



Sveriges lantbruksuniversitet
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Fakulteten för veterinärmedicin och
husdjursvetenskap

Impact of housing on the behaviour and welfare of riding school horses

Inhysningens betydelse för ridskolehästars beteende och välfärd

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Abstract

The traditional housing of riding school horses consists of individual housing in boxes or tie-stalls with a couple of hours of turnout every day. Group housing is increasing in popularity and may be a way to tend to the horse's natural behaviour and needs. In this study the behaviour of riding school horses in different housing systems was observed during turnout, during grooming and saddling, and during riding lessons. Results showed generally only small differences between housing systems. Group-housed horses tended to engage in more positive behaviours and more positive social interactions during turnout, while individually housed horses tended to show more threats and aggression during grooming and saddling. Based on the results from this study, no conclusions can be drawn on the welfare of riding school horses in the different housing systems.

Sammanfattning

Ridskolehästar hålls traditionellt i boxar eller spiltor med några timmars utevistelse per dag. Lösdrift blir allt mer populärt och kan vara ett sätt att tillfredsställa hästens naturliga beteende och behov. I denna studie undersöktes effekten av inhysningssystem på ridskolehästars beteende vid hagvistelse, vid skötsel och sadling samt vid ridning. Resultaten visade att det inte fanns så stora skillnader mellan inhysningssystemen vad gäller hästarnas beteende. Hästar i lösdrift hade en tendens att ägna sig åt mer positiva beteenden och mer positiva sociala interaktioner under hagvistelsen, medan hästar i individuell uppstallning hade en tendens att visa mer hot och aggression vid skötsel och sadling. Inga slutsatser kan dras vad gäller ridskolehästars välfärd i olika inhysningssystem.

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Introduction

About 450 riding schools are members of the Swedish Equestrian Federation (SvRF), housing almost 10 000 riding school horses (*Equus caballus*) altogether (SvRF, 2017). Housing affects horses' well being in many ways, for instance behaviour towards humans (Søndergaard & Ladewig, 2004) and presence of abnormal behaviours (Bachmann et al., 2003). Approximately 85 % of Swedish horse owners use individual housing in boxes or tie-stalls, while 25 % use group housing for some or all horses. The majority of Swedish horse owners claim that their horses are out in paddocks together with other horses (Enhäll et al., 2010), the length of the turnout however varies a lot (Svala, 2008; Wallberg, 2010). Individual housing is widely used in riding schools, 95 % of riding schools and trail riding companies use boxes while 60 % have tie-stalls to some extent (Enhäll et al., 2010). The widespread use of boxes and tie-stalls could be explained by for example traditions, safety, space saving, economy and the common use of old buildings for riding schools (Ventorp & Michanek, 2001; Svala, 2008). In a survey, Swedish riding school managers had mixed feelings about group housing in riding schools, the benefits were thought to be well-being of the horses and working environment, while the drawbacks especially concerned safety (Hallman & Öqvist, 2011). The Swedish Equestrian Federation are not opposed to group housing for riding schools in general, but safety for riding school pupils is of great importance and it is recommended that they are not allowed to handle the horses too much on their own (SvRF, 2010). Group housing has increased in popularity in recent years and many believe that it will become more common in the future, particularly because it is perceived as better from a horse welfare perspective (Svala, 2008). The Swedish animal welfare legislation states that animals should be able to perform natural behaviour (SFS 1988:534, 4 §) and that horses should be given the opportunity to satisfy their need for social contact (DFS 2007:6, 2 chapter, 1 §) and it could be argued that group housing is more in line with that.

This thesis is a part of the project "Impact of housing on horse welfare, work, safety and pedagogics on Swedish riding schools", a collaboration between the Swedish University of Agricultural Sciences (SLU), Gothenburg University and the national equestrian centre Flyinge. Riding schools with individual housing were compared to riding schools with group housing, with the aim to investigate if there are any differences regarding horse welfare, working environment, safety for riding school pupils and staff, pedagogics and how owners argue for their housing system. Both housing systems are often criticised on several matters and therefore it is necessary to gain more knowledge on how both horses and humans are affected by the choice of housing in riding schools.

Health examination, physiological parameters and/or behavioural parameters are usually used in assessments of animal welfare (Fraser & Broom, 1990). Using behaviour as a welfare indicator has several advantages: it gives a simple and fast assessment without disturbing or stressing the animals and furthermore, the animal's own decision-making gets to play a part (Dawkins, 2004). Despite the fact that horses have changed quite a lot on the exterior since domestication, it seems like their species-specific behaviour have remained almost unchanged (Waran, 1997; Christensen et al., 2002b). By gaining more knowledge on behaviour in different housing systems and how housing affects horse behaviour, there are potential benefits for horse welfare.

Background

Horse behaviour

Feed seeking

Horses are prey animals living in groups that move around large areas, grazing for a large part of the day (Duncan, 1980; Boyd et al., 1988). Their digestive system is designed to process a continuous input of fibre, with a small stomach and quick passage of digesta through the small intestine (McDonald et al., 2011). Despite the process of domestication horse behaviour does not seem to have changed very much (Christensen et al., 2002b). Free-ranging horses can spend 16-17 hours per day grazing or browsing, divided into eating bouts of 30 minutes up to 4 hours. While grazing the horse move continuously, making locomotion an essential part of feeding behaviour (McGreevy, 2012). Stabled horses are commonly fed 2-4 meals per day and often lots of grains or concentrate feed (Henderson, 2007). Hay requires a lot more chewing compared to grains due to the high fibre content, this will result in a much longer feeding time. It has also been shown that horses' motivation to eat hay increase when they are fed a low-forage diet (Elia et al., 2010). Horse behaviour will be affected when the need for feeding and feed seeking is not satisfied. For instance, it has been shown that the frequency of abnormal and stereotypic behaviours increase on a low-fibre diet (Willard et al., 1977; McGreevy et al., 1995a).

Resting behaviour

Resting behaviour includes resting and sleeping, standing up or lying down. While standing resting or sleeping, the horse usually keeps one leg bent in a resting position (McDonnell, 2003). Horses normally sleep 3-5 hours per day and drowse 2 hours per day (McGreevy, 2012). They can sleep standing up, but deep sleep requires relaxation of the body and only occurs while the horse is lying down (Fraser, 2010). Recumbent resting behaviour is affected by dimensions of the resting area and also by social rank, where high ranked horses usually spend more time resting (Zeitler-Feicht & Prantner, 2000). Resting is important to restore energy, and sleep is essential for horse welfare (Fraser, 2010).

Grooming behaviour

Grooming behaviour include self-grooming and mutual grooming. Self-grooming can be rolling on the ground, shaking, scratching against something or scratch, bite or rub with the own teeth or hooves (McDonnell, 2003). Grooming is used for coat care (Feist & McCullough, 1976) and the behaviour is performed by horses of all ages and genders (Sigurjónsdóttir et al., 2003). A reduction in grooming behaviour can be seen during times of impaired health (Fraser, 2010). Grooming behaviour can be an indication of well-being but also of negative emotions, like rolling to ease abdominal pain (Zeitler-Feicht & Baumgartner, 2016).

Social behaviour

Social behaviours can be used for example to make friends or to mark dominance within the group. Horses communicate with body and head postures, facial expressions and sounds; sometimes the signals are very subtle. Various vocal signals can be used, for example neighing in friendly approach, squealing during play fighting or snorting when facing a novel object (McDonnell, 2003). Free-ranging horses live in herds divided into smaller groups, usually family/harem groups and bachelor groups (Feist & McCullough, 1976). The harem groups are relatively stable (Salter & Hudson, 1982), but group size depends on the amount of resources available (Stevens, 1990) and size of the home range differs depending on environmental conditions (Berger, 1977).

Horses are very motivated to seek social contact (Søndergaard et al., 2011) and if they are prevented to interact with other horses it can result in both physiological signs of stress (Mal et al., 1991b) as well as behavioural changes (Christensen et al., 2002a). Being a part of a social group has been crucial for the survival of horses in the wild, thus it is incredibly stressful for them to be left alone unless they are allowed to gradually get used to it (McGreevy, 2012). The level of gregariousness differs between horses and can be predicted already at eight months of age (Lansade et al., 2008). It has been shown that horses practice social facilitation, where members of the group perform the same behaviour at a given time. Active behaviours are most often synchronised, for example it is common that the whole group graze simultaneously (Rifá, 1990). Studies on Przewalski's horse (*Equus przewalskii*) have shown that groups of horses synchronise their behaviour 50-90 % of the time (Van Dierendonck et al., 1996; Souris et al., 2007). Sweeting et al. (1985) showed that social facilitation to some extent depends on visual contact between horses. In a group, most horses seem to stay within two meters from their nearest neighbour (Jørgensen et al., 2009). Within the group horses can form pairs that have a closer friendship, so called affiliates. They often stand closer together than the rest of the group and engage in mutual grooming. These horses are usually of similar rank and age (Clutton-Brock et al., 1976).

Affiliative behaviour

Affiliative behaviour promotes group cohesion: friendly, positive behaviours and gestures, for example mutual grooming or touching. Performing this type of behaviour is a way to maintain friendship (Feist & McCullough, 1976) and also for reconciliation (Cozzi et al., 2010). When two horses perform mutual grooming they stand close together, side by side, using the teeth to scratch the other horse (McGreevy, 2012). Feh and De Mazières (1993) presented the preferred grooming spot, located at the base of the neck. When horses are scratched in this spot their heart rate decrease, which indicates that mutual grooming has a calming effect. When horses have been socially deprived for a longer period, increased frequency of mutual grooming can be seen (Christensen et al., 2002a). Van Dierendonck and Spruijt (2012) argue that affiliative behaviour is very important for the well-being of domestic horses and Boissy et al. (2007) discuss that these behaviours could be indicators of good emotional states and might therefore be used in assessment of animal welfare. Zeitler-Feicht and Baumgartner (2016) conclude that horses voluntary being together can be a potential indication of positive emotions.

Play behaviour

It has been argued that play helps strengthening muscles and skeleton (Byers & Walker, 1995), practice for future demanding situations (Špinková et al., 2001) and practice in social interactions (Bekoff, 1984). However, some believe that play does not have any obvious benefits, at least for adult animals (Martin & Caro, 1985). The disadvantages of play have also been discussed, for example the cost of energy, but it appears that the advantages outweigh the disadvantages in both short and long term (Oliveira et al., 2010). Play behaviour is common among young horses (Fagen & George, 1977; McDonnell & Poulin, 2002) but is also present among adult horses (Boyd et al., 1988; McDonnell & Poulin, 2002). It appears that there is more play behaviour in gelding groups or mixed gender groups compared to mare groups (Sigurjónsdóttir et al., 2003; Jørgensen et al., 2009). McDonnell and Poulin (2002) developed an ethogram for equine play behaviour with four categories: object play, play sexual behaviour, locomotor play and play fighting. They also distinguish factors or behaviours that either initiate or terminate play. For example, muzzle connection, light pushing or pinching or tossing of the head can be seen as behaviours that initiate play, while laid-back ears, forceful biting, kicking or striking or one or more horses prancing away often terminates a play session. New situations like altered weather conditions or new objects can stimulate play behaviour (McDonnell & Poulin, 2002).

Play behaviour can sometimes end in a fight and it can be difficult to distinguish between play fighting and real fighting. Pellis and Pellis (1987) observed this difference in rats and could see that there were differences both in what body part the rats chose to attack and what strategy that was used. In a study by Hausberger et al. (2012), horses that played more frequently had higher levels of (chronic) stress, measured by oxidative stress, and showed more aggression toward humans. Christensen et al. (2002a) saw that when horses had been socially deprived for a long time, they engaged in more play on pasture compared to horses that had been housed in groups. Play is a lot more common among domesticated horses and it may have to do with confined housing and lack of challenging environment (Hausberger et al., 2012). Still, some propose that play behaviour can be an indicator of positive emotions and good welfare (Boissy et al., 2007). Zeitler-Feicht and Baumgartner (2016) discuss that play fighting is associated with elevated levels of stress and therefore not only related to positive emotional states in adult horses. It is concluded that social play only can act as an indicator of positive emotions in juvenile horses (Zeitler-Feicht & Baumgartner, 2016).

Agonistic behaviour

Agonistic behaviour can occur when individuals of the same species meet and include aggression, threats, appeasement and avoidance behaviour (McDonnell & Haviland, 1995). Aggressive behaviour can for example be used to determine or maintain dominance between horses (Haupt et al., 1978), which is supported by the fact that aggressive interactions mainly seem to happen between individuals in the middle of the hierarchy and that these interactions seem to decrease with time. Altogether, agonistic interactions seem to vary a lot in both type and intensity (McDonnell & Haviland, 1995). There seems to be more agonistic interactions between affiliates compared to interactions with other group members, but with lower intensity (Ellard & Crowell-Davis, 1989). There does not seem to be any differences in aggressive behaviour when comparing mares and geldings, or when mixed groups are compared to keeping mares and geldings separated (Vervaecke et al., 2007; Jørgensen et al., 2009). Rutberg and Greenberg (1990) studied feral pony mares and saw that mares that recently had reached adult size were the ones most frequently involved in agonistic interactions. Christensen et al. (2011) saw that horses did not appear to adapt to regrouping since agonistic interactions did not decrease when group composition was changed every week. Unstable groups have been shown to increase the risk for bite and kick injuries (Knubben et al., 2008).

When horses are kept on pasture or during semi-feral conditions there are usually not many injuries related to aggressive interactions, and those that do appear are almost always minor (McDonnell & Haviland, 1995; Grogan & McDonnell, 2005). Commonly, more aggressive behaviour can be seen in a domestic environment (Haupt & Keiper, 1982). Social isolation can lead to more aggressive behaviour when meeting other horses, this has been observed in individually housed stallions (Christensen et al., 2002a). The size of the paddock affects the number of aggressive behaviours among group-housed horses. The smaller area per horse, the more aggression can be seen (Jørgensen et al., 2009; Flauger & Krueger, 2013). Aggression is also reduced when the paddock gets bigger, at least up to 331 m² per horse according to Flauger and Krueger (2013). Jørgensen et al. (2009) could see that the majority of aggressive interactions consisted of threats and without physical contact. Access to roughage also seems to affect the number of agonistic behaviours, among group-housed horses the risk for agonistic behaviour decreased when roughage was available (Jørgensen et al., 2011). The use of feeding stations can however increase agonistic behaviour (Zeitler-Feicht et al., 2010). In a study where a large group of horses were held in a small area with very limited access to feed, there were

few social interactions between the horses and no positive interactions whatsoever could be seen (Benhajali et al., 2008).

Explorative behaviour

Investigation and exploration can be seen in horses of all ages. Curiosity is a good sign that the horse is healthy and interested in its environment (Fraser, 2010). Explorative behaviour can be displayed through for example sniffing, licking, pawing or mouthing (McDonnell, 2003). Frustration behaviours are often seen when there is no opportunity for exploration and a barren environment without stimuli can result in apathy (Wood-Gush & Vestergaard, 1989). Stabled horses without the company of conspecifics often learn to use objects in their environment to keep themselves occupied (McGreevy, 2012). An abnormally high frequency of explorative behaviour can be an indication of poor welfare due to a restricted environment (Zeitler-Feicht & Baumgartner, 2016).

Movement behaviour

As a prey animal made to survive in vast grasslands, the horse's locomotion ability is of great importance. The herd can move across large areas daily to find resources like feed, water and shelter. Walk is the slowest gait, used for example for continuous movement during grazing. For faster movement, trot and canter or gallop is used. A group of horses can move together, sometimes in a line, a behaviour called trekking (McDonnell, 2003). Horses that are prevented from moving or interacting with conspecifics show much more movement and general activity when they are turned out (Mal et al., 1991a; Chaya et al., 2006). Daily exercise seems to decrease movement during turnout, while larger paddock size seems to promote general activity (Jørgensen and Bøe, 2007). The activity level depends on housing design (Rose-Meierhöfer et al., 2010) and horses are more motivated to move in a group compared to exercising alone (Lee et al., 2011).

Abnormal behaviour

Abnormal behaviour can be defined as behaviour that deviates from the animal's normal repertoire regarding for example frequency, intensity or in what context they are performed (Fraser & Broom, 1990). One type of abnormal behaviour is stereotypies that commonly are explained as repetitive behaviour without any obvious function (Mason, 1991). Common equine stereotypies are for example crib biting, weaving and box walking. Other abnormal behaviours can be wood chewing, abnormal aggression, apathy or hyper activity (McGreevy, 2012). In the literature the occurrence of stereotypic behaviour has been reported to be everything from 2 % up to 30 % (Vecchiotti & Galanti, 1986; McGreevy et al., 1995b; Luescher et al., 1998; Normando et al., 2002; Albright et al., 2009). Stereotypies commonly develop after weaning or at least when the horse is very young (Waters et al., 2002). They can be indicators of frustration due to an unpredictable or otherwise stressful environment, either right now or earlier in life (Mason, 1991). To prevent abnormal behaviour horses should be provided with company of other horses, daily free movement and a lot of roughage but no or just a little concentrate (Bachmann et al., 2003). Possibilities to see other horses and/or interact with them seem to result in less stereotypic behaviour (McGreevy et al., 1995a; Cooper et al., 2000; Mills & Davenport, 2002). There is a correlation between poor welfare and the development of abnormal behaviour. Many crib-biting horses seem to have ulcers or inflammations in the gastrointestinal tract (Nicol et al., 2002) and young horses are prone to develop stereotypic behaviour as a response to sudden isolation (Visser et al., 2008). However, already existing abnormal behaviour does not necessarily reveal very much about the current welfare status, since the behaviour becomes a habit (Mason & Latham, 2004).

Human-horse interactions

It is possible that the horse's behaviour towards humans can say something about horse welfare. For example, Fureix et al. (2010) found a correlation between aggression towards humans and vertebral problems (assumed to be reflected as chronic back pain or discomfort). Unwanted or changed behaviour can be an indication of reduced health and the presence of physical problems should always be investigated prior to any other actions. Aggressive or threatening behaviour to humans can be a learned behaviour or caused by fear. It can be the result of previous inadequate handling, maybe by punishing the horse to correct unwanted behaviour. Earlier experience is vital to the horse's response to humans; it can learn that aggressive behaviour can be successful in removing the perceived threat (McGreevy, 2012).

Housing can affect how the horse behaves toward humans. In one study, young horses reared in a group were much easier to handle while individually reared horses showed more unwanted behaviour at training, for example biting or kicking toward humans (Søndergaard & Ladewig, 2004). On the other hand, it seems that individually housed horses more rapidly make contact with humans (Søndergaard & Halekoh, 2003). Horses on pasture show less unwanted behaviours, are nicer to handle compared to stabled horses (Rivera et al., 2002; Losonci et al., 2016) and also adapt faster to the start of training (Rivera et al., 2002). In a study by Lesimple et al., (2011) it was investigated what affects the reactivity of riding school horses. Breed and housing turned out to be significant factors for the behavioural response to for example a novel object test. Horses from riding schools with individual housing showed a stronger reaction to a novel object, compared to horses from riding schools with group housing and they were more likely to set off in trot or canter when faced with the unfamiliar object. It was argued that this response is more unpredictable and could potentially be a safety issue for riding schools. Gender or age had no effect on the reactivity of the horses (Lesimple et al., 2011).

McGreevy and McLean (2007) discuss that riding and handling makes the horse face many ethological challenges, where it is expected to act counterintuitive and not according to its instincts. Social challenges are for example leaving the group or being close to aggressive horses. Environmental challenges can be approaching frightening objects and cross obstacles instead of avoiding them. Hawson et al. (2010) emphasise the importance of understanding horse behaviour and application of learning theory as measures to prevent horse-related injuries. In a study where horse-related accidents were investigated, it was stressed that better education in horse behaviour is crucial for safer handling and management of horses (Northey, 2003).

Behavioural problems during riding can be a safety issue, especially at riding schools where many riders lack experience. Unwanted behaviours can have many causes, one of them being pain. Hockenhull and Creighton (2012) discuss potential welfare issues related to this, either because of underlying pain and discomfort or because of the way the rider solves the problem. Through a survey, Hockenhull and Creighton (2012) could distinguish three themes associated with the risk of ridden behaviour problems: type of saddle and regular checks to make sure the saddle fits, hoof care and shoeing, and the approach of the rider. Furthermore, a nervous rider or handler will increase heart rate of the horse by unconsciously implying preparation to flee (Keeling et al., 2009). Buckley et al. (2013) investigated misbehaviour during riding in Pony Club horses in Australia. Misbehaviours were classified as either dangerous (rearing, aggressive to other horses, bolting etc) or unwelcome (shying, tossing the head, reacting to noise etc). The incidence of misbehaviour was affected by many factors, mainly related to nutrition and exercise. The authors recommends maintaining a healthy body condition score and to exercise the horse at least 3 times per week (Buckley et al., 2013). Other horses can become unresponsive

to signals from the handler or rider and described as lazy or non-cooperative. These horses have learned that they cannot help themselves to get out of a painful or stressing situation, thus giving up. This phenomenon is usually referred to as learned helplessness (McGreevy, 2012).

Animal welfare

Animal welfare can be defined in many different ways. Broom (1986) describes it as the animal's mental and physical condition, through which it is easier or more difficult to handle the environment. Dawkins (2004) believes that welfare can be assessed by asking if the animals are healthy and if they are content with what they have. Duncan and Petherick (1991) argues that welfare depends on how the animal feels in different situations while Broom (1996) also discuss that welfare depends on how much the animal has to handle and if it succeeds or fails in the attempt to handle different situations. One of the most famous definitions of animal welfare is "The five freedoms", stated by the Farm Animal Welfare Council (FAWC) in 1965. It is said that ideally, animals have "freedom from hunger and thirst, freedom from discomfort, freedom from pain, injury or disease, freedom to express natural behaviour, and freedom from fear and distress" (FAWC, 1979). The world organisation for animal health, Office International des Epizooties (OIE), agrees with this definition and emphasise that welfare is perceived by the animal itself and correlates with the way that they are treated through life (OIE, 2016).

Behaviour as a welfare measure

Three parts of welfare can be distinguished: good physical health and biological function, positive affective states, and natural development and behaviour (Fraser, 2009). Instead of only looking at lack of negative experiences, positive experiences can be used as indicators of good welfare. Positive emotions can contribute to improved animal welfare, for example through anticipation of rewards, ability to control the environment to some extent, and positive experiences early in life (Boissy et al., 2007). It seems like deprivation of some behaviours can result in a strong rebound effect, with a strong increase in frequency of the behaviour when the animal is no longer prevented to perform the behaviour (Nicol, 1987). If the prevention of performing a highly motivated behaviour results in lasting negative emotions, the animal can experience suffering (Dawkins, 1988). Examples of behavioural indicators of good welfare in horses could be being together with other horses (Zeitler-Feicht & Baumgartner, 2016), presence of social grooming (Van Dierendonck & Spruijt, 2012), and self-grooming (Zeitler-Feicht & Baumgartner, 2016). Parameters of reduced welfare may be stereotypic behaviour (Mason & Latham, 2004), absence of body care (Fraser, 2010) and frustration behaviour induced by stress from separation from other horses (McGreevy, 2012).

Aim and research questions

The aim of this thesis is to investigate if the behaviour of riding school horses is different depending on how they are housed and if these differences can indicate level of welfare. Research questions were:

- Is there a difference in horse behaviour in riding schools with different housing systems?
- Is there a difference in horse welfare from a behavioural perspective in riding schools with different housing systems?

Material and method

Riding schools with group housing were compared to riding schools with individual housing in boxes or tie-stalls. Group housing was defined as horses kept together outside with access to a shed all day and night except during riding school activity. This corresponded to a mean of 20 hours of turnout daily. Riding schools with individual housing kept horses in paddocks during 5-7 hours per day and the rest of the day and night in an individual box or tie-stall. Since all riding schools differed in for example management, number of horses, stable design and group sizes during lessons, the method had to be flexible.

Horses and riding schools

Horses from Swedish riding schools were used for behavioural observations. 8 riding schools took part in the study, 4 with group housing and 4 with individual housing in boxes and/or tie-stalls. The participating riding schools owned 13-30 horses each (table 1), with a mean of 21,5 horses. All horses belonged to the riding schools or riding associations and were adult mares or geldings. Many different breeds were represented, for example Swedish Warmblood, Lusitano, Shetland pony and Fjord horse. It was common to have many crossbreeds and imported horses. The horses were observed in their home environment during February and March 2017.

Table 1. Amount of horses in each riding school

Riding school	Housing system	Number of horses
1	Group housing	21
2	Group housing	29
3	Group housing	13
4	Group housing	22
5	Individual housing	27
6	Individual housing	14
7	Individual housing	16
8	Individual housing	30

Data collection

Preliminary observations were made to ensure feasibility of the method. During data collection, one day was used for each riding school and a pair of riding schools was visited two days after each other. Horses were studied by direct observation at three different situations for each riding school: during turnout, in the stable during grooming and saddling, and during riding lessons.

For all three situations, and for scan sampling, ethograms were created where the behaviours were explained. Protocols for data collection (appendix 1) were made in Microsoft Excel and a tablet was used to register behaviours in the protocol. Ad libitum sampling was used, meaning that all relevant behaviours that could be observed were registered. Scan sampling was also used for the observations during turnout, where a group of horses was scanned at several occasions and the behaviour of each horse was registered (Martin & Bateson 2007). Behaviour frequency was calculated as number of observations divided by number of horses and number of minutes.

Turnout

119 horses were observed during turnout. Most horses were divided into bigger or smaller groups when turned out, but in one riding school some horses were kept alone. Altogether there were between 1-16 horses per paddock. Firstly, the paddock with the largest number of horses was chosen for the study. If horses and ponies or mares and geldings were not kept together, two paddocks were observed. If the horses seemed to be disturbed or interrupted by the presence of the observer they were given time to settle and go back to normal activity before data collection began. A sketch over the paddock was drawn for scan sampling. The characteristics of the paddock were registered, regarding for example type of land, hardened surfaces, fencing, vegetation, enrichment and buildings. Weather conditions were also noted, as well as the use of blankets and headcollars. Scan sampling was performed three times for each paddock: at the start of the observation, after 15 minutes and after 30 minutes, except for one paddock where the horses went inside after 12 minutes. The horses' position and behaviour was registered using six behaviour categories (Table 2). The horses were also observed continuously during at least 30 minutes for each paddock. All data in the paddock was collected between hours 10:00-15:00 and the ethogram for behaviours during turnout can be seen in table 3.

Table 2: Ethogram for scan sampling

<i>Behaviour</i>	<i>Description</i>
Standing active	The horse is standing with an alert position
Standing resting	The horse is standing with one leg resting, head somewhat lowered and eyes half-shut or shut
Eating/feed seeking	The horse eats from a feeding station or from the ground: forage, grass or other vegetation in the paddock
In movement	The horse is moving in some direction
Lying resting	The horse is lying down, either with the head up or with both head and legs stretched out
Standing active playing	The horse stands close to another horse, performing some sort of social play behaviour

Table 3: Ethogram for behaviour during turnout

<i>Behaviour</i>	<i>Description</i>
Affiliative behaviours	
Mutual grooming	Two horses standing close together, scratching each other with the teeth
Eat together	Two or more horses eat from the same pile of forage or piece of grass
Grooming	
Rolling	Rolling on the ground
Scratch object	Scratching against a tree, building, fence or other object
Scratch self	Scratching with the help of the own body
Play	
Head/neck/chest nip or bite	Horses nipping or biting on each other's heads, necks or chests. One bout ends when the horses walk away from each other or change activity
Leg bite	Nip or bite towards the legs of another horse
Pick up	Picking something up with the mouth or teeth
Nip/bite blanket	Nip or bite on another horse's blanket
Rear	Horses rearing towards each other, balancing on their hind legs
Stamping	Putting one front leg down with force, usually in response to another horse
Agonistic behaviours	
Kick threat	Threatening to kick another horse by lifting the hind leg rapidly
Kick	Kicking another horse
Bite threat	Threatening to bite another horse by lunging towards it, snapping in mid-air or showing the teeth
Bite	Biting another horse
Move horse	Moving another horse away using the own body. Followed by a submissive behaviour from the other horse
Ears back	Ears are laid back to mark a threat towards another horse
Herd/chase	Following another horse, not letting it stop
Hindquarter threat	Turning the hind against another horse to mark a threat
Explorative behaviours	
Sniff horse	Sniffing another horse somewhere on the body
Sniff object	Sniffing an object in the paddock
Pawing	Pawing in the ground with the front hoof
Licking	Licking an object in the paddock
Locomotor behaviours	
Trot	Moving in trot
Canter/gallop	Moving in canter or gallop
Buck	Lowering the head and leaping with all four legs in the air
Trek	Two or more horses walking together, sometimes in line
Sounds	
Squealing	Making a squealing sound
Neighing	Neighing
Sigh	Extended exhalation through the nose or mouth
Snort/blow	Quick and sharp exhalation through the nostrils, can be combined with head held high and tense body
Other behaviours	
Flehmen	Head lifted and upper lip drawn back, showing the teeth, associated with olfactory investigation
Yawn	Long inhalation with the mouth wide open
Gnawing on the interior	Biting/gnawing on fences, poles or other things in the paddock
Cough	The horse coughs; pause for at least 5 seconds = one bout done

In the stable

63 horse observations were made in the stables. Behaviour was mainly observed in conjunction with grooming before riding lessons. The different configurations of the stables and the fact that we could not choose which horses to include resulted in more or less difficulty observing many horses at once. The observation spot was chosen to enable at least two horses being watched at once. The horses were observed continuously and all behaviours were registered. All data in the stable was collected between hours 15:00-19:00.

Table 4. Ethogram for behaviour in the stable

<i>Behaviour</i>	<i>Description</i>
Ears back grooming	Ears are laid back when the horse is groomed
Ears back saddling	Ears are laid back when the horse is saddled
Bite threat grooming	Threatening to bite when groomed
Bite threat saddling	Threatening to bite when saddled
Bite grooming	Biting human when groomed
Bite saddling	Biting human when saddled
Nip	Nipping when groomed, looking for treats or nipping in clothes. Not biting
Kick grooming	Kicking when groomed
Kick saddling	Kicking when saddled
Bite threat towards passer	Tries to bite a person walking by
Kick the wall	Kicks into the wall of the box or tie-stall
Paw	Pawing with a hoof in the floor
Raised head	The horse raise its head to avoid getting the bridle or headcollar on
Shaking the head	Shaking the head up or down or from side to side
Not lifting hoof	Refusing to lift the hoof when it is going to be cleaned
Pull away leg	When a hoof is cleaned the horse pulls the leg away and put the hoof down again
Stamping	Putting a front leg down with force, or waving with a hoof
Not still	When groomed or saddled the horse is not standing still but stepping around or moving forward and backward. One bout ends when the horse stops for ~5 seconds or change activity
Whip tail	When groomed the horse whips with its tail to show discomfort or irritation
Moving human	Steps to the side to move a human, but not squeezing into the wall
Can reach another horse	Two or more horses can touch each other (sniff, nip etc.) when groomed
Can reach feed	The horse can reach feed when groomed, for example a bag of forage
Led without lead rope	Person leading a horse without a lead rope, only headcollar
Human shouting	Human shouting to correct horse behaviour
Human hitting	Human hitting the horse to correct behaviour
Tied up in long lead rope	The horse is tied up in a lead rope long enough for it to get caught in/put a leg over it
Sigh	Long exhalation through the nose or mouth
Biting on interior	Biting or gnawing on for example crib, door or other objects
Pull teeth against bars	The horse puts the teeth against the bars and pulls the head up and down, creating a distinct sound
Cough	The horse coughs; one bout is done when there is a pause for at least 5 seconds
Wind-sucking	Sucking in air without holding on to something, stereotypic behaviour
Crib-biting	Holding on to for example the edge of the crib with the teeth, sucking in air, stereotypic behaviour
Weaving	Changing the weight back and forth from left to right, stereotypic behaviour
Hand-feeding	A horse is fed treats from the hand
Left alone with bridle on	A horse is left alone in the box with the bridle on

Riding lessons

85 horse observations were made during riding lessons. Horse behaviour was studied by direct observation in the riding arena. The horses were observed continuously and all behaviours were registered during at least 30 minutes for each riding school, 1-2 riding lessons per riding school. The level varied, from beginners to more advanced riders. All data during lessons was collected between hours 15:30-19:30.

Table 5. Ethogram for behaviour during riding lessons

<i>Behaviour</i>	<i>Description</i>
Ears back	Ears are laid back when passing or being close to another horse
Whip tail	Whip the tail when another horse is close
Sigh	Long exhale through the nose or mouth
Pull head down	Pulling the head down, at the same time pulling the reins from the rider's hand
Nip at mounting	Nip or bite rider or other person at mounting
Not still at mounting	Stepping around or backing when the rider is mounting or preparing for mounting
Shake the head	Horse shaking the head up and down when riding
Tongue out	Tongue sticks out during riding
Show discomfort	The horse shows obvious discomfort at riding, for example ears back, kicks into the wall, whips the tail, stomps to the ground
Gape	When riding the horse opens the mouth wide
Shaking the bit	Short rapid shaking of the head up and down
Cough	The horse coughs during riding
Shying	The horse is frightened by something and tries to move away from the scary object
Running away	The horse is frightened by something and runs away or jumps
Freeze	The horse is frightened by something and freezes to the ground/stands absolutely still
Scratch head	The horse scratches its head against the front leg
Back/step around	Backing, stepping around in a circle or stepping sideways instead of moving forward
Close behind another horse	The distance to the horse in front is less than one horse length
Whip use	The rider uses the whip with some force
Turns	The horse decides what way to go by spontaneously turning or ignoring the rider's aids
Accelerate	The horse spontaneously increase the speed or change to a faster gait
Slow down/stop	The horse spontaneously slows down or stops, or change to a slower gait
Side by side	Two or more horses are next to each other side by side, for example due to a rider deciding to overtake another horse
Fall off	A rider falls off the horse
Cough	The horse coughs; one bout is done when there is a pause for at least 5 seconds
Kick	The horse kicks towards another horse
Bite threat	Bite threat towards another horse
Kick out	The horse is balancing on the front legs, hind legs kicking out
Buck	Lowering the head and leaping with all four legs in the air, with or without hind legs extending
Rear	The horse is rearing, balancing on the hind legs

Behaviour analysis

Turnout

Ethological needs

Data was analysed based on ethological needs, the registered behaviours were categorised according to table 6. Feed seeking was however not included since eating was only registered in scan sampling and not in continuous sampling.

Table 6. Behaviours seen in the paddock, categorised after ethological needs

Social contact	Movement	Grooming	Feed seeking	Exploration
Mutual grooming Neighing Eat together Sniff horse Trekking Snorting Light head push Squealing Stamping Head/neck/chest nip or bite Leg bite Nip/bite blanket Rear Ears back Move horse Herd/chase Hindquarter threat Bite threat Bite Kick threat Kick	Trot Canter/gallop Buck	Rolling Scratch object Scratch self Mutual grooming	Eating Eating snow Pawing	Pawing Licking Pick up Sniff horse Sniff object Gnawing Flehmen

Positive and negative behaviours

Behaviours were also categorised according to whether the horses were in a clear positive or negative emotional state of mind (table 7). Because of shortcomings in data collection, no play or movement behaviours were included in this analysis since it was difficult to determine afterwards whether these behaviours were carried out in a positive or negative emotional state.

Table 7. Behaviours categorised after positive or negative emotional status

Positive, all	Positive social	Negative social
Mutual grooming Sniff horse Eat together Neighing Scratch object Scratch self Pawing Licking Pick up Rolling Sniff object Yawn Eating Eating snow Trekking	Mutual grooming Sniff horse Eat together Neighing Trekking	Herd/chase Bite threat Bite Kick threat Kick Ears back Move horse Hindquarter threat

In the stable

Behaviours seen in the stable were divided into four categories, as can be seen in table 8. A few behaviours are represented in more than one category, since some categories can be seen as sub-categories to the first one ("not content") and the fact that some behaviours can be seen as indicators for several things (for example both "impatience" and "not content").

Table 8. Categories of behaviours in conjunction with grooming or saddling

Behaviours indicating that the horse is not content	Aggressive behaviours	Behaviours indicating impatience	Behaviours indicating that the horse is not cooperative
Ears back grooming Ears back saddling Bite threat grooming Bite threat saddling Bite saddling Kick grooming Kick saddling Raised head Shaking head Not still Refuse halter Whip tail Stamp/wave hoof Moving human Bite threat passer Wall kick Pawing	Bite threat grooming Bite threat saddling Bite saddling Kick grooming Kick saddling	Pawing Shaking head Stamp/wave hoof Not still	Raising head Not lift hoof Pull away hoof Refuse halter

During riding lessons

Behaviours during riding lessons were divided into categories as seen in table 9. Only the first four categories were included in the statistical analysis, since the other two categories will be used later on in the project.

Table 9. Categories of behaviours seen during riding lessons

Behaviour during mounting	Behaviour towards other horses	Behaviour indicating that the horse is not content	Behaviour related to riding	Behaviour related to equipment	Behaviour related to movement needs
Nip/bite threat Not still	Ears back Whip tail Bite threat Kick	Backing/stepping around Discomfort Shake head Pull head down	Close other horse Whip use Turn Accelerate Slow down/stop Side by side Fall off	Tongue out Gape Shake bit	Shying Run away Freeze

Statistical analysis

Firstly, descriptive analysis was carried out to explore the collected data. Results were then analysed using Minitab Express (Minitab, Inc. 2014-2015). Paired t-tests were used to compare horse behaviour in group housing and individual housing. The accepted p-level was set to 0,05.

Results

Turnout

Results from scan sampling (figure 1) showed that the proportion of behaviours observed during scans was quite similar when housing systems were compared. Individually housed horses showed a little less standing resting and more playing in general.

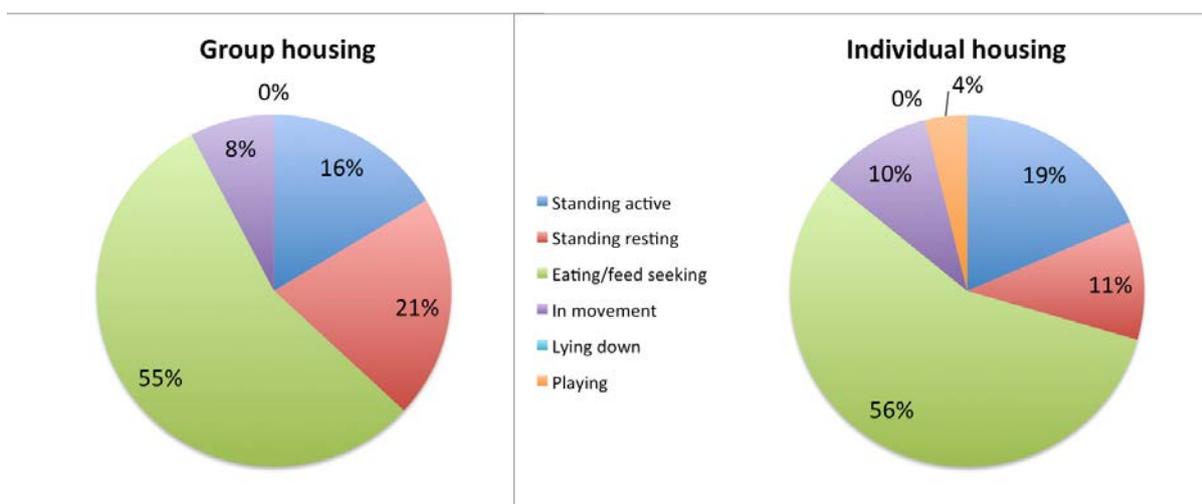


Figure 1. Results from scan sampling, presented as percentage of the total number of observed behaviours.

Table 10 shows the results from scan sampling in each riding school, where the distribution of scanned behaviours can be seen.

Table 10. Results from scan sampling for all riding schools

Riding school	Standing active	Standing resting	Feeding	In movement	Lying down	Playing
1 - Group housing	20,5 %	27,3 %	47,7 %	4,5 %	0 %	0 %
2 - Group housing	16 %	14 %	68 %	2 %	0 %	0 %
3 - Group housing	27 %	21,6 %	37,8 %	13,5 %	0 %	0 %
4 - Group housing	7,8 %	20,3 %	60,9 %	10,9 %	0 %	0 %
5 - Individual housing	18 %	23,1 %	48,7 %	5,1 %	0 %	5,1 %
6 - Individual housing	26,7 %	13,3 %	36 %	16 %	0 %	8,9 %
7- Individual housing	33,3 %	8,3 %	37,5 %	20,8 %	0 %	0 %
8 - Individual housing	4,2 %	0 %	91,7 %	4,2 %	0 %	0 %

The distribution of behaviours according to the categories of ethological needs (table 6) can be seen in figure 2. Social behaviours, grooming behaviours and explorative behaviours were quite similar in both housing systems, while movement differed a little more. Horses from individual housing systems showed some trot, canter and bucking while horses from group housing barely moved in other gaits than walk. There were however no significant differences in movement behaviour between group housing and individual housing ($p=0,1063$). Neither were there any significant differences in social behaviour, grooming behaviour or explorative behaviour.

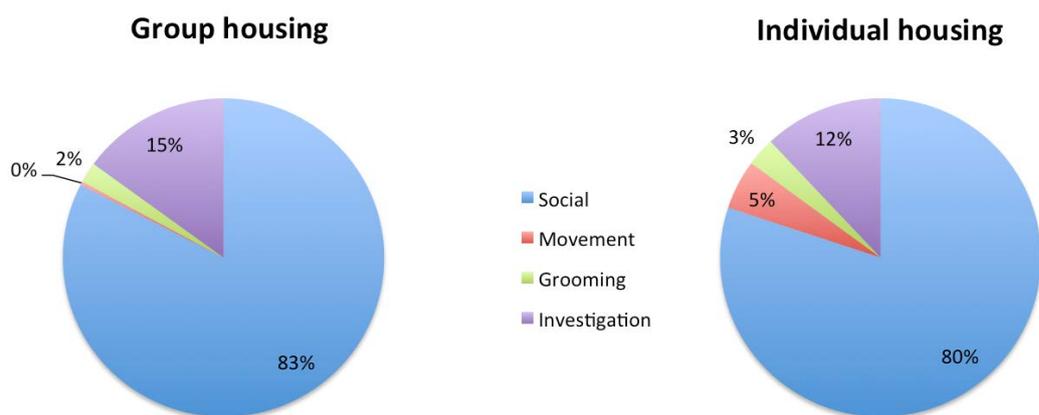


Figure 2. Behaviours indicating different ethological needs, percentage of the total amount of behaviours.

There was no significant difference in negative social interactions during turnout, but there was a tendency for group-housed horses to engage in more positive social interactions (figure 3, $p=0,0901$) as well as more positive behaviour overall (figure 3, $p=0,090$). There was also a

tendency for group-housed horses to sigh more during turnout ($p=0,068$). No stereotypic behaviour was seen during turnout.

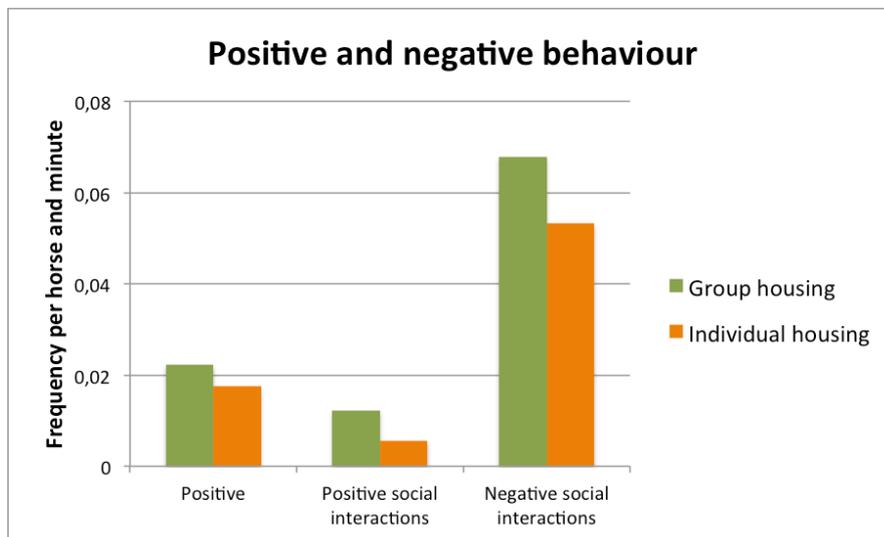


Figure 3. Frequency of behaviours performed in a clear positive or negative emotional state.

In the stable

Individually housed horses laid their ears back more frequently during saddling compared to group-housed horses (figure 4, $p=0,037$). No significant differences were found on laying the ears back during grooming.

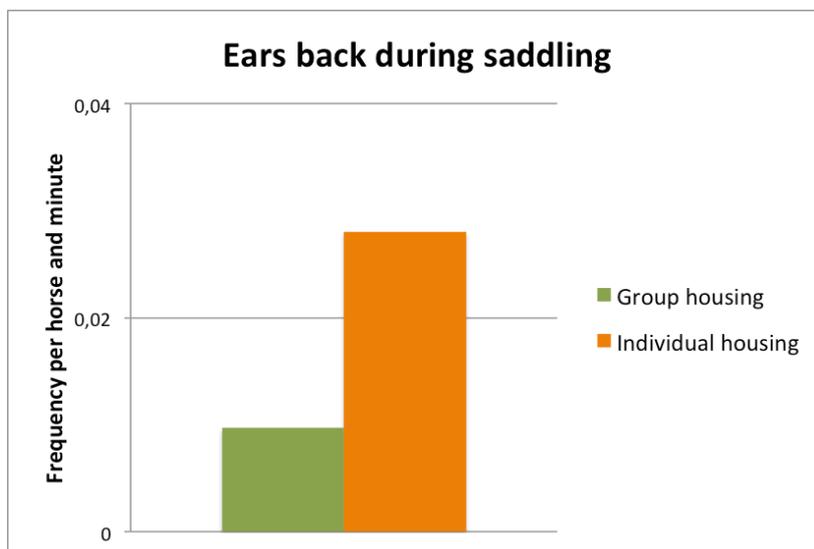


Figure 4. Frequency of horses laying their ears back during saddling.

No significant differences were found regarding behaviours indicating that the horse is not content, behaviours indicating impatience or behaviours indicating that the horse is not cooperative. There was a tendency that individually housed horses displayed more aggressive behaviours during grooming and saddling (figure 5, $p=0,066$).

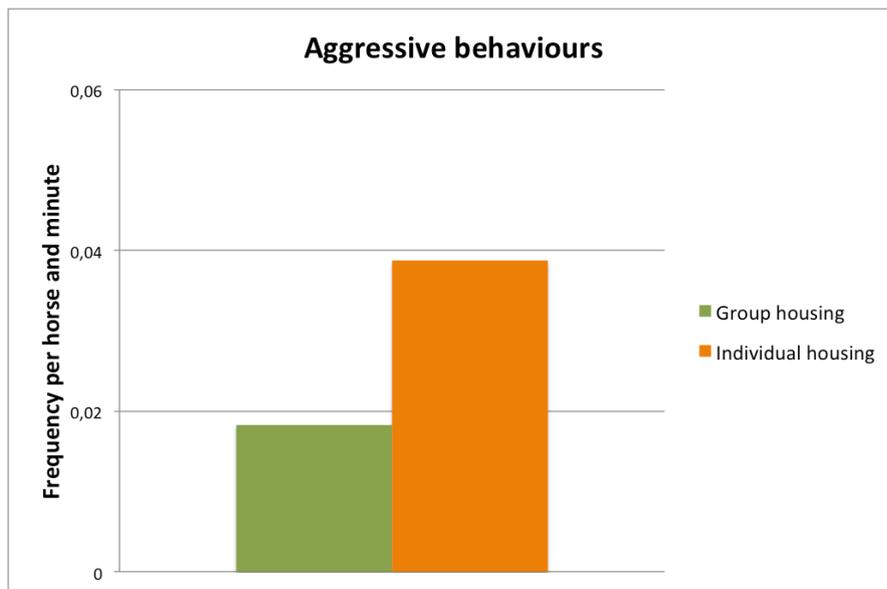
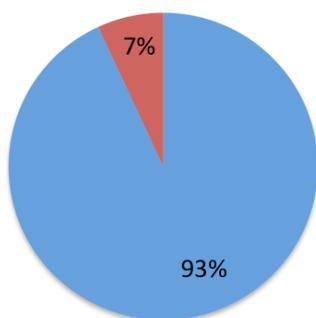


Figure 5. Frequency of aggressive behaviours at grooming and saddling. Behaviours include bite threat, biting and kicking.

The aggressive behaviours showed during grooming or saddling could be categorised into either threatening behaviour (ears laid back or bite threat) or acting out (biting or kicking). The proportion of acting out was somewhat larger in individually housed horses (figure 6).

Type of aggression, group housed horses



Type of aggression, individually housed horses

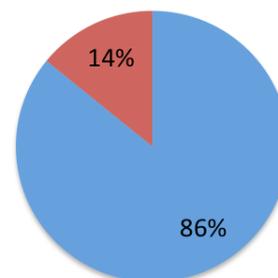


Figure 6. Proportion of aggressive behaviours that are either just threatening (ears laid back or bite threat) or acting out (biting or kicking).

Riding lessons

There was a tendency for individually housed horses to nip more in conjunction with mounting (figure 7, $p=0,063$). There was no significant difference regarding horses not standing still at mounting and preparing for mounting.

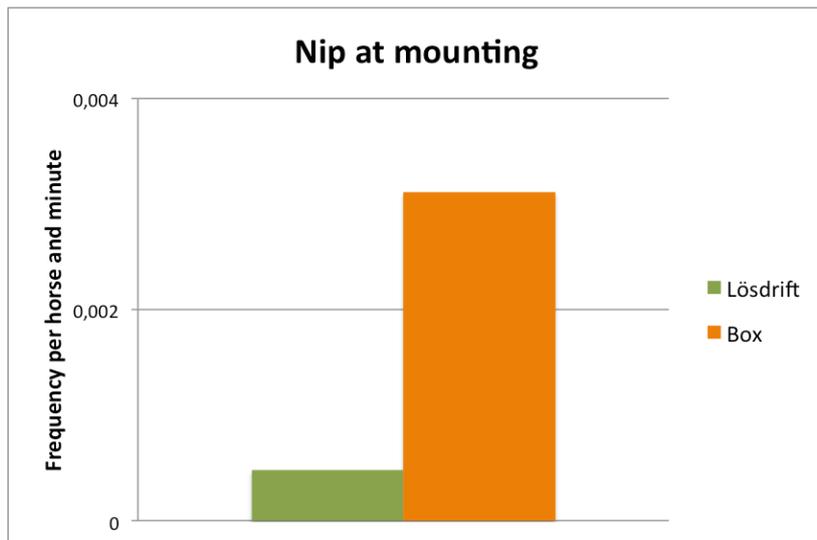


Figure 7. Frequency of nipping or threatening to bite the rider or other person at mounting.

No significant differences in behaviour towards other horses were found. In general there were very few aggressive interactions between horses during riding lessons, none at all in group-housed horses and only a minimal amount in individually housed horses. No significant differences were found regarding behaviours indicating that horses were not content during riding, behaviours related to riding and equipment or behaviours related to movement needs.

Discussion

The results showed some differences in behaviour between riding school horses housed in groups and riding school horses that were individually housed, although most results were not significant. Some results indicated that individually housed horses showed more threats and aggression towards humans, a result that is very relevant for riding schools considering that horses often are handled by children and teenagers, not always supervised.

In this study ad libitum sampling was used, meaning that all behaviours that were visible to the observer were registered (Martin & Bateson, 2007). This of course means that more noticeable behaviour tended to be registered before other behaviour. There are also some limitations in having one person registering all behaviour of a group of up to 17 horses; it is simply not possible to notice everything. Considering this, longer observation time might have been preferable, especially for turnout.

Turnout

Results from scan sampling do not reveal any striking differences between group-housed horses and individually housed horses when mean values are compared (figure 1). However, when looking at the riding schools separately (table 10), there are large differences in distribution of behavioural categories. This is not very surprising considering the great variation in for example feeding practice, group size and paddock design. For instance, one of the individual riding schools (number 8) provided horses with free access to haylage in the paddock. This, together with an otherwise non-stimulating environment, resulted in horses spending almost all time eating (91,7 % of all behaviours scanned). In comparison, horses at the three other riding schools with individual housing were feeding 36-48,7 % of the total number of behaviours scanned.

Almost all horses had access to feed during turnout, either in feeding stations, in hay nets or on the ground. Two of the riding schools with individual housing did not provide horses with feed during turnout, although one of them had some growth of grass in the paddocks. This ought to have affected the horses' behaviour in different ways. With access to feed horses spend a lot of time eating and not as much time on other activities. This was obvious in the riding school where horses had no feed during the observation time, horses were extremely active engaging in play, exploration, grooming and also moved around a lot. No stereotypic behaviour was observed during turnout, which might have been affected by the fact that almost all horses had access to feed during turnout and were kept together with other horses, some of the factors known to decrease the risk for stereotypic behaviour (Bachmann et al., 2003).

No significant differences could be seen regarding social behaviour, grooming behaviour, explorative behaviour or movement behaviour. However, a little more movement behaviour could be seen in individually housed horses. This might be an indication of a rebound effect caused by a lot of standing still in a box or tie-stall during a large part of the day and night, as seen in other studies (Mal et al., 1991a; Chaya et al., 2006). The lack of significant differences may however be a result of riding school horses getting a lot of daily exercise, something that has shown to decrease activity during turnout (Jørgensen and Bøe, 2007).

No significant difference in negative social behaviours could be seen during turnout, neither for overall agonistic interactions nor for moving another horse or laying the ears back. Large variations could be seen between different paddocks, even in the same riding school, but in general there were quite many agonistic interactions in both group-housed and individually housed horses, although the intensity of interactions was not recorded. Group-housed horses can maintain a stable group to a greater extent, perhaps giving them more opportunities to bond with other horses. Ellard and Crowell-Davis (1989) found more agonistic interactions between affiliates, although less intense. This might give a clue to why there were quite a lot of agonistic interactions also in riding schools with group housing. Individually housed horses may on the other hand be more aggressive when reunited with other horses (Christensen et al., 2002a). Group-housed horses were generally kept in larger groups and in slightly larger paddocks. It seems like a smaller area per horse increases aggression (Jørgensen et al., 2009; Flauger & Krueger, 2013), maybe contributing to agonistic behaviour during turnout. Feeding practice can affect the incidence of aggressive behaviour, but since this was not related to housing system but rather to management of the individual riding schools, no conclusion can be drawn regarding this.

There was a tendency for more positive behaviour overall and more positive social interactions in group-housed horses. This might be caused by group-housed horses spending more time together, enabling them to fulfil their desire for social contact (Søndergaard et al., 2011) and form affiliations which seems to be important for domestic horses (Van Dierendonck & Spruijt, 2012) and the presence of affiliative behaviour could be an indication of good horse welfare (Boissy et al., 2007). Play and movement behaviour was excluded from the analysis of positive and negative behaviour, due to the difficulty in knowing the horses' emotional state in retrospect. Play behaviour is usually seen as an indication of positive emotions, however some of the play seen in this study bordered on the line between play fighting and real fighting. This was the case in the one paddock where the horses had no feed for most of the turnout. No play behaviour at all was seen in group-housed horses, neither during scan sampling nor during continuous sampling. Since play behaviour seems to be more common in horses that are not allowed to socialize with other horses (Christensen et al., 2002a) and horses kept in restricted

environments (Hausberger et al., 2012), it might not be very surprising that individually housed horses were the only ones playing during observations. Hausberger et al. (2012) also found higher levels of stress in horses that played frequently. Despite this, it is likely that horses can experience positive emotions while playing (Boissy et al., 2007), even if the situation leading up to the intensive play might sometimes indicate a reduction in overall welfare. For adult horses, social play might however not be a useful indication for positive emotional states (Zeitler-Feicht & Baumgartner, 2016).

In the stable

Horses in individual housing laid their ears back more during saddling. During grooming there was no difference in laying the ears back. During both grooming and saddling altogether, there was a tendency for individually housed horses to show more aggressive behaviour. There was also a larger proportion of acting out aggression in individually housed horses, including biting and kicking. This type of aggression can be an indication of pain or discomfort (Fureix et al., 2010; McGreevy, 2012) but might as well be a learned behaviour (McGreevy et al., 2012). There is barely any research done on behavioural problems at handling, especially in riding school horses. McGreevy (2012) discuss the probability that horses often have learned that threatening or aggressive behaviour is rewarding, making the habit stick. In a riding school horses are handled by many different persons with varying skills. This may result in a stressful environment for the horse, particularly if riding school pupils are not taught handling of horses in the same way.

There are several studies suggesting that group-housed horses show less unwanted and aggressive behaviour towards humans (Rivera et al., 2002; Søndergaard & Ladewig, 2004; Losonci et al., 2016). Maybe group-housed horses are less stressed due to the fact that they can live a more natural life most of the time, while individually housed horses in traditional riding school management are only in the company of other horses a couple of hours per day. The remaining time is spent standing still in a box or tie-stall, a lot of the time without any occupation.

Riding lessons

There was a tendency for more nipping or bite threats at mounting among individually housed horses. This is probably linked to the tendency that individually housed horses showed more threats and aggression during grooming and saddling. When girthing up prior to mounting the horse can carry out bite threats more easily since it is not tied-up. This too can be a learned behaviour that might be difficult to eliminate (McGreevy, 2012). Not standing still at mounting did however not differ between group-housed and individually housed horses.

Behaviour towards other horses was not significantly different for group housed and individually housed horses. Horses were generally not interacting aggressively with one another during riding lessons except for a few observations of ears laid back and tail whipping in individually housed horses. No actual biting or kicking towards other horses were seen, indicating that riding school horses seem to get along quite well regardless of housing system. Almost all horses were kept in groups during turnout, although most often separated based on gender or size, probably affecting their interactions when exercised together. In all other observations no significant differences could be seen, indicating that there are many factors affecting horse behaviour during riding, apart from housing system.

Riding school horses are often managed differently compared to privately owned horses. They are most often turned out together, exercised together and not very often faced with unknown situations, this minimises the amount of ethological challenges they have to face (McGreevy & McLean, 2007). They also get frequently exercised, probably decreasing the risk for ridden misbehaviour (Buckley et al., 2013). Neither was there any significant difference regarding behaviours relating to horses showing unfulfilled movement needs. Some escape behaviour was seen on a few occasions, but these were all the effect of unpredictable external stimuli that was unrelated to housing system. Lesimple et al. (2011) saw that individually housed horses were more prone to run away when faced with a novel object, but this could not be seen in the present study.

Implications for horse welfare

In this study there were only small differences in behaviour between horses in group housing and horses in individual housing. Consequently, no major conclusions can be drawn on the welfare of riding school horses in the different housing systems. In group housing there tended to be more positive social interactions and more positive behaviour during turnout, indicating a more positive emotional state for these horses, which can be interpreted as a sign of good welfare (Boissy et al., 2007). Individually housed horses showed social play behaviour during turnout, something that on the one hand could indicate social deprivation (Christensen et al., 2002a) but on the other hand could indicate positive emotions while playing (Boissy et al., 2007). Threatening and aggressive behaviour during handling was seen more often in individually housed horses. These behaviours may be the cause of many factors but regardless; it is a sign of negative emotions, probably originating from previous negative experiences for the horse.

Horse behaviour has not changed much despite domestication (Christensen et al., 2002b) and housing system should be designed to meet the natural behaviour. In riding schools there are even more factors to take into consideration, but well-being of the horses should be one of the top priorities. If horses are provided with enough space, agonistic behaviour can be reduced (Flauger & Krueger, 2013) as well as injuries related to aggression (McDonnell & Haviland, 1995; Grogan & McDonnell, 2005). From a behavioural perspective, group housing is most definitely suitable for riding school horses and perhaps future research could give even more insight to how horse behaviour is affected by housing systems.

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Appendix

Appendix 1

Table 11. Protocol for observations during turnout

TURNOUT	Mutual grooming	Eat together	Rolling	Scratch object	Scratch self	Head/neck/ chest nip or bite	Leg bite	Pick up	Nip/bite blanket
Date:	Rearing	Stamping	Kick threat	Kick	Bite threat	Bite	Move horse	Ears back	Herd/chase
Riding school:									
Housing system:	Hindquarter threat	Sniff horse	Sniff object	Pawing	Licking	Trot	Canter/gallop	Buck	Trekking
Number of horses:									
Observation time (start and stop):	Squealing	Neighing	Sigh	Snort	Flehmen	Yawn	Gnaw on interior	Cough	Light head pushing
Paddock size:									

Table 12. Protocol for observations in the stable

STABLE	Ears back grooming	Ears back saddling	Bite threat grooming	Bite threat saddling	Bite grooming	Bite saddling	Nip	Kick grooming	Kick saddling
Date:									
Riding school:	Nip/bite threat towards passer	Kick wall	Pawing	Raised head	Shaking the head	Not lifting hoof	Pull away leg	Stamping	Not still
Housing system:									
Number of horses:	Whip tail	Move human	Can reach other horse	Can reach feed	Led without lead rope	Human shouting	Human hitting	Tied up long lead rope	Sigh
Observation time (start and stop):									
Number of pupils:	Biting on interior	Pull teeth against bars	Cough	Wind-sucking	Crib-biting	Weaving	Hand-feeding	Left alone bridle on	
Appr. age/level pupils:									
Other persons:									

Table 13. Protocol for observations during riding lessons

RIDING	Ears back	Whip tail	Sigh	Pull head down	Nip at mounting	Not still at mounting	Shake the head	Tongue out
Date:								
Riding school:	Show discomfort	Gape	Shaking the bit	Cough	Shying	Running away	Freeze	Scratch head
Housing system:								
Number of horses:	Back/step around	Close behind other horse	Whip use	Turn	Accelerate	Slow down/stop	Side by side	Fall off
Ponies vs horses:								
Observation time (start and stop):	Cough	Kick	Bite threat	Kick out	Buck	Rear		
Level:								