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EFFECT OF AUDITORY ENRICHMENT (MUSIC) IN PREGNANT SOWS WELFARE

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ABSTRACT: Studies have shown that the benefits from music can improve the welfare conditions of laboratory, pet and production animals. The study aimed to evaluate the influence of music (Antonio Lucio Vivaldi compositions) on behavior aspects (position, activity, stereotypes, social and agonistic behavior) and physiological responses (respiratory rate and rectal temperature) in gestating sows in individual cages (stage 1), and collective stalls (stage 2). 28 animals were studied, 14 belonged to music group, and 14 to the control group (without music).The respiratory rate had the lowest averages in the group with music, for example, in stage 1, time 1, values of 19.28 and 21.50 mov.min^{-1}. In stage 2, the values found in the same time were 20.36 and 24.16, and in time 2, values of 24.37 and 27.18 mov.min^{-1}. These findings follow in stage 2 until time 4.Behaviors position, activity, stereotypes and agonistic interaction with the researcher were also influenced by the music. We concluded from the results that music influenced the behavior of animals, providing greater relaxing and reduce stereotypes aspects related to a better welfare.

KEY WORDS: animal behavior, physiological parameters, sound stimuli stereotypes.

INTRODUCTION

The breeding systems of swine in Brazil are currently mostly intensive, where animals are kept in restricted areas, making it impossible to express their natural behaviors (BAXTER et al., 2011).Because of this, several researches have been carried out in order to improve the physical, psychological and social conditions of animals raised in confinement and/or captivity. As a technique to improve the biological functioning of the animal created in intensive systems by the modification of the environment, there is the environmental enrichment (COLEMAN et al., 2012).

In recent years, researches have been directed at exploring the impact of sound stimulation as a method of environmental enrichment for captive and confined animals. There are scientific reports that prove the benefits of such stimuli for laboratory animals, pets and some species of production (CRUZ et al., 2011).The effects of noise in general and music in particular on the behavior and level of animal welfare need to be highlighted in terms of scientific research.

Music can provide benefits by "masking" sudden, artificial noises that are potentially stressful to the animal, and "breaking" the silence or transforming a monotonous audibly environment, known to affect the development of normal cognitive abilities in a pleasant environment and more productive (CRUZ et al., 2011).

The physiological benefits of listening to music are already well elucidated for humans, which refer to reduction of anxiety, pain relief, and reduction of physiological parameters that, when elevated, may be related to stress, such as blood pressure and heart rate (BINNS-TURNER et al., 2011), indicating that music could be used to enrich the environment for animals raised in intensive systems.

The value of music as environmental enrichment for animals depends on the musical style used, speed of music, rhythm, tone, frequency, intensity, etc., which will influence the behavioral and physiological responses of the animals (ALWORTH & BUERKLE, 2013).

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Therefore, this study has the aim of evaluating the interference of auditory sensorial enrichment through music in the level of welfare of sows during the gestation. Within this context, we intend to evaluate specifically: (1) the relation of music with the responses of physiological variables of pregnant females; (2) the relation of music with aspects of the behavior of sows in the gestation stages.

MATERIAL AND METHODS

The experiment was conducted at the Esmeralda farm, whose main activity is the commercial production of swine, located in the municipality of Mogi-Mirim, SP, latitude of 22°32'37", longitude of 46°58'15" W and altitude of 607m, the climate of the region is considered as mesothermal tropical, according to the Köppen classification (1936).The experimental phase started on June 12th until September 18th , 2014.In order to carry out the research, 28 pregnant sows were studied, followed during the two stages of the study, stage 1 (36 days) referring to the period in which the sows were housed in individual cages, and stage 2 (71 days) referring to the stage that the animals were housed in collective stalls. At each stage, 14 animals were assigned to the group with music (WM) and 14 to the control group (without music - WOM).The animals of the WM group were submitted to the musical repertoire, which consisted of 12 compositions of the composer Antonio Lucio Vivaldi, during two days per week (behavioral evaluation day - BE and physiological evaluation - PE), throughout the study, the control group remained exposed only to sounds coming from their environment.

We decided to perform the behavioral and physiological evaluations on different days, since the act of measuring the rectal temperature of the animals, for example, already influences the animals' behavior. Thus, behavioral evaluations were already being influenced by the manipulation of the animal, especially at the stage where the sows were housed in collective stalls, where the experimenter had to enter the facility. The sound stimulus was reproduced for two consecutive hours, with intervals between the reproductions of two hours; this was done from 8:00 a.m. to 6:00 p.m. For the reproduction of the musical repertoire, two sound boxes were used in both stages, whose sound frequency of the compositions was in the range that covers the range perceived by the swine, which is of 20 Hz – 20.000 Hz (GUSTAFSSON, 1997).In order for the sound pressure level to be known and monitored, two digital sound level meter, MSL-1352 C model, Minipa ® brand were used. This measurement was carried out in both groups, with and without music.

The hearing range of swine is similar to that of humans, hearing problems can be caused by exposure to the sound pressure level above 85 dB, and noise above 100 dB was verified during manual feeding of swine and it is suggested that during this task the worker wear ear protector (GUSTAFSSON, 1997).

Ethograms were elaborated based on behavioral elements registered in sows housed in individual gestation cages and in collective stalls according to preliminary studies (GONÇALVES et al., 2014). The ethograms were adjusted according to the observations made on the farm, consisting of position, activity, stereotypy and agonistic behaviors (Table 1).On BE days (one day per week), observations were made from 8:00 a.m. to 6:00 p.m. Every ten minutes instantaneous sampling of behavior was done. The observations were divided in time ranges, from 8 a.m. to 10 a.m. (1); from 10:10 a.m. to 12h (2); from 12:10 p.m. to 2:00 p.m. (3); from 2:10 p.m. to 4:00 p.m. (4) and from 4:10 p.m. to 6:00 p.m. (5).In the stage 1, 305 behavioral registers were totaled, and in the second stage, 610 observations were recorded.

In the days after the BE, the physiological parameters were measured (respiratory rate and rectal temperature).The records were carried out at the following times: time 1 (from 9:00 a.m.), time 2 (from 11:00 a.m.), time 3 (from 1:00 p.m.), time 4 (from 3:00 p.m.) and time 5 (from 5:00 p.m.).In stage 1, these records totaled 25 collections. In the stage 2, 50 collections were totaled.

TABLE 1. Ethogram used in this study to evaluate the behavior of sows.

Class	Behavior	Description
Posture	Lying (1,2)	Ventral or laterally lying
	Standing (1,2)	In the standing position
	Sitting (1,2)	In the sitting position
Activity	Inactive (1,2)	Animal lying down or sitting with closed eyes.
	Alert (1,2)	Animal is open-eyed with no manifestation of activities and behaviors.
	Drinking(1,2)	Drinking water in the drinking fountain or water accumulated in the feeder
	Sniffing (1,2)	Sniffing the floor or other component of the cage/stall.
Agonistic behavior	Interacting negatively with other animals(2)	Interacting negatively, aggressively with neighboring animals, from the same stall or researcher (including pushing, pursuing, threatening and biting).
Social behavior	Positively interacting with other animals (2)	Positively interacting with neighboring animals, from the same stall (including nibbling, sniffing and licking parts of the body).
Stereotyped behavior	Looking/licking (1,2)	Looking/licking floor, bar or feeder in the absence of substrate.
	Bars/grids(1,2)	Repeatedly biting the bars of the cages or grids of the stall gate.
	False chewing (1,2)	Movement of the tongue repetitively, presenting chewing movement without the presence of food.
	Opening and closing the mouth (1,2)	Opening and closing the mouth repeatedly.
	Gritting the teeth (1,2)	Emitting sound and performing compatible movement to grit the teeth.

Individual cages (1); collective stalls (2)

To characterize the environment, dry bulb temperature, relative humidity as well as thermal comfort indexes were studied. Climatic variables were recorded throughout the experimental period, using dataloggers. With the record of microclimatic data, the specific enthalpy values of air (kJ/kg of dry air) were calculated according to [eq. (1)], as proposed by RODRIGUES et.al (2010).

$$h = 1.006.t + \frac{RH}{bp}.10^{\left(7.5.\frac{t}{237.3}+t\right)}.(71.28 + 0.052.t) \quad (1)$$

that,

h = Specific enthalpy of air (kJ/kg of dry air);

t = Temperature of dry bulb (ºC);

RH = Air relative humidity (%),

bp = Local barometric pressure (considered the value of 706.79mmHg).

The temperature and humidity index (THI) proposed by THOM (1959), were also calculated using dry bulb temperature (Dbt) (ºC), relative humidity (RH) (%) and dew temperature data (dpt).

$$THI = dbt + (0.36.dpt) + 0.42 \quad (2)$$

The data were analyzed by statistical software Minitab17 (2009). For the data that did not show normality, we chose to use the Mann-Whitney non-parametric statistical test ($P \leq 0.05$).The other data that showed their confirmed normality were submitted to the Tukey test ($P < 0.05$) for comparison of the averages.

RESULTS AND DISCUSSION

Table 2 shows that the environment in which the animals were inserted did not present differences for the averages values of Dbt, RH, H and THI (P> 0.05).

TABLE 2. Average values, standard deviation (SD) of environmental variables for the groups (WM: with music; WOM: without music), according to the stages (1 and 2), in the days of behavioral evaluation (BE) and physiological evaluation (PE).

Treat.	Stages	DAY	Dbt (ºC)	RH (%)	H (kJ.kg^{-1})	THI
WM	1	BE	24.96±1.40	49.78±8.38	67.47±6.36	71.65±1.37
WOM	1	BE	25.00 ±1.42	49.79±8.35	67.46±6.34	71.66±1.34
WM	1	PE	24.80±2.41	50.89±9.49	68.65±7.70	71.55±2.23
WOM	1	PE	24.79±2,.44	50.95±9.45	68.65±7.66	71.56±2.27
WM	2	BE	24.07±2.45	54.24±12.98	71.07±13.20	70.86±2.35
WOM	2	BE	24.05±2.44	45.23±12.91	71.05±13.17	70.87±2.36
WM	2	PE	23.07±3.75	51.58±15.77	63.61±13.84	69.19±3.75
WOM	2	PE	23.07±3.73	51.58±15.70	63.62±13.89	69.22±3.82
CV%			7.38	16.67	15.56	3.45

Treatment – WM (with music), WOM (without music); Dbt – dry bulb temperature; RH – relative humidity; H – enthalpy; THI – temperature and humidity index.

The averages values of Dbt were higher than the recommended values for pregnant sows (12 to 18ºC) according to studies of MOSTAÇO et al. (2014). With regard to RH, the averages were outside the recommended standards (60 to 80%) (MOSTAÇO et al., 2014).

The enthalpy results were within the recommended for pregnant sows, according to the equation proposed by RODRIGUES et al. (2010), with minimum and maximum enthalpy comfort values ranging from 40.80 to 86.57 kJ/kg of dry air. In a study using this same equation, the average value of enthalpy (h) for pregnant sows created in individual cages and collective stalls was 80.01 kJ/kg of dry air (VIEIRA, 2012).These data are slightly above the values obtained in this research, but still within the range recommended for swine.

On the other hand, the average value of H, for pregnant sows, corresponding to the period of housing in individual cages and collective stalls was 40.26 kJ/kg of dry air (NUNES, 2011).These data are below the averages values of this study and below the range recommended for pregnant sows. These values may vary according to the conditions of air temperature, relative humidity and local barometric pressure.

When analyzing the values of THI, values that were very close to those considered ideal (70), taking into account that the studies performed with this index are based on researches with dairy cattle. There is a variation in the proposed values of THI in the literature, and HAHN (1985) reports that THI values below 70 indicate a normal, non-stressing condition; values between 71 and 78 is critical; between 79 and 83 indicates danger and above 83 already constitutes an emergency situation. At some times, this index was close to 70, and the maximum average value was 71.66, which is located within the lower critical limit.

For the physiological variables, there was no significant difference (P> 0.05) for the rectal temperature. For the respiratory frequency in the first stage, a difference was observed between the groups at time 1 (p <0.05), and in the second stage, significance was found (P <0.05) at times 1, 2, 3 and 4 (Table 3).The average of RF in stage 1 at all times was close to that recommended for pregnant sows (20 mov.min^{-1}), even at times when music was not offered. The statistical difference (P <0.05) between the averages of 19.28 and 21.50 mov.min^{-1} (WM and WOM), in the first time range, may be related to the presence of music, since the other variables, such as Dbt, RH, H and THI were similar between groups.

In stage 1, both the animals in the group with music and the animals in the group without music had access to a trough that remained full of water, and at its end the water overflowed at various times of the day, causing the water to flow through the floor, which made it moist. So the animals lay down and the heat exchange by conduction was favored. So in this first stage, this fact may have been important on the responses coming from the values of the respiratory frequencies observed.

In the second stage, the increase of the RF of the sows was consistent throughout the times with decreases of the averages in the time 5.The only time at which the average values were close to the recommended range (15 to 20 mov.min^{-1}) were in the first time (9 a.m.) for the group with music (20.36 mov.min^{-1}). After this period, for both groups the RF was high. In the fourth time (3 p.m.), the highest values of RF, 49.29 and 64 mov.min^{-1} were observed for the WM and WOM groups. This response was expected due to the fact that this time has shown the higher averages of Dbt and lower values of relative humidity.

TABLE 3. Mean values of respiratory frequency (RF) and rectal temperature (RT) for animals' group: with music (WM) and without music (WOM), according to the stages (1 and 2).

			Physiological evaluation				
			Times (2)				
Treat.	Stage (1)	Variable	1	2	3	4	5
Group WM	1	RF (mov.min^{-1})	19.28*	19.92	19.86	21.35	16.14
Group WOM	1		21.50*	19.35	19.50	21.71	18.14
Group WM	2		20.36*	24.37*	32.48*	49.29*	34.14
Group WOM	2		24.16*	27.18*	43.90*	64.00*	37.67
Group WM	1	R T(ºC)	37.37	37.63	37.73	38.03	38.01
Group WOM	1		37.32	37.56	37.71	38.02	38.00
Group WM	2		38.04	38.05	38.22	38.18	38.10
Group WOM	2		38.15	38.08	38.17	38.10	38.08

(1) Stage 1: sows in individual cages; Stage 2: sows and collective stalls; (2) The times refer to specific times of collection: 9 a.m. (time 1); 11 a.m. (time 2); 1 p.m. (time 3); 3 p.m. (time 4) and 5 p.m. (time 5); (*) Averages followed by * are significant by the Mann Whitney Test at 5% probability.

In a study with sows housed in individual cages, their RF observed in the times of 9 a.m. and 3 p.m., showed values of 50.6 and 75.4 mov.min^{-1}, in the collective stalls the values of RF were 47.5 and 65.4 mov.min^{-1}, respectively (SANTOS, 2013).The results presented in the study mentioned above showed higher values than those obtained in this research.

In the first stage, the results indicate that the animals preferentially activated the mechanisms of non-evaporative losses. The animals housed in the collective stalls (step 2) did not have any protection against the sun (propylene mesh, vegetation, etc.), since this side of the shed was exposed to the solar rays throughout the day. So that the evaporative losses happened in this case, which is evidenced by the high respiratory rate values.

The values obtained for RF, which differed significantly ($P < 0.05$) in both stages, showed lower values for the WM group, suggesting that the music may have been able to influence the RF of the animals in certain periods. Such reductions may signal a greater relaxation of the animals in the WM group, and even in the stage 2, where the highest RF averages were observed in both groups, due to the climatic conditions, in the time ranges (1 and 5) where differences were observed, the WM group showed the smaller averages.

In a study evaluating the effects of relaxing music on cancer patients with chronic pain, there was a reduction in blood pressure, heart rate and respiratory rate (NOBRE, et al., 2012).The rectal temperature response curves were similar in both groups at all times, within each stage. There is a

variation throughout the day according to the times, but the averages values are still considered normal for pregnant sows (38.6ºC) (HANNAS, 1999).

The lying position variable (Figure 1) showed a significant difference (P <0.05) in stage 2, in the first range, the values were 80.19 and 66.87% for the WM and WOM groups and in the fifth range; the values were 97.28 and 91.58%, respectively for the WM and WOM groups. In stage 2, the average values over the experimental period for the lying position were 88.74 and 84.87% for the WM and WOM groups, respectively.

Lying position variable

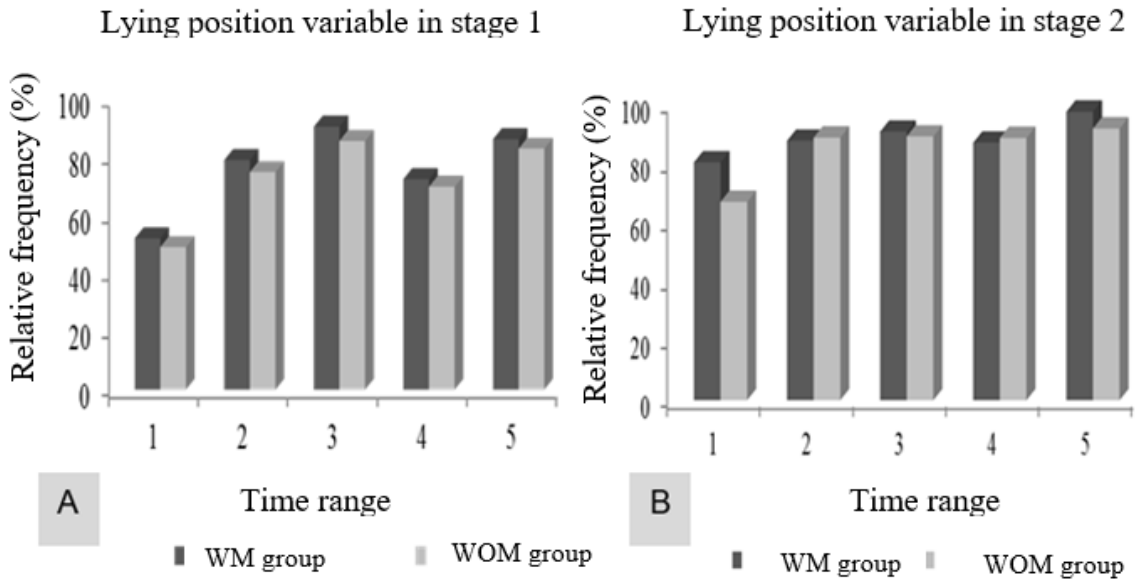

FIGURE 1. Relative frequency to the lying position, in stages 1 and 2 for the WM (with music group) and WOM (without music group) over the time ranges.

The average presented for the stage 2 is above the one found by NUNES (2011), who verified in 77.1% of the observations of pregnant sows in the lying posture. This value is below the averages results of this study, for this variable in the stage 2.

The high percentage of the expression of this behavior, especially in the stage 2 may be associated with room temperature, because in most of the observed periods the Dbt was out the comfort zone. The increase of heat in the environment could promote the prostration of the females in an attempt to optimize the heat losses. The increase of the ambient temperature is associated with the increase of the frequency of swine in the lying position (KIEFER et al., 2012).

Concerning the behavior of the standing variable, the difference (P <0.05) was observed only in the stage 2, in the first time range (from 8 a.m. to 10 a.m.) with values of 19.81 (WM) and 29.78% (WOM), and in the fifth time range with an average of 2.55 and 5.44% for WM and WOM groups. The time range 1 showed the highest percentages of standing behavior in both stages, due to the fact that in the morning, between 7 a.m. and 7:30 a.m. the supply of feed happened, after that there was a period of the animals' agitation that lasted until 10 a.m., followed by a reduction of this behavior. The averages along the time ranges for the standing variable in stage 1 were 20.60 (WM) and 22.81% (WOM), in stage 2, the average values were 9.09 (WM) and 11.41% (WOM).

For PANDORFI (2005), sows in individual cages showed frequency of standing position for 7.87% of the observed times, while those housed in collective stalls had 13.43% of reported frequency. The values mentioned for this variable in the individual gestation are inferior to the results of the stage 1, but in the stage 2, the data are close to the results of this research.

The sitting variable differed (P <0.05) in the stage 1, in the time range 3 (between 12:10 p.m. and 2:00 p.m.) with 1.48 and 4.88%, for the groups WM and WOM, and in the stage 2 in the first

(0.00 and 3.35%) and in the range 5 (0.17 and 3.98%), always the lowest values coming from the WM group. The averages over the period for the stage 1 were 3.36 and 5.25%, for the WM and WOM groups, and in the stage 2, the average values were 2.43 and 3.71% for the WM and WOM groups. Aiming to characterize behavioral aspects of pregnant sows, the average frequencies of the sitting position were observed for female swine housed in individual cages and in collective stalls, resulting in 4.40% and 0.58% for each type of housing (PANDORFI, 2005).Staying seated or standing inactive for long periods may indicate poor welfare. The lying position, on the other hand, may reflect a good welfare situation in the case of sows housed in collective stalls (McGLONE, 2013). The behaviors of inactive activity (Figure 2), alert and sniffing showed statistical differences (P <0.05) in both stages. In the stage 1, for the inactive variable, the first time range showed averages of 32 and 21.14%, and in the time range 3, values of 75.50 and 58.62%.In the stage 2, the range 1 showed 59.57 and 33.06%, the range 3 obtained 77.91 and 63.44% and the range 5 with 87.21 and 66.39%.

Inactive activity variable

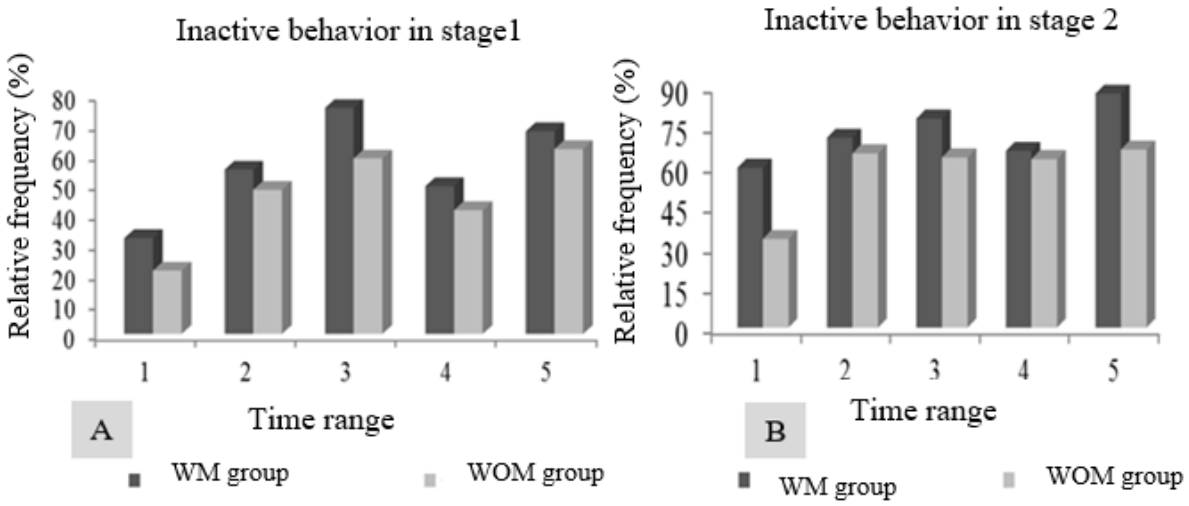

FIGURE 2. Percentage of inactive behavior for the groups with music (WM) and without music (WOM) for the stage 1 (A) and second stage (B) along the times ranges.

The highest frequencies of inactive behavior are always from the WM group. The averages of this inactive behavior throughout the stage 1, taking into account all the time ranges, were 55.89 and 46.20% for the WM and WOM group. In the stage 2, the averages were 72.67 and 58.32% for the WM and WOM groups. The inactive behavior of pregnant sows in collective stalls was observed in 78.6% of the time in the study of SANTOS (2013).In addition to the question of the area available per animal, for animals housed in collective stalls, other factors may be related to the differences found, for example, climatic conditions, substrate supply, observation methodology, among others.

The alert activity, in stage 1, was different in the third time range (10.71 and 16.44%); in the second stage, this difference was found in the first range (20.12 and 28.49%), in the third range (13.22 and 22.24%) and in the fifth range (6.59 and 15.73%).The smallest values are always obtained from the WM group. In the stage 1, the presented averages for this variable over the observed period were 19.20 (WM) and 21.94% (WOM).The alert behavior percentage of sows housed in individual cages was 14.6% (SANTOS, 2013). These results are closer to the values showed by the WM group. In the stage 2, the averages over the period were 15.33 and 21.86% for the WM and WOM groups. When the percentage of the alert behavior of sows housed in collective bays was observed, there was an average value of 11.3% (SANTOS, 2013). The values of this variable for the WM group are closer to the results of the cited study.

For the sniffing variable, the significant difference (P <0.05) in the first stage was observed in the time range 3, with values of 0.7 and 2.67%, and in the second stage, in range 1, values of 2.63

and 6.98% and in the fifth range, 0.57 and 2.53%.With the lowest values relative to the WM group. The act of sniffing or looking is considered a sign of exploitation of the environment, which in situations of confinement appears much inferior compared to the expression presented by the animals in their natural environment (MAIA et al., 2013).The presented results regarding the sniffing behavior showed little frequency in this research, probably due to the restricted area at the disposition of the animals and absence of substrate for manipulation.

In general, the WM animals were more inactive, consequently less alert and less likely to perform other activities. This situation may indicate that the animals of the WM group were more relaxed than the animals in the control group. Classical music played for dogs from a shelter showed that the animals spent more time sleeping, less time vocalizing and reduced body tremor when compared to animals exposed to another style. This shows that classical music can mitigate stress situations (KOGAN, et al., 2012).

When evaluating the stereotypy data, observed in stage 1, between the WM and WOM groups, the false chewing (FC) behaviors (12.01 and 16.88%) differed statistically ($P < 0.05$) in the first time range and biting the bar (BB) in the second (0.52 and 2.39%) and fifth time range (1.43 and 3.19%), where the lowest observed values were from the WM group. The average values over the period studied in stage 1 of the FC behavior were 6.68% (WM) and 9.42% (WOM) and BB showed values of 1.83 and 3.43% for the groups with and without music. In sows housed in individual cages, values referring to the stereotypy FC and BB were 15.07 and 7.5%, (BERG, 2014).

In the second stage, the stereotyped looking/licking behavior (L/L) differed ($P < 0.05$) in the first time range (8.79 and 17.68%), FC in the first one (5.80 and 8.93 %), in the third (2.70 and 5.97%) and in the fifth time range (4.75 and 8.16%), and for the BB stereotypy, the difference was found in the first time range (0,00 and 1.13%), always the lowest frequencies are from the WM group. The averages over the period in stage 2 of the L/L behavior were 2.49 and 4.85% for the groups with and without music, FC showed an average of 4.53 and 7.09% for the WM and WOM groups and for BB the average values were 0.06 and 0.41% for the WM and WOM groups, respectively. Studying the behavior of sows housed in collective stalls, PANDORFI (2005) found an average frequency of 9.94% for the L/L stereotypy.

Regarding the FC behavior, the average value was 12.48% of the observed times, throughout the gestation period in collective stalls (VIEIRA, 2012).The average values of this stereotypy were 8.07% in sows housed in collective stalls (NUNES, 2011).The practice of looking the floor without the presence of substrates and false chewing evidences the need of the swine to explore the environment in the search for food (RUSHEN, 1984).The grinding of the teeth behavior did not differ statistically ($P < 0.05$), however, such stereotypy was a finding that did not obtain reports in the literature for production animals. The studies found refer to research with laboratory animals, and the most commonly found name is bruxism. Rats that had a stressful situation showed this behavior when compared to animals that were not submitted to such situation. The authors proposed that emotional stress might have led to bruxism (LV et al., 2002).An explanation for this behavior is that it may be related to the psychological stress that the animals may be subjected to, because they are in confinement, as the other stereotypes are a consequence of the frustration, the grinding of the teeth can also be another way of the animals express this condition.

When the averages of all stereotypes at each stage were verified, for the group with and without music, the data showed values of 19.64 and 26.16% in stage 1. In the stage 2, these values were 7.74 for the WM group and 14.13% for the WOM group. In the both stages, the highest frequency of observations regarding stereotyped behaviors was for the group without music, indicating that the music may have been able to minimize its expression.

Social and agonistic behaviors (Table 4) were only observed in the stage 2 and no significant differences were observed ($P > 0.05$).In relation to the agonistic interaction of the animals in front of the researcher, there was a significant difference ($P < 0.05$) at all times, with the WOM group showing this behavior, this was observed at the moments when it was necessary to enter the bays to

measure the RT of the animals. This behavior consisted of one or more animals directing aggressive behaviors against the researcher, such as biting and pulling part of the clothing, boots, and sometimes the skin. The researcher should not act in order to interfere the animal behavior, however, there was no other way to measure the rectal temperature of the animals housed in collective stalls without the entrance of the same in the facility, which made possible the expression of such behavior in the animals, specifically from the control animals.

TABLE 4. Relative frequency (%) of social and agonistics behaviors, and absolute frequency of the agonistic interaction behavior with researcher, in both groups (WM and WOM), by time, in stage 2.

Behavioral evaluation Social and agonistics behavior						
		Times (1)				
Treat.	Variable	1	2	3	4	5
Group WM	Social Behavior	0.09	0.83	0.00	0.47	0.00
Group WOM		0.00	0.35	0.14	0.16	0.44
Group WM	Agonistics Behavior	0.00	0.00	0.00	0.31	0.00
Group WOM		0.37	0.00	1.14	0.38	1.22
Group WM	IBR	0.00*	0.00*	0.00*	0.00*	0.00*
Group WOM		1.57*	1.71*	1.28*	1.42*	1.28*

(1) The times refer to specific times of collection as follows: 9 a.m. (time 1); 11 a.m. (time 2); 1 p.m. (time 3); 3 p.m. (time 4) and 5 p.m. (time 5); (*) Averages followed by * are significant by the Mann Whitney Test at 5% probability.

For the sound pressure differences between the time ranges (during behavioral evaluation days) and times (physiological evaluation days) were detected for the WM group, since in this group musical reproduction was intermittent, and this altered the sound pressure according to the time and time range. This situation was observed in the time ranges and times 1, 3 and 5, when the group with music showed higher levels of sound pressure, both for the behavioral and physiological evaluation days, because those were the moments that the musical repertoire was reproduced. The average maximum value of 71.13 dB was from the WM group, during a period when the music was being played, even during the whole musical reproduction period, the level of 85 dB was not exceeded.

CONCLUSIONS

The animals in the group with music in both stages (stage 1: animals housed in individual cages; and stage 2: animals housed in collective stalls), showed in several moments lower values of respiratory frequency, higher percentage of relaxation behaviors, smaller expressions of stereotypes, and absence of agonistic interaction against the human presence compared to the group of sows without music.

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