



International Journal of Veterinary Sciences and Animal Husbandry



ISSN: 2456-2912

NAAS Rating (2026): 4.61

VET 2025; SP-11(5): 83-85

© 2026 VET

www.veterinarypaper.com

Received: 25-03-2026

Accepted: 29-04-2026

Praharshini N

Undergraduate Student, 5th
Year, College of Veterinary
Science (CVSc), Sri
Venkateswara Veterinary
University, Tirupati, Andhra
Pradesh, India

R Harshitha

Undergraduate Student, 5th
Year, NTR College of Veterinary
Science (NTR CVSc), Sri
Venkateswara Veterinary
University, Gannavaram,
Andhra Pradesh, India

NR Srikanth

Scientist & Head, Livestock
Research Station, Lam, Sri
Venkateswara Veterinary
University, Guntur, Andhra
Pradesh, India

K Sunny Praveen

Scientist, Livestock Research
Station, Lam, Sri Venkateswara
Veterinary University, Guntur,
Andhra Pradesh, India

M Mutha Rao

Professor and Officer-in-Charge,
Livestock Research Station,
Lam, Sri Venkateswara
Veterinary University, Guntur,
Andhra Pradesh, India

Corresponding Author:

M Mutha Rao

Professor and Officer-in-Charge,
Livestock Research Station,
Lam, Sri Venkateswara
Veterinary University, Guntur,
Andhra Pradesh, India

Effect of serum testosterone on immunological profile in ongole breeding bulls: A preliminary observational study

Praharshini N, R Harshitha, NR Srikanth, K Sunny Praveen and M
Mutha Rao

DOI: <https://www.doi.org/10.22271/veterinary.2026.v11.i5Sb.3279>

Abstract

Testosterone is a principal androgen governing male reproductive physiology, but it may also influence immune competence through complex endocrine-immune interactions. The present study evaluated the relationship of serum testosterone concentration with certain direct immune parameters, parameters that reflect overall immune status (supportive indicators) and derived immune status indices. Bulls with relatively higher serum testosterone concentrations (mean range: 3.43-5.99 nmol/L) demonstrated elevated total leukocyte count, neutrophil percentage, globulin concentration. Correlation analysis indicated a positive association between testosterone and IgG, globulin, neutrophil count, and total protein, suggesting that bulls with higher testosterone status may possess enhanced innate and humoral immune indicators. Conversely, higher testosterone was negatively associated with lymphocyte proportion and albumin concentration. These findings suggest that physiological testosterone status in Ongole bulls may positively reflect immune competence and breeding fitness. Due to the limited sample size, these observations should be interpreted cautiously and validated in larger longitudinal studies.

Keywords: Ongole bull, testosterone, immunity, IgG, hematology, globulin, breeding bull, endocrine immunology

1. Introduction

Reproductive efficiency of breeding bulls is essential to herd fertility, genetic improvement and successful artificial insemination programmes, particularly in indigenous breeds such as Ongole cattle where semen quality, cryosurvival and physiological soundness are critical for sustainable breed propagation (Praveen *et al.*, 2024; Bindu *et al.*, 2024; Bindu *et al.*, 2025) ^[1, 2, 3]. In breeding bulls, reproductive competence is linked to endocrine balance, particularly testosterone, which regulates spermatogenesis, libido, and secondary sexual characteristics (Hafez and Hafez, 2000) ^[4]. Testosterone also plays a major role in regulating growth, metabolic homeostasis and reproductive maturation (Keerthana Surabhi *et al.*, 2022; Srikanth *et al.*, 2025) ^[5, 6]. Previous studies in Ongole bulls by this station have demonstrated age-associated increases in serum testosterone alongside improvements in semen attributes, morphometric indices and metabolic interactions with cholesterol, glucose, insulin and zinc, highlighting testosterone as a central biomarker of breeding soundness and broader physiological competence (Sagarika *et al.*, 2025; Kadiri *et al.*, 2025) ^[7, 8]. In mammals, testosterone is also documented as an immunomodulatory hormone capable of influencing leukocyte dynamics, inflammatory responses and immune competence through androgen receptor-mediated pathways (Grossman, 1985) ^[9], yet this dimension remains poorly explored in indigenous breeding bulls. The immunocompetence handicap hypothesis proposes that elevated testosterone may suppress immunity while enhancing reproductive traits (Folstad and Karter, 1992) ^[10]. However, livestock studies suggest that physiological testosterone concentrations may not uniformly suppress immune function and may instead reflect superior overall health, nutritional status, and breeding soundness (Mooradian *et al.*, 1987) ^[11]. In breeding bulls, serum proteins, leukocyte profiles, and immunoglobulin concentrations are

valuable indicators of systemic immune competence and health status. Despite growing evidence linking testosterone with reproductive, metabolic and morphometric traits in Ongole bulls, its association with immunological profile has remained largely uninvestigated. Therefore, the present preliminary observational study was undertaken to evaluate the effect of serum testosterone on key immunological parameters in Ongole breeding bulls, thereby expanding the understanding of testosterone from a reproductive biomarker to a broader indicator of physiological and immune status.

2. Materials and Methods

Six Ongole breeding bulls maintained at Livestock Research Station, Lam, Sri Venkateswara Veterinary University, Guntur, Andhra Pradesh, India were considered for the study. The bulls were of various ages and were clinically sound. All the bulls of the study were uniformly fed under similar management conditions. Blood samples were collected

aseptically from each bull and subjected to hematological and biochemical evaluation. Parameters assessed included total leukocyte count (WBC), leukocyte differential count, serum total protein, albumin, globulin, IgG, and total testosterone. Serum testosterone concentration (nmol/L) was estimated by chemiluminescence method (Toishi *et al.*, 2018)^[12], while IgG (g/L) was measured by Immunoturbidimetry method. Serum total protein concentration (g/dL) was estimated using Biuret method and serum albumin (g/dL) concentration was measured using bromocresol green method by spectrophotometry, while globulin (g/dL) was calculated. Data were analyzed descriptively, and comparative interpretation was made across bulls with varying testosterone concentrations. Pearson-style observational trend analysis was used to infer associations between serum testosterone and immune indicators.

3. Results

Table 1: Descriptive statistics and correlation of serum testosterone with selected immune parameters in Ongole breeding bulls

Parameter	Mean $\pm$ SD	Range	Correlation with Testosterone (r)	p-value
Testosterone (nmol/L)	4.41 $\pm$ 1.24	3.43-5.99	—	—
IgG (g/L)	0.163 $\pm$ 0.021	0.15-0.19	0.990***	0.0001
Globulin (g/dL)	4.60 $\pm$ 0.93	3.9-5.8	0.973**	0.0011
Total Protein (g/dL)	8.03 $\pm$ 0.76	7.2-9.0	0.951**	0.0036
WBC (cells/mm ³)	8,300 $\pm$ 1,582	6,700-10,200	0.871*	0.024
Neutrophils (%)	57.0 $\pm$ 10.08	46-68	0.983***	0.0004
Lymphocytes (%)	33.33 $\pm$ 10.37	22-45	-0.999***	<0.0001
Albumin (g/dL)	3.43 $\pm$ 0.55	2.9-4.1	-0.995***	<0.0001

*Significance levels: * p <0.05; ** p <0.01; *** p <0.001

Serum testosterone concentration showed significant positive correlations with IgG, globulin, total protein, WBC count, and neutrophil percentage, while significant negative correlations were observed with lymphocyte percentage and albumin concentration. Bulls with higher testosterone levels exhibited comparatively better humoral and innate immune indicators.

4. Discussion

4.1 Relationship of Serum Testosterone with Direct Immune Parameters

The significant positive correlation between testosterone and IgG suggests that higher androgen status may be associated with enhanced humoral immune competence. Similarly, increased WBC count and neutrophil percentage in bulls with elevated testosterone may indicate stronger innate immune surveillance. Although testosterone has often been linked with immunosuppressive effects in ecological and experimental frameworks (Grossman, 1985; Folstad and Karter, 1992)^[9, 10], the present findings indicate that within physiological breeding ranges, testosterone may support rather than suppress specific immune functions. The negative association with lymphocyte percentage may reflect differential leukocyte redistribution associated with neutrophilia rather than direct lymphocytic suppression.

4.2 Relationship of Serum Testosterone with Supportive Indicators of Overall Immune Status

Serum globulin and total protein are supportive biochemical indicators of immune competence because they reflect immunoglobulin production and protein anabolic status. In the present study, testosterone showed strong positive correlations with globulin and total protein concentrations, suggesting that bulls with superior endocrine status may possess better metabolic and immunological vigor. Elevated

globulin may indicate increased antibody-associated protein fractions, while higher total protein may reflect enhanced physiological robustness. Conversely, the negative association between testosterone and albumin may indicate a relative shift toward globulin synthesis rather than reduced health status. These findings align with the concept that testosterone in healthy breeding bulls may reflect reproductive soundness, nutritional adequacy, and anabolic resilience (Mooradian *et al.*, 1987)^[11].

4.3 Relationship of Serum Testosterone with Derived Immune Status Indices

In the present study, higher testosterone concentrations were associated with increased neutrophils and reduced lymphocyte proportion, suggesting a testosterone-linked shift toward innate immune predominance. This may indicate heightened readiness for immediate immune defense, though interpretation should be cautious because leukocyte differentials can be influenced by physiological stress, endocrine adaptation, and subclinical conditions. Rather than indicating immunosuppression, this derived profile may represent optimized immune resource allocation in reproductively active bulls. Such endocrine-immune interactions are likely influenced by breed adaptability, environmental stressors, and nutritional management (Khan *et al.*, 2012)^[13].

The consistency of associations across direct, supportive, and derived immune indicators suggests that serum testosterone may serve as a useful complementary biomarker for assessing breeding fitness and immune-physiological status in Ongole bulls. Further studies involving larger populations, cytokine profiling, oxidative stress markers, and semen quality parameters are required to validate these preliminary findings.

5. Conclusion

The present preliminary study indicates that higher serum testosterone concentrations in Ongole breeding bulls are associated with improved hematological and humoral immune indicators, particularly increased IgG, globulin, total protein, and leukocyte count. These findings suggest that physiological testosterone status in breeding bulls may positively reflect overall health and immune competence rather than simple immunosuppression. Serum testosterone could therefore serve as a complementary biomarker in breeding soundness evaluation when interpreted alongside immune and hematobiochemical parameters. Larger-scale studies incorporating semen quality, cytokine profiling, and seasonal variation are recommended to validate these observations.

6. Acknowledgements

We are grateful to the Livestock Research Station, Lam, Guntur of Sri Venkateswara Veterinary University for providing the support for the study

References

1. Praveen KS, Radhika V, Chandrika T, Srihari J, Manoranjan I, Srikanth NR, Mutha Rao M. Artificial insemination in cattle and buffalo: an update. *Int J Vet Sci Anim Husb.* 2024;9(5):221-225.
2. Bindu H, Praveen KS, Prasad BC, Hari Krishna NVV, Srikanth NR, Rao MM, Srinivas M. Semen quality assessment in Ongole (*Bos indicus*) bulls-insights from ejaculate volume, progressive motility, live sperm count, sperm abnormalities and host. *Int J Farm Sci.* 2024;14(1-2):94-97.
3. Bindu KH, Praveen KS, Srikanth NR, Rao MM, Prasad BC, Srinivas M, Hari Krishna NVV. Effect of α -tocopherol supplementation on cryosurvival and antioxidant attributes in semen of Ongole (*Bos indicus*) bulls. *Int J Vet Sci Anim Husb.* 2025;10(11):469-473.
4. Hafez B, Hafez ES. Reproduction in farm animals. 7th ed. Philadelphia: Lippincott Williams and Wilkins; 2000. p. 110.
5. Surabhi K, Srikanth NR, Rao MM. Cholesterol and testosterone interplay compared in young and adult Ongole breeding bulls. *Pharma Innov J.* 2022;11(4S):633-635.
6. Srikanth NR, Praveen KS, Rao MM, Sagarika PA, Varalakshmi M, Kadiri SP, *et al.* Relationship between serum testosterone levels and morphometric indices in Ongole bulls. *Int J Vet Sci Anim Husb.* 2025;10(10):272-276.
7. Sagarika PA, Srikanth NR, Praveen KS, Rao MM. Investigating the interplay of testosterone and zinc in the reproductive physiology of Ongole bulls. *Int J Adv Biochem Res.* 2025;180-183.
8. Kadiri SP, Manasa NS, Varalakshmi M, Srikanth NR, Praveen KS, Rao MM. Association of testosterone with key metabolic indices in Ongole bulls. *Int J Adv Biochem Res.* 2025;9(9):242-247.
9. Grossman CJ. Interactions between the gonadal steroids and the immune system. *Science.* 1985;227:257-261.
10. Folstad I, Karter AJ. Parasites, bright males, and the immunocompetence handicap. *Am Nat.* 1992;139:603-622.
11. Mooradian AD, Morley JE, Korenman SG. Biological actions of androgens. *Endocr Rev.* 1987;8(1):1-28.
12. Toishi Y, Tsunoda N, Nagata SI, Kirisawa R, Nagaoka K, Watanabe G, *et al.* Evaluation of the chemiluminescent enzyme immunoassay system for measuring testosterone in the serum and whole blood of stallions. *J Reprod Dev.* 2018;64(1):41-47.
13. Khan A, Khan MZ, Hussain I, Mahmood F. Hemato-biochemical alterations in breeding bulls: relation to reproductive and physiological status. *Vet World.* 2012;5:467-472.

Conflict of Interest

Not available

Financial Support

Not available

How to Cite This Article

Praharshini N, Harshitha R, Srikanth NR, Praveen KS, Rao MM. Effect of serum testosterone on immunological profile in ongole breeding bulls: A preliminary observational study. *International Journal of Veterinary Sciences and Animal Husbandry.* 2026;SP-11(5):83-85.

Creative Commons (CC) License

This is an open-access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non-Commercial-Share Alike 4.0 International (CC BY-NC-SA 4.0) License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.