Evaluation of Horses' Daytime Activity Budget in a Model of Ethological Stable: A Case Study in Italy

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The increasing interest in animal welfare and the knowledge of equine physiological and ethological needs have led to the development of different types of horses' management and housing systems. The research presented here aimed to assess the daytime activity budget of horses. Focal animal sampling was used as an observational sampling method, and the five animals were observed for a total of 9920 minutes in the paddock and inside the stall. The results showed that horses spent most of the daytime in foraging behaviors, followed by resting behaviors, and locomotion. Social behaviors (s.e. allogrooming, olfactory investigation) were rare, and the stereotypic behaviors (s.e. oral and locomotor stereotypies) occupied 2.74%±2.74% of the total time. The percentage of time spent in foraging, resting, and locomotion, reflects the activity budget observed in free-roaming feral horses. However, the rare occurrence of positive social inter- actions and the presence of some stereotypies could be aspects to ameliorate. This kind of housing facility could be considered a good alternative to traditional management; indeed, it might offer a better trade-off between the needs of the horse and the management goals from humans.

Introduction

The horse (*Equus caballus*) was domesticated during the late-Neolithic, and the behavioral and morphological characteristics of the modern horse are the result of an environmental adaptation (Davies, 2017). Horses are prey animals, their sensory abilities enable them to explore the environment and rapidly identify the presence of predators, and their locomotor apparatus enables them to reach high speeds (Mills & Nankervis, 1999; Pageat, 2007). They are animals characterized by a high level of sociality and they live in herds, where they find protection (Galli, 2006; Mills & Nankervis, 1999).

Nowadays, horses have an important role as sport animals but also as companion animals. In response to economic and practical demands, different management and housing facilities have been developed (Baragli & Pagliai, 2016). However, there is still a long way to go to create a housing facility that can safeguard animal welfare, especially concerning the possibility of allowing horses to express their species-specific behavior (Paoletti et al., 2009).

Broom (1986) defined welfare as the condition of an animal in its attempts to cope with their environment. When an animal lives in suboptimal conditions, one of the first indicators of poor welfare can be the modification of its behavior, such as the development of anomalous behaviors (s.e. stereotypies). The modification of the behavior can be accompanied by a change in the physiological mechanisms (s.e. an excessive or prolonged activation of Hypothalamic–pituitary–adrenal axis and cortisol production), which can negatively influence the health of the animal (Broom & Johnson, 1993; Dawkins, 1990).

Animal welfare is not only the evaluation of the health state of the animals, but it takes into account also the environment, the impact of human-animals' interactions, and animals' management. Indeed, human beings are responsible for the management and keeping of the animals and they must ensure that the five freedoms are respected (Biagi, Nannipieri, Signorini, & Bagliacca, 1998; Brambell Committee, 1965). Freedom from thirst, hunger and malnutrition, freedom to have an adequate environment, freedom from pain, injury and disease, freedom to manifest species-specific behavioral characteristics, freedom from fear and discomfort. These freedoms are reported

in the Brambell Committee (1965) and are the basis of the international animal welfare laws.

In Italy, most of the time the horses are maintained in individual stalls for much of the day, spatially isolated from their conspecifics, with whom they have only visual and auditory contact (Baragli & Pagliai, 2016). Sometimes, they are led out to an outdoor paddock for a period of time during the day, but without contact with other horses (Panzera, 2016). It has been observed that the behavior of horses in this kind of traditional management system diverges from the behavior observed in their wild conspecifics, which have the same biological and behavioral needs of domestic horses (Flannigan & Stookey, 2002; Franchini & Worthington, 2013). In traditional management, the failure to acknowledge horses' needs often leads to the development of anomalous behaviors, such as stereotypies, because the animals have difficulty in adapting to this kind of environment (Flannigan & Stookey, 2002; Hockenhull & Creighton, 2014). It has been shown that 40% of horses in traditional stables show anomalous behaviors, 10% of that was represented by stereotypies, such as cribbing, weaving, or pacing (Baragli & Pagliai, 2016). Epidemiological studies conducted by McGreevy, Cripps, French, Green, and Nicol (1995), Nicol, Davidson, Harris, Waters, and Wilson (2002), Henderson and Waran (2001) and Thorne, Goodwin, Kennedy, Davidson, and Harris (2005) have investigated the developmental causes of equine stereotypies and have linked the incidence of the stereotypies to some management factors, such as the food rich in concentrates, poor access to fiber and social isolation. A deficit in environmental stimulation can cause deprivation and an emotional state of frustration, boredom, and the horses can develop stereotypies (Cooper & McGreevy, 2007). For example, a diet rich in fiber, which requires a large percentage of a horse's time to consume in order to meet its dietary needs and helps to buffer the acidity of the stomach, can prevent or reduce the intensity of oral stereotypy, such as cribbing, compared to a diet rich in concentrates (Cooper & McGreevy, 2007). Indeed, horses are grazing animals, and, when it is possible, they spend most of the day eating (Cooper & McGreevy, 2007; McGreevy & Nicol, 1998). Another study has demonstrated that the visual and tactile contact between horses through the grates of the boxes can reduce significantly the incidence of locomotor stereotypies, such as nodding and waving (Cooper, McDonald, & Mills, 2000). Also, the physical exercise and the time that a horse spends outside its box can influence the development of stereotypies. Horses that spend most of the day inside the boxes can express locomotor stereotypies, inside the box, such as box-walking and weaving (McGreevy, 1996). Usually, less stereotypic behavior is observed in the paddock, where the horse has more stimuli and the possibility of satisfying its motivations. However, horses in paddocks can also show stereotypies: especially older subjects that have spent most of their time isolated in individual boxes and have already developed stereotypies can show these behaviors also in other environments (Cooper & McGreevy, 2007)

The traditional management systems do not take into account three main behavioral needs of the horse, sociability, locomotion, and foraging behavior. In traditional management systems, sociability is compromised by isolation and few opportunities for interaction with conspecifics. Confinement in boxes lasting for most of the day makes horses assume unnatural postures of the body. Finally, in the traditional management system, foraging behavior of the horse, which is a monogastric grazing animal, is affected by the amount and quality of the food. Indeed, often the ration is low in fiber and high in concentrate and the food is administered 2–3 times per day.

Those are the aspects that are necessary to change. Housing facilities should favor the locomotion, a feeding system that respect horses' natural needs, and the socialization between conspecifics as well as between horses and people (Baragli & Pagliai, 2016).

This study aimed to evaluate the activity budget of a group of horses housed in a new stable, named Ethological Stable that has been designed taking into account the needs of both humans and horses. The main hypothesis was that horses in the ethological stable should show an activity budget more similar to the one reported in the literature for feral horses than the one of the animals who live in boxes, with a very low percentage of stereotypic and anomalous behaviors. This hypothesis was developed considering the layout and the management practices of the analyzed stable, which try to take into the biological and behavioral needs of horses more than other structures that are present in Italy.

Materials and Method

The Ethological Stable

The Ethological Stable considered in this study is about one thousand square meters wide, composed of 12 indoor Big Boxes© in addition to an area where the horse can be shod and treated, a saddlery, and a clubhouse.

The Big Box© is divided into two halves of about 20 m^2 each, for a total of 40 m^2 (8 m x5m). In one half the floor is covered by sand, the other half of the bedding is made of high-density shock- resistant rubber that offers rigid support. It allows the horse to choose the surface on which to stand or lie on, between the soft sand and the shock-absorber rubber mat. The sand portion has an underlying system that suspends it from the ground without dispersing it. This system lets the urine drain away. The pavement underneath is washed by an automatic water system that transports the liquids outside into a specific tank. The sand is of fluvial origin with a large granulometry, and is washed and deprived of fillers, which constitutes the finest powdered part dangerous for breathing. The stalls are cleaned daily by collecting manure and later cleaning with automatic sweeping machines on the rubber mat. The sand can be collected only where dirty directly in daily management and it is replaced weekly replacing the sand removed during cleaning. When horses are inside the stable, the hay is placed outside the door of the box, easily reachable from the main openings, while cereals or dry food is fed in a bucket hooked to the grates in the lower front part of the Big Box© (Figure 1).

Outside the stall, there is an 18 m. round pen, an outdoor arena, a 'Paddock Paradise' of 1.5 ha, and individual paddocks, divided by electrified fences, which extends to 5 ha. The "Paddock Paradise" was conceived for the first time with the idea of providing horses an environment more like their natural habitat, to satisfy the behavioral needs of the species as much as possible. It consists of a ring route, normally divided into two parts by an electrified mobile fence. Along its entire path, it has a variation in vegetation, varying from low shrubs to hedges and trees, areas where to roll, linear areas and plains are spaced by areas with a raised surface, and wood logs and a pool of water are also present. To increase the space available to the horses, there is a rectangular paddock that can be joined to the "Paddock Paradise." Along the whole path, you find drinking and feeding stations, with the hay given on the ground (Figure 2).

During most of the daytime period, horses are in paddocks, however, if they are inside, hay is provided *ad libitum* allowing them to eat constantly and with their head lowered, as it happens when grazing. The same concept applies to water, which remains outside and placed close to the floor. The boxes are divided by grates and horses can see each other inside the stable and to touch and groom through the window between the boxes.

Figure 1. Big Box© – Picture of the Big Box© (http://www.laprosperacentroequestre.it/).

Subjects and Behavioral Assessment

The subjects observed were five horses, which were raised in traditional stables and were now moved into the Ethological stables. They were four mares (two Sella Italiano, 11 and 16 years old, one Trotter, 14 years old, and one Hungarian horse, 16 years old), and one gelding (Sella Italiano, 14 years old).

The observation period lasted from April to October 2019. Focal animal sampling was used for all of the five horses (Altmann, 1974). The observations were conducted in four daily bands: bands B (8.00 am −12.00 pm) and C (12.00 am – 6.30 pm), during which the horses remained outside in the paddocks (PP = Paddock Period), and the bands A (7.00 am – 8.00 am) and D (8.00 pm-9.00 pm), when the horses were inside the stalls (BBP = Big Box© period). During the observation outside the stable, an observer recorded the animals using a Sony HDR-CX240E camera, whereas during the bands A and D webcams (Each ® Italy 7548AHD) were installed above the stall of each horse. A single observation lasts 60 minutes and a continuous recording method was employed.

The ethogram employed was that reported by McDonnell (2003), and three other behaviors were added (Backwards, Licking/chewing, Lip-smacking). The entire ethogram consisted of 110 behaviors divided into 11 categories (see appendix 1). When it was not possible to observe the entire animal during the analysis of the video, it was recorded as "not visible."

The analysis of video was made with the software BORIS (Behavioral Observation Research Interactive Software) (Friard & Gamba, 2016), employing a continuous recording method for all focal animals (Altmann, 1974). A total of 5320 minutes in the paddocks (PP) and 4200 minutes in the Big Box© (BBP) were analyzed.

Video Analysis

The behaviors were categorized into states and events. States have a measurable duration, while the events are instantaneous and only frequencies can be recorded (Altmann, 1974). Therefore, the mean frequency and standard error of the main events observed in PP and BBP were calculated and

Figure 2. Paddock Paradise – Pictures of the Paddock Paradise made by Giulia Schiavoni and from http://www.laprosperacentroequestre.it/.

expressed in acts/hour, whereas the percentage duration of state behaviors was calculated, to analyze the daily activity budget of the group. The observed behaviors were divided into 12 behavioral categories: foraging behavior, elimination behavior (defecation and urination), locomotion, standing alert, resting, grooming and insect control, investigation, aggressive behavior, affiliative behavior, reproductive behavior, comfort behavior, anomalous behavior.

The observer that recorded and analyzed the video did two weeks of training before the beginning of the study.

Initially, the daily activity budget of each subject was calculated including the observations from both the PP and BBP, and then separately in each period. The mean percentage and the standard error of each behavioral category was calculated, to obtain the activity budget of the group. Due to the small sample size, only descriptive statistics have been used to illustrate the time budgets of the horses and the differences between the two periods were not compared with statistical tests. Any power analysis was performed because the five animals considered was the only resident animals in the structure when the research was conducted.

Results

Horses spent most of the daytime (7.00am-9.00pm) in foraging behavior (67.76%±2.51%), particularly in grazing, which occupied 98.99% of the total time spent in foraging. The second behavioral category most represented was resting (18.88%±2.12%), followed by locomotion (5.20%±0.51%), stand alert (4.03%±0.78%), and anomalous behaviors (2.74%±2.74%). On the other hand, the lowest percentages were recorded for grooming and insect control (0.62%±0.04%), investigation (0.45%
±0.07%), elimination (0.23%±0.02%), affiliative behavior (0.04%±0.02%), reproductive behavior (0.03%±0.03%), comfort behavior (0.01%±0.004%), and aggressive behavior (<0.01%) (Table 1 and Figure 3).

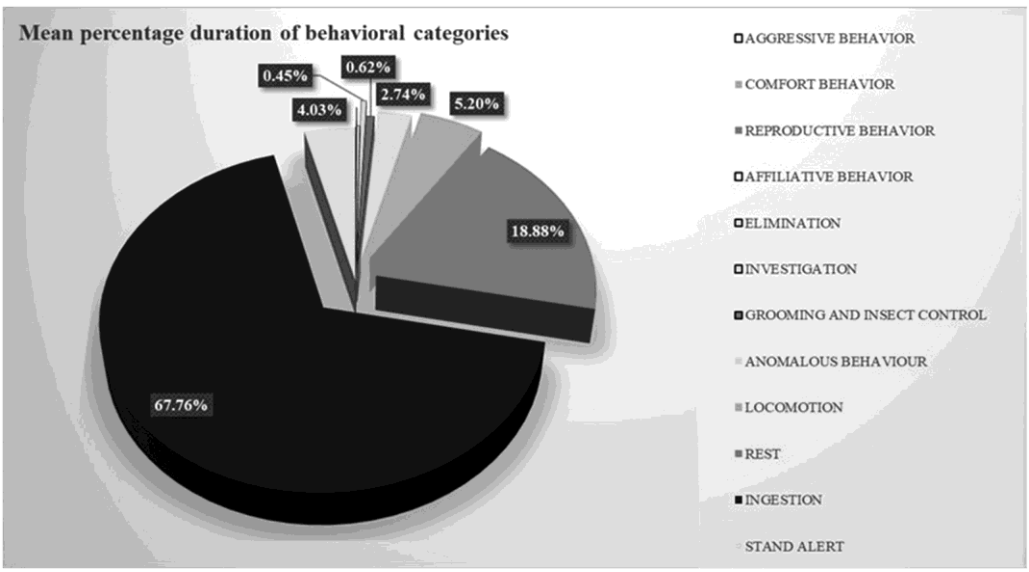

Figure 3. Daytime activity budget- The durations of the considered behavioral categories expressed as a percentage, calculated according to the total observational time, when the horse where in Paddock and in the Big Boxes (PP+BBP).

Table 1. Comparison between the activity budgets of feral and stabled horses measured in 24 hr by *Kiley-Worthington, M. (1990) and the study's results. "Standing" includes standing while resting and sleeping and standing alert. PP = Paddock Period; BBP = Big Box Period.

Behavior	*Feral Horses (Equus Caballus)		*Isolated Stabled Horse + restricted long fiber food	Ethological Stable		
	Summer	Winter		BBP+PP	PP	BBP
Eating	56.17%	61.55	25%	67.76% ± 2.51%	81.31% ±4.16%	49.17% ±1.81%
Standing	22.2%	24.2%	65%	20.67% ± 1.58	9.09%±2.78%	36.85% ±2.63%
Lying	11.6%	7.9%	10%	2.13% ±1.21%	0%	5.04%±2.85%
Moving	9.5%	6.2%	0%	5.20% ± 0.51	5.27%±0.85%	5.13%±0.41%

Considering the single behavioral category of resting, we distinguished between resting recumbent (10.25%) and resting while standing (88.09%), sleeping recumbent (1.02%), and sleeping while standing (0.65%). Sleeping behaviors were observed only inside the boxes. The percentage duration of standing alert in BBP was almost twice that in the PP (Table 1 and Figure 4a).

The observed anomalous behavior occupied only 2.74% of the total observational time, and, within this category, we observed miscellaneous abnormal behaviors (1.13%), locomotor stereotypies (4.80%), and oral stereotypies (94.07%).

Considering the activity budget recorded in PP and in BBP, the percentages of time spent in foraging behavior (PP = 81.31%±4.16%; BBP = 49.17%±1.81%), grooming and insect control (PP = 0.89%±0.08%; BBP = 0.24%±0.05%), social behaviors (PP = 0.10%±0.07; BBP = 0.04%±0.03%), and elimination (PP = 0.32%±0.05; BBP = 0.11%±0.04%) were higher in PP than when the horses were in Big Boxes©. When the horses were inside the boxes, the percent of time of resting (35.97%±0.85%), standing alert (5.91%±1.24%)and investigating (0.64%±0.19%) were higher rather than for the horses in paddocks (respectively 6.47%±0.41%; 2.62%±0.60%; 0.31%±0.03%). The percentage duration of locomotion and anomalous behavior, recorded was similar in PP (5.27%±0.85%; 2.82%±2.82%) and BBP (5.13%±0.41%; 2.63%±2.63%) (Figure 4(a),Figure 4(b)).

Regarding the events recorded during the observation, the most frequent ones were the stamp (Figure 5(a)) and the swish/swat insects (Figure 5(b)), two behaviors that belong to the grooming and insect control category. The mean frequency of both of these events was higher in the PP compared to in the BBP. Events that were observed more frequently in BBP were licking and chewing, yawning, and stretching (Figure 6(a)). General social communication behaviors were observed more frequently while the horses were in paddock, especially vocalization, and flehmen, whereas the aggressive behavior "ears laid back" had a higher frequency in the BBP (Figure 6(b)).

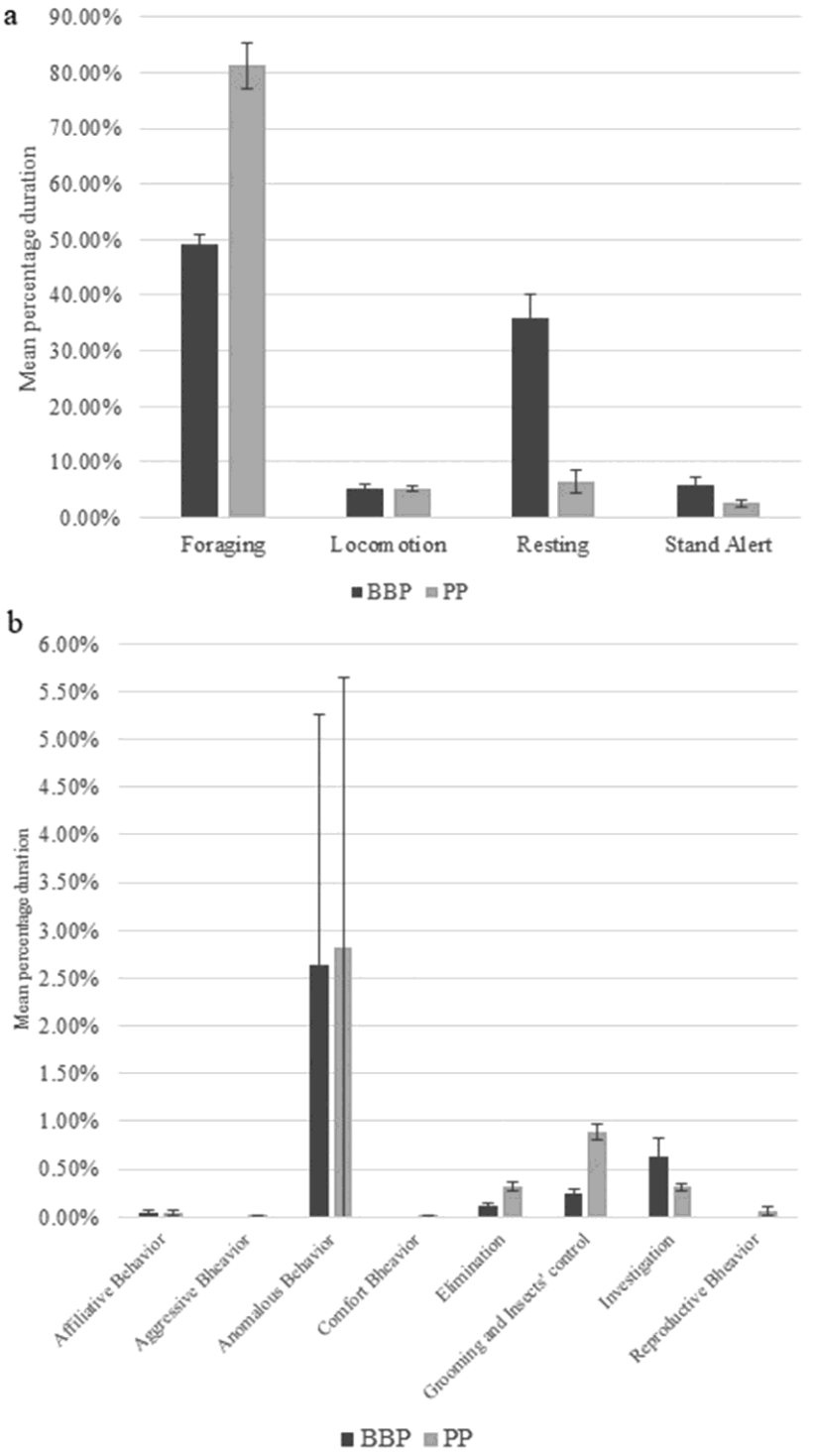

Figure 4. Comparison of the two periods- a) Comparison between the mean percentage durations and standard errors of foraging, resting and locomotion in paddock (PP) and into the Big Box (BBP); b) Comparison between the mean percentage durations and standard errors of affiliative behavior, aggressive behavior, reproductive behavior, comfort behavior, elimination, grooming and insect control, investigation and anomalous behavior in paddock (PP) and into the Big Box (BBP).

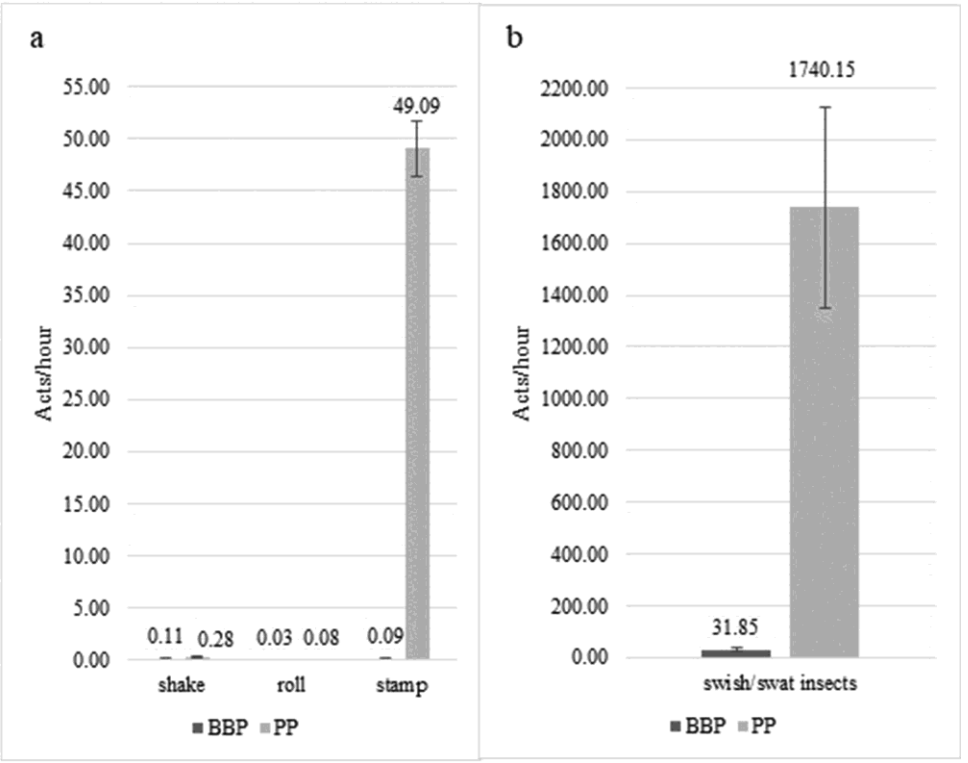

Figure 5. Mean frequencies and standard error of events of grooming and insect control category – a) Frequencies of stamp, roll and shake; b) Frequency of swish/swat insect. PP = Paddock Period; BBP = Big Box Period.

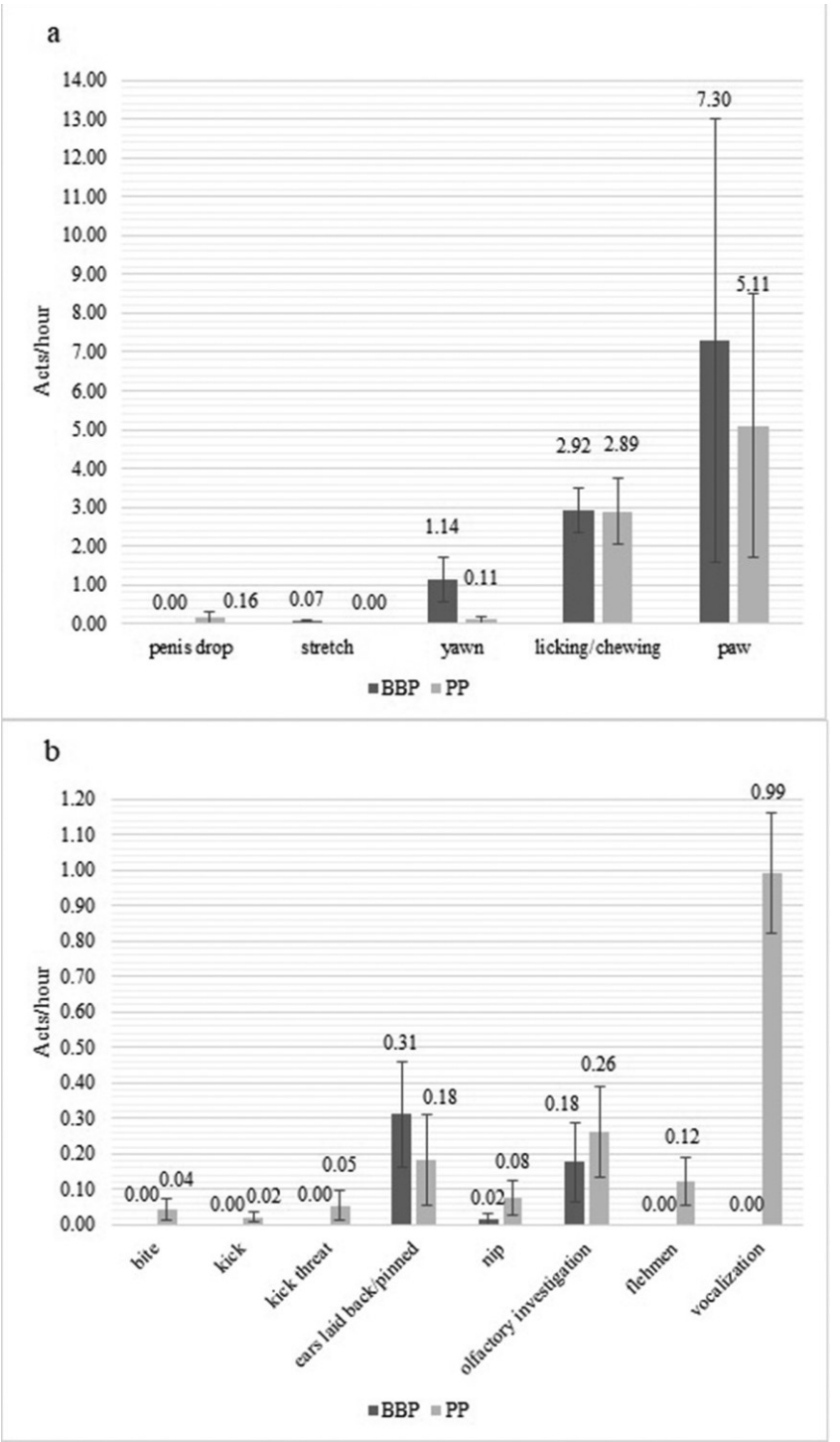

Figure 6. Mean frequencies and standard error of the other events observed a) frequencies of locomotor (paw and stretch), resting (yawn) and comfort and relief (penis drop and licking and chewing) behaviors; b) frequencies of generalsocial communication events. PP = Paddock Period; BBP = Big Box Period.

Discussion

The aim of this research was to observe the behavior of a group of horses stabled in a new facility (Ethological Stable) designed to promote natural behavior, recording them both inside the Big Box and outside in paddocks. The layout and the management practices of the analyzed stable tries to take into account both the biological and behavioral needs of horses and the human's practical requests.

Our results showed that for most of the daytime, horses are occupied in foraging behaviors (67.76%±2.51%), mainly grazing. The second most common activity was resting (18.88%±2.12%), predominantly expressed when the subjects were inside the Big Boxes. The third most common activity was locomotion (5.20%±0.51%). These data are very similar to the results of Ransom and Cade (2009), who monitored the daily activity budget of free-roaming horses. Previously, Kiley- Worthington (1990) underlined how feral horses spent 60% of their time in foraging. On the contrary, in a condition of social isolation and with a planned feeding schemes, horses spent 65% of their time in resting while standing, which is three times more than free-roaming horses, and only 15% of their time in foraging activity (Table 1) (Kiley-Worthington, 1990). In traditional management, horses mainly receive diets rich in concentrate and low in fiber (Marsden, 1995). This kind of diet can be consumed in less than 2 hours and alters the normal feeding behavior of the horse (McGreevy, 2004). In nature, horses are non-ruminant grazer, the food moves quickly through the digestive apparatus and it is low in energy and high in fiber. Therefore, these animals need to spend most of their time eating, to achieve their caloric and nutrient needs (Burla, Ostertag, Patt, Bachmann, & Hilmann, 2016). The main feeding behavior observed in feral and pastured horses, like in our study, is grazing (Mills & McDonnel, 2005).

The second most common behavior observed in our study is resting (18.88%±2.12%), which is usually divided into stand-resting and lying. Lying occupies a small part of the daily time (approx. one hour per day, about 4% of the activity budget), but this time usually does not vary during the day (Mills & McDonnel, 2005). On the contrary, the time spent standing while resting changes during the day and is inversely related to the time spent foraging, with the more time they spend in resting while standing, the less time they dedicate to foraging and vice versa (Duncan, 1985; Mills & McDonnel, 2005). Our results show that, while they were in the paddock (PP), horses spent more time in foraging behaviors (81.31%±4.16%) and less time resting (6.47%±0.41%) compared to in BBP, respectively, 49.17%±1.81% and 35.97%±0.85%. The lower duration of foraging recorded in BBP may be explained with the fact that, during the night, the horses were in the box and they did not have hay for the entire night, as it was provided at 7.00 am and 7.00 pm, while during the day they were in paddocks and the hay is provided *ad libitum*. Moreover, because of the organization of horses' handling and the stable's personnel schedule, we were able to record animals in Big Box only during early morning and late evening, and not during the entire night, so it can be considered a limitation in the calculation of the activity budget of the horse in BBP. The total of lying duration recorded was 11.41% of the entire resting duration. The study conducted by Raabymagle (2006) observed that the box size positively influenced the duration of lying behavior, with horses spending more time lying in recumbent positions in the largest boxes. Horses reach REM and slow-wave sleep in recumbent positions (Houpt, 1980). Sleep is important for thermoregulation and energy con- servation; also, it is a restoration process that allows the recovery of a vigilance state and helps the consolidation of memories (Berger & Phillips, 1995; Dukas & Clark, 1995; Smith, 1995). An increase in sleeping time, especially for a sport horse, might lead to an improvement in their wellbeing (Belling, 1990). The Big Box © offers the animals a large area that allows them to spend a part of their time lying recumbent, allowing an opportunity to sleep. In our study, the lying behavior (resting and sleeping while recumbent) occupied 2.13% of the total time of observation, which is lower than the results reported both for feral and stabled horses by Kiley-Worthington (1990). The lack of observational data during all-night is a limitation of this study, and it could have influenced our results. However, according to the literature, the layout of the Big Box©, bigger than a conventional box, could positively

influence the time spent in a lying position, the sleeping time and, therefore, the welfare of the horses. However, further investigations about this aspect should be conducted.

The part with the sand, which is in the back of the box, has been created to give to horses the possibility of rolling. Rolling is a behavior beneficial for coat care and it is a comfort behavior (Mills & McDonnel, 2005). This behavior was rarely recorded during the research. The frequency of swish/swat insect and stamp was higher in PP than in BBP, probably because the horses remained in the paddock during the warmer part of the day, and outside there was a higher presence of insects.

Alert behavior occupied 4.03% of the activity budget. The alert behavior was higher in BBP (5.91%±1.24%), as during the webcam recordings, the stable boy usually prepared and distributed the hay and the feedstuffs. This is probably the same reason for the higher frequency of licking and chewing, yawning, stretching behavior, and pawing. An increase of alertness was noticed in the anticipation of a reward in rats (Van der Harst, Baars, & Spruijt, 2003), and also yawning and stretching were observed in other species (dogs and lions) associated with high arousal anticipatory situation, such as feeding (Baenninger, 1997; Gessa, Vargiu, & Ferrari, 1966). Also in horses, yawning, stretching, and pawing can occur during anticipatory situations, for example before the distribution of food ration (Górecka-Bruzdaq, Fureix, Ouvrard, Bourjade, & Hausberger, 2016; Peters, Bleijenberg, van Dierendonck, van der Harst, & Spruijt, 2012). On the other hand, "licking and chewing," which is a very misunderstood behavior, because is often wrongly interpreted as stress behavior, is a behavior that reflects a relaxation after a stressful situation. Indeed, it is associated with the return of salivation after a stress situation after a stressful situation (the passage from the activation of the sympathetic nervous system to that of the parasympathetic nervous system) (Lie & Newberry, 2018). The arrival of food can determine relief for the animals, who show other behaviors such as pawing, yawning, and stretching usually associated with an excitation state. Anticipatory behaviors occur before the arrival of a reward during the appetitive phase, characterized by high arousal of the animal (Craig, 1918).

Other behaviors usually shown during anticipation are stereotypies (Peters et al., 2012), but our results showed a similar percentage of anomalous behaviors in PP (2.82%±2.82%) than in BBP (2.63%±2.63%). In this study, the anomalous behaviors occupy 2.74% of the time.

The five horses considered in this study came from different traditional stables, and when they arrived at the Ethological Stable had already displayed anomalous behaviors, particularly, one of them an oral stereotypy (lip-smacking) and one a locomotor stereotypy (head shaking). In adult horses, stereotypies cannot be eradicated, and they become part of the behavioral repertoire of the individual, often elicited as a conditioned response (Waran, 2007). The duration and frequency of anomalous behavior can be reduced by the presence of a conspecific, identified as a social buffer.

Indeed, in social animals, the presence of conspecifics significantly modifies the physiological and behavioral response to stress (Panzera, 2016). In the analyzed housing facility, the horses did not form a herd, usually were in paddocks alone, and only two of them sometimes shared the paddock. This situation resulted in a low frequency and duration of social behavior, and a higher frequency of vocalization in PP than in BBP. This kind of communication helps animals to keep in contact from a distance, and when they cannot see each other (Waran, 2007). Horses can perceive and localize sounds from distance (Fraser, 2010), and use vocalizations to express their emotional state. According to the frequency and the intensity used, the different vocalizations assume different meanings (Yeon, 2012). Even if the boxes were separated by grates and the horses could see each other, the social behaviors observed were fewer than in the paddocks. One of the behaviors with a higher frequency in the box than in the paddock was the "ears lied back/pinned," an aggressive behavior, which can occur during competitions, when the resources are concentrated (Waran, 2007), as in our case during the distribution of hay to the horse.

As the animals came from different stables and were kept isolated for most of their life, it means that the formation of a herd can be difficult because most of them do not have the social competencies necessary to live together. The Big Box© might facilitate the formation and maintenance of social bonds, but on the other hand, it is necessary to pay attention and put animals with close social bonds in adjacent boxes. Indeed, the social bonds or friendship is

a social structure that is very important for the cohesion of the herd (Seyfarth & Cheneyal, 2012). These bonds can last throughout the lives of horses, and they can be between individuals of the same gender or not (Cameron, Setsaas, & Linklater, 2009). The paired bond can also involve more than two individuals and are identifiable by the index of closeness during the daily activities and the frequencies of mutual grooming (Feh & de Mazieres, 1993). Evolution has promoted the formation of social bonds for the advantage of the individual because the "friend" is both a physical obstacle and sentinel of the presence of a predator. Moreover, friendship means collaboration between animals (Seyfarth & Cheneyal, 2012).

Conclusions

Analyzing the daytime activity budget of the horses and comparing our results with the literature, in this facility the behavioral categories most represented are the same reported for feral horses (Table 1). Feral horses and domestic horses belong to a unique genus (*Equus caballus*). Genetic selection made by humans has modified some morphological features of horses, such as the color of the coat or the size, but their behavioral needs, such as the possibility of grazing for most of the time, are the same (Franchini & Worthington, 2013). The presence of a stable group and the acquisition of correct social competencies by the subjects can promote the creation of a single herd. The formation and maintenance of social bonds might be promoted by the presence of large paddocks, which can be shared by the animals, and by the layout of the boxes.

In conclusion, this kind of facility could be considered a good alternative to traditional management, because it tries to take into account the behavioral needs of the horse and the practical management needs of humans. This study represents preliminary work; indeed, it has some limitations. The stable used for the research is the only one in Italy and, at the beginning of the study, it had just started, so the sample of subjects was too small to conduct a formal comparison using statistical analysis. Moreover, because of the management of the stable itself, we were able to record animals in the Big Boxes© only in two limited-time bands. It would be interesting, for example, recording the animals during all-night, when they are in the Big Boxes©. Indeed, for the feature of these kind of boxes, it is necessary to consider the social links between the horses and pay attention to their behavior. Therefore, further studies are necessary to evaluate the welfare in the facility, also considering other parameters.

Research Data for This Article

The data that underlie the findings of this study are available from the corresponding author, [PA Accorsi], upon reasonable request.

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