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Effect of Season on Biochemical Profile of Osmanabadi Goat under Agro-Climatic Conditions of Chhattisgarh Plains

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ABSTRACT

The current study was undertaken at Goat Unit of Krishi Vigyan Kendra, Durg located within the campus of College of Veterinary Science and Animal Husbandry, Anjora, Durg. Blood samples were collected from 20 adult female goats every month during summer (n=80), rainy (n=80) and winter (n=80) season to investigate the blood biochemical parameters in Osmanabadi goat. The results obtained during the investigation revealed the significant seasonal variation ($P< 0.01$) in all the biochemical parameters studied, i.e. serum glucose, total protein, albumin, globulin, Albumin: Globulin ratio and blood urea nitrogen (BUN). The mean total serum protein for summer was significantly higher ($P< 0.01$) than rainy and winter season. A similar trend was recorded in case of serum globulin and BUN values, but the reversed trend was observed in the mean values of serum albumin, A:G ratio and serum glucose. Thus, the observations of the study could able to establish the seasonal variation in biochemical parameters and could serve as reference values for Osmanabadi goat reared under the agro-climatic conditions of Chhattisgarh plains lies in the central zone of India.

HIGHLIGHTS

- Biochemical profiling of Osmanabadi goats reared under different management systems in Chhattisgarh plains.
- Significant seasonal variations were observed in all the biochemical parameters studied.

Keywords: Goat, Osmanabadi, Biochemical profile, Season

Goats are an inbuilt converter of low protein forages into high-quality food under diverse climatic conditions and resilient to extreme and inconstant environments, often in water scarcity conditions. The goats are able to consume and digest tannin-rich browse as they secretes the proline-rich proteins and effectively extract nutrients from it (Silanikove, 2000; Basha *et al*., 2012). India is the second-largest in the goat population (148.88 million) in the world next to China. Goat population of Chhattisgarh state is 4.01 millions, equating to 2.7% of the Indian goat population with 24.19% increase against previous census (DADF, 2019). Mostly the goats are maintained under extensive management system, however intensive or semi-intensive systems are followed at organized farms (Kumar, 2007). Abundant availability of natural pastures, wild leaves and grasses in Chhattisgarh state makes the goat farming more attractive and economically viable. Recently Osmanabadi breed of goat is introduced in the Chhattisgarh state through various societal development

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extension projects. In response to the market indicators, the goat production system is slowly but undoubtedly shifting from extensive to semi-intensive and intensive systems of management. Animals perform optimum under the comfortable climatic conditions in the thermoneutral range (Vasava, 2017). Seasonal variation in temperature and humidity affects the physiological and metabolic activities of goats (Piccione *et al.,* 2012). Given this, the present experiment was aimed to investigate the effect of season on biochemical parameters of Osmanabadi goats under environmental conditions of the Chhattisgarh plains.

MATERIALS AND METHODS

Location and environment

The present experiment was carried out at Goat Unit of Krishi Vigyan Kendra, Durg, located within the campus of College of Veterinary Science and Animal Husbandry, Anjora, Durg. The apparent seasons in Chhattisgarh are summer (February to May), rainy (June to September) and winter (October to January). Summer season is hot and dry with high temperatures in all parts of the state, whereas winters are usually pleasant and dry.

Metrological observation

Relative Humidity-Temperature data logger (HTC^{TM} EasyLog) was used to record the meteorological data during the experimental period. The temperature-humidity index (THI) was calculated by using the following formula, as suggested by the NRC, 1971.

$$THI = (1.8 \times T + 32) - [(0.55 - 0.0055 \times RH) \times (1.8 \times T - 26)]$$

Where T is the Air temperature (˚C)

And RH is the relative humidity (%)

Animals and experimental design

Twenty healthy adult female goats of Osmanabadi breed were selected randomly based on live body weight and equally distributed in two groups, i.e. ten each in the extensive and semi-intensive management group. The duration of the study was of one year (12 months) covering all three seasons. The Institutional Animal Ethics Committee approved the research.

Collection of the blood sample

Blood sample from each animal in both groups (n=20) was collected from the jugular vein at monthly interval throughout the experimental period of one year (n=240). By centrifugation @3000 rpm for 10 minutes, serum was separated and collected in the sterilized tube.

Biochemical parameters

Biochemical parameters included glucose, total protein, albumin and blood urea nitrogen was analyzed as per the standard methods using analytical kits from BioLab Pvt. Ltd, Mumbai with the help of Clinical Biochemistry Analyser (SYSTRONIC; Type: diaSIL-100).

STATISTICAL ANALYSIS

The pooled data of both groups were subjected to the standard statistical procedures recommended by Snedecor and Cochran (2004). The data was statistically analyzed by One Way ANOVA. Analysis of variance (ANOVA) was done with the help of Duncan's Multiple Range Test by IBM SPSS Statistics 22 Software (SPSS, 2013).

RESULTS AND DISCUSSION

Environmental variables

The mean and standard error values of daily ambient temperature (˚C) (minimum, maximum and average), average relative humidity (%) and THI for different seasons during the experimental period are presented in Table 1. From the data, we observed that average temperature (˚C) values during summer were higher than the critical temperature of 24-27˚C for most species. A THI less than 74 is considered as normal, 75-78 alarming, 79-83 danger, and above 84 as an emergency (Hernandez *et al*., 2011). In the study, THI was alarming during summer and is considered as a danger in rainy.

Blood glucose

The mean glucose level (mg/dl) for different seasons is presented in Table 2; depicted in Fig. 4 and monthly mean values in Table 3; depicted in Fig. 2. Mean values of glucose were within the normal range and recorded as

Table 1: Mean ±SE of environmental variables in different season during experiment

	Summer (n=121)	Rainy (n=122)	Winter (n=123)	Overall (n=366)	P -value
Minimum Temp	27.33 ^{b} ± 0.51	26.37 ^{b} ± 0.32	16.11^{a} ± 0.37	23.24 ± 0.35	0.000
Maximum Temp	38.69 ^{c} ± 0.60	33.15 ^{b} ± 0.49	28.83^{a} ± 0.34	33.53 ± 0.35	0.000
Average Temp	33.01 ^{c} ± 0.54	29.76 ^{b} ± 0.39	22.47^{a} ± 0.27	28.38 ± 0.33	0.000
Average Humidity	25.75 ± 1.29	69.62 ^{c} ± 1.86	59.71 ^{b} ± 1.42	51.79 ± 1.32	0.000
THI	77.30 ^{b} ± 0.48	80.10 ^{c} ± 0.25	71.38^{a} ± 0.45	76.24 ± 0.30	0.000

n=days. **: P<0.01 ^{a,b,c} Means with different superscripts within a row differ significantly.

Table 2: Mean ±SE values of biochemical parameters in Osmanabadi goats in different seasons during experiment

Biochemical parameters	Seasons			P -value
	Summer (n=80)	Rainy (n=80)	Winter (n=80)	
Glucose (mg/dl)	52.08^{a} ± 0.52	55.59^{b} ± 0.51	58.31^{c} ± 0.41	0.000
Total protein (g/dl)	7.02^{c} ± 0.04	6.84^{b} ± 0.03	6.71^{a} ± 0.05	0.000
Albumin(g/dl)	3.21^{a} ± 0.03	3.49^{b} ± 0.03	3.45^{b} ± 0.05	0.000
Globulin(g/dl)	3.81^{b} ± 0.05	3.36^{a} ± 0.04	3.26^{a} ± 0.06	0.000
A/G ratio	0.^{86a} ± 0.02	1.06^{b} ± 0.02	1.09^{b} ± 0.02	0.000
BUN (mg/dl)	15.43^{c} ± 0.26	14.33^{b} ± 0.34	13.51^{a} ± 0.26	0.000

n= blood samples. **: P<0.01 ^{a,b,c} Means with different superscripts within a row differ significantly.

for summer, rainy and winter, respectively. Winter glucose levels were significantly higher (P<0.05) than the rainy and summer season, as well as levels in summer, were significantly lower than the rainy season (Table 2). In the winter season, the highest value of serum glucose was recorded in November and the lowest in January. Likewise in the summer season, the highest and lowest value was recorded in March and May, respectively and in rainy season highest in September and lowest in June. Lower level of glucose during hot season may be due to increased glucose oxidation (Collier *et al.,* 2008) and decreased gluconeogenesis and glycogenolysis (Itoh *et al.,* 1998). Findings of the present study are in agreement with Bahga *et al.* (2009), Ocak *et al.* (2010), they reported decreased blood glucose level during summer season and increased during winter season in goats and Kataria *et al*. (2002) in camel,. In present study, the decreased feed intake during summer season may be the reason for decreased level of glucose (Banerjee *et al*., 2015). Contrary to the present findings of the present study Sejian and Srivastava (2009) reported a significantly higher glucose level (P<0.05) during the hot period.

Total protein

The mean and standard error values for total protein (g/dl) in Osmanabadi goat for different seasons are presented in Table 2; depicted in Fig. 3, and monthly mean values are presented in Table 3; depicted in Fig. 1.

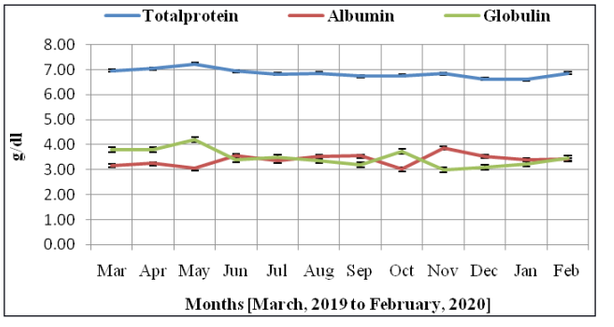

Fig. 1: Monthly means of total protein, albumin and globulin in Osmanabadi goat

There was a significant variation (P<0.01) observed between all the seasons. The values of total protein was

found to be significantly lower in winter followed by rainy and summer season In winter season the highest value of total protein was observed at and lowest at for the month of November and January, respectively. In the summer season, the highest and lowest value was recorded in May and February respectively and in rainy season lowest in September and highest in June. The values of total protein were found to be within the normal range for goat. Elevated total protein level in hot season may be due to vasoconstriction and decreased plasma volume during heat stress (Helal *et al*., 2010). This finding is in close agreement with Inbaraj *et al.* (2017) in Teressa goats. A similar observation was also recorded in other species (Rasooli *et al.,* 2004). Ribeiro *et al*. (2018) reported higher serum total protein level in hot season. However, Hooda and Naqvi (1990), found no significant effect on serum total protein in goat and sheep.

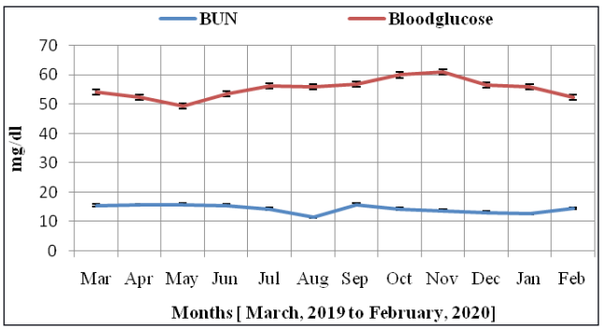

Fig. 2: Monthly means of BUN and glucose in Osmanabadi goat

Albumin

The mean and standard error values of albumin (g/dl) for different seasons presented in Table 2; depicted in Fig. 3 and monthly mean values are presented in Table 3; depicted in Fig. 1. Mean value for serum albumin in summer was found significantly lower (P<0.01) than rainy and winter seasons. While considering the monthly values, in summer season the highest value of serum albumin was recorded in the month of November and the lowest in the month of October. The highest and lowest value was recorded in February and May, respectively in summer season and highest in June and lowest in July in the rainy season. The values of serum albumin were found to be within the normal range for goat. Similar results were observed by Abdelatif *et al.* (2009). However, El-Nouty *et al.* (1990) found that the rise in ambient temperature during summer was associated with a significant increase in albumin and the slight rise in serum globulin level in goat.

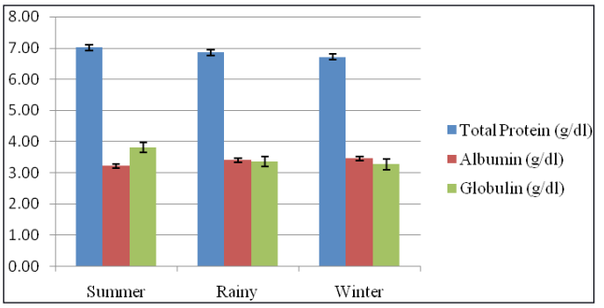

Fig. 3: Seasonal means of total protein, albumin and globulin in Osmanabadi goat

Globulin

The mean and standard error values of globulin (g/dl) for different seasons are given in Table 2; depicted in Fig. 3 and monthly mean values are presented in Table 3; depicted in Fig. 1. Mean value for serum globulin in summer was found significantly higher (P<0.01) than rainy and winter seasons. In winter season the highest value of globulin was observed at and lowest at for the month of November and January, respectively. In the summer season, the highest and lowest value was recorded in May and February, respectively and in rainy season lowest in September and highest in July. Rumosa Gwaze *et al.* (2010) attributed high globulin values to internal parasite infestations. However, during the present a routine deworming schedule was followed experiment to protect the goats against internal and external parasites. The browse species containing condensed tannins (CT) interfere with the immunity (Solaiman *et al.*, 2010). The higher globulin level in summer in the current study may be due consumption of tannin rich browse species and in cases of infection of contagious ecthyma and pneumonia that were observed occasionally. Similar observation has been reported by Chikwanda and Muchenje (2017). Contrarily, Dar *et al.* (2019) reported higher globulin concentration during the winter season in Badri cattle.

Albumin: Globulin ratio

The mean and standard error values Albumin: Globulin

Table 3: Monthly mean values for biochemical parameters in Osmanabadi goats

Month	Biochemical parameters					
	Blood glucose (mg/dl)	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	A G ratio	BUN (mg/dl)
January (n=20)	$55.90^{cd} \pm 0.37$	$6.61^{a} \pm 0.10$	$3.39^{cde} \pm 0.08$	$3.22^{abc} \pm 0.09$	$1.07^{def} \pm 0.04$	$12.72^{ab} \pm 0.51$
February (n=20)	$52.35^{b} \pm 0.98$	$6.86^{ab} \pm 0.06$	$3.40^{cde} \pm 0.05$	$3.46^{cd} \pm 0.05$	$0.99^{de} \pm 0.02$	$14.57^{cd} \pm 0.65$
March (n=20)	$54.15^{bc} \pm 0.80$	$6.95^{cd} \pm 0.09$	$3.16^{ab} \pm 0.04$	$3.79^{e} \pm 0.11$	$0.85^{b} \pm 0.03$	$15.59^{d} \pm 0.53$
April (n=20)	$52.40^{b} \pm 0.94$	$7.04^{de} \pm 0.09$	$3.24^{bc} \pm 0.07$	$3.80^{e} \pm 0.10$	$0.87^{bc} \pm 0.04$	$15.74^{d} \pm 0.41$
May (n=20)	$49.40^{a} \pm 1.14$	$7.22^{e} \pm 0.08$	$3.03^{a} \pm 0.06$	$4.20^{f} \pm 0.08$	$0.73^{a} \pm 0.02$	$15.82^{d} \pm 0.42$
June (n=20)	$53.45^{b} \pm 1.51$	$6.94^{cd} \pm 0.06$	$3.55^{e} \pm 0.08$	$3.39^{bcd} \pm 0.10$	$1.08^{ef} \pm 0.05$	$15.55^{d} \pm 0.54$
July (n=20)	$56.20^{cd} \pm 0.80$	$6.83^{abcd} \pm 0.06$	$3.34^{bcd} \pm 0.05$	$3.49^{d} \pm 0.06$	$0.96^{cd} \pm 0.02$	$14.30^{bcd} \pm 0.51$
August (n=20)	$55.90^{cd} \pm 0.73$	$6.86^{bcd} \pm 0.06$	$3.51^{de} \pm 0.06$	$3.35^{bcd} \pm 0.08$	$1.07^{def} \pm 0.04$	$11.59^{a} \pm 0.73$
September (n=20)	$56.80^{d} \pm 0.72$	$6.74^{abc} \pm 0.06$	$3.54^{e} \pm 0.07$	$3.20^{ab} \pm 0.07$	$1.13^{f} \pm 0.04$	$15.87^{d} \pm 0.50$
October (n=20)	$59.95^{e} \pm 0.82$	$6.76^{abc} \pm 0.10$	$3.01^{a} \pm 0.07$	$3.74^{e} \pm 0.13$	$0.83^{b} \pm 0.05$	$14.45^{cd} \pm 0.48$
November (n=20)	$60.95^{e} \pm 0.82$	$6.84^{abcd} \pm 0.06$	$3.85^{f} \pm 0.06$	$2.99^{a} \pm 0.06$	$1.31^{g} \pm 0.05$	$13.76^{bc} \pm 0.31$
December (n=20)	$56.45^{cd} \pm 0.58$	$6.62^{ab} \pm 0.11$	$3.53^{de} \pm 0.09$	$3.09^{a} \pm 0.07$	$1.16^{f} \pm 0.04$	$13.11^{abc} \pm 0.66$
P- value	0.000	0.000	0.000	0.000	0.000	0.000

n= blood samples. **: P<0.01. $^{a,b,c,d,e,f,g:}$ Means with different superscripts within a column differ significantly.

ratio was recorded as for summer, rainy and winter season, respectively (Table 2) (The monthly mean values of A: G ratio is presented in Table 3. The values for winter was found significantly higher (P<0.01) than values of summer followed by the rainy season. While considering the monthly values, in the summer season, the highest value of Albumin: Globulin ratio was recorded in the month of February and the lowest in the month of May. The highest and lowest value was recorded in November and October, respectively in the winter season and highest in September and lowest in July in the rainy season. Sharma and Puri (2013) also reported similar observations in Marwari goats.

Blood urea nitrogen (BUN)

The mean and standard error values of blood urea nitrogen (mg/dl) goat between different seasons presented in Table 2; depicted in Fig. 4 and monthly mean values are presented in Table 3; depicted in Fig. 2. Significantly lower (P<0.01) values of serum BUN was found in winter and significantly higher in summer followed by rainy season. In the summer season, the highest and lowest value was recorded in May and February, respectively and in rainy season lowest in September and highest in August. The highest value was observed at and lowest at for the month of October and January in the winter season, respectively. The increased level of BUN may be due to reduced blood flow toward kidney (Rathwa *et al*., 2017) and loss of extra-cellular fluid due to high temperature during summer and rainy seasons (Rasooli *et al*., 2004). Similar findings of higher BUN level during hot season have been reported by Suhair (2012), Ghosh *et al. (*2013), and Indu *et al.* (2014). In addition, higher BUN level may be attributed to increased utilization of amino acids through protein mobilization from muscle mass during hot season (Shreedhar *et al.,* 2013).

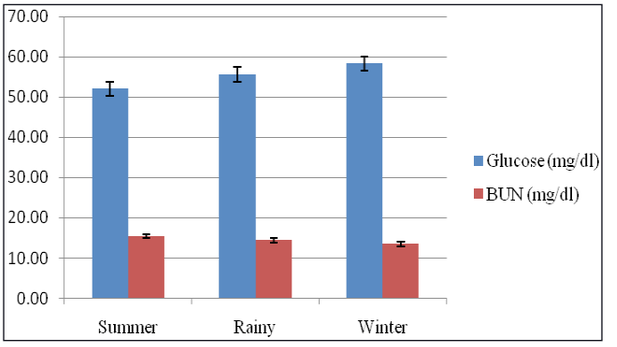

Fig. 4: Seasonal means of BUN and glucose in Osmanabadi **goat**

CONCLUSION

The results obtained revealed the significant seasonal variation ($P< 0.01$) and showed averagely adequate values in all biochemical parameters studied. The observations of the study could able to establish the seasonal variation in biochemical parameters. It could be concluded that irrespective of the management system adopted, goats can thrive well in all the management systems. Since it was the first time that biochemical parameters were investigated in Osmanabadi goats managed under the extensive and semi-intensive management system under the agro-climatic conditions of Chhattisgarh plains in the central zone of India, the data could serve as reference values for Osmanabadi goat reared in this region.

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