Effect of heat stress on behaviour and physiological parameters of Osmanabadi goats under katcha housing system in Mumbai

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Abstract

The aim of this research was to study the effect of heat stress on behaviour and physiological parameters with eighteen goats of almost similar in age, sex and weight into three groups. The consideration of this experiment was taken on Post weaning Osmanabadi kids i.e after 3 months of age. Three groups were divided basing on the duration of grazing on pasture land to make distinguish on the measures of getting outside temperature and humidity. They are categorized as (T_1) zero hours, (T_2) two hours and (T_3) four hours heat exposure. Skin and rectal temperature had no significant differences among the treatment groups but respiration and pulse rate were increased with the increased of heat stress from T_1 to T_2 group ($P<0.05$). Lying time ($P<0.05$) varied significantly in experimental groups. There were significant changes ($P<0.05$) in number of urination and defecation per hour but no significant changes was found in duration per urination in heat treated groups. It can be concluded that heat stress had significant changes on some physiological parameters and behaviour of goat.

Key words: Heat stress; Osmanabadi goat; physiological parameters; blood profiles

Introduction

Goats are very important farm animals in India. That's why they are called as poor man's cow taking a broader picture of small and marginal farmers. There are 24 registered breeds of goats in India. Among them Osmanabadi goat is one of the best breeds viewing its hardiness, resistance to diseases and advantage of dual benefits of milk and meat. Their native tract is Maharashtra state and adjoining areas of Andhra Pradesh states. As far as heat tolerance is concerned, this breed is quite preferred over other breeds. but the rearing of the goats in the area above thermoneutral zone is a challenging task. Mumbai is a coastal city of Maharashtra. The agony of pain is not due to the affliction of temperature but due to high humidity in this region. In summer season, the humidity ranges from 90-95%.To maintain body homeostasis, domestic animals respond to hot environments in various ways, such as changes in rectal temperature and respiration rate (Sano *et al*., 1985). Increased temperature and pulse rate are the important indicators of heat stress of goats (Helal *et al*., 2010; Sanusi *et al*., 2010). The problems of reducing feed intake, impairment of endocrine functions and the changing pattern of blood flow in its distribution arise due to the effect of heat stress (Eltawill and Narendran, 1990). Thus, heat stress has been generally associated with detrimental effects on physiological equilibriums of goats and their various systems (nervous, endocrine and immune) have been implicated with specific responses and reciprocal regulatory influences (Castanheira *et al.*, 2010). Excessive heat stress may cause hyperthermia and potentially have several physiological side effects and economical impacts on the livestock industry (Lowe *et al.*, 2001). Moreover, under these conditions the animal's productivity severely affected that result in a tremendous economic loss for the goat industry. Therefore, the present study was conducted to investigate the following specific objectives:

i) To analyse the physiological parameters of goats under heat stress.
ii) To investigate the behaviour of goats under heat stress.

Material and Methods

Eighteen indigenous goats either of sex after weaning were selected for the experiment which were almost similar in age and weight. The heat stress period was taken into consideration as 30 days, from 1st May to 31st May, 2015. For acclimatization to the predisposing climate condition, One month was given to animals as a free trial basis. The entire experiment was conducted in Instructional Livestock Farm Complex, Department of Livestock Production Management, Bombay Veterinary College, Mumbai, Maharashtra, India.

The concerned housing of the animals is katcha housing system, which is a cost effective housing system looking out the small and marginal farmers of India. Another advantage is about its maintaining subdued temperature in summer so that providing comfort to the animals. All the goats were kept in three groups (6 kids in each group) in the room separated with small pieces of bamboo like fence materials. Roughage and concentrate feed were supplied everyday at adequate amount. For facilitation of clean and cool water in ad libitum, a water trough of similar sizes was provided for each group. The house was well ventilated and the floor space provision is 0.8m^2 per kid. The floor, stall, water trough, and feeder were cleaned every day. The faeces were removed carefully from the house. Every attempt was executed to make the floor of the pen clean and dry since the floor materials is not of concrete rather of normal soil without any artificial layout. Three treatment groups were made as follows: 0 hours heat exposure control group; 2 hours heat exposure (12 am to 2 pm heat exposure in grazing) and 4 hours heat exposure (12 am to 4 pm heat exposure in grazing).

The initial body weight of each animal was recorded and the animals were weighed weekly by using hanging digital weighing balance and the weighing were carried out at the same time before morning feeding. The data of ambient temperature and relative humidity of these experimental days was collected from Regional Metrological Centre, Mumbai, Maharashtra, India. The average temperature and relative humidity over the 30 days was 43.6^{0}C and Relative Humidity was 88%. Rectal temperature was recorded with Digital Thermometer. The characteristics of behaviours were determined continuously for 30 consecutive days for 4hrs. The jaw movement was recorded by close supervision. Lying time, no. of urination/hr and no. of defecation were determined with close observation and watch. Rumination time and no. of rumination were determined with stop watch. Respiration rate and panting rate were recorded by observing the flank movement of goat. Pulse rate was measured from base of tail by touching. The most iconic way that was adopted was the simultaneous taking of all the observations by three different people to augment the accuracy of experiment. Data were analyzed statistically using the analysis of variance technique in accordance with the principle of Completely Randomized Design (CRD) as proposed by Snedecor and Cochran, 1982.

Results and discussion

Table 1 shows the rectal temperature, respiration/ panting rate and pulse rate in control (T1), and high temperatures- (T2 and T3) exposed goats. There were no changes to rectal temperatures in goats exposed to heat treatments. These results are inconsistent with those of Marai *et al.,* (1997), who reported that heat stress increased rectal temperatures in goats. The relative difference between our results might be due to using different experimental conditions and/or breed and age of goats. The respiration rate tended to increase with T2 heat stress, was increased with T3 heat stress compared to the control group. The present results were in agreement with Habeeb *et al.,* (1992), who reported that respiration rate can be elevated through heat stress in goats. During summer, the respiration rate is higher than in winter for goat (Fahmy, 1994). Goats exposed to heat exposure showed higher pulse rate compared to the control group. The rate increases on exposure to high environmental temperature (Aboul-Naga, 1987. The eating time and chewing rate in control (T1), and high temperatures (T2 and T3) exposed goats and also shows the rumination time, number of rumination per minute in control (T1), and high temperatures- (T2 and T3) exposed goats. There were no changes to rumination time in goats exposed to different heat treatments. However, relative to control groups, the number of rumination per hour was decreased by T2 and T3. Rumination time is decreased cause of heat exposure. Studies show dry matter intake to decrease significantly following exposure to heat stress in Croix, Karakul, Rambouillet breed of sheep (Monty *et al.,* 1991). So it can be equated that due to low intake of dry matter, rumination time is also decreased.

Table 1: Effect of heat stress on behaviour and physiological parameters of Osmanabadi goats

Physiological parameters	T1	T2	T3	Levels of Sig.
Rectal Temperature (^{0}F)	101.20±2.10	102.45±1.46	104.72±1.63	NS
Respiration rate/minute	45.00^{b}±1.28	124.3^{ab}±2.38	132^{a}±0.96	**
Pulse rate/minute	85.73^{c}±1.42	93.73^{b}±2.42	98.73^{a}±1.02	**
Rumination time(min/2hr)	14.60±0.82	13.00±0.70	10.6±1.04	NS
No. of rumination/2hr	0.90^{a}±0.03	0.86^{b}±0.02	0.78^{c}±0.02	**
Lying time(min)/2hr	12.63^{a}±0.22	8.52^{c}±0.17	9.84^{b}±0.25	**
No. of urination/2 hr.	4.7^{a}±0.45	3.7^{b}±0.34	2.12^{c}±0.41	**
Duration per urination/s	5.2±0.27	4.87±0.33	4.7±0.28	NS
No. of defecation/2 hr	2.5^{a}±0.40	1.04^{b}±0.14	1.02^{b}±0.16	**

***^{abc}Means (± SE) within a row showing different superscripts are significantly different (P<0.05).*

The lying time in control (T1), and high temperatures- (T2 and T3) exposed goats. Heat-treated goats showed an elevation in standing and lying time compared to control goats. The table also shows the number of urination per hour, duration per urination, and number of defecation per hour in control (T1), and high temperatures- (T2 and T3) exposed goats. There were no changes to duration per urination in goats exposed to different treatment. However, the number of urination and defecation showed significantly decreased in heat treated groups compared to control goats. The above results are in close agreement with Alam *et al.,* (2011).

Conclusion

From the above study it can be concluded that the harmful effect of heat stress on animals displays the undesirable performance which ultimately create hurdle in good marketing of food animals via affecting the growth of the animals. So in case of goat farming also, the slashing aspect of heat stress should be considered for betterment.

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