

# Haematological Guide for Endangered Bargur Breed – The Hilly Cattle of Tamil Nadu

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## How to cite this paper:

Palanisamy, G., Gowrimanokari, K., Subash, R., Kumaravelu, N., & Kumar, V. (2020). Haematological Guide for Endangered Bargur Breed - The Hilly Cattle of Tamil Nadu. *International Journal of Livestock Research*, 10(5), 27-33. doi:

<http://dx.doi.org/10.5455/ijlr.20200304114643>

**Received** : Mar 04, 2020  
**Accepted** : Mar 29, 2020  
**Published** : May 31, 2020

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## Abstract

*Bargur cattle breed is a medium sized, draught breed of cattle available in Tamil Nadu, India and it is a unique breed well adapted to special type of climatic, nutritional, environmental and pathogenic exposure. The current study was formulated to establish the normal reference haematological range for different age groups of Bargur cattle which were maintained in the TANUVAS-Bargur Cattle Research Station, Bargur, Tamil Nadu, India. In this study, haematological parameters such as Total Erythrocyte Count (TEC) 106/ $\mu$ L, Total leukocyte count (TLC)103/ $\mu$ L, Packed cell volume (PCV) percentage, Haemoglobin concentration (Hb) g/dL, Mean corpuscular volume (MCV)(fl), Mean Corpuscular haemoglobin (MCH) pg, Mean corpuscular haemoglobin concentration (MCHC) g/dL and platelets 103/ $\mu$ L were estimated with use of Automatic Haematological Analyser for different age groups. The average corresponding values were  $8.46 \pm 0.42$ ,  $11423.08 \pm 518.52$ ,  $34.40 \pm 2.31$ ,  $11.15 \pm 0.79$ ,  $40.89 \pm 1.63$ ,  $13.31 \pm 0.54$ ,  $32.62 \pm 0.50$  and  $303785.71 \pm 23665.90$ , respectively, obtained in the present study for adult Bargur cattle. Study results indicated that all the haematological values were under the normal physiological range. These findings of this study may serve as reference values in which alterations due to metabolic, nutrient deficiency, physiological and health status can be compared for diagnostic and therapeutic purposes.*

**Keywords:** Age Group, Bargur Breed, Cattle, Haematology Profile

## Introduction

India has vast bio-diversified cattle breeds. These cattle breeds are well adapted to the different geographical - climatic conditions prevailing in their respective native tracts and are tolerant to tropical heat, relatively more resistant to tropical diseases and thrive well with meager feedstuff mostly with crop residues (Ganapathi *et al.*, 2012). Each breed has its own unique adaptation to its own ecological niche. Bargur is a median sized, draught purpose hill cattle breed of Bargur hills in Tamil Nadu, India. It is the only hill cattle breed present in hilly tract of Tamil Nadu. This breed is having its unique characteristics to adopt in hilly and harsh environment and humid tropical climate. Its home tract is restricted to a narrow geographical area in and around Bargur hills at an elevation of ~1000 m above mean sea level (MSL) (Pundir *et al.*, 2009). This cattle breed was 0++ famous for its draught qualities especially for its power of endurance and unsurpassed speed in trotting (Nivsarkar *et al.*, 2000). Bargur breed is having unique characters in management, disease resistance and climate adaptation. Importance of determining the haematological indices of domestic livestock species have been well acknowledged and documented (Opara *et al.*, 2006). Hematological values can provide the strong valuable baseline information which inturn helps to assess the realistic evaluation of managemental practices, physiological and nutritional status of the animals and also help to diagnose and asses the health status (Radostits *et al.*, 2006, Jezek *et al.*, 2006, Mir *et al.*, 2008). Metabolic disorders, nutritional deficiencies and prevalence of the diseases can be easily detected by proper analysis and monitoring of blood and other body fluids (Otto *et al.*, 1992). However, this requires for the establishment of normal reference values for the particular species. Pathological values are defined as those values deviating from the normal standard reference values (Radostits *et al.*, 2006). Evaluation, analysis and interpretation of the obtained results mainly depend on the standard reference values for different species of the animals in different regions as well as under existing environmental or climatically conditions. Since, the Bargur cattle breed used in the present study did not show any significant clinical signs and/or pathological symptoms, therefore they were believed as healthy animals and the result or data obtained can serve as standard reference values for this breed in future in veterinary science and animal husbandry (Kaneko *et al.*, 1997). Similar type of work was conducted in indigenous Khillar breed of cattle in Northern Karnataka and parts of Maharashtra (Sripad *et al.*, 2014). There is paucity of literature or information for Bargur breed on hematological values. To the best of our knowledge and based on the availability of the literature, this study is to be the first systematic report on normal hematological indices for Bargur breed in India. The present investigation describes about the composition of blood profiles of the relatively genetically pure germplasm of Bargur breed of Tamil Nadu. The data is given in the present communication can serve as the standard reference values for Bargur breed grown in its native home tracts.

## Materials and Methods

Bargur breed of cattle (body condition score 5-6 out of 10, classified as good) were maintained at TANUVAS-Bargur Cattle Research Station, Bargur, Tamil Nadu, India utilised for the study. This station is situated in the breeding tract of endangered Bargur cattle at Bargur hills of Tamil Nadu (77°E longitude and 11°58'N latitude). The entire breeding tract is elevated about 700-1050 m MSL. Experimental animals used in the present study were in apparently normal health and physiological condition and were maintained under uniform feeding, lighting, housing and other managemental practices as per the farm schedule. Experimental animals were fed with green fodder, dry fodder and concentrate fortified with mineral mixture and salt and watering was *ad libitum*. The experimental animals (n=60) were divided into four groups as per dentition viz, group 1: animal with milk teeth (n=12), group 2: animal with 2 permanent teeth (n=11), group 3: animal with 4 permanent teeth (n=24) and group 4: animal with 6 permanent teeth (n=13). In this experiment, both male (n=18) and female (42) were included-. Blood samples (3 mL) were collected from venipuncture of jugular vein in EDTA containing tube (1.8mg EDTA per mL of blood) in 1700 to 1800 h. These samples were brought to the laboratory immediately in an ice box at a temperature of 4°C for analysis in the automatic blood analyser. The haematological parameters such as Total Erythrocyte Count (TEC), Total leukocyte count (TLC), Packed Cell Volume (PCV), Haemoglobin (Hb) count, Mean Corpuscular volume (MCV), Mean corpuscular haemoglobin (MCH) and Mean corpuscular haemoglobin concentration (MCHC) and platelet counts were determined with the help of automatic haematological analyser ( 3 part celenium junior, Trivitron) present in Teaching Veterinary Clinical Complex, TANUVAS-Veterinary College and Research Institute, Tirunelveli, Tamil Nadu. The statistical analysis of the data was performed as per standard procedures. Analysis of variance (ANOVA) was performed using a generalized liner model (SPSS 32 statistical package). Means were analyzed by one-way analysis of variance (ANOVA), followed by the Tukey's post hoc test to determine significant differences between the different experimental groups and student's "t" test between the male and female groups using the SPSS 32 statistical package /PC computer program. Differences with values of

$p < 0.05$  were considered to be statistically significant.

## Result and Discussion

Haematological values in terms of leukocytic parameters, erythrocytic parameters and thrombocytic parameters have been mentioned in Table 1 for male and female and in Table 2 for different age groups. All the haematological parameters were within the normal physiological range of cattle as depicted in Merck's Veterinary Manual. Haemoglobin, PCV, TEC and TLC were significantly ( $p < 0.01$ ) differed between the sexes. The first three parameters were significantly higher in male than in female whereas TLC was significantly higher in female than in male. Haematological profiles for different age groups revealed that there was no significant difference except TLC ( $p < 0.05$ ).

Bargur cattle are highly endangered cattle breed of Tamil Nadu. Metabolic, nutritional, health as well as physiological status of animal can be determined by analysis, evaluation and monitoring the blood and other bio-fluids are by the use of the different clinical pathological and also with chemistry procedures (Bogin 1994, Kaneko *et al.*, 1997). Pathologic values are defined as the values that are deviated from the standard normal reference's values (Kaneko *et al.*, 1997), for that, it is required to establish the normal reference values for different haematological and biochemical induces. In the present study, the animals used were almost healthy by observation, palpation and percussion and did not reveal any abnormal clinical signs and/or pathological conditions, therefore, this can be considered as healthy animals and the hematological as well as the biochemical profiles of these animals can work as the standard reference values for the Bargur cattle for future use in Bargur native tract of Tamil Nadu or having similar nutritional, climatic or environmental conditions in other parts of country. These established standard values will be served as reference values and which will be helpful to estimate the health status of these precious germplasm of Bargur cattle in any future studies related to this bovine species. However, the final interpretation of obtained results by laboratory analysis will depend on the standard reference values of each and every species of animal in different geographical as well as the environmental conditions.

Study on the blood composition can address the valuable information about on the general health of the animal and so that, this can be utilized to evaluate the health status of the animal. Deviation of values in certain blood parameters from their normal ranges could be a very good guide to make diagnosis or for differential diagnosis of a particular disease or pathological condition (Radostits *et al.*, 2006). Hematological profile or complete blood count (CBC) is being very essential in evaluation of the animal health status as well as the laboratory data clinical interpretation which is a prerequisite for proper diagnosis for different patho-physiological as well as infectious disorders in the Bargur cattle (Opera *et al.*, 2006). Moreover, the CBC is an important as well as the powerful diagnostic tool in the component of a minimum database for disease diagnosis. It can also be used to monitor or watch the response to treatment or therapy, to follow up the severity of a disease or illness or used as a starting point to formulate a list of differential diagnosis. Interpretation on the CBC can be grouped into three divisions as erythrocyte, leukocyte and platelets evaluation. Each of these divisions can be interpreted separately and individually and integration of these divisions is very much important to get highest diagnostic yield or result (Barger, 2003). Haematological examination is also done as a routine screening procedure for assessment of general health (Gutienez De Lar *et al.*, 1971). Blood values are also clear indicators to assess the stress and welfare of animals (Anderson *et al.*, 1999).

Knowledge on the hematological values is very much useful to diagnose the different pathological as well as the metabolic disorders, which are adversely or deleteriously affect the reproductive and productive performance of the cows (Ahmad *et al.*, 2003). Therefore, these hematological data can help to a large extent to determine the disease course and their outcome of several viral, bacterial and parasitic diseases (Swenson 1970). Factors such as breed, sex, age, seasonal variation, pregnancy, lactation, nutritional and health status of the animal alter hematological attributes (Mirzadeh *et al.*, 2010). The haematological parameters in the present study were compared with other indigenous cattle breeds studied in India (Hallikar breed: Lankesh *et al.*, 2015, Khillar breed of Karnataka: Sripad *et al.*, 2014). The hematological profiles were higher in the Bargur cattle than in other indigenous cattle breeds such as Hallikar, Khillari, Hariana, Hardhenu and Sahiwal (Mahima *et al.*, 2013). This might be due to Bargur is a hilly breed and the breeding tract of these breed is in higher altitude and oxygen content is less as compared to plain land, therefore this breed needs more TEC and Hb.

**Table 1:** Haematological parameters for male and females in Bargur breed of cattle (mean  $\pm$  SEM)

Parameters	Merck's Veterinary Manual	Overall mean	Male (n=18)	Female (n=42)	Similar to the present study	Higher than the present study	Lower than the present study
Haemoglobin (g/dL)	8-15	11.46	12.76 $\pm$ 0.49 <sup>a</sup>	10.90 $\pm$ 0.32 <sup>b</sup>	Bedenicki <i>et al.</i> , 2014 ; Manjappa <i>et al.</i> , 2018	-	Mahima <i>et al.</i> , 2013 ; Bedenicki <i>et al.</i> , 2014 ; Suharti <i>et al.</i> , 2017 ; Sripad <i>et al.</i> , 2014
PCV (%)	24-46	35.6	39.78 $\pm$ 1.46 <sup>a</sup>	33.80 $\pm$ 5.73 <sup>b</sup>	Otto <i>et al.</i> , 2000 ; Mahima <i>et al.</i> , 2013 ; Manjappa <i>et al.</i> , 2018 ; Sripad <i>et al.</i> , 2014	-	Suharti <i>et al.</i> , 2017
TEC (10 <sup>6</sup> / $\mu$ L)	05-10	8.62	9.33 $\pm$ 0.28 <sup>a</sup>	8.31 $\pm$ 0.18 <sup>a</sup>	Sripad <i>et al.</i> , 2014	-	Mahima <i>et al.</i> , 2013; Bedenicki <i>et al.</i> , 2014 ; Manjappa <i>et al.</i> , 2018 ; Suharti <i>et al.</i> , 2017
TLC (10 <sup>3</sup> / $\mu$ L)	04-12	12.02	10.75 $\pm$ 3.60 <sup>a</sup>	12.56 $\pm$ 4.01 <sup>b</sup>	-	Sripad <i>et al.</i> , 2014	Mahima <i>et al.</i> , 2013; Bedenicki <i>et al.</i> , 2014 ; Manjappa <i>et al.</i> , 2018; Suharti <i>et al.</i> , 2017
Neutrophil (%)	15-45	35.47	34.72 $\pm$ 0.84	35.50 $\pm$ 0.77	Bedenicki <i>et al.</i> , 2014; Manjappa <i>et al.</i> , 2018; Sripad <i>et al.</i> , 2014	Mahima <i>et al.</i> , 2013	
Lymphocyte (%)	45-75	56.75	57.56 $\pm$ 1.55	56.40 $\pm$ 1.15	Bedenicki <i>et al.</i> , 2014; Sripad <i>et al.</i> , 2014	-	Mahima <i>et al.</i> , 2013; Manjappa <i>et al.</i> , 2018
Monocyte (%)	02-7	2.75	2.72 $\pm$ 0.30	2.76 $\pm$ 0.23	Sripad <i>et al.</i> , 2014	Mahima <i>et al.</i> , 2013 ; Manjappa <i>et al.</i> , 2018	Bedenicki <i>et al.</i> , 2014
Eosinophil (%)	2-20	4.47	4.33 $\pm$ 0.40	4.52 $\pm$ 0.32	Manjappa <i>et al.</i> , 2018 ; Sripad <i>et al.</i> , 2014	Mahima <i>et al.</i> , 2013	Bedenicki <i>et al.</i> , 2014
MCV (fl)	40-60	40.78	42.26 $\pm$ 4.49	40.14 $\pm$ 0.68	Mahima <i>et al.</i> , 2013; Manjappa <i>et al.</i> , 2018; Sripad <i>et al.</i> , 2014	Suharti <i>et al.</i> , 2017	Bedenicki <i>et al.</i> , 2014
MCH (pg)	11-17	13.17	13.48 $\pm$ 1.50	13.04 $\pm$ 0.24	Mahima <i>et al.</i> , 2013; Manjappa <i>et al.</i> , 2018	Sripad <i>et al.</i> , 2014	Suharti <i>et al.</i> , 2017
MCHC (g/dL)	30-36	32.47	32.17 $\pm$ 1.34	32.60 $\pm$ 0.33	Manjappa <i>et al.</i> , 2018 ; Suharti <i>et al.</i> , 2017	-	-
Platelets (10 <sup>3</sup> / $\mu$ L)	100-800	299.91	290.88 $\pm$ 45.33	303.78 $\pm$ 23.66			

PCV: Packed Cell Volume, TEC: Total erythrocyte count, TLC: Total leukocyte count, MCV: Mean Corpuscular Volume, MCH: Mean Corpuscular Haemoglobin, MCHC: Mean Corpuscular Haemoglobin Concentration. Within rows means with different letters (a, b) differ significantly ( $p < 0.01$ ) between male and female groups

**Table 2:** Means for haematological parameter for different age groups of animals in Bargur breed of cow (mean  $\pm$  SEM)

Parameters	Merck's Veterinary Manual	Overall mean	Milk teeth (n=12)	2 teeth (n=11)	4 teeth (n=24)	6 teeth and above (n=13)	Similar to the present study	Higher than the present study	Lower than the present study
Haemoglobin (g/dL)	8-15	11.46	12.76 $\pm$ 0.49	10.90 $\pm$ 0.32	11.90 $\pm$ 0.39	11.15 $\pm$ 0.79	Bedenicki <i>et al.</i> , 2014 ; Manjappa <i>et al.</i> , 2018	-	Mahima <i>et al.</i> , 2013; Bedenicki <i>et al.</i> , 2014; Sri Suharti <i>et al.</i> , 2017 ; Sripad <i>et al.</i> , 2014
PCV (%)	24-46	35.6	39.78 $\pm$ 1.46	33.80 $\pm$ 5.73	37.16 $\pm$ 1.12	34.40 $\pm$ 2.31	Otto <i>et al.</i> , 2000 ; Mahima <i>et al.</i> , 2013; Manjappa <i>et al.</i> , 2018; Sripad <i>et al.</i> , 2014	-	Sri Suharti <i>et al.</i> , 2017
TEC (10 <sup>6</sup> / $\mu$ L)	05-10	8.62	9.33 $\pm$ 0.28	8.31 $\pm$ 0.18	8.63 $\pm$ 0.27	8.46 $\pm$ 0.42	Sripad <i>et al.</i> , 2014	-	Mahima <i>et al.</i> , 2013; Bedenicki <i>et al.</i> , 2014; Manjappa <i>et al.</i> , 2018; Sri Suharti <i>et al.</i> , 2017
TLC (10 <sup>3</sup> / $\mu$ L)	04-12	12.02	10.75 $\pm$ 3.60 <sup>a</sup>	12.56 $\pm$ 4.01 <sup>c</sup>	12.70 $\pm$ 5.30 <sup>c</sup>	11.42 $\pm$ 5.18 <sup>b</sup>	-	Sripad <i>et al.</i> , 2014	Mahima <i>et al.</i> , 2013; Bedenicki <i>et al.</i> , 2014; Manjappa <i>et al.</i> , 2018; Sri Suharti <i>et al.</i> , 2017
Neutrophil (%)	15-45	35.47	34.72 $\pm$ 0.84	35.50 $\pm$ 0.77	34.83 $\pm$ 1.08	35.92 $\pm$ 1.32	Bedenicki <i>et al.</i> , 2014; Manjappa <i>et al.</i> , 2018; Sripad <i>et al.</i> , 2014	Mahima <i>et al.</i> , 2013	
Lymphocyte (%)	45-75	56.75	57.56 $\pm$ 1.55	56.40 $\pm$ 1.15	58.38 $\pm$ 1.21	57.23 $\pm$ 2.03	Bedenicki <i>et al.</i> , 2014 ; Sripad <i>et al.</i> , 2014	-	Mahima <i>et al.</i> , 2013; Manjappa <i>et al.</i> , 2018
Monocyte (%)	02-07	2.75	2.72 $\pm$ 0.30	2.76 $\pm$ 0.23	2.83 $\pm$ 0.30	2.38 $\pm$ 0.33	Sripad <i>et al.</i> , 2014	Mahima <i>et al.</i> , 2013; Manjappa <i>et al.</i> , 2018	Bedenicki <i>et al.</i> , 2014
Eosinophil (%)	02-20	4.47	4.33 $\pm$ 0.40	4.52 $\pm$ 0.32	3.96 $\pm$ 0.37	4.46 $\pm$ 0.62	Manjappa <i>et al.</i> , 2018; Sripad <i>et al.</i> , 2014	Mahima <i>et al.</i> , 2013	Bedenicki <i>et al.</i> , 2014
MCV (fl)	40-60	40.78	42.26 $\pm$ 4.49	40.14 $\pm$ 0.68	41.67 $\pm$ 0.83	40.89 $\pm$ 1.63	Mahima <i>et al.</i> , 2013; Manjappa <i>et al.</i> , 2018; Sripad <i>et al.</i> , 2014	Sri Suharti <i>et al.</i> , 2017	Bedenicki <i>et al.</i> , 2014
MCH (pg)	11-17	13.17	13.48 $\pm$ 1.50	13.04 $\pm$ 0.24	13.54 $\pm$ 0.25	13.31 $\pm$ 0.54	Mahima <i>et al.</i> , 2013; Manjappa <i>et al.</i> , 2018	Sripad <i>et al.</i> , 2014	Sri Suharti <i>et al.</i> , 2017
MCHC (g/dL)	30-36	32.47	32.17 $\pm$ 1.34	32.60 $\pm$ 0.33	32.67 $\pm$ 0.43	32.62 $\pm$ 0.50	Manjappa <i>et al.</i> , 2018; Sri Suharti <i>et al.</i> , 2017	-	-
Platelets (10 <sup>3</sup> / $\mu$ L)	100-800	299.91	290.88 $\pm$ 45.33	303.78 $\pm$ 23.66	250.95 $\pm$ 21.15	351.00 $\pm$ 63.31			

TEC: Total erythrocyte count, TLC: Total leukocyte count, MCV: Mean Corpuscular Volume, MCH: Mean Corpuscular Haemoglobin, MCHC: Mean Corpuscular Haemoglobin Concentration. Within rows means with different letters (a, b, c) differ significantly ( $p < 0.05$ ) among the experimental groups

## Conclusion

Most of the analyzed haematological profiles were in normal range, which clearly indicates that, the study Bargur bovine populations were in healthy condition. Thus, during diagnostic procedure or measurement, it is very useful to compare the values obtained from ill or sick animals with normal reference values of healthy animal. The values or findings of the present study may serve as the standard reference values in which deviations due to metabolic, nutrient deficiency, physiological and health status can be compared for diagnostic, prognostic and therapeutic purpose for Bargur cattle.

## Conflict of Interests

There is no conflict of interest.

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