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EVALUATION OF HAEMATOLOGICAL PARAMETERS OF SURTI GOATS DURING SUMMER AND WINTER SEASON UNDER INTENSIVE PRODUCTION SYSTEM

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ABSTRACT:

The present research work was undertaken to study seasonal variation in haematological parameters of Surti goats during summer and winter season under intensive production system on eight adults clinically healthy female Surti goats. The meteorological variables like temperature and relative humidity were recorded on daily basis at 7.30 a.m. and 2.30 p.m. during experimental period as well as meteorological data for last 10 years from year 2004 to 2014 collected from the observatory for estimation of THI. Blood samples were collected from the Surti goats at a weekly basis for the estimation of haematological study throughout the experimental period. Haematological attributes like Red Blood Cells (x 10^6/µl) , White Blood Cells (x 10^3/µl), Mean Corpuscular Volume (fl),Mean Corpuscular Haemoglobin (pg), Mean Corpuscular Haemoglobin Concentration (g/dl) showed significantly ($P<0.05$) higher level during summer season than in winter season with significantly ($P < 0.01$) positive correlation with the THI.

KEY WORD: *Haematological parameter, Seasonal variation, Surti goats, Temperature Humidity Index (THI).*

INTRODUCTION:

Climate change is occurring globally and poses serious threats to animal husbandry in some areas. Developing countries are found to be the most

affected one. Environment plays an important role in health and production of animals. Complex interaction of climate with animal affects animal health and production. Animals perform optimum under comfortable climatic conditions in thermo neutral range. The variation in climatic variables like temperature, humidity and radiations were recognized as the potential hazards in the growth and production of all domestic livestock species.

Stress is the inability of an animal to cope up with its environment, a phenomenon which is often reflected in a failure to achieve genetic potential (Dobson and Smith, 2000). It is the body's reaction to stimuli that disturb homeostasis. Thermal stress requires more attention, considering that the environmental temperature variations have major effects on animal production (Nardone *et al*., 2010). According to 2012 Livestock census, India possesses 135.17 million goats. India possesses 20 recognized breeds of goat, which constitute 20-25 % of the total goat population and remaining are non-descript. Goats are multi-purpose animals producing meat, milk, skin and hair. Goats are mainly concentrated in ecologically fragile, arid and semiarid areas. In India, it is generally known as 'poorman's cow' and as 'wet nurse' of infants in Europe.

Goat plays an important role in the economy of thousands of poor livestock owners who earn their livelihood by rearing them in different terrain and climatic condition. In the developing countries, goats make a very valuable contribution, especially to food industry, rural employment and GDP. Hence, it is imperative to address goat production under the present scenario of climate change, which is adversely affecting health and production status of animals by altering the homeostasis and other thermo-regulatory responses to maintain the thermal balance.

Blood is an important and reliable medium for assessing the health status of individual animal (Ramprabhu *et al*., 2010).Variations in blood markers of animals are due to several factors such as altitude, feeding, age, sex, breed, diurnal and seasonal variation, temperature and the physiological status. Haematological parameters are helps in diagnosing the different conditions. Haematological parameters are good index of stress indicator because change in these helps in determining the adaptations of the animal to their environment.

There has been no study on seasonal variation in accordance with haematological parameters of adult Surti goats. In view of the above facts an investigation was planned at Department of Physiology and Biochemistry, College of Veterinary Science and A.H., Anand on Surti goats during summer & winter season.

MATERIALS AND METHODS:

The experiment was conducted during the seasons of summer (15/04/2015 to 14/06/2015) and winter (01/12/1015 to 31/01/2016) on eight adult clinical healthy female Surti goats reared in the Department of Livestock Production Management, College of Veterinary Science & Animal

Husbandry, AAU, Anand. All female animals were about to 4-7 years of age. The research was approved by the Institutional Animal Ethics Committee (IAEC, Project No.:200/VBC/2015). The experimental animals were separated from the flock only at the time of blood collection. The experimental animals were fed according to the ICAR feeding standard (ICAR, 1998).

The meteorological variables like dry bulb temperature and relative humidity were recorded inside the experimental facility with the help of a Sling Psychrometer. It was recorded on daily basis at 7.30 a.m. and 2.30 p.m. during the experimental period. Meteorological data for a decade (2004-2014) were collected from the Department of Agricultural Meteorology, B. A. College of Agriculture, AAU, Anand. On the basis of dry bulb temperature and relative humidity, THI was calculated using the formula of Mader *et al*. (2006).

$$THI = (0.8 \times Tdb) + [(RH/100) \times (Tdb - 14.4)] + 46.4$$

Where, Tdb = Dry bulb Temperature

RH = Relative Humidity

Blood samples were collected in the morning hours from animals at weekly interval throughout the experimental period. One to two ml of whole blood from each animal was collected aseptically from jugular vein in K_3EDTA vaccutainer. Samples collected in K_3EDTA were used for hematological examination. Fresh collected whole blood was immediately subjected to haematological analyses in the laboratory of the Department of Veterinary Physiology and Biochemistry, College of Veterinary Science and

Animal Husbandry, AAU, Anand. All haematological parameters were determined by using fully Automated Haematology cell counter (Model BC- 2800 Vet, Mindray).

Statistical analysis:

The data obtained in the present study were subjected to statistical analyses by applying the one way Completely Randomised Design (CRD) using computer software for CRD. Correlation between THI and haematological parameter was obtained by using SPSS software 17.

RESULTS AND DISCUSSION:

Temperature humidity index is an important factor for measuring the environmental stress of animals during different seasons. THI values during summer and winter for the last decade were 82.09±0.48 and 66.14±0.38 (Table 1), respectively, while the respective values during the experimental period were 82.55±1.22 and 59.36±2.24 (Table 2).

In the present study the mean value of haematological attributes like Red Blood Cells (x 10^6/µl) , White Blood Cells (x 10^3/µl), Mean Corpuscular Volume (fl),Mean Corpuscular Haemoglobin (pg), Mean Corpuscular Haemoglobin Concentration (g/dl) were 15.55±0.54 , 12.92±0.81

,17.91±0.69,6.24±0.14,35.10±0.56 during summer season where as in winter season the mean value were 14.40±0.43, 9.59±0.72, 16.12±0.84 , 5.54±0.19 ,33.85±0.28, respectively. Non significant increase showed by Haemoglobin (g/dl) and Pack Cell Volume (%) level during summer season (8.87±0.27 , 26.35±1.03) than in winter (8.59±0.35, 25.10±1.22) season (Table 3), respectively. The haematological parameters such as RBC, WBC, MCV, MCH and MCHC showed significantly ($P < 0.01$) positive correlation ($r = 0.85, 0.94, 0.95, 0.95$ and 0.81, respectively) with the THI.

Temperature humidity index of 65 or less is considered comfort zone, up to 72 is critical zone and 74 to 83 is considered as severe stress zone as reported by Kohli *et al*. (2014). During present study, the temperature humidity index was in between 74 to 83 during summer season and classified as severe stress zone. Thus, obtained climatic data revealed that the Surti goats were experiencing severe heat stress during summer season.

Erythrocytes are important non nucleated cells of animal body. The primary function of erythrocyte is to serve as a carrier of haemoglobin. Any alteration in RBC count shows pathological changes in body.Selvaraj *et al*. (2004) and Banerjee *et al*.(2015) reported higher total erythrocyte value during winter season than summer season in Mecheri sheep and in goats.

In summer season, hypoxemia occurs because of low oxygen concentration in air and so erythrocytes concentration gets increased. As temperature increases , air expands and the number of O_2 molecules per unit volume decreases, so the blood forming organ automatically produce large quantities of extra red blood cells (Guyton, 1981).Malnutrition during the cold season may lead to a decrease in the RBC count.

White blood cells (WBC) or leukocytes are cells of the immune system involved in defending the body by phagocytosis against both infectious disease and foreign materials to produce or at least transport and distribute antibodies in immune response. Present results were similar to the findings of Alam *et al*. (2011) in goats and Babe *et al*. (2015) in Iraqui black female goats during summer season. The increased WBC count in summer compared with winter season was mainly attributed to hot season (Lee *et al*., 1976). Pathogens during hot season may contribute in blood viscosity which leads to allergic effects that induce WBC production (Okab *et al*., 2008).

Haemoglobin serves for the transportation of oxygen from the lungs and carbon dioxide in the opposite direction. It assists in acid base regulation by elimination of carbon dioxide from the lungs and by buffering action. Results of the present study regarding haemoglobin are in agreement with the results of Nawel *et al*. (2014) in goats. However, contradictory result other than this with significant increase and decrease reported by Babe *et al*. (2015) and Banerjee *et al*. (2015), respectively.

Non significant increased haemoglobin values in this study may be attributing to increase in environmental temperature. Many reporters suggested that in summer season increased blood oxygen carrying capacity changes erythrocyte numbers and haemoglobin concentration (Elssia, 2011).

Result of the present study regarding pack cell volume is in agreement of Nawel *et al*. (2014) in goats. Non significant increased PCV values in this study may be attributing to increase in environmental temperature. It indicates either an increase in the number of circulating RBC or reduction in circulating plasma volume. The higher value of PCV has been reported to be an adaptive mechanism to provide water necessary for evaporation and cooling process (El-Nouty *et al*., 1990). It can be seen in animals with hemo concentration due to reduced water intake.

Higher MCV and MCH values during summer were reported by Abdelatif *et al*. (2009) in Nubian goats. Higher MCH and MCHC values during summer have also been reported by Kumar and Pauchaura (2000) in crossbred dairy cattle. Increased value of these parameters may attribute to size and number of erythrocytes during summer and winter season. It may be attributed to concomitant increase or decrease in Hb concentration (NRC, 1971).

CONCLUSION:

The haematological attributes like RBC, WBC, MCV, MCH and MCHC, significantly ($P < 0.05$) affected by summer season and they were significantly ($P<0.01$) positively correlated with THI. It was concluded that environmental stress was able to induce marked changes in the haematological parameters.

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Authors Contribution:

Dr.Vasava is carried out whole research work and Dr.Rathwa is continuously providing his helping hand during research work. Dr. Pande is guided during the whole research work from research plan to manuscript preparation. Dr. Pathan and Dr.Madhira are helped in analysis part of parameters and proofing of manuscript.

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Table 1: Effect of season (summer or winter) on THI values during 2004 -2014 (means±s.e.m.)

	Summer			Winter		
Year	7.30 am	2.30 pm	Average	7.30 am	2.30 pm	Average
2004	78.15	84.68	81.42	55.17	73.22	64.20
2005	77.69	85.20	81.45	54.02	73.37	63.70
2006	78.34	84.32	81.33	59.60	75.20	67.40
2007	79.17	84.91	82.04	59.93	75.06	67.09
2008	77.48	82.66	80.07	58.66	74.92	66.79
2009	78.21	84.04	81.13	57.72	74.65	66.19
2010	79.85	84.91	82.38	57.52	74.41	65.96
2011	78.98	85.28	82.13	57.20	75.65	66.42
2012	78.92	84.80	81.86	56.88	76.90	66.89
2013	79.30	93.51	86.41	57.95	77.47	67.71
2014	79.86	85.68	82.77	56.45	73.86	65.16
Mean ±SE			82.09±0.48 *			66.13±0.38

Value having ' * ' as superscripts is defer significantly (P <0.05) between seasons (summer and winter)

Table 2: Effect of season (summer or winter) on THI values during the experimental period (means±s.e.m.)

Week	Summer			Winter		
	7.30 am	2.30 pm	Average	7.30 am	2.30 pm	Average
1	76.17	84.31	80.24	57.64	67.81	62.72
2	75.90	83.74	79.82	55.15	64.55	59.85
3	79.16	87.54	83.35	50.24	61.52	55.88
4	78.04	84.75	81.40	50.92	61.70	56.31
5	79.60	86.08	82.84	55.69	68.70	62.20
6	81.44	87.09	84.27	54.81	66.47	60.64
7	82.09	87.63	84.86	55.99	65.89	60.94
8	82.11	87.54	84.82	47.17	61.33	54.25
9	80.44	82.34	81.39	54.75	68.08	61.42
Mean ±SE			82.55±1.52*			59.36±2.24

Value having ' * ' as superscripts is defer significantly (P <0.05) between seasons (summer and winter)

Table 3:Haematological attributes (Mean±SE) during experimental period

Parameters	Season		SEm	CD (0.05)	CV %
	Summer	Winter			
RBC (× 10^6/µL)	15.55±0.54*	14.40±0.43	0.18	0.51	10.39
Hb (g/dl)	8.87±0.27	8.59±0.35	0.13	NS	12.75
PCV (%)	26.35±1.03	25.10±1.22	0.43	NS	14.23
WBC (× 10^3/µL)	12.92±0.81*	9.59±0.72	0.27	0.77	21.02
MCV (fl)	17.91±0.69*	16.12±0.84	0.25	0.70	12.58
MCH (pg)	6.24±0.14*	5.54±0.19	0.06	0.19	9.80
MCHC (g/dl)	35.10±0.56*	33.85±0.28	0.17	0.48	4.27

*** Significant at P<0.05 , NS = Non significant**

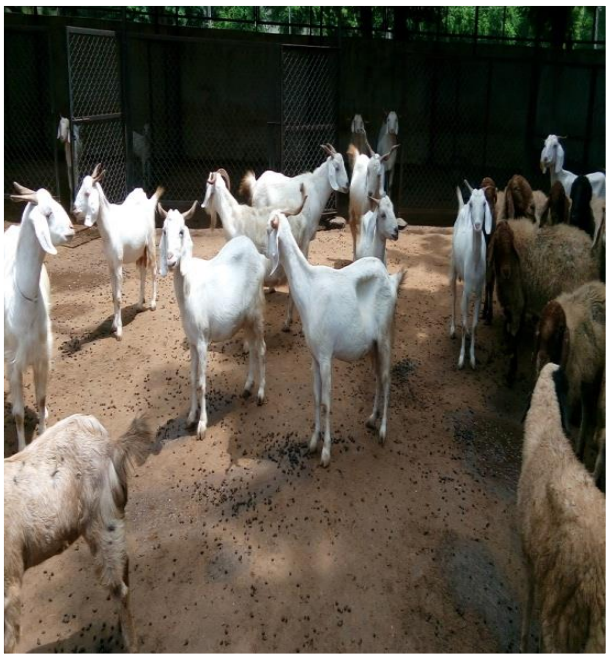

Plate 1 Animal Shed & Surti goats

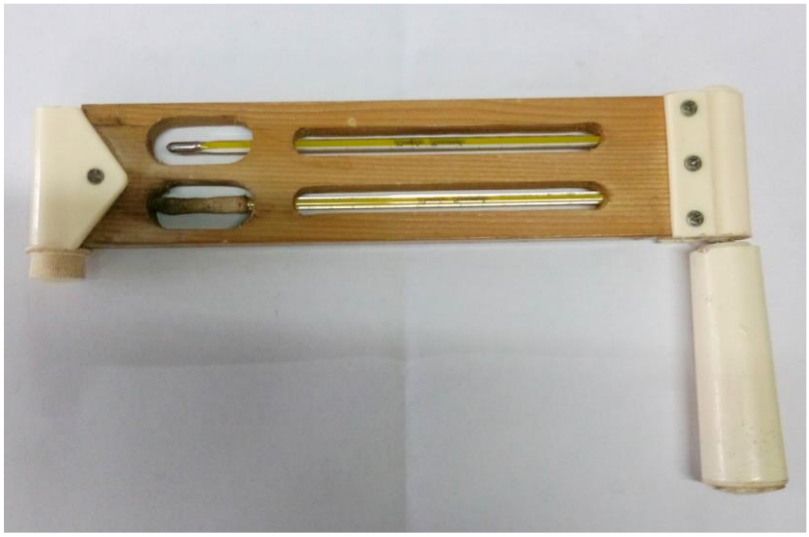

Plate 2 Sling Psychrometer

Plate 3 Collection of blood sample

Plate 4 Automated Haematology Cell Counter