Evalution of Haematological and Serum Biochemical Indices of Sheeps in Central Odisha, India

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Abstract:-

The hematological and biochemical parameters of 120 apparently healthy sheep consisting of 60 adults (30male and 30 female) comprised of 3 indigenous and popular breeds of sheep of central Odisha , India were studied. Data were analyzed for the effect of breed, sex and season packed cell volume (PCV) was significantly higher (P<0.05) for Koraput ram of the Odisha. Haemoglobin (Hb) values was higher (P<0.05) for Ganjam sheep. Red blood cell count (RBC) was significantly (P<0.05) for Ganjam ewes. The mean corpuscular hemoglobin (MCH) was higher in Ganjam ram (17.89 Pg) while the values were much higher in Bolangir ewe lamb. The mean corpuscular hemoglobin concentration (MCHC) was significantly higher (P<0.05) for adult sheep than in lambs. The mean corpuscular volume (MCV) was observed to be higher for Koraput ram (98.8 fl) while the values were much higher in Bolangir ram lamb. Bolangir ewe had the highest white blood cell count (WBC). White blood cell differential shows that lymphocytes was significantly higher (P<0.05) for Bolangir sheep (adult). Neutrophils was significantly higher (P<0.05) for Ganjam ewe (adults and lambs). Eosinophils was observed only in Bolangir sheeps (adult and lamb). Monocytes was observed only in Koraput ram. The serum sodium ranged from (140.0 to 156.0 mmol/l) for adult sheep of all breeds, (140.0 to 160.0 mmol/l) for sheep lambs of all breeds.

Key words:- *Hematology, blood chemistry, breeds, sheep, lamb, ewe.ram.central Odisha.*

INTRODUCTION:-

Animal Husbandry Department plays an important role in up-liftment of the economic status of the rural and urban people of Odisha, India. The department is implementing different Animal Husbandry programmes like Feeding, Breeding, Management as well as Marketing in scientific methods, in order to safe-guard the livestock and poultry from different diseases and to provide better health coverage and breeding facilities. The aim of this department is to increase livestock production and productivity in terms of milk, meat and egg to meet the demand of the people and to generate self employment for rural youths under employment mission programme.

Small ruminants such as sheep and goats play important role in the livestock subsector of the Indian agricultural economy (Lakpini et al., 2002)[55]. Nigeria hosts 21,230 million sheep (Adu et al., 1979)[8] and over 70% of the sheep population in Nigeria is found in the sahelo savanna regions where three of the four breeds of sheep (Balami, Yankasa and Ouda) predominant (Adu and Ngere, 1979[8]).In Odisha three important breeds of sheeps are found, such as Bolangir breed,Koraput breed and Ganjam breed.

Blood is an important index of physiological and pathological changes in an organism (Mitruka and Rawnshey, 1977)[46]. The primary function of the blood is to transport oxygen from respiratory organs to body cells (Duke, 1975)[33] distributing nutrients and enzymes to cells and carrying away waste products thereby maintaining homeostasis of the internal environment (Bentrick, 1974)[23]. The various functions of the blood are carried out by the individual and

collective actions of its constituents – the haemotological and biochemical components (Akinmutimi, 2004)[9].

Haematological tests have been widely used for the diagnosis of various diseases and nutritional status of animal. The information gained from the blood parameters would substantiate the physical examination and together with medical history provide excellent basis for medical judgment (Schalm et al., 1975[69]). addition, it would help determine the extent of tissue and organ damage, the response of defence mechanism of the patient and aid in the diagnosing the type of possible anemia (Schalm, 1975)[69].

A quantifiable variation was reported in blood parameters due to altitude, management, feeding level, age, sex, breed, health status, method of blood collection, hematological techniques used, diurnal and seasonal variation, ambient temperature and physiological status (excrement, muscular exercise, pregnancy, estrus, parturition, time of sampling, water balance and transportation.(Kausslish and Arora, 1977; Schalm et al., 1975[69]).

Physiologic and pathological changes can be best evaluated when normal blood values are available for comparison. Even though considerable information is available on the normal blood parameters of domestic animals, the values are that of exotic breeds kept under different environment and management conditions).

This study was therefore an attempt to come up with normal hematological and biochemical reference values in indigenous sheep breeds found in the central Odisha , in India raised under free ranged system as by breed, sex and age. The present study was undertaken to evaluate the haematological and biochemical indices in sheep on natural grazing land in semi arid Odisha region of India

MATERIRALS AND METHODS

a) Experimental Location

The sheep breeds used in this study were obtained from different locations in the semi-arid region of Central Odisha, India. The climate of the region is characterized by long dry (October to May) and short rainy (June to September) seasons and reaches maximum in August, with mean annual rainfall of mm minimum and maximum respectively. It has annual maximum 1450mm and 50mm minimum temperatures of45 ^{0}C and 10^{0}C respectively .The natural vegetation of the area is deciduous characterized by trees and grasses.

DATA COLLECTION

Blood samples were collected from the jugular vein of apparently 120 healthy sheep of different breeds consisting of 60 adults (30 rams and 30 ewes) and 60 young ones (30 rams lambs and 30 ewe lamb) from different locations in the Central Odisha ,in India. The live weights of the adult and young sheep were 21.5±0.94 and 7.5±0.23 Kg respectively. The sheep were bled through jugular vein and 10ml of blood collected. 3ml of the blood samples were collected into plastic tube containing EDTA for haematological studies. The remaining 7ml of blood samples were deposited in anti-coagulant free plastic tube and allowed to clot at room temperature within 3hrs of collection. The serum samples were stored at -20^{0}C for biochemical studies. Total erythrocytic counts and total leukocytic counts were determined with the aid of Haemocytometer (Neubaur counting chamber) and Hb concentration was determine by Sahl's (acid haematin) method (Benjamin, 1978).

Mean corpuscular Haemoglobin concentration (MCHC), mean corpuscular Haemoglobin (MCH), Mean Corpuscular Volume (MCV) values were calculated (Patterson et al., 1960)[65]. Serum Aspartate Aminotransferase, Serum Aslanine Aminotransferase and Alkaline phosphatase were analysed spectriphotometric linked reaction method (Cheesbrough, 2004)[28]. Other biochemical analysis was done using the method described by Ogunsani et al. (2002).

STATISTICAL ANALYSIS

Mean values and standard errors were calculated and the results were treated statistically using t-test assessing the mutual statistical differences between adult and young animals Snedecor and Cochram (1982) and one-way ANOVA was used to assess the statistical difference between male and female.

RESULTS

a)*Haematology (Adults)*

The results of the hematological values for adult sheep is shown in Table 1. The packed cell volume (PCV) was significantly different ($P<0.05$) between breeds with Koraput ram having the highest (64.0%) volume. The haemoglobin (Hb) values ranged from (9.80 to 12.90 g/dl) with Ganjam having the highest value (12.90 g/dl). The highest value of (9.66 g/dl) was observed in Ganjam ewe for red blood cell count (RBC) while Koraput ram had the least (6.49 g/dl). MCH values ranged from 10.46 in Ganjam ewe to 17.89 Pg in Ganjam ram. Bolangir ram was observed to have the highest mean corpuscular haemoglobin concentration (MCHC). Koraput ram was observed to have the highest mean corpuscular volume (MCV). Bolangir ewe had the highest value for white blood cell count (29.76 x 10 g/l). the lymphocytes values ranged from 52.00% in Ganjam ewe to 81.00% in Bolangir ewe or all the breeds had lymphocytes values above 70% except for Ganjam ewe which had below 55% though the highest value for neutrophils was observed in Balami ewe (48.00%). Eosinophils was observed only in Bolangir goats. Monocytes was observed only in Koraput ram.

b) Haematology (Lambs)

The results of the haematological parameters for lambs is shown in Table 2. Bolangir ewe lamb had the highest (PCV) (45.3%) compared to other breed and sex. Haemoglobin values was observed to be highest in the Ganjam ram and ewe lamb (12.2 and 12.2 g/dl respectively). The RBC values ranged from 4.23 for Bolangir ram lamb to 8.69 g/dl in Koraput ram lamb. Mean corpuscular haemoglobin (MCH) values ranged from 12.8 in Koraput ram lamb and ewe lamb to 20.4 Pg in Bolangir ewe lamb. Koraput ram lamb was observed to have the highest mean corpuscular hemoglobin concentration (MCHC). Bolangir ram lamb had the highest mean corpuscular value while Koraput ram lamb had the highest value for white blood count (27.89 x 109/l). The lymphocytes values ranged from 58.00% in Ganjam ram lamb to 76.00^ in Koraput ram lamb. The lymphocyte value for Ganjam ewe lamb is low (45.00%), though the highest value for neutrophils was observed in Ganjam ewe lamb (54.00%). Eosinophils values was observed only in Bolangir ewe lamb.

c) Biochemical Indices (Adults)

The results of biochemical indices of the adult sheep is shown in Table 3. The serum sodium and globulin were significantly higher (P<0.05) in Bolangir ewe. The values for serum potassium was highest in Koraput ewe (14.2 mmol/l) the chloride and albumin values were observed to be highest in the Bolangir ram values for hydrogen carbonate (HCO-3) (26.0 mmol/L), creatinine (156.0 mmol/L) and cholesterol (2.5 mmol/l) were higher in Ganjam ram. Koraput ram was observed to mmol/L). The serum potassium, chloride, urea, glucose, total protein and globulin were significantly higher (P<0.05) in Koraput ram lamb than any of the breed and sexes.Ganjam ram lam was observed to have the highest value for hydrogen carbonate HCO-3 (27.0 mmol/l) and creatinine (139.0 mmol/L). aspartate Aminotransferase (ASP) and Alanine Aminotransferase (ALT) were higher in Koraput ewe lamb (143.0 and 45.0I μ/L).

Table 1 : **Sheep Haematology (Adult).**

	Bolangir		Koraput		Ganjam	
	Ram	Ewe	Ram	Ewe	Ram	Ewe
PCV (%)	28.92± 0.02^{e}	37.11± 1.0^{c}	64.06± 2.14^{a}	36.10± 1.02^{c}	39.05±0.96^{b}	32.02±0.23^{d}
Hb (g/dl)	9.80± 0.01^{c}	10.71± 0.04^{b}	9.93± 1.4^{bc}	11.94± 1.11^{a}	12.91±0.22^{a}	10.15±0.16^{ab}
RBC (g/dl)	7.80± 0.62 ^{b}	9.31± 0.78^{a}	6.49± 0.01^{c}	9.25± 0.02^{a}	7.21±0.42^{b}	9.66±1.22^{a}
MCH (Pg)	12.95± 0.02^{c}	11.50± 0.01^{cd}	15.32± 1.12^{b}	12.90± 0.04^{c}	17.±0.24^{a}	10.46±0.12^{cde}
MCHC (%)	33.90± 1.21^{a}	28.80± 1.04^{c}	15.40± 1.11^{d}	33.00± 2.16^{a}	33.08±1.01^{a}	31.56±0.76^{b}
MCV (fl)	38.00± 3.21^{c}	39.80± 2.04^{c}	98.80± 3.16^{a}	39.00± 1.04^{c}	54.09±2.32^{b}	33.12±1.06^{d}
WBC (x10^{9}/L)	20.3± 0.93^{d}	29.76± 1.11^{a}	22.62± 1.26^{c}	27.70± 2.06^{b}	5.2±0.23^{e}	5.80±0.29^{e}
WBC Differentials						
Lymphocytes (%)	76.00± 2,11^{b}	81.00± 3.26^{a}	71.00± 1.42^{c}	72.00± 1.57^{c}	77.00±1.10^{b}	52.00±0.55^{d}
Neutrophils (%)	20.00± 1.01^{e}	19.00± 1.01^{e}	26.00± 0.92^{c}	28.00± 1.33^{b}	23.00±1.26^{a}	48.00± 2.33^{a}
Eosinophils (%)	4.0± 0.02	0	0	0	0	0
Monocytes (%)	0	0	3.0± 0.02	0	0	0
Basophils (%)	0	0	0	0	0	0

a, b, c, means in the same row with different superscript differ significantly (P<0.05); PCV=Packed Cell Volume; Hb=Haemoglobin; RBC=Red Blood Cell; WBC= White Blood cells; MCV=Mean corpuscular volume; MCH=Mean corpuscular haemoglobin; MCHC=Mean corpuscular haemoglobin Concentration; Means within the same row with different superscripts are significantly different (P<0.05); NS=Not significant.

Table 2 **: Haematological Indices of Different Breeds of Lambs.**

	BOLANGIR SHEEP		KORAPUTSHEEP		GANJAMSHEEP	
	Ram lamb	**Ewe lamb**	**Ram lamb**	**Ewe lamb**	**Ram lamb**	**Ewe lamb**
PVC(%)	43.8 ± 2.33^{b}	45.3 ± 1.45^{a}	33.5 ± 0.66^{e}	34.7 ± 0.45^{d}	38.00 ± 1.22^{c}	38.00 ± 1.21^{c}
Hb(g/dl)	5.6 ± 0.62^{d}	9.3 ± 0.72^{bc}	11.1 ± 1.04^{b}	10.1 ± 0.02^{b}	12.20 ± 0.26^{a}	12.20 ± 0.21^{a}
RBC(g/dl	5.23 ± 1.0^{c}	4.44 ± 1.03^{d}	8.69 ± 1.04^{a}	7.92 ± 1.06^{b}	8.33 ± 0.04^{a}	7.26 ± 0.02^{b}
MCH(pg)	13.2 ± 1.04^{cd}	20.4 ± 2.14^{c}	12.8 ± 0.02^{e}	12.8 ± 0.02^{e}	14.65 ± 0.02^{c}	1680 ± 0.06^{b}
MCHC(%)	12.8 ± 0.44^{d}	20.5 ± 2.06^{c}	33.1 ± 1.14^{a}	13.5 ± 1.02^{d}	32.11 ± 1.02^{b}	32.11 ± 0.56^{b}
MCV(fl)	103.5 ± 1.01^{a}	102.0 ± 1.01^{a}	$38.6.\pm2.66^{c}$	94.3 ± 0.01^{b}	45.7 ± 0.06^{d}	52.34 ± 3.06^{c}
WBC(×10/L)	20.44 ± 1.02^{c}	21.89 ± 1.01^{c}	27.0 ± 0.56^{a}	24.39 ± 0.02^{b}	4.7 ± 0.56^{d}	4.2 ± 0.51^{d}
WBC Differentials						
Lymphocytes(%)	69.0 ± 2.14^{c}	73.0 ± 2.92^{b}	76.0 ± 1.22^{a}	65.0 ± 0.67^{d}	57.00 ± 0.33^{e}	45.00 ± 0.21^{b}
Neutrophilis(%)	30.0 ± 0.4^{c}	25.0 ± 0.01^{d}	24.0 ± 0.03^{d}	30.0 ± 1.21^{c}	43.00 ± 1.22^{b}	54.00 ± 2.12^{a}
Eosinophilis(%)	0	4.0±0.11	0	0	0	0
Monocytes(%)	1.0 ± 0.01^{NS}	0	0	0	0	1.00 ± 0.01^{NS}
Basophilis(%)	0	0	0	0	0	0

a, b, c, means in the same row with different superscript differ significantly (P<0.05); PCV=Packed Cell Volume; Hb=Haemoglobin; RBC=Red Blood Cell; WBC= White Blood cells; MCV=Mean corpuscular volume; MCH=Mean corpuscular haemoglobin; MCHC=Mean corpuscular haemoglobin Concentration; Means within the same row with different superscripts are significantly different (P<0.05); NS=Not significant.

Table 3 :- **Sheep Biochemical Indices (Adults).**

	Bolangir		Koraput		Ganjam	
	Ram	Ewe	Ram	Ewe	Ram	Ewe
Sodium (mmol/L)	144.0 ± 3.12^{cd}	156.0 ± 4.11^{a}	140.0 ± 2.22^{e}	148.0 ± 3.14^{b}	146.0 ± 0.21^{c}	145.00±0.26
Potassium (mmol/L)	12.4 ± 0.62	10.8 ± 0.92^{NS}	7.4 ± 0.62^{b}	14.2 ± 0.98^{a}	5.0 ± 0.33^{e}	4.60 ± 0.23^{e}
Chloride (mmol/L)	109.0 ± 2.16^{a}	108.0 ± 2.08^{a}	106 ± 1.33^{b}	108.0 ± 1.06^{a}	108.0 ± 0.14^{a}	109.00 ± 0.12^{a}
HCO^{-3} (mmol/L)	22.0 ± 0.62^{c}	20.0 ± 0.04^{d}	21.0 ± 0.04^{d}	18.0 ± 0.08^{e}	26.0 ± 0.21^{a}	24.00 ± 0.11^{b}
Urea (mmol/L)	8.5 ± 0.04^{a}	7.0 ± 0.01^{b}	8.9 ± 0.62^{a}	8.3 ± 0.83^{a}	4.4 ± 0.03^{c}	4.50 ± 0.21^{c}
Creatinine (mmol/L)	97.0 ± 1.33^{c}	68.0 ± 1.06^{f}	103.0 ± 1.04^{b}	76.0 ± 0.62^{e}	156.0 ± 2.19^{a}	90.00 ± 1.22^{d}
Cholesterol (mmol/L)	2.5 ± 0.04^{d}	3.1 ± 0.09^{b}	2.5 ± 0.66^{d}	2.7 ± 0.42^{c}	3.5 ± 0.04^{a}	2.00 ± 0.02^{e}
Glucose (mmol/L)	3.0 ± 1.06^{a}	3.34 ± 1.04^{a}	2.5 ± 0.04^{b}	2.78 ± 0.02^{b}	2.1 ± 0.56^{b}	2.90 ± 0.11^{b}
Total protein (g/L)	73.0 ± 0.26^{d}	86.0 ± 2.11^{b}	94.0 ± 0.23^{a}	83.0 ± 0.14^{c}	55.0 ± 0.22^{f}	57.00 ± 0.02^{e}
Albumin (g/L)	33.0 ± 1.12^{a}	29.0 ± 1.11^{bc}	30.0 ± 0.56^{b}	23.0 ± 0.41^{e}	29.0 ± 0.33^{bc}	27.00 ± 0.21^{d}
Globulin (g/L)	40.0 ± 0.62^{d}	57.0 ± 1.02^{b}	44.0 ± 0.11^{c}	56.0 ± 0.22^{a}	26.00 ± 0.56^{f}	$30\text{-}00\pm2.23^{e}$
AST (IU/L)	99.0 ± 2.67^{d}	110.0 ± 3.23^{b}	126.0 ± 1.14^{a}	107.0 ± 0.92^{c}	44.0 ± 0.17^{e}	43.00 ± 0.44^{e}
ALT (IU/L)	32.0 ± 1.72^{c}	17.0 ± 0.47^{d}	39.0 ± 0.62^{a}	38.0 ± 0.78^{a}	16.0 ± 1.22^{d}	7.00 ± 0.62^{e}
ALP (IU/L)	55.0 ± 1.34^{d}	29.0 ± 0.94^{f}	65.0 ± 1.24^{c}	42.0 ± 1.10^{e}	184.0 ± 1.32^{a}	178.00 ± 0.23^{b}

a, b, c, means in the same row with different superscript differ significantly (P<0.05); AST=Aspartate Aminotransferase; ALT= Alanine Aminotransferase; ALP= Alkaline Phosphatase; Means within the same row with different superscripts are significantly different (P<0.05); NS=Not significant

Table 4:- Biochemical Indices of Different Breeds of Sheep lambs

	Bolangir		Koraput		Ganjam	
	Ram lamb	Ewe lamb	Ram lamb	Ewe lamb	Ram lamb	Ewe lamb
Sodium (mmol/L)	156.0± 1.01^{c}	160.0± 2.02^{a}	158.0± 2.14^{b}	142.0± 1.03^{e}	148.00±2.13^{d}	140.00±1.44^{f}
Potassium (mmol/L)	10.4± 0.02^{b}	13.4± 0.04^{a}	13.5± 0.04^{a}	9.8± 0.002^{b}	5.00±1.06^{c}	4.70±0.56^{c}
Chloride (mmol/L)	110.0± 0.07^{a}	108.0± 0.05^{b}	110.0± 2.1^{a}	108.0± 2.4^{b}	109.00±3.21^{b}	104.00±2.33^{c}
HCO^{-3} (mmol/L)	25.0± 1.21^{b}	20.0± 1.06^{d}	18.0± 0.62^{e}	22.0± 1.14^{c}	27.00±0.05a	24.00±0.02^{b}
Urea (mmol/L)	7.0± 0.04^{a}	6.1± 0.02^{b}	7.5± 0.45^{a}	7.2± 0.52^{a}	5.70±0.03^{c}	6.10±0.07^{b}
Creatinine (mmol/L)	42.0± 1.04^{f}	86.0± 2.16^{d}	68.0± 1.42^{e}	107.0± 1.73^{b}	139.00±2.09^{a}	98.00±0.98^{c}
Cholesterol (mmol/L)	1.9± 0.01^{c}	3.5± 0.04^{a}	2.5± 0.02^{b}	2.3± 0.45^{b}	1.80±0.04^{c}	2.00±0.01^{b}
Glucose (mmol/L)	3.0± 0.01^{a}	3.0± 0.01^{a}	3.0± 0.48^{a}	2.78± 0.07^{b}	2.40±0.05^{b}	2.20±0.04^{b}
Total protein (g/L)	73.0± 1.41^{b}	69.0± 0.98^{c}	83.0± 1.14^{a}	71.0± 0.21^{b}	64.00±1.02^{d}	60.00±1.03^{e}
Albumin (g/L)	26.0± 0.17^{de}	32.0± 1.01^{a}	27.0± 0.78^{cd}	29.0± 0.01^{b}	30.00±0.66^{b}	28.00±0.23^{bc}
Globulin (g/L)	47.0± 1.04^{b}	37.0± 1.01^{d}	56.0± 1.13^{a}	42.0± 0.52^{c}	34.00±0.56^{e}	32.00±0.32^{f}
AST (IU/L)	47.0± 1.33^{d}	110.0± 2.14^{c}	126.0± 0.16^{b}	143.0± 1.14^{a}	20.00±0.14^{f}	24.00±0.23^{e}
ALT (IU/L)	22.0± 0.74^{c}	44.0± 0.26^{a}	39.0± 1.28^{b}	45.0± 1.92^{a}	8.00±0.12^{e}	9.00±0.33^{d}
ALP (IU/L)	29.0± 1.11^{f}	48.0± 1.26^{e}	65.0± 0.45^{d}	82.0± 0.12^{c}	105.00±1.23^{b}	305.00±3.54^{a}

a, b, c, means in the same row with different superscript differ significantly (P<0.05); AST=Aspartate Aminotransferase; ALT= Alanine Aminotransferase; ALP= Alkaline Phosphatase; Means within the same row with different superscripts are significantly different (P<0.05); NS=Not significant

The PCV in adult female sheep were generally higher than in adult males while it was observed to be higher in the young males than in young females. The result generally showed adults sheep to have higher values in PCV than in lambs. In the sheep, age and sex exhibited remarkable influence on the PCV values.

The packed cell volume (PCV) obtained in the present study (28.90 to 64.0% for adults) was higher than the normal range (28.47 to 30.25% for adults) reported for sheep (Baneejee, 2007[22]; Rusuff et al. 1954; Bianca 1955)[25]. The increase in PCV might be attributed to high environmental temperature. This is similar to the report of Patterson et al. (1960) who reported that increase in environmental temperature cause an increase in PCV. The higher PCV values obtained in this study might likely be a sign of healthier sheep. Adult sheep tend to have higher PCV values than lambs and this agrees with previous work (Schalm et al., 1975[69]). The result of the haemoglobin (Hb) value shows that Balami sheep had higher values than other breeds but the value obtained in this study fall within the normal range reported for sheep (Baneejee, 2007)[22]. There was observed difference in adult and young goats which suggest the oxygen carrying capacity of the blood was higher in adult sheep. Generally, increase in the Hb concentration is associated with greater ability to resist disease infection and low level is an indication of disease infection and poor nutrition (Cheesbrough, 2004[28]; Tambuwal et al., 2002). The RBC values obtained in this study were within the normal values reported by (Campbell et al., 2003)[23]. The RBC values was observed to be higher in the ewes than in the in the rams and also it was observed that the RBC values in the rams and ewes were higher than in the ram lamb and ewe lamb. The difference due to age and sex is a signal of the health status of the various age groups and sex among the sheep breed studied which is in agreement with the findings of Schalm et al. (1975)[69] and Addas et al. (2010)[2]. The high RBC counts may be associated with conditions that cause the body to make too many red blood cells

(Polycythemia) or impaired pulmonary function, while low RBC counts may be associated with iron deficiency, internal bleeding, some types of anemia or some vitamin deficiency.

The values of MCV, MCHC and MCH significantly increased and are very important in the diagnosis of anemia and also serve a useful index of the capacity of the bone marrow to produce red blood cells (Awodi et al., 2005)[12]. The increased in MCV, MCHC and MCH are greatly influenced by age and sex (Egbe– Nwiyi, 2000)[37].

The leucocyte count (WBC) was higher in adult female sheep than the values obtained for male sheep breeds. The WBC values of the adults are comparable to the young sheep. This findings is similar to the reports of Egbe- Nwiyi et al. (2000)[37] and Addass et al. (2010)[2] who reported that age has no significant influence but sex had an influence ($P<0.05$) on the total WBC. The higher leucocyte count (WBC) in this study is an indicator of immune response to infections or toxic substances in the organism and a low count is an indication of pathogenic infection or presence of antigens in the organism (Bradbury et al., 1999) [25]but the higher WBC in female adult sheep was not in agreement with (Schalm et al., 1975)[69]. The higher values of WBC observed may also be attributed to the extensively managed sheep which makes them face challenges from microbes when on free range. The result also reveals the significant effect of age and sex on the health status of these sheep breeds.

The white blood cell differentials (lymphocytes and neutrophils) levels are comparable among the breed, age and sex groups of animals. There was significant influence of age, sex and breed on lymphocyte count. The value for lymphocytes was higher for Bolangir ewe breed than other breeds. The lymphocytes constituted majority of the WBC counts and the cells increased with age in early life in both sexes of sheep and goats (Egbe-Nwiyi et al., 2000)[37]. The high lymphocyte counts in the animals in this study are favoured by the findings of (Milson et al., 1960)[59] and (Wilkins and Hodges, 1962) and it might be attributed to stress and immune response to the environment (Cole, 1980[30]) which harbours various detectable and undetectable parasitic and or bacterial organisms. The value for neutrophils was higher for Balami sheep breed (both adult and lambs). Sex influences was observed for neutrophils with mostly females (adult and lambs) having the higher value than the males which is in contrast with observation made by Egbe-Nwiyi et al., (2000[37]) for sheep and goats in arid zone of Nigeria. The difference may be attributed to specie difference. The values for eosiniphils in the present study was observed to be higher for Bolangir sheep breed (ram) and ewe lamb while the other breeds had no eosinophils. Like neutrophils, they are very effective killing machine (Ganong, 2005)[40]. Monocyte generally was not observed in all the breeds except in Ouda ram while yakasa ram lamb and Balami ewe lamb had very low values.

Serum biochemical indices is used to determine the level of heart attack, liver damage and to evaluate protein quality and amino acid requirements in animals as reported by (Harper et al. 1979)[43]. The values of serum electrolyte of sodium potassium and chloride ranged from 140.0 to 156.0 mmol/L, 4.60 to 12.4 mmol/L and 106.0 to 109.0 mmol/L respectively. The values obtained in this study are above the normal range reported by Baneejee (2007)[22]. The electrolytes are known to regulate osmotic pressure, maintain membrane potentials and acid base balance and transmit nerves impulses sodium and potassium deficiency affect the tubes of kidney resulting in inability to concentrate urine (Latimer et al., 2004)[57]. The comparison shows that (lambs) have higher sodium and chloride values than adult sheep. The values show significant variation but are all within range in terms of breed and sex. Bolangir sheep tend to have higher values than the other breeds. The result of hydrogen carbonate ions reveals that there is breed and sex difference with Ganjam rams having higher values than other breeds.

The urea level in the study shows that Koraput and Bolangir breed (adults) had higher values than balami breeds. The values for adult sheep are higher than the young sheep (lamb). Generally, the values tend to be higher compared to the values 1.5 mmol/L (Oduye and Adedevon (1976[61]). The high level of serum urea has been attributed to excessive tissues protein catabolism associated with protein deficiency (Oduye and Adedevon (1976)[61]. The urea value obtained was within the range of 8 to 20 mg/dl (Banejee, 2007)[22] in matured domestic animals and 5.28 mg/dl for free ranging desert big-horn sheep.

The creatinine values in the present study were within normal range and differ ($P<0.05$) among breeds. The values were higher in the adults than lambs in all the breeds. High creatinine is indicative of poor protein and amino acid metabolism that can lead to impaired renal function and cardiac infarction (Gray and Howarra, 1980). Increased creatinine has been associated with tannin toxicosis in cattle consuming tannin-rich oak fodder (Garg et al, 1992)[41].

For goats in the semi-arid region the cholesterol values show inconsistency for breed, sex and age prolonged, high level of blood cholesterol may result in its deposition on the walls of the blood vessels and these deposits may eventually harden to atheroschlerotic plaque, this may block important blood vessels and result in a myocardial infraction.

The glucose levels show inconsistency for breed sex and age. Serum glucose is an indicator of cito metabolism, in high energy diets (Coles, 1986)[29]. When glucose is lower than the normal range is an indication of hypoglycemia while higher levels are indication of hyperglycemia (Olorunnisomo, 2012)[62].

The values for total protein concentration obtained were higher in Ouda ram (adult) than other breed sex and age. This agrees with the report of (Kamatu et al, 1988) and (Duke, 1955)[34] that plasma protein help to transport calcium and phosphorus and other substances in the blood by attachment to the albumin. The albumin level in the studied shows that Yankasa sheep (adult lamb) had higher values than the other breeds. The values were higher in the males than females in all breeds. A reading of albumin less than the normal physical value of albumin usually indicates hypoalbuminemia (Altman, 1979)[11].

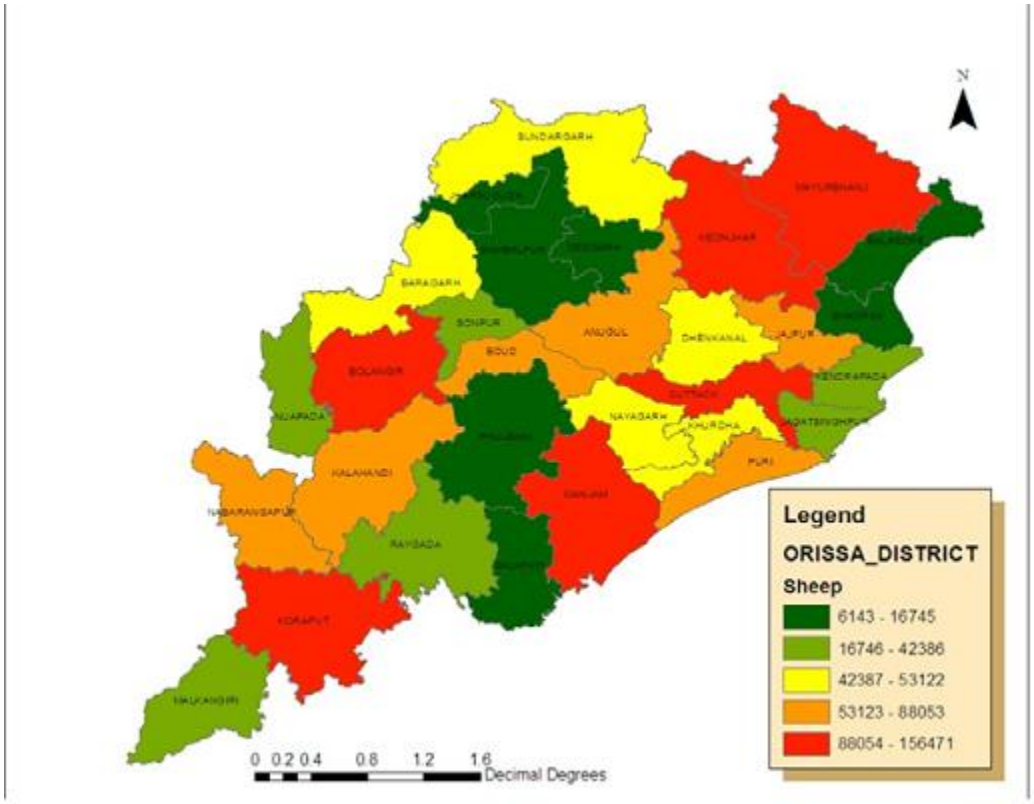
The result of the ALT and ALP were higher in the rams than in ewes while for AST the result is in consistent. Contrary to the results obtained for the lambs, all the aminotransferases (AST, ALT and ALP) were higher in the ewee lambs than ram lambs. This clearly shows that there is a significant influence ($P<0.05$) of there parameters on age, sex and breed. AST level is helpful for the diagnosis and following of cases of myocardial infarction, hepatocellular disease and skeletal muscle disorders. In trauma or in diseases affecting skeletal muscle, after a renal infarct and in various haemolytic conditions (Alex and LaVerne, 1983)[10].

The concentration of Serum Alanine Aminotransferase in tissues is not nearly as great as for Serum Aspartate Aminoferase. It is present in moderately high concentration in liver, but is low in cardiac and skeletal muscles and in other tissues. Their uses for clinical purpose are primarily for the diagnosis of liver diseases (DeRitis et al., 1972)[32] and resolve some ambiguous increase in serum Alanine Aminotransfase in cases of suspected myocardial infarction (Aach et al., 1981)[1]. When both enzymes (i.e. Alanine Aminotransferase and Aspartate Aminotransferase) are elevated in serum, the liver is the primary source of the enzymes (liver ischemia because of congestive heart failure or other sources of liver cell injury) (DeRitis et al., 1972)[32]. If the serum Aspartate Aminotransferase is elevated while the serum Alanine Aminotransferase remains within normal limit in case of suspected myocardial infarction, the results are compatible with myocardial infarction (Alex and LaVerne, 1983)[10]

CONCLUSION

From the present study, it can be concluded that the haematological and biochemical parameters for sheep studied fall within normal range. The observed differences may be due to nutritional and environmental effect. Age, sex and breed also showed remarkable influence on the haematologiclal values of sheep in central Odisha, India. To make dairying a viable livelihood option for small, marginal farmers and landless persons.. Enhance per-capita availability of milk. Enhance productivity of small ruminants to increase rural incomes. Popularize poultry rearing as a profitable, low cost backyard activity among rural poor.

Sheep distribution in the State (District wise) In Odisha.



Bolangir/Dharamagada Sheep (RAM)

Bolangir/Dharamagada Sheep (EWE)

Koraput Sheep (RAM)

Koraput Sheep (EWE)

Ganjam Sheep (RAM)

Red Ganjam Sheep (EWE with Lamb

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