Music Therapy for Pigs Created in Open Pen

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ABSTRACT

Music therapy is related to art, science and education and can be used in different methodologies and goals. For the purpose of reducing diseases, stress, encouraging physical and psychological health, music could be studied and used as a tool to animal welfare. Among the animals production, the economic activity of pig farming is of great importance in world agribusiness. Pig meat is the most consumed meat on the planet. Thus, the objective of the research was to analyze the influence of the music therapy in the production of pigs in the growing phase raised in open pen, assessing the welfare and behavior of the animals. The study was carried out in the southeastern region of Brazil, in the city of Piracicaba-SP with coordinates of latitude 22º 43 '31 "S and longitude 47º 38' 57" W, during the month of September 2015. Among the behaviors analyzed, it was verified that the agonistic presented statistical differences between the pen without music and the pen with music. For the behavior ludic ones, there was difference for animal interaction. After analyzed the results of this research, is possible conclude that exists a tendency of music therapy to have a positive influence in the behavior and welfare of the growing pigs raised in open pens.

Keywords: animal welfare, animal behavior, music, swine

INTRODUCTION

Music therapy is related to art, science and education and can be used in different methodologies and goals and it is, still, in the process of formation by the influence of population cultures (ALMEIDA & CAMPOS, 2013).

For Smith (2010) it is a science that, through the sound and rhythmic elements, acts in preventing diseases by seeking balance of mind and body and also in rehabilitation, reeducation and treatment of different pathologies. Furthermore, music therapy has the ability to form and provide positive changes in a group through the cooperation and learning of individuals (CUNHA & OLIVEIRA, 2014).

It is proven that music operates in quality of life by reducing stress, anxiety and promoting comfort and relaxation in humans by the influence on the regulation of the hypothalamus-pituitary axis, in the sympathetic and immunological nervous system (YAMASAKI et al., 2012).

In non-human animals, sentient beings that interact with other beings and with the environment, significant results showed the decrease of stress in management, milking time and improvement in milk production (CALAMITA et al., 2016).

At another point, currently, there is a significant growth of meat consumers concerned about from animals that have been created, handled and slaughtered in productions that value animal welfare and have a sustainable thinking.

Despite the millennial records of the human-animal interaction and the breeding of captive animals, only in the last four decades the animal welfare has been recognized as a science in the academic environment due to advances in research in the ethological area (SAAD et al., 2011).

For the purpose of reducing diseases, stress, encouraging physical and psychological health, music should be studied and used as a tool to animal welfare. There is scientific evidence that the exposure of music to animals can generate gains in productive performance and/or better well-being (ALWORTH et al., 2013; DÁVILA et al., 2011; JONGE et al., 2008; SILVA et al., 2017).

The economic activity of pig farming is of great importance in world agribusiness. According to the United States Department of Agriculture, pig meat is the most consumed meat on the planet. The main producers of pig meat are: China, European Union, United States, Brazil and Russia (USDA, 2020).

Thus, the objective of the research was to analyze the influence of the music therapy in the production of pigs in the growing phase raised in open pen, assessing the welfare and behavior of the animals.

MATERIAL AND METHOD

The use of animals for this research has been approved by the Ethics Committee in the Use of Animals (CEUA) with protocol 2015-4 and study conducted in the southeast region of Brazil, in the city of Piracicaba-SP with coordinates of latitude 22º 43' 31"S and longitude 47º 38' 57" W.

For this study, the preference test method was used. Two pens with compact concrete floor were interconnected by a central opening of one meter (m) so the animals could opt for the environment of their preference: with the sensory agent (music) or without the sensory agent. Each pen had 27 square meters (m^2) and was equipped with a 0.60 x 1.20 meters (m) concrete feeder and an automatic drinker fixed on the wall. Thus, the installation for the study totaled 54 m², two feeders and two drinkers.

The study occurred in September 2015 and lasted seventy-two hours (three days), from 6 a.m. to 7 p.m. and, by raffle, an acoustic box was added in the right pen. Thus, this pen was defined as “pen with music” (with the sensory agent music) and the other pen was defined as “pen without music” (without sensory agent music).

With the use of a non-toxic marker, ten growing pigs with average age of 63 days and average weight of 22 kilograms (kg) were identified on the back and randomly and equally allocated in the installation one day before the beginning of the study. Figure 1 shows layout of study.

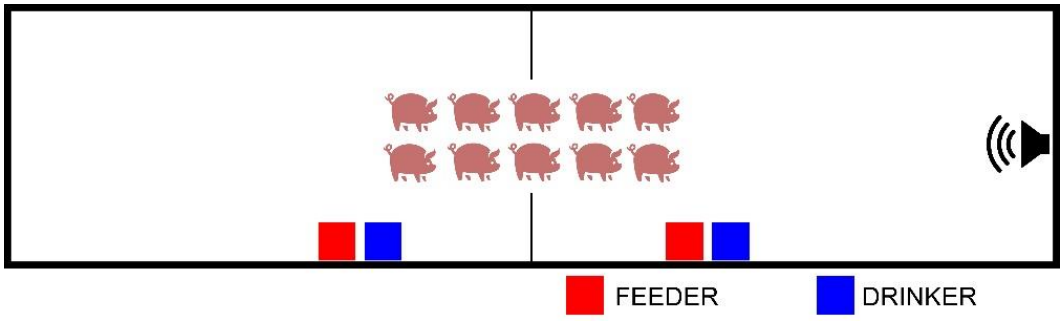

Figure 1 – Layout of study

During the daily 12 h, Bach's classical music (cello Suite No. 1-Prelude) was constantly played with the appropriate volume was played in the "pen with music" with the appropriate volume to not be heard by the pigs that were in the "pen without music". In a preliminary analysis, both the "pen without music" and the "pen with music" were divided into 12 quadrants of 1.5 x 1.5 m. Simultaneously in each pen and for one minute (min) per quadrant, the sound intensity was collected in decibels (dB) that were transferred to a computational program for subsequent analysis. The choice of music was based on previous research with the same animal species (JONGE et al., 2008).

Every 15 min of the hour (6 a.m. to 6:15 a.m., 7 a.m. to 7:15 a.m., 8 a.m. to 8:15 a.m. … 6 p.m. to 6:15 p.m.) the behaviors were counted through the scanning method on both pens through the elaboration of an ethogram according to previous researches (JONGE et al., 2008; AHMAD et al., 2011; KAMMERSGAARD et al., 2011). Each behavior and your description are shows in Table 1.

Table 1 - Behaviors analised in the research

BEHAVIORS	DESCRIPTION
Agonistic	fights (social conflict, assault with bites and shoving) and persecution (threat and fugue among animals)
Stereotyped	aerophagia (abnormal movements with tongue and mouth, bite the air) and belly nosing (press the other animal's body with the nose)
Ludic	play (running and jumping) and animal interaction (contact between animals without damage)
Normal	drink, eat, defecate, lay/sleep, exploitation of the environment (rummage the floors and installations) and urinate

Source: Created for authors based in JONGE et al., 2008; AHMAD et al., 2011; KAMMERSGAARD et al., 2011.

Before the beginning of the counting of the behaviors, the quantity of animals within each pen was recorded. At the end of each even hour (6:15 a.m., 8:15 a.m., 10:15 a.m. … 6:15 p.m.), two pigs from each pen were randomly chosen for assessing the rectal temperature, in degrees Celsius (˚C) using a digital thermometer.

For the control of environmental variables, the dry bulb temperature-DBT (˚C) and the relative humidity-RH, in percentage (%), were monitored on the two pens with data loggers (HOBO®) and the data was transferred to a computational program for analysis. For the evaluation of thermal comfort, the temperature and humidity index (THI) was used (BUFFINGTON et al., 1982), according to the following equation:

$$THI = 0.8\,DBT + \frac{RH(TBS - 14.3)}{100} + 46.3$$

in which:
THI = temperature and humidity index, dimensionless;
DBT= Dry bulb temperature, °C;
RH = air relative humidity, %.

The equipment used in this research was positioned at 1.5 m from the floor. The acoustic box was placed on top of the wall with the protection of the ceramic tile roof, the data loggers were hung on the roof and the decibelimeters and audio recorders were kept with the researchers trained for use in the 12 quadrants.

The behaviors counted through the ethogram were subjected to the square root transformation ($\sqrt{x} + 0.5$) and to the analysis of variance (ANOVA); then, the averages were compared by Tukey test ($\alpha = 0.05$). The data of the other variables were subjected to ANOVA and the averages compared to the Tukey test ($\alpha = 0.05$). The analyses were done in SAS Software, version 9.3 (SAS Institute, Cary, NC, United States).

RESULTS AND DISCUSSION

In this section is presented about the results and discussion of research. This section show in first moment, about sound and climate data. In second moment, is presented behaviors data and the discussion about the results. Below, Table 2 shows, for the study conditions, the values of the sound intensity, in dB, and the ambient temperature values (˚C) and relative humidity (%) in both pens.

Table 2 –Average values and standard deviation of sound intensity, dry bulb temperature and relative humidity and the temperature and humidity index in the "pen without music" and the "pen with music"

Pen	Sound Intensity (dB)	DBT (˚C)	RH (%)	THI
"pen without music"	44.00 ± 4.15 a	23.78 ± 2.95 a	63.66 ± 19.72 a	52.52
"pen with music"	45.54 ± 3.80 a	23.36 ± 2.84 a	63.64 ± 19.66 a	52.25

Averages followed by different letters in the same line differ from each other to the level of 5% of significance by the Tukey test.
dB: decibels; DBT: dry bulb temperature; ˚C: degrees Celsius; RH: relative air humidity; %: percentage; THI: Temperature and Humidity Index.

The sound intensity (dB) for both pens ("pen with music" and "pen without music") was statistically equal, i.e. the music played in the "pen with music" was not heard by the animals in the "pen without music" and, thus, did not interfere with the results obtained in the study.

Using an audio analyzer, it was verified that the sound frequency in the "pen without music" remained below 10 khz (khz), while in the "pen with music" exceeded 15 khz. According to Heffner and Heffner (1992), swine species possesses the ability to detect the frequencies of 40 Hz to 40.000 Hz.

Figure 2 shows the spectrogram of the sound frequency for the "pen without music" in left side and "pen with music" in right side. Is important describe than audio was recorded at same time on two pens and with the music played in the "pen with music". In this figure is possible to observe than the sound of music from "pen with music" was not present in the "pen without music".

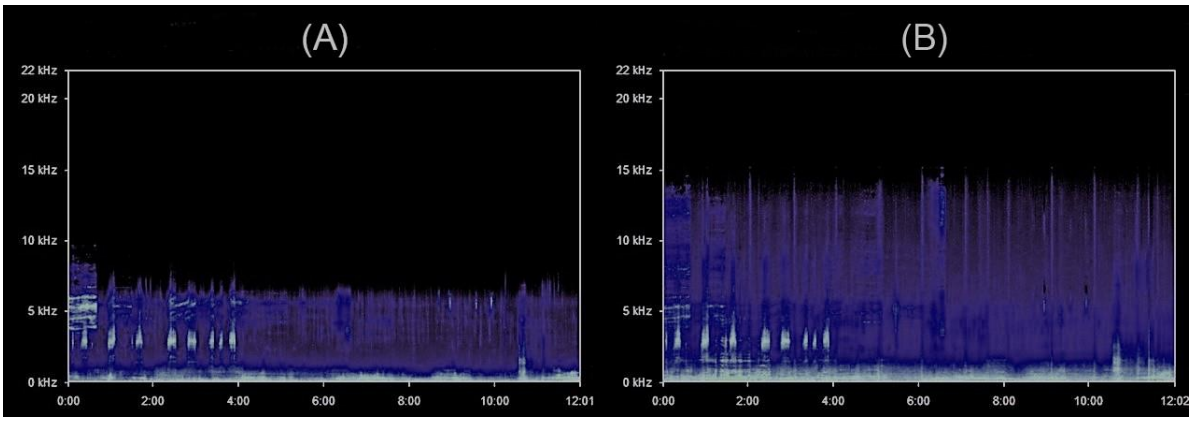

Figure 2 – Spectrogram of the sound frequency in the "pen without music" (A) and in the "pen with music" (B). Legend: Hz: Hertz; khz: Quilohertz.

Environmental variables temperature (˚C) and relative humidity (%) also have not influenced the results of the study. The ideal temperature for growing pigs is 21 ˚C, with limits between 16-27 ˚C (NATIONAL FARM ANIMAL CARE COUNCIL, 2014) and humidity should not exceed 70% (SAMPAIO et al., 2004), limited between 40-90% (FERREIRA, 2011). The welfare and productive performance of animals are constantly affected by the temperature (DIAS et al., 2015), while moisture intervenes in the exchange of heat between the animal and the environment. According to Hanh (1985), the THI with the value of up to 70 represents a safe environment for animals.

Table 3 presents the number of pigs (unit) and rectal temperature (˚C) in both pens.

Table 3 – Average values and standard deviation of the quantity of pigs and the rectal temperature in the pen without the sensory Agent ("pen without music") and the Sensory Agent music ("pen with music")

Pen	Number of Pigs (unit)	Rectal temperature (˚C)
"pen without music"	6.17 ± 2.59 a	38.97 ± 0.36 a
"pen with music"	3.83 ± 2.59 b	39.05 ± 0.36 a

Averages followed by different letters in the same line differ from each other to the level of 5% of significance by the Tukey test.

˚C: degrees Celsius.

During the study, the hierarchy of dominance among the animals was established. After this process, the dominant swine had the preference to remain in the pen without the sensory agent, contributing to all other animals also to stay for a longer period within the pen without music. This occurrence influenced the result of the number of pigs in the pens and consequently in some normal behavior of the species.

The social hierarchy consists of the dominant swine and the other dominated animals and it is evident in small groups and observed in all the productive stages of production (MEESE & EWBANK, 1973).

According to Muirhead and Alexander (1997), the normal rectal temperature of pigs weighing between 25-45 kg is 39 ˚C, which is similar to the values collected in this study.

When observing the values of the temperature, humidity and rectal temperature, it can be understood that the animals remained in good environmental conditions and that such variables did not interfere with the behavioral evaluation during the research. This information can be proven with the THI values found in this study.

The number of agonistic and stereotypical, normal and playful behaviors for both pens is shown on Figures 3, 4 and 5.

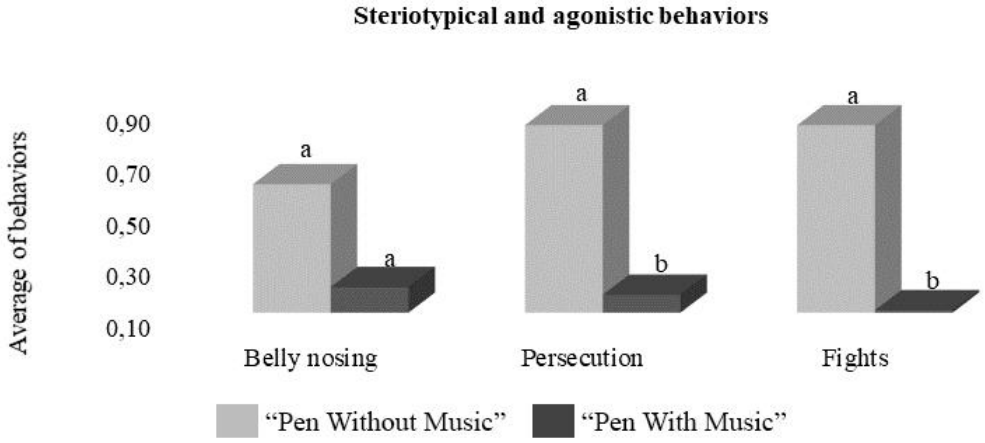

Figure 3 – Stereotypical and agonistic behaviors of pigs in growing phase for pens without the sensory agent ("pen without music") and with the sensory agent music ("pen with music")

Among the stereotypical behaviors, the aerophagia was not observed in this study and belly nosing did not present statistical difference between the pens observed.

The opposite occurred for the agonistic behaviors of persecutions and fights while verifying that the values in the region pen with music (0.17±0.45, 0.11±0.40; respectively) were statistically smaller when compared to the region pen without music (0.83±1.71, 0.83±1.48; respectively). The total number of persecution behaviors was 29 to the pen without the music against 6 for the pen with the music and 29 against 4 for the fights. Such results indicate that the music can present a trend of reduce in the behavior of fights and persecutions between the swine, favoring and promoting a positive welfare.

Furthermore, in addition this point, the autors Gvaryahu, Cunningham e Tienhoven (1989) noted that classical music decreased the dread in broiler chickens while evaluating feeding time and the reduction of the the immobility of animals.

When studying classical music for pregnant sows housed in collective stalls, Silva et al. (2017) stipulated five point-time observation schedules (9 a.m., 11 a.m., 1 p.m., 3 p.m. and 5 p.m.) and found no differences in the relative frequency of the agonistic behavior of the sows between the pen with the music (0.00, 0.00, 0.00, 0.31 and 0.00; respectively) and pen without the music (0.37, 0.00, 1.14, 0.38 and 1.22; respectively). In contrast, it was found a statistical difference in agonistic interaction with the researcher at all times for

pen with (0.00, 0.00, 0.00, 0.00 and 0.00; respectively) and without (1.57, 1.71, 1.28, 1.42 and 1.28; respectively) music.

Sounds have the ability to activate the brain regions that benefit behavior and stimulate changes in the cognitive and motor areas of animals (MOREIRA, 2012). Figure 4 shows normal behaviors observed in the study.

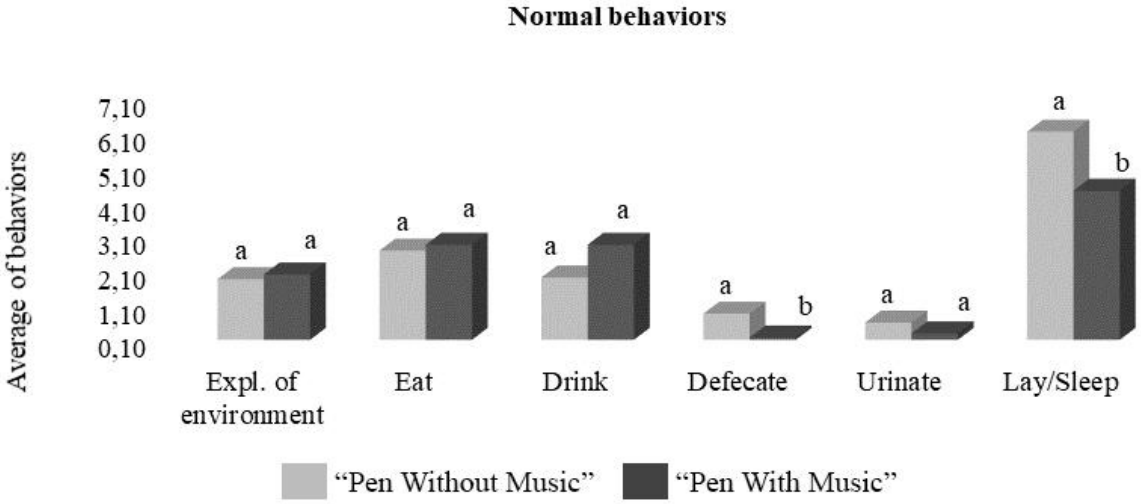

Figure 4 - Normal behaviors of pigs in growing phase for pens without the sensory agent ("pen without music") and with the sensory agent music ("pen with music")

For normal behaviors, there was statistical difference between the "pen without music" (0.86 ±1.11 and 6.14 ± 2.87; respectively) and "pen with music" (0.17 ± 0.45 and 4 43 ± 3.75; respectively), for defecate and lay/sleep behaviors, with a total count of 30 against 6 to defecate and 215 against 155 to lie lay/sleep. Defecate and lay/sleep presented largest results in "pen without music", because the dominant pig had the preference to stay in this pen with the other animals in the group. For other behaviors there was no preference between the pens with or without the sensory agent music. Furthermore, during the study was observed a relationship between eating-drinking and defecating-lay/sleep. The associated behaviors were performed concomitantly by the animals.

Figure 5 shows the ludic behaviors (animal interaction and play) observed during the study.

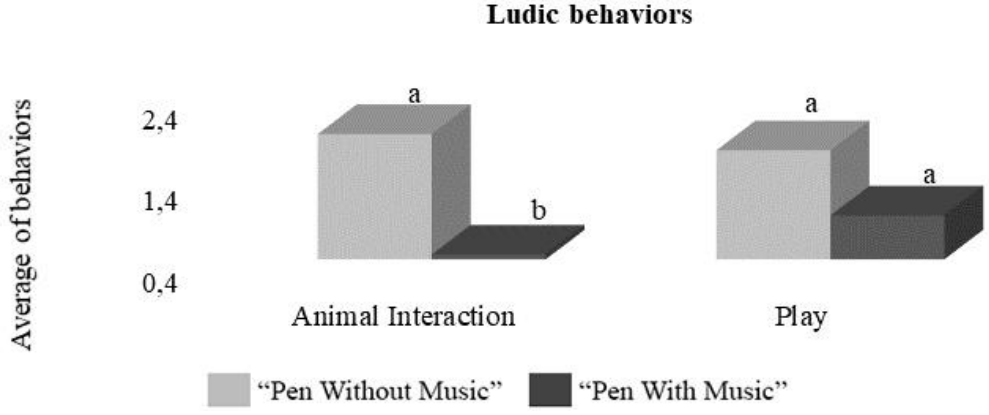

Figure 5 - Ludic behaviors of pigs in growing phase for pens without the sensory agent ("pen without music") and with the sensory agent music ("pen with music")

For ludic behaviors, it was noted a difference of animal interaction between the "pen without music" (1.94 ± 2.30) and the "pen with music" (0.46 ± 0.70) with a total count of 68 versus 16. In the pen with music, the animals preferred to interact with the sound, attitude clearly displayed when the pigs remained seated, with the head up and look fixed, indicating that the music is favorable for the swine and improves welfare, also confirmed by the decrease in agonistic behaviors found in this study.

Jonge et al. (2008) reported that the piglets who heard music before weaning played more and decreased the agonistic behaviors at the nursery stage, indicating a positive welfare.

By checking the total quantity of all behaviors collected by the ethogram during the survey, it was observed that, during the morning, there was a greater frequency of activities at 9 p.m. and, in the afternoon, at 4:00 p.m.

By verifying positive results, the increase in scientific research in this area can contribute significantly to the practical use of music therapy to aim for animal welfare and, consequently, productive and economic improvement.

CONCLUSIONS

Among the observed behaviors, it was found more behavior of animal interaction and less behaviors of persecution and fight. After analyzed the results of this research, is possible conclude that exists a tendency of music therapy to have a positive influence in the behavior and welfare of the growing pigs raised in open pens.

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