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Haematology of Nellore Brown Ewes and Lambs Reared in Different Systems of Rearing

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A B S T R A C T

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 WBC (10^3/ µl) count of ewes in G1, G2 and G3 group had significant (P<0.01) difference between G1 and G3 group but the means of G1 and G2 group was not comparable. In lactating ewes, the mean RBC (10^6/µl) count of G2 group had no significant (P<0.01) effect with G3 group. The mean Haemoglobin (g/dl) in G1, G2 and G3 groups in dry ewes and had significant (P<0.01) difference between the three groups. The mean PCV (%) during dry period was significantly (P<0.01) higher in G1 than G2 and G3 groups. In lambs, the WBC (10^3/ µl) count was higher in G3 group followed by G2 and G1 group at the 90^{th} and 180^{th} day of study. The mean RBC (10^6/µl) of lambs at the 180^{th} day was higher in G1 than G2 and G3 group. The mean Haemoglobin (g/dl) of lambs in G2 and G3 groups had no significant (P < 0.05) effect at 180^{th} day.

Introduction

Blood serves as a pathological reflector of the toxicant and other conditions in exposed animals. Animals with good blood composition are likely to show good performance. The animals which are subjected to large seasonal variability in environmental conditions under various feeding management systems with different nutritional planes also show changes in blood metabolites. Changes in blood metabolites correlated with nutritional status act as an indication of the animal clinical well-being and its tissue function and physiological status. Level of circulating blood constituents can therefore be useful as indicators in defining the nutritional and physiological status of animal reported by O'Kelly (1973).

Materials and Methods

Site of the study

The present study was conducted at Livestock Research Station, Mamnoor, Warangal district, Telangana state situated at an altitude of 290 meters above mean sea level on 79.59^0 longitudes and 17.9^0 latitude. The minimum and maximum temperature ranges from 16.2 and 42.9^0C. The average annual rainfall of the area is 994 mm. Some rainfall during the summer and post monsoon months and it is mainly in the form of thunder storms.

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 age were 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.

Blood collection for haematology

The whole blood sample (2 ml) was collected into a clean, dry, sterilized vacutainer tube of 5 ml capacity containing K3 ethylene diamine tetra acetic acid (EDTA) as anticoagulant. The vacutainer tube were kept in cool ice pack immediately after collection maintaining temperature at 5 ^{0}C. Various haematological parameters viz. haemoglobin, packed cell volume, total erythrocyte count, total leukocyte count, were estimated by hemo auto-analyzer with in 24hrs.

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

Results and Discussion

Haematology of Ewes in different systems of rearing

The haematological values recorded in the present study were within the normal range of sheep at different ages reported by (Egbe-Nwiyi *et al.,* 2000).

The Haematology of ewes in different systems of rearing at different physiological stages are presented in Table 1.

WBC (10 ^{3}/ µl)

The mean WBC (10 ^{3}/ µl) count at the staring of the study in the ewes was 12.50 ± 0.31, 12.88 ± 0.32 and 12.54 ± 0.21, respectively in G1, G2 and G3 groups and had no significant (P<0.05) effect between the three groups.

The mean WBC (10 ^{3}/ µl) count in ewes during pregnancy was 11.76 ± 0.34, 13.74± 0.49and 14.75 ± 0.33, respectively in G1, G2 and G3 groups and significant (P<0.01) difference was observed between G1 and G3 group but G1 and G2 groups had no significant difference.

The mean WBC (10 ^{3}/ µl) count during lactation period in ewes was significantly higher in G3 (15.61 ± 0.79) than G2 (13.08 ± 0.54) and G1 (11.94 ± 0.39) groups and the means of G1 and G2 groups was not comparable (P<0.01).

In the ewes during dry period the mean WBC (10 ^{3}/ µl) count in G1, G2 and G3 group was 11.69 ± 0.32, 13.04 ± 0.35and 15.25 ± 0.50, respectively. By analysis of the data observed that the means WBC (10 ^{3}/ µl) count of three groups had significant (P<0.01) difference.

The mean WBC (10 ^{3}/ µl) count of ewes in the G1 group was lower than G2 and G3 group and had significant (P<0.05) effect in all physiological conditions in the present study except at the stating of the study (Table 1). In semi-intensive and extensive system of rearing, the animals are more exposed to pathogens and environmental stress factors than intensive rearing and higher WBC counts found in the former rearing systems to combat these threatening circumstances. The WBC count in the present study was slightly higher than results reported by Dutta *et al.,* (1996), Kalleswarappa (1999), Kumar *et al.,* (2009) and Nayak *et al.,* (2013) because blood parameters of animals differed 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 (Mbassa and Poulsen, 2003).

Agrawal *et al.,* (2004) reported similar results as in the present study that post parturient animals had slightly higher WBC count than pregnant and lactating animals had more WBC

count than dry animals in their study (Owusu *et al.,* 2016 and Gupta *et al.,* 2008).

RBC (10^6/µl)

The mean RBC (10^6/µl) count at the starting of the study in ewes of G1, G2 and G3 groups were 9.02 ± 0.33, 9.46 ± 0.20 and 9.38 ± 0.28, respectively and significant (P<0.05) difference was not observed between G1, G2 and G3 group.

The mean RBC (10^6/µl) count in pregnant ewes was significantly (P<0.01) higher in G1 (12.05 ± 0.29) group than G2 (10.25 ± 0.27) and G3 (9.05 ± 0.18) group.

In lactating ewes, the mean RBC (10^6/µl) count was 10.89 ± 0.21, 9.54 ± 0.35 and 8.88 ± 0.32 in the G1, G2 and G3 group, respectively and had no significant (P<0.01) effect between G2 and G3 group.

The mean RBC (10^6/µl) count was 11.06 ± 0.24, 9.42 ± 0.23 and 8.64 ± 0.26 in G1, G2 and G3 groups, respectively in dry ewes and significant (P<0.01) effect was observed in the RBC (10^6/µl) count in dry ewes between three groups.

The mean RBC (10^6/µl) of ewes in the present study was higher in G1 than G2 and G3 group during pregnancy, lactation and dry period. The RBC values at different physiological stages in sheep were higher than the values reported by Agrawal *et al.,* (2004) and Kumar *et al.,* (2009).

Haemoglobin (g/dl)

At the staring of the study, the mean haemoglobin (g/dl) in the ewes was in the range 8.22 -8.66 in the three groups and significant (P<0.05) difference was not observed between the groups. The mean haemoglobin (g/dl) in pregnant ewes of G1, G2 and G3 groups were 10.53 ± 0.12, 9.01 ± 0.20and 8.34 ± 0.32, respectively and highly significant (P<0.01) effect was found between the three groups.

In the ewes during lactation, the mean haemoglobin (g/dl) was 9.26 ± 0.19, 8.14 ± 0.33 and 7.06 ± 0.28, respectively in the G1, G2 and G3 groups and statistical analysis revealed that three groups had significant (P<0.01) effect.

The mean haemoglobin (g/dl) in G1, G2 and G3 group was 9.66 ± 0.22, 8.53 ± 0.24 and 7.71 ± 0.22, respectively in dry ewes and significant (P<0.01) effect was observed between the three groups.

The Hb (g/dl) concentration in ewes during pregnancy was higher than lactation and non-lactation period in all the three groups. These results were in agreement with findings of Kumar *et al.,* (2009). The Hb (g/dl) concentration of ewes in G1 group at different physiological stages was significantly (P<0.01) higher than G2 and G3 group (Table 1). This might be due to heat stress in extensive system which can lead to denaturation and precipitation of haemoglobin molecules in the erythrocytes leading to decreased concentration of Hb in the blood. Sejian *et al.,* (2010) reported lower Hb levels in the sheep maintained on low plane of nutrition and depleted nutrient resources, which is evident from the present study. The Hb (g/dl) concentration of ewes observed in the present study was within normal physiological range reported by Agrawal *et al.,* (2004) and Nayak *et al.,* (2013).

PCV (%)

The mean PCV (%) values in the three groups at the starting of the study was in the range 30.64 – 31.32 and had non - significant (P<0.05) effect among the groups.

The mean PCV (%) values was significantly (P<0.05) higher in G1 (32.18 ± 0.65) than G3 (29.33 ± 0.56) group during pregnancy in ewes and the means of the G1 and G2 group are comparable. The PCV (%) in the ewes was significantly (P<0.05) lower in G3 than G2 and G1 group (Table 25). Similar results were reported by Karthik (2020). The results of the present study was in contrary to Kochewad (2015) who reported higher PCV (%) values in extensive system than intensive system reared animals might be due to hemo concentration developed by dehydration leading to release of erythrocytes concentrated in spleen. However, the ample supply of clean drinking water to the grazing sheep throughout the study period might have combated the hemo-concentration and altered the results.

The mean PCV (%) values were 33.29 ± 0.43, 31.17 ± 0.34 and 28.99 ± 0.43 during lactation period in the G1, G2 and G3 group ewes, respectively and significant (P< 0.01) effect was observed between the three rearing systems.

The mean PCV (%) value was significantly (P<0.01) higher in G1 (32.36 ± 0.38) than G2 (30.96 ± 0.21) and G3 (29.23 ± 0.38) group in dry ewes.

Haematology of Lambs reared in different systems of rearing

Haematology of lambs reared in different systems of rearing is presented in Table 2.

WBC (10^3/ µl)

The mean WBC (10^3/ µl) count of lambs reared in G1, G2 and G3 groups were10.00 ± 0.39, 10.78 ± 0.54 and 10.48 ± 0.44, respectively at the starting of the study.

At the 90th and 180th days of the study, the mean WBC (10^3/ µl) count was higher in G3 group followed by G2 and G1 group. Statistical analysis of data found that G1 group had significant (P<0.01) effect with G3 group but non - significant (P<0.01) difference was observed between G2 and G1 group.

The major functions of the WBC are to fight infections, defend the body by phagocytocis against invasion by foreign organisms and to produce or at least transport and distribute antibodies in immune response. Thus, animals with low white blood cells are exposed to high risk of disease infection, while those with high counts are capable of generating antibodies in the process of phagocytocis and have high degree of resistance to diseases and enhance adaptability to local environmental and disease prevalent conditions Etim *et al.*, (2014). The WBC count in the lambs was significantly (P<0.05) higher in G3 than G1 group at 90th and 180th day of the study (Table 2). The results of the present study was not in agreement with Sahoo *et al.*, (2016) and Kumawat *et al.*, (2017) who observed the WBC count had non-significance (P<0.01) difference between supplemented and non-supplemented lambs.

RBC (10^6/µl)

Red blood cell contains oxygen and carbon dioxide in the body. A decreased number of red blood cells thus means a decrease in the amount of oxygen to be delivered to the tissues, as well as the level of carbon dioxide returning to the lungs. The vitality level has increased in the animals living under intensive system of rearing as compared to other system of rearing observed by Raju *et al.*, (2015).

The mean RBC (10^6/µl) count in the lambs at the starting of the study was in the range of 9.1 – 9.75. At the 90th day of study, the mean RBC (10^6/µl) in the lambs was 9.95 ± 0.20, 9.67 ± 0.23 and 8.33 ± 0.22 in the G1, G2 and G3 groups, respectively but G1 and G2 group had significant (P<0.01) effect with G3 group.

The mean RBC (10^6/µl) of lambs at 180th day of the study was higher in G1 (10.11 ± 0.43) than G2 (9.33 ± 0.39) and G3 (8.58 ± 0.24) group and significant (P<0.05) effect was not observed between G1 and G2 group but the means of G1 and G3 was comparable statistically.

The RBC count of lambs in the G1 group was significantly (P<0.05) higher than G3 group of lambs (Table 26). The RBC count observed in the present study was within the range reported by Dutta *et al.*, (1996) and Kalleswarappa (1999). Contrary to the present results Sahoo *et al.*, (2016) and Kumawat *et al.*, (2017) reported non-significant difference between different systems of rearing in RBC count.

Table.1 Hematology of ewes in different systems of rearing

S.no.	Group	WBC (10^3/ µl)	RBC (10^6/µl)	Hb (g/dl)	PCV (%)
At the starting of the study					
1.	G1	12.50 ± 0.31	9.02 ± 0.33	8.62 ± 0.22	30.64 ± 0.30
2.	G2	12.88 ± 0.32	9.46 ± 0.20	8.22 ± 0.27	31.03 ± 0.24
3.	G3	12.54 ± 0.21	9.38 ± 0.28	8.56 ± 0.23	31.32 ± 0.21
	SEM	0.164	0.157	0.140	0.147
	P	0.591	0.491	0.450	0.171
During Pregnancy					
		**	**	**	**
1.	G1	11.76 ± 0.34 ^{b}	12.05 ± 0.29 ^{a}	10.53 ± 0.12^a	32.18 ± 0.65 ^{a}
2.	G2	13.74± 0.49 ^{a}	10.25 ± 0.27 ^{b}	9.01 ± 0.20 ^{b}	30.71 ± 0.43 ^{a}
3.	G3	14.75 ± 0.33 ^{a}	9.05 ± 0.18 ^{c}	8.34 ± 0.32 ^{b}	29.33 ± 0.56 ^{b}
	SEM	0.290	0.231	0.185	0.356
	P	0.00	0.00	0.00	0.003
During lactation					
		**	**	**	**
1.	G1	11.94 ± 0.39^b	10.89 ± 0.21 ^{a}	9.26 ± 0.19 ^{a}	33.29 ± 0.43 ^{a}
2.	G2	13.08 ± 0.54 ^{b}	9.54 ± 0.35 ^{b}	8.14 ± 0.33 ^{b}	31.17 ± 0.34 ^{b}
3.	G3	15.61 ± 0.79 ^{a}	8.88 ± 0.32 ^{b}	7.06 ± 0.28 ^{c}	28.99 ± 0.43 ^{c}
	SEM	0.407	0.213	0.208	0.356
	P	0.00	0.00	0.00	0.00
During dry period					
		**	**	**	**
1.	G1	11.69 ± 0.32 ^{c}	11.06 ± 0.24 ^{a}	9.66 ± 0.22 ^{a}	32.36 ± 0.38 ^{a}
2.	G2	13.04 ± 0.35 ^{b}	9.42 ± 0.23 ^{b}	8.53 ± 0.24 ^{b}	30.96 ± 0.21 ^{b}
3.	G3	15.25 ± 0.50 ^{a}	8.64 ± 0.26 ^{c}	7.71 ± 0.22 ^{c}	29.23 ± 0.38 ^{c}
	SEM	0.319	0.209	0.180	0.286
	P	0.00	0.00	0.00	0.00

Means within a column having different superscripts 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

Table.2 Haematology of lambs in different systems of rearing

S.no.	Group	N	WBC (10^3/ µl)	RBC (10^6/µl)	Hb (g/dl)	PCV (%)
At the starting of the study						
1.	G1	12	10.00 ± 0.39	9.10 ± 0.45	7.42 ± 0.30	23.90 ± 1.01
2.	G2	12	10.78 ± 0.54	9.75 ± 0.54	7.80 ± 0.29	23.52 ± 0.89
3.	G3	12	10.48 ± 0.44	9.29 ± 0.50	7.13 ± 0.33	22.73 ± 0.97
	SEM		0.250	0.277	0.179	0.589
	P		0.489	0.646	0.332	0.155
At 90th day of the study						
			**	**	**	
1.	G1	12	11.45 ± 0.34^{b}	9.95 ± 0.20^{a}	9.28 ± 0.28^{a}	24.12 ± 0.83
2.	G2	12	13.13 ± 0.42^{ab}	9.67 ± 0.23^{a}	8.20 ± 0.13^{b}	23.85 ± 0.62
3.	G3	12	13.93 ± 0.42^{a}	8.33 ± 0.22^{b}	7.31 ± 0.11^{c}	22.35 ± 0.66
	SEM		0.258	0.220	0.569	0.429
	P		0.003	0.001	0.000	0.200
At 180th day of the study						
			**	**	**	
1.	G1	12	11.63 ± 0.33^{b}	10.11 ± 0.43^{a}	9.55 ± 0.24^{a}	25.55 ± 1.07
2.	G2	12	13.45 ± 0.35^{ab}	9.33 ± 0.39^{ab}	8.15 ± 0.16^{b}	24.57 ± 0.80
3.	G3	12	14.87 ± 0.95^{a}	8.58 ± 0.24^{b}	7.50 ± 0.24^{b}	22..73 ± 0.97
	SEM		0.462	0.247	0.239	0.59
	P		0.007	0.000	0.030	0.139

Means within a column having different superscripts 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

Haemoglobin (g/dl)

The mean haemoglobin (g/dl) in the lambs of G1, G2 and G3 group at the starting, 90th and 180th day of the study was7.42 ± 0.30, 7.80 ± 0.29 and 7.13 ± 0.33; 9.28 ± 0.28, 8.20 ± 0.13 and 7.31 ± 0.11; 9.55 ± 0.24, 8.15 ± 0.16 and 7.50 ± 0.24, respectively. Statistical analysis of the data found that significant (P<0.05) difference was not observed between the three groups at the starting of the study in haemoglobin but had significant (P<0.01) effect between the three groups at the 90th day of the study. At 180th day of the study, the mean haemoglobin (g/dl) of lambs in G2 and G3 groups had no significant (P<0.01) effect.

The Hb (g/dl) concentration in lambs was significantly (P<0.05) lower in G3 than G2 and G1 group (Table 26). The Hb (g/dl) in lambs observed in the present study remained within the normal range of age and species specific reported by Benjamin (1985). The similar observations reported by Abd-El-Hafiz *et al.*, (1980), Naqvi *et al.*,(1991), Dutta *et al.*, (1996) in sheep of Assam, Kalleswarappa (1999) and Devendran *et al.*, (2009). Further, Nayak *et al.*, (2013) who reported slightly higher Hb values than the present study. Similarly, Kochewad (2015) observed significant difference between rearing systems but Kumawat *et al.*, (2017) who reported non-significance (P<0.05) difference between supplemented and non-supplemented group in lambs.

PCV (%)

The mean PCV (%) of the lambs at the starting of the study was23.90 ± 1.01, 23.52 ± 0.89 and 22.73 ± 0.97 in the G1, G2 and G3 groups, respectively. At 90th and 180th day of the study, the mean PCV (%) was slightly higher in G1 (24.12 ± 0.83 and 25.55 ± 1.07) than G2 (23.85 ± 0.62 and 24.57 ± 0.80) and G3 (22.35 ± 0.66 and 22.73 ± 0.97) groups but significant (P<0.05) effect was not observed between the groups.

The PCV (%) values observed in G1 group lambs was higher than G2 and G3 group but had no significance (P<0.05) between rearing system at 90th and 180th day of the study (Table 26). The similar results reported by Sahoo *et al.,* (2016) and Karthik (2020). Devendran *et al.,* (2009) who observed slightly higher PCV values than the present study at 6-9 months age in lambs. The PCV values of the present study was within normal range reported by Etim *et al.,* (2014).

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