Indian Journal of Animal Sciences **93** (2): 232–234, February 2023/Short Communication
https://doi.org/10.56093/ijans.v93i2.123259

Hemato-biochemical profile of indigenous Badri cattle of Uttarakhand

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Received: 12 April 2022; Accepted: 27 January 2023

Keywords: Badri cattle, Biochemicals, Haematology, Uttarakhand

India has diversified animal genetic resources with 50 well recognized cattle breeds (DAHD 2019). In the past few years, preservation and conservation of the indigenous germplasm has gained much attention and attempts are being made to improve the indigenous cattle breeds. Badri is a first registered cattle of Uttarakhand (Accession number INDIA_CATTLE_2400_BADRI_03040) (ICAR-NBAGR 2016). It is reared in hilly areas of Kumaon and Garhwal regions of the state mainly for draught and milk purposes. It is a small sized breed (200-250 kg BW) which is well adapted to the hills, prevailing climatic conditions and more resistant to diseases (Pundir *et al*. 2014). In Uttarakhand, livestock owners prefer Badri cattle and the preferences include religious importance which is ranked first. Others include better adaptability in hilly region, disease resistance medicinal properties of milk and urine, manure, livelihood generation, docile temperament, less labour and input required for its maintenance, taste of milk above crossbred and exotic breeds, better feed conversion efficiency, easy availability in local market and draught power (Joshi *et al.* 2018). Haematological, biochemical and hormonal profile are important bioindicators of the physiological state of an animal (Kumar *et al.* 2017).

Haematological values of farm animals are influenced by geographical location, season, climate, day length, time of the day, life habit of a species, nutritional and physiological status and also on other non-genetic factors like age, sex and management system (Etim *et al.* 2014). Therefore, this study was carried out in Badri cattle to establish the normal reference values of haemato-biochemical parameters.

A total of 40 healthy adult female animals aged between 4 to 8 years and body weight 200-250 kg were selected from Instructional dairy farm of GBPAUT, Pantnagar, Uttarakhand, India. The experimental animals were maintained and fed as per the standard practices followed at the farm. Blood samples from each animal were taken from jugular vein after taking all necessary aseptic and ethical measures. Hb, PCV, TEC, ESR, TLC, MCV, MCH, MCHC, DLC, ALC, N: L were estimated by standard procedure as described in Jain (1986). Serum total protein, albumin, globulin, A:G, urea, creatinine, glucose, cholesterol, triglycerides, HDL, LDL, calcium, phosphorous, Ca:P, total bilirubin, ALT, AST, ALP, GGT and CK were estimated using biochemical kits spectrophotometrically (Erba®Mannheim Germany). The results obtained were analyzed by calculating mean, standard deviation, and standard error mean.

The mean±SEM values of Hb, PCV, ESR, TEC, TLC, MCH, MCHC, MCV, DLC, N: L and ALC are presented in Table 1. The range of values were in conformity with the values recorded for indigenous breeds of cattle as reported by Mahima *et al.* (2013) and Ganguly *et al.*

Table 1. Mean and SEM values of haematological parameters of Badri cattle

Parameter	Mean±SEM
Haemoglobin (g/dl)	9.06±0.54
Packed cell volume (%)	34.7±1.45
ESR (mm/24 h)	9.23±1.14
TEC (10^6 /µl)	13.51±0.97
TLC (10^3 /µl)	7.50±0.87
MCV (fl)	31.70±2.42
MCH (pg)	8.48±0.86
MCHC (%)	30.44±1.32
Differential leucocyte count (DLC)	
(i) Lymphocytes (%)	52.43±2.0
(ii) Neutrophils (%)	42.25±1.63
(iii) Monocytes (%)	0.85±0.15
(iv) Eosinophils (%)	3.35±0.26
(v) Basophils (%)	0.15±0.06
N: L	0.89±0.08
Absolute leucocyte count (ALC)	
(i) Lymphocytes (10^3 /µl)	4.04±0.27
(ii) Neutrophils (10^3 /µl)	3.17±0.24
(iii) Monocytes (10^3 /µl)	0.06±0.01
(iv) Eosinophils (10^3 /µl)	0.25±0.02
(v) Basophils (10^3 /µl)	0.08±0.00

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(2017) for Hariana, Kumar *et al*. (2017) and Roy *et al.* (2010) for Sahiwal, Kapale *et al*. (2008) for Gaolao, Iype *et al*. (2016) for Kasargod and Pampori *et al*. (2015) for Kashmiri cattle. The mean haemoglobin level was within normal physiological range for cattle as reported by Jain (1986). Haemoglobin value was on lower side in present study as compared to Hariana cattle and Kashmiri cattle as reported by Mahima *et al*. (2013) and Pampori *et al*. (2015), respectively. PCV was on higher side as compared to Gaolao cattle and Sahiwal cattle as reported by Kapale *et al.* (2008) and Kumar *et al.* (2017), respectively. However, PCV was on lower side as compared to Kashmiri and Hariana cattle as reported by Pampori *et al*. (2015) and Mahima *et al.* (2013), respectively. ESR value was lower than Kasargod cattle (Iype *et al.* 2016). TEC is on higher side as compared to all indigenous cattle breeds. The TLC value was in agreement with the values reported in indigenous breeds of cattle by Kapale *et al*. (2008) in Gaolao cattle, Sripad *et al.* (2014) in Khillar cows, Kumar *et al*. (2017) in Sahiwal cattle, Narayana *et al.* (2015) in Hallikar breed and Mahima *et al*. (2013) in Hariana cattle. MCV and MCH were on lower side, whereas, MCHC within the normal range of indigenous cattle. The values recorded for differential leukocyte counts in the present study were within the normal physiological range established for cattle. The erythrocytic parameters such as TEC, haemoglobin concentration, PCV, ESR, MCV, MCH and MCHC could vary depending on age, sex, season, nutrition, physiological status, genetic makeup, disease conditions, exercise, excitement, lactation, pregnancy, time of the day, various environmental factors, stress, degree of dehydration, altitude, etc.

The mean±SEM values of total protein, albumin, globulin, A:G, urea, creatinine, glucose, cholesterol, triglycerides, HDL, LDL, Ca, P, Ca:P and total bilirubin are presented in Table 2. The range of values were in conformity with the values recorded for indigenous breeds of cattle as reported by different researchers. Mean serum total protein values were lower than adult Sahiwal cattle (Roy *et al*. 2010 and Kumar *et al*. 2017), Kashmiri cattle (Pampori *et al*. 2015) and higher than Hariana cattle (Mahima *et al.* 2013). Mean serum albumin values were lower than adult Sahiwal cattle, Hariana cattle and Kashmiri cattle as reported by Kumar *et al*. (2017), Mahima *et al.* (2013) and Pampori *et al*. (2015), respectively. Serum globulin levels were on lower side as compared to Kashmiri cattle as reported by Pampori *et al*. (2015) and higher than Hariana cattle (Mahima *et al.* 2013). Serum A: G was on lower side as compared to Kashmiri cattle (Pampori *et al*. 2015) and Hariana cattle (Mahima *et al.* 2013). Serum total bilirubin values were higher than Sahiwal cattle (Kumar *et al.* 2017). Mean triglycerides of Badri cattle were found on higher side as compared to Sahiwal cattle (Kumar *et al.* 2017) and lower than Kashmiri cattle (Pampori *et al*. 2015). Serum creatinine mean values were higher than Sahiwal cattle (Kumar *et al*. 2017), Kashmiri cattle (Pampori *et al*. 2015) and Hariana cattle (Mahima *et al*. 2013). Mean blood urea concentration was higher than Kashmiri cattle (Pampori *et al*. 2015) and Hariana cattle (Mahima *et al.* 2013). Mean blood glucose values were lower in Badri cattle in comparison to Sahiwal (Roy *et al*. 2010 and Kumar *et al.* 2017). Mean serum calcium values were lower in Badri cattle in comparison to Sahiwal (Roy *et al*. 2010 and Kumar *et al.* 2017) and Hariana cattle (Mahima *et al.* 2013). Mean serum phosphorus value was lower than Sahiwal (Roy *et al*. 2010 and Kumar *et al.* 2017) and Hariana cattle (Mahima *et al.* 2013). Serum Ca: P was higher than Hariana cattle as reported by Mahima *et al*. (2013). Serum cholesterol level were lower than Hariana cattle as reported by Mahima *et al*. (2013). The mean±SD values of ALT, AST, ALP, GGT and CK are presented in Table 3. Mean serum activity of ALT and AST were lower than mean values of Kashmiri cattle (Pampori *et al*. 2015), Hariana cattle (Mahima *et al.* 2013) and Sahiwal cattle (Roy *et al*. 2010 and Kumar *et al*. 2017). Mean serum activity of ALP was lower than mean values of Sahiwal cattle as reported by Kumar *et al*. (2017). The above haematological and biochemical parameters were within normal physiological range of indigenous cattle.

Table 2. Mean and SEM values of biochemical parameters of Badri cattle

Parameter	Mean±SEM
Total protein (g/dl)	7.43±0.18
Albumin (g/dl)	2.56±0.07
Globulin (g/dl)	4.80±0.17
A:G ratio	0.57±0.03
Urea (mg/dl)	37.09±1.98
Creatinine (mg/dl)	2.04±0.05
Glucose (mg/dl)	44.44±1.51
Cholesterol (mg/dl)	107.65± 5.46
Triglycerides (mg/dl)	21.92±1.14
HDL (mg/dl)	19.73±1.14
LDL (mg/dl)	24.45±1.36
Calcium (mg/dl)	7.29±0.17
Phosphorus (mg/dl)	5.61±0.21
Ca: P	1.38±0.06
Total bilirubin (mg/dl)	0.43±0.03

Table 3. Mean and SD values of serum enzymes activity of Badri cattle

Serum enzyme	Mean±SD
ALT (U/L)	26.14±9.88
AST (U/L)	45.94±12.75
ALP (U/L)	29.94±16.72
GGT (U/L)	5.99±3.29
CK (U/L)	25.34±9.63

It was concluded that the various haemato-biochemical values established in Badri cattle could serve as reference values and are useful for academic purposes. Any alteration due to metabolic, nutritional deficiency and physiological status can be compared for diagnostic and therapeutic

purpose in Badri cattle, which is a unique breed well adapted for hilly terrains of the Uttarakhand and more resistant to diseases.

SUMMARY

Badri cattle is the first registered cattle breed of Uttarakhand and reared in the Kumaon and Garhwal regions. The study was undertaken with the objective of establishing the normal reference values of certain haematological and biochemical parameters in Badri cattle maintained at Instructional Dairy Farm of Govind Ballabh Pant University of Agriculture and Technology (GBPUAT), Pantnagar, Uttarakhand, India. Healthy animals (40) aged between 4 to 8 years, having good body condition score (BCS) and 200-250 kg body weight were selected randomly and blood samples were collected. The haematological parameters such as haemoglobin concentration (Hb), packed cell volume (PCV), total erythrocyte count (TEC), total leucocyte count (TLC), erythrocyte sedimentation rate (ESR), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), differential leukocyte count (DLC), Neutrophil: lymphocyte (N: L), and absolute leucocyte count (ALC) were estimated. The biochemical parameters such as total protein, albumin, globulin, albumin: globulin (A:G), urea, creatinine, glucose, cholesterol, triglycerides, HDL (High density lipoprotein), LDL (Low density lipoprotein), total bilirubin, ALT (Alanine aminotransferase), AST (Aspartate transaminase), ALP (Alkaline phosphatase), GGT (Gamma-glutamyl transferase) and CK (Creatinine kinase) were also estimated. The normal haematological and biochemical values established in the present study could be helpful in the diagnosis of certain ailments in Badri cattle and the values would also be useful for academic purposes.

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