



A Guide on Hemato-Biochemical Profiles of Indigenous Manipuri Cattle

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ABSTRACT

The present study was aimed to establish a reference value of hematology and serum biochemical parameters of indigenous Manipuri cattle. The blood samples were collected from ten numbers (n=10) of apparently healthy indigenous Manipuri cattle from College Livestock Farm Complex (LFC), Jalukie, Nagaland. The hematology and serum biochemical parameters were estimated by utilizing an automated blood cell and biochemical analyser, respectively. Differential Leukocytes Count (DLC) was evaluated after staining the slides with Leishman's stain. The overall value (Mean \pm SEM) for Packed Cell Volume (PCV), Haemoglobin (Hb) concentration, Total Erythrocyte Count (TEC), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC), Red Cell Distribution Width (RDW), Total Leukocyte Count (TLC), Lymphocytes, Neutrophils, Monocytes, Eosinophils, and Basophils were recorded as 32.24 \pm 1.40%, 13.15 \pm 0.77g/dL, 7.47 \pm 0.28 $\times 10^6/\mu\text{L}$, 43.3 \pm 1.42 fL, 17.64 \pm 1.02 pg, 40.64 \pm 1.13 g/dL, 14.11 \pm 0.44, 14.05 \pm 0.94 $\times 10^3/\mu\text{L}$, 56.75 \pm 4.80 %, 31.48 \pm 3.49 %, 8.75 \pm 0.84 %, 5.25 \pm 0.96 %, 0.625 \pm 0.32 % respectively. Similarly, the overall mean value (Mean \pm SEM) of Glucose, Calcium, Albumin, Blood Urea Nitrogen (BUN), Urea, Creatinine, Uric acid, Bilirubin, Cholesterol, Alanine Amino Transferase (ALT), Aspartate Amino Transferase (AST) and Alkaline Phosphatase (ALP) were 55.53 \pm 3.35 mg/dL, 11.23 \pm 0.23 mg/dL, 2.72 \pm 0.05 g/dL, 14.96 \pm 1.14 mg/dL, 31.99 \pm 2.45 mg/dL, 0.49 \pm 0.11 mg/dL, 0.86 \pm 0.07 mg/dL, 0.10 \pm 0.007 mg/dL, 143 \pm 9.78 mg/dL, 27.94 \pm 1.76 U/L, 71.39 \pm 4.19 U/L, and 62.4 \pm 6.89 U/L respectively. The hemato-biochemical values were within the physiological normal ranges of cow except TLC. It can be concluded that the data of this study will be act as a guide on hemato-biochemical profiles of indigenous Manipuri cattle.

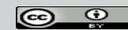
HIGHLIGHTS

- Normal hemato- biochemical values of indigenous Manipuri cattle.

Keywords: Biochemical, Indigenous, Hematology, Manipuri cattle, Reference Interval (RI)

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The indigenous cattle of Manipur are medium size, stout, hardy and a dual purpose animal. The coat colour varies from brown (76%), black (12%), gray (4%) and spotted with black or white patches on brown body (8%). The bullocks have medium hump with small horns (Pundir *et al.*, 2015). The cattle are well adapted to climate condition of Manipur with an approximate average annual rainfall of 1,467.5 mm varying from 933 mm at Imphal to 2,593 mm at Tamenglong. The farmer rears these cattle for dual purpose; both milk and drought under open grazing system. The average daily milk yield is 2.65 ± 0.18 kg (2.0 to 4.5 kg), hence it has open up an opportunity to boost up the milk yield in the state of Manipur via systematic genetic improvement programs. However, at the same time, a declining pattern of 20.86% in indigenous cattle population (2.19 lakhs) was registered in Manipur (Pundir *et al.*, 2015). Therefore; it is prerequisite to promote scientific rearing of indigenous Manipuri cattle for conservation and genetic improvement programs.

The hematology and serum biochemical values are acts as disease diagnostic tool in bovine medicine (Roland *et al.*, 2014; Macrae, 2017). It also acts as an index for assessment of stress either due to nutritional, environmental or physical, and assessment of adaptability to a given geographical location (Sejian *et al.*, 2014). However, the RI of hematological variables has changed between 1957 and 2006 (Goldmann *et al.*, 2013). Various factors contribute towards physiological variability of blood hematology profile of animals. The factor includes age, sex, breed, stress, diet, body condition, reproductive status, recent activity, hydration, ambient temperature and altitude (Wood and Quiroz-Rocha, 2010; Krimer, 2011). Therefore, RI of a breed or species in one geographical location cannot be taken as RI in another locality, hence strengthening of a base line data in relation to hematology and serum biochemical profiles of domestic livestock species have been given due importance (Opara *et al.*, 2006). As such, there is no literature on hemato-biochemical profiles of indigenous Manipur cattle. Hence, the present study was conducted for establishing a baseline value of hemato-biochemical profiles of indigenous Manipuri cattle.

MATERIALS AND METHODS

Location of works

The experiment was conducted in College of Veterinary Sciences and Animal Husbandry, Central Agricultural University (I), Jalukie, Peren District, Nagaland, India which is situated at an altitude of 800-2500 meters above the sea level, latitude and longitude position being 25° 57' N and 93° 72' E, respectively. The temperature of Jalukie, Peren District ranged between 18°C to 35°C. The mean average annual rainfall ranges from 1500 mm to 3000 mm.

Selection, blood sampling and processing

The indigenous Manipuri cattle were maintained in the College LFC under open grazing system. These cattle were brought from College of Agriculture, CAU, Imphal for assessment of utility and for germplasm conservation. A total of ten (n=10) numbers of apparently healthy cattle was selected for the experiment. Blood samples (3ml) were collected from jugular vein by direct puncture with a sterile needle at 7.30 A.M. in the morning before feeding and watering. Immediately after collection, 1 ml of blood was transferred to EDTA vacutainer tubes for estimation of hematology parameters in an automated blood cell analyser and DLC. The remaining 2 ml of blood were transferred into a sterile glass tube and allowed to clot. The clotted blood in glass tube was transported to the laboratory for further processing. The glass tubes were centrifuged at 3000 rpm for 10 minutes at room temperature. The serum samples were stored in aliquot at -20°C until analysis of serum biochemical parameters.

Quantification of haemato-biochemical parameters

The hematology parameters estimated in this study were Packed Cell Volume (PCV), Hemoglobin (Hb), Total Erythrocyte Count (TEC), Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC), Red Cell Distribution Width (RDW), Total Leukocyte Count (TLC), Lymphocytes, Neutrophils, Monocytes, Eosinophils and Basophils. These parameters were estimated using an automated blood cell counter (Model No: MS4Se), Melet Schloesing Laboratories, France. DLC was evaluated

after staining the slides with Leishman's stain (Lot No: 2349311117, Fisher Scientific). Identification and counting of different types of leukocytes was done by observing the slides under 1000X magnification.

The estimated serum biochemical parameters in this study were Glucose, Calcium, Albumin, Blood Urea Nitrogen (BUN), Urea, Creatinine, Uric acid, Bilirubin, Cholesterol, Alanine Amino Transferase (ALT), Aspartate Amino Transferase (AST) and Alkaline Phosphatase (ALP). These biochemical parameters were estimated utilizing an automated biochemical analyzer (Erba-EM-200).

The data obtained from the present experiment was analyzed using a Graph Pad prism 5. All data were expressed as Mean \pm SEM and compared with normal physiological value for cattle depicted in Merck's Veterinary Manual.

RESULTS AND DISCUSSION

The mean hematology profile of indigenous Manipuri cattle is presented in Table 1. The hematology profile obtained from the present experiment was compared with the RI for cattle depicted in Merck's Veterinary Manual as well as three other different sources (Kraft and Durr, 2005; Wood and Quiroz-Rocha, 2010; George *et al.*, 2010). Also, the hematological values were compared with earlier reports on Indian, exotic as well as crossbred cattle. The haematological value of indigenous Manipuri cattle was

slight variation from previous reports on various recognized breed of cattle (Sreedhar *et al.*, 2013; Sripad *et al.*, 2014; Bedenicki *et al.*, 2014; Bedenicki *et al.*, 2014; Manjappa *et al.*, 2018; Hossain *et al.*, 2018; Palanisamy *et al.*, 2020), but the values were within the normal physiological range except TLC and MCHC. MCHC value was higher than RI for cattle depicted in the Merck's Veterinary Manual but within the normal physiological range of three other sources. PCV value was higher compared to RI of cattle depicted in previous reports (Kraft and Durr, 2005; Wood and Quiroz-Rocha, 2010; George *et al.*, 2010), but within the normal physiological range for cow depicted in the Merck's Veterinary Manual. TLC of Manipuri cattle was higher than RI for the cattle. The higher TLC was might be due to physiological causes such as excitation and fear at the time of blood collection. Earlier, it was revealed that physiological stress such as excitation, fear, and exercise triggers endogenous or exogenous corticosteroid exposure, resulting in leukocytosis (Klinkon and Zadnik, 1999; Jones and Allison, 2007; Tornquist and Rigas, 2010).

The mean serum biochemical profile of indigenous Manipuri cattle is presented in Table 2. The mean serum biochemical value obtained from the present experiment was compared with the RI for cattle depicted in Merck's Veterinary Manual as well as earlier reports of Indian, exotic as well as crossbred cattle. Although, the serum biochemical value of indigenous Manipuri cattle was slight variation from earlier reports (Cozzi *et al.*, 2010; Mahima *et al.*, 2013; Sreedhar *et al.*, 2013; Bedenicki *et al.*, 2014;

Table 1: Mean hematology values of indigenous cattle of Manipur

Parameters (Unit)	Reference Interval of cow as per Merck's Veterinary Manual	Indigenous Manipuri cattle		
		Minimum value	Maximum value	Mean \pm SEM (n=10)
PCV (%)	24-46	27.1	36.8	32.24 \pm 1.40
Hemoglobin (g/dL)	8-15	10.3	16.1	13.15 \pm 0.77
TEC ($\times 10^6/\mu\text{l}$)	5-10	7.38	9.05	7.47 \pm 0.28
MCV (fl)	40-60	35.9	49.2	43.3 \pm 1.42
MCH (pg)	11-17	13.4	21.8	17.64 \pm 1.02
MCHC (g/dl)	30-36	35.3	44.3	40.64 \pm 1.13
TLC ($\times 10^3/\mu\text{l}$)	4-12	9.18	17.03	14.05 \pm 0.94
Lymphocytes (%)	62-63	31	68	56.75 \pm 4.80
Neutrophils (%)	15-33	20	53	31.48 \pm 3.49
Monocytes (%)	0-8	5	12	8.75 \pm 0.84
Eosinophils (%)	0-20	2	9	5.25 \pm 0.96
Basophils (%)	0-2	0	2	0.625 \pm 0.32

Table 2: Mean serum biochemical values of indigenous cattle of Manipur

Parameters (Unit)	Reference Interval of cow as per Merck's Veterinary Manual	Indigenous Manipuri cattle		
		Minimum Value	Maximum value	Mean \pm SEM (n=10)
Glucose (mg/dL)	40-100	40.70	76.50	55.53 \pm 3.35
Calcium (mg/dL)	8-11.4	10.20	12.30	11.23 \pm 0.23
Albumin (g/dL)	2.5-3.8	2.45	2.95	2.72 \pm 0.05
BUN (mg/dL)	10-25	8.7	19.6	14.96 \pm 1.14
Urea(mg/dL)	—	18.6	41.9	31.99 \pm 2.45
Creatinine (mg/dL)	0.5-2.2	0	0.79	0.49 \pm 0.11
Uric acid (mg/dL)	—	0	1	0.86 \pm 0.07
Bilirubin (mg/dL)	0-1.6	0.08	0.15	0.10 \pm 0.007
Cholesterol (mg/dL)	71-156	88	187	143 \pm 9.78
ALT (U/L)	6.9-35	22.3	42.5	27.94 \pm 1.76
AST (U/L)	60-125	52.7	95.1	71.39 \pm 4.19
ALP(U/L)	18-153	16	107	66.9 \pm 11.15

Maurya and Singh, 2016; Xuan *et al.*, 2018; Hossain *et al.*, 2018; Alekish and Ismail, 2019; Bhadauria *et al.*, 2020), however the variation was within the normal physiological range for cattle depicted in Merck's Veterinary Manual. Further, the normal physiological range of haemto-biochemical profiles suggested that the indigenous Manipur cattle were well adapted to the climatic condition of Jalukie, Peren Nagaland.

Knowledge of hemato-biochemical profiles provide baseline information, which can give an important clue for determination of productive performance, managerial practices, general health status, metabolic diseases diagnosis and feeding management (Friendship and Henry, 1992; Otto *et al.*, 1992; Radostits *et al.*, 2006; Roland *et al.*, 2014). Any deviation from the RI could be a good guide to a veterinarian for differential diagnosis of a particular disease or pathological condition (Radostits *et al.*, 2006; Roland *et al.*, 2014). Hence, a complete blood count (CBC) is prerequisite for differential pathophysiological diagnosis including infectious diseases (Opera *et al.*, 2006; Roland *et al.*, 2014). The CBC is also used for monitoring of therapy, follows up the severity of a disease and help in assessment of prognosis (Barger, 2003; Roland *et al.*, 2014). Similarly, the serum biochemical profile is essential indicators of weight gain, metabolic disorders, general health status of animals, assessment and screening for subclinical liver damage as well as a routine herd investigations and monitoring (Swenson, 1970; Friendship and Henry, 1992; Kaneko *et al.*, 1997;

Macrae, 2017). Serum albumin and globulin provides a useful screening test for chronic weight loss and ill-thrift. Also, serum albumin concentration reflects the dietary nitrogenous intake and endogenous demands (Macrae, 2017). The serum enzymes especially AST is a good indicator of hepatic disorders. Serum ALP and ALT are tend to be non-specific compared to AST, thus not a reliable indicator of hepatic damage in bovine. AST concentration is increased in acute hepatic damage, muscle damage (e.g. white muscle disease), heart disease and copper poisoning in bovine (Macrae, 2017). Therefore, a reference value on haemato-biochemical parameters is essential for determination of animal health and routine herd investigations and monitoring. Since, there is no literature on hemato-biochemical profiles of indigenous cattle of Manipur. Also, the animals used in present experiments were apparently healthy and did not exhibit any clinical signs and/or pathological conditions; therefore, the hemoto-biochemical values recorded in present study can be referred as reference values. Furthermore, this value will be helpful for determination of general health status as well as any future studies related to this bovine species.

CONCLUSION

The analyzed hemato-biochemical profiles of indigenous Manipuri cattle were within normal range except TLC. Overall, the data of hematology and serum biochemical values may be served as a guide on hematology and serum biochemical values and can be utilized for growth

assessment, health status, disease diagnosis, routine herd investigations & monitoring and any future studies related to this bovine species.

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