SHORT COMMUNICATION

Effect of Different Floor Space Allowances on Body Weight Changes, Voluntary Feed, Nutrients, and Water Intake in Indigenous Sheep

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Abstract

Present study was conducted on 45 adult dry non-pregnant (25-30 kg) farm born indigenous ewes. The animals were divided into three treatment groups, *i.e.*, T_1: 1.5 m^2 (4 animals in each pen), T_2: 1.25 m^2 (5 animals in each pen) and T_3: 1.0 m^2 (6 animals in each pen) floor space allowances with three replications in each treatment. The animals were maintained on farm feeding for 42 days of experiment with 15 days of adaptation period. The body weight of experimental animals was not influenced significantly ($p<0.05$) by different treatment groups, indicating that the floor space of 1.5, 1.25 and 1.0 m^2 did not affect body weight of ewes. The DMI in term of g/d, was significantly ($p<0.05$) lower by 2.38 and 1.51 % in T_2 and T_1 compared to T_3. DCP intake (g/d) was reduced by 1.66 and 1.05 % in T_2 and T_1 compared to T_3, while TDN intake (g/d) was reduced by 2.22 and 1.42 % in T_2 and T_1 compared to T_3 group, respectively. Contrary to this, reduction in water intake (l/d) was observed by 11.6 and 16.0 % in T_2 and T_3 compared to T_1.

Key Words: Dry matter intake, Floor space, Indigenous ewes, Nutrient intake, Water intake.

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Introduction

Appropriate housing is crucial to animal husbandry sector. The range of micro-climates to which the animals are exposed can be moderated with the right kind of housing structures or modifications. It is questionable in terms of economic returns (Slade and Stubbings, 1994) for sheep housing, but is beneficial because it protects animals from unpredictable and challenging environments (Casamassima *et al.,* 2001) and makes management practices such as feeding, watering, breeding, and lambing easier and smoother (Berge, 1997). The availability of sufficient floor space for sheep is an important housing parameter because it provides comfort, promotes cleanliness with a low risk of injury, resulting in better health, increased growth rate and productivity and improved welfare. The ideal floor should be hygienic, dry, resilient, temperature resistant and animal-friendly (Boe *et al.,* 2006).

Animal behaviour is regarded as one of the first markers of welfare in reaction to changes in the environment caused by various types of housing and management (Engeldal *et al.,* 2013). Change in space allowance, particularly floor space in the resting area, is more susceptible to sheep aggression than changes in group size (Jorgensen *et al.,* 2009). Animals' feeding, resting, and standing behaviour may be affected by the amount of floor space available (Centoducati *et al.,* 2015). Insufficient floor space encourages divergent behaviour and declines output (Mason *et al.,* 2007). The present study was therefore planned to study the effect of different floor space allowances on body weight changes, and voluntary feed/nutrients and water intake in indigenous sheep.

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Materials and Methods

The present experiment was carried out at Livestock Farm Complex (LFC), Veterinary College, Kamdhenu University, Anand (Gujarat, India). Total 45 adult dry non-pregnant (20-35 kg body weight) farm born indigenous ewes (Marwari, Patanwadi & Dumma) were distributed randomly on body weight basis into three treatment groups according to provision of floor space *i.e.*, T_1: 1.5 m^2 (4 animals in each pen), T_2: 1.25 m^2 (5 animals in each pen) and T_3: 1.0 m^2 (6 animals in each pen) with three replications in each treatment. The experimental ewes were kept in well-ventilated and full-monitored asbestos roof house constructed length wise east to west in direction having earthen (kachcha) floor in both covered and uncovered area. The present experiment was conducted for six-week duration with 15 days of adaptation period prior to start of the experiment. The experimental ewes were maintained according ICAR (2013) feeding standard. The ewes were fed thrice in a day, *i.e.*, 200 grams compound concentrate mixture (Amul dan) and 300 grams dry roughage (sorghum hay) in the morning (8.30 am and 10:30 am, respectively), and 1.5 kg green fodder (maize) in the afternoon (4:30 pm). The decreased or increased in quantity of feed and water offered to experimental ewes depended upon the leftover on the next day morning.

The body weight (kg) of all animals from each treatment was recorded individually prior to morning feeding and watering using electronic weighing machine every fortnightly, and subtracted from previous body weight to know the status of body weight of experimental animals throughout the experimental period. The left-over quantity of feed and water was collected and weighed every morning to obtain an estimate of intake by subtracting the amount of leftover from quantity offered. The daily record of feed and water intake was maintained throughout the experimental period. The samples of feed offered were subjected to oven drying every week for determination of dry matter content. The values thus obtained were used in computing the dry matter intake (DMI; g/d) by the animals. The data were analyzed using factorial completely randomized design (Snedecor and Cochran, 1994).

Results and Discussion

The mean initial body weight (kg) of adult ewes was recorded 30.20±0.24, 30.51±0.20 and 30.45±0.20, whereas at the end of the experiment it was recorded as 31.28±0.35, 31.60±0.08 and 31.73±0.67 for T_1, T_2 and T_3 groups, respectively. The treatment effect and interaction of treatment and period did not differ significantly. However, period effect influenced significantly ($p<0.05$) the body weight, being higher at 4th fortnight (Table 1). It indicated that the ewes reared on 1.5, 1.25 and 1.0 m^2 floor space did not affect body weight significantly. Earlier experiments carried out by few scientists also recorded non-significant effect of floor space on growth of animals (Van *et al.*, 2007; Zhang *et al.* 2009; Jongman *et al.*, 2017; Thakur *et al.,* 2017). On the contrary, Horton *et al.* (1991) reported significant influence of different space allowance on the growth of animals, which contraindicated present finding. At the end of the experiment, even after having significantly higher ($p<0.05$) DMI in T_3, the difference in body weight gain was similar in T_1 and T_3 groups, so energy gained by taking more feed may be utilised in eating, standing and negative social interactions in T_3 group as this group was having 33.33 % less space compared to control group. Similar trend for such behaviour was observed by Thakur *et al.* (2017) in Beetal kids.

Table 1: Fortnightly body weight (kg) of indigenous ewes on different floor space

Fortnightly periods	Floor space allowance		
	T_1 (1.5 m^2)	T_2 (1.25 m^2)	T_3 (1.0 m^2)
P_1	30.20±0.24	30.51±0.20	30.45±0.20
P_2	30.04±0.33	30.12±0.35	30.14±0.24
P_3	30.54±0.43	30.33±0.54	30.73±0.26
P_4	31.28±0.35	31.60±0.08	31.73±0.67
Mean	**30.51±0.21**	**30.64±0.22**	**30.76±0.24**

Note: Treatment mean did not differ significantly ($p >0.05$).

The DMI was significantly ($p<0.05$) influenced by treatment and period. The animals of T_3 group consumed overall 1.51 and 2.38% higher DM ($p<0.05$) than animals of T_1 and T_2 groups, respectively (Table 2). Thakur *et al.* (2017) also reported significantly higher time spending for eating in lower space allowance group as compared to higher or desirable space allowance group in Beetal kids. This may be the reason that in present study, DMI was significantly ($p<0.05$) higher in T_3 group as compared to other groups. Norouzian (2017) also reported lesser DMI in middle space allowance group as compared higher and lower space allowance group of growing lambs, which supports present findings. Animals may not prefer to sit in lower floor space allowance shed, which may be the reason of more standing that finally leads to higher consumption of feed. Sheep are very social animals or herding animals and maintain strict adherence to their flock, which may also be the reason of no adverse effect of lower space allowance observed for DMI (Jongman *et al.,* 2017). Significantly higher water intake (l/d) in T_1 group may also be the reason of lower feed intake as compared to T_3 group. Contrarily, Sheikh *et al.* (2022) reported significantly higher DMI in Surti goats for 1.5 m^2 floor space allowances as compared to 1.25 and 1.0 m^2. In Goats, dominant behaviour may be more pronounced as compared to sheep that may be the reason that dominant goat does not allow sub-ordinates to consume sufficient feed in less space allowance.

The DCPI (Digestible Crude Protein Intake) and TDNI (Total Digestible Nutrient Intake) were significantly ($p<0.05$) influenced by treatment and period effect. The animals of T_3 group consumed overall significantly ($p<0.05$) higher DCP (by 1.05 and 1.66%) and TDN (1.42 and 2.22 %, respectively) than animals of T_1 and T_2 groups, whereas DCP and TDN intake of both T_1 and T_2 groups were at par (Table 2). As significantly higher DM intake was observed in T_3 group, they will be definitely having higher DCP & TDN intake compared to other groups. Norouzian (2017) in growing lambs also recorded similar results. Similarly, Surti goats reared on 1.5 m^2 floor space were reported to consume significantly ($P<0.05$) more DCP and TDN than goats reared on 1.25 and 1.00 m^2 floor space allowances (Sheikh *et al.,* 2022).

The water intake per day/animal and per kg DM intake was significantly ($p<0.05$) influenced by treatment and experimental periods. However, interaction of treatment and period did not influence these parameters significantly. The water intake per day/animal in animals of T_1 group was observed significantly (p<0.05) higher by 11.60 and 16.00 %, and that of per kg DM intake by 10.86 and 17.43% as compared T_2 and T_3 group, respectively (Table 2). Results of Sheikh *et al.* (2022) on Surti goats closely supports the present findings. The results for water intake obtained by Modi (2019) were, however, contrary to present finding. El-Sabry *et al.* (2023) reported that different space allowances did not significantly affect drinking behaviour. Thakur *et al.* (2017) in their experiment on Beetal kids reported no significant difference for morning water intake, while evening water intake was significantly increased with reducing space allowance.

Table 2: Overall mean (±SE) DM, DCP and TDN and water intake of indigenous ewes on different floor space

Performance parameter	Floor space allowance		
	T_1 (1.5 m^2)	T_2 (1.25 m^2)	T_3 (1.0 m^2)
DMI (g/d/animal)	718.12^x±8.25	711.83^x±8.96	729.15^y±8.71
DCP Intake (g/d/animal)	45.15^x±0.36	44.87^x±0.39	45.63^y±0.38
TDN intake (g/d/animal)	421.73^x±4.54	418.27^x±4.96	427.79^y±4.79
Water intake (l/d/animal)	2.50^y±0.07	2.21^x±0.06	2.10^x±0.06
Water intake (l/kg DMI/ animal)	3.50^y±0.11	3.12^x±0.10	2.89^x±0.10

Superscripts (x, y) within the row differ significantly between treatment (P<0.05).

Conclusion

The body weight of experimental ewes did not differ significantly (P<0.05) by the floor space allowance. The ewes reared on 1 m^2 floor space allowance consumed significantly (P<0.05) more DM, DCP and TDN per animal (g/d) as compared to ewes reared on 1.25 and 1.5 m^2 floor space allowance. However, water intake per animal (l/d,) was more in ewes having 1.5 m^2 space allowance as compared to ewes reared on 1.25 and 1.0 m^2 floor space allowance.

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