Research Article

EFFECT OF TEMPERATURE VARIATION ON LEUTINISING HORMONE, FOLLICLE STIMULATING HORMONE AND CORTISOL HORMONE DURING VARIOUS STAGES OF REPRODUCTION IN CHHOTANAGPURI EWE IN GODDA

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ABSTRACT
The present study was carried out to see the effect of different housing system on 24 non-pregnant healthy Chhotanagpuri ewes which were allocated equally to three different groups. Animals of group I were kept between the temperature range of 35^0C to 40^0C in intensive system in hot and humid condition, animals of group II were kept under intensive system between 20^0C-27^0C and animals of group III were kept under extensive system and served as control. The ewes allotted to different treatment groups were of nearly similar age and body weight. The physiological considerations like reproductive hormones LH, FSH and other important metabolic hormones like Cortisol plays vital role in regulating the reproductive efficiency. Therefore Plasma LH, plasma FSH and plasma Cortisol hormones concentration were estimated during the experiment. The study revealed that the Plasma LH and plasma FSH concentration between different groups did not vary significantly ($p< 0.01$) while plasma Cortisol hormone varied significantly ($p< 0.05$) among the groups. All the three hormones varied significantly within group. The plasma LH level decreased from day 20 to 135 and started increasing significantly on expected day of parturition and reached its highest level at two days after parturition in all the groups. The FSH concentration decreased on day 20 and 45 of gestation and was lowest at two days after parturition in all the groups. The plasma cortisol reached peak level at expected date of parturition but decreased drastically to its lowest level 2 days after parturition. The study reveled that different housing system did not had any significant effect on the blood hormonal profiles during different stages of gestation.

INTRODUCTION

Sheep is an important species of farm livestock and different breeds vary substantially in their physiological, morphological, genetic characteristic and reproductive characters i.e. ovulation, fecundity and lambing. Food, nutrition and environmental security in the new millennium with the fast growing human population are the challenging job for the agricultural scientists. Among ruminants sheep is considered to be one of the most important livestock in India and ranks 3rd in the world population, having 4.8% of total world population (Banerjee, 2005). It has good characteristics like small size, better feed efficiency, high-prolificacy and sturdy nature. Sheep is also known as poor man "mobile bank". Sheep is gaining importance due to its excellent wool, meat, milk and skin quality as well as its high prolificacy; therefore they contribute towards the productivity, stability and sustenance of many farming system of our country.

The breeds have generally been named after their native place of origin like Chhotanagpuri sheep. The actual profitability of sheep keeping depends on the exploitation of fertility potential. Production and reproduction of the animals depend on internal as well as external factors (Hafez, 1991). This can be achieved by providing good nutrition management and also good environment to animals. Continuously elevated environmental temperature and humidity shows a significant decrease in the incidence of behavioral estrus and a pre-ovulatory LH surge at the expected time of estrus cycle in ewes (Hill *et al*., 2009).

It is at this juncture nutritionists have made attempts to search and exploit the new unconventional and abundantly available agro- industrial / forest based wastes as unconventional feed ingredients to balance the straw and other poor quality diets, which may be capable to provide them minimum and maximum energy and protein without hampering their biological activity and finally they maintain their body weight, reproduction and production system for optimum requirement.(Kumar *et al.*, 2017)

The main natural physical environmental factors affecting livestock system includes air temperature , relative humidity (RH), solar radiation , atmospheric pressure and wind speed (WS) (Hahn *et al.,* 2003). All these environmental factors are pooled to produce heat stress on animals, which is defined as any combination of environmental variables producing conditions that are higher than the temperature range of the animals thermoneutral zone (TNZ) (Buffington *et al.,* 1981).

The physiological considerations like reproductive hormones Estrogen, Progesterone, LH and FSH level in serum during pregnancy play vital role in regulating the reproductive efficiency. Estrogen and progesterone helps in the growth and development of uterus, fallopian tube, vagina, endometrial gland and duct system of mammary gland (Mc Donald, 1988).

In recent times, studies on sheep production and reproduction have gained importance because of its economic value. While considerable amount of information's are available on various physiological aspects of reproduction in other breeds of sheep, almost no information is available on these aspects in Chhotanagpuri sheep of Jharkhand. Keeping this in view, the present study was undertaken to determine the relationship between temperature changes on hormone profile of chhotanagpuri ewe.

MATERIAL AND METHODS

The experiment was conducted on 24 non-pregnant healthy ewes of similar age (14-24 months) and average body weight (14.6 Kg) reared under uniform managemental practices. The animals were selected from various villages of block Poraiyahat of Godda, for the present experiment. The selected animals were allocated equally to three different groups. Animals of group I were kept in intensive system between the temperature range of 35^0C to 40^0C and maintained in hot and humid condition using climatic chamber. Animals of group II were kept under intensive system maintained in temperature range of 20^0C - 27^0C. The temperature was maintained by using gunny bags on asbestos roof and sprinkling of water on the side of window and roof. About 1.5 inches fine sand was provided on the floor for cooling effect. Animals of group III were kept under in extensive system and served as control. Animals in all the groups were bred naturally on occurrence of oestrus.

Blood samples were collected by jugular venipuncture in heparinized vaccutainer tubes on the day 0 (estrus), 20, 45, 90, 135, expected day of parturition and also two days after parturition from ewes of all the three groups. The collected blood samples were taken immediately to the laboratory in ice box. Plasma was separated by centrifugation at 3000 rpm for 20 minutes and stored at -20ºC±5ºC till analysis. LH and FSH were estimated by ELISA technique at Nuclear Research Laboratory (NRL), Indian Veterinary Research Institute, Izatnagar, Bareilly, U.P.

LH and FSH were determined by solid phase ELISA based in the "Sandwich" Principle. Two separate antibody molecules utilized in assay were directed against distinct antigenic determinants of LH and FSH, respectably. The LH and FSH present in the test sample reacts simultaneously with one antibody immobilized on micro well and with other antibody conjugated to horse radish peroxidase enzyme as described by Jack *et al*. (1995).

The cortisol concentration in plasma was determined by solid phase Enzyme-Linked Immunosorbent Assay as per method described by Thomas (1992).

Statistical analysis of the data collected during the study of different parameters was done by using standard formulae and methods described by Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The initial average plasma LH concentration on day of estrus in group I, II and III animals were 0.84±0.05, 0.85±0.05 and 0.86±0.07 ng/ml respectively (Table-1) during the experimental period. Analysis of variance showed the plasma LH concentration did not vary significantly among different group of animal at all periods of observation. The decreasing trend in plasma LH found from the day 0 with lowest value on day 135 of gestation. The findings were in agreement with Nalbandov (1970) in swine and cow that gonadotropins is usually high at the time of conception, but it diminishes gradually during gestation and lowest just before parturition which was suggestive of decrease in pituitary potency which is inversely related to increase in production of progesterone by placenta during gestation in gilt and cow. Al-Gubory *et al.* (2003) studied pulsatile LH secretion in 5 ewes on day 10, 20, 60 & 120 of pregnancy & also on day 10 post partum. LH declined steadily throughout pregnancy lower ($P<0.01$) on day 60 (0.19 ± 0.3 ng/ml) on day 120 (0.18 ± 0.4 ng/ml) on day 10 of the estrous cycle (0.55 ± 0.04 ng/ml) which was similar to present findings. This decrease may be due to significant reduction in the number and amplitude of LH pulses.

Table 1. Mean ± S.E. of Luteinizing Hormone concentration (ng/ml) of Chhotanagpuri ewes in different groups at different periods.

Periods	Groups		
	Group-I (Hot & Humid)	Group-II (Cold treatment)	Group-III (Control)
Day 0	^{D}0.84±0.05	^{CD}0.85±0.05	^{D}0.86±0.07
Day 20	^{B}0.55±0.01	^{B}0.55±0.01	^{B}0.55±0.01
Day 45	^{B}0.51±0.01	^{B}0.47±0.02	^{B}0.47±0.02
Day 90	^{A}0.29±0.01	^{A}0.29±0.01	^{A}0.31±0.01
Day 135	^{A}0.26±0.01	^{A}0.27±0.01	^{A}0.28±0.01
Expected Day of Parturition	^{C}0.71±0.04	^{C}0.78±0.04	^{C}0.71±0.04
Two days after Parturition	^{D}0.83±0.05	^{D}0.87±0.05	^{D}0.83±0.05

Values having similar superscript in column did not differ significantly ($p<0.01$).

Table 2. Mean ± S.E. of FSH concentration (ng/ml) of Chhotanagpuri ewes in different groups at different periods.

Periods	Groups		
	Group-I (Hot & Humid)	Group-II (Cold treatment)	Group-III (Control)
Day 0	^{D}106.10±3.39	^{E}109.88±5.11	^{E}110.75±5.38
Day 20	^{B}49.54±3.06	^{B}50.71±1.56	^{B}52.42±2.46
Day 45	^{A}39.85±5.00	^{A}33.84±1.05	^{A}33.50±1.02
Day 90	^{C}70.53±1.65	^{D}71.26±1.13	^{D}71.05±0.99
Day 135	^{B}56.57±3.21	^{C}59.47±0.93	^{C}60.56±0.73
Expected Day of Parturition	^{A}36.73±1.23	^{A}37.36±1.14	^{A}38.80±0.94
Two days after Parturition	^{A}33.39±1.36	^{A}34.94±1.19	^{A}36.65±0.82

Values having similar superscript in column did not differ significantly ($p<0.01$).

Table 3. Mean ± S.E. of Plasma Cortisol concentration (ng/ml) of Chhotanagpuri ewes in different groups at different periods.

Periods	Groups		
	Group-I (Hot & Humid)	Group-II (Cold treatment)	Group-III (Control)
Day 0	^{A}4.05±0.21^{b}	^{A}3.19±0.14^{a}	^{A}3.89±0.17^{b}
Day 20	^{A}5.31±0.19^{b}	^{A}4.48±0.24^{a}	^{A}5.06±0.24^{ab}
Day 45	^{B}10.33±0.97	^{B}9.64±0.27	^{B}10.92±0.80
Day 90	^{C}14.30±0.89	^{C}12.33±0.58	^{B}11.85±0.94
Day 135	^{D}21.57±1.27^{b}	^{D}23.10±1.00^{b}	^{C}21.61±1.50^{a}
Expected Day of Parturition	^{E}25.44±0.84	^{E}25.49±0.99	^{D}24.69±0.89
Two days after Parturition	^{A}3.78±0.23	^{A}3.60±0.18	^{A}3.19±0.21

Values having similar superscript in a row (small alphabet) and column (capital alphabet) did not differ significantly ($p<0.05$).

The initial average plasma FSH concentration on day of estrus in group I, II and III animals were 106.10±3.39, 109.88±5.11 and 110.75±5.38 ng/ml respectively (Table-2). Analysis of variance revealed a non-significant ($p<0.01$) variation observed on plasma FSH concentration among all the groups. However, it decreased up to day 45 of gestation and lowest at two days after parturition in all the groups. FSH

concentration was highest on the day of estrus. Present results are in agreement with the findings of Xia *et al.* (2003) and Gado H.M. *et al* (2014) in sheep. Yuan *et al.* (2003) reported FSH concentration in the adult sheep as significantly higher at 90 day than that at 120 day of gestation FSH concentration similar to present finding.

The initial average plasma cortisol concentration on day of estrus in group I, II and III animals were 4.05+0.21, 3.19±0.14 and 3.89±0.17 ng/ml respectively (Table-3) during the experimental period. Analysis of variance revealed a significant ($P<0.05$) variation in plasma cortisol concentration among different groups on day 0 and 20 of gestation. The results showed increasing trend in plasma cortisol concentration upto the expected date of parturition but the level was lowest on two days after parturition. Increase in plasma cortisol level on day 135 of gestation was reported by Arthur (1996) in sheep. Significant variation was observed between the groupie and III on day135. Goode and Thompson (1986) reported that cold exposure of lactating goats during early pregnancy increases plasma cortisol concentration which was similar to our findings. Nazifi *et al.* (2003) reported no significant differences in the concentration of cortisol at either heat stress or cold stress which was not in agreement with the present finding.

On the basis of present study and the findings it is concluded that the different housing system did not had any significant effect on the blood hormonal profiles during different stages of gestation.

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