

EFFECT OF USING TWO MUSIC TYPES ON NON-PREGNANT NON-LACTATING ARABI EWES BEHAVIOUR AS A TOOL FOR WELFARE IMPROVEMENT

Ronak A. Meshabaz ^{a*}, Nizar J. Hussein ^{a, b}, Mhamed A. M. Mersham ^a and Mhamed S. S. Mhamed ^a

^a Dept. Environmental Science, Faculty of Science, University of Zakho, Kurdistan Region – Iraq.
(ronak.meshabaz@uoz.edu.krd)

^b Dept. Animal Production, College of Agriculture, University of Duhok, Kurdistan Region – Iraq.

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ABSTRACT:

The present study was designed to determine whether playing two music types will improve behaviour of non-pregnant, non-lactating Arabi sheep. Thirty Arabi ewes, aged 2 – 3 years, were included in the study. Ewes were divided into three groups, 10 ewes each. The groups were: Control (with no music exposure); Classic music exposure and Fast music exposure. The sound level for classic and fast music groups was 80 dB with the frequency of 1 KHz. The behavioural data were collected using direct observations for six respective days. Results revealed that using music, both classic and fast, significantly decreased the frequency of aggressive behaviours ($P < 0.001$), vocalization ($P < 0.01$), defecation ($P < 0.05$) and walking behaviour ($P < 0.05$). In addition, there were significant effects of music on the average time spent standing ($P < 0.01$), lying and feeding ($P < 0.001$). Whereas no significant difference was found on the average time spent drinking. It was shown that there were significant differences in time spent lying ($P < 0.01$) and time spent feeding ($P < 0.01$) over time. Finally, there was a significant difference in the proportion of time spent lying ($P < 0.001$) as well as in the proportion of time spent feeding between control and music groups ($P < 0.01$). From this study, it can be concluded that exposing non-pregnant, non-lactating ewes to classical music is beneficial for ewes' welfare, due to the reduction of aggressive behaviour.

KEYWORDS: Music, Arabi sheep, behaviour, welfare.

1. INTRODUCTION

Animal welfare, according to Broom (1986), is defined as “a state of individual as regards its attempts to cope with its environment”. Difficulties in coping or failing to cope with the environment are both indicators for poor welfare (Broom, 1991). Mental and physical aspects are both included in animal welfare, which allows animals to have all freedoms, including freedom to express normal behaviours (Dolins, 1999; Prunier *et al.*, 2013). Therefore, comprehending the behaviour of an animal is an important aspect in animal welfare. Behavioural expressions allow scientists to determine the animal welfare (Fraser, 2014). Through behavioural observations we can assess whether sheep welfare is impaired through their following actions : increasing vocalization frequency; less time spent feeding, which is similar to less time spent lying, as well as lesser comfort behaviours and several other parameters, including facial expression (Orgeur *et al.*, 1998; Dwyer *et al.*, 1998; Broekman, 2015). Therefore, to improve animal behaviour, environmental enrichments have been used such as music (O’Brein, 2014). Goats and sheep have a well-developed capacity of hearing (Tracey and Fleming, 2007). Hence, sounds may possibly act as stressors. This depends on their amplitude and frequency (McAdieet *et al.*, 1993; Talling *et al.*, 1998; Quaranta *et al.*, 2002; Moore, 2012; Johns *et al.*, 2015). Sheep are able to detect sounds at -6 dB and can hear sounds between 125 Hz to 42 KHz, with the best sensitivity at 10 KHz (Heffner and Heffner, 1990).

The effect of music is well documented in humans. It has been widely used as a therapeutic tool in many disorders in humans, for instance, Alzheimer disease (Simmons-Stern *et al.*, 2010; Simmons-Stern *et al.*, 2012), Parkinson disease (de Dreu *et al.*, 2012), depression (Maratos *et al.*, 2008), autistic spectrum

disorder (Gold *et al.*, 2006), schizophrenia (Mössler *et al.*, 2011) and aphasia (van der Meulen *et al.*, 2012). Using sensory enrichments, such as music, have been studied in several animals, including sheep, dairy cattle, piglets, goats, mice, rats, fish, horses, monkey and poultry, mainly day-old chicks (Uetake *et al.*, 1997; Campo *et al.*, 2005; de Jonge *et al.*, 2008; Xu *et al.*, 2009; Papoutsoglou *et al.*, 2010; Stachurska *et al.*, 2015; Xing *et al.*, 2016). Although, using music is a vital tool for improving piglets and dairy cows' welfare and behaviour where it reduces the stress on cows and increases milk yield (O’Brein, 2014). Animals may have negative effects on welfare if they are exposed to the music for long-term like goats in the alpine regions that are permanently equipped with chime bell (Johns *et al.*, 2015). Music does not affect horses' behaviour when they are exposed to short term isolation distress. Moreover, the welfare of young horses improved with relaxing music (Wilson *et al.*, 2011). Anxiety was reduced in mice using classical music (Chikahisa *et al.*, 2006, 2007; Escribano *et al.*, 2014). It was an effective tool in reducing blood pressure in rats (Akiyama and Sutoo, 2011; Nakamura *et al.*, 2007).

Several studies have been undertaken on the effect of sound and noise on lamb and sheep. A study by Sevi *et al.* (2001) showed that cortisol levels were increased in lambs with increasing the sound levels (Sevi *et al.*, 2001). In addition, the feed intake of sheep was decreased when they were exposed to high sound levels (Harbers *et al.*, 1975), but, the lamb behaviour was not affected with noise at high sound levels (Quaranta *et al.*, 2002). However, little is known about the effect of music on non-pregnant non-lactating sheep behaviour. Therefore, the present study was designed to determine whether playing two music types will improve behaviour of non-pregnant non-lactating Arabi sheep or could worsen it.

* Corresponding author

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2. MATERIALS AND METHODS

2.1. The study Site

This study was carried out in the animal farm of the College of Agriculture, Summel, 15 Km west of Duhok, Kurdistan Region – Iraq, at national grid reference (36° 51' N, 52° 02' E) with altitude of 473m above the sea level. The study lasted 6 days in November, 2016. Ewes were provided with hay and barley in addition to vitamins and minerals supplementation as well as ewes were given a free access to water.

2.2. Subjects and treatments

Thirty Arabi ewes, aged 2 – 3 years, were included in this study. Ewes were divided into three groups, 10 ewes each. The groups were: control (with no music exposure), classic music exposure and fast music exposure. The sound level for classic and fast music groups was 80dB with the frequency of 1 KHz using stereo wireless Bluetooth speaker (Bluetooth 2.1). The sound volume was tested using a digital sound meter (Voltcraft SL-200, Voltcraft®, Germany). Their average weight was 49 ± 5; 54 ± 4 and 50 ± 5, for control, classic and fast music groups, respectively. The study area was 8 * 17m (width and length). Animals were placed in their groups 3 days before the study to be adapted with their environment.

2.3. Data collection

In the first day of the study, the data were collected only from the control group, followed by a classical music and fast music group in the second and the third day, respectively. Similarly, the procedure was repeated for the other three days for all groups. Each group lasted one-hour observation starting from 11:30 am to 12:30 pm. All behavioural data that were collected in the present study are presented in Table (1) with their descriptions. The behavioural data were collected by 2 observers. The first observer was recording the following behaviours as frequency per unit time: aggressiveness, vocalisation, defecation and walking. Whereas, the other observer recorded lying, standing, feeding and drinking as duration per unit time. The behaviour were observed in 2 mins intervals using instantaneous and scan sampling methods to measure the frequency and the duration of the chosen behaviours. In addition, the following points were considered by observers based on Pifeleti (2011) before recording any behavioural data:

1. Observer must be familiarized with the species interested.
2. The ethogram must be set to contain a list of behaviours that would be catalogued with their descriptions.
3. Animal behaviour scoring must be practised by the observer to obtain accurate behaviours.

Table 1: Ethogram: list of the observed behaviours that were recorded during this study with their descriptions.

Behaviours	Descriptions
Aggressiveness	All agonistic interactions with and without physical contact received in the feeding area with and without displacement.
Vocalization	Occurrence of each vocal sound was recorded.
Defecation	Excretion of faeces in holding pen.
Walking	Moving around in pen, not standing stationary.
Lying	Lying included resting and sleeping behaviour, when animals were lying on all four legs.
Standing	Standing described the animals standing as well as moving, more precisely, when the feet had to carry the animal's body weight.
Feeding	When an animal had its head put completely through the feed barrier and over the feeding table.
Drinking	Muzzle in contact with water and ingesting water.

(Source: adapted from Molony *et al.*, 2002, 2012; Chapagain *et al.*, 2014; Aguilar, 2016)

2.4. Data analysis

All the recorded data were stored in the Microsoft Excel spreadsheet, and then, data were prepared for statistical analysis. Thus, all data from each prepared table were projected to Past3 software programme (PAleontological Statistics, Version 3.08) to be analysed (Folk.uio.no., 2016). In addition, summary statistics was obtained from Past3 software programme. Residual plots confirmed by a Shapiro-Wilk normality test showed that all behavioural data to be nonparametric. Therefore, they were analysed using Kruskal-Wallis test followed by a two-sample nonparametric test by using Mann-Whitney U-test to obtain differences between all behavioural observations from both treatments with control.

All tables and graphs were prepared in in the Microsoft Excel spreadsheet.

3. RESULTS

Table 2 shows the effect of two music types, classic vs fast, on the behaviour of Arabi sheep in comparison with control. There was a significant effect of music on aggressiveness ($P < 0.001$), vocalization ($P < 0.01$), defecation and walking ($P < 0.05$) behaviours. In addition, there were significant effects of music on the average time spent standing ($P < 0.01$), lying and feeding ($P < 0.001$). Whereas no significant difference was found on the average time spent drinking (Table 3).

Table 2. The effect of music on the behaviour of non-pregnant non-lactating Arabi sheep. The behaviours presented as frequency (mean ± SE) per minute per animal.

Behaviours	Groups			P-value
	Control	Classic	Fast	
Aggressiveness	2.12 ± 0.39 ^a	2.10 ± 0.28 ^b	0.27 ± 0.09 ^c	0.001
Vocalisation	1.32 ± 0.36 ^a	0.02 ± 0.01 ^b	0.67 ± 0.28 ^a	0.01
Defecation	0.28 ± 0.07 ^a	0.13 ± 0.05 ^{ab}	0.12 ± 0.05 ^b	0.05
Walking	4.52 ± 0.61 ^{ab}	3.08 ± 0.43 ^a	4.63 ± 0.49 ^b	0.05

Note: Different letters in rows (a,b,c) indicates significant differences ($P < 0.01$)

Table 3. The effect of music on the behaviour of non-pregnant non-lactating Arabi sheep. The behaviours presented as duration (mean ± SE) per minute per animal.

Behaviours	Groups			P-value
	Control	Classic	Fast	
Lying	0.80 ± 0.07 ^a	0.22 ± 0.07 ^b	0.39 ± 0.09 ^b	0.001
Standing	0.35 ± 0.07 ^a	0.68 ± 0.09 ^b	1.53 ± 0.44 ^c	0.01
Feeding	0.63 ± 0.07 ^a	0.10 ± 0.01 ^b	0.25 ± 0.06 ^c	0.001
Drinking	0.003 ± 0.002 ^a	0.006 ± 0.004 ^a	0.008 ± 0.007 ^a	n.s

Note: Different letters in rows (a,b,c) indicates significant differences N.S means not significant

It is shown in Figure (1) that there were significant differences in time spent lying ($P < 0.01$) and time spent feeding ($P < 0.01$) over time. The control group had spent more time in lying followed by fast and classic music groups. In the first 40 mins of observation, the time spent lying for the fast music group was higher than the classic music group while it was lower in

the last 20 mins of observation than fast music group (Figure 1,a). Whereas, time spent feeding in the classic music group of sheep was higher than other groups. The control group spent more their time with feeding in the first and last 20 mins than the fast music group (Figure 1,b).

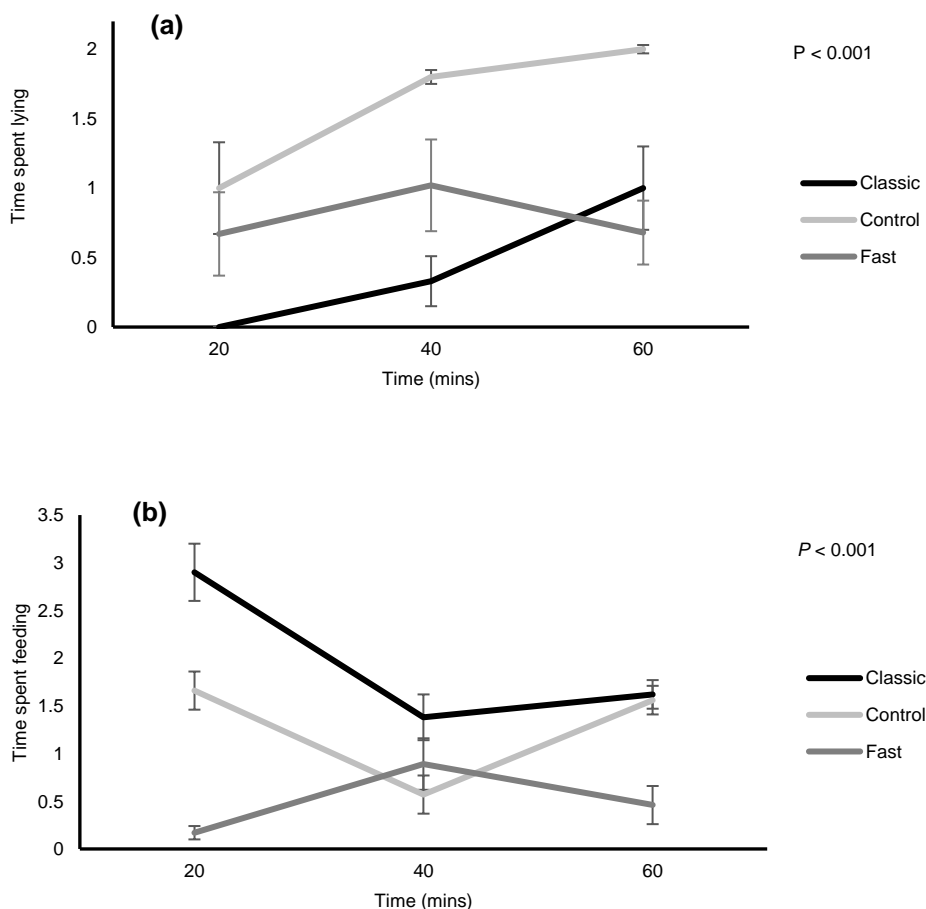


Figure 1. The effect of music on time spent a: lying and b: feeding behaviour of non-pregnant non-lactating Arabi sheep throughout one hour observation.

The proportions of time spent lying and feeding behaviours are shown in Figure (2). There was a significant difference in the proportion of time spent lying ($P < 0.001$) as well as in the proportion of time spent feeding between control and music groups ($P < 0.01$). The control, fast music

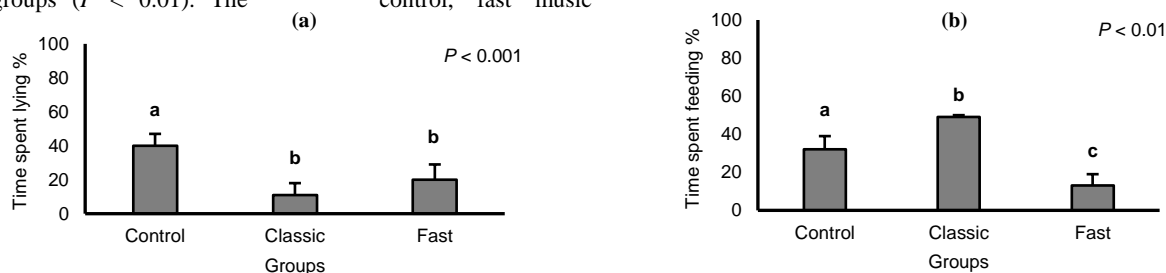


Figure 2. The effect of two music types, classic and fast, on the proportion of a: lying and b: feeding behaviour of non-pregnant non-lactating Arabi sheep.

4. DISCUSSION

The main purpose of the present study was elucidating the effect of playing two music types on the behaviour of non-pregnant, non-lactating Arabi sheep. There was a considerable effect of music on the behaviour of sheep. In general, the average time spent feeding and lying per minute was higher in control group ($P < 0.001$) than the music groups (Table 3). The control group also shows higher aggressiveness ($P < 0.001$), vocalization ($P < 0.01$) and defecation ($P < 0.05$) frequencies per minute than other groups (Table 2). In addition, the control group spent 20% and 29% more time with lying behaviour ($P < 0.001$) than fast and classic music groups, respectively (Figure 2,a). Whereas, the classic music group spent 12% and 36% more time with feeding behaviour ($P < 0.001$) than control and fast music groups, respectively (Figure 2,b). In the control and classic music groups, time spent lying was increased with time while it was decreasing at the last 20 mins of observation for the fast music group (Figure 1,a); whereas, the classic music group spent more time feeding over time followed by the control and fast music group (Figure 1,b).

Exposing non-pregnant non-lactating Arabi ewes to the music, with sound levels of 80 dB, in the present study reduced aggressive behaviours and vocalization frequency. This indicates that the music does not impair sheep welfare (Broekman, 2015). However, high sound levels, such as 95 dB, did not affect lambs' behaviour (Quaranta *et al.*, 2002). It was found that increasing the noise level from 45 to 95 dB will increase cortisol hormone levels in the blood, which leads to stress in sheep (Sevi *et al.*, 2001). Whereas, contradictory results were found with using music at 80 dB in the present study. Similar results were found by Wilson *et al.* (2011), who found that using music reduced stress in horses. Similarly, music reduced stress, fear and aggression in race horses (Stachurska *et al.*, 2015). Playing music in playroom pre-weaning reduced aggressiveness in piglets post-weaning (de Jonge *et al.*, 2008). Furthermore, similar to the present study's results on sheep, classical music reduced stress response in chicks at the first week of age (Hafizah *et al.*, 2015). The findings of the present study confirmed that music had a significant effect on sheep behaviour in reducing aggressiveness, even though no significant effect was found of the effect of music on the time spent drinking. Hence, this study's finding was consistent with the previous study's result found by Quaranta *et al.* (2002).

Classic music ewes spent more time eating than control and fast music groups. This finding is consistent with the previous results found with horses by Wilson *et al.* (2011), who stated that horses are more likely to eat more than control group. Although, the sound levels between 75 and 95 dB decreased

and classic music groups spent (40 ± 7), (20 ± 9) and (11 ± 7) % of their time with lying behaviour (Figure 2,a) and (32 ± 7), (13 ± 6) and (49 ± 1) % of their time with feeding behaviour, respectively (Figure 2,b).

feeding time in sheep ($15 - 19.2\%$), compared to control (24.1%), the difference was not significant (Quaranta *et al.*, 2002). In the same way, the feed intake of sheep was decreased when they were exposed to the sound levels between 75 dB and 100 dB (Harbers *et al.*, 1975). In addition, the feed intake of broilers was not affected with classical music for first five weeks (Hafizah *et al.*, 2015). Therefore, this study's results did not agree with their findings with using classic music, but similar results were found with using fast music in this study, where the percentages of time spent feeding in this study for control, classic and fast music groups were 32, 49 and 13%, respectively. Thus, this study showed that sheep are likely to eat more feed and spend more time eating when they were exposed to classical music. Exposure of Arabi ewes to 80 dB decreased lying behaviour significantly comparing to control group (Figure 2,a). Lying behaviour of ewes exposed to 85 dB was decreased from 38.6% (control) to 27.2%. However, the difference was not significant (Quaranta *et al.*, 2002). As a result, the present study's finding of lying behaviour was in line with previous research. However, no obvious effect of relaxing music was shown on horses (Wilson *et al.*, 2011).

5. CONCLUSION

From the present study, it can be concluded that using music had considerably decreased aggressive behaviours in non-pregnant, non-lactating Arabi ewes. In addition, vocalization frequency was reduced with playing music. Furthermore, classic music, rather than fast music, increased time spent feeding. Therefore, playing music, particularly classic music, is beneficial for sheep welfare, however, concrete conclusion cannot be made as fast music reduced feeding time and both played music types decreased lying time, compared to control group. For that reason, further research is required to elucidate the effect of music on sheep welfare using facial expression, ear postures and behaviour.

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