SVU- International Journal of Veterinary Sciences, 7(3): 24-35, 2024
Print ISSN: 2535-1826 **Online ISSN: 2535-1877**

Research Article Open Access

Equine Haemoparasites at a Nigerian Polo Tournament: Prevalence and Handler Practices

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Abstract

Haemoparasitic infections in horses are caused by microorganisms that live either inside or outside cells in the bloodstream. There is a dearth of data on the prevalence of haemoparasitic infections, specifically among horses participating in polo tournaments, where the gathering of horses from various regions could facilitate transmission of these infections. Hence, we aimed to investigate the prevalence of equine haemoparasites, risk factors, and knowledge, attitude, and practices (KAP) of horse handlers during a polo tournament in Jos, Plateau State. Blood samples were collected from 120 polo horses and examined for haemoparasite via microscopy. Also, a structured questionnaire was administered to horse handlers to assess their KAP towards haemoparasitic infection. The overall prevalence was 51.7%, with *Anaplasma marginale* being the most common (45.2%), followed by *Theileria equi* (24.2%), *Trypanosoma spp.* (12.9%), *Babesia caballi* (9.7%), and *Anaplasma centrale* (8.1%). Risk factors significantly associated with higher odds of infection included being a stallion (OR=10, p=0.050), age 5–15 years (OR=2.8, p=0.008), Sudanese Country-Bred breed (OR=3.62, p=0.001), and horses from Kano (OR=5.7, p=0.013), Katsina (OR=5.3, p=0.003), and Zaria (OR=7.1, p=0.037) compared to Abuja. A KAP survey of 58 horse handlers revealed 75.9% had satisfactory knowledge, 96.6% had a satisfactory attitude, but only 31% had satisfactory practices regarding haemoparasitic infections. Gaps existed in recognising haemoparasite names, transmission routes, regular monitoring, and implementing preventive measures. The findings highlight the high burden of haemoparasitic infections among polo horses. There is a need for interventions, such as handler education programmes and improved biosecurity practices, in Nigeria's polo industry.

Keywords: Babesia, Microscopy, Welfare

DOI: 10.21608/svu.2024.303767.1332.
Received: July 12, 2024 Accepted: August 23, 2024 Published: August 25, 2024,
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Citation: Edeh et al., Equine Haemoparasites at a Nigerian Polo Tournament: Prevalence and Handler Practices. SVU-IJVS 2024, 7(3): 24-35.

Competing interest: The authors have declared that no competing interest exists.

Introduction

Equine haemoparasitic infections pose significant health risks to horses worldwide. These infections are caused by various microorganisms that inhabit the bloodstream of vertebrate hosts, including Babesia, Theileria, Anaplasma, and Trypanosoma. Transmitted primarily by arthropod vectors such as ticks and biting flies (Mosqueda et al., 2012; Stuen et al., 2013; Joachim et al., 2022), these parasites can cause a range of clinical manifestations in horses, from subclinical infections to severe, life-threatening conditions (Nimako-Boateng et al., 2022).

Babesia caballi and *Theileria equi*, the causative agents of equine piroplasmosis, are among the most significant haemoparasites affecting horses globally. These protozoan parasites infect erythrocytes, leading to haemolytic anaemia, fever, and, in severe cases, organ failure (Rothschild, 2013). *Anaplasma phagocytophilum*, responsible for equine granulocytic anaplasmosis, targets neutrophils and can cause fever, depression, and limb oedema (Pusterla and Madigan, 2013).

Trypanosoma species, particularly *T. evansi* and *T. equiperdum*, are notable equine haemoparasites in many tropical and subtropical regions. These flagellated protozoa can cause a wasting disease known as "surra" in horses, characterized by fever, anaemia, and progressive weakness (Desquesnes et al., 2013).

In Nigeria, several studies have reported the presence of these haemoparasites in horses (Turaki et al., 2014; Ehizibolo et al., 2012; Ememe et al., 2019; Mshelia et al., 2020; Onyiche et al., 2020; Idoko et al., 2021; Alaba et al., 2022). Ehizibolo et al. (2012) found a prevalence of 8.6% in northern Nigeria, while Alaba et al. (2022) reported 13.5% in the southwest. However, data specific to horses participating in polo tournaments, where animals from various regions converge, remains scarce.

Polo tournaments in Nigeria hold significant socio-economic importance. Horses are a vital commodity in the country, used for recreation, sport, transportation, and work. Polo events, hosted year-round, draw both exotic and indigenous polo ponies from across Nigeria (Mshelia et al., 2020). These tournaments generate substantial economic activity beyond the sport itself. During the events, there is a vibrant market for buying, selling, and trading horses and related tack and gear. The tournaments also facilitate the movement and hiring of skilled grooms between regions, creating employment opportunities. Furthermore, these polo events help preserve Nigeria's rich equestrian culture and traditions. Overall, the socio-economic impact of polo tournaments extends far beyond the sport, contributing to the country's economic development and cultural heritage.

Polo tournaments present a unique epidemiological scenario for haemoparasitic infections. The gathering of horses from different geographical areas may facilitate the transmission and spread of these parasites, potentially exposing animals to strains they haven't previously encountered. Furthermore, the stress of travel and competition may compromise horses' immune systems, making them more susceptible to infection or exacerbating existing subclinical infections.

Understanding the prevalence, risk factors, and management practices associated with haemoparasitic infections in this context is crucial for developing control strategies. Therefore, this study aimed to investigate the prevalence of equine haemoparasites among horses participating in a polo tournament in Jos, Nigeria, identify associated risk factors, and evaluate the knowledge, attitudes, and practices (KAP) of horse handlers regarding these infections.

Material and methods

Study area

The study area is located in Jos, Plateau State, Nigeria (Figure 1). The city of Jos is found in Nigeria's north-central region. As per the 2006 census, there are approximately 900,000 residents in the city. The city is located on the Jos Plateau, which is part of the Guinea Savannah in north-central Nigeria. One of the prominent sports institutions in the state is the Jos Polo Club.

Study design and sampling method

A cross-sectional study was conducted among horses participating in the Jos Polo Tournament in Plateau State, Nigeria. A random sampling method was used which involved randomly selecting horses from the population without any specific criteria, ensuring that each horse had an equal chance of being included.

Study animals

A total of 120 polo horses were included in this study. They were all brought into Jos from different parts of the northern region of Nigeria for the polo tournament. Information regarding age, breed, sex, and the specific location they came from was recorded. Age was determined by using dentition as described by Richardson et al. (1995) and classified into young (< 5 years), adult (5 to 15 years), and old (> 15 years) (Akinniyi et al., 2023).

Sample collection

Blood collection was done in the early hours of 8 to 9 AM following the proper restraint of each animal through the external jugular vein using a 21-gauge needle fixed to a 5-ml syringe. Five millilitres of blood were dispensed into a sample bottle containing 1 mg of ethylenediamine tetraacetic acid (EDTA) for haemoparasite screening. These samples were placed on an ice pack and transported immediately to the laboratory.

Parasite identification

A thin blood smear was prepared on a standard microscope glass slide (75 mm by

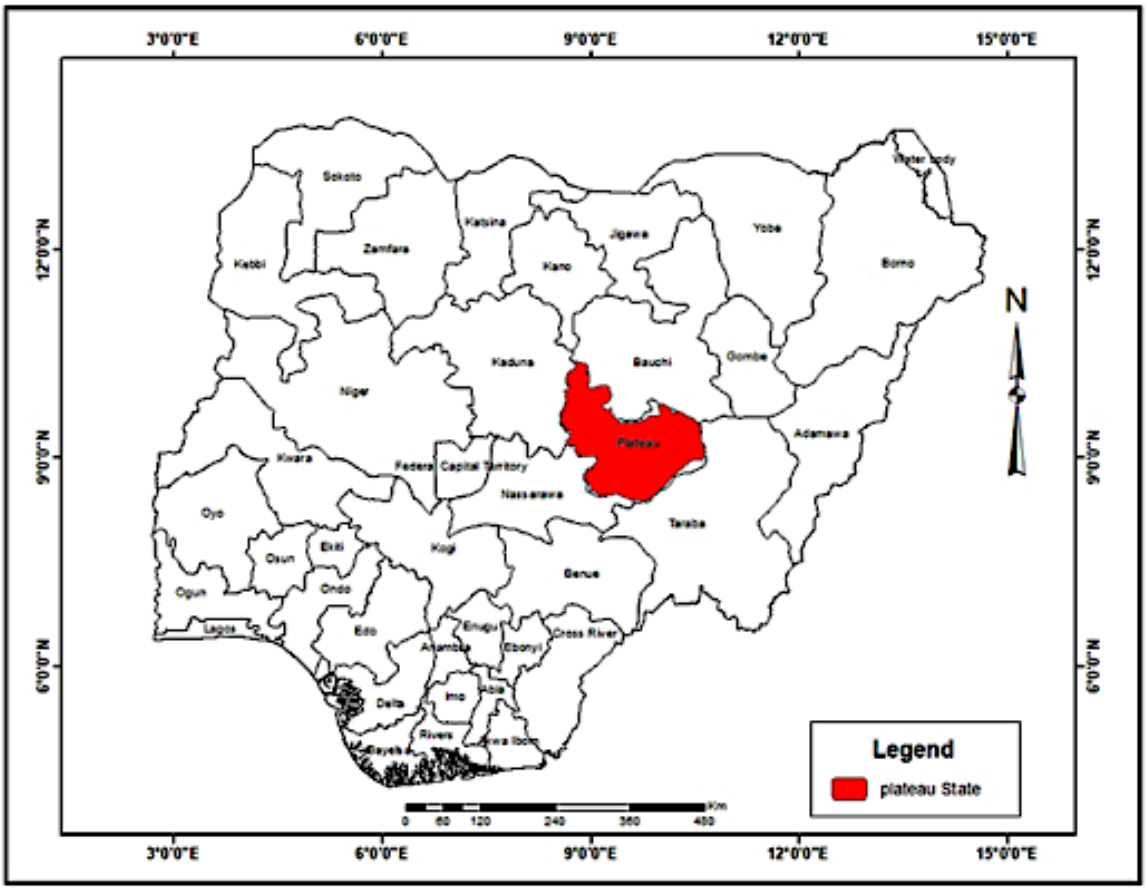

Figure 1: Map of Nigeria showing Plateau State (source: Waida et al., 2022)

25 mm), air dried, fixed in methyl alcohol for 3-5 min, stained in 5% Giemsa stain for 30-45 min in a staining jar, and rinsed in buffered distilled water for identification of *Theileria equi* or *Babesia caballi*, *Anaplasma spp.*, and trypanosomes as described by Kamani et al. (2010).

Also, the buffy coat was examined for motile parasites as previously (Ehizibolo et al., 2012). After staining, the slides were examined under a light microscope using a 100x oil immersion objective lens. At least 200 fields were systematically examined for each slide. For Babesia and Theileria, the presence of small (1-2 µm) or large (2-5 µm) intraerythrocytic piroplasms was noted. Anaplasma was identified by the presence of small, dark-staining inclusion bodies (0.3-1.0 µm) in the periphery of erythrocytes. Trypanosomes were recognized by their characteristic flagellated appearance and undulating membrane.

Questionnaire Survey

A structured questionnaire was made for 58 horse handlers. The survey underwent pre-testing process. The questionnaires were reviewed and revised after analysis in light of the feedback that was received. The pretesting step played a vital role in identifying and resolving any potential issues or ambiguities in the questionnaire, making sure it was clear, relevant, and suitable for the target population. Refining the questionnaire with pretest feedback, the researchers improved the data collection instrument's validity and reliability. The refined questionnaire was then administered to the participants. The first section collected sociodemographic data, while the other 3 sections gathered data on the knowledge, attitude, and practices of horse handlers towards haemoparasitic infection. The questionnaire included four questions, each covering knowledge, attitude, and practices. Each correct response was assigned a score of 2, while the wrong response received a score of 0. The maximum scores possible were 8 each for knowledge, attitude, and practices. so, individuals scoring 4 or above for each were categorised as having satisfactory knowledge, attitude, and practice, while those scoring below 4 for each were considered unsatisfactory.

Data analysis

The collected data were summarised and presented in tables using descriptive statistics. Using binary multivariate logistic regression, odds ratios were used to estimate the strength of the risk factors. Confidence intervals of 95% (95% CIs) were calculated, and values of $P \leq 0.05$ were considered significant. IBM SPSS Statistics (version 26; IBM Corp., Armonk, NY, USA) was used for the analysis.

Results

Prevalence of equine haemoparasitic infection based on where the horses came from

After sampling a total of 120 horses, the highest prevalence was found in horses from Zaria (5/7; 71.4%), followed by Kano (10/15; 66.7%), and Katsina (24/37; 64.9%). The overall prevalence of haemoparasitic infection across all locations was 51.7% (62/120) (Table 1).

Table 1: Prevalence of equine haemoparasitic infection based on where the horses came from

Where the horses came from	No. of horses	No. of horses with haemoparasitic infection	Prevalence of haemoparasitic infection (%)
Abuja	27	7	25.9
Kaduna	24	12	50
Kano	15	10	66.7
Katsina	37	24	64.9
Yola	10	4	40
Zaria	7	5	71.4
Overall	120	62	51.7

Summary of haemoparasites found in horses with haemoparasitic infection

In Table 2, *Anaplasma marginale* was the most prevalent (28; 45.2%), followed by *Theileria equi* (15; 24.2%), *Babesia caballi* (6; 9.7%) (Figure 2), *Trypanosoma spp*. (8; 12.9%) (Figure 3), and *Anaplasma centrale* (5; 8.1%).

Table 2: Summary of haemoparasites found in horse with haemoparasitic infection

Haemoparasite	Frequency	Percentage
Anaplasma centrale	5	8.1
Anaplasma marginale	28	45.2
Theileria equi	15	24.2
Babesia caballi	6	9.7
Trypanosoma spp.	8	12.9
Total	62	100

Risk factors associated with equine haemoparasitic infection

The results show that stallions (87.5%) had a significantly higher risk of infection compared to geldings (41.2%) (OR = 10, p = 0.050). Horses aged 5–15 years (66.7%) had a significantly higher risk of infection compared to those under 5 years (41.1%) (OR = 2.8, p = 0.008). For the "> 15 years" age group, the odds ratio is infinity (∞) because all horses in this group had a haemoparasitic infection.

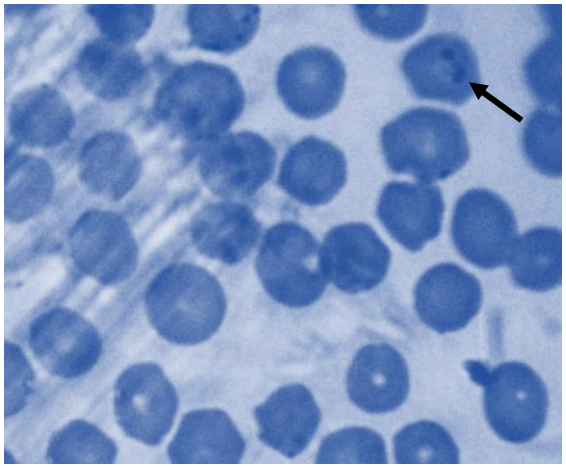

Figure 2: Merozoite of Babesia caballi within erythrocyte (black arrow). They are pyriform shaped and formed pairs joined at their posterior ends

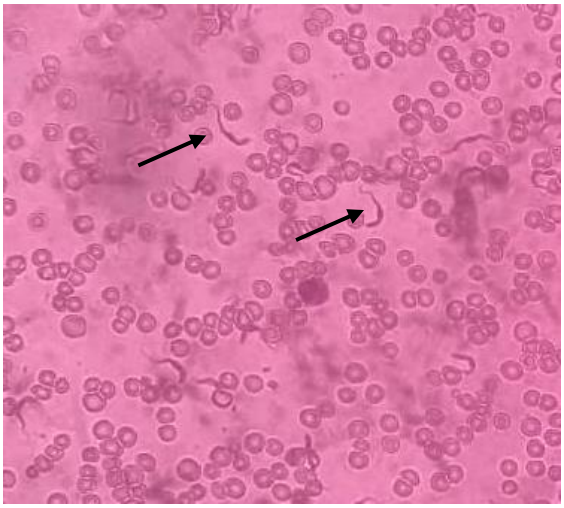

Figure 3: *Trypanosoma sp.* Observed (black arrows)

Additionally, Sudanese Country-Bred horses (67.9%) had a significantly higher risk of infection compared to Argentine polo ponies (36.8%) (OR = 3.62, p = 0.001).

The prevalence of haemoparasitic infection in Kaduna (50%) is higher than in Abuja (25.9%), but the difference is not statistically significant (OR = 2.9, 95% CI: 0.88–9.25, p = 0.08). The prevalence in Kano (66.7%) is significantly higher than in Abuja (OR = 5.7, 95% CI: 1.44–22.62, p = 0.013), indicating that horses in Kano have 5.7 times higher odds of haemoparasitic infection compared to horses in Abuja.

The prevalence in Katsina (64.9%) is also significantly higher than in Abuja (OR = 5.3, 95% CI: 1.77–15.75, p = 0.003), indicating that horses in Katsina have 5.3 times higher odds of haemoparasitic infection compared to horses in Abuja. The prevalence in Yola (40%) is higher than in Abuja, but the difference is not statistically significant (OR = 1.9, 95% CI: 0.4–8.8, p = 0.409). The prevalence in Zaria (71.4%) is significantly higher than in Abuja (OR = 7.1, 95% CI: 1.1-45.5, p = 0.037), indicating that horses in Zaria have 7.1 times higher odds of haemoparasitic infection compared to horses in Abuja (Table 3).

Table 3: Risk factors associated with equine haemoparasitic infection

Factor	No. of horses	No. of horses with haemoparasitic infection	Prevalence of haemoparasitic infection (%)	OR (95% CI)	P value
Sex					
Gelding	17	7	41.2	Reference	
Mare	95	48	50.5	1.5 (0.51, 4.15)	0.479
Stallion	8	7	87.5	10 (1, 100.5)	0.050
Age					
< 5 years	45	30	41.1	Reference	
5-15 years	45	30	66.7	2.8 (1.10, 7.33)	0.008
> 15 years	2	2	100	∞	0.999
Breed					
APP	57	21	36.8	Reference	
SCB	56	38	67.9	3.62 (1.7, 7.9)	0.001
Others	7	3	42.9	1.29 (0.26, 6.31)	0.757
Location					
Abuja	27	7	25.9	Reference	
Kaduna	24	12	50	2.9 (0.88, 9.25)	0.080
Kano	15	10	66.7	5.7 (1.44, 22.62)	0.013
Katsina	37	24	64.9	5.3 (1.77, 15.75)	0.003
Yola	10	4	40	1.9 (0.4, 8.8)	0.409
Zaria	7	5	71.4	7.1 (1.1, 45.5)	0.037

APP = Argentine polo pony, SCB = Sudanese Country-Bred, ∞ = infinity, * = significant ($p < 0.05$)

Demography of horse handlers

This table describes the demographic characteristics of the horse handlers involved in the study. The majority of the handlers were male (58/58; 100%), aged between 31 and 40 years (22/58; 37.9%), had secondary education (42/58; 72.4%), and had been involved with horses for more than 10 years (30/58; 51.7%). Most handlers had between 11 and 20 horses (22/58; 37.9%) (Table 4).

Knowledge, attitudes, and practices (KAP) of horse handlers towards equine haemoparasitic infection

Regarding knowledge, 51.7% of handlers did not know what haemoparasites are. 58.6% were not aware of the names of any haemoparasites, and 65.5% were aware of how haemoparasites are transmitted and familiar with clinical signs associated with

Table 4: Demography of horse handlers

Sociodemographic	Number	Percentage
Age (year)		
21-30	16	27.6
31-40	22	37.9
41-50	14	24.1
51-60	6	10.3
Gender		
Male	58	100
Female	0	0
Education Status		
None	4	6.9
Primary	10	17.2
Secondary	42	72.4
Tertiary	2	3.4
Years of being involved with horses		
1-5 years	6	10.3
6-10 years	22	37.9
> 10 years	30	51.7
No. of horses they have		
1-10	12	20.7
11-20	22	37.9
21-30	18	31
31-40	4	6.9
> 40	2	3.4

infections. Based on attitude, 86.2% were concerned about the impact of haemoparasites on horse health and welfare. 65.5% believed regular monitoring and management of haemoparasites were important; 93.1% were worried about the potential consequences of haemoparasite infections; and 72.4% were willing to invest time and resources in implementing control measures. Concerning practices, 82.8% did not regularly monitor their horses for signs of haemoparasite infections, 93.1% did not take measures to prevent the introduction and spread of haemoparasites in their stables or farms, 69.0% consulted veterinarians for the diagnosis and treatment of suspected infections, and 79.3% did not practice proper biosecurity measures to control the spread of haemoparasites (Table 5).

In the present study, 75.9% of the horse handlers had satisfactory knowledge of equine haemoparasitic infections, while 24.1% had unsatisfactory knowledge. 96.6% of the horse handlers had a satisfactory attitude towards equine haemoparasitic infection, while 3.4% had an unsatisfactory attitude. 31% of the horse handlers have

Table 5: Knowledge, Attitudes, and practices of horse handlers towards equine haemoparasitic infection

Knowledge		
Question	Frequency	Percentage
Do you know what Haemoparasites are?		
Yes	28	48.3
No	30	51.7
Do you know the name of any haemoparasite?		
Yes	24	41.4
No	34	58.6
Are you aware of how haemoparasites are transmitted?		
Yes	38	65.5
No	20	34.5
Are you familiar with the clinical signs associated with equine haemoparasite infections?		
Yes	38	65.5
No	20	34.5

Table 5 continue: Knowledge, Attitudes, and practices of horse handlers towards equine

Attitudes		
Are you concerned about the impact of equine haemoparasites on the health and welfare of horses?		
Yes	50	86.2
No	8	13.8
Do you think regular monitoring and management of equine haemoparasites is important for horse owners/handlers?		
Yes	38	65.5
No	20	34.5
Are you worried about the potential consequences of haemoparasite infections in your horses?		
Yes	54	93.1
No	4	6.9
Are you willing to invest time and resources in implementing control measures for equine haemoparasites?		
Yes	42	72.4
No	16	27.6

satisfactory practice towards equine haemoparasitic infections, while 69% have unsatisfactory practice (Figure 4).

Discussion

The present study reveals a high prevalence (51.7%) of haemoparasitic infections among horses participating in a polo tournament in Jos, Nigeria. This prevalence is notably higher than previous reports from other regions of Nigeria, such as the 8.6% reported by Ehizibolo et al. (2012) in northern Nigeria and the 13.5% found by Alaba et al. (2022) in the southwest. The higher prevalence observed in our study may be attributed to the unique context of the polo tournament, where horses from various regions converge, potentially facilitating parasite transmission.

Our findings align more closely with studies from other African countries. For instance, Nimako-Boateng et al. (2022) reported a prevalence of 76.9% in Ghana, which is higher than our observations. This variability across studies underscores the importance of considering local factors such as climate, vector distribution, and management practices when interpreting prevalence data.The predominance of *Anaplasma marginale* (45.2%) in our study contrasts with findings from other regions. Javed et al. (2014), for example, found *Theileria equi* to be the most prevalent haemoparasite in horses in Pakistan. This discrepancy might be due to differences in vector ecology, host susceptibility, or diagnostic methods employed. The high prevalence of *A. marginale* in our study population warrants further investigation into its impact on equine health and performance in the Nigerian polo industry.

Risk factors identified in this study, including horse age, sex, and breed, provide valuable insights for targeted control strategies. The higher risk observed in stallions and horses aged 5-15 years aligns with findings from other studies (Rüegg et al., 2007; Del Pino et

Table 5 continue: Knowledge, Attitudes, and practices of horse handlers towards

Practices		
Do you regularly monitor your horses for signs of haemoparasite infections?		
Yes	10	17.2
No	48	82.8
Do you take measures to prevent the introduction and spread of haemoparasites in your stable/farm?		
Yes	4	6.9
No	54	93.1
Do you consult with a veterinarian for the diagnosis and treatment of suspected haemoparasite infections in your horses?		
Yes	40	69.0
No	18	31.0
Do you practice proper biosecurity measures (e.g., disinfection, isolation of new horses) to control the spread of haemoparasites?		
Yes	12	20.7
No	46	79.3

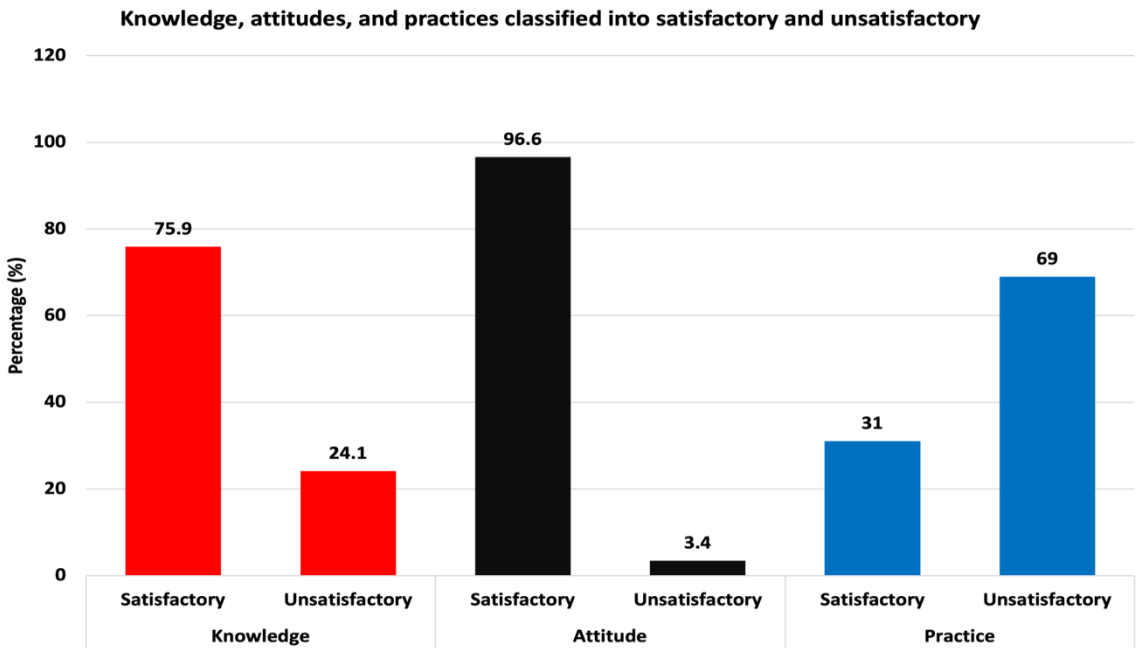

Figure 4: Knowledge, attitudes, and practices classified into satisfactory and unsatisfactory

al., 2016), suggesting that these groups may require more intensive monitoring and preventive measures.

The knowledge, attitudes, and practices (KAP) survey revealed important gaps in handlers' understanding and implementation

of haemoparasite control measures. While most handlers showed satisfactory knowledge and attitudes, the low proportion (31%) demonstrating satisfactory practices is concerning. This discrepancy between knowledge and practice has been observed in other studies of animal health management (Gunn et al., 2008; Shortall et al., 2016) and highlights the need for practical, hands-on training in addition to theoretical education.

Our study has several limitations that should be considered. The reliance on microscopic techniques alone for parasite detection may have underestimated the true prevalence, as molecular methods often reveal higher infection rates (Bhoora et al., 2010). Additionally, the cross-sectional nature of the study precludes conclusions about causality in the observed associations.

In conclusion, this study demonstrates a high prevalence of haemoparasitic infections among polo horses in Nigeria, with notable variations across different locations and horse populations. The identified risk factors and gaps in handlers' practices provide valuable targets for intervention. Future research should focus on longitudinal studies to better understand the dynamics of these infections in the polo horse population and the effectiveness of various control strategies.

Implementation of comprehensive education programs for horse handlers, coupled with improved biosecurity measures and regular health monitoring, could significantly reduce the burden of these infections in the Nigerian polo industry.

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