

Seroprevalence for Rift Valley Fever Virus and Associated Risk Factors in Cattle Slaughtered in Major Abattoirs of Federal Capital Territory, Abuja, Nigeria

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Abstract

Rift Valley Fever (RVF) is a mosquito-borne zoonotic disease that significantly impacts human and animal health, especially in sub-Saharan Africa. Despite its recognition as an emerging public health threat, the epidemiological understanding of RVF in Nigeria remains limited, particularly within high-risk environments like abattoirs. This study assessed the seroprevalence of RVF virus (RVFV) in cattle slaughtered at major abattoirs in Abuja, Nigeria, and evaluated the knowledge, attitudes, and practices (KAP) of abattoir workers regarding RVF transmission and prevention. A cross-sectional study was conducted across three major abattoirs in Abuja using a multistage sampling technique. A total of 182 blood samples were collected from cattle aged ≥ 6 months and analyzed for RVFV-specific antibodies using competitive ELISA (cELISA). Additionally, 144 structured questionnaires were administered to abattoir workers, animal health officials, and meat vendors to assess KAP and potential risk factors. The overall seroprevalence of RVFV among slaughtered cattle was 1.1%, with two positive cases detected at Dei-Dei and Karu abattoirs. No significant difference in seropositivity was observed based on age or sex. Only 32.6% of respondents had heard of RVF, and 31.9% were aware of its zoonotic potential. Risky practices were common: 54.9% ate within abattoirs, 42.4% consumed raw animal products, and 85.4% had frequent contact with animal blood. Environmental and occupational risk factors such as high humidity ($p = 0.001$), mosquito density ($p = 0.001$), and extensive husbandry systems ($p = 0.001$) were significantly associated with RVF exposure risk. Enhanced surveillance, routine screening, and targeted educational interventions are essential to mitigate zoonotic RVF transmission in Nigeria.

INTRODUCTION

RVF (RFV) is a serious emerging threat to human and animal health. It is a vector-borne zoonosis that causes severe illness and high fatality in both animals and humans, posing a serious global public health threat (Kwaśnik et al., 2021, Adams et al., 2017). The disease has been frequently reported in domestic livestock and various wildlife species (Megenas et al., 2024, Clark et al., 2018). RVF is a tripartite negative-sense RNA virus within the Phlebovirus genus of the Phenuiviridae family that replicates exclusively in the host cytoplasm (Bird et al., 2022). The virus was first identified in 1931 in East Africa (Boushab et al., 2015), but since then, multiple outbreaks have recurred across Egypt, Saudi Arabia, Yemen, and West and East Africa during El Niño associated rainy seasons (Anyangu et al., 2010; Faye et al., 2010; WHO, 2024). Though RVF has long been known, the scale of human morbidity and mortality during recent epidemics marks it as an increasingly serious emerging threat.

Current surveillance systems significantly underestimate the true incidence of RVF viral infection, particularly in African settings where diagnostic methods often lack species-level specificity (Gerken et al., 2022). Numerous serological surveys detecting RVFV antibodies in livestock and humans during non-epidemic periods further demonstrate ongoing, under-recognized transmission (Rostal et al., 2010; Blomström et al., 2016). No confirmed cases of human-to-human or nosocomial transmission have been documented to date, despite investigations in outbreak and hospital settings (WHO 2024). Human

infection remains largely zoonotic, resulting from direct contact with infected animal tissues, rather than vector bites or person-to-person spread (Al-Hamdan et al., 2015).

Livestock, particularly domestic ruminants remain the primary hosts of RVFV, notably in West Africa. However, the virus has also been detected in diverse wild and domestic species at livestock–wildlife interfaces, suggesting a broader ecological role in maintenance and transmission (Ndengu et al., 2021; Alhaji et al., 2020). Frequent transboundary livestock movement in Nigeria and neighboring countries has contributed to intermittent RVF outbreaks and elevated seroprevalence in both humans and animals (Alhaji et al., 2020, Poueme et al., 2019). Serological studies in wildlife including buffalo and giraffe, which show occasional antibody presence, but viremia levels appear insufficient for sustaining mosquito-borne transmission, reinforcing the role of domestic cattle as the key amplifying hosts (Ndengu et al., 2021).

The epidemiology of RVFV in nomadic pastoral herds in Nigeria is poorly understood till date. In Nigeria, there has been no report of an outbreak of RVF among humans, but antibodies against the virus have been found in a few studies in livestock and humans. So therefore, the aim of this study is to assess the seroprevalence and risk factors of Rift Valley Fever Virus (RVFV) in cattle slaughtered at major abattoirs in Federal capital Territory of Nigeria, while also evaluating the knowledge, attitudes, and practices (KAP) of abattoir workers. This research seeks to generate data that can guide targeted interventions and inform policies to reduce zoonotic transmission and enhance public health preparedness.

MATERIALS AND METHODS

Study area

The study was carried out in the Federal Capital Territory (FCT) which is the capital of Nigeria Fig. 1. the city is located in the nation's middle belt, and lies between latitudes 8.25 and 9.20 degrees North of the Equator and longitudes 6.45 and 7.39 degrees East of Greenwich Meridian, Abuja is geographically located at the center of the country (Ibrahim *et al.*, 2025). The Federal Capital Territory has a landmass of approximately 7,315 km², and it is situated within the savannah region with moderate climatic conditions. The territory is presently made up of six area councils, namely; Abaji, Abuja Municipal Area Council, Bwari, Gwagwalada, Kuje and Kwali councils (Adepoju *et al.*, 2014).

Figure 1: Map of the Federal Capital Territory, Abuja, Nigeria. source

Study Design

This is a cross-sectional epidemiological studies where the blood of the cattle slaughtered for beef were examined and sampled for RVF infection. A multistage sampling technique was used for this study. First, a simple random sampling was used to select 3 out of the 6 Area Councils in Abuja. The major abattoirs in the selected Area Councils were listed and selected in Table 1, they include Kubwa and Deidei

abattoirs in Bwari Area Council, Gwagwalada abattoir in Gwagwalada Area Council and Karu abattoir in AMAC. Samples were then obtained from the respective abattoirs by a way of convenient sampling method. A systematic sampling technique was employed for the selection of animals that were sampled. Cattle slaughtered in each of the abattoir for consumption was considered and blood samples from the slaughtered cattle were collected from the severed jugular vein for transportation to the NyaNya Veterinary Laboratory in NyaNya, FCT, Abuja, Nigeria for serum collection, storage and packaging before transporting to Virology Unit Laboratory of National Veterinary Research Institute Vom, Jos, Nigeria for laboratory analysis.

Cattle eligible for inclusion were those aged six months and above and slaughtered in major abattoirs in the FCT as listed earlier. Livestock stakeholders resident within the FCT were also included for the Knowledge, Attitude and Practices assessment. Animals not slaughtered for meat or intended for human consumption and stakeholders not resident in the FCT were excluded from the study.

The required sample size was determined using Thrusfield's formula for prevalence studies; $N = Z^2 \times P \times (1 - P) / d^2$, where Z is 1.96, d is 0.05, and P is the expected prevalence of 11.3% (based on a previous study by Alhaji et al., 2020 conducted in North Central Nigeria). This gave a minimum sample size of 154, which was rounded up to 180 to ensure even distribution across abattoirs. Slaughtered animals were visually examined for signs of RVF infection, and data including age, sex, breed, and market source were recorded. Blood samples (5 mL) were collected from 180 animals in September 2023.

Laboratory Analysis

Samples were allowed to clot in the field, transported in plain vacutainer tubes under cold chain to Nyanya Veterinary Clinic Laboratory, and Blood sample were centrifuged at 3000 rpm for 20 minutes at Nyanya veterinary clinic. The resulting sera were transferred into sterile, labeled tubes and stored temporarily at -20°C before being transported on ice packs to the Virology Unit of the National Veterinary Research Institute (NVRI), Vom, for laboratory analysis.

Competitive Enzyme Linked Immuno Sorbent Assay (C-Elisa)

The sera samples were screened using ID screenR Rift Valley fever competition multi-species ELISA kit (IDVET, Montpellier, France) following the manufacturer's instructions. Briefly, 50 μL each of ELISA buffer and test sera were added to each well containing the RVFV antigen-coated test plates. Positive and negative control sera were added to the designated wells of each test plate and were incubated for 45 min at 37°C . The plates were emptied and washed three times with 300 μL of wash solutions, and 100 μL of the diluted conjugate was added to all the plates and incubated for 30 min at 21°C . The plates were then emptied and washed 3 times with 300 μL washing solution, and 100 μL of the substrate solution was dispensed to all the wells and were incubated for 15 min at 21°C in the dark. Thereafter, 100 μL of stop solution was added to all the wells. Readings were taken using a spectrophotometer Multiskan® ELISA

reader (Thermo Scientific, USA), and the optical density (OD) was determined at 450 nm. The positivity of each sample was determined by calculating its competition percentage (CP).

Samples that will have competition percentage (S/N %) of $\leq 40\%$ was considered positive for RVF antibodies. Those between 40% and 50% was considered doubtful, and those with competition percentage greater than 50% was considered negative for RVF antibodies.

Study Instruments (Questionnaire design)

A structured interviewer administered questionnaire was adapted from two study conducted in Jos (Anejo-Okopi et al., 2020) and Niger State (Alhaji et al., 2018), Nigeria. The questionnaire was transformed through google form and deployed into google format for data collection. The questionnaire was designed to capture five important aspects of KAP among the population in the study area. This includes respondents' Socio-demographic, attitude, preventive practices, knowledge of transmission and risk factors of Rift valley fever. To measure the levels of various aspects of Knowledge, Attitude and Practice (KAP), the questionnaire was divided into five distinct sections (SS1). In each section, relevant questions were asked from the respondents to assess knowledge, attitude, preventive practices and risk factor knowledge were asked respectively.

Data Management and Statistical Analysis

Data obtained from this study was entered, cleaned and analyzed using Microsoft office excel and Epi Info (EpiInfo® version 7). Results obtained were expressed as percentages and levels of association between extrinsic risk factors and sero-positivity was obtained using the chi-square test. Values of $p < 0.05$ were regarded as statistically significant.

RESULTS

Sero-prevalence of RVF in Cattle slaughtered in the FCT abattoirs using cELISA

The overall prevalence of RVF in cattle slaughtered in the three abattoirs within the Federal Capital Territory (FCT) indicated a total of 2 (1.1%) positive samples for cattle slaughtered as shown in Table 1. Out of a total of 182 serum samples tested, 2 (1.1%) were positive for RVF at both Dei - Dei and Karu abattoirs with 1 sample each (1.64%) respectively, while there was no prevalence of RVF at Gwagwalada abattoir with all sample (0%) being negative using cELISA

Table 1
Distribution of Rift Valley Fever in Slaughtered Cattle According to
Abattoirs in FCT

Abattoir	NS	Positive cELISA	95% CI	
		No (%)	Lower	Upper
Gwagwalada Abattoir	60	0 (0)		
Karu Abattoir Abuja	61	1 (1.64)	0.08	7.82
Dei-Dei Abattoir	61	1 (1.64)	0.08	7.82
Total	182	2 (1.1)	0.18	3.58

cELISA = Competitive Enzyme Linked Immunosorbent Assay, P=Proportion, NS = Number of animals sampled

Sex-Specific Sero-prevalence of RVF in Slaughtered Cattle in the FCT using cELISA

Out of the 99 serum samples that were collected from the male animals, 1 (1.01%) was positive for RVF, while from the 83 samples collected from the female animals, 1 (1.20%) was positive by cELISA in the study location as shown in Table 2.

Table 2
Sex-Specific Sero-prevalence of Rift Valley Fever in cattle slaughtered in
FCT using cELISA

Sex	NS	Positive cELISA	Proportion (%)	95% CI	
		No (%)		Lower	Upper
Male	99	1 (1.01)	1.01	0.05	4.88
Female	83	1 (1.20)	1.20	0.06	5.80
Total	182	2 (1.1)	1.1	0.18	3.58

cELISA = Competitive Enzyme Linked Immunosorbent Assay, C.I = Confidence interval, NS = Number of animals sampled

Age-Specific Sero-prevalence of RVF in Slaughtered Cattle in the FCT using cELISA

Out of the 182 slaughtered cattle sampled in the abattoirs located in FCT, 122 of the samples cattle were adults (above one year of age) while 60 samples collected were young (below one year of age). Among the animals slaughtered and sampled, 2 (1.64%) adults were positive for RVF while no positive sample (0%) in young for RVF by cELISA in the Federal capital Territory (FCT) according to Table 3.

Table 3
Age-Specific Sero-prevalence of Rift Valley Fever in
Slaughtered Cattle in FCT using cELISA

Age	NS	Positive cELISA	95% CI on OR	
		No (%)	Lower	Upper
Adult	122	2 (1.64)	0.28	5.31
Young	60	0 (0)	-	-
Total	182	2 (1.1)	0.18	3.58

cELISA = Competitive Enzyme Linked Immunosorbent Assay, C.I = Confidence interval, NS = Number of animals sampled

Socio-demographic Representation of the Respondents on the Knowledge and Risk Factors of RVF

The socio-demographic features of the respondent represented in Table 4 showed that majority of the respondents (41%) fell within the age bracket of 21–30, and 74.30% of the respondent were male. The highest population of respondent (39.60%) had no formal education while 52.10% of the respondent kept livestock animals at home as a secondary source of livelihood. However, 38.20% of the respondents had more than 6 years of working experience within the abattoir environment and most of them were abattoir workers.

Table 4
Socio-demographic Representation of Knowledge of Livestock Stakeholders
on Rift Valley Fever in FCT

Variable	Frequency(n)	Percentage (%)
Age categories		
11–20	17	11.8
21–30	59	41
31–40	39	27.1
41–50	18	12.5
51–60	7	4.9
Above 60 years	4	2.8
Sex		
Male	107	74.3
Female	37	25.7
Level of Education		
None	57	39.6
Primary	29	20.1
Secondary	7	4.9
Tertiary	51	35.4
Occupation		
Animal Health Officials	47	32.6
Abattoir workers	80	55.6
Meat vendors	17	11.8
Are there livestock in your house		
Yes	75	52.1
No	69	47.9
Length of stay at the abattoir (years)		
Less than 1 year	27	18.8
1–2 years	24	16.7
3–5 years	38	26.4

Variable	Frequency(n)	Percentage (%)
Age categories		
Above 6 years	55	38.2

Assessment of the Level of knowledge on Transmission, Attitude, Preventive Practices and Possible Exposure of Abattoir Workers to Rift Valley Fever Virus in the FCT

Out of the 144 respondents only 47 (32.6%) of the respondents had knowledge about what RVF is, and 46 (31.9%) were aware that the disease can be transmitted from the animals to humans and vice versa while 98 (68.1%) does not have any idea on the mode of transmission of RVF in humans and animals (Table 5).

In the study location, as shown in Table 6, 79 (54.9%) responders accepted to eating inside the abattoir during working hours, 61 (42.4%) agreed to consuming raw meat/milk and 65 (45.2%) and 83 (57.7%) neither eat inside the abattoir nor consume raw meat in the study location respectively. Majority of the farmers 102 (70.8%) use protective clothing while conducting abattoir activities while 90 (62.5%) used protective boot also when working in the abattoir. Of the 144 questionnaire respondents, 88(61.8%) responded that they washed their hands during and after abattoir activities, 53 (36.8%) used hand gloves and 123(85.4%) always have contact with the blood of slaughtered animals while inside the abattoir (4.5.2).

Table 5
Knowledge of Respondents about Rift Valley Fever Virus

Variable	Frequency(n)	Percentage (%)
Do you have Knowledge about Rift Valley Fever		
Yes	47	32.6
No	97	76.4
Knowledge of the dynamics of RVF transmission in humans and animals?		
Yes	46	31.9
No	98	68.1
Do you know RVF is zoonotic		
Yes	46	31.9
No	45	31.3
Not Sure	53	36.8

Table 6
Behaviour of Respondents to Preventive Practices Against Rift Valley Fever while Working

Variable	Frequency(n)	Percentage (%)
Do you eat while working at the abattoir		
Yes	79	54.9
No	41	28.5
Sometimes	24	16.7
Do you consume raw or improperly processed meat and milk		
Yes	61	42.4
No	44	30.6
Sometimes	39	27.1
Do you wear a protective clothing at work		
Yes	102	70.8
No	10	6.9
Sometimes	32	22.2
Do you wear protective foot gear like boot		
Yes	90	62.5
No	18	12.5
Sometimes	36	25
Do you wear hand gloves		
Yes	53	36.8
No	65	45.1
Sometimes	26	18.1
Do you regularly wash hands at work		
Yes	88	61.8
No	6	4.2
Sometimes	49	34
Do you normally have contact with the blood of slaughtered animals		

Variable	Frequency(n)	Percentage (%)
Do you eat while working at the abattoir		
Yes	123	85.4
No	21	14.6

As shown in Table 7, majority of the respondents 64 (44.4%) experience mosquitoes bite more than 5 times daily, with 41 (28.5%) experiencing about 1–2 times daily mosquito bites, 78 (54.25%) respondents sometimes have fever involvement following mosquito bites and 79 (54.95%) had once in a while in regards to frequency of illness following mosquito bites. Of the 144 respondents that participated in the study with respect to experiencing malaria like symptoms, it showed that majority 74 (51.45) experience the symptoms associated with malaria once in a while. Out of the 144 responders of the questionnaire in the study location, 60 (41.7%) consult medical personnel, 90 (62.5%) self-medicate on antibiotics/antimalaria drugs, while 20 (13.9%) self-medicate using local herbal drugs when they are sick.

The attitude of respondents with respect to recovery following malaria treatment showed that 77(53.5%) sometimes recover following self-medication against malaria and feel that antibiotic can be used as treatment drug (Table 4.5.3). Most of the respondents 73(50.7%) don't normally run malaria tests before commencement of treatment when sick. Very few 4(2.8%) usually have a negative test results following the conduct of malaria test when they're sick while 67(46.5%) don't carry out malaria test when they're sick

Table 7
Possible Exposure of Respondents to Rift Valley Fever Virus

Variable	Frequency(n)	Percentage (%)
Frequency of Mosquito bites		
More than 5 times daily	64	44.4
1–2 times daily	33	22.9
few times weekly	41	28.5
no mosquito bite	6	4.2
Fever involvement		
Always	48	33.3
Sometimes	78	54.2
Not really	18	12.5
Frequency of illness		
Almost often	42	29.2
Once in a while	79	54.9
Rarely	23	16
Malaria like symptoms		
Almost often	48	33.3
Once in a while	74	51.4
Rarely	22	15.3
Do you consult a doctor when sick		
Yes	60	41.7
No	84	58.3
What drug do you take while sick		
Antimalaria	56	38.9
Antibiotics	34	23.6
Herbal	20	13.9
Prescribed by a doctor	34	23.6
Recovery following malaria Treatment		

Variable	Frequency(n)	Percentage (%)
Frequency of Mosquito bites		
Yes	57	39.6
No	7	4.9
Sometimes	77	53.5
No treatment	3	2.1
Do you normally run malaria tests before commencement of treatment		
Yes	31	21.5
No	73	50.7
Sometimes	40	27.8
Outcome of malaria test		
Usually positive	24	16.7
Usually negative	4	2.8
Sometimes positive	49	34
No malaria test	67	46.5

Socio-Ecological Drivers for Rift Valley Fever Occurrence in Slaughtered Cattle

The data in Table 8 examines various risk factors associated with the potential occurrence of Rift Valley Fever (RVF) infection among different groups, including Animal Health Officers, Abattoir Workers, and Meat Vendors. The analysis shows significant associations between these risk factors and the likelihood of RVF infection. High temperature was identified as a significant risk factor, with a chi-square value of 7.51 and a p-value of 0.020, High rainfall was also significantly associated with RVF infection risk, with a chi-square value of 8.88 and a p-value of 0.010. High humidity also showed a strong association with RVF infection, with a chi-square value of 29.09 and a p-value of 0.001. High mosquito density was another significant risk factor, with a chi-square value of 22.03 and a p-value of 0.001. The extensive husbandry management system also showed a significant association with RVF infection risk, with a chi-square value of 20.99 and a p-value of 0.001.

Table 8: Risk Factors Associated with Possible Occurrence of Rift Valley Fever infection

VARIABLES	Agreed	Disagreed	χ ²	P-Value
High temperature				
Animal Health Officer	31	16	7.51	0.020*
Abattoir workers	35	45		
	6	11		
Meat Vendors				
High rainfall				
Animal Health Officer	28	19	8.88	0.010*
Abattoir workers	30	50		
Meat Vendors	4	13		
High humidity				
Animal Health Officer	37	10	29.09	0.001*
Abattoir workers	25	55		
	5	12		
Meat Vendors				
High mosquito density				
Animal Health Officer	33	14	22.03	0.001*
Abattoir workers	22	58		
	8	9		
Meat Vendors				
Extensive husbandry management system				
Animal Health Officer	29	18	20.99	0.001*
	17	63		
Abattoir workers	7	10		
Meat Vendors				

*Significance at $p < 0.05$

DISCUSSION

One of the key risk factors for RVFV transmission is direct contact with the blood of infected animals during slaughtering processes, meat transportation, and handling procedures in abattoirs. In such environments, the virus can colonize carcasses, knives, tables, and other equipment, especially when hygiene is poorly maintained, posing a substantial risk of infection to both animals and humans through contact with contaminated surfaces and infected blood. Its zoonotic nature also poses a significant public health concern due to its ability to be transmitted among domestic animals, wildlife, and humans, particularly those in close contact with infected animals like the abattoir workers.

Earlier studies on RVFV conducted in Northern Nigeria in the eighties reported varied prevalence rates of 6.6% in sheep, 2.8% in cattle, and 1.0% in goats (Ezeifeke et al., 1982). However, in the twenties, Alhaji et al. (2020), reported a higher prevalence of 11.3% in cattle with seropositivity of RVFV IgM among pastoral cattle herds reported as 5.6%, with nomadic herds with 7.4% and agro-pastoral herds with 3.8%, this is also emphasized by Opayele et al. (2018), which reported 5.3% of seropositive for anti-RVFV IgG, and this low rate is also similar with our result of 1.1% based on seropositivity, and this prove the growing evidence of the virus's continued presence in Nigeria. The findings of Oragwa et al. (2023), which revealed a 13.7% prevalence, further proved that the silent but persistent circulation of RVFV in both human and animal populations. These observations strongly indicate that Nigeria remains at high risk of a future RVF outbreak, especially when environmental and ecological conditions become conducive for virus amplification and transmission.

There was no significant difference in the prevalence rate in females than males, both female and male animals sampled had a prevalence rate of 1.1% respectively, which is not consistent with earlier findings that female livestock are left to stay longer than male counterparts in the herd, resulting in longer periods of exposure to risks of infection (El-Mamy et al., 2011; Sumaye et al., 2013) and also similar to previous conclusion by Alhaji et al. that revealed that demographic factors such as sex were not significantly associated with RVFV occurrence (Alhaji et al., 2020). This study revealed an age specific prevalence rate of RVF virus to be 1.6% in adult animals of age group of more than one year and above while no positive sample was recorded in the young animals of 0–12 months old that were sampled in the study. Previous studies conducted in Nigeria by Adamu et al. 2021 and other African countries like Mozambique by Fafete et al. 2007 also reported different higher prevalence of 33.5%, 16.3%, 12.11%, 22.8% and 1.0% in sheep, cattle and goats, respectively in older animals. This reported prevalence in older animals can be associated with the animal's age as they have stayed longer in life and in the herd more than the younger ones

The socio-demographic features of the respondent represented in Table 4 showed that majority of the respondents 41% fell within the age bracket 21–30 and 74.3% of the respondents were male, and the highest population of respondent 39.6% had none formal education, 55.3% were abattoir workers, 38.2% of the respondents had more than 6 years of working experience in the abattoir and most of them keep livestock animals at home, and this is also similar with Alhaji et al., 2020 findings, which revealed that majority of the pastoralists that participated in their study were male, married, and lacked formal education, showing generally low awareness of zoonotic RVFV. Knowledge of the mode of transmission

and zoonotic nature of RVFV plays a vital role in guiding effective action plans focused on disease mitigation. We found the level of this knowledge to be low among the respondents. This may be due to a lack of proper dissemination of information by extension workers on best practices on preventing vector-borne diseases like RVF as reported by Shabani, *et al.* (2015) and Alhaji, *et al.* (2018) which is chiefly transmitted by *Aedes* and amplified by other arthropods. Furthermore, the observed low proportion of abattoir workers with awareness regarding RVF could result from an absence of informed programs earmarked for educating herders on emerging and re-emerging infectious diseases. Limited surveillance for emerging and neglected tropical diseases in parts of Nigeria can result in sporadic cases going unreported, which hinders overall public health responses. This can be done through public health education, surveillance, monitoring, reporting and sharing information between member countries. Low pastoralists knowledge about RVF zoonosis may be attributed to a low level of formal education, making them susceptible to potential risks of infection.

Some of the risky practices the abattoir workers engaged in that could predispose them to RVFV infection include slaughtering, evisceration and processing of raw meat without personal protective equipment (PPE) such as gloves, aprons, goggles, and gumboots (Tekki *et al.* 2012), as well as blowing air with their bare mouths into the subcutaneous tissue of small ruminants to enhance flaying, which is a common practice in many abattoirs in Nigeria. These behavioral practices, which are of public health significance, make the abattoirs and slaughterhouses high-risk environments that provide excellent prospects for transmission of disease agents from animals to humans. Data collected and analyzed in this study also showed that 54.9% of the respondents frequently eat while working in the abattoir, out of the respondents which 42.2% consumed raw or improperly processed meat and meat. The consequence of not properly processing meat and milk often results in consumption of infected meat and milk in animal products with 62.5% not using any protective clothing while working. This corroborates earlier suggested by Oragwa *et al.* (2023) that the more likely means of exposure of occupationally at-risk persons to RVFV infection were blood, bodily secretions and tissues of slaughtered infected animals rather than mosquito bites (Oragwa *et al.*, 2022). Moreso, it was observed, during the sample collection, that most of these butchers slaughtered, eviscerated and processed the animals without donning personal protective equipment, while some had open wounds from knife cuts on their hands, which increased their risk of contracting the virus through infected animal fluids and tissues (Oragwa *et al.*, 2022)..

As observed in this study, the widespread exposure of the respondents to mosquito bites more than 5 times daily calls for concern as the RVFV can be transmitted through bites. This can occur when people sleep and stay in mosquito endemic areas. Whereas 95.8% of the participants had experienced varying frequencies of mosquito bites in the last few years, only few 4.2% reported that they were not always bitten by mosquitoes; 44.4% experienced at least five mosquito bites daily, 22.9% experienced about 1–2 bites daily, and 28.5% experienced few bites weekly. The bite also leads to fever involvement sometimes as reported by 54.2% of the respondents while 33.3% reported they always experience fever following mosquito bite which may lead to human illness that will necessitate treatment by trained medical personnel. Besides, most participants 87.5% reported that they experienced intermittent illnesses over

the time (ranging from the time of sampling to few years in the retrospective), which sometimes involved fevers in 87.5% of them. Development of malaria-like symptoms during such illnesses was reported to occur “almost often” and “once in a while” by 33.3% and 51.4% of the participants, respectively. Following such illnesses, 58.3% of them reported that they did not visit any healthcare facility for malaria parasite test (i.e., microscopic examination of thick and thin blood smears) but rather embarked on self-medication with anti-malarial drugs. Only 39.6% of the participants reported impressive recovery following such medications while the rest did not.

The analysis of risk factors associated with Rift Valley Fever (RVF) infection among various occupational groups, including Animal Health Officers, Abattoir Workers, and Meat Vendors, reveals critical insights into the environmental and management conditions that facilitate the transmission of this zoonotic disease. The significant associations identified particularly with high temperature, rainfall, humidity, mosquito density, and extensive husbandry practices underscore the multifaceted nature of RVF epidemiology. High temperatures were found to be a significant risk factor for RVF infection, with a chi-square value of 7.51 and a p-value of 0.020. Similarly, high rainfall was significantly associated with RVF infection risk, evidenced by a chi-square value of 8.88 and a p-value of 0.010. This relationship is likely due to the creation of favorable breeding habitats for mosquitoes, as flooding can lead to increased standing water, which is conducive to mosquito reproduction (Oguntolu et al., 2022). The correlation between rainfall and RVF outbreaks has been documented in various regions, suggesting that monitoring precipitation patterns could be vital for predicting and controlling RVF risks (Kire, 2023; Tabassum et al., 2023). Humidity also emerged as a critical factor, with a chi-square value of 29.09 and a p-value of 0.001, indicating a robust association with RVF infection. High humidity levels prolong the survival of mosquitoes, thereby increasing the likelihood of virus transmission (Lapa, 2024; Alomar et al., 2023). This finding is supported by ecological studies that demonstrate how humidity interacts with temperature and rainfall to create optimal conditions for mosquito populations, which in turn enhances the risk of RVF outbreaks (Padmanaban et al., 2022; Alomar et al., 2023). This aligns with findings from recent studies indicating that elevated temperatures can enhance the survival and reproduction rates of mosquito vectors, such as *Aedes* and *Culex* species, which are known carriers of the Rift Valley fever virus (Lapa et al., 2023; Boko et al., 2022). Alhaji, et al. (2018) further revealed that several socio-ecological factors were significantly linked to RVFV occurrence, including the presence of mosquitoes, rivers/streams, high rainfall, irrigated rice fields, bushy vegetation, animal movement, and seasonal changes. They noted that these factors substantially increased the likelihood of RVFV transmission within herds, likewise frequent travel to significantly increased infection risk ($P = 0.004$). Furthermore, the role of temperature in vector ecology is emphasized by research that highlights how climate conditions directly influence mosquito population dynamics, thereby affecting the transmission potential of RVF (Connors & Hartman, 2022; Wang et al., 2022).

The analysis further identified high mosquito density as a significant risk factor, with a chi-square value of 22.03 and a p-value of 0.001. This finding corroborates existing literature that establishes a direct link between mosquito population density and the incidence of RVF, emphasizing the need for effective vector control strategies in high-risk areas (Hurk, 2024; Bron, 2023). The extensive husbandry

management systems were also highlighted, showing a significant association with RVF infection risk (chi-square value of 20.99, p-value of 0.001). Such systems often involve grazing livestock over large areas, increasing exposure to mosquito vectors (Ikegami et al., 2022; Kire, 2023). The integration of environmental and management factors into RVF prevention strategies is crucial, as these elements collectively influence the dynamics of disease transmission.

CONCLUSION

In conclusion, this study detected RVF antibodies in 1.1% of slaughtered cattle, confirming serological evidence of RVFV circulation in Nigeria Federal Capital abattoirs and slaughterhouses. Poor hygiene practices in abattoirs and lack of sanitation among stakeholders pose significant public health risks. The findings highlight the urgent need for nationwide RVF surveillance, improved meat handling practices, and cross-sectoral collaboration to enhance food safety, control RVF transmission, and ensure public health protection. We also recommend that, regular RVF screening, strict hygiene, public awareness, isolation of infected animals, use of barrier precautions, and integrated One Health surveillance are essential to prevent RVF spread in the nation. Further studies and stakeholder sensitization are also strongly recommended.

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Figures

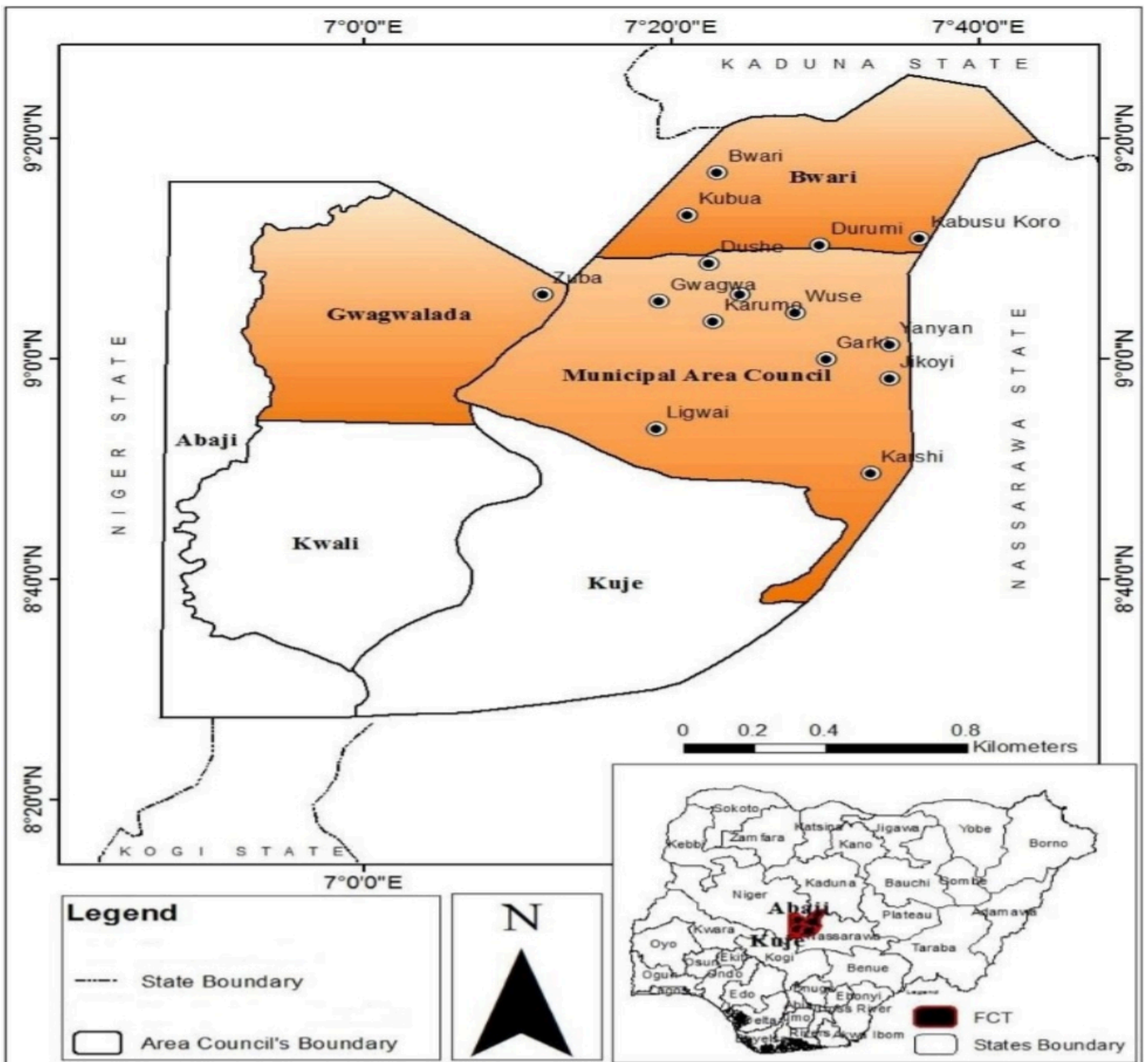


Figure 1

Map of the Federal Capital Territory, Abuja, Nigeria. source