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Research article

Effects of playing classical music on behavior of stabled horses

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Abstract

The potential benefits of music on animals might be through auditory enrichment which modifies the behavior of animals. Our preliminary study focused on using classical music for stabled horses which had stereotypic behaviors. The study was to investigate the effects of playing classical music on the general behaviors of stabled horses (n=4, performed stereotypies) in 5 periods. The 1st period was a 3-day control period during which no music was played. The 2nd, 3rd and 4th periods were 3-day periods of music. The 5th period was for 3 days when no music was played. During the days the classical music was played from 9:00 to 14:00. The behavior of horses was observed from 9:00 to 19:00. The results showed that the frequency of ingestion (P=0.003) and standing alert (P=0.004) during 10 hours observation were affected when music was played. When the periods of music increased, the frequency of ingestion increased. Meanwhile, there was a tendency for the frequency of standing alert to decrease, however, there was no difference in (P>0.05) between the different phases of music. The frequency of standing alert before the period of music was significantly higher (P<0.05) than that of the period after music. The frequencies of the total stereotypies (P=0.05) in 10-hours observation were affected by the periods of music. In conclusion, the classical music seems to keep the horse more relax according to the behavior results. The total number of stereotypies was reduced when classical music was played.

Keywords: classical music; behavior; horse

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INTRODUCTION

Auditory enrichment may be a potentially effective, low-cost, easy form of enrichment for animals (Robbins and Margulis, 2014). For many years, music has been successfully used to reduce stress, depression, pain, and anxiety in animals (reviewed by Dhungana et al., 2018). It has been reported that playing slow music (less than 100 beats per minute) to cattle increased their milk yield. Meanwhile, playing classical music may help mitigate some of the stress inherent for kenneled dogs (Kogan et al., 2012; Bowman et al., 2017).

Videan et al. (2007) demonstrated that music should not be regarded as simply noise: music can be used to improve the psychological and (potentially) physiological well-being of captive chimpanzees and other laboratory primates. A number of zoos have experimented with playing music or natural sounds to animals as a form of enrichment with varying degrees of success, often reporting more calm behavior in the animals (Robbins and Margulis, 2014; Young, 2003). In general, there were several studies of the effects of different music genres on physiology and behavior in animals. The classical and country music have been found to have more positive effects on behavior than rock music and natural sounds may have variable effects, which sometimes lead to increased stress (reviewed by Robbins and Margulis, 2014). Moreover, Bowman et al. (2017) investigated the physiological and behavioral response of kennelled dogs to medium-term (5 days) auditory enrichment with five different genres of music including Soft Rock, Motown, Pop, Reggae and Classical, to determine whether increasing the variety of auditory stimulation reduces the level of habituation to auditory enrichment. It was found that visit satisfaction for owners exposed to original classical music was significantly greater than that for owners not exposed to music (Engler and Bain, 2017). However, Snowdon et al. (2015) found that cats showed a significant preference for and interest in species-appropriate music compared with human music.

In horses a number of highly motivated activities that cannot be adequately expressed in conventional stables may lead to stereotypy (Cooper and McGreevy, 2002). A stereotypy is a repeated, relatively invariant sequence of movements with no obvious function (Broom and Kennedy, 1993), which are thought to be a consequence of suboptimal environmental or housing condition (Briefer Freymond et al., 2019). There may be an overall deficit in environmental stimulation, which might lead to emotional states such as boredom, deprivation or frustration in horses (Cooper and McGreevy, 2002). Barren environments and social isolation have also been linked to many equine behavioral problems and stereotypies as well (Jørgensen et al., 2011). However, stereotypies are common in captive animals, but it remains unclear if they are pathological by-products of captive conditions or if they have an adaptive function (Freymond et al., 2020).

Wells and Irwin (2008) found a significant effect of classical music on stereotypy in zoo-housed Asian elephants (Elephas maximus), with elephants showing less stereotypy when exposed to classical music. It was also found that classical music was associated not only with the reduced occurrence of an alert state of behavior (Carter and Greening, 2012) and psychophysiological stress in horses, but also with positive emotional states for race horses (Stachurska et al., 2015).

Kędzierski et al. (2017) suggested that playing relaxing music for 3 hours a day had more positive effects on a horse's emotional state than for 1 hour. Wiśniewska et al. (2019) found that music therapy applied in everyday several-hour sessions has a positive effect on the relaxation of geriatric horses. There are several questions to which the authors could not find answers, such as whether classical music could reduce the frequency of stereotypy in stabled horses. How many hours of musical stimuli would be appropriate for stabled horses or stereotypic horses based on the studies of non-stereotypic horses (Hartman and Greening, 2019; Carter and Greening, 2012).

Although animals react differently to different types of music, our study focused on using classical music for stabled horses which had stereotypic behaviors especially during fully captive environment caused by African horse sickness (AHS) outbreak after confirmation of its emerging in Thailand during March 2020 (King et al., 2020). The objective of this study was to investigate the effect of classical music on general behaviors and stereotypies of stabled horses. We predicted that stereotypy would be lower when classical music was played as compared to control conditions. We hypothesized that increasing the amount of music during stimuli period would change ingestion, standing alert and resting behavior of horses. Thus, we predicted that during the music stimuli periods, ingestion, standing alert and resting behavior would be different compared with no music stimuli.

MATERIALS and METHODS

Animal

Four thoroughbred gelding horses (age 9-11 years; displaying stereotypic behavior) were kept in individual stables (3.35 m × 3.8 m). The floor surface of the stables was half exposed concrete and half concrete covered by rubber matting with a straw bedding which was cleaned as required throughout the day. The horses could see outside from the front feeding area and from the back door. Horses could visually communicate with neighbors only from the front feeder and back door areas as the left and right remaining walls of the stable were solid. All of the horses studied are used for racing. When the African horse sickness was confirmed in horses in Thailand during March 2020 (King et al., 2020), weekly racing activity was cancelled. These horses had only about 1 hour of exercise daily during the morning (05:00-08:00 hrs) before feeding time. A mosquito net system was applied on the stables to protect the horses against biting flies. The study location was Thep Phanom House, Soi Prawanda 2 Village, Pho Klang Subdistrict, Mueang District, Nakhon Ratchasima Province.

Each horse was kept in their usual stable during the trial with free access to hay and water. They were given 4 kg of feed pellets per day per horse divided into 4 times per day (08:00, 14:00, 18:00 and 20:00 hrs). The commercial feed for race horses and working horses (MaxWin 001R) was used. The composition of the feed was crude protein (minimum) 14%, fat (minimum) 5%, fiber (minimum) 8%, fiber (maximum) 10% and moisture (maximum) 12%.

Methods

The classical music, Beethoven's Symphony No. 9 (Carter and Greening, 2012) was played from 9:00 to 14:00 hrs. From 14:00 to 19:00 hrs, no music was played in the stables. The loudness of the sound speaker was set at 65-70 decibel level. The ABA cross-over study design was used in this study. The study was divided into 5 periods. The first one was the 3-day control period with no music played to the horses. The second, third, and fourth periods were 3-day periods of music, respectively. The fifth period was a 3-day period with no music played. All the observation took place between June and July 2020.

Behavioral observation

The behavior of the horses was recorded from 09:00 to 19:00 hrs by CCTV cameras (VStarcam-C21, WATASHI). There were two observers who had an experience in behavioral study in charge of data collection. An instantaneous time and scan sampling observation technique was used (Martin and Bateson, 1986). The data was collected from the clips. It was paused at every 5 minutes the observer recorded each behavior was at the time during 10 hours observation, which totaled 120 times per individual horse. The general behavior (ingestion, standing alert, locomotion, resting, grooming, investigation, elimination) and stereotypic behaviors were observed. The behavioral description is shown in an Ethogram (McDonnell, 2003; Hartman and Greening, 2019) (Table 1). The procedures of the experiment were performed followed the guidelines for the ethical use of animals in applied ethology studies (Sherwin et al., 2003).

Table 1 Ethogram

Behaviors	Description
General	
Ingestion	Muzzle is lowered to ground/within bucket; lips grasp hay/bedding; licking the feeder, masticating, prehending or swallowing food/water.
Standing alert	Rigid stance with the neck elevated and the head oriented toward the object or animal of focus. The ears are held stiffly upright and forward, and the nostrils may be slightly dilated.
Locomotion	Locomotor activities, such as jumping and walking.
Resting	Standing rest or dozing, lateral or sternal recumbent rest/ sleep and yawning.
Grooming	Including auto-grooming, stamping, swishing
Investigation	Including sniff, lick and pawing
Elimination	Including urination and defecation.
Stereotypies	
Cribbing	Involving grasping of surface with incisors while arching the neck and drawing a gulp of air into the throat and then expelling it, repeated rhythmically in bouts typically lasting from minutes to as long as an hour.
Head shaking	Repeated, rhythmic head movements.
Pacing	Stylized repetitious locomotion at any gait, usually along a perimeter.
Coprophagia	Ingestion of feces in adults.
Tongue rolling	Extraneous moving of the tongue in and out of mouth.

(McDonnell, 2003; Hartman and Greening , 2019)

Data analysis

The SPSS software (version 16.0; SPSS Inc.; Chicago, IL, USA) was used for the statistical analysis. The frequency of ingestion, standing alert, locomotion, resting, grooming, investigation, elimination and stereotypic behavior for a total of 10 hours observation were analyzed using One-way ANOVA, to find the differences between each period (before music, music phases 1-3 and after music) in the stabled horses. If the behavioral data were not normally distributed, they were square root transformed prior to analysis. Means were compared using Duncan's multiple-range test and the significance was determined at $P < 0.05$.

RESULTS

General behavior

The frequency of ingestion during 10 hours of observation were significantly affected by the periods of music (df=4, F=4.49, P=0.003) (Table 2). The frequency of ingestion for phases 2-3 of music were significantly higher than that of the preceding period before music was played. When the periods of music were increased, there was a tendency for the frequency of ingestion to increase also, however, there was no difference between phases 2 and 3 of music. Similarly, there was no difference between the periods before and after music was played.

The frequency of standing alert during 10 hours of observation was significantly affected by the periods of music (df=4, F=4.32, P=0.004) (Table 2). When the periods of music increased, there was a tendency for the frequency of standing alert to decrease, however, there was no difference ($P>0.05$) between the different phases of music. The frequency of standing alert before the period of music was significantly higher ($P<0.05$) than that of the period after music.

The frequency of locomotion during 10 hours of observation was not affected by the periods of music ($P>0.05$). The frequency of resting during 10 hours of observation was not affected by the periods of music ($P>0.05$). The frequency of grooming during 10 hours of observation was not significantly affected by the periods of music ($P>0.05$). There was only a tendency for the frequency of grooming to decrease over the periods of music.

The frequency of investigation during 10 hours of observation was not affected by the periods of music ($P>0.05$). When the periods of music were increased, there was a tendency for the frequency of investigation to decrease. The frequency of elimination during 10 hours of observation was not significantly affected by the periods of music ($P>0.05$) (Table 2). There was only a tendency for the frequency of elimination to decrease over the periods of music.

Table 2 Effects of music phases on frequencies of behaviors in stabled horses (n=4, performed stereotypies)

Behaviors	Before music	Music phase 1	Music phase 2	Music phase 3	After music	P-value
General						
Ingestion	48.00±3.27[a]	51.50±2.67[a]	63.34±3.13[b]	63.58±4.34[b]	49.83±4.24[a]	0.003
Standing alert	27.33±1.75[b]	20.42±2.88[a]	19.67±2.05[a]	15.83±1.21[a]	20.00±1.75[a]	0.004
Locomotion	6.00±1.34	4.58±0.75	3.25±0.87	3.83±1.11	3.25±0.64	ns
Resting	19.75±3.42	24.25±4.59	22.42±4.18	27.42±5.49	33.67±4.57	ns
Grooming	2.25±0.54	3.58±0.97	2.83±0.72	1.42±0.48	2.58±0.96	ns
Investigation	10.00±1.51	12.00±3.24	6.17±1.49	3.75±1.02	7.75±2.57	ns
Elimination	0.42±0.19	0.92±0.42	0.67±0.33	0.42±0.19	0.50±0.19	ns
Stereotypies						
Cribbing	2.33±1.39	0.83±0.30	1.17±0.47	2.08±0.80	0.67±0.28	ns
Head shaking	1.58±0.76	0.92±0.40	0.33±0.19	0.92±0.42	0.92±0.58	ns
Pacing	0.08±0.08	0.25±0.13	0.17±0.11	0.08±0.08	0	ns
Coprophagia	0	0	0.08±0.08	0.17±0.11	0.17±0.11	ns
Tongue rolling	3.25±1.21	1.75±0.69	0.92±0.38	1.42±0.65	1.58±0.99	ns
Total stereotypies	7.25±1.99[b]	3.75±0.82[a]	2.67±0.45a	4.67±0.69[ab]	3.33±1.04[a]	0.05

Values are presented as Mean ± SE. ns: P-value >0.05 [a, b, c] means within the same row with different superscripts were significantly different at P<0.05.

Stereotypies

According to the equid ethogram, our study found that the stereotypies included cribbing, head shaking, pacing, coprophagia and tongue rolling. However, the coprophagia was a rare behavior in this study. Each kind of stereotypic behavior during 10 hours of observation was not affected by the periods of music (P>0.05), except the frequencies of total stereotypies (df=4, F=2.50, P=0.05) (Table 2). The frequency of the total number of stereotypies significantly decreased when music was played and carry on until the post-music period. However, there was no significant difference between the different phases of music. The frequency of the total number of stereotypic behaviors after the period of music was significantly lower than that of the period before music was played.

DISCUSSION

General behavior

Our results indicate significant increasing of ingestion behavior by classical music intervention. This finding is consistent with the study of Hartman and Greening (2019). Meanwhile, Kogan et al. (2012) observed the use of classical music in order to mitigate stress increased resting behavior in kenneled dogs. Hartman and Greening, 2019 also suggested that playing music induces a relaxed state that encourages more resting. Although there was no statistical difference in resting during each music period in our study, the amount of resting possibly increase after a longer period of music.

This preliminary sample size was only four. The larger sample size is suggested, so more robust results could be found. It is also importance to note that the environment, such as temperature, humidity, and human disturbance inside the stable that was fully covered with net for AHS prevention might influence the daily horse behaviors and stress. Moreover, this behavioral study was conducted a month after the horses received AHS vaccine with quarantine, plus no racing activity due to COVID-19 situation, their general behaviors might compromise and affect to their stress baseline.

Stereotypies

Jørgensen et al. (2011) mentioned that barren environments and social isolation might be related to equine stereotypies. Although the horses could not perform social behavior with other horses in the stable, they still had visual contact with others in our study. Broom and Kennedy (1993) claimed that the presence of stereotypies tells us that individuals are showing that they must be having some difficulty in coping with their environment. Whether stereotypy reduces the adverse impact of the environment on the individual at that time, or just shows that the individual is psychologically damaged, the problem must be there.

Every horse observed in this study showed stereotypies, however, their frequency was very low. During the 10 hours of observation, the maximum total frequency of stereotypies was 7.25 before periods of music. During periods of music the frequency of total stereotypies decreased, but they increased once the music stimuli stopped. If animals which show stereotypies are placed under better conditions, they usually show a reduction in the occurrence of the stereotypies although long-established stereotypies may continue (Broom and Kennedy, 1993). These results are consistent with those of Wells and Irwin (2008) for zoo-housed Asian elephants which showed less stereotypies when exposed to classical music. However, some studies of rodents have indicated that music may increase physiological stress (reviewed by Videan et al., 2007). Robbins and Margulis (2014) found that the frequency of stereotypies increased in gorillas with classical music stimuli.

Our results prove that the stereotypies in stabled horses were lower when classical music was played and this finding is consistent until post-music period. However, it was notice that the third period music (Day 7-9) showed increasing stereotypies. The further study is needed to find out whether or not this was a signaling of tolerance of music in reduction stereotypies over the time.

Periods of Music

According to the literature review, the duration of music stimuli used in the research were varied but all the results were positive in horses, such as in the study of horse weanlings raised as a single group, when the music was played continuously for six hours daily during the treatment with music for five days by Wilson et al. (2011). Stachurska et al. (2015) treated racing horses with music for 5 hours in the afternoon (13:00 to 18:00 hrs.) and Kędzierski et al. (2017) treated racing horses with music for 1 hour a day, and for 3 hours a day in the afternoon after training sessions, respectively. Hartman and Greening (2019) used auditory stimulation for 5 hours per night continuously for 5

nights to investigate the occurrence of nocturnal equine sleep-related behavior in stabled horses. Wiśniewska et al. (2019) treated geriatric horses for 28 days between 19:00 to 22:00 hrs. The horses they investigated were without any stereotypic behavior.

Thus, music may have a beneficial effect on the behavior of stabled horses and improve their welfare, even in a short period (Wilson et al., 2011). With increasing exposure to periods of music in our study for 5 hours per day (9:00 am to 14:00 pm) for 9 days, the total ingestion, standing alert and stereotypies were affected in stabled horses. When we focus on the reduction of stereotypies in stabled horses, a suitable duration of music stimuli of 5 hours for 4-6 days was found to be better for the reduction of stereotypies in stabled horses. Since there is no standard information available on this subject, further studies of the effects of the duration of music stimuli on the reduction of stereotypies in large sample size of stabled horses is needed.

CONCLUSION

The classical music seems to keep the horse more relax according to the behavior results. The total number of stereotypies was reduced when classical music was played.

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AUTHOR CONTRIBUTIONS

Xin Huo: Conceptualization, Methodology, Project administration, Software, Writing-original draft, Writing-Review & Editing, Supervision. Matchirathakorn Wongkwanklom: Resources, Investigation, Data curation Thanakon Phonraksa: Investigation, Data curation and Pongchan Na-Lampang: Writing-Review & Editing.

CONFLICT ON INTEREST

The authors declare that they have no conflict of interest.

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