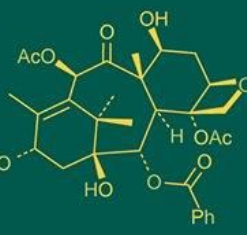
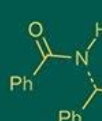


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Analyzing haematological and serum biochemical parameters of Theni Malaimadu cattle for breeding and health assessments

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Abstract

Theni Malaimadu cattle, a resilient breed indigenous to the Theni district of Tamil Nadu, play a crucial role in the region's traditional agriculture. This study analyzed haematological and biochemical parameters of adult males and females to assess their health status and suitability for breeding purposes. Results revealed significant differences, with adult males exhibiting higher levels of haemoglobin (11.76 ± 1.00 g/dl) and RBC counts ($8.75 \pm 0.59 \times 10^6$ Cells/ μ l) compared to females (Hb: 9.92 ± 2.35 g/dl; RBC: $6.05 \pm 2.57 \times 10^6$ Cells/ μ l). Biochemical assessments showed that male cattle had elevated alkaline phosphatase (ALP) levels (756.80 ± 261.80 U/L) compared to females (550.83 ± 350.45 U/L), indicating higher metabolic activity. Additionally, glucose levels were significantly lower in males (52.96 ± 13.19 mg/dl) than in females (78.60 ± 38.01 mg/dl), reflecting the latter's reproductive energy requirements. These findings highlight the health markers that should be considered in breeding programs aimed at enhancing resilience and productivity in this breed, emphasizing the importance of maintaining Theni Malaimadu cattle for sustainable agriculture.

Keywords: Theni Malaimadu cattle, haematology, biochemistry, selective breeding, health assessment, sustainable agriculture

Introduction

Theni Malaimadu cattle are a locally adapted, hardy breed found predominantly in the Theni district of Tamil Nadu, India. Known for their resilience and adaptability to harsh environmental conditions, these cattle are valued not only for their role in traditional agriculture but also for cultural activities such as jallikattu (Tamil Nadu's traditional bull-taming sport). However, as selective breeding programs in India have focused predominantly on milk yield, there is a risk that indigenous breeds such as the Theni Malaimadu may lose prominence, potentially impacting genetic diversity, disease resistance, and the ability to thrive in low-input farming systems (Naseer *et al.*, 2020; Singh *et al.*, 2021) ^[6, 9].

Analyzing haematological and biochemical parameters is essential for understanding the breed's health profile, which in turn aids in formulating effective breeding strategies. Blood parameters such as haemoglobin, erythrocyte and leukocyte counts, and biochemical markers like liver enzymes and cholesterol levels offer insights into the physiological robustness of these cattle. This study provides a baseline assessment of these health markers and their implications for sustainable breeding, focusing on both adult males and females to highlight any sex-based differences that could inform future selection practices (Verma & Singh, 2018; Sharma & Patel, 2018) ^[10, 8].

Materials and Methods

Experiment design

The study was conducted on twelve adult Theni Malaimadu cattle, consisting of six adult male (Bull) and six adult female (cow). All animals were selected from local herds within the Theni district, with an age range of 3-5 years to ensure maturity.

Sample Collection and Analysis

Blood samples were collected from the jugular vein and analyzed for haematological parameters, including haemoglobin (Hb), packed cell volume (PCV), red blood cell (RBC)

count, white blood cell (WBC) count, and platelet count. Serum biochemical analyses included liver enzymes (ALP, ALT, AST), glucose, cholesterol, total protein, and urea. All analyses were conducted using an automated blood analyzer, and IBM SPSS Statistics version 21 was used for statistical analysis to determine mean values, standard deviations, and t-Test (significance level $p < 0.05$).

Breeding Analysis

To enhance the genetic potential of Theni Malaimadu cattle, this study emphasizes the need for a selective breeding program based on the identified health parameters. Key traits for selection should include:

- **Haemoglobin Levels:** Higher haemoglobin levels may indicate better adaptability and productivity under low-input farming conditions, making this a desirable trait for selection (Ali *et al.*, 2017; Kumar *et al.*, 2019) ^[1, 5].

- **RBC Count:** A robust RBC count can reflect overall health and resilience, suggesting that males with higher counts should be prioritized in breeding programs to improve herd vitality (Dutta *et al.*, 2020) ^[3].
- **Biochemical Markers:** Traits such as lower glucose levels in males may suggest a metabolic adaptation beneficial for energy efficiency. Incorporating biochemical markers like ALP and AST can provide insights into liver function and overall health, assisting breeders in selecting healthier animals (Bhattacharya *et al.*, 2022) ^[2].

Results and Discussion

Haematological Profiles

The haematological parameters of Theni Malaimadu cattle are summarized in Table 1.

Table 1: The haematological parameters of Theni Malaimadu cattle are summarized

Parameter	Adult Male (Mean±SD)	Adult Female (Mean±SD)
Hb (g/dl)*	11.76±1.00	9.92±2.35
PCV (%)*	32.06±2.96	28.08±6.16
RBC (X10 ⁶ Cells/μl)*	8.75±0.59	6.05±2.57
WBC (X10 ³ Cells/μl)	7.43±1.45	7.87±2.21
Platelets (X10 ⁶ Cells/μl)	2.29±1.12	2.48±0.84
Lymphocyte (%)	65.91±16.68	68.47±14.89
Monocyte (%)	6.90±1.36	7.82±1.79
Granulocyte (%)	27.19±16.99	23.72±14.07

Haemoglobin and RBC levels were higher in adult males, aligning with findings in similar breeds where males are physiologically more robust, enhancing their suitability for labour-intensive agricultural roles. Statistical analysis indicated significant differences in haemoglobin ($p = 0.002$), PCV ($p = 0.004$) and RBC counts ($p = 0.005$) between sexes, underscoring the need for sex-specific considerations in breeding strategies. WBC counts were comparable across sexes, indicating a stable immune profile for both genders (Rana *et al.*, 2021) ^[7].

Serum Biochemical Profiles

Serum biochemical parameters are detailed in Table 2.

Table 2: Biochemical parameters are detailed

Parameter	Adult Male (Mean±SD)	Adult Female (Mean±SD)
Albumin (g/dl)	4.03±0.16	4.00±0.46
ALP (U/L)	756.80±261.80	550.83±350.45
ALT (U/L)	28.18±8.24	36.88±14.12
AST (U/L)	101.68±30.94	86.60±13.04
Direct bilirubin (mg/dl)	16.82±37.56	0.10±0.09
Total bilirubin (mg/dl)	0.66±1.31	0.04±0.06
Cholesterol (mg/dl)	162.40±63.81	191.00±51.48
Creatinine (mg/dl)	0.61±0.49	1.10±0.22
Glucose (mg/dl)	52.96±13.19	78.60±38.01
Total protein (g/dl)	7.47±0.92	7.25±0.99
Urea (mg/dl)	32.26±5.50	14.32±4.64

Most parameters show no significant difference between males and females, indicating similar health profiles in these measures. However, significant differences in creatinine and urea suggest there may be distinct physiological characteristics in kidney function or protein metabolism between the groups. Higher levels of ALP in males reflect their elevated metabolic activity, while glucose levels were

higher in females, possibly linked to greater energy reserves required for reproduction. The elevated bilirubin levels in males indicate potential stress or metabolic demands that warrant further investigation. These biochemical differences underscore the importance of considering sex-specific health markers when selecting for breeding, particularly in traits related to endurance and metabolic efficiency (Gowda *et al.*, 2019) ^[4].

Conclusion

This study establishes a baseline for haematological and serum biochemical parameters in Theni Malaimadu cattle, highlighting important sex-based differences in health markers. The results indicate that males may possess metabolic profiles suited for physically demanding roles, such as in sports (Jallikattu and Rekla) or agricultural labour activity, while females show metabolic patterns that may support reproductive health, vital for sustaining herd productivity. These insights are valuable for selective breeding programs aiming to enhance the resilience and adaptability of this indigenous breed within low-input farming systems. By emphasizing health markers specific to Theni Malaimadu cattle, breeding practices can safeguard the breed's continued contribution to sustainable agriculture, particularly in regions where resources for intensive farming are limited. However, it is important to note that this study was conducted with a minimum sample size. Further research with larger sample sizes is required to confirm these findings and enhance the reliability of the results.

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Conflict of Interest Statement

The authors have declared that no conflict of interests exist.

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