



Breed-Specific Parasitic Burden and Hematological Response in Muturu and Zebu Cattle: A Study from Ogun State, Nigeria

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Article History: 24-747 Received: 04-Dec-24 Revised: 30-Jan-25 Accepted: 31-Jan-25 Online First: 20-Oct-25

ABSTRACT

This study investigated parasitism in Muturu and Zebu cattle breeds across various locations in Ogun State, Nigeria, to assess their comparative susceptibility and resilience to parasitic infections. A total of 274 cattle (76 Muturu and 198 Zebu) were sampled for blood, fecal, and ectoparasite analysis. The packed cell volume (PCV) and parasitic loads were quantified. Results showed that Zebu cattle had higher infection rates of hemoparasites (61.6%) compared to Muturu (69.7%), with *Babesia* being the most prevalent in both breeds. Ectoparasite burden was also higher in Zebu (average 27.7 ticks/animal) than in Muturu (13.1 ticks/animal). Despite a high parasitism rate (90.8%), Muturu cattle maintained higher mean PCV values (34.8±5.1) compared to parasitized Zebu (29.9±4.4, 85.4% parasitized). Muturu demonstrated superior hematological health under various parasitic infections, consistently maintaining higher PCV levels. The study highlights the superior adaptability and resilience of Muturu cattle to parasitic infections in Ogun State, Nigeria, suggesting their potential for improving livestock production in regions with high parasitic prevalence. These findings have significant implications for breed selection and management strategies in tropical cattle farming.

Key words: Parasitic burden, Hematology, Cattle, Muturu, Zebu, Nigeria.

INTRODUCTION

Cattle production is a vital component of Nigeria's agricultural sector, significantly contributing to national food security and rural livelihoods (Talabi et al. 2023). However, the industry faces numerous challenges, including feed scarcity during the dry season, exposure to parasitic infections during migratory grazing, and a heightened prevalence of parasitic diseases during the rainy season (Ibrahim et al. 2022). Notably, diseases such as dermatophilosis, caused by *Dermatophilus congolensis* (Hussein 2021), and parasitic gastroenteritis (PGE), predominantly linked to infections by roundworms such as *Haemonchus contortus*, adversely impact cattle productivity, growth, and survival, particularly in younger animals, leading to significant economic losses for farmers and the broader livestock industry (Bolaji et al. 2023; Muriu 2023; Strydom et al. 2023). In southwestern Nigeria, the agro-ecological and climatic conditions differ markedly from those of the northern regions, making the performance of cattle breeds such as Zebu and Muturu an important area

of study (Ajakaye and Adejuyigbe 2024). Zebu cattle, known for their adaptability to arid environments, are highly susceptible to parasitic infections in more humid zones (Hanotte et al. 2002). In contrast, Muturu cattle, indigenous to southern Nigeria, are reputed for their resilience to endemic diseases and parasitic infections (Nwoga et al. 2021; Ajayi et al. 2022). Understanding the comparative performance of these breeds under the ecological conditions of Ogun State offers critical insights into their adaptability, productivity, and health (Bello et al. 2021; Njobdi et al. 2023).

Despite their economic importance, there is limited data on breed-specific differences in parasitic susceptibility, hematological health, and productivity in southwestern Nigeria. This study aims to address this knowledge gap by systematically evaluating Zebu and Muturu cattle in Ogun State, focusing on parasitic loads, hematological parameters, and general health status. The findings will inform decisions on breed selection and management practices to optimize cattle production and reduce parasitic burdens in this region.

Cite This Article as: Iledare AM, Omotainse OS, Akinsanya AO, Oyewusi IK, Otesile EB and Talabi AO, 2026. Breed-Specific parasitic burden and hematological response in Muturu and zebu cattle: A study from Ogun State, Nigeria. International Journal of Veterinary Science 15(1): 153-158. <https://doi.org/10.47278/journal.ijvs/2025.123>

MATERIALS AND METHODS

Ethical approval

The study followed the humane method for handling animals as outlined by CACC, 1993 (Bowd 1997) and was approved by research ethical committee with reference number UNAAB/IFSERAR/IRG 43.

Study area

The study was conducted across three prominent cattle farming locations in Ogun State, Nigeria: The University of Agriculture Abeokuta (UNAAB) Cattle Farm, Gbonogun Cattle Ranch, and Ipokia Farm Settlement (Fig. 1). These sites were selected for their significant cattle populations and their representation of the diverse agro-ecological conditions in the state. Ogun State lies in southwestern Nigeria, between latitudes 6.2°N to 7.8°N and longitudes 3.0°E to 5.0°E, with a tropical climate characterized by distinct wet and dry seasons.

Sample collection

A total of 274 cattle were sampled, comprising 76 Muturu and 198 Zebu cattle. Sampling was stratified by breed and location to ensure a representative population. Blood, fecal and ectoparasites were collected from the various fields.

Blood samples (5mL each) were aseptically collected from the jugular veins of each animal using sterile syringes. The samples were transferred into labeled bijoux bottles containing 250µL of 200 mM disodium ethylene diamine tetraacetic acid (Na₂EDTA) to prevent coagulation and preserve sample integrity for hematological analysis. Critical hematological parameters, packed cell volume (PCV) was analyzed using methods previously described by Akande et al. (2010) and Omotainse et al. (2016).

Approximately 10g of fresh fecal matter was collected directly from the rectum of each animal using sterile

polythene bags. Samples were immediately preserved on ice and transported to the Parasitology Laboratory where they were examined for helminth eggs according to the protocols earlier described by Thienpont et al. (1979) and Soulsby (1982).

Animals were inspected visually for ectoparasites, and infected individuals were recorded. Ectoparasites were carefully removed using sterilized forceps and preserved in labelled vials containing 70% ethanol. The specimens were later identified and quantified using a stereomicroscope (Soulsby 1982).

Statistical analysis

The collected data were analysed using descriptive statistics and presented as percentages and means. Chi-square tests were conducted to determine significant associations between parasite infestation, breed, and location.

RESULTS

The distribution of animals assessed is presented in Table 1. Of the total of 274 animals, 76 were Muturu, while 198 were Zebu breed of cattle.

The number of animals infected with Hemo-parasites is presented in Table 2. The number of ticks and species counted from the animals is presented in Table 3. An average of 13.1 ticks was counted on each Muturu, while 27.7 ticks were counted on each Zebu cattle.

The mean PCV of parasitized and non-parasitized animals is presented in Table 4. In this study, 90.8% of the Muturu assessed had one parasite or the other, while 85.4% of the Zebu are parasitized. The mean PCV of hemo-parasitized, helminth-parasitized and ecto-parasitized animals is presented in Table 5. Mean PCV of parasitized and non-parasitized animals based on the various locations is presented in Table 6.

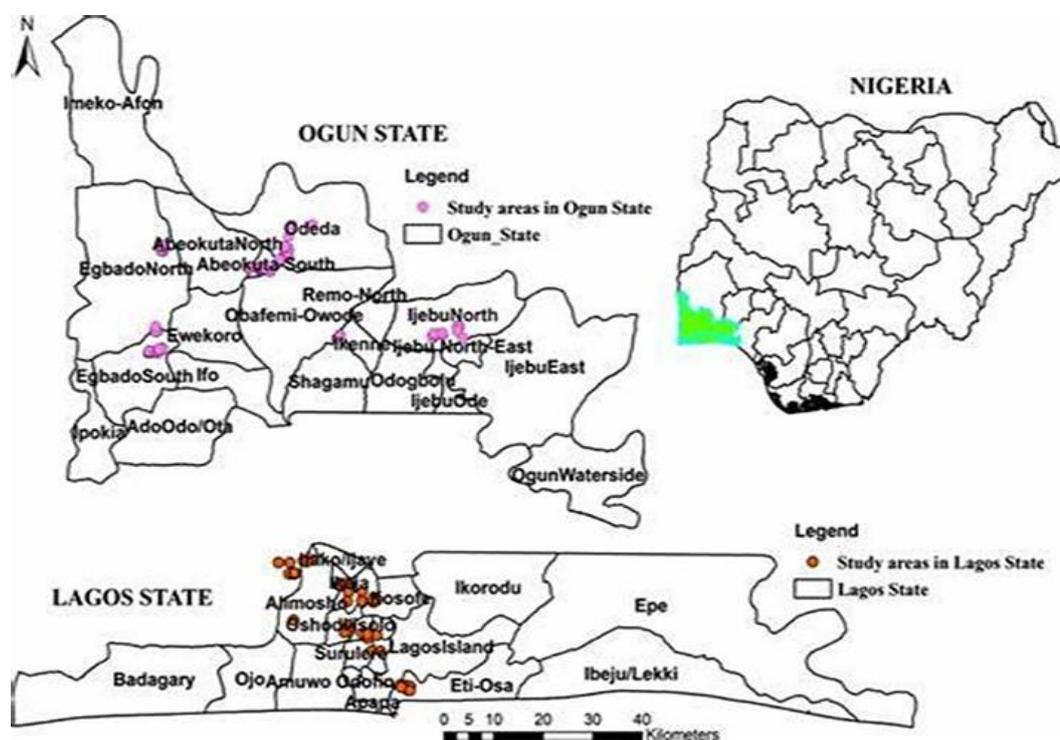


Fig. 1: Map of Ogun State, Southwest Nigeria.

Table 1: Distribution of animals based on location, breed, age and sex in the study

Location	No of Animals	Breed		Age		Sex	
		Muturu	Zebu	Young	Adult	Male	Female
UNAAB farm	15	7	8	0	15	1	14
Ipokia	60	60	0	12	48	11	49
Gbonogun	15	1	14	2	13	0	15
Odeda	22	6	16	2	20	3	19
Alabata	162	2	160	17	145	16	146
Total	274	76	198	33	241	31	243

Table 2: Number of animals infected with hemo-parasites

Hemo-Parasite	Muturu (%)	Zebu (%)
Babesia alone	12 (22.6)	54 (44.3)
Anaplasma alone	16 (30.2)	22 (18.0)
Trypanosomes alone	1 (1.9)	1 (0.8)
Babesia and Anaplasma	6 (11.3)	21 (17.2)
Babesia and Trypanosomes	3 (5.7)	13 (10.7)
Anaplasma and Trypanosomes	7 (13.2)	4 (3.3)
Babesia, Anaplasma and Trypanosomes	8 (15.1)	7 (5.7)
Total	53 (100.0)	122 (100.0)

Table 3: Ecto-parasite load based on breed

Ecto-Parasite	Muturu (n)	Zebu (n)
Amblyomma	390 (38)	1454 (82)
Boophilus	140 (17)	2000 (102)
Rhipicephalus	176 (16)	422 (37)
Total	706 (54)	3876 (140)

Table 4: Mean Packed Cell Volume of Parasitized and Non-parasitized animals

Breed	Parasitized (n)	%	Non-parasitized (n)	%
Muturu	34.8±5.1 (69)	90.8	39.0±2.8 (7)	9.2
Zebu	29.9± 4.4(169)	85.4	36.0± 4.0 (29)	14.6

Chi-square tests were conducted on Table 2, 3, 4 and 6 to determine significant associations between parasite infestation, breed, and location. The test on Table 2 (hemo-parasite infection) showed a significant difference (P=0.004) between Muturu and Zebu cattle, suggesting certain parasites are more prevalent in one breed. Similarly, Table 3 (ecto-parasite load) indicated a highly significant association (p < 0.0001), with Zebu cattle harboring more ecto-parasites than Muturu. In Table 4 (parasitized vs. non-parasitized PCV), the test was not significant (p = 0.32), meaning both breeds had similar parasitization rates. However, Table 6 (PCV levels by location) showed a highly significant result (p < 0.0001), indicating that PCV values of parasitized and non-parasitized cattle varied

significantly by location. Overall, these findings suggest that breed, parasite type, and location influence infestation patterns and cattle health, with Zebu cattle being more burdened by ecto-parasites and environmental factors playing a crucial role in PCV variations.

Table 5: Mean Packed Cell Volume of hemo-parasitized, Helminth-parasitized and Ecto-parasitized animals

Parasite type	Muturu (n)	Zebu (n)
Hemo-Parasitized	37.6±5.1 (5)	33.3±3.2 (3)
Helminth-parasitized	39.5±1.3 (4)	33.0±4.6 (9)
Ecto-parasitized	37.2±6.3 (5)	33.4±4.5 (20)
Hemo- & Helminth-parasitized	38.8±3.7 (6)	30.6±3.0(17)
Hemo & Ecto-parasitized	33.3±4.5 (19)	31.7±3.7(31)
Helminth & Ecto-parasitized	37.4±7.3 (7)	30.7±3.1(18)
Hemo, Helminth & Ecto-parasitized	33.3±4.3 (23)	27.2±3.9(71)

Chi-square tests were conducted on Table 2, 3, 4 and 6 to determine significant associations between parasite infestation, breed, and location. The test on Table 2 (hemo-parasite infection) showed a significant difference (p = 0.004) between Muturu and Zebu cattle, suggesting certain parasites are more prevalent in one breed. Similarly, Table 3 (ecto-parasite load) indicated a highly significant association (P<0.0001), with Zebu cattle harboring more ecto-parasites than Muturu. In Table 4 (parasitized vs. non-parasitized PCV), the test was not significant (p = 0.32), meaning both breeds had similar parasitization rates. However, Table 6 (PCV levels by location) showed a highly significant result (p < 0.0001), indicating that PCV values of parasitized and non-parasitized cattle varied significantly by location. Overall, these findings suggest that breed, parasite type, and location influence infestation patterns and cattle health, with Zebu cattle being more burdened by ecto-parasites and environmental factors playing a crucial role in PCV variations.

DISCUSSION

This study investigated parasitism in two cattle breeds, Muturu and Zebu, across various locations, analyzing the distribution of hemo-parasites, ecto-parasites, and their impact on animal health through parameters such as Packed Cell Volume (PCV). A total of 274 animals were assessed, comprising 76 Muturu (27.7%) and 198 Zebu (72.3%). Muturu cattle were primarily concentrated in Ipokia, while Zebu were more widely distributed, with Alabata having the highest number of Zebu cattle.

Table 6: Mean Packed Cell Volume of Parasitized and Non-parasitized animals based on the location

Location	Mean PCV of Parasitized		Mean PCV of Non- Parasitized	
	Muturu (n)	Zebu (n)	Muturu (n)	Zebu (n)
UNAAB farm	32.9±3.7 (7)	29.2±2.7 (6)	None	33.0±9.9 (2)
Ipokia	35.8±4.5 (55)	None	39.0±3.4 (5)	None
Gbonogun	22.0±0.0 (1)	26.9±3.2 (14)	None	None
Odeda	33.8±7.1 (4)	34.4±4.4 (14)	39.0±1.4 (2)	36.0±4.2 (2)
Alabata	24.5±2.1 (2)	29.8±4.3 (135)	None	36.3±3.5 (25)

Table 7: Chi-Square Analysis Results

Table	Chi-square	P-value	Degrees of Freedom	Significance
Hemo-parasites (Table 2)	18.871	0.004	6	Significant
Ecto-parasites (Table 3)	265.924	1.80E-58	2	Significant
Parasitized vs Non-parasitized (Table 4)	0.986	0.320	1	Not Significant
Location-based PCV (Table 6)	228.460	4.16E-42	12	Significant

In this study, 88% of the cattle sampled were adults (Table 1). While no age-based selection criteria were applied, this distribution could be attributed to the higher economic value of adult cattle or higher mortality in younger cattle, as suggested in previous studies (Nwoga et al. 2021; Abwage & Antia 2022). Similar age distributions have been reported in Thailand and Zimbabwe, where older cattle predominate due to their increased economic value in breeding and milk production (Thanasuwan et al. 2021; Pfukenyi et al. 2020). Female animals were more prevalent across all locations, aligning with findings by Lawal-Adebawale (2012) that female cattle are economically more valuable due to their role in milk production, breeding, and meat production.

Muturu cattle are known for their trypanotolerance and resistance to parasitic infections (Abwage & Antia 2022; Ndlovu et al. 2024), whereas Zebu cattle are highly susceptible to hemo-parasitic infections (Gboeloh and Araka 2022). This aligns with our findings, where infection rates were significantly higher in Zebu cattle compared to Muturu (Table 2), further highlighting the inherent resistance of the Muturu breed.

Among hemo-parasites, Babesia was the most common infection in both breeds, affecting 44.3% of Zebu cattle and 22.6% of Muturu (Table 2). A higher ecto-parasite burden was also observed in Zebu cattle, with an average of 27.7 ticks per animal compared to 13.1 ticks per Muturu (Table 3), with Boophilus being the predominant tick species. As Boophilus is a known vector of Babesia, its high prevalence could explain the higher Babesia infection rates in Zebu cattle (Friedhoff 2018; Rahman et al. 2023). Similar studies in Jabalpur, India also found that Zebu breeds have significantly higher tick infestations than local cattle breeds (Marskole et al. 2020). However, limited studies have examined tick distribution in Ogun State, highlighting the need for further research into ecto-parasite control strategies.

Parasitized Muturu cattle had a mean PCV of 34.8 ± 5.1 , with a high parasitization rate of 90.8% (Table 4). Despite this, Muturu cattle maintained significantly higher PCV values than parasitized Zebu (29.9 ± 4.4 , 85.4% parasitized). This further supports their tolerance and/or resilience to parasitic infections (Ndlovu et al. 2024). Non-parasitized Muturu cattle had an even higher mean PCV of 39.0 ± 2.8 , reinforcing their strong hematological health and adaptive traits to parasitic stress.

These findings suggest that effective rearing of Zebu cattle requires targeted deworming programs, improved grazing practices, and genetic improvements to mitigate their high susceptibility to parasitism. This supports prior research by Akande et al. (2010), which noted that Muturu cattle exhibited lower parasitic prevalence and higher PCV values than other breeds. A study by Kamani et al. (2020) in North-Central Nigeria also found a correlation between high parasitic load and reduced PCV levels, reinforcing the need for strategic parasite control programs.

Muturu cattle demonstrated better hematological health under haemo-parasitic infections, with a Mean PCV of 37.6% compared to Zebu's 33.3% (Table 5). This observation aligns with Abwage & Antia (2022), who found that Muturu cattle maintain stable PCV levels despite parasitic infections.

Animals with multiple parasitic infections recorded

the lowest PCVs, particularly in Zebu cattle (27.2%), confirming that co-infections exacerbate hematological stress. This supports previous studies that reported severe PCV depletion in Zebu cattle with combined parasitic infections (Gboeloh and Araka 2022; Bello et al. 2023). Research in Thailand and other parts of Africa also indicates that co-infections significantly increase anemia rates in Zebu cattle (Jittapalpong et al. 2021). Ipokia recorded the largest sample size of Muturu cattle, likely due to their adaptability to humid environments and the dominance of traditional farming systems. Conversely, Alabata had the highest number of Zebu cattle, reflecting its savannah-like conditions favoring commercialized farming (Table 6).

The chi-square analysis revealed statistically significant associations between breed, parasite type, and location ($p < 0.05$), confirming that Zebu cattle are more vulnerable to ecto-parasites, while hemo-parasite infections vary significantly by breed. Location also significantly influenced PCV variations, indicating that environmental and management factors impact cattle health. However, parasitization rates between breeds were not significantly different, suggesting that both breeds face similar overall exposure levels, but differ in resilience and hematological response.

At Gbonogun, Muturu cattle recorded an unusually low Mean PCV (22.0 ± 0.0), while Zebu cattle performed slightly better (26.9 ± 3.2). This deviation from the typical trend of Muturu resilience may be due to high parasite loads, poor forage quality, or environmental stressors unique to Gbonogun. Extreme conditions may overwhelm even naturally resilient breeds, as noted by previous studies (Adebambo 2001; Gboeloh and Araka 2022).

This study highlights the importance of breed selection in parasite-prone environments (Bahbahani et al. 2018). Muturu cattle demonstrated superior resistance to haemo-parasitic infections and maintained higher PCV levels, reinforcing their suitability for regions with high parasite prevalence. These findings have significant implications for cattle breeding programs, supporting the promotion of Muturu cattle to enhance livestock productivity and meet national protein demands (Nwoga et al. 2021; Ndlovu et al. 2024).

DECLARATIONS

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Acknowledgment: The authors sincerely appreciate the management and staff of the Federal University of Agriculture, Abeokuta, for their support and access to laboratory facilities. We are also grateful to the local livestock farmers and veterinary field officers in Ogun State who facilitated sample collection and provided valuable insights during the study.

Conflict of Interest: The authors declare that there are no conflicts of interest related to this study.

Data Availability: The datasets generated and analyzed during this study are available from the corresponding author upon reasonable request.

Ethics Statement: All animal procedures were conducted in accordance with institutional ethical standards and approved by the Research Ethics Committee of the College of Veterinary Medicine, Federal University of Agriculture, Abeokuta.

Author's Contribution: Iledare A.M. collected data, interpreted laboratory results, and conducted data analysis alongside Omotainse S.O., who also performed the laboratory work and drafted the manuscript. Akinsanya A.O. assisted with sample collection and data interpretation. Talabi A.O. conceptualized the study, coordinated the research activities, and provided technical support. Otesile E.B. and Oyewusi I.K. reviewed the manuscript and provided guidance. All authors read and approved the final manuscript. All authors read and approved the final manuscript.

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