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Mohit Antil
Livestock Production Management division, Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttar Pradesh, India

Bhuvaneshwar Rai
Animal Physiology and Reproduction division, Central Institute for Research on Goats, Makhdoom, Mathura, Uttar Pradesh, India

Chetna Gangwar
Animal Physiology and Reproduction division, Central Institute for Research on Goats, Makhdoom, Mathura, Uttar Pradesh, India

Ramachandran Natesan
Animal Physiology and Reproduction division, Central Institute for Research on Goats, Makhdoom, Mathura, Uttar Pradesh, India

Seema Yadav
Livestock Production Management division, Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttar Pradesh, India

Correspondence
Mohit Antil
Livestock Production Management division, Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttar Pradesh, India

Effect of bedding material on enzymatic and hormonal profile of Barbari kids during winters

Mohit Antil, Bhuvaneshwar Rai, Chetna Gangwar, Ramachandran Natesan and Seema Yadav

Abstract
The present study was conducted with the objective to compare the enzymatic and hormonal profiles of Barbari Kids raised on different bedding materials during winter season. Thirty post-weaned Barbari kids of about three months age were selected from the institutional flock, which were divided into three groups viz. group I, II and III with ten kids in each group and were kept on plastic slats, soil and rubber mats, respectively. The mean values of triiodothyronine (T3) were 2.19, 1.82 and 2.23 (IU/L) in Gr-I, II and III, respectively and were comparable ($P>0.05$) among all the groups. The mean thyroxine (T4) values were 3.59, 2.68 and 2.58 (µg/dl) in Gr-I, II and III, respectively. The concentration of T4 was significantly higher ($P<0.05$) in Gr-I than Gr-II and III. The mean cortisol values were 64.28, 45.01 and 75.12 (ng/ml) in Gr-I, II and III, respectively. The concentration of cortisol was comparable ($P>0.05$) among Gr-I and II and also among Gr-I and III, whereas significantly different ($P<0.05$) among Gr-II and III. The mean AST values were 55.30, 50.64 and 62.07 (IU/L) in Gr-I, II and III, respectively and were comparable ($P>0.05$) among all the groups. The mean ALT values were 13.75, 11.57 and 20.45 (IU/L) in Gr-I, II and III, respectively and were significantly higher in Gr-III ($P<0.05$) as compared to other groups. The mean ALP values were 49.95, 46.53 and 39.49 (IU/L) in Gr-I, II and III, respectively and were comparable ($P>0.05$) among the groups. ALT increased whereas AST remain unchanged during stress. Levels of AST and ALT are helpful in diagnosis of comfort level to the animals. The increase in cortisol and T4 levels can be attributed to the increased energy requirement to augment gluconeogenesis due to lower surface temperature of slatted floor and more disease incidence on rubber floor.

Keywords: Bedding material, enzymatic, hormonal, barbari goat kids, winter season

Introduction

The adaptability to wide range of climatic conditions is one of the most pertinent reason for preference of goats, as compared to other domestic species, among small and marginal farmers of India for their livelihood (Devendra 1990; Rekib 1998) [3] [13]. Goats exhibit excellent adaptability to all types of environmental severities and superior performance over the other domesticated ruminants (Shkolnik and Silanikove 1981; King 1983) [14] [8]. The survival of goats at very high as well as very low temperatures has been ensured by their well-developed adaptive mechanisms. However, thermal stress often results in reduction of their productivity despite their adaptability to climatic adversities, (Al-Tamimi 2007) [1].

Bedding material is key factor of housing affecting kids during winters. The bedding material can help in facilitation of better animal welfare and health (Behera *et al*., 2016) [2]. Unavailability of appropriate bedding may lead to stress and reduction in comfort during winters, which consequentially hampers the productivity of livestock making them prone to different diseases and parasitic infestation. The ability to moderate the extremes of climatic stress and providing favourable microclimate is an essential function of the bedding material (Rahman *et al*., 2013) [11]. The pivotal characteristics of bedding material for farm animals are considered to be thermal conductivity, softness, cleanliness and slipperiness. These characteristics affect both animal preferences and thermoregulatory behavior (Færevik *et al*., 2005) [4]. When an animal is exposed to environmental stress it utilizes the energy available for different productivities to maintain a thermal balance between the heat they produce or gain from their environment (Lu, 1989) [9]. This is clearly manifested through various reactions, e.g., hormonal changes leading to increment in metabolism leading to heat production during winters to maintain body temperature and enzymatic changes (Behera *et al*., 2016) [2]. Keeping all these aspects in mind, the present study was conducted with following objective to study the effect of bedding materials on various enzymatic and hormonal parameters.

Materials and methods

The present study was conducted at Experimental shed complex on ICAR-Central Institute for Research on Goat (C.I.R.G) Makhdoom, Mathura, Uttar Pradesh, India. The climate is hot and semi-arid. Weather turns colder with winter stretching from November to February and summer ranges from May to August month annually.

The animal experiment was initiated in December 2017 and ended in March 2018. A total of 30 post weaned Barbari kids (21 males and 9 females) aged 3 months were selected from institute flock. The kids were randomly allocated to the two treatment groups (Plastic slats and rubber mat) and one control group (Soil floor) on the basis of similar body weight.

Table 1: Dimensions of partitions of pen made for different groups

Group	Bedding material used	Dimensions of partition
1	Plastic Slats	10 feet x 10 feet
2	Soil	10 feet x 10 feet
3	Rubber mats	10 feet x 10 feet

Each group comprised of ten kids (7 males and 3 females). While selecting the animals, due care was taken to minimize the error by narrowing down the range of age and live weights of these experimental animals as far as possible. The study was conducted for a period of 90 days duration with an adaptation period of 1 week prior to recording of variables. The animals were raised under an intensive housing system. A single pen (400 feet^2) was partitioned equally into 4 parts using welded wire mesh. The control and treatment groups were housed in separate partition of the pen having different bedding materials. Out of the three groups, second group served as control.

Blood collection, preservation and analysis

Blood samples were collected on 20th, 50th and 80th day of experimental trail. About 10 ml blood was collected from all the experimental kids in the morning (before feeding) by jugular vein puncture. Blood flow was stopped by applying finger pressure on a gauze pad on the blood sampling site till the bleeding was stopped. Blood was taken into clean and dry test tube and kept in slanting position for 45 minutes to separate serum.

Estimation of hormones in serum samples

Tri-iodothyronine (T_3), Thyroxine (T_4) and cortisol were estimated in plasma samples by Cal biotech CBI Tri-iodothyronine (T_3) ELISA kits (CA, USA). These are solid phase competitive assay to determine the total T_3, T_4 and Cortisol in the serum samples.

Estimation of serum enzymatic constituents

ALT and AST were estimated by the method described by Reitman and Frankel (1957) [12] using diagnostic kit manufactured by Span Diagnostics Limited, Surat, India. Serum alkaline phosphatase (ALP) activity was estimated by p-nitrophenyl phosphate (pNPP) method as per Kalplan and Lavernal (1983) [7] using diagnostic kit manufactured by Span Diagnostics Limited, Surat, India.

Statistical analysis

The experimental data generated were analyzed using one way or two way ANOVA (statistical package SPSS 20.0) and means were compared using Duncan's multiple range test. The P values less than 0.05 were taken to indicate statistical significance by adopting standard statistical procedures (Snedecor and Cochran, 1994) [16].

Result and Discussion

Blood hormonal parameters

The results on the effect of bedding materials on different blood enzymes *viz*. triiodothyronine (T3), thyroxine (T4) and cortisol have been presented in Table 2.

Ambient temperature is one of the key regulator of endocrine gland activity including adrenal and thyroid. The mean T3 values were 2.19, 1.82 and 2.23 (IU/L) in Gr-I, II and III, respectively and were comparable (P>0.05) among all the groups. The mean T4 values were 3.59, 2.68 and 2.58 (µg/dl) in Gr-I, II and III, respectively. The concentration of T4 was significantly higher (P<0.05) in Gr-I than Gr-II and III. The mean cortisol values were 64.28, 45.01 and 75.12 (ng/ml) in Gr-I, II and III, respectively. The concentration of cortisol was comparable (P>0.05) among Gr-I and II and also among Gr-I and III, whereas significantly different (P<0.05) among Gr-II and III.

However, contrary to our results Behera *et al*. (2016) [2] and Singh *et al.* (2017) [15] reported lower T4 and cortisol levels in kids raised on slatted floor, but that was not statistically significant. The increase in cortisol and T4 levels can be attributed to the increased energy requirement to augment gluconeogenesis due to lower surface temperature of slatted floor and more disease incidence on rubber floor.

Table 2: Effect of different bedding materials on hormonal parameters of kids in different groups

Attributes	GROUPS			SEM	P Value
	I	II	III		
Triiodothyronine (ng/ml)					
20 day	1.99	1.72	2.51	0.09	0.133
80 day	2.38	1.92	1.95		
Mean value	2.19	1.82	2.23		
Thyroxine (µg/dl)					
20 day	3.39	3.13	2.71	0.16	0.02
80 day	3.80	2.22	2.46		
Mean value	3.59^{A}	2.68^{B}	2.58^{B}		
Cortisol (ng/ml)					
20 day	75.99	47.88	93.15	4.56	0.020
80 day	52.57	42.13	57.09		
Mean value	64.28^{AB}	45.01^{B}	75.12^{A}		

^{A,B,C} Means bearing different superscripts in a row differ significantly (p<0.05)

Serum enzyme profile

The results on the effect of bedding materials on different blood enzymes *viz*. aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) have been presented in Table 3.

The values of different blood enzymes *viz*. aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) reported in the study were in close agreement with the reference range for goats (Fraser *et al.* 1986) [5]. The mean AST values were 55.30, 50.64 and 62.07 (IU/L) in Gr-I, II and III, respectively and were comparable (P>0.05) among all the groups. The mean ALT values were 13.75, 11.57 and 20.45 (IU/L) in Gr-I, II and III, respectively and were significantly higher in Gr-III (P<0.05) as compared to other groups. The mean ALP values were 49.95, 46.53 and 39.49 (IU/L) in Gr-I, II and III, respectively and were comparable (P>0.05) among the groups.

Similar to our findings, Ocak *et al.* (2009) [10] and Singh *et al.*

(2017) [15] reported that serum ALT increased whereas AST remain unchanged during stress. Levels of AST and ALT are helpful in diagnosis of comfort level to the animals (Gupta *et al.*, 2013) [6].

Table 3: Effect of different bedding materials on plasma enzyme profile of kids in different groups

Attributes	GROUPS			SEM	P Value
	I	II	III		
AST (IU/L)					
20 day	60.05	55.06	61.26	2.08	0.077
50 day	56.96	56.12	58.07		
80 day	48.88	40.74	66.87		
Mean value	55.30	50.64	62.07		
ALT(IU/L)					
20 day	11.45	9.67	22.47	1.00	0.001
50 day	16.24	14.11	19.30		
80 day	13.57	10.95	19.57		
Mean value	13.75^{B}	11.57^{B}	20.45^{A}		
ALP (IU/L)					
20 day	48.19	44.16	40.68	2.73	0.288
80 day	51.72	48.89	38.30		
Mean value	49.95	46.53	39.49		

^{A,B,C} Means bearing different superscripts in a row differ significantly ($p<0.05$)

Ambient temperature is one of the key regulator of endocrine gland activity including adrenal and thyroid. The concentration of T4 was significantly higher ($P<0.05$) in Gr-I than Gr-II and III. The mean cortisol values were 64.28, 45.01 and 75.12 (ng/ml) in Gr-I, II and III, respectively. The concentration of cortisol was comparable ($P>0.05$) among Gr-I and II and also among Gr-I and III, whereas significantly different ($P<0.05$) among Gr-II and III. The following findings indicate towards presence of thermal stress in kids housed on plastic slats, The level of cortisol and ALT were higher in kids housed on rubber mats as excreta from the kids stuck to the surface of rubber mats along with retention of moisture, therefore, provided unfavorable conditions for resting and ideal conditions for disease proliferation.

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