

Evaluation of the Behavioral and Productive Effect of Frequency-modified Music in Piglets in a Commercial Production System

In swine production, one of the stages where there is a higher percentage of mortality is between the birth and the weaning of piglets. The mortality of piglets is associated in part with the stress of the sows, due to the restriction of high motivation behaviours such as to root and due to the establishment of social hierarchy in piglets.

One strategy that has been used in various species to reduce stress is the use of classical music. However, in a previous study carried out by the authors, it was found that the sow's response stimulated stress-type behaviours with classical music instead of relaxation. In this study, the use of frequency-modified music by composer and sound behaviourist, Janet Marlow, was proposed and adjusted to the auditory comfort range of the swine hearing range, as environmental enrichment. Frequency-modified music has been clinically tested in horses with results that positively influenced their performance in races (Stachurska et al., 2015). It is hypothesized that music that is frequency-modified based on hearing range, produces a relaxing effect in piglets that stimulates affirmative social behaviour, improves weight gain and reduces mortality.

Purpose of Modifying Stress Behaviours in Piglets

1. Piglets show aggression to other piglets within the first week of life while forming a teat order.
2. Introducing new pigs into a group may lead to aggression as the pigs establish social ranks. Pigs may spend 1–2 minutes nosing each other, vocalising, and then biting until one of the pigs retreats.
3. During estrous cycles, sows may show severe aggression toward newly added sows.
4. During breeding, boars may fight and become very vocal.
5. Using tranquilizers such as azaperone (2.2 mg/kg) or amperozide (1 mg/kg) can help reduce aggression but may not be economical.
6. Tail biting is seen mostly in confined pigs.
7. Overcrowding and boredom seem to be the main causes of aggression. Slatted floors without bedding, low-salt diets, and low-iron soil seem to predispose pigs to tail biting.
8. When the sow is stressed, usually, the sow will bark to warn piglets walking by her head and then later attack them, biting them to death.
9. Regrouping or overcrowding increases stress levels as well. These two factors (confinement and crowding) lead to chronic stress, delayed puberty, and failure to reproduce. On the other hand, acute and mild stress such as transport and gentle handling accelerate estrous cycles.

Environmental enrichment in early stages is usually successful. Feeding smaller quantities more frequently and

providing toys, bedding to root, corn on the cob, and clean tires can be enriching and mentally stimulating for pigs. The inclusion of species-specific swine music is an enhancement to their enrichment to diminish stress.

Swine Hearing Range Data

The hearing of pigs range from 42 Hz to 40.5 kHz with a region of best sensitivity from 250kHz to 16kHz. Because these animals are unable to localise high-frequency tones, it seems unlikely that selective pressure to use the interaural spectral-difference cue for sound localisation is behind their high-frequency hearing. Instead, researchers suggest that these and other hoofed mammals evolved high-frequency hearing in order to use monaural locus cues which prevent front/back locus reversals.

Process for Composing Swine-Specific Music

Using the Logic Pro program, original music based on the swine hearing range sensitivity was originally composed and modified by frequency and decibel levels accordingly. The music was designed to be broadcast at a comfortable volume in an agriculture setting considering a modest amount of noise and squealing coming from multiple pigs. Speakers were provided which were pre-loaded with repeating, modified swine music placed near three large areas of the pigs interacting during less daily activity. The music permeated the environment with specific tones, volume and frequency content to elicit calm behaviour. Proposing that the music will trigger an ear/behaviour response to the piglet's listening comfort as opposed to the transmission of other pig sounds causing reactive stress behaviour.

Included in the compositions are sounds of nature such as water streams and songbird vocalising to add to the environment. The goal here is to help the pigs feel their natural life to ease stress in an unnatural setting.

Instrumentation

Flutes, Harp, Strings, Chorus-Voice, Nature Sounds, Piano-Synthesizer

Most of the music has been modified within 10,000Hz to 12,000 Hz, within the comfort zone of swine hearing.

Materials and Methods

The study was carried out in a commercial swine farm in the central zone of Chile. A total of 14 litters were used in two rooms, 7 per room was one of the rooms where the music played in (Grupo Música, GM), while in the other room it was kept in normal conditions (Group Control, GC). The music was played between 8:00 and 4:30 p.m., from one day before delivery until weaning, by means of a music system with 2-audio system speakers, Sony model Mhc-rg590s.

For the study, the animals that were closest to the speakers were selected. The speaker's volume did not exceed 75 dB, a parameter that was evaluated with a sound level meter (model MS-6708). The music used in the study for the selected pigs consisted of ten compositions of designed music, with sustaining instruments and sounds of nature. The frequency levels were placed in the hearing comfort zone



between 10,000 Hz and 12,000Hz, with the auditory spectrum of the pigs being between 40.5 Hz and 40 kHz (Heffner and Heffner, 1990).

Productive parameters such as mortality, were measured by birth weight / weaning weight and face injuries. The behaviour was recorded and recorded by CCTV cameras. By sampling the litter and discontinuous recording with intervals of 1 minute, measurements were made of the proportion of times that the piglets performed play, rest, and aggression behaviour. Breastfeeding on day 0, 7, 14 and 21 of lactation.

Results and Discussion

Studies on the use and effect of music in pigs are scarce (eg de Jonge et al., 2008), so this is a line of research that has an interesting projection. In the present study, the parameters such as mortality, birth and weight weaning of the piglets did not show significant differences with the music ($p > 0.05$). Thus, music did not improve productive performance, as occurred in racehorses (Stachurska et al., 2015).

However, this result may be related to the time of exposure to music, because in the study, the aforementioned differences were found in the performance of the careers after three months of exposure to music that was frequency-modified and in the present study the piglets were exposed to music from one day the birth to the weaning, that is no more than 22 days. As for the behaviour, on day 0 a smaller proportion of time spent in the GM attacks than in CG ($p = 0.001$). When comparing both groups throughout breastfeeding, it was found that the music stimulated more rest ($p = 0.004$) and reduced the rate of aggression ($p < 0.001$).

Conclusions

This is the first study using music that is specifically designed for swine hearing. The process of species specific music to calm behaviour has been proven in other biometric studies modifying pulse rates, HRV and activity levels in dogs, cats and horses. It is concluded that the swine-specific music had a positive effect on the behaviour of the piglets, so it can be attributed to the calming effect, thus increasing their animal welfare in an agricultural production system.

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Janet Marlow

Janet Marlow, M.A., Sound Behaviourist, is internationally known as a researcher, composer and author. In 1997, Janet Marlow innovated a science-based method of altering the frequency and decibel levels in designed music that elicits calm behaviours in dogs, cats, horses and birds. By acknowledging acute hearing in each species, music can be altered accordingly, thereby Janet Marlow's innovation of species-specific music. Results have been clinically proven with repeatable and measurable results over twenty years. Her work on species-specific music has been published in the Journal of Equine Veterinary Science and the International Animal Health Journal. In 2009, she founded Pet Acoustics Inc., an award-winning global brand with multiple species-specific products that have helped thousands of animals worldwide to diminish stress in their living environment for better animal welfare. Janet Marlow was named Woman of Influence in the Pet Industry by Pet Age Magazine. She has authored books on animal hearing, most recently, What Dogs Hear: Understanding Canine Hearing and Behaviour.

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