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Preliminary insights into the relationship between serum testosterone and hematological parameters in Ongole breeding bulls

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Abstract

The study was designed to evaluate the relationship between serum testosterone concentration and certain hematological parameters in Ongole breeding bulls. Blood samples for hematology were collected from six clinically healthy Ongole breeding bulls maintained under similar managemental conditions. Previously analyzed serum testosterone concentrations of same bulls were correlated with certain hematological parameters like hemoglobin, red blood cell count, packed cell volume, erythrocyte indices, red cell distribution width, platelet count, and platelet indices. Descriptive statistics and Pearson's correlation analysis were performed. Correlation analysis showed a significant negative relation between serum testosterone and RBC count and RDW-CV. Strong positive correlations were observed with serum testosterone by MCV, MCH, and RDW-SD. Platelet count displayed positive correlation with testosterone. Findings suggest the probable influence of serum testosterone on erythrocytic morphology and platelet-related parameters in Ongole breeding bulls. However, due to the limited size of the sample, future studies in large sample size are warranted to validate these observations to establish physiological relevance.

Keywords: Ongole bulls, testosterone, hematology, erythrocyte indices, platelet indices, *Bos indicus*

1. Introduction

The reproductive performance of breeding bulls plays a key role in preserving the fertility of the herd, enhancing genetic progress, and warranting the efficacy of artificial insemination performance. Taking into consideration indigenous cattle breeds like Ongole, the fertility efficiency of breeding males is calculated from not only the semen production and quality of the semen, but also by the quality of their semen to withstand semen processing and cryopreservation procedures. Hence, evaluation of physiological and reproductive parameters in breeding bulls is necessary for preserving genetic soundness that improve breeding outcomes, and thereby supports the long-term sustainability of organized cattle improvement programmes. (Praveen *et al.*, 2024; Bindu *et al.*, 2024; Bindu *et al.*, 2025) ^[1, 2, 3]. Keeping aside its well-recognized role in reproduction, testosterone is a vital endocrine regulator which influences a wide range of physiological processes. Normal body growth and development, nutrient utilization and energy metabolism along with support to the metabolic balance are some of the key functions of the testosterone that help in normal physiology of a breeding bull. (Keerthana Surabhi *et al.*, 2022; Srikanth *et al.*, 2025) ^[4, 5]. Studies made at this station on Ongole breeding bulls shown that as the age advances, in general, there was a progressive rise in circulating testosterone and these hormonal changes also enhanced semen quality traits, body and testicular morphometrics, with significant relationships towards metabolic constituents like cholesterol, glucose, insulin, and zinc. Together, these findings from our previous suggest that testosterone plays a role as a valuable marker that reflects the overall physiological status and breeding fitness of breeding bulls, in addition to being an indicator of reproduction potential. (Sagarika *et al.*, 2025; Kadiri *et al.*, 2025) ^[6, 7]. Testosterone is also reported to help in regulation of hematological processes and the maintenance of normal blood

cell populations. It contributes to the formation and maturation of blood cells by promoting erythropoietic activity as well as stimulating bone marrow and also supports the maintenance of adequate hemoglobin levels playing an important role in sustaining oxygen-carrying capacity and overall physiological performance in breeding bulls (Bassil *et al.*, 2009; Bhasin *et al.*, 2022) [8, 9]. Stand-alone researches in other mammalian species also indicated associations between testosterone and hematological parameters. (Dilbar *et al.*, 2014) [10]. Even though physiological importance of testosterone is reported, scanty information is available regarding its association with hematological characteristics in Ongole breeding bulls. Therefore, the present preliminary study was undertaken to evaluate serum testosterone levels and their association with selected hematological parameters in Ongole breeding bulls.

2. Materials and Methods

The present study was carried out taking into consideration six actively breeding Ongole bulls that were being maintained at Livestock Research Station, Lam, Guntur, Andhra Pradesh, India for Sri Venkateswara Veterinary University. The bulls of the study belong to different ages and are verified to be clinically sound. Similar managerial practices along with similar feeding was given to these bulls during the study.

Blood samples were collected aseptically from the jugular vein using sterile EDTA-coated vacutainer tubes and analyzed using an automated hematology analyzer. The hematological parameters evaluated included: Hemoglobin (Hb), Red blood cell count (RBC), Packed cell volume (PCV), Mean corpuscular volume (MCV), Mean corpuscular hemoglobin (MCH), Mean corpuscular hemoglobin concentration (MCHC), Red cell distribution width (RDW-CV (Coefficient of Variation) and RDW-SD (Standard Deviation), Platelet count, Mean platelet volume (MPV), Platelet distribution width (PDW), Plateletcrit (PCT) and Platelet large cell ratio (P-LCR). The serum testosterone concentration values of the same bulls from our previous study (Praharshini *et al.*, 2006) [11] were correlated with these hematological parameters. Descriptive statistics were measured for all hematological parameters. To determine the association between serum testosterone and hematological parameters, Pearson's correlation coefficient was used.

3. Results

Pearson's correlation coefficients between serum testosterone concentration and hematological parameters along with the descriptive statistics in Ongole breeding bulls are presented in Table 1.

Table 1: Descriptive Statistics and Correlation of serum testosterone with hematological parameters in Ongole breeding bulls

Parameter	Mean $\pm$ SD	Range	Correlation coefficient (r)	p-value
Total Testosterone (nmol/L) (Praharshini <i>et al.</i> , 2026) [11]	4.41 $\pm$ 1.24	3.43–5.99	—	—
Hemoglobin (g/dL)	10.23 $\pm$ 0.61	9.7–11.0	-0.773	0.071
RBC Count (million/ μ L)	6.24 $\pm$ 0.80	5.41–7.19	-0.877*	0.022
Packed Cell Volume (%)	28.43 $\pm$ 1.91	27.2–30.9	-0.614	0.194
MCV (fL)	45.93 $\pm$ 3.45	43.0–50.3	0.998**	<0.01
MCH (pg)	16.50 $\pm$ 1.17	15.3–17.9	0.968**	<0.01
MCHC (g/dL)	36.03 $\pm$ 0.60	35.6–36.8	-0.305	0.556
RDW-CV (%)	19.07 $\pm$ 0.81	18.1–19.9	-0.861*	0.028
RDW-SD (fL)	30.23 $\pm$ 1.59	28.3–31.8	0.845*	0.034
Platelet Count ($10^3/\mu$ L)	281.67 $\pm$ 104.48	151–376	0.791	0.061
MPV (fL)	6.57 $\pm$ 0.58	6.1–7.3	-0.730	0.100
PDW (%)	15.17 $\pm$ 0.42	14.8–15.7	-0.433	0.390
PCT (%)	0.178 $\pm$ 0.059	0.104–0.229	0.774	0.071
Platelet Large Cell Ratio (%)	9.80 $\pm$ 6.28	5.5–17.9	-0.642	0.169

*Significance levels: *p < 0.05; **p < 0.01

Significant associations between serum testosterone concentration and the hematological parameters in Ongole breeding bulls were revealed by correlation analysis. Significant positive correlations were shown between serum testosterone and erythrocyte indices *viz.*, MCV, MCH and RDW-SD. On the contrary, significant negative correlations were observed with RBC and RDW-CV. Parameters like platelet count and platelet crit were positively associated with testosterone without any significance.

4. Discussion

The present study analyzed the correlation between serum testosterone concentration and certain hematological parameters in actively breeding Ongole bulls. Traditionally, testosterone has been associated with stimulation of erythropoiesis through increased erythropoietin production and bone marrow activity (Bachman *et al.*, 2014) [12]. The contrast observation in the present study might be attributed to probable dependence on physiological stage, endocrine balance, and breed-specific factors. A very strong positive correlation was observed between testosterone concentration

and MCV as well as MCH. These findings suggest influence of testosterone on erythrocyte morphology and hemoglobinization. In cattle and other mammalian species, the variations in erythrocyte indices were reported as a consequence to hormonal variations (Dilbar *et al.*, 2014) [10].

A positive association between testosterone and RDW-SD was observed. On the contrary, a negative association between testosterone and RDW-CV was observed. These two contrast observations indicate probable alterations in erythrocyte size distribution based on endocrine status. Red cell distribution parameters are considered sensitive indicators of erythrocyte heterogeneity and physiological adaptations (Salvagno *et al.*, 2015) [13]. Platelet count shown a positive trend with serum testosterone concentration. This statistically insignificant association, might be attributed to a possible modulatory role of testosterone on thrombopoietic activity. Alterations in the hematological parameters as a consequence to endocrine variations have previously been reported in bovines (Roland *et al.*, 2014) [14]. The present investigation is a preliminary nature of the study involving a small size sample. However, the findings of this study provide indication

regarding possible hemato-endocrine interactions in Ongole breeding bulls. A further investigation using larger populations, repeated sampling, and seasonal evaluation is warranted.

5. Conclusion

The study revealed significant associations between serum testosterone concentration and selected hematological parameters in Ongole breeding bulls. Testosterone showed strong positive correlations with MCV and MCH, while negative associations were observed with RBC count and RDW-CV. These observations suggest a possible influence of testosterone on erythrocyte morphology and hematological dynamics in breeding bulls. Further studies involving larger sample sizes are required to validate these preliminary findings.

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