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Research

Effect of different types of housing on behavior of Malpura lambs during winter in semi-arid tropical environment

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ABSTRACT

During winter, different types of sheds were constructed to reduce lamb mortality. A study was conducted to assess the effect of different types of housing on the behavior of Malpura lambs during the winter in semiarid tropical condition in terms of suckling, feeding, lying, standing, social interaction, and oral stereotype. Sheds are constructed to reduce winter mortality. This study was carried out for a period of 1 month during winter (January-February). Twenty-one lambs of aged 3-5 weeks were divided into 3 groups of 7 animals each such as G-I (control, n = 7), G-II (bamboo dome, n = 7) and G-III (thermocol-insulated cold-protected shed, n = 7). The G-I lambs were maintained in normal asbestos roofed shed (side wall wire net, curtains at night time), whereas G-II lambs were maintained in a local hand-made bamboo dome structures. G-III lambs were kept in thermocol-insulated (roof and doors were made up of asbestos, thermocol, and polyvinyl chloride sheet, brick side wall) roofed shed from 6:30 PM to 7 AM. The lambs were exposed to their mother in the morning (7 AM to 7:30 AM) and evening (5:30 PM to 6 PM) for suckling. Lambs were provided with ad libitum green fodder, dry roughage, and concentrate in an open area from 8 AM to 5:30 PM. Behavioral recording was carried out for 1 animal from each group daily (once weekly for each animal) by 3 people (1 person for 1 lamb). G-III lambs showed higher weekly body weight gain and higher milk intake. Total feeding time was 22.44% higher in G-III compared to G-I lambs. Drinking time was higher in G-I lambs compared with those in the other groups. Standing time was significantly higher ($P < 0.05$) in G-II lambs, whereas lying time was higher in G-I lambs. The lambs kept in the dome showed a greater frequency of oral stereotypies. The findings from this experiment provide useful information to understand the necessity of adequate space and the effects of temperature requirements for behavioral expression and growth of lambs in semiarid tropical environments.

Introduction

Productivity of livestock is substantially increased through shelter management by mitigating environmental stress (Nienaber and Hahn, 2007). Environmental factors have a profound effect on lamb survival in extensive management (Everett-Hincks et al., 2014). Shelter may manipulate the microenvironment, which can affect lamb survival. Provision of suitable housing is one of the key factors for successful raising of lambs. Postnatal growth rate depends mainly on nutrition and management, which includes the housing system (Bach, 2012) .

In the semiarid region, sheep farming is one of the most important livelihoods for the poor and marginal farmers. During winter, lamb mortality and slow growth rate are the major constraints in sheep rearing in this region. As the farmers are poor and marginal, they need a low-cost rearing system that can protect the lambs from cold. They generally keep the lambs inside bamboo

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domes to protect them from cold. Mostly the organized farmer prefers asbestos roofing sheds. We have also constructed 2 types of novel sheds for lambs to protect them from cold. One is thermocol-insulated shed and another is low-cost bamboo dome structure. These types of sheds mainly focus on the enrichment of the microenvironment. Environmental enrichment has an effect on physiology and behavior of animals of different species (Young, 2003) and can be particularly effective in the research setting to reduce the incidence or severity of undesirable or abnormal behaviors.

Behavior is considered as "first line of defense" of animals in response to environmental change. Behavioral observation can give information on animal's preference, requirements, and internal states (Engeldal et al., 2013). Available floor space allowance may affect the feeding, lying, and standing behavior of animals (Centoducati et al., 2015). Inadequate space availability may develop abnormal behaviors that injure the animal itself or other animals in the social group (Mason et al., 2007). Environmental enrichment may reduce the frequency or severity of these behaviors or even prevent them from developing. In sheep that have inadequate space to move and lack of environmental stimulation in their housing may lead to the development of abnormal behaviors like stereotype behaviors (Price, 2008). Abnormal mouth movements like licking objects or themselves are commonly seen when animals are raised in individual crate. Keeping the animals in groups help in socialization, increases space access, and influences their activity and play (Kor et al., 2011). Although some researchers reported that the type of housing has no effect on growth performance and feed conversion ratio (Van et al., 2007; Villeneuve et al., 2009), naturally ventilated calf housing during winter has been shown to have a positive effect on feed intake and growth rate of young calves (Razzaque et al., 2009).

The growth of lamb depends on milk intake. Therefore, understanding of suckling behavior is necessary for the sheep industry. Postnatal growth rate depends on nutrition and management (i.e., grouping strategies and housing systems). Many studies have been done on suckling behavior of lambs (Nowak et al., 1997). Housing can affect the feeding, drinking, standing, and resting behavior of sheep (Sevi et al., 2009; Caroprese et al., 2009). If the housing conditions do not facilitate this behavioral synchrony, the conditions may directly increase the frequencies of physical displacements and disturbed resting (Bøe et al., 2006).

This experiment was conducted on Malpura lambs. Malpura breed originated and it is well adapted to the environment of arid and semiarid tropical regions of India. There has been limited study regarding the effect of environment factors or housing system on the behavior of sheep. Most of the behavioral studies were carried out under grazing conditions. Hence, an attempt has been made in this study to establish the effect of housing on the behavior of lambs. We sought to determine the effect of different types of housing during winter on behavior and growth performance of lamb.

Materials and methods

Site of the study

The experiment was carried out at the sheep farm of ICAR-Central Sheep and Wool Research Institute, Avikanagar, Rajasthan, for a period of 35 days (5 weeks) during January and February. The institute is located at the longitude of 75°28′E and latitude 26°26′N and at an the altitude of 320 m above the mean sea level in the semiarid region of the country. The average annual ambient temperature and humidity ranged from 3°C (minimum) to 46°C (maximum) and 10% (minimum) to 85% (maximum), respectively. The annual rainfall of this area is erratically distributed throughout the year, which ranged from 200 to 500 mm. The mean maximum temperatures, minimum temperatures, relative humidity, and temperature − humidity index during the study period (35 days) in different sheds are summarized in Table 1. The temperature − humidity index was calculated using the formula given by Marai et al. (2007).

Experimental animals and management

Twenty-one Malpura lambs aged 3-5 weeks with an average body weight of 9.97 ± 0.51 kg were used in this study. The present study was carried out for 35 days. Twenty-one lambs were randomly allotted into 3 groups of 7 lambs each such as, G-I (n = 7; control), G-II (n = 7; bamboo dome), and G-III (n = 7; thermocol-insulated cold-protected shed). During the first 7 days, lambs were kept in different sheds for adaptation. The lambs were kept in different shelters during night time (6:30 PM to 7 AM). The lambs were exposed to their mother once in the morning (7 AM to 7:30 AM) and again in the evening (5:30 PM to 6 PM) for suckling in an open area where they were kept during the day times. They were provided with ad libitum green fodder, dry roughage, concentrate (barley, 650 g/kg; groundnut cake, 320 g/kg; minerals, 30 g/kg including 10 g/kg NaCl; crude protein, 180 g/kg; and total digestible nutrients, 650 g/kg) and water in an open space of 9 m × 5.4 m from 8 AM to 5:30 PM.

Housing system

The lambs of the control group (G-I) were maintained in asbestos-roofed shed. The height of the roof was 2.55 m at the center and 1.73 m at the side. The length and width were 2.6 m and 2.5 m, respectively. Four sides of the shed were covered by wire net fencing. During night time, the sides were covered with curtains to protect them from chilling draught. Seven lambs were kept in this system, each having floor space allowance of 0.93 m^2, and cubic air space per lamb was 1.99 m^3.

The lambs of the second group (G-II) were kept in the dome-shaped structure which was constructed of bamboo. The height of the dome was 0.48 m; the diameter was 0.9 m and in each dome, 2 lambs were kept. Floor space allowance for each animal was 0.32 m^2; cubic air space per lamb was 0.08 m^3. The domes were kept inside the asbestos-roofed shed. Four bamboo domes were used to keep the 7 experimental lambs. One extra lamb (non experimental lamb) was kept along with the last lamb in the fourth dome to make it consistent.

The lambs of the third group (G-III) were maintained in thermocol-insulated cold-protected shed. The height of the shed

Table 1
Meteorologic data during the experimental period in different housing

Weather parameters[a]	G-I	G-II	G-III
Minimum temperature (°C)	8.5 ± 0.7^{e}	14.6 ± 0.5^{c}	11.8 ± 0.6^{d}
Maximum temperature (°C)	25.0 ± 0.3^{c}	23.9 ± 0.4^{cd}	22.6 ± 0.4^{d}
Relative humidity (%)	59.2 ± 4.5	66.4 ± 2.0	56.4 ± 3.7
Temperature − humidity index[b]	12.5 ± 0.9^{d}	16.1 ± 0.6^{c}	14.0 ± 1.0^{cd}
Wind velocity (m/s)	5.58 ± 0.4	5.58 ± 0.4	5.58 ± 0.4

G-I, control; G-II, dome; G-III, thermocol insulated.
Values within a row with different superscripts (c, d, e) differ significantly at $P < 0.05$.
[a] The meteorologic data were recorded at 7 AM and 2 PM.
[b] Temperature − humidity indices (THI) were calculated with the formula of THI = db °C − [(0.31 − 0.31 RH) (db °C − 14.4)], given by Marai et al. (2007).