

High Burden of Canine Brucellosis in an urban Setting: Evidence from Multi-Species Surveillance in Abuja, Nigeria (2022-2024)

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Abstract

Background: Brucellosis is a neglected zoonotic disease with substantial public health and economic consequences, particularly in low- and middle-income countries where surveillance remains limited. In Nigeria, inadequate epidemiological data continue to hinder effective control efforts. This study assessed the temporal trends, species distribution, and public health implications of brucellosis using veterinary surveillance data from the Federal Capital Territory (FCT), Nigeria, between March 2022 and August 2024. A retrospective analysis of 460 animals screened for brucellosis was conducted, incorporating data on species, sex, infection status, and sampling date. Serological diagnosis was performed using the Rose Bengal Test. Descriptive statistics were used to estimate prevalence, while Chi-square analysis evaluated associations between infection status, sex, and species. Temporal patterns were examined through monthly data aggregation.

Results: The overall seroprevalence was 35.0% (161/460). Females exhibited a significantly higher prevalence (42.3%) compared to males (21.3%) ($\chi^2 = 20.388$, $p < 0.001$). Dogs showed the highest prevalence (46.3%) and accounted for the largest proportion of positive cases (42.9%). Temporal analysis revealed a progressive increase in cases, with peaks observed in 2024, while livestock maintained lower but persistent infection rates.

Conclusion: These findings indicate a rising trend of brucellosis in the FCT, with dogs emerging as key contributors to disease burden. Strengthened surveillance and a One Health approach are essential for effective control.

Introduction

Brucellosis, caused by bacteria of the genus *Brucella*, is a highly contagious zoonotic disease with a global distribution, impacting both animal health and human well-being (Akinyemi *et al.*, 2022). This disease is classified by the World Health Organization (WHO, 2023) as a neglected zoonosis. It remains a major public health concern, particularly in developing countries where animal husbandry practices and food handling may be suboptimal (Akinyemi *et al.*, 2022). The disease in animals is primarily characterized by reproductive disorders, including abortions, infertility, and retained fetal membranes, leading to significant economic losses in livestock production (Oluwadele *et al.*, 2025).

In humans, brucellosis, often referred to as undulant fever, presents with a wide array of nonspecific symptoms, including fever, arthralgia, fatigue, and malaise, and can lead to chronic, debilitating conditions if not promptly diagnosed and treated (Akinyemi *et al.*, 2022). Transmission to humans typically occurs through direct contact with infected animals or their secretions, consumption of contaminated animal products like unpasteurized milk or undercooked meat, and inhalation of aerosols (Akinyemi *et al.*, 2022; Feng *et al.*, 2026). Certain occupational groups, including veterinarians, livestock owners, animal handlers, and butchers, are at a particularly high risk of exposure due to their close contact with potentially infected animals and animal products (Pereira *et al.*, 2020; Oluwadele *et al.*, 2025).

Nigeria, with its large and diverse livestock population and prevalent free-range animal husbandry practices, faces a significant burden of brucellosis (Akinyemi *et al.*, 2022). Despite its endemic status, comprehensive national data on the prevalence and distribution of human and animal brucellosis remain fragmented, resulting in underreporting and inadequate control measures (Akinyemi *et al.*, 2022; Momoh *et al.*, 2025). Previous studies have shown varying seroprevalence rates across different regions and animal species in Nigeria (Akinyemi *et al.*, 2022; Oluwadele *et al.*, 2025). The Federal Capital Territory (FCT), being a rapidly urbanizing area with a mix of livestock and companion animals, represents a critical interface for zoonotic disease transmission.

This study aimed to evaluate the monthly and yearly distribution of brucellosis cases, compare screening frequencies and positivity rates across different animal species, identify seasonal patterns, and determine species-specific risk factors using frontline veterinary surveillance data in the FCT, Nigeria, from March 2022 to August 2024. The results are expected to offer valuable insights into the current epidemiology of brucellosis in the FCT, guide targeted surveillance and control efforts, and highlight the public health risks for at-risk populations and the wider community.

Materials and methods

Study Area and Duration

This retrospective study utilized clinical records from routine veterinary surveillance conducted by the Department of Veterinary Services, Agriculture and Rural Development Secretariat, Federal Capital Territory (FCT), Nigeria. The study period spanned from March 2022 to August 2024.

Data Collection

Data were extracted from veterinary records documenting brucellosis screening activities. A total of 460 animals were included in the dataset. Variables collected comprised animal species (cattle, dogs, goats, pigs, and sheep), sex, brucellosis infection status (positive or negative), and date of screening (month and year). Only complete and properly documented records were included in the analysis.

Laboratory Procedure

Serological screening for brucellosis was performed using the Rose Bengal Test (RBT), a rapid slide agglutination assay for detecting antibodies against *Brucella* spp (Kebede & Fesseha, 2022). Serum samples were equilibrated to room temperature prior to testing. Positive and negative control sera were included for quality assurance. Agglutination indicated a positive result, while the absence of visible clumping was interpreted as negative.

Data Analysis

Descriptive statistics were used to summarize animal distribution and estimate prevalence. The prevalence rates were calculated overall and stratified by species and sex. Associations between categorical variables were assessed using the Chi-square test, with statistical significance set at $p < 0.05$. Temporal trends were analyzed using monthly aggregated data. A composite time variable (MONTHYEAR) was generated in SPSS to ensure chronological ordering. Trend patterns were visualized using line graphs, including species-specific plots, to illustrate variations in disease burden. All analyses were conducted using IBM SPSS Statistics version 25.

Results

Out of 460 animals screened for brucellosis between March 2022 and August 2024, 161 animals were positive, resulting in an overall brucellosis prevalence of 35.0% as summarized in Table 1 below.

Table 1
Prevalence of Brucellosis Cases (N = 460)

Variable	Sum	Prevalence
No Examined	460	35.0%
No Positive	161	

Sex Distribution

The sex distribution of animals included in the study is presented in Fig. 1 below, showing a higher proportion of females, $n = 300$ compared to males, $n = 160$.

Table 2 below shows the prevalence of brucellosis across sex. The prevalence of infection was significantly higher in females (42.3%) compared to males (21.3%), with a statistically significant association between sex and infection status ($\chi^2 = 20.388$, $df = 1$, $p < 0.001$).

Table 2
Cross tabulation between Sex and Prevalence of Brucellosis

Sex	Examined	Positive	Prevalence
Female (F)	300	127	42.3%
Male (M)	160	34	21.3%

$\chi^2 = 20.388$, $df = 1$, $p < 0.001$

Species distribution as shown in Table 3 revealed that Dogs constituted the largest proportion of screened animals (149), followed by Goats (92), Sheep (100), Pigs (65), and Cattle (54). The prevalence varied significantly across animal species ($p < 0.05$), with Dogs exhibiting the highest prevalence (46.3%),

followed by Goats (38.0%), Cattle (27.8%), Pigs (27.7%), and Sheep (24.0%). In terms of contribution to total positive cases, Dogs accounted for the largest share (42.9%, 69/161), while Cattle contributed the least (9.3%, 15/161). This is shown in Table 4.

Table 3
Prevalence of Brucellosis by Animal Species

Animal	Examined	Positive	Prevalence
Cattle	54	15	27.8%
Dogs	149	69	46.3%
Goat	92	35	38.0%
Pigs	65	18	27.7%
Sheep	100	24	24.0%

Statistically significant association between animal species and infection status (χ^2 , $p < 0.05$)

Table 4
Contribution of Animal Species to Total Positive Cases

Animal	Positive cases	% of total cases
Dogs	69	42.9%
Goat	35	21.7%
Sheep	24	14.9%
Pigs	18	11.2%
Cattle	15	9.3%

Monthly Trend of Positive Cases

The monthly trend of brucellosis positive cases is illustrated in Fig. 2, showing a gradual increase in positive cases over time, with more pronounced peaks observed towards the later part of the study period.

Species-Specific Monthly Trends

To further elucidate the contributions of individual animal species to the overall trend, specie-specific trends in brucellosis cases are presented in Fig. 3, where dogs consistently contributed the highest number of positive cases across most months.

Discussion

The overall prevalence of brucellosis of 35.0% observed in this study is comparatively high relative to several reports from Nigeria and other regions. Earlier studies in Nigeria have documented lower and variable prevalence rates across animal species, including 5.6–19.6% (Aworh *et al.*, 2017) and 15.1–23.3% in slaughtered livestock (Ukwueze *et al.*, 2020). National estimates further indicate ranges of 3.3–40.9% in cattle and 1.6–19.6% in goats (Akinyemi *et al.*, 2022), underscoring significant regional variability. Outside Nigeria, lower prevalence values have been reported in cattle (2.9–6%) and goats (1.6–2%) in countries such as Argentina, Costa Rica, and Ethiopia, although higher rates approaching 34.9% have been recorded in parts of the Middle East (Ducrotoy *et al.*, 2021). The relatively elevated prevalence in the present study may reflect intensified transmission dynamics, closer human–animal interactions within the urban FCT environment, and/or improved case detection through routine surveillance systems.

The significantly higher prevalence observed in female animals is consistent with the established pathophysiology of brucellosis. *Brucella* species exhibit a strong predilection for reproductive tissues, with physiological changes during pregnancy and parturition enhancing susceptibility and bacterial shedding (Corbel, 2006; Akinyemi *et al.*, 2022). This finding aligns with previous reports in livestock and companion animals (Ukwueze *et al.*, 2020; Anyaoha *et al.*, 2020; Momoh *et al.*, 2014). However, some studies have reported no significant association between sex and infection (Olufemi *et al.*, 2018), suggesting that sex-related differences may be influenced by management systems, reproductive status, and sampling strategies.

Species-specific analysis revealed that dogs exhibited the highest prevalence and contributed the largest proportion of positive cases. This finding is epidemiologically significant and suggests a potentially expanding role of companion animals in the transmission dynamics of brucellosis in urban settings. Previous studies have emphasized the zoonotic importance of canine brucellosis, particularly in environments characterized by close human–animal interaction (Oosthuizen *et al.*, 2019; Lucero *et al.*, 2022). More recent evidence from Nigeria also points to increasing detection of brucellosis in dogs, which supports the pattern observed in this study (Momoh *et al.*, 2014; Anyaoha *et al.*, 2020; Ayinla *et al.*, 2025).

Notably, this observation contrasts with the conventional understanding that livestock species are the primary reservoirs of brucellosis globally (McDermott *et al.*, 2020; FAO, 2023). The apparent discrepancy may reflect the urban nature of the study area, increased contact between humans and companion animals, or differences in surveillance intensity across species. It may also indicate a gradual epidemiological shift rather than a complete departure from established patterns. Consequently, the role of dogs as potential reservoirs and amplifiers of infection in urban ecosystems warrants closer attention. In contrast, livestock species (cattle, goats, pigs, and sheep) exhibited lower but persistent infection rates. Given their well-established role as reservoirs of different *Brucella* species, these findings likely reflect underdiagnosed or reduced surveillance intensity rather than genuinely low prevalence.

(Ducrotoy *et al.*, 2021; FAO, 2023). Previous studies in Nigeria have reported moderate prevalence levels in livestock populations (Akinyemi *et al.*, 2022), supporting their continued epidemiological importance despite lower representation in the present dataset. This underscores the need for balanced surveillance efforts across both livestock and companion animals. Temporal analysis demonstrated a progressive increase in brucellosis cases over the study period, with more pronounced peaks observed toward the later months. This pattern suggests a growing burden of disease within the study population and is consistent with findings from endemic regions where brucellosis persists due to weak control measures and sustained transmission cycles (Dadar *et al.*, 2021; WHO, 2023). However, it is important to interpret this trend cautiously, as apparent increases may also be attributable to improvements in surveillance coverage, reporting systems, and diagnostic practices (McDermott *et al.*, 2020).

Seasonal variation was also evident; aligning with previous studies that have reported significant differences in prevalence across months, often linked to environmental conditions and management practices (Noudeke *et al.*, 2017). Factors such as breeding cycles, climatic conditions, and animal movement patterns may contribute to these fluctuations. Importantly, the overall temporal trend appeared to be strongly influenced by patterns observed in the dog population, alongside intermittent contributions from livestock species. This highlights the importance of species-specific dynamics in shaping overall disease trends.

The zoonotic nature of brucellosis presents significant public health concerns, particularly for individuals with occupational or domestic exposure to animals. Veterinarians and animal health workers are at elevated risk due to frequent contact with infected tissues, secretions, and aborted materials (Pereira *et al.*, 2020). The high burden observed in dogs in this study further extends this risk to small animal practitioners, who may not traditionally be considered a primary risk group for brucellosis. Pet owners are also vulnerable, particularly through close contact with infected dogs during breeding, parturition, or exposure to contaminated bodily fluids. This supports previous findings that identify *Brucella canis* as an under-recognized zoonotic pathogen in household settings (Oosthuizen *et al.*, 2019). The growing role of companion animals in disease transmission therefore, represents an important public health concern in urban environments.

Livestock owners and farmers remain at risk through direct contact with infected animals and exposure to contaminated animal products. Although livestock cases were less frequent in this study, their role in maintaining transmission cycles is well established (FAO, 2023; Akinyemi *et al.*, 2022). Similarly, butchers and abattoir workers are at increased risk due to occupational exposure during slaughter and carcass processing. Evidence from Nigeria indicates low awareness and inadequate adherence to biosafety practices among these groups, further increasing vulnerability (Adesiyani *et al.*, 2025). Additional risks associated with the handling and consumption of contaminated animal products has also been reported (Feng *et al.*, 2026).

Overall, the findings of this study highlight a complex and evolving epidemiological landscape of brucellosis in the FCT, characterized by high prevalence, emerging importance of companion animals,

and persistent livestock involvement. These results underscore the need for strengthened surveillance systems, improved occupational health practices and the implementation of integrated One Health approaches to effectively control and prevent brucellosis.

Conclusion

This study reveals an increasing trend of brucellosis in the Federal Capital Territory (FCT), Nigeria, between 2022 and 2024, with a high overall prevalence of 35.0%. Dogs emerged as the primary contributors to the disease burden, exhibiting the highest prevalence and accounting for the largest proportion of positive cases. The higher prevalence observed in females underscores the reproductive tropism of *Brucella* spp. and its role in sustaining transmission. These findings suggest a potential epidemiological shift toward greater involvement of companion animals in urban transmission dynamics. The zoonotic implications are significant, particularly for veterinarians, pet owners, livestock handlers, and abattoir workers. Strengthening integrated surveillance systems that include both livestock and companion animals, alongside a One Health approach emphasizing targeted control, improved diagnostics, and public awareness, is essential for effective prevention and control of brucellosis in the FCT.

Declarations

Consent to participate: This study utilised data and samples obtained through routine veterinary surveillance activities at the Veterinary Diagnostic Laboratory, Federal Capital Territory, Nigeria. The animals were not sampled specifically for research purposes, and no additional procedures were performed beyond standard diagnostic practices.

As the study was based on secondary data derived from routine clinical records, formal ethical approval was not required. All samples were submitted to the laboratory as part of standard veterinary care and were appropriately labeled. Data were handled anonymously, and no identifiable information of animal owners was included in the analysis in accordance with standard veterinary public health practice.

Consent for publication: Not applicable.

Availability of data: Data generated from this retrospective study will be made available on request.

Competing interests: The Authors declare that there is no conflicting interest

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Authors' contributions: Elochukwu Victoria Chukwu- Conceptualization; methodology; investigation; data curation; formal analysis; visualization; writing, original draft.

Augustin Onyedikachi Adika- writing, review, and editing

Chisom Onyekanihu Amaka- visualization

Jimada Bello Muhammed- Performed computation

Musa Halidu- Analysis, Figures

Chidimma Ezekwe Nnabuchi- Writing

Adeyinka Olamide Agbato- Investigation, writing, Verification of results

All authors reviewed the manuscript

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Figures

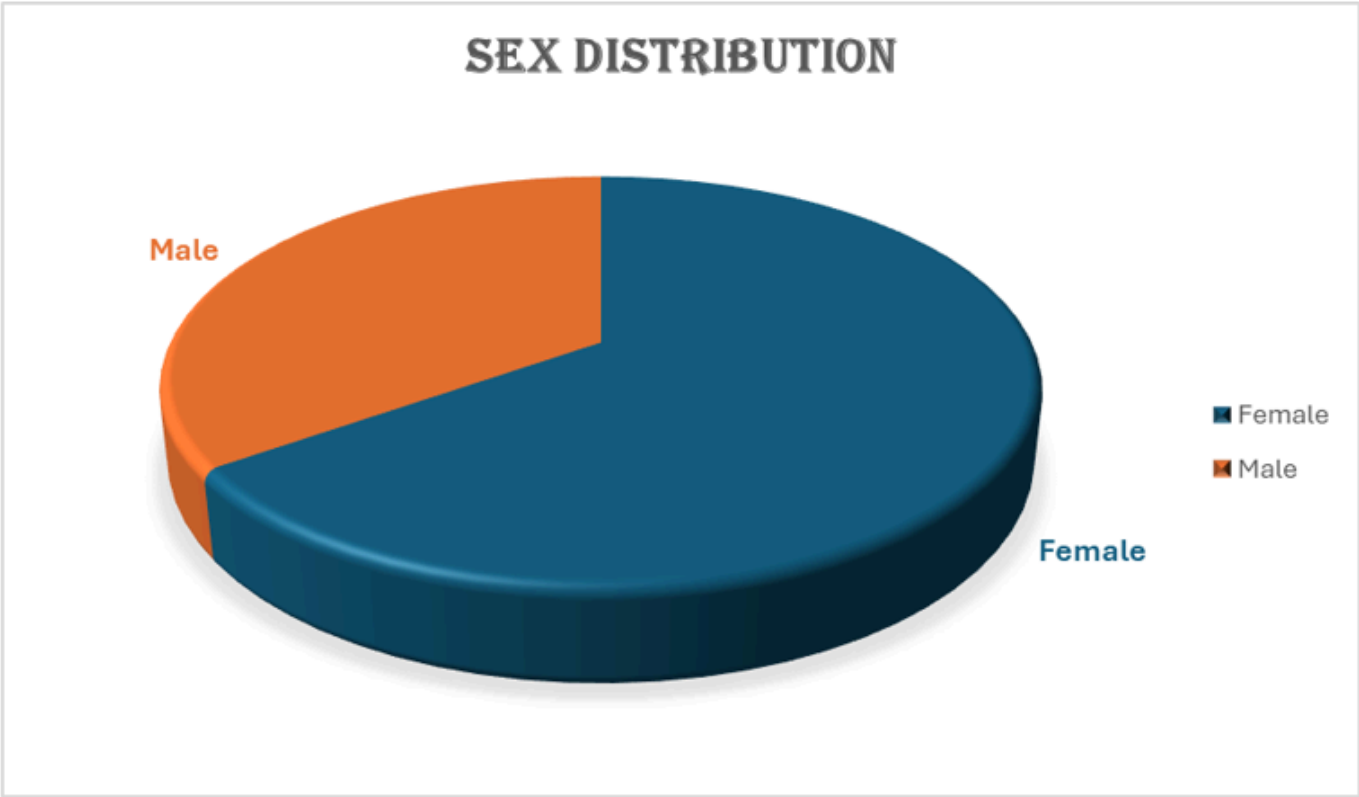


Figure 1
Sex distribution of animals screened for brucellosis in the FCT, Nigeria (March 2022- August 2024).

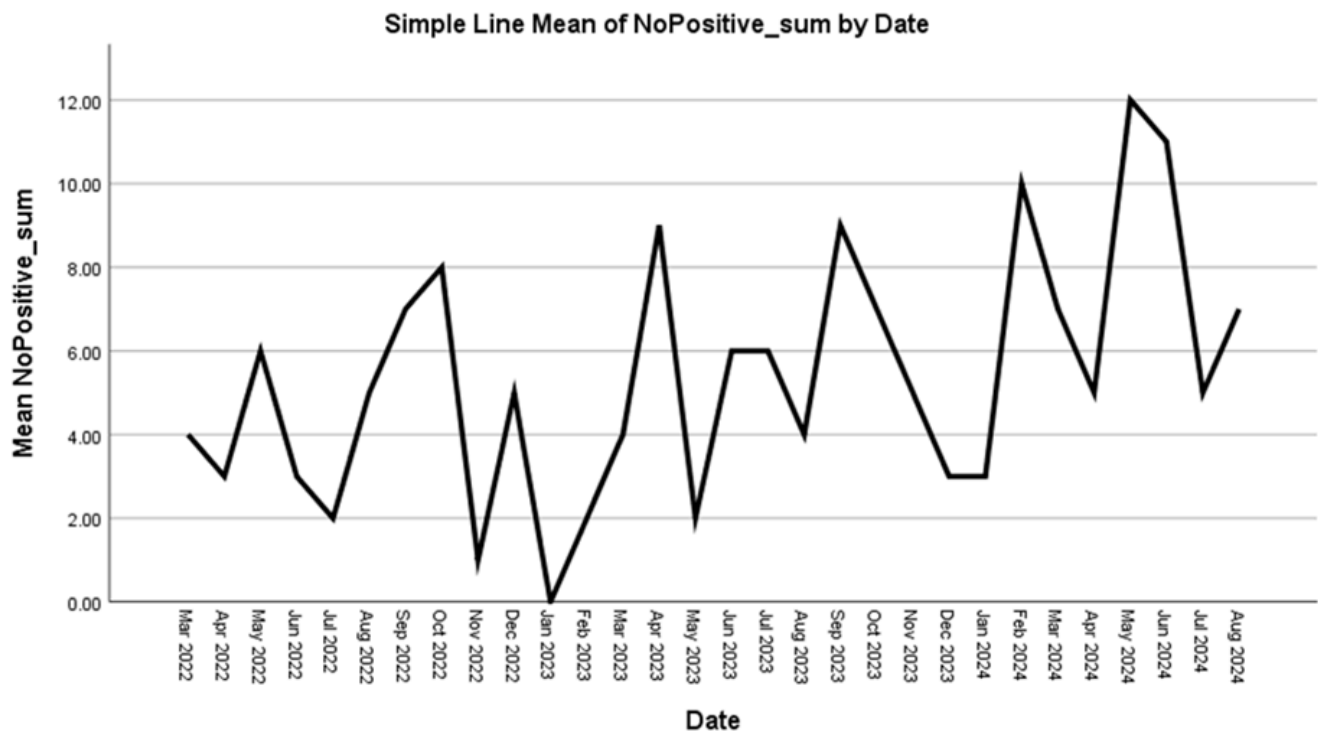


Figure 2

Monthly Trend of brucellosis Positive Cases across all animal species in the FCT, Nigeria (March 2022-August 2024).

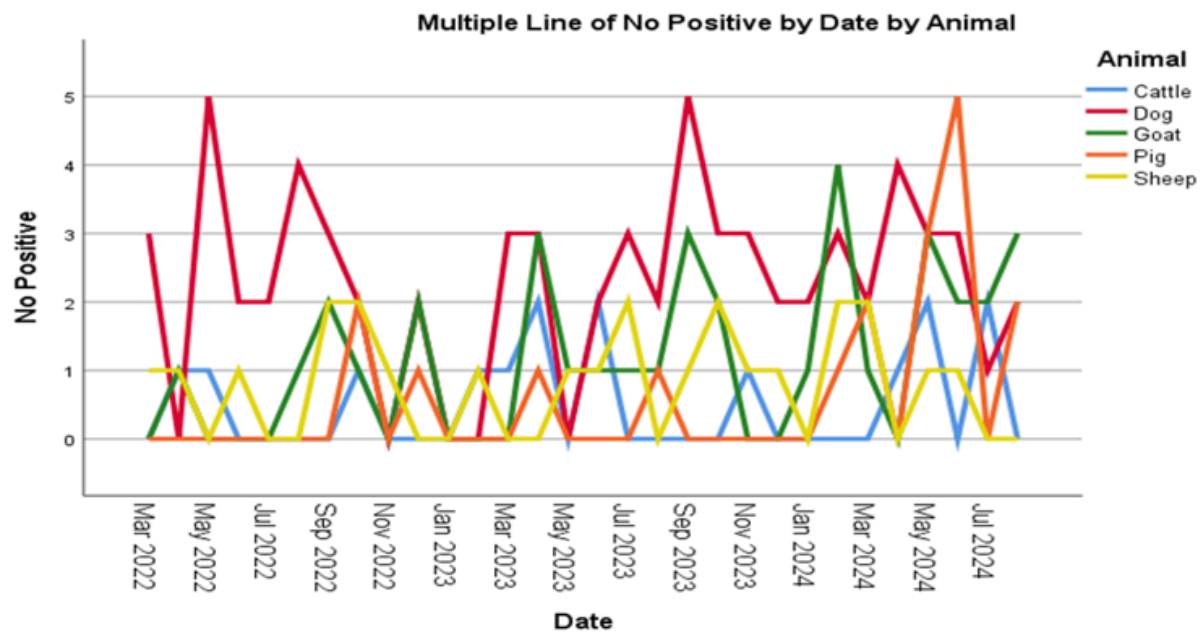


Figure 3

Species-specific monthly trends of brucellosis positive cases among animals in the FCT, Nigeria (March 2022- August 2024).