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EFFECT OF DIFFERENT TYPES OF FLOORS ON BEETAL GOATS' PREFERENCE, LYING, STANDING, AND ELIMINATION BEHAVIOR

[a]Samee Ullah, [b]Muhammad Shahbaz Azhar, [c]Zaman Javed, [a]Nisar Ahmad, [d]Muhammad Niaz Asghar, [e]Muhammad Mujahid Anwar

[a] *Department of Livestock Management, University of Veterinary and Animal Sciences, Lahore, Pakistan.*

[b] *Department of Zoology, Wildlife and Fisheries, Pir Mehr Ali Shah Arid Agriculture University Rawalpindi, Pakistan.*

[c] *Faculty of Veterinary and Animal Sciences, Pir Mehr Ali Shah Arid Agriculture University Rawalpindi, Pakistan.*

[d] *Faculty of Veterinary and Animal Sciences, Gomal University Dera Ismail Khan KPK. Pakistan.*

[e] *Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany.*

A B S T R A C T

Production and performance of small ruminants is affected by the fluctuation of the housing system. Therefore, the current study was conducted to investigate the behavior of Beetal goats on different types of floors including soil, sand, sawdust, and concrete. Twenty-eight (n=28) female Beetal goats having age of 3±0.5 years and weight 40±5kg were selected randomly and behavioral observations were recorded from 20 March to 3 May 2019 (spring season). All animals were individually weighed and randomly divided into 4 groups (G1, G2, G3, and G4) have seven animals each. Each group was restricted (remain on the one floor) for 10 days to each of the four treatments i.e., T1 (soil), T2 (sand), T3 (sawdust), and T4 (concrete). After the restriction phase, free access was given to all four groups for all the four treatments i.e., T1 (soil), T2 (sand), T3 (sawdust), and T4 (concrete) for 2 days, so that animal can spend time at any floor willingly and no of animals spending time between treatments was recorded. The data for the selected parameters (Lying time, lying bouts, standing time and other, Preference lying time, Preference Standing time and other, Defecation frequency, Urination frequency) were collected for one hour at 12:00, 16:00, 20:00, 24:00, 04:00, and 08:00 hours in the last two days of each treatment period. The method of behavioral observation was based on the method of "Time sampling and "Point sampling. The maximum average lying time observed on soil was 37.00min/hr, urination frequency was observed more on sand (1.10/hr) and defecation frequency was found more on soil (1.33/hr.) Average lying time during the free access period was also higher on soil 30.53min/hr as compared to other flooring types. Finally, it is found that lying time was higher on the soil floor, although the result was not significantly more urination frequency was noticed on the sand floor. Multiple floors in the far may provide the preferred area for goats lying and elimination and consequently help in managing the animal health security. The purpose of this study is to provide awareness about the effect of floor on the production and performance of Beetal goats.

Keywords: Soil; sand; Urination; Defecation; Time sampling; Point sampling

Corresponding Author: Muhammad Shahbaz Azhar
Email: shahbazazhar954@gmail.com

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INTRODUCTION

Nowadays, small ruminants are facing serious ecological problems like decreasing grazing lands and feed shortage (Neave and Zobel, 2020; Villalba et al., 2010). While changes in the climate mainly temperature fluctuations affect the production of small ruminants (Gelasakis et al., 2019; Marino et al., 2016). It also influences the environment of the housing system (Jørgensen and Bøe, 2009). Since they have such close physical touch with it, small ruminants consider the floor to be a crucial component of their home. Farmers are

utilizing a variety of flooring materials, which may have an impact on the hygiene and health of their livestock (Tölü and Savaş, 2019). The severity of injured hocks was less on farms that were using deep litter material, such as compost, sand, and horse manure, compared with farms using foam mattresses (Van Gastelen et al., 2011b). Research on sheep held in Norway revealed that the animal firstly preferred to lie down on straw or wood as compared to expanded metal and straw to the wooden floor after feeding (Færevik et al., 2005; Wadhwani et al., 2016). Likewise, a study on goats revealed that goats spent less time resting when the resting area was small as compared to the medium and large area, lying time also increase in the activity area due to a decrease in lying space(Ali et al., 2016; Andersen and Bøe, 2007).

Sand floor typically has a lower bacterial count than organic beddings (Fairchild et al., 1982; Van Gastelen et al., 2011a). Elimination (urination, defecation) behavior also varies by changing types of floors. A study on goats in New Zealand revealed that the frequency of urination on wood shavings was more as compared to other floor types (Bach et al., 2016; Kroesen, 2020; Sutherland et al., 2017). Generally, studies have been conducted on the production of the goats but the behavioral study was not linked to the production and welfare (Absmanner et al., 2009; Smid et al., 2020). There is little information available regarding the reaction of small ruminants housed on different floors, despite the fact that the impact of bedding material on the behaviors, health, and welfare of dairy cattle has been extensively investigated. (Tuyttens et al., 2008). There is a massive potential in goats' production, so a better farming plan should be managed to facilitate the farmers for future intensive farming (GarcÍa et al., 2011; Salwiczek et al., 2009). To date, it is a task to find a suitable flooring material that may be attractive and comfortable for the goats with minimum labor costs at the same time (Smid et al., 2020; Yunta et al., 2012). The purpose of the research is to explore the effect of floor types and bedding material on the behavioral performance of Beetal goats.

MATERIALS AND METHODS

Study area

The study was conducted to investigate the behavior of Beetal Goat at Small Ruminants Training & Research Centre, B block, having *latitude 31.0582951 N, longitude73.8746542* E at University of Veterinary and Animal Sciences Ravi Campus Pattoki, Punjab, Pakistan.

Experimental design

In this experiment, twenty-eight (n=28) female Beetal goats having 40±5 kg weight was selected randomly and behavioral observations were recorded from 20 March to 3 May 2019. During these months' climate remain moderate in Pakistan but at the start of May, the hot season starts. All animals were individually weighed and randomly divided into 4 groups (G1, G2, G3, and G4) equally. Each group had 7 animals and each group has remained there for 10 days to each of the four treatments i.e., T1 (soil), T2 (sand 3 inches), T3 (sawdust), and T4 (concrete). According to 4×4 Latin square design, all the four groups of animals were rotated against the four treatments, and hence at the end of the experiment, each one of the 4- animal groups experienced each treatment for the same period. The flooring material was daily clean and changed if needed to avoid dirtiness of the animal body.

The data for the selected parameters observations (Lying time, lying bouts, standing time & other, Preference lying time, Preference Standing time & other, Defecation frequency, Urination frequency) was collected for one hour at 12:00, 16:00, 20:00, 24:00, 04:00, and 08:00 hours in the last two days of each treatment period (Keskin et al., 2005). The method of behavioral observation was based on the method of "Time sampling and "Point sampling and the observed activity was the lying, and elimination behavior (Tapkı et al., 2006). After the restriction phase, free access was given to all four groups for all the four treatments i.e., T1 (soil), T2 (sand), T3 (sawdust), and T4 (concrete) for 2 days, so that animal can spend time at any floor willingly and number of animals spending time between treatments was recorded. During this period each group of goats were housed in the pens to provide access to all four flooring surfaces simultaneously. Each flooring quadrant was a meal feeder that was attached to the side of the pen above the floor of the pens, respectively.

Statistical analysis

A 4×4 Latin square design was used and data collected were analyzed using PROC GLM procedures by using SAS Package 9.1 and results were declared statistically significant at $P \leq 0.05$. The following statistical model was assumed to analyse the data.

$$Y_{ijk} = \mu + \alpha_i + \beta_j + +\varepsilon_{ijk}$$

Where, $\mu =$ Population mean, α_i = Represents the i_{th} group effect, β_j = Shows the j_{th} period effect, ε_{ijk} = Represents the error term which is assumed NID ($0, \sigma^2$).

RESULTS

During the free access periods, goats spent more time lying on soil and concrete and less time on sand and

sawdust (as minutes per one hour 30.53: soil, 17.41: sand, 24.44: sawdust and 28.83 concrete, P < 0.0025*). Goat spent more time (P < 0.05) while lying on the soil floor than all other floor types. The different pattern was observed in standing time, while goats standing on different flooring type that was (as minutes per one hour 29.46: soil, 42.58: sand, 35.55: sawdust 38.16: concrete, P < 0.0025*). The goats spent more time standing on the sand and concrete floor as compared to others. The average lying and standing time is shown in (Figure 1 and Table 1).

Table 1. Average behavioral parameters (minutes/hr.) during the observation time.

Parameter	Treatment				SEM	P-value
	Soil	Sand	Saw Dust	Concrete		
Lying time	37.00	35.08	31.41	31.86	1.28	0.001*
Lying bouts	1.59	2.22	2.28	1.94	0.21	0.10
Standing time &other	23.00	24.91	28.58	28.13	1.28	0.001*
Preference lying time	30.53	17.41	24.44	28.83	2.73	0.002*
Preference Standing time & other	29.46	42.58	35.55	38.16	2.73	0.002*
Defecation frequency	1.33	1.26	1.31	1.04	0.14	0.58
Urination Frequency	1.10	1.22	1.01	1.07	1.10	0.67

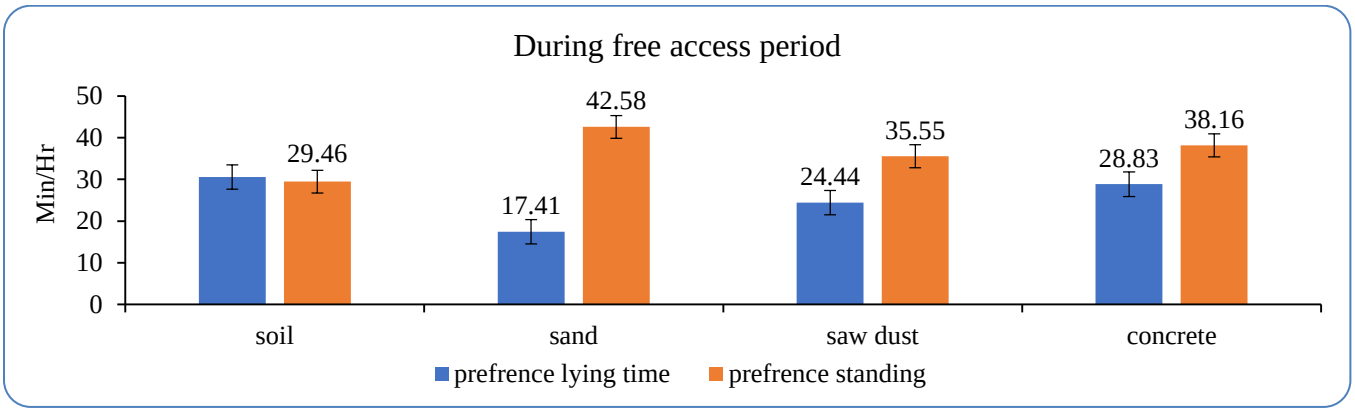

Figure 1. The average lying, lying bouts and standing time (min/hr.) on different floors during the free access period.

During the restriction phase, (in which all floor not provided collectively) there was a significant difference (P < 0.05) in the time, the goats spent lying on four surfaces (as minutes per one hour 37.00: soil, 35.08: sand, 31.41: sawdust 31.86: concrete, P < 0.0019*). Lying bouts duration was shorter initially when goats were housed on saw dust due to softness effect of days on lying time and also flooring surface not influenced lying bouts frequency (1.59: soil, 2.22: sand, 2.28: saw dust 1.94: concrete, P > 0.1036). However, goats performed more lying bouts on saw dust of flooring material (Calculated by sample pointing and time pointing method) (Tapkı et al., 2006). The average lying time and bouts during restriction period is shown in (Table 1).

The average observed standing time of animals was 23.00min/hr on soil, 24.91min/hr on sand, 28.58min/hr on saw dust and 28.13min/hr on concrete (Figure 1). During the restriction period, the place where goat's defecation (SED: 0.14, P > 0.58) and (SED: 1.1060, P > 0.6777) was not influenced by flooring type. Goats urinated more on sand as compared to other floorings because of best absorber of liquid as compared to other floorings. In addition, goats defecated more on soil compared to other floorings (Figure 2).

DISCUSSION

The result of this research shows that soil may be an appropriate floor for Beetal goats. During the preference test, goats showed more preference while lying on the soil floor. Lying bouts did not differ between the floors so much but were greater on sawdust and sand. The present research showed a significant preference for soil over sand, sawdust and concrete, and preference was shown as soil > concrete >

saw dust > sand respectively. Soil floor was structurally closer to the natural environment than any other surfaces. Therefore, in the present study, it may be a reason that last floor (soil) involves influenced goats lying preference because mostly soil floor is used commonly in Pakistan. The results of this research are in line with the research in which goats want to lie in steep cliff habitats when allowed to be feral (Fregonesi et al., 2007; Shi et al., 2013). Hence goats may have an innate, natural preference for hard surfaces. An additional aspect that affected preferences is the dryness percentage which was the highest for soil floor as compared to others. Finding of the study in line with (Bøe et al., 2007). Similar results were found as goat did not prefer the straw bedding material and spent very little time on this material.

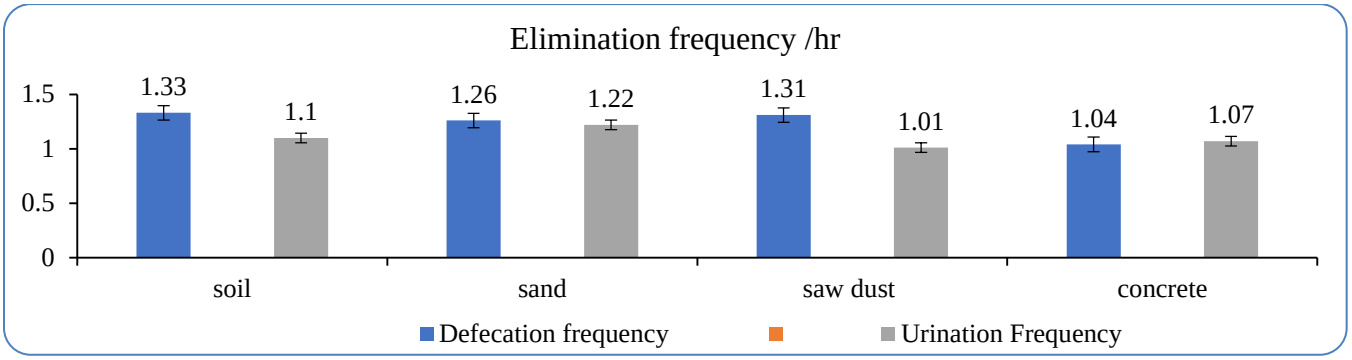

Figure 2. The average elimination frequency on different floors during the restriction period.

On the other hand, during the preference test saw dust was renewed so it may be preferred by goats as compare to sand while in the case of concrete it is similar to hard rock which was the first habitat of goats. This preference of concrete floor compared to sand showed similarity with this research in which the researcher found that in the past decades about 10,000 years ago goats were domesticated in mountains (Zeder and Hesse, 2000). The results of this research are also in line with (Manninen et al., 2002) reported that animals preferred other bedding than mattresses and sand in winter, possibly owing to insulating properties. Results of this analysis were non-compatible with (Clayton and Emery, 2009; Tucker et al., 2009) they found that cattle and their calves were preferred to lie on the soft bedding materials i.e. straw, wood shavings that also provides the insulation properties.

In the present study, lying bouts duration and frequency was similar among goats on all flooring types but on saw dust and soil goat performed more lying bouts as compared to other one of the major reasons is the softness of the floor. This is suggested that as moisture content increased in sand and saw dust discomfort of goats had increased. The results of this research are also agreed with the findings of (Sutherland et al., 2017) who reported that goats performed more lying bouts on wood shaving in open access.

Researchers found that fecal avoidance or location or behavior preference can affect where an animal defecate or urinate (Sutherland et al., 2017). According to the present study, it was found that goats have different urination and defecation behavior when they are restricted and when they are free. During the restriction period, goat's elimination behavior was not affected by floor types used. The reason for this may be that, that eliminating urine and faeces is need of goat-like animals. As they are restricted and cannot move freely to go to their preferred place for elimination, they eliminate the place where they are restricted regardless of their preference. According to this study covering faces with soil is easier as compared to other flooring material, they preferred soil floor more than other floors. Fecal avoidance behavior is usually performed by grazing animals to reduce risk of ingesting parasites (Sutherland et al., 2017). So, to avoid getting dirty with their feces, their ancestors made defecating on the soil as routine which they follow today. Similarly, they also defecate on the soil to reduce exposure to infective parasite larvae present in feces.

The research result that "goats prefer to urinate on soft-nature surfaces like sand and wood shavings as compared to hard surfaces due to its absorption property to avoid from splash back on the body" is in line with (Sutherland et al., 2017) who found that elimination behavior was more on wood shavings rather than other bedding materials because of soft nature of wood shavings. The reason for not urinating on the concrete floor in the non-restriction period is that urine will get splashed on the concrete floor due to which goats won't be able to avoid their bodies from sprinklings of urine. Similarly, they don't defecate as well on concrete. The reason may be the same that they won't be

able to avoid their bodies from getting dirty with feces on the concrete floor.

CONCLUSION

In a nutshell, we can conclude that goats prefer lying on soil. They may have inherited this tendency from ancestors who lived their entire lives on earth floors, which could be the cause. Despite the fact that it is not statistically significant. Similarly they prefer to defecate more on soil for maintaining their bodies clean from faces. Along with that, goats prefer sand floors for urination due to the quick-absorbing capacity of sand. Concluding, we can say that soil and sand floor already used are the good options for indoor housed goats. However, practically providing different floor types needs to be considered in combination with the natural behavior of the goats.

CONFLICTS OF INTEREST

The authors declared no conflict of interest. The funders had no part in the design, collection analyses and interpretation and writing of short communication.

AUTHOR'S CONTRIBUTION

All authors contributed and supported towards writing of this manuscript.

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