Haematological Profile of Indigenous Punganur Cattle

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ABSTRACT

This study aimed to establish baseline haematological reference values of Punganur cattle, to address the data gaps due to its limited population. Blood samples from 175 healthy cattle were collected three times, at intervals of 15 days. Data on 18 parameters, including total leucocyte count, lymphocyte, monocyte, granulocyte, erythrocyte, haemoglobin, packed cell volume, mean corpuscular volume, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, RBC distribution width, platelet count, mean platelet volume, platelet distribution width, and plateletcrit were collected and recorded. These data would serve as baseline reference values for the health assessment of Punganur cattle.

Keywords: Punganur cattle, Andhra Pradesh, Haematological profile

INTRODUCTION

The Punganur cattle are considered the smallest Bos indicus cattle breed from the Punganur area of Chittoor district of Andhra Pradesh with accession number India_Cattle_0100_Punganur_03022 (NBAGR, 2024). Despite its smaller size, the breed has demonstrated resilience to various diseases, heat tolerance, and low management requirements, which make it well-suited to the harsh environmental conditions (Ekambaram *et al.*, 2015). The breed's genetic integrity is threatened by a rising rate of crossbreeding with exotic cattle, diluting the genetic pool of the breed, and also due to the increasing preference for exotic and crossbred cattle, reducing the population of Punganur cattle (Avinash *et al.*, 2024). Haematological values of this breed can provide valuable insights into the animals' health, influenced by factors such as nutrition, stress, reproductive status, age, sex, and environmental conditions like temperature and humidity. Despite its significance, there is a lack of comprehensive data on the haematological profiles of Punganur cattle. The current literature on this breed is sparse. Hence, there is a necessity to gather breed-specific reference values for this indigenous cattle breed. Therefore, the present study aims to establish baseline haematological values for Punganur cattle.

MATERIALS AND METHODS

A total of 175 clinically healthy Punganur cattle belonging to different age and sex groups, namely cows (n = 52), bulls (n = 35), heifers (n = 27), young bulls (n = 24), female calves (n = 17), and male calves (n = 20), comprising males (n = 79) and females (n = 96), maintained at the Livestock Research Station (LRS), Palamaner, Sri Venkateswara Veterinary University and the farms maintained by farmers of the breed's native tract of Chittoor district, Andhra Pradesh, were selected for the study. Blood samples were collected in the early hours of the day three times from the same animals, with a 15-day interval between each collection, resulting in a total of 525 samples (175 samples per collection). The haematological profiles for the 525 samples were analysed to determine baseline haematological values of the breed. The mean temperature and relative humidity were 22-35°C and 53-56%, respectively.

About 5 ml of whole blood was collected from the jugular vein of each animal using a 5 ml

K3E (EDTA) BD Vacutainer tube. The blood samples collected were then labelled and transported to the laboratory for haematological analysis, performed within 24 hours. A total of 18 haematological parameters, viz. Total Leucocyte Count (TLC), Lymphocyte, Monocyte and Granulocyte counts, Lymphocyte, Monocyte and Granulocyte Percentage, Total Erythrocyte Count (TEC), Haemoglobin (Hb), Haematocrit / Packed Cell Volume (PCV), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC), Red Cell Distribution Width (RDW), Platelet Count (PLT), Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), and Plateletcrit (PCT) were estimated using a Mindray BC-2800 Auto Hematology Analyzer. Statistical analysis was performed using SPSS software employing repeated measures ANOVA to assess the baseline haematological values.

RESULTS AND DISCUSSION

The results of the haematological profile are presented in Table I and compared with the available literature IN other breeds such as Hardhenu, Sahiwal, and Hariana cattle (Deepak *et al.*, 2017), Malnadgidda cattle (Sripad *et al.*, 2018a), Deoni cattle (Sripad *et al.*, 2018b), Khillar cattle (Sripad *et al.*, 2014), and Gaolao cattle (Kapale *et al.*, 2014). In this study, the mean TLC observed was 9.02 ± 0.19 x 10^3/µl, which is similar to the values reported for Punganur, Hardhenu, and Sahiwal cattle. However, higher TLC values were noted in Malnadgidda cattle (12.69 ± 0.42), Deoni cattle (10.61 ± 0.36), Hariana cattle (10.49 ± 0.20), and Khillar cattle, whereas a lower value (7.58 ± 0.68) was observed in Gaolao cattle. These findings indicate a balanced immune response in Punganur cattle, with their leucocyte levels supporting adequate defence against common infections in their environment (Ohfuji, 2020). The mean percentages of lymphocytes, monocytes, and granulocytes were 54.21 ± 0.68, 11.747 ± 1.474, and 35.019 ± 0.604, respectively, in Punganur cattle. The lymphocyte percentage was lower than that reported for Hardhenu (64.46 ± 1.39), Sahiwal (64.12 ± 1.43), Hariana (62.81 ± 1.13), Khillar (62.32 ± 1.09), and Gaolao cattle (66.93 ± 2.39). In contrast, the monocyte percentage in Punganur cattle was significantly higher than that reported in Hardhenu, Sahiwal, Hariana, Khillar, and Gaolao cattle. While the granulocyte percentage and the lymphocyte, monocyte, and granulocyte counts in Punganur cattle could not be directly compared with those of other breeds due to the paucity of published data, the present findings provide valuable baseline reference values for this breed.

The mean TEC in this study was 6.90 ± 0.09 x 10^6/µl, similar to the values reported for Deoni cattle and is within the normal physiological range (Radostits *et al.*, 2000). However, higher values were reported for Gaolao (9.78 ± 0.46), Hariana (8.52 ± 0.24), Sahiwal (8.65 ± 0.25), Hardhenu (8.40 ± 0.25), and Khillar (7.57 ± 0.30) cattle. The mean Hb in Punganur cattle was 9.13 ± 0.09 g/dl, as that of Deoni (9.83 ± 0.29 g/dl) and Khillar (10.11 ± 0.34 g/dl) cattle, but higher than Malnadgidda cattle (8.05 ± 0.17 g/dl), indicating efficient haemoglobin synthesis. The HCT in Punganur cattle (27.27 ± 0.34%) was lower than that of Deoni (32.35 ± 1.14%), Khillar (33.54 ± 0.99%), Hardhenu (30.98 ± 1.22%), Sahiwal (30.51 ± 1.56%), Hariana (30.67 ± 1.26%), and Gaolao cattle (32.03 ± 1.39%). Despite having lower haemoglobin content and PCV, Punganur cattle appear to be well adapted to their native environment. This adaptation, shaped by genetic, nutritional, and environmental factors, enables them to thrive in hot, arid climates with scarce resources, optimizing oxygen utilization to match their lower metabolic demands (Nora, 1998).

The mean values of MCV, MCH, MCHC, and RDW were 41.88 ± 1.37 fl, 14.13 ± 0.50 pg, 33.97 ± 0.41 g/dl, and 18.25 ± 0.12%, respectively, all within the physiological range

reported by Radostits *et al.* (2000). The MCV in Punganur cattle (41.88 ± 1.37 fl) was lower than that of Malnadgidda (45.97 ± 3.00 fl), Deoni (51.03 ± 1.31 fl), Khillar (47.46 ± 3.90 fl), Hardhenu (48.56 ± 0.87 fl), Sahiwal (47.89 ± 0.63 fl), and Hariana (50.41 ± 0.76 fl) cattle, indicating smaller RBCs cells in Punganur breed. The MCH in Punganur cattle (14.13 ± 0.50 pg) was similar to that in Khillar cattle (13.59 ± 0.32 pg), but lower than in Deoni cattle (15.25 ± 0.55 pg), with higher MCH values observed in Sahiwal (14.65 ± 0.50 pg), Hardhenu (14.40 ± 0.53 pg), and Hariana cattle (15.02 ± 0.60 pg). These variations indicated that while Punganur cattle have a lower haemoglobin content per red blood cell, they still maintain an efficient system for oxygen transport, supporting their metabolic needs. Differences across breeds may be attributable to genetic, nutritional, or environmental factors unique to each breed. The MCHC in Punganur cattle (33.97 ± 0.41 g/dl) was within the typical range and comparable to Khillar cattle (31.72 ± 1.82 g/dl). In contrast, Hariana and Sahiwal cattle had higher MCHC values (35.02 ± 1.20 g/dl and 34.60 ± 0.50 g/dl, respectively), indicating a greater concentration of haemoglobin within each red blood cell, contributing to a stronger oxygen-carrying capacity. Although Punganur cattle exhibited slightly lower MCHC values, they remain within a healthy range, reflecting efficient erythropoiesis and haemoglobin utilization (Lawrence *et al.*, 2000). The RDW in Punganur cattle was 18.25 ± 0.12%, reflecting normal variation in RBC size. Although RDW values are not widely reported in other breeds, RDW is an important indicator of anisocytosis (variation in RBC size). Higher RDW values in other breeds may indicate a greater range of red cell sizes, possibly due to nutritional deficiencies or other physiological factors. The uniform RDW in Punganur cattle suggests stable erythropoiesis and a lack of significant haematological stress or disease (Radostits *et al.*, 2000).

Table I: Haematology Reference Values in Punganur Cattle (Mean ± SE)

Parameter	Herd (n=175)
TLC (10^3/µl)	9.02 ± 0.19
LYM (10^3/µl)	4.96 ± 0.12
MON (10^3/µl)	0.93 ± 0.02
LYM (%)	54.21 ± 0.68
MON (%)	11.747 ± 1.474
GRAN (%)	35.019 ± 0.604
TEC (10^6/µl)	6.90 ± 0.09
Hb (g/dl)	9.13 ± 0.09
HCT/PCV (%)	27.27 ± 0.34
MCV (fl)	41.88 ± 1.37
MCH (pg)	14.13 ± 0.50
MCHC (g/dl)	33.97 ± 0.41
RDW (%)	18.25 ± 0.12
PLT (10^3/µl)	310.03 ± 9.36
MPV (fl)	5.83 ± 0.19
PDW (%)	16.30 ± 0.04
PCT (%)	0.19 ± 0.04

The PLT in Punganur cattle (310.028 ± 9.359 x 10^3/µl) was within the physiological range (Radostits et al., 2000) and comparable to values in Deoni (273.45 ± 16.59 x 10^3/µl) and Khillar (274.35 ± 15.42 x 10^3/µl) cattle, but significantly higher than that of Malnadgidda cattle (221.8 ± 10.12 x 10^3/µl). These values suggest that Punganur cattle exhibit a robust platelet production, which is critical for maintaining effective blood clotting

mechanism and overall health (Benoit *et al.*, 2018). In Punganur cattle, the MPV was 5.826 ± 0.186 fl, within the physiological range (Merck, 2024), and the PCT was 0.187 ± 0.035%, also within the normal range (Schalm, 2011). MPV is a key indicator of platelet size and can reflect platelet activation, while PCT assesses overall platelet mass, which is critical for understanding clotting function. The values observed in Punganur cattle indicate a normal distribution of platelet size and volume, reflecting effective platelet production and functionality. Although comparative data for MPV and PCT are limited for indigenous breeds, the values in Punganur cattle suggest that they maintain a stable haemostatic function.

CONCLUSION

The extensive dataset obtained in this study provides valuable reference values to enhance the understanding of the breed's physiological traits, presenting significant insights for breeding and management practices. These baseline values would serve as essential tools for veterinarians to facilitate health assessments and interventions for Punganur cattle, besides providing adequate support for conserving of this endangered breed.

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