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EVALUATION OF THE KNOWLEDGE, ATTITUDE AND PRACTICES ON ANTHRAX OF LIVESTOCK FARMERS IN TINKABERRI COMMUNITY, PORT LOKO DISTRICT, SIERRA LEONE

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ABSTRACT

Background: Anthrax, an infectious zoonosis caused by the spore-forming Bacillus anthracis, remains endemic in Sierra Leone. Recurrent outbreaks, including those in 1994 and 2022, threaten the livelihoods of rural livestock farmers and pose significant public health risks. Persistent transmission cycles are often fueled by inadequate carcass disposal, low vaccination coverage, and significant knowledge gaps. This study evaluated the knowledge, attitudes, and practices (KAP) of livestock farmers in Tinkaberri, Port Loko District, to inform targeted One Health interventions**.**

Methods: A cross-sectional survey was conducted among 50 livestock farmers in the Tinkaberri community. Participants were selected via convenience sampling based on specific inclusion criteria: age ≥18 years, livestock ownership, and residency ≥6 months. Data were collected using structured questionnaires covering sociodemographic, anthrax recognition (symptoms and transmission), attitudes toward outbreak response, and behavioral practices. Descriptive statistical analysis was performed using SPSS version 25.0, with results expressed as frequencies and percentages.

Results: The cohort was predominantly male (72%) and aged 18–50 years; 52% had no formal education. While 94% of respondents recalled the 2022 outbreak due to radio sensitization, deep technical knowledge was lacking: only 15% possessed comprehensive awareness of the disease. Regarding symptoms, 67% recognized human skin lesions and 50% identified sudden animal death, yet 60% remained unaware of broader animal symptoms. Knowledge of transmission was inconsistent; 78% identified contact with infected tissues, but only 7% and 4% identified inhalation and consumption, respectively. Crucially, 78% lacked knowledge of prevention methods. Despite these gaps, attitudes were positive, with high willingness to vaccinate. Reported practices showed improvement, with 74% avoiding the slaughter of suspect animals and a majority shifting toward carcass burial over inaction**.**

Conclusions: The 2022 outbreak served as a powerful catalyst for basic awareness and improved carcass management in Tinkaberri. However, profound deficits in knowledge regarding transmission routes and preventative measures maintain a high zoonotic risk profile. Sustained, multi-sectoral One Health strategies are essehtial. Future efforts should prioritize intensified

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community sensitization via radio and door-to-door campaigns, subsidized vaccination programs, and the formalization of outbreak reporting protocols to safeguard both animal and human health in endemic regions.

Keywords: Anthrax, One Health, Zoonosis, Livestock Farmers, Sierra Leone, KAP Study.

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INTRODUCTION

Anthrax is a formidable zoonotic disease caused by the spore forming Gram positive bacterium Bacillus anthracis (Fasanella et al., 2010). With a history deeply intertwined with human civilization, it remains a persistent threat to global public health. While its profile was elevated internationally following the 2001 bioterrorism attacks in the United States, where aerosolized spores caused 22 cases and 5 deaths, the primary impact of the disease is felt in endemic developing regions (Goel, 2015). In these settings, B. anthracis typically afflicts herbivores through the ingestion of soil borne spores, subsequently spilling over into human populations via occupational exposure during farming, butchery, and tanning (Dixon et al., 1999; Demirdag et al., 2003; Hendricks et al., 2022). Human infection manifests in three primary clinical forms: cutaneous, which accounts for 95 percent of cases and features a characteristic black eschar, gastrointestinal, and the highly lethal inhalational form.

In sub Saharan Africa, where livestock sustains rural economies, anthrax outbreaks exhibit marked seasonality linked to drought flood cycles that expose dormant spores (Munangandu et al., 2012; Lembo et al., 2011; Hoffmann et al., 2017). Sierra Leone exemplifies this burden. Despite the critical role of livestock in providing food security and economic stability for its 7 million citizens, the country has endured recurrent epizootics, including in 1994 and the severe 2022 outbreak in Port Loko and Karene Districts (Morens et al., 2008; Shivachandra et al., 2016). That event resulted in the loss of 223 animals and triggered human infections, exposing critical vulnerabilities such as poor surveillance and underreporting driven by economic fears of quarantine (Raymond et al., 2010; WHO, 2008; Ahmed et al., 2010).

The persistence of anthrax in Sierra Leone is driven by a cycle of environmental contamination and risky agricultural practices. Farmers, often resorting to slaughtering sick animals to recoup financial losses, unwittingly facilitate transmission through contaminated meat and hides, while improper carcass disposal fosters resporulation (Hossain et al., 2015; Dey et al., 2020; Turnbull et al., 1999). Effective management requires a multisectoral One Health approach integrating veterinary, medical, and environmental surveillance. While tools such as ciprofloxacin for humans and Sterne live attenuated vaccines for livestock are available, their impact is often limited by veterinary shortages and low vaccine uptake in resource limited settings (Kamal et al., 2011; Weiss et al., 2015; Friedlander et al., 1999).

Global patterns show similar trends from Zimbabwe to Zambia, yet Sierra Leone lags in community level data, with few prior assessments of knowledge, attitudes, and practices amid endemicity (Hendricks et al., 2014; Mondal and Yamage, 2014; Blackburn et al., 2021). Although post 2022 radio sensitization elevated outbreak awareness, it failed to bridge deficits in symptom recognition and prevention (Ihekweazu et al., 2021; Gelaw and Asaminew, 2013). This void hampers evidence based policymaking by the Ministries of Agriculture and Health, who require localized insights to deploy targeted measures such as house to house education and subsidized vaccines (Mukarati et al., 2020; Monje et al., 2020).

The present cross sectional study addresses this imperative by evaluating the knowledge, attitudes, and practices among livestock farmers in Tinkaberri Community, Port Loko District, which served as a focal point for the 2022 outbreak. The primary aim was to assess the

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community understanding of anthrax etiology, clinical manifestations in both humans and animals, and modes of transmission, while determining how these factors influence behaviors during outbreaks, including carcass disposal and reporting. By evaluating attitudes toward vaccination and quarantine alongside current husbandry risks, this research provides the localized evidence necessary to inform scalable One Health strategies that avert future zoonoses and protect rural livelihoods.

METHODS

Study Design and Population

Adopting a cross-sectional survey design, the investigation targeted livestock owners and residents in Tinkaberri, a community within Port Loko District, Northern Sierra Leone's most populous administrative unit (614,063 inhabitants per 2015 census; updated 2022 projections indicate sustained density). Encompassing 5,719 km² and 11 chiefdoms; predominantly Temne Muslim demographics the district borders Western Area (west), Kambia (north), Bombali (east), and Tonkolili (south), with Port Loko town as capital and Lusar its largest city. Purposive sampling prioritized outbreak-affected farmers for face-to-face interviews post-verbal consent, emphasizing comparability across knowledge levels; participants received multilingual explanations (English, Krio, Temne, Fula) with assurances of confidentiality and study-exclusive data use.

Sample Size Determination

A sample of 50 respondents sufficed for Tinkaberri's scale, adjusted from district-wide estimates via Fisher's formula for infinite populations:

$$n = \frac{z^2 pq}{d^2}$$

Where
z=1.96 (95% confidence),
p=0.29 (prevalence per Bylaiah et al., 2021)
q=1−p= 0.71
d=0.05 (precision)
Yielding n≈316. Locale-specific constraints (limited owners) warranted downsizing, aligning with feasibility while preserving representativeness

Inclusion and Exclusion Criteria

Inclusion: Livestock farmers/community members in Tinkaberri Chiefdom (anthrax-reported site), residency ≥6 months. Exclusion: Non-residents or those outside affected chiefdoms, ensuring focus on high-risk cohorts.

Data Collection Instrument and Procedure

The pre-piloted questionnaire featured four validated segments:

Sociodemographic.

Knowledge

Attitudes

Practices

Data Management

Raw data transcribed to password-protected Microsoft Excel spreadsheets; duplicates excised, internal consistency verified (e.g., cross-field logic), and quality audited per variable for completeness/accuracy.

Data Analysis

Descriptive analytics via IBM SPSS Statistics v25.0: frequencies, percentages tabulated for sociodemographics/KAP domains; charts/tables visualized trends (e.g., knowledge levels: detailed/basic/general/misinformed/none). No inferential tests applied, prioritizing prevalence

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snapshots.

Ethical Considerations

Institutional approvals procured from COMAHS-USL Dean (Faculty of Clinical Sciences), MoHS, ONS, and EPA-SL. Principled conduct upheld respondent autonomy/dignity via informed verbal consent, strict privacy (no identifiers), and anonymized reporting; GPS geocoded sites ecologically without personal linkage; data restricted to publication. No animal interventions occurred, mitigating welfare concerns.

RESULTS

The study evaluated the knowledge, attitudes, and practices among livestock farming communities on anthrax in animals and humans in Port Loko district, Sierra Leone. Table 1 shows the sociodemographic characteristics of participants. Old Adults and retired comprised 44% of the participants. Males comprised 72 % of the respondents from the survey. 52 percent of the respondents had no schooling with 20 % having some tertiary education. Also 84 % of the respondents said they were traders.

Table 1: Sociodemographic characteristics of respondents

Variable	Frequency	Percentage
Age		
Youth	11	22
Adult	11	22
Old adult	7	14
Young adult	6	12
Retired	15	30
Gender		
Male	36	72
Female	14	28
Educational level		
No schooling	26	52
Primary	1	2
Secondary	10	20
Tertiary	10	20
Postgraduate	1	2
Other	6	12
Occupation		
Farmer	1	2
Trader	42	84
Self employed	3	6
Government employed	2	4
Other	2	4
Knowledge on anthrax		
Detailed knowledge	6	15
Basic knowledge	10	26
Misinformation	2	5
No knowledge	11	28
General awareness	10	26

Knowledge of anthrax among respondents

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The knowledge of anthrax was tested among the respondents in Tinkaberi community, Port Loko District. As shown in table 1 and figure 2, 28 percent of the respondents indicated they had no knowledge of anthrax. Twenty six percent had basic knowledge, 26 percent had general awareness, and five percent were misinformed. Fifteen percent of the respondents reported having detailed knowledge of anthrax

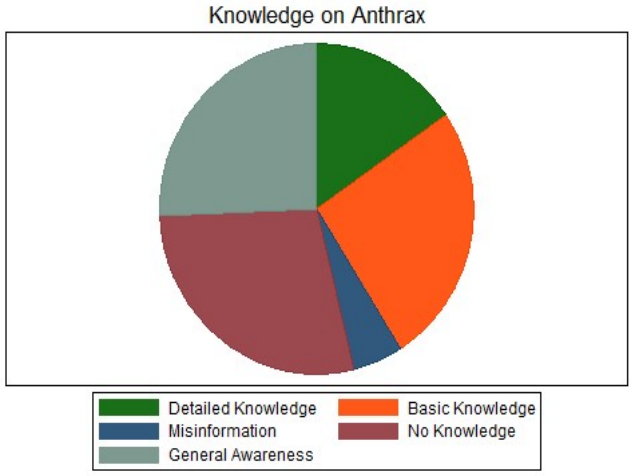

Fig 2. Knowledge on Anthrax among Livestock Farmers in Tinkabereh Community

Respondents specific knowledge of anthrax symptoms, mode of transmission, and prevention was also tested (Table 2). Forty-four percent of the respondents reported neighbors as their source of information. Also, 38 percent reported veterinary officers as their source of information on anthrax. For knowledge about symptoms of animals, respondents were more aware of sudden death (50%), followed by bleeding from orifices (24 %), bloating (17 %), don't know (5 %), while absent of rigor mortis and no symptoms accounted for 2 % each. For knowledge of human anthrax symptoms, more respondents were aware of skin lesions (67 %), but less so for severe cough (4 %), severe diarrhoea (4%), Maddness (4%), inflammation (4%). Fifteen percent indicated they don't know about symptoms in human and 4% said no symptoms in human. Surprisingly, 60 % of respondent indicated they don't know about symptoms of anthrax in animals, 22 % said yes to having knowledge, and 18 % said they have no knowledge of animal anthrax (Table 2). For knowledge on mode of transmission of anthrax from animal to human, 78 % responded contact with infected tissues, followed by don't know (11%), inhalation of bacterial spores (7 %), and eating meat from dead carcasses (4 %). In addition, for knowledge about anthrax prevention, more respondents indicated they don't know (78 %), followed by yes (12 %), and no (10 %) (Table 2). Furthermore, majority of respondents said avoiding contact with dead animal fluid (63 %) is a method for preventing anthrax disease. Fifteen percent of respondents said burying dead animals is a method for preventing anthrax disease. Six percent of respondents said they don't know of preventive methods for anthrax, while others said eating inspected meat (6 %) and not skinning suspected animals as a method of prevention. A smaller number of respondents said they used other methods of prevention (2 %) and no known prevention methods (2 %).

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Table 2: Response of participants pertaining to their knowledge towards anthrax

Variable	Frequency	Percentage
Source of information about anthrax		
Health officers	3	6
Local market	3	6
Neighbors	22	44
Not applicable	2	4
Quack	1	2
Veterinary officers	19	38
Knowledge about symptoms of animal		
Absent of rigor mortis	1	2
Bleeding from orifices	10	24
Bloating	7	17
Don't know	2	5
No symptoms	1	2
Sudden death	21	50
Knowledge about symptoms of human		
Don't know	4	15
Skin lesions	18	67
Severe cough	1	4
Severe diarrhea	1	4
Gets mad	1	4
Inflammation	1	4
No symptoms	1	4
Knowledge about symptoms of animal anthrax		
No	9	18
Yes	11	22
Don't know	30	60
Knowledge on mode of transmission of anthrax from animal to human		
Contact with infected tissues	21	78
Eating meat from dead carcasses	1	4
Inhalation of bacteria spores	2	7
Don't know	3	11
Knowledge about anthrax prevention		
Yes	6	12
No	5	10
Don't know	39	78
Knowledge about preventive method of anthrax (vaccination)		
Contact with dead animal fluid	30	63
Burying dead animals	7	15
Eating inspected meat	3	6
Not skinning suspect animals		
Don't know		
No prevention known		
other		

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Quack	1	2
Veterinary Officers	19	38
Knowledge about symptoms of animal		
Absent rigor mortis	1	2
Bleeding from orifices	10	24
Bloating	7	17
Don't Know	2	5
No symptoms	1	2
Sudden death	21	50
Knowledge about symptoms of human		
Don't know	12	20
Skin lesions	34	68
Severe cough	2	4
Severe diarrhoea	1	2
Gets mad	1	2
Inflammation	1	2
No symptoms	1	2
Knowledge about symptoms of animal anthrax		
No	9	18
yes	11	22
Don't know	30	60
Knowledge on mode of transmission of anthrax from animal to human		
Contact with infected tissues	39	78
Eating meat from dead carcasses	2	4
Inhalation of bacteria spores	4	7
Don't know	3	11
Knowledge about anthrax prevention		
Yes	6	12
No	5	10
Don't know	39	78
Knowledge about preventive method of anthrax (Vaccination)		
contact with dead-animal fluid	30	60
Burying dead animals	7	15
Eating inspected meat	3	6
Not skinning suspect animals	3	6
Don't Know	3	6
No prevention known	1	2
Other	1	2

The attitude and practice of respondents

The attitude and practices of the livestock farming community respondents was also tested (Table 3). Ninety-four percent of the respondents were aware of the May 2022 anthrax disease outbreak in their community. Sixty percent reported their source of awareness was from personal farm affected, 26 % through radio, 12 % through local authority sensitization, and 2% through religious leaders. For what support they can offer in the event of another outbreak of anthrax disease, 54 % of respondents said they will participate in sensitization outreach, 36 % said they will inform authority about it, while 8% said they will do nothing (Table 3). For vaccination of animals to prevent anthrax disease, 70 percent of respondents said they would vaccinate to prevent the disease. For livestock farming practices that are linked to anthrax disease transmission, 74 percent of respondents said they were not involved in slaughtering, while 26 % said they were involved in slaughtering. A significant majority of respondents said they will bury the carcass of anthrax infected dead animals, 18 % said they will do nothing, dispose of via burning (4 %), and 4 % said they will allow cobbler for skinning.

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Table 3: Attitude and practices of respondents towards anthrax

Theme	Variable	Frequency	Percentage
Attitude			
	Are you aware of the may 2022 Anthrax disease outbreak		
	Yes	47	94
	No	3	6
	If yes how?		
	Sensitization by local authority	6	12
	Radio	13	26
	Personal farm affected	30	60
	Through religious leader	1	2
	What support can you offer in the event of another outbreak of anthrax disease		
	Inform authority about the outbreak	18	36
	Participate in sensitization outreach	27	54
	Provide	1	2
	None	4	8
	Vaccination of animals against anthrax		
	Yes	35	70
	No	15	15
Practice			
	Participation of respondents in affected animal slaughtering		
	Not involved in slaughtering	37	74
	Involved in slaughtering	13	26
	Carcass management		
	Buried	37	74
	Dispose of via burning	2	4
	Allow cobber for skinning	2	4
	Do nothing	9	18

DISCUSSION

The 2022 anthrax outbreak in the Tinkaberri Community of the Port Loko District was a pivotal event that caused substantial livestock losses and exposed the fragile intersection of animal health and human safety in Sierra Leone. This study evaluated the current knowledge, attitudes, and practices of livestock farmers to provide the empirical evidence needed for effective One Health interventions (Fasanella et al., 2010; Morens et al., 2008). Our findings reveal a community in transition where high awareness of recent trauma has begun to shift behaviors, yet profound technical knowledge deficits remain that could jeopardize future containment efforts.

The demographic profile of the respondents reflects the socio economic reality of rural livestock herding in Sierra Leone. The predominance of male participants at 72 percent is consistent with gender norms in livestock herding where women less frequently head households, and the finding that 52 percent of the cohort lacks formal education mirrors patterns observed in comparable African KAP studies (Sitali et al., 2017; Traxler et al., 2019; Mesfin et al., 2021). This high rate of illiteracy is a critical factor in public health communication, as it often constrains the comprehension of technical disease information and increases reliance on informal peer networks rather than formal veterinary guidance (Dutta et al., 2021).

A stark knowledge gap was identified in our results. While 94 percent of respondents recalled the 2022 outbreak through personal loss or radio sensitization, only 15 percent demonstrated detailed anthrax understanding. This level of technical awareness is significantly lower than the 58 percent adequate knowledge reported among Zambian pastoralists (Sitali et al., 2017). Furthermore, the primary source of information was neighbors at 44 percent followed by veterinary officers at 38 percent. This peer dominated flow of information is common in resource limited

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settings but presents a risk for the spread of misconceptions regarding disease prevention (Dutta et al., 2021).

Clinical recognition of the disease remains inconsistent. While 50 percent of farmers identified sudden animal death as a symptom, 60 percent were unaware of broader signs such as bleeding or bloating, which is lower than the awareness levels found in studies of Indian farmers (Dutta et al., 2021). In contrast, human cutaneous lesions were correctly identified by 67 percent of participants, aligning with visible zoonotic manifestations that are more easily recognized by the public (Mesfin et al., 2021). Transmission knowledge showed partial penetration; 78 percent identified tissue contact as a risk, yet 78 percent also lacked knowledge of prevention methods. This contrast suggests that while farmers recognize the danger of contact, they do not yet understand how to stop an outbreak through vaccination or reporting.

Despite these cognitive gaps, the study observed a promising translation of awareness into practice. The 2022 crisis appears to have catalyzed safer behaviors, with 74 percent of farmers now avoiding the slaughter of suspect animals. Furthermore, 78 percent of respondents favored deep burial over inaction or burning, suggesting that sensitization can drive risk reduction even when technical comprehension is incomplete (Sitali et al., 2017; Traxler et al., 2019). The attitudinal shift was equally significant; 70 percent of farmers expressed support for livestock vaccination and 36 percent showed a willingness to notify authorities. These figures indicate a reduction in vaccine hesitancy amid the perceived threat of the disease (Mesfin et al., 2021).

The strengths of this study include its community embedded approach, capturing real time dynamics in a hard to reach setting following a major health event. However, several limitations must be noted. The localized nature of the Tinkaberri sample limits the generalizability of the findings to other districts. Additionally, the reliance on self-reported data introduces potential recall bias or social desirability bias. While the sample size of 50 was modest, the application of Fishers formula validated the adequacy of the data for this specific population (Bylaiah et al., 2021).

In conclusion, while the 2022 sensitization catalyzed attitudinal and practice gains amid endemic knowledge voids, sustained multisectoral One Health action is imperative. We recommend the implementation of multilingual radio campaigns and house to house education alongside subsidized Sterne vaccines and expanded veterinary extension services. Only through a comprehensive approach can Sierra Leone fortify its rural communities and safeguard livelihoods against the recurrence of this resilient pathogen (Turnbull et al., 1999; Blackburn et al., 2021).

COMPETING INTERESTS

All the authors involved in writing the content of this manuscript and disclosed no conflicts of interest whatsoever.

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