



## Impact of bedding material on behavioural pattern of Osmanabadi goat kids

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### ABSTRACT

Bedding materials play significant role to provide comfortable microenvironment to animals under intensive production system, which can be assessed by behaviour of the animal. The present study observed the effect of bedding material in different behaviour parameters of Osmanabadi goat kids. A total number of 18 Osmanabadi goat kids between 2-3 months of age were distributed into three groups (6 kids per group): control (T0) and treatments (T1, T2). The kids in T0 were reared in concrete floor without any bedding material, whereas treatment groups T1 and T2 were composed of wood shavings and straw bedding material, respectively. At the end of experiment lying time per day of T2 group was significantly higher as compared to T0 and T1 groups. Lying time per bout was significantly higher in T2 group than T0 group, but corresponding values were similar to that of T1 group. Standing time per day was higher in concrete floor (T0) as compared to wood shavings and straw bedding group. Fighting behaviour was significantly higher in kids kept in concrete floor and wood shavings group than those kept in straw bedding group. Grooming behaviour was higher in T2 group as compared to T0, but similar to T1 group and kids had more negative behaviour in concrete floor. Overall, it can be concluded that straw bedding has a positive influence on the welfare of growing kids and therefore can be used as an alternative bedding material in growing goat kids.

**Keywords:** Bedding, Behaviour, Osmanabadi goat kids, Straw bedding

Animal welfare includes not only physical health but also psychological well-being. Bedding substrates can help animals adapt to a new environment by providing them with environmental enrichment. The animals reared on the bedding material, showed a tendency of higher body weight gain (Sutherland *et al.* 2019). Researches have shown that softer floors like straw bedding, wood shavings are preferred than harder floor like concrete or different kinds of slatted floors (Faerevik *et al.* 2005). Less lying and more standing poses give stress to animals. The indirect effect of stress is reduced feed intake, which lowers desired body condition score and reduced secretion of leptin (Bova *et al.* 2014), thus affecting the growth, onset of puberty, birth weight, growth of mammary tissues and milk production. The main problem of kid rearing is the post-weaning environmental condition that leads to poor growth, which is significantly affected by housing management (Dadi *et al.* 2008).

The knowledge about animal behaviour is an effective tool for better farm management and to eliminate abnormal conditions that may cause poor feed conversion ratio, poor carcass value and increased mortality (Fraser and Broom 1990). Growth rate, production and income are directly affected by feeding behaviour. It is an important

parameter for evaluation of animal welfare (Yakan *et al.* 2007). Further, bedding materials have thermo-insulation properties and are most essential in pens with no climate control facilities (Wolf *et al.* 2010). Bedding material is a key component in housing of kids during winters (Behera *et al.* 2016). Basically, bedding materials are selected based on their availability and cost effectiveness. In general, straw bedding is most preferred by the animals and has positive effect on their welfare status (Tolu and Savas 2019); although there is a dearth of a comparative studies using different bedding materials and furthermore probe their effect on behaviour of goat kids. Keeping these in view, present study was envisaged to study the effect of bedding materials on behaviour (lying, feeding, standing and social behaviour) of Osmanabadi goat kids.

### MATERIALS AND METHODS

The present study was conducted at Seed centre of Osmanabadi goats under Directorate Research Service, DSVCKV, Durg, Chhattisgarh, India which is situated at height of 317 meters above mean sea level at latitude and longitudes between 20°23' and 22°02' N and 80°46' and 81°58 E, respectively. The weather of this place is dry tropical, which is moderate. But summer season is warm. In summer the highest temperature reaches up to 45°C in May-June, whereas in winter temperature falls down up to 10°C. Total 18 Osmanabadi weaned kids of 2-3 months of

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age were selected for the experiment and randomly divided in three groups. T0, T1 and T2 with 6 animals in each group. All the animals of T0 group were reared on concrete floor without bedding material as control. The kids of T1 group were reared on concrete floor with wood shaving and straw served as the bedding material in T2 group. The total duration of experiment was 60 days during winter season. Standard management practices were adopted during the research work. The animals were kept in well ventilated, pucca floored house in hygienic condition. The animals were fed as per farm standard (National Research Council, 2001). Free access of fresh and clean water *ad libitum* was given to the experimental animals. Experimental procedures were approved by the Institutional Animal Ethics Committee

The behaviour of all kids were recorded by using CCTV (CP Plus camera's - night vision) cameras for 24 h every fortnight for 2 months and the data was analyzed for lying behaviour (daily lying time, lying bout and bout duration), feeding time (daily feeding time, feeding bout and bout duration), standing time and social behaviour (grooming and fighting). Statistical analysis was done by using IBM-SPSS® software package version 25. The data obtained was analysed by one way analysis of variance (ANOVA) using general linear model. Tukey post hoc test was used to compare pairwise difference and was considered as statistically significant when  $P \leq 0.05$ .

## RESULTS AND DISCUSSION

### *Effect of bedding material on behaviour of Osmanabadi goat kids*

**Lying time/day:** The average lying time/day of T2 group was significantly higher ( $P \leq 0.01$ ) than that of control (T0) group and T1 group on 15<sup>th</sup> day and 30<sup>th</sup> day of experiment. Interestingly, the lying time/day in groups with bedding material was found to be consistently higher than control group from day 45<sup>th</sup> to 60<sup>th</sup> of the study (Table 1). At 60<sup>th</sup> day, average lying time/day of kids of T2 group was significantly higher ( $P \leq 0.01$ ) than T1 and T0 groups. The difference in lying time/day between the groups may be attributed to preference of kids towards soft material (straw and wood shavings) used in treatment groups than concrete. Earlier research had documented the importance of bedding material for enhancing the animal welfare in farms. Provision of straw bedding helped to improve animal welfare by increasing comfort and enriching the environment (Tuytens 2005). The present findings of mean

lying time are in accordance with Pascual-Alonso *et al.* (2015) who reported that straw area was used frequently for resting (lying) by fattening lambs as compared to concrete or without straw area. Straw was involved in providing softness and the thermal conductivity to the animals from hard surface and cold climatic conditions during the winter (Faerevik *et al.* 2005). According to Fregonesi and Leaver (2001), deep straw was preferred by dairy cows over cubicles housing. Recently, Sutharland *et al.* (2019) found that kids spent more lying time on wood shaving with lamps than other treatments indicating wood shaving could offer better comfort and improve welfare as compared to normal floor. When stalls were bedded with more amount of bedding material (straw), cows spent more time resting on thick bedded surface, indicating additional bedding to be more comfortable (Tucker *et al.* 2009). Lower level of plasma cortisol level in bedding (straw) supplemented kids might be favour that straw bedding could help to cope up with environmental challenges (Teixeira *et al.* 2012). Tolu and Savas (2019) reported that goats spent more time for lying over straw than slatted and solid floors. The result exhibited that the thermal conductivity and softness of the floor were of great importance for kids.

**Lying bout:** The findings suggested that the lying bout did not differ significantly between the groups. There was no change in lying frequency in kids during the study. Though lying or resting time was higher in treatment groups suggesting increased comfort in bedding material leading to increased duration of resting (Supplementary Table 1). In disagreement with the present results, Tucker *et al.* (2009) found that lying bouts/day were higher when stall had more bedding (straw) in dairy cattle. Similarly, Campler *et al.* (2018) found that deep bedded straw during dry period increased the number of lying bouts compared to a cubical housing. This may be due to difference in behaviour among species and physiological state of animals used in aforesaid studies. Contrary to the present findings, Sutharland *et al.* (2019) documented that kids showed more lying bouts on wood shaving with heat source than kids in pen with no heat lamps. This may be attributed to different experimental settings, effect of climatic conditions, age and difference in individual behaviour across breeds of goats.

**Lying time/bout:** At the beginning and 15<sup>th</sup> day of the experiment, mean lying time/bout of all the three groups was comparable. However, at 30<sup>th</sup>, 45<sup>th</sup>, and 60<sup>th</sup> day the mean lying time/bout of T2 group was significantly higher ( $P \leq 0.05$ ) than the T0 group but similar to T1 group

Table 1. Impact of bedding material on lying time/day (minutes) in Osmanabadi goat kids (Mean±S.E.)

Day	Overall mean	T0	T1	T2	P value
0	590.78±8.2	584.50±19.91	583.33±12.87	604.50±8.46	0.526
15	622.22±13.49	584.17 <sup>a</sup> ±17.64	607.50 <sup>a</sup> ±23.49	675.0 <sup>b</sup> ±10.22	0.008**
30	618.65±17.50	555.32 <sup>a</sup> ±18.86	618.33 <sup>a</sup> ±26.90	682.32 <sup>b</sup> ±16.49	0.003**
45	631.00±11.38	591.00 <sup>a</sup> ±6.20	638.33 <sup>ab</sup> ±22.61	663.67 <sup>b</sup> ±15.12	0.019*
60	626.67±12.32	573.00 <sup>a</sup> ±8.01	631.67 <sup>b</sup> ±19.01	675.33 <sup>c</sup> ±8.28	0.000**

Mean bearing different superscripts within a row differed significantly \*\* $P \leq 0.01$ , \* $P \leq 0.05$ . T0, Concrete floor; T1, Wood shavings and T2, Straw.

Table 2. Impact of bedding material on lying time/bout (minutes) in Osmanabadi goat kids (Mean±S.E.)

Day	Overall mean	T0	T1	T2	P-value
0	30.17±0.99	29.07±2.21	28.72±1.14	32.74±1.38	0.196
15	29.21±0.95	28.40±1.46	28.91±1.86	30.44±1.81	0.686
30	27.77±0.97	24.58 <sup>a</sup> ±0.55	27.86 <sup>ab</sup> ±1.02	31.28 <sup>b</sup> ±1.81	0.006**
45	31.10±1.84	25.95 <sup>a</sup> ±1.10	30.11 <sup>ab</sup> ±1.41	33.90 <sup>b</sup> ±4.28	0.001**
60	30.13±0.96	27.27 <sup>a</sup> ±1.55	30.71 <sup>ab</sup> ±1.58	32.42 <sup>b</sup> ±1.35	0.023*

Mean bearing different superscript within a row differed significantly, \* $P \leq 0.05$ , \*\* $P \leq 0.01$ . T0, Concrete floor; T1, Wood shavings and T2, Straw.

(Table 2). The present study showed increased duration of lying rather lower bouts in treatment groups as compared to control group. This finding suggested that uninterrupted resting/lying behaviour was exhibited in straw bedding group kids followed by wood shaving kids. Some studies showed that, average lying time/bout (minute/bout) did not affect by more amount of bedding material (Tucker *et al.* 2009). In contrast to present investigation, Haley *et al.* (2001) concluded that the duration of individual lying bouts was longer on concrete flooring. On mattress flooring, cows stood up and lay down more often than on concrete.

**Feeding time:** In different consecutive day up to the end of the experimental period there was no significant difference of average feeding time of kids of the control and treatment group. However, mean feeding time (minutes/day) of T2 group had non-significantly higher values as compared to control and T1 groups on 30<sup>th</sup>, 45<sup>th</sup> and 60<sup>th</sup> day of experiment (Supplementary Table 2). Similar to the present results, Wolf *et al.* (2010) reported no significant effect of bedding material on feeding behaviour of the lambs. Day *et al.* (2006) used straw and plastic slat beddings for lambs, they found no significant difference in feed intake among lambs. Kartar and Yanar (2011) reported that different types of floor did not affect the feeding behaviour of Brown Swiss calves. There was no significant difference between loose housing and conventional housing for feeding behaviour of kids (Bhakat and Nagpaul 2005). The increase in the feeding time with the progression of the experiment may be attributed by the growing age of the kids (Zamuner *et al.* 2023). The group with straw bedding showed slightly higher feeding time followed by wood shaving group and control group which explains the higher comfort in straw bedding followed by wood shaving group and concrete group.

**Feeding bouts/day:** The feeding behaviour (bouts/day) of Osmanabadi kids was non-significant in treatment groups as compared to its respective control. There was non-significant difference observed between the treatments throughout the experimental period (Supplementary Table 3). The results of present investigation are in agreement with Wolf *et al.* (2010) observed no significant effect of bedding material on feeding behaviour of lambs, i.e. feeding time and frequency. Fraser *et al.* (1991) documented no significant effect of straw bedding on the feeding behaviour of growing pigs. The present finding showed that bedding material had no adverse effect on

the feeding frequency or normal feeding behaviour as compared to control group.

**Feeding time/bout:** The present result showed that bedding material had no significant effect on feeding time / bout (Supplementary Table 4). This can be well explained with the fact that feeding time and feeding bout did not differ among all the three groups, which is in the agreement with other researchers. Wolf *et al.* (2010) reported no significant effect of bedding material on feeding behaviour of the lambs. Day *et al.* (2006) used straw and plastic slat beddings for lambs, they found that there was no significant difference in feed intake among lambs. Kartar and Yanar (2011) reported that different types of floor did not affect the feeding behaviour of Brown Swiss calves.

**Standing time:** The average standing time of group T0 and T1 was significantly higher ( $P \leq 0.01$ ) than that of T2 on 15<sup>th</sup> day of the experiment. The result showed a decreasing trend in average standing time (minutes/day) in T1 and T2 groups from 0 day to 30 day of experiment period, however no such trend was observed in the control group during the experiment (Supplementary Table 5). Moreover, to this the average standing time was significantly ( $P \leq 0.01$ ) higher in control group followed by T1 than T2. Present findings of mean standing time/day are in accordance with Pascual-Alonso *et al.* (2015) who reported that standing time was significantly higher in the areas without straw bedding than the area with straw bedding. The study of Tolu and Savas (2019) showed that dairy goats had more standing behaviour over the slatted floor than straw. This can be the reason in our experiment also, as the straw is softer material compared to wood shaving and concrete floor making comfortable floor to lie down, thereby reducing the standing time in treatment groups as compared to the control group. In contrary to present results Wolf *et al.* (2010) documented that the lambs used woodchip almost twice than straw for lying or standing and preferred by lamb over straw. This may be attributed due to difference in the quality of bedding material, difference of species behaviour and effect of different climatic conditions. It was observed during the entire experimental period that the average standing bouts/day of Osmanabadi kids did not differ significantly.

**Standing bouts:** Results showed no significant difference in average standing bouts/day between the groups during entire experiment duration (Supplementary Table 6). The normal standing frequency of kids didn't vary. However, the average standing time per bout was lower in treatment

Table 3. Impact of bedding material on grooming frequency in Osmanabadi goat kids (Mean±S.E.)

Day	Overall mean	T0	T1	T2	P-value
0	9.22±0.48	9.50±0.76	9.00±1.00	9.17±0.87	0.921
15	9.50±0.58	8.83±1.22	9.00±0.96	10.67±0.98	0.390
30	10.17±0.54	9.00 <sup>a</sup> ±0.36	9.33 <sup>ab</sup> ±0.33	11.83 <sup>b</sup> ±1.01	0.076
45	9.22±0.38	8.00 <sup>a</sup> ±0.51	9.67 <sup>ab</sup> ±0.89	10.33 <sup>b</sup> ±0.76	0.033*
60	10.56±0.51	9.00 <sup>a</sup> ±0.51	10.33 <sup>ab</sup> ±0.71	12.33 <sup>b</sup> ±0.88	0.017*

Mean bearing different superscript within a row differed significantly, \*\*P≤0.01, \*P≤0.05. T0, Concrete floor; T1, Wood shavings and T2, Straw.

Table 4. Impact of bedding material on fighting frequency in Osmanabadi goat kids (Mean±S.E.)

Day	Overall mean	T0	T1	T2	P-value
0	7.22±0.37	7.83±0.65	6.67±0.71	7.17±0.60	0.472
15	8.22±0.38	8.67±0.76	8.67±0.66	7.33±0.49	0.276
30	7.06±0.51	8.33±0.80	7.33±1.02	5.50±0.42	0.065
45	6.78±0.46	8.50 <sup>b</sup> ±0.61	7.00 <sup>b</sup> ±0.51	4.83 <sup>a</sup> ±0.40	0.001**
60	7.11±0.70	9.33 <sup>b</sup> ±0.80	7.67 <sup>b</sup> ±1.22	4.33 <sup>a</sup> ±0.49	0.004**

Mean bearing different superscript within a row differed significantly, \*\*P≤0.01. T0, Concrete floor; T1, Wood shavings and T2, Straw.

groups as compared to the control group.

**Standing time/bout:** The effect of bedding material on average of standing time/bout was found non-significant between the groups. Though our result showed no significant effect of bedding material on standing time/bout (Supplementary Table 7) a non-significantly higher standing time/bout in control group was found as compared to the T1 and T2 groups. In agreement with present investigation, Pascual-Alonso *et al.* (2015) studied spatial preferences and behavioural patterns of lambs during fattening in straw enriched pens. They found that in the areas without straw, animals walked more, remained standing longer periods (P≤0.05) per bout as compared to the pen with straw. Previously, a study conducted on lactating cow it was found that the duration of individual bouts of standing was longer on concrete flooring (Haley *et al.* 2001). Cows stood up and lay down more on mattress flooring often than on concrete. On concrete cows spent more time standing without eating. This is explained by the fact that the lying behaviour in the bedding groups is high as compared to the concrete floor without bedding. While the concrete floor without bedding didn't provide much comfort and thermoregulation to the kids making them stand for longer time/bout.

**Grooming frequency:** The grooming frequency of T2 group was significantly higher than T0 and T1 group at 30<sup>th</sup> day, 45<sup>th</sup> day and 60<sup>th</sup> day of experiment (Table 3). Comfort behaviour patterns presenting in sleeping, lying and grooming behaviour were accepted as measure of animal welfare (Duncan 1995). The study revealed that wood shaving bedding with heat source or without heat source did not affect the grooming behaviour (Sutharland *et al.* 2019). Panivivat *et al.* (2004) found that self-grooming behaviour of calves was higher on sand and rice hull than those housed on long wheat straw might be due to rice hull adhered to the skin of calves and its increased self-grooming.

**Fighting frequency:** The average fighting bouts of T2 group was observed to be significantly (P≤0.01) lower than T0 and T1 group during 45<sup>th</sup> and 60<sup>th</sup> day of experiment (Table 4). The results of present experiment are in accordance with Pascual-Alonso *et al.* (2015) who observed that the provision of straw bedding reduces the aggressive and stereotypic behaviour of fattening lambs than without straw areas and Teixeira *et al.* (2015) also found that agonistic behaviour was more at the beginning (0 day) and then gradually decreased on straw bedding and level of plasma cortisol concentration was also lower in animals. According to Day *et al.* (2008), when full length or halved chopped straw as a bedding material was provided to pigs, tail-biting was reduced than chopped straw and level of nosing other pigs, aggression and tail-biting was significantly reduced as compared to no straw treatment.

It can be concluded that standing, lying, feeding, grooming and fighting frequency of goat kids were observed favourably by providing bedding material than concrete floor to ensure better animal welfare and production. Undesirable behaviours were observed in concrete floor. Hence, straw can be recommended as better bedding material than wood shavings.

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