Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 6 [12] November 2017: 59-62

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.876
Universal Impact Factor 0.9804
NAAS Rating 4.95

ORIGINAL ARTICLE **OPEN ACCESS**

Seasonal Effects on Serum Biochemical and Hormonal Profile in Deoni Crossbred Cow

Chandrashekhar*, Shrikant Kulkarni[1], Sathisha, K. B[2]., Srinivas Reddy Bellur[2]., Vinay, P. Tikare[3]., I. J. Reddy[4]., S. M. Kartikesh[1]

*Part of M.V.S$_C$ thesis submitted to Karnataka Veterinary Animal and Fisheries Sciences University, Bidar-585401, Karnataka, India

1. Associate Professor, Department of Veterinary Physiology and Biochemistry, Veterinary College, Bidar-585401.Karnataka.India.
2. Assistant Professor, Department of Veterinary Physiology and Biochemistry, Veterinary College, Bidar-585401.Karnataka.India.
3. Assistant Professor, Department of Veterinary Pharmacology and Toxicology, Veterinary College, Bidar-585401.Karnataka.India.
4. Principal Scientist, Animal Physiology Division, National Institute of Animal Nutrition and Physiology (NIANP), Bangalore. Karnataka. India.

ABSTRACT

The study was conducted to obtain baseline data and compare the effect of different season's on blood biochemical and hormonal profile in Deoni crossbred cows. Animals with same physiological and nutritional status under same managemental practice were selected from the private organised dairy farm near Halliked, Bidar. Mean tempteture humidity index (THI) of different seasons was calculated using local metrological data. Blood sample was collected twice in each season between 2 PM to 3 PM. The mean THI values for winter, spring and summer were 66.9, 73.3 and 82.4 respectively in experimental area. Analysis of the data showed significantly (P≤0.05) lower mean glucose, total proteins, triglycerides, cholesterol, sodium and potassium concentrations in summer whereas seasons had no effect on albumin concentration. Creatinin was lower in winter and BUN was higher in summer. There was a significant decrease in serum T_3 and T_4 levels from winter to summer. Cortisol was higher in summer and the lowest was recorded during spring.
***Key Words**: Deoni, Season, THI, Metabolite*

Received 04.10.2017 Revised 15.10.2017 Accepted 01.11.2017

INTRODUCTION

The seasonal variation in climatic like temperature, humidity and radiations were recognized as the potential hazards in the growth and production of all domestic livestock species. Low and High ambient temperature cause discomfort and enhance the stress level which in turn results in depression of the physiological and metabolic activities of the animal. Homeotherms try to maintain constant core body temperature by changing the dry matter intake level, pulse rate, respiration rate, blood metabolite concentration, peripheral blood flow rate, sweating and panting etc. Summer and winter stress leads to severe changes in the blood biochemical and hormonal concentration there by decreases the production performance of the animals [1].

In general, the zebu (*Bos indicus*) cattle have higher degree of thermo tolerance compared with temperate (*Bos taurus*) cattle because of lower metabolic rate and greater sweating capacity [2]. Crossbred cows have been exploited for blending the adaptability of tropical cattle with the high milking potential of exotic breeds. Genetic improvements that enhance production traits may increase the susceptibility to high thermal load as there is a close relationship between metabolic heat generation and the level of production. In this study physiological performance, hematological, biochemical and stress hormonal parameters of Deoni crossbred cows were assessed under local climatic conditions, in different seasons.

MATERIALS AND METHODS

The present experiment was conducted for a period of six months comprising winter (Dec-Jan), spring (Feb-Mar) and summer (April-May). Eight Deoni crossbreed cows with an average age of 3-4 years and average body weight of 325-350 kg were selected organized dairy farms near Livestock Research and Information Centre (LRIC), Hallikhed, Bidar. Geographically this area is situated an elevation of 701.04 meters above mean sea level at 17º 85'N latitude and 77º 27 E longitude. Blood samples were collected from jugular vein, two times in each season from all the animals for estimation of, biochemical and hormonal parameters. Serum sample for hormone estimation was stored at -20^{0}C until the analysis.

The blood biochemical parameters viz., glucose, total protein, albumin, triglycerides, cholesterol, creatinin and blood urea nitrogen were estimated using semi automated biochemistry analyzer (ARTOS®) by SWEMED BIOMEDIALS PVT.LTD using SWEMED® Diagnostic Kits**,** Bangalore following the instructions and procedure supplied with the diagnostic kits. Serum concentrations of electrolytes viz., sodium and potassium were estimated by automated ion selective electrode based electrolyte analyzer (LABLYTE™, TRIVITRON HEALTH CARE LTD, CHENNAI).

The hormonal parameters viz., tri-iodothyronine (T_3), thyroxin (T_4) and cortisol were estimated by radio immune assay (RIA) technique by using a multi well gamma counter PC-RIA.MAS (STRSTEC) which is calibrated for I^{125} using RIA kits (BECKMAN COULTER) at National Institute of Animal Nutrition and Physiology, Adugodi, Bengaluru. The data obtained from the present study subjected to statistical analysis using one way ANOVA as per the standard procedure described by Snedecor and Cochran [3].

RESULTS AND DISCUSSION

The mean values of ambient temperature, relative humidity and temperature-humidity index (THI) prevailing during the experimental period are presented in Table 1. Mc Dowell *et al,* [4] suggested that temperature-humidity index could be used as indicator of thermal climatic conditions. Temperature-humidity index of 72 or less are considered cool/comfortable, 75-78 moderate stress and values greater than 78 cause extreme distress. In our study the THI value during summer is 82.4 considered to cause heat stress in cows; the value during winter (66.9) is cool and comfortable and the value during spring (73.3) was not so cool but comfortable to cows.

The mean values of selected biochemical and electrolyte concentration of Deoni crossbred cattle were presented in Table.2 The glucose concentration was significantly (P≤0.05) higher in winter and spring season as compared to summer indicating negative effect of heat stress on blood glucose concentration. These findings are in agreement with the reports of Rasooli *et al.* [5], Shrikhande *et al.* [6], Muna *et al.* [7] and Das *et al,* [8]. Blood glucose concentration indicates energy status of dairy animals. The decrease in the glucose concentration during the summer could be due to the reduction in feed intake as a result of thermal stress and probably due to depletion of hepatic glycogen [9].

Table 1. Local climatic parameters during winter, spring and summer seasons of experimental period

Season	Air temperature (^{0}C)			Relative humidity (%)			THI (mean)
	Maximum	Minimum	Mean	Maximum	Minimum	Mean	
Winter (Dec – Jan)	27.8 (20.9-31.6)	15.1 (9.7-20.0)	21.4	76.5 (44.9-100.0)	30.3 (14.9-66.3)	53.4	66.9
Spring (Feb – Mar)	32.7 (28.6-33.6)	18.8 (14.8-18.8)	25.7	67.9 (46.7-97.4)	22.7 (9.6-49.4)	45.3	73.3
Summer (Apr – May)	39.6 (31.9-43.0)	24.3 (20.3-28.9)	31.3	63.7 (33.9-90.6)	19.0 (10.6-35.8)	41.3	82.4

Table 2. Biochemical parameters (Mean± SE) during different seasons in Crossbred Deoni cows.

Parameter	Winter	Spring	Summer
Glucose (mg/dl)	50.92±0.58^a	49.29±1.06^a	46.47±0.70^b
Total protein (g/dl)	8.36±0.11^a	8.28±0.20^b	7.35±0.18^c
Albumin (g/dl)	4.54±0.06	4.47±0.09	4.15±0.07
Triglycerides (mg/dl)	40.01±0.24^a	38.99±0.18^a	37.07±0.52^b
Cholesterol (mg/dl)	63.96±0.63^a	62.38±0.48^a	59.85±0.40^b
Creatinine (mg/dl)	1.52±0.81^a	1.82±0.08^b	1.64±0.08^{ab}
Blood urea nitrogen (mg/dl)	24.03±0.85^a	23.24±0.60^a	29.60±0.45^b
Sodium (mmol/L)	138.91±0.69^a	137.51±1.50^a	133.90±0.72^b
Potassium (mmol/L)	4.55±0.09^a	4.58±0.15^{ab}	4.26±0.07^b

$^{a, b, c}$ *Means with different superscript differ significantly (P≤0.05) between the seasons*

Table 3. Tri-iodothyronine (T_3), Thyroxine (T_4) and Cortisol levels (Mean± SE) during different seasons in Crossbred Deoni cows.

Parameter	Winter	Spring	Summer
Tri-iodothyronine (ng/ml)	0.79±0.01[a]	0.70±0.01[b]	0.61±0.01[c]
Thyroxine (ng/ml)	41.02±0.15[a]	39.02±0.67[b]	37.02±0.16[c]
Cortisol (ng/ml)	19.55±0.20[a]	16.93±0.14[b]	22.19±0.26[c]

[a, b, c] *Means with different superscript differ significantly (P≤0.05) between the seasons*

The results of the present study showed a lower total protein concentration during summer season as compared to winter and spring season. These results are in conformity with the reports of Muna *et al.* [7] in cattle. Total protein content is usually used as an indicator of animals' nutritive status reflecting food intake and metabolism. Heat stress during summer inhibits appetite centre via satiety centre to reduce feed intake as one of the thermoregulatory mechanisms to reduce metabolic heat production. The reduced feed intake and subsequent poor nutritive status of the animal may be attributed for reduced total serum protein concentration during summer. These findings are in contrast to the findings of Shrikhande *et al.* [6] and Das *et al.* [8] who reported higher total protein concentration during summer. These workers concluded that the animals suffer from severe dehydration at high ambient temperature which leads to elevation of total protein concentration in blood. In this experiment there was no significant (P≤0.05) difference in the albumin concentration. These results are similar to the findings of Cozzi *et al.* [10] who reported that although total protein level increased during summer, the albumin fraction is unaffected by season. Contrary to these results Rasooli *et al.* [5] and Das *et al.* (9) have reported higher where as Muna *et al.* [7] have recorded higher albumin concentration during summer, winter months respectively.

The concentration triglycerides were significantly (P≤0.05) lower in summer as compared to winter and spring seasons. These results are in agreement with the results of Ahmed and Abdalla [9]. The decrease in the triglycerides during summer may be attributed mainly for decrease in voluntary food intake by the animals in hot climatic conditions. These findings differ with the reports of Giuseppe *et al.* [11] who recorded higher levels of triglycerides in dairy cows during summer season and lower during spring season. Serum cholesterol was significantly (P≤0.05) lower in summer as compared to winter and spring. These results are in conformity with the findings of Ahmed and Abdalla [9]. A reduction in liver activity reported during heat exposure could also explain the lower cholesterol level during summer [5].

The statistical analysis of the data revealed wide variation in the creatinin concentration during different seasons which was lower during summer. These results are in agreement with the work of Muna *et al.* [7]. In contrast, Ronchi *et al*. [12] recorded increased creatinine in blood during heat stress. They are of the opinion that increased creatinine during hot environmental condition is because of excess muscular catabolism for energy supply. The mean values of blood urea nitrogen was significantly (P≤0.05) higher in summer as compared to winter and spring. These results corroborate the findings of Rasooli *et al.* [5] in HF heifers. The apparent summer hike of BUN could be due to increased catabolism of amino acids for energy. Some of these amino acids could be derived from the protein mobilization of muscle tissue, which also support increase in the level of BUN observed during summer season. The increase in urea level may be due to increase in the level of cortisol which induces catabolism of body proteins.

The mean serum concentration of Na^+ and K^+ were significantly lower in summer as compared to winter and spring. These results are in agreement with the findings of El Nouty *et al.* [13] who documented the simultaneous relationship among thermal stress, plasma aldosterone level and urine electrolyte concentration in bovines. Concurrent with this, there were significant fall in serum and urinary K+. Coppock *et al.* [14] reported that enhanced heat dissipation during heat stress may also lead to electrolyte losses through sweat, saliva, polypnea and urine. This may lead to fall in plasma Na+, K+ and Cl- concentration. In contrast, Prava and Dixit [15] reported that the serum sodium values during summer were significantly higher in summer in the Frieswal cattle. This discrepancy could be attributed to difference in the sweating ability of different breeds.

The mean values of T_3 and T_4 were significantly (P≤0.05) higher in winter as compared to spring and summer (Table.3). High concentration of serum thyroxine (T_4) and triiodothyroxine (T_3) in various species have been reported [5] in winter. In contrast, Ahmed and Abdalla [9] reported the higher T_3 and lower T_4 in cows during summer. Cold environment may be a stimulus to increase the thyrotrophic hormone output thereby resulting in a higher concentration of thyroid hormones in serum. It is believed that in hot environments, adaptive response is usually associated with decrease in food intake and metabolic heat production. Therefore, during summer heat acclimation and physiological adjustment by thermoregulatory centre induce a decrease in endogenous heat production influenced mainly by thyroid hormones [16].

The mean cortisol was significantly (P≤0.05) higher in summer followed by winter and the lowest was recorded during spring. The rise in cortisol level during summer in the present study is in agreement with Chandra Bhan *et al*. [17] and Ahmed and Abdalla [9]. The blood cortisol level is generally considered as a reliable physiological index for determining animal response to stress. Certain environmental stressors have the potential to activate the Hypothalamic-portal axis and sympatho-adrenal medullary axis.

REFERENCES

1. Ganaie, A.H., Shanker, G., Bumla, N.A., Ghasura, R.S., Mir, N.A., Wani, S.A. and Dudhatra, G.B., (2013). Biochemical and Physiological Changes during Thermal Stress in Bovines. *J. Vet. Sci. Tech.,* 4(1): 1-6
2. Hansen, P.J., (2004). Physiological and cellular adaptation of Zebu cattle to thermal stress. *Anim. Rep. Sci.,* **82-83**: 349-360
3. Snedecor, G.W. and Cochran, W.G., (1994). Statistical methods. *Edn.* 8th Oxford and IBH Publications company., Calcutta, India
4. Mcdowell, R.E., Hooven, N.W. and Camoens, J.K., (1976). Effects of climate on performance of Holsteins in first lactation. *J. Dairy Sci.,* **59**: 965–973
5. Rasooli, A., Nouri, M., Khadjeh, G.H., and Rasekh, A., (2004). The influences of seasonal variations on thyroid activity and some biochemical parameters of cattle. *Iranian J. Vet. Res.,* **5**(2): 1383
6. Shrikande, G. B., Rode, A.M., Pradhan, M.S. and Ashlesha, K.S., (2008). Seasonal effect on the composition of blood in cattle. *Vet. world,* **1**(11): 341-342
7. Muna H. Al-Saeed, Haidar K. A. and Rashad F .G. (2009). Selective evaluation of certain blood and biochemical parameters of local cattle during winter and summer seasons. *Bas. J. Vet. Res.,* **8** (1): 138-143
8. Das Hemen, Lateef, A., Panchasara, H.H., Sanap, M.J., Nilufar, H. and Parsani, H.R., (2014). Seasonal effect on blood biochemical parameters in kankrej cattle at different level of their productivity**.** *Ind. J. Field Vets.,* **9**: 12-16
9. Ahmed Omer Alameen and Abdalla Mohamed Abdelatif, 2012. Metabolic and Endocrine Responses of Crossbred Dairy Cows in Relation to Pregnancy and Season under Tropical Conditions**.** *American-Eurasian J. Agri. & Environ. Sci*., **12** (8): 1065-1074
10. Cozzi, G., Ravarotto, L., Gottardo, F., Stefani, A.L., Contiero, B., Moro, L., Brscic,M. And Dalvit, P., (2011). Short communication: Reference values for blood in Holstein dairy cows: Effect of parity, stage of lactation, and season of production. *J. Dairy Sci.*, **94**: 3895-3901
11. Giuseppe Mazzullo, Claudia Rifici, Floria Cammarata, Gino Caccamo, Maria Rizzo and Giuseppe Piccione, (2014). Effect of different environmental conditions on some hematological parameters in cow. *Ann. Anim. Sci.,* **14**(4): 947-954
12. Ronchi, B., Bernabucci, U., Lacetera, N.G., Supplizi, A.V. and Nardone, A., (1999). Distinct and common effects of heat stress and restricted feeding on metabolic status of Holstein heifers. *Zoot. Nutr. Anim*., **25**: 11-20
13. El-Nouty, F.D., Al-Haidary, A.A. and Salah, M.S., (1990). Seasonal variation in hematological values of high-and average yielding Holstein cattle in semi-arid environment. *J. King Saudi arabia Univ.*, **2**(2): 173-182
14. Coppock, C.E., Grant, P.A. and Portzer, S.J., (1982). Lactating dairy cow responses to dietary sodium, chloride, bicarbonate during hot weather. *J. Dairy Sci.,* **65**:566
15. Prava, M. and Dixit, N.K., (2006). Serum electrolyte level in Frieswal cattle. *Ind. J. Dairy Sci.,* **59**: 390-394
16. Bernabucci, U., Lacetera, N., Baumgard, L.H., Rhoads, R.P., Ronchi, B. and Nardone, A., (2010). Metabolic and hormonal acclimation to heat stress in domesticated ruminants. *Animal.*, **4**: 1167-1183
17. Chandra Bhan, Singh, S.V., Hooda, O.K., Upadhyay, R.C., Beenam and Vaidya Mangesh, (2012). Influence of temperature variability on physiological, haematological and biochemical profile of growing and adult sahiwal cattle. *J. Env. Res. Dev.,* **7**(2A): 986-994

Citation of this Article
Chandrashekhar, S Kulkarni, Sathisha, K. B., S Reddy Bellur., Vinay, P. Tikare., I. J. Reddy., S. M. Kartikesh. Seasonal Effects on Serum Biochemical and Hormonal Profile in Deoni Crossbred Cow. Bull. Env. Pharmacol. Life Sci., Vol 6 [12] November 2017 : 59-62