The Pharma Innovation Journal 2021; SP-10(10): 1422-1425

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; SP-10(10): 1422-1425

www.thepharmajournal.com
Received: 07-08-2021
Accepted: 09-09-2021

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Haematlogy of Nellore brown ewes and lambs reared in different systems of rearing

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Abstract
The study was conducted at Sheep unit, Livestock Research Station, Mamnnor, Warangal. The ewes and lambs were divided into three groups i.e Intensive (G1), Semi-Intensive (G2) and Extensive (G3) group by using Completely Randomized design. The mean total serum protein (g/dl) of ewes during lactation in the G1 group was significantly (P<0.05) higher than G2 and G3 groups. The mean serum albumin (g/dl) of ewes during the dry period in the G1, G2, and G3 groups was 3.58 ± 0.13, 3.29 ± 0.18, and 3.15 ± 0.17, respectively, and no significant (P<0.05) difference was observed between the groups. The serum total protein of lambs in the G3 group was lower than G2 and G1 groups but did not differ significantly (P<0.05) on the 180th day of the study. The mean serum cholesterol (mg/dl) of ewes and lambs in the G1 group was significantly (P<0.01) higher followed by the G2 and G3 group except at the time of starting of the study.

Keywords: sheep, total protein, albumin, globulin, cholesterol

Introduction
Blood is an important and reliable medium for estimate the health status of individual animals (Oduye, 1976) [13]. Blood parameters of animals are differing due to several factors such as breed, age, sex, health status, altitude, management, feeding level, hematological techniques used, seasonal variation, temperature, and physiological status of the animal.
Blood biochemistry gives a reliable and consolidated measure of the sufficiency of dietary nutrients that can be used regardless of the physiological state of the animal (Pambu-Gollah *et al*., 2000) [15]. Haematology and serum biochemistry assay of livestock determine the physiological disposition of the animals to their nutrition. The serum vitamin, protein and lipid concentrations are affected by diet/nutrition (Onasanya *et al*. 2015) [14].

Material and Methods
Animals: Sixty Nellore brown ewes (1.5 – 2 years) and 36 lambs of 3 month age group were selected from Sheep unit for the present study. Three rams of average 2 years agewere selected for tupping of ewes during study period. The ewes and lambs in each system of rearing kept separately in different sheds. The animals were housed in well ventilated shed made up of asbestos sheet roofing with morum flooring and maintained under hygienic condition. The sheds were cleaned every day morning and lime was applied on the floor once in every fifteen days. The animals were provided with bore well water *ad libitum* for drinking purpose. The waterers were cleaned every day and filled with fresh water in the morning and evening. The ewes and lambs were dewormed at the starting of the study. Prophylactic measures against Sheep pox, Enterotoxaemia, Pests des petits ruminants, Blue tongue, Hemorrhagic Septicemia, endo and ecto parasitic infections were carried out as per the institution calendar to ensure animal health condition throughout the study period. The estrous ewes were identified by teaser rams in the morning and evening hours. The separated estrous ewes were tupped by designated rams and date of tupping were recorded.

Experimental Procedure: The study was conducted for a period of more than 1 years from March 2019 to June 2020. All 60 ewes and 36 lambs selected for the study was allotted to three rearing systems i.e Intensive (G1), Semi- intensive (G2) and Extensive (G3) system by using Complete Randomized Design (3 x 20, 3 x 12). In G1 group, the ewes and lambs were kept in the shed throughout the day provided with farm grown chaffed green fodders (APBN,

CO-3 and 4, Super Napier, SSG and Hedge lucernae which ever available in the farm) in the morning and evening time, concentrate feed @ 1% of their body weight offered only in the evening time and not sent for grazing. The left over fodder and feed were removed from manger early morning every day. In G2 group, the ewes and lambs were sent for grazing for about 6 hours per day and offered 200 and 100 grams of concentrate feed, respectively in the shed in the evening time. For G3 group ewes and lambs no concentrate feed were offered in the shed and sent for grazing for 8-10 hours per day. The concentrate feed offered to the ewes in G1 and G2 group contain CP – 17.3 per cent, TDN – 72 Per cent.

Serum collection for Blood

For serum collection blood was collected into dry, clean and sterilized vacutainer tube plain containing clot activator. The vacutainer tubes kept in slant position for 2 hours without disturbance and serum were collected into 1 ml tarson micro centrifuge tubes. These serum samples were centrifuged in cool centrifuge at 3000 rpm for 5 minutes and then transferred into new tarson micro centrifuge tubes and stored at -20 ^{0}C until the analysis. The following biochemical constituents were estimated by using standard kits.

The statistical significance of blood parameters were analyzed as per the methods described by Snedecor and Cochran (1994) [24].

Results and Discussion

Serum Biochemical Parameters of Ewes

Serum total protein (g/dl)

The serum total protein (g/dl) in the G1 group was higher than G2 and G3 group during pregnancy, lactation and non-lactation period. The higher serum total protein in intensive sheep due to effective conversion of non-protein nitrogen substances into amino acids and protein (Reddy *et al*., 2019) [20]. The intensively reared sheep may have higher microbial rumen count, which are known to synthesize proteins from the available non-protein source. The serum total protein (g/dl) of ewes observed in the present study was within the range reported by Dutta *et al. (*1996) [4], Gupta *et al.* (2005) [7] and Nayak *et al.* (2013) [12].

In the present study during the dry period, serum total protein increased in the G1 and G2 group over pregnancy due to decreased maternal serum protein concentrations due to increased fetal growth, and in particular the use of maternal circulation amino acids for protein synthesis in the fetal muscles (Antunovic *et al*., 2002) [2]. During lactation, the serum total protein of ewes in the G1, G2 and G3 group was slightly higher than pregnancy due to the high energy needed for milk synthesis in animals (Piccione *et al*., 2009) [16].

Serum albumin (g/dl)

The total protein comprises mainly albumin and globulin and these two together indicates the actual protein status of the animal. Among them albumin gives a long term measure of protein status. The serum albumin (g/dl) of ewes in G1, G2 and G3 group during pregnancy, lactation and dry period were not statistically significant (P<0.05). Gupta *et al.* (2005) [7] who observed similar serum albumin values in ewes during pregnancy, lactation and dry period. Further, Roil *et al.* (1974) [22] and Nayak *et al.* (2013) [12] who observed similar albumin values in the adult sheep in their studies.

Serum globulin (g/dl)

Globulins not only enhance immunological status of the animal but also help in interpretation of abnormal albumin concentrations (Rameshkumar *et al.*, 2003) [19]. The serum globulin (g/dl) levels of ewes observed in the present study was within range reported by Karthik (2020) [8].

Serum cholesterol (mg/dl)

The Serum cholesterol (mg/dl) in G1 group was significantly (P<0.01) higher than G2 and G3 group in all physiological conditions (Table 1). The serum cholesterol level decreased during pregnancy than lactation and dry period in the three groups opined that increased turnover of cholesterol from plasma pool for synthesis of progesterone during late pregnancy (Prakash and Tandon 1979) [18]. The higher serum cholesterol during the lactation period in all the groups indicated that the body fat reserve are mobilized for glucose metabolism especially when glucose level fall during increased demand for energy during early lactation (Gupta *et al.*, 2005) [7].

The serum cholesterol level of ewes observed in the present study was similar to findings of Kumar *et al.* (2009) [9], slightly higher than Dutta *et al. (*1996) [4] and lower than Gupta *et al.* (2005) [7] which may be due to differences in physiological and nutritional status of animals.

Table 1: Serum biochemical parameters of ewes in different systems of rearing

S.no.	Group	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Cholesterol (mg/dl)
At starting of the study					
1.	G1	6.21 ± 0.17	3.39 ± 0.11	2.81 ± 0.10	80.18 ± 2.62
2.	G2	6.22 ± 0.13	3.38 ± 0.08	2.84 ± 0.07	81.27 ± 2.71
3.	G3	6.19 ± 0.16	3.36 ± 0.90	2.83 ± 0.97	83.23 ± 2.09
	SEM	0.086	0.053	0.051	1.40
	P	0.991	0.951	0.980	0.685
During Pregnancy					
					**
1.	G1	6.51 ± 0.20	3.55 ± 0.13	2.96 ± 0.10	99.01 ± 3.41^{a}
2.	G2	5.99 ± 0.18	3.26 ± 0.18	2.74 ± 0.08	75.18 ± 1.65^{b}
3.	G3	5.93 ± 0.14	3.28 ± 0.07	2.65 ± 0.10	74.93 ± 1.17^{bc}
	SEM	0.11	0.08	0.06	2.67
	P	0.057	0.259	0.077	0.000
During lactation period					
					**
1.	G1	6.63 ± 0.16^{a}	3.53 ± 0.07	3.10 ± 0.16	104.01 ± 2.80^{a}
2.	G2	6.08 ± 0.18^{b}	3.38 ± 0.14	2.70 ± 0.06	81.43 ± 1.90^{b}
3.	G3	6.06 ± 0.10^{bc}	3.25 ± 0.05	2.82 ± 0.09	77.43 ± 0.99^{bc}
	SEM	0.10	0.06	0.07	2.69
	P	0.021	0.123	0.063	0.000

During dry period					
					**
1.	G1	6.71 ± 0.31[a]	3.58 ± 0.13	3.13 ± 0.20[a]	101.14 ± 2.45[a]
2.	G2	6.27 ± 0.22[ab]	3.29 ± 0.18	2.98 ± 0.16[ab]	77.86 ± 2.19[b]
3.	G3	5.65 ± 0.29[b]	3.15 ± 0.17	2.50 ± 0.16[b]	75.31 ± 1.64[bc]
	SEM	0.18	0.10	0.11	2.60
	P	0.041	0.190	0.045	0.000

[a, b, c] means with different superscripts row wise differ significantly **(P<0.01), *(P<0.05)
G1 : Intensive system,
G2 : Semi-Intensive system,
G3 : Extensive system
SEM : Standard Error Mean,
P :Probability value

Serum Biochemical Parameters of Lambs

Serum total protein (mg/dl)

At the starting of the study, the Serum total protein (mg / dl) of lambs was similar in the three groups, and had no substantial difference. In the 90th and 180th day of the study, the serum total protein (mg / dl) of lambs was higher in G1 group than in G2 and G3 group but had no significance (P<0.05) difference between groups (Table 2). The higher serum total protein in intensive system of rearing may be due to increased concentrate intake than semi-intensive and extensive system of rearing. Similar results of the present study were reported by Porwal *et al.* (2005) [17], Muralidharan *et al.* (2012) [11]. Further, Kumawat *et al.* (2017) [10] who observed significance (P<0.05) difference in the serum total protein between the treatments in Magra lambs.

Serum albumin (g/dl)

Albumin is the main protein that makes up more than 50 percent of the total serum protein and plays a major role in the absorption of the body with amino acids in the form of storage and the preservation of the osmotic balance of the blood as well as the transfer of a large number of nutrients into the bloodstream (Ahmed *et al*., 2020) [1].

The serum albumin (g/dl) of lambs in the G3 group was non-significantly (P<0.05) lower than G2 and G1 group at 90th and 180th days study (Table 2). The lower serum albumin in extensive system of rearing due to deficiencies in dietary protein and parasitism. Similar results reported by Porwal *et al.* (2005) [17] and Muralidharan *et al.* (2012) [11].

Table 2: Serum biochemical parameters of lambs in different systems of rearing

S.no.	Group	N	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Cholesterol (mg/dl)
At the starting of the study						
1.	G1	12	5.92 ±0.25	3.23 ± 0.10	2.69 ± 0.19	77.39 ± 0.76
2.	G2	12	6.05 ± 0.18	3.44 ± 0.11	2.61 ± 0.15	79.02 ± 2.52
3.	G3	12	5.95 ± 0.33	3.33 ± 0.16	2.63 ± 0.19	74.98 ± 3.12
	SEM		0.14	0.07	0.10	1.34
	P		0.936	0.248	0.556	0.489
At 90th day of study						
						**
1.	G1	12	6.06 ± 0.13	3.24 ± 0.10	2.82 ± 0.07	96.27 ± 4.45[a]
2.	G2	12	5.84 ± 0.15	3.06 ± 0.10	2.79 ± 0.11	70.47 ± 3.79[b]
3.	G3	12	5.69 ± 0.12	2.83 ± 0.16	2.86 ± 0.08	65.05 ± 1.56[bc]
	SEM		0.079	0.075	0.049	3.43
	P		0.169	0.074	0.835	0.000
At 180th day of study						
						**
1.	G1	12	6.06 ± 0.27	3.20 ± 0.19	2.86 ± 0.10	96.20 ± 3.27[a]
2.	G2	12	5.59 ± 0.22	2.96 ± 0.17	2.64 ± 0.08	73.55 ± 2.53[b]
3.	G3	12	5.38 ± 0.13	2.79 ± 0.67	2.59 ± 0.06	64.72 ± 5.39[bc]
	SEM		0.13	0.09	0.	3.51
	P		0.084	0.171	0.062	0.000

[a, b, c] means with different superscripts row wise differ significantly **(P<0.01), *(P<0.05)
G1 : Intensive system,
G2 : Semi-Intensive system,
G3 : Extensive system
SEM : Standard Error Mean,
P :Probability value

Serum globulin (g/dl)

The Serum globulin (g/dl) of lambs in G3 group was slightly higher than G1 and G2 group at 90th day of the study but on 180th day of study, the serum globulin in lambs was higher in G1 group followed by G2 and G3 group. The serum globulin of lambs in the three groups did not differ significantly (P<0.05) throughout the study period. The results of the study was within range reported by Ghanim *et al.* (2016) [6].

Serum cholesterol (mg/dl)

The Serum cholesterol (mg/dl) of lambs in the G1, G2 and G3 group in the starting of the study had no substantial

difference. At 90th and 180th day of the study, G1 group lambs had significantly (P<0.05) higher serum cholesterol followed by G2 and G3 group.

Higher levels of cholesterol in the intensive rearing system could be attributed to higher levels of free fatty acids as a result of decreased stress levels (Fleming, 1997) [5] as demonstrated in the present study. Higher cholesterol level in intensive system, but within physiological limits is suggestive of superior body condition and less stress in this systems of rearing.

Similar results of the present study serum cholesterol level was reported by Dutta *et al.* (1996) [4], Devendran *et al.* (2009) [3], Reddy *et al.* (2010) [21], Muralidharan *et al.* (2012) [11] and Sahoo *et al.* (2016) [23] in their studies.

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