated restrictions interfere with species-specific behavioural needs. Isolation from the herd, restricted movement, alterations in the daily routine, as well as pain and discomfort associated with injuries, may induce stress and consequently contribute to behavioural disturbances. Specific housing conditions are of key importance in this context. Ruet et al. (62) demonstrated that, in horses kept in individual stalls, factors such as inappropriate bedding, lack of a window within the stall and incorrect amounts of concentrate feed may influence the occurrence of stereotypies, aggression, reduced reactivity and stress-related behaviours. If, during periods of necessary isolation, horses are housed in poorly designed stalls – for example, with insufficient space – this may hinder natural lying down and rising behaviour. Over prolonged periods, such conditions may lead to sleep deprivation (particularly REM sleep deprivation), injuries and increasing frustration (78).

Moreover, continuous confinement within a stall limits environmental stimulation, leading to increasing boredom and frustration. This problem becomes particularly evident when the restriction of freedom occurs abruptly. Unfortunately, such treatment is usually introduced suddenly, without the possibility to properly prepare animals for these changes, and may therefore be distressing, especially for young and inexperienced horses (71). Prolonged exposure to such conditions may also result in persistent reduced responsiveness to environmental stimuli, which has been interpreted as a depression-like state (43, 62). Werhahn et al. (74) observed that horses kept in confinement were more restless. According to Chaya et al. (15), confinement combined with isolation exerts a more negative effect on horse behaviour than confinement alone. These behavioural consequences may also become clinically relevant when movement is reintroduced. Following a period of confinement, horses may show an excessive locomotor response, described as post-inhibitory rebound, which can complicate controlled exercise and increase the risk to both the horse and the handler (57). In summary, although box rest may be an essential element of therapy, veterinary recommendations should be balanced with attention to behavioural needs (34) in order to minimise the negative behavioural and psychological consequences of prolonged confinement.

The importance of environmental enrichment during box rest

During box rest, management should aim to minimise the behavioural consequences of confinement without compromising the therapeutic restrictions required for recovery. Providing opportunities to fulfil selected species-specific needs may help horses remain calmer during prolonged confinement and facilitate safer handling (60). The type and extent of such interventions should therefore be adjusted to the individual horse and its clinical condition, particularly to the degree of locomotor restriction required during convalescence (57). Environmental enrichment involves the introduction of techniques, devices, and procedures aimed at improving the animals' living conditions (67). These systems must fulfil strictly defined functional criteria. Their primary objective is to stimulate natural, species-specific behaviours while simultaneously reducing the occurrence of behavioural abnormalities (18). Studies conducted by Brauns et al. (10) provide evidence of the positive effects of enrichment on both the physiology and behaviour of horses. Such solutions provide mental and physical stimulation and may help minimise the negative effects of stress associated with housing conditions. In practice, effective environmental enrichment should focus on four aspects: ensuring appropriate social interactions, motivating activity and eliminating inactivity, broadening and diversifying the behavioural repertoire and providing a more stimulating environment (67). Brunet et al. (12) classified environmental enrichment into physical, occupational, sensory, feeding and social enrichment. A similar classification was proposed by Kaleta (39), who, instead of occupational enrichment, introduced the term "manipulative enrichment". Based on the presented classifications (Tab. 2), practical forms of enrichment are discussed below and grouped according to the dominant function they perform during

Tab. 2. Classification of environmental enrichment

Type of enrichment	Main characteristics	Examples	Reference
Physical	Diversification of the physical environment through additional structural elements	Additional structures in the paddock or stall	12
Occupational	Stimulation of physical or cognitive activity	Exercise; tasks requiring information processing	12
Manipulative	Provision of objects or devices enabling animals to manipulate them	Toys and technical devices	39
Sensory	Stimulation of one or more senses	Visual, olfactory, auditory, gustatory, or tactile stimuli	12
Feeding	Modification and diversification of feeding methods	Novel or diversified diet; interactive feeding	12
Social	Providing opportunities for social contact	Contact with horses, other species, or humans	12

Source: author's own work

box rest. In reality, however, the boundaries between particular types of enrichment are often blurred, and their effects on the horse's organism may be multidimensional.

Solutions supporting feeding behaviour

Since the basic need of horses is the opportunity to graze and forage, they show considerable interest in feeding enrichment (38). This is particularly important because an increase in time devoted to feed intake is associated with a reduction in time spent performing stereotypic behaviours. Such an effect may be achieved by providing hay in small-mesh hay nets, which effectively slow feed consumption (47). This feeding method may increase physiological arousal associated with motivation to obtain food and promote the expression of natural foraging behaviours (10). Moreover, Correa et al. (20) indicate that the use of hay bags or hay nets reduces locomotion within the stall and the frequency of weaving, which may be beneficial during convalescence requiring restricted movement. However, this approach has certain limitations, particularly in the case of horses diagnosed with asthma. To minimise respiratory exposure to respirable dust, hay should be provided from the ground or from nets placed outside the stall (22). Lick blocks, hanging toys, various hay balls, and hiding food within the stall function not only as feeding enrichment, but also as physical, occupational and sensory enrichment. Bulens et al. (14) demonstrated that horses showed only limited interest in balls equipped with handles. In contrast, feeding toys (Snak-a-Ball®) and lick devices (Likit® or Tongue Twister®) imitate natural, prolonged foraging behaviour, which exerts a calming effect (75).

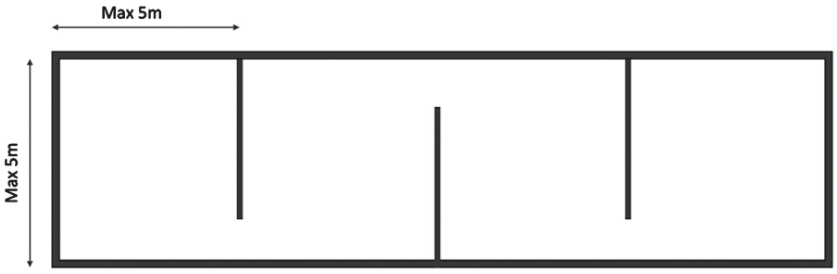


Fig. 1. Paddock designed to prevent trotting (source: 57)

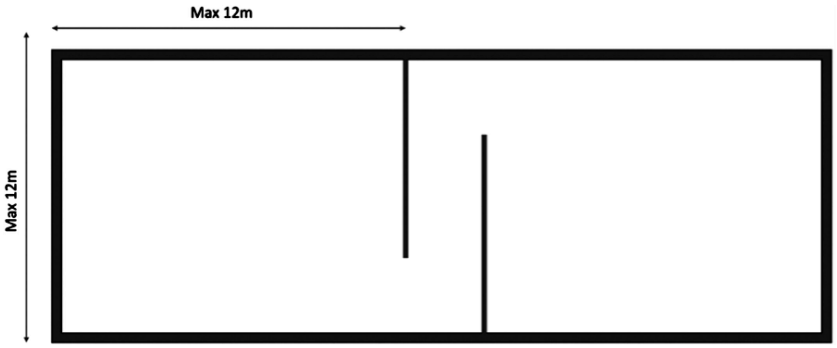


Fig. 2. Paddock designed to prevent galloping (source: 57)

Solutions supporting controlled locomotion

The reintroduction of physical activity during box rest should occur gradually, and the extent and pace of the increase in movement should depend on the individual's condition. In situations where the animal's health status allows controlled movement, solutions enabling its safe implementation should be considered (57). Controlled exercise may complement periods of box rest when permitted by the horse's clinical condition. Dry and water treadmills provide exercise under controlled conditions, with the possibility of adjusting its duration and intensity, while water treadmills additionally allow the load on the locomotor system to be modified by adjusting water depth. Both forms are used in the rehabilitation of numerous orthopaedic and neurological disorders (54). Freire et al. (25) demonstrated that horses performing locomotor exercise for at least 1 hour daily or spending time on pasture exhibit a lower frequency of undesirable behaviours during handling after temporary stall confinement. The best results were observed in individuals allowed access to paddocks compared with those exercised on treadmills, horse walkers or under saddle. Therefore, when the horse's clinical condition permits limited voluntary movement, appropriately designed turnout areas may provide an alternative to conventional exercise while maintaining a degree of locomotor control. One such solution was proposed by Pearson (57). It involves creating a paddock divided into smaller sections with connecting passages between them (Fig. 1). This design limits the possibility of moving at higher gaits by dividing the available space into smaller sections and corridors (Figs. 1-2). Pearson (57) emphasises that, in certain clinical situations, the horse's locomotor abilities may be so severely restricted that activity can only occur in the form of short hand-walks, controlled grazing, or may even need to be completely eliminated. Thus, controlled locomotion should not be regarded as environmental enrichment per se, but as a complementary management strategy that may help address the behavioural consequences of prolonged confinement when permitted by the therapeutic protocol. When physical activity must be severely restricted or entirely excluded, environmental enrichment that does not interfere with locomotor restrictions becomes particularly important.

Solutions supporting the expression of social behaviour

The final category of enrichment comprises social enrichment, defined by Bloomsmith et al. (7) as providing access to direct or indirect contact with individuals of the same or different species, including humans. De Oliveira et al. (56) indicate that, depending on the quality of the relationship and the level of individual

engagement, social interactions may provide appropriate stimulation, support the expression of positive emotions, activate the animal, provide a sense of security and reduce boredom. In view of horses' constant need for social contact, resulting from their species-specific behavioural pattern, it may be concluded that horses subjected to box isolation should be provided with continuous contact with other tolerated individuals housed in neighbouring stalls. This is supported by the findings of Bini de Lima et al. (6), who demonstrated that the presence of another horse, even without physical contact, significantly reduced stress indicators in horses subjected to short-term restraint. The animals showed lower heart rate, calmer breathing and fewer facial signals indicative of tension, confirming the importance of social contact for maintaining horse welfare.

An example of a solution intended to facilitate social contact with another horse may be the social stall proposed by Gmel et al. (26), equipped with bars within the partition wall that allow horses to extend their heads towards neighbouring individuals.

Another solution proposed by Borthwick (9) involves replacing bars with a low partition wall. Another method that supports horse welfare is the use of mirrors in stalls. It has been demonstrated that mirrors can help reduce certain stereotypic behaviours in horses, such as weaving. The animal may perceive its reflection as the presence of another individual, which reduces stress and decreases feelings of isolation (27, 51). However, this interpretation remains uncertain. Studies on mirror self-recognition in horses have demonstrated increased interest and exploratory behaviours towards mirrors, suggesting their potential value as environmental enrichment (3). Stable design may also facilitate visual contact with conspecifics. For example, English-style stables with open upper doors allow horses to observe their surroundings and neighbouring horses (76).

Another approach to helping alleviate the effects of social isolation in horses may be to provide them with contact with animals of other species, such as goats. Research (77) indicates that the presence of goats can partially reduce the anxiety and excessive locomotor activity of horses. However, it does not provide full social support, nor does it eliminate the emotional effects of isolation. The presence of an animal of a different species may therefore be a helpful solution in situations where contact with other horses is not possible.

Mandel et al. (46) and de Oliveira et al. (56) emphasise that social enrichment should not be confused with other forms of environmental enrichment. The authors also highlight the crucial role of the human factor. They indicate that practices used by caregivers play a fundamental role in the development of positive human–animal relationships. Since horses demonstrate sensitivity to human emotions, a positive attitude during interactions may significantly contribute to the development or strengthening of a proper horse–human relationship based on trust. In contrast, negative interactions may lead to opposite effects, including the emergence of avoidance behaviours or a reduced willingness of the horse to re-establish contact with humans (28).

The importance of the human factor increases particularly under conditions of restricted movement, such as during box rest, when opportunities to express natural behavioural needs are limited. In such situations, humans may serve as a key source of social and cognitive stimulation. One recommended method for working with horses during box rest may involve positive reinforcement-based training. The use of food rewards during the learning process promotes the formation of positive associations and enhances task retention. Sankey et al. (64) demonstrated that horses trained using positive reinforcement displayed a greater number of affiliative behaviours, such as sniffing and licking, whereas horses trained without it exhibited four- to six-fold higher frequencies of undesirable behaviours, including biting and kicking. Positive reinforcement methods, including target and clicker training, may therefore provide cognitive stimulation during box rest (21, 24). They also promote willingness to cooperate, strengthen trust and reduce stress. Furthermore, they may reduce behavioural problems resulting from separation, which is particularly important in the context of box rest (57, 63).

Appropriately selected environmental enrichments may constitute an important element supporting the welfare of horses undergoing box rest. Consideration of the animal's behavioural needs, such as the opportunity to express feeding behaviour, establish social contact and receive cognitive stimulation, may positively influence the emotional state of horses and reduce the risk of stereotypies and other behavioural disorders associated with prolonged restriction of movement. In veterinary practice, particular importance should be attached to the individual adjustment of enrichment types to the horse's clinical condition, temperament and locomotor abilities, so that they support the process of convalescence. At the same time, further studies are still required to assess the effectiveness of specific forms of environmental enrichment under clinical conditions, especially regarding their effects on behaviour, stress levels and the course of recovery in horses.

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