Mambilla Journal of Science and the Environment Vol. 9, Issue 2, Page No. 114-121

MAMBILLA JOURNAL OF SCIENCE AND THE ENVIRONMENT

journal homepage: https://oer.tsuniversity.edu.ng/index.php/mjse

PREVALENCE AND ASSOCIATED RISK FACTORS OF *Taenia* SPECIES IN CATTLE SLAUGHTERED AT JALINGO ABATTOIR, TARABA STATE, NIGERIA

[1*] Nuhu, A., [1] Wama, B.E.

[1]Department of Biological Sciences, Taraba State University, Jalingo-Nigeria.

ARTICLE INFO

Article history:
Received 15 August 2025
Received in revised form 25 August 2025
Accepted 28 August 2025

Keywords:
Abattoir, *Taenia*, Prevalence, Jalingo metropolis, Cattle, Risk Factors.

ABSTRACT

Taeniasis, caused by *Taenia* species, poses significant public health and economic concerns in Nigeria, where cattle serve as intermediate hosts for *Taenia saginata*. This study assessed the prevalence of *Taenia* spp. in cattle slaughtered at Jalingo abattoir, Taraba State, and explored associated risk factors. A cross-sectional abattoir survey was conducted on 218 cattle through antemortem assessment and postmortem inspection of the stool. Structured questionnaires were also administered to cattle owners, butchers, and handlers to evaluate knowledge and management practices. Data were analysed using descriptive statistics and chi-square tests at a 5% significance level. The overall prevalence of *Taenia* spp. was 50.9% (111/218). Male cattle had higher prevalence (71.7%) compared to females (28.6%), while Sokoto Gudali (28.4%), Red Bororo (27.1%), and White Fulani (24.3%) were the most affected breeds. Infection was more common in cattle over two years of age. Questionnaire results highlighted key risk factors: low deworming practices (34.4%), grazing on land exposed to human waste (45.9%), and reliance on surface water sources. Awareness was limited, with only 45.0% of respondents recognizing the zoonotic nature of *Taenia* spp., and nearly half admitting to consuming undercooked beef. The findings reveal a high prevalence of taeniasis at Jalingo abattoir, underscoring risks to food safety and public health. Improved abattoir inspection, regular deworming, sanitation measures, and public education are essential for controlling transmission and safeguarding meat consumers.

1. Introduction

Taeniasis is a parasitic disease caused by tapeworms of the genus *Taenia* and remains a significant public health concern and economic burden in many parts of the world, particularly in tropical and subtropical regions. Cattle serve as the intermediate host for *Taenia saginata*, one of the most common species, and play a crucial role in the transmission of the parasite to humans (Murrell, 2005). Taeniasis and cysticercosis are recognised as important neglected zoonoses at the human–animal interface, driven by gaps in food safety, sanitation challenges, and complex livestock value chains. In cattle, infection with the larval stage of *T. saginata* leads to carcass downgrading, organ condemnation, and processing delays, resulting in notable economic losses for abattoirs and the beef sector, even though infected animals are usually asymptomatic. In humans, taeniasis acquired from eating undercooked infected beef is often mild, but it sustains the parasite's transmission cycle and contributes to public health and economic costs in endemic settings. The World Health Organization lists taeniasis/cysticercosis as a condition requiring coordinated "One Health" interventions across veterinary, environmental, and public health domains, with meat inspection, improved sanitation, and health education identified as core strategies (WHO, 2020). Transmission occurs when human faeces containing tapeworm eggs contaminate pastures or water sources. Cattle grazing on contaminated fields or drinking infected water ingest the eggs, which develop into cysticerci within muscle tissue. Humans complete the cycle by consuming inadequately cooked beef containing viable cysts, leading to adult tapeworm development in the gastrointestinal tract (Garcia *et al*., 2014). Diagnosis of taeniasis in humans is primarily through stool examination for eggs, though species identification requires examination of the scolex or gravid proglottids due to morphological similarities among *Taenia* eggs (Larry *et al*., 2009).

Across Africa, and in parts of Asia and Latin America, abattoir studies consistently detect bovine cysticercosis, with prevalence influenced by factors such as husbandry practices, meat inspection capacity, sanitation standards, and

* Corresponding author. Tel.: +2348030627210
E-mail address: amainyaunuhu01@gmail.com

consumer habits; even modest infection rates result in substantial economic losses from carcass condemnation, cold storage for cyst viability checks, and trimming of predilection sites, as illustrated by a Kaduna State study reporting a 37.7% prevalence and annual losses of about ₦92 million (Kadir *et al*., 2025), while Nigerian surveys show prevalence in cattle and humans ranging from 26.2% in south-eastern multi-abattoir studies to lower figures elsewhere, reflecting regional differences in sourcing, seasonal patterns, and inspection rigour (Fabiyi & Adamu, 2015; Nyifi *et al.*, 2024). In Taraba State, evidence from livestock value chains indicates ongoing transmission risks. A 2024 study in Wukari detected porcine cysticercosis in slaughtered pigs, pointing to environmental contamination and food safety gaps relevant to bovine exposure. Earlier findings from the Ibi slaughterhouse also confirmed *Taenia* spp in cattle, signalling active local transmission cycles. Jalingo, the state capital, is a hub for cattle rearing and beef consumption, with its main abattoir processing large volumes daily for local and regional markets. However, concerns remain over hygiene practices, insufficient inspection protocols, and potential contamination with parasitic infections such as *Taenia* spp. A study by Onah and Chiejina (2008) documented widespread taeniasis across Northern Nigerian abattoirs, underscoring the urgency for improved sanitary and inspection measures.

Globally, recent analyses continue to highlight taeniasis as persistent food-borne and occupational hazards with measurable health and economic impacts in both low- and high-income countries. Even in regulated markets, *T. saginata* imposes costs due to enhanced inspection and cold treatment requirements for suspected carcasses (Dadios *et al*., 2024).

Against this background, assessing *Taenia* spp. in cattle slaughtered at the Jalingo abattoir is both timely and significant. This study will provide current prevalence estimates, identify commonly affected carcass sites, and assess potential economic losses. The findings will inform practical improvements in meat inspection, hygiene, and public health awareness, contributing to regional One-Health strategies that protect consumers, safeguard livelihoods, and reduce waste in the beef value chain.

2. Materials and Methods

2.1 Study Area

The study was conducted at the Jalingo Abattoir, located in Jalingo, the capital city of Taraba State, Nigeria. Jalingo is situated in the North-Eastern part of Nigeria and served as a major hub for livestock trade and slaughter activities within the state and surrounding regions.

Jalingo is located at approximately latitude 8.90°N and longitude 11.37°E. Covering an area of about 190.4 km², it served as a key administrative and commercial center in the region. As of 2025, Jalingo had an estimated population of 438,971 (Population Hub, 2025). The city experienced a tropical savanna climate, characterized by a hot, partly cloudy dry season and an oppressive, cloudy wet season. Average temperatures ranged from 16°C to 37°C, with annual rainfall concentrated between May and October. Jalingo shared borders with Ardo-Kola, Lau and Yorro Local Government Areas. The Jalingo main Abattoir served as a primary site for livestock slaughtering in the state capital, it had been operational for over 35 years but faced challenges related to waste and facilities maintenance. The abattoir processed a significant number of animals daily, including approximately 50–55 cattle daily (Oruonye, 2015).

2.2 Study Design

A cross-sectional abattoir-based study was employed, with data collected at a single point in time across consecutive slaughter days. Information was obtained through systematic post-mortem meat inspection, with optional laboratory confirmation for *Taenia* spp., alongside a brief interviewer-administered questionnaire administered to owners, traders, butchers, and handlers to assess risk factors, public health and economic implications, as well as potential control options.

2.3 Study Population

The population comprised all cattle presented for slaughter at Jalingo Abattoir during the study period. Respondents for the questionnaire were owners, traders/agents, butchers, or handlers accompanying animals on the day of slaughter.

2.4 Sample and Sampling Technique

A systematic random sampling technique was adopted for the selection of cattle for examination. During each day of the sampling period, every nth cattle presented for slaughter was selected for detailed postmortem examination until the desired sample size was achieved. The sampling interval (n) was determined by dividing the average daily number of cattle slaughtered by the number of cattle to be sampled per day. This method ensured that each animal had an equal chance of being selected and helped in obtaining a representative sample of the cattle slaughtered at the abattoir.

2.5 Data Collection
Data collection involved both antemortem and postmortem inspection procedures conducted by trained personnel.

2.5.1 Antemortem Inspection
Prior to slaughter, selected cattle underwent routine antemortem inspection as practiced at the abattoir. General observations were made on the physical condition of the animals, including signs of illness, emaciation, abnormal gait, or any other visible clinical signs that might have been indicative of a parasitic infection or other diseases. Relevant demographic data such as apparent breed, sex, and estimated age (based on dentition or general appearance) were also recorded.

2.5.2 Postmortem Inspection
Following slaughter, the carcasses and organs of the sampled cattle were subjected to thorough postmortem inspection for the presence of *Taenia* spp. This involved;

Visual Examination: The surface and cut sections of these organs were meticulously examined for small, bladder-like cysts that may be translucent, whitish, or greyish.

Palpation: Affected muscles were also palpated to detect deeper, embedded cysts that may not be immediately visible

Recording of Findings: The number, size, and location of any observed cysts were recorded. Cysts were also classified as live (clear fluid, intact bladder), degenerate (caseous, calcified), or dead.

2.5.3 Specimen Collection and Identification
All suspected *Taenia* spp. metacestodes found during postmortem inspection were carefully excised and collected. Each collected cyst was placed in a labeled container with 10% neutral buffered formalin for preservation.

2.5.4 Questionnaire
A structured questionnaire was designed to gather information on socio-demographic characteristics, potential risk factors associated with taeniasis in cattle such as age, sex, breed, and origin, to provide data to inform the development of effective control strategies against taeniasis in cattle, and to investigate the risk factors associated with taeniasis in cattle.

2.6 Laboratory Analysis
i. From each selected cattle, a sample of stool was collected immediately after slaughter.
ii. The samples were labelled and placed in sterile sample bags to avoid contamination.
iii. The samples were examined under a microscope for confirmation metacestodes.
iv. Data on infection status (positive/negative) was recorded for each animal.

2.7 Data Analysis
All collected data (from both postmortem inspection and questionnaires) were entered into a Microsoft Excel spreadsheet and subsequently analysed using appropriate statistical software SPSS version 26.0. Descriptive statistics were used to summarize the data, including frequencies and percentages for qualitative variables (e.g., prevalence rates, location of cysts, responses to questionnaire items) and means and standard deviations for quantitative variables (e.g., age of cattle, respondent age).

The prevalence of *Taenia* spp. was calculated as the percentage of infected cattle out of the total number of cattle examined. Associations between the presence of *Taenia* spp. metacestodes and various risk factors (e.g., age, sex, breed, body condition, and management practices gathered from the questionnaire) were assessed using the Chi-square (χ^2) test. A p-value of less than 0.05 ($p<0.05$) was considered statistically significant.

3. Results
Table 1: Prevalence of *Taenia* spp. in Cows at Jalingo Abattoir

Sex	Positive (% within sex)	Negative (% within sex)	Total (% of sample)
Male	81 (71.7%)	32 (28.3%)	113 (51.8%)
Female	30 (28.6%)	75 (71.4%)	105 (48.2%)
Total	**111 (50.9%)**	**107 (49.1%)**	**218 (100.0%)**

Table 2: Potential Risk Factors Associated with Taenia spp. in Cattle such as Age, Sex and Breed at Jalingo Abattoir

Item	Frequency	Percentage (%)
Primary breed		
Red Bororo	59	27.1
Sokoto Gudali	62	28.4
White Fulani (Zebu)	53	24.3
Other	44	20.2
Age range		
>4 years	88	40.4
2–4 years	98	45.0
<2 years	32	14.6
Cattle source		
Markets	54	24.8
Neighbouring states	53	24.3
Jalingo & surroundings	60	27.5
Other	51	23.4
Parasitic treatment		
Only when sick	86	39.4
Regularly	75	34.4
Never	57	26.1
Water source		
Ponds	54	24.8
Rivers/streams	84	38.5
Boreholes/wells	47	21.6
All of the above	33	15.1
Grazing in human waste-exposed areas		
Don’t know	51	23.4
No	67	30.7
Sometimes	54	24.8
Yes, often	46	21.1
Last deworming		
Never	54	24.8
>6 months	47	21.6
3–6 months	66	30.3
Within 3 months	51	23.4
Body condition		
Fat	40	18.3
Good	39	17.9

Item	Frequency	Percentage (%)
Moderate	52	23.9
Thin	52	23.9
Emaciated	35	16.1
Shared grazing		
Don't know	49	22.5
Private	55	25.2
Sometimes	57	26.1
Frequently	57	26.1
Waste handling		
Collected & disposed	67	30.7
Used as manure	52	23.9
Left to decompose	59	27.1
Other	40	18.3
Undercooked/raw beef consumption		
Not applicable	45	20.6
No	72	33.0
Occasionally	48	22.0
Yes, often	53	24.3
Household history of taeniasis		
Don't know	90	41.3
No	55	25.2
Yes	73	33.5

Table 3: Public health and economic implications of *Taenia* infection in cattle slaughtered at Jalingo Abattoir

Variable	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
Hygiene_Sanitation	1.8%	9.2%	13.3%	44.6%	31.0%
Owners_Preventive	1.8%	6.6%	18.1%	36.2%	37.3%
Education_Control	0.7%	12.2%	13.7%	37.3%	36.2%
Support_Inspection	0.7%	10.7%	14.0%	39.5%	35.1%
Preventive_Effect	1.8%	5.5%	10.0%	49.4%	33.2%
Awareness_Control	2.2%	7.0%	11.4%	40.6%	38.7%
Strict_Inspection	1.1%	7.4%	15.9%	38.7%	36.9%
Support_Gov_Regulations	0.7%	7.0%	15.1%	41.3%	35.8%

Table 4: Effective Control Strategies of *Taenia* spp. in Cows at Jalingo Abattoir

Item	Frequency	Percentage (%)
Are you aware that tapeworms (Taenia spp.) can infect both cattle and humans?		
Yes	98	45.0
No	120	55.0
Total	**218**	**100.0**
How do you currently handle cattle that appear sick or underweight before slaughter?		
I do nothing	73	33.5
I sell them	77	35.3
I separate and treat them	68	31.2
Total	**218**	**100.0**
What is the typical method of human waste disposal in the community where your cattle graze?		
I don't know	42	19.3
Communal pits	62	28.4
Open defecation	55	25.2
Flushing toilets	59	27.1
Total	**218**	**100.0**
How often do you receive information or training on animal health and disease prevention?		
Never	59	27.1
Sometimes	84	38.5
Regularly	75	34.4
Total	**218**	**100.0**
What do you believe is the biggest challenge in preventing diseases like Taeniasis in cattle?		
Inadequate sanitation	57	26.1
Cost	50	22.9
Lack of knowledge	57	26.1
All of the above	54	24.8
Total	**218**	**100.0**

4. Discussion

This study found a high overall prevalence of *Taenia* spp. among slaughtered cattle (50.9%), highlighting the continuing public health and economic challenge posed by bovine cysticercosis in Nigeria. This level of infection aligns with reports by Ademola & Onyiche, (2013) and Luka *et al.,* (2017) who reported prevalence rates ranging from 30% to 60%. Luka *et al.* (2017) reported 45.6% prevalence in Plateau State abattoirs, while Abah and Arene (2015) documented 53.2% prevalence in Port Harcourt. However, the prevalence in this study is markedly higher than the 23.3% reported in Ibadan (Opara *et al.,* 2012) and the 28.4% recorded in Maiduguri (Okoli *et al.,* 2016), suggesting strong regional variation possibly linked to environmental sanitation, cattle management practices, and veterinary services access.

A striking finding in this study was the significant difference in prevalence between male (71.7%) and female (28.6%) cattle. This sex-related disparity has been reported in several Nigerian studies. For instance, Pam *et al.* (2013) found higher infection in males (64.2%) compared with females (35.8%) in Plateau State, attributing this to longer periods of grazing exposure since males are often kept for draft or sold later, increasing cumulative risk. Similarly, Opara *et al.* (2012) observed that males used for labour had higher infection rates, a pattern consistent with our findings. By contrast, some studies outside Nigeria, such as Kebede *et al.* (2009) in Ethiopia, reported higher infection in females, which they associated with reproductive stress and longer lifespan in herds. These variations highlight the influence of cultural livestock management practices on transmission risk.

Breed-related prevalence patterns in this study (Sokoto Gudali 28.4%, Red Bororo 27.1%, White Fulani 24.3%) reflect the dominance of these breeds in northern Nigeria. Similar breed distributions were noted in reports from Zaria (Ademola & Onyiche, 2013) and Plateau (Luka *et al.*, 2017). The predominance of infection among animals aged ≥2 years is also consistent with earlier findings in Nigeria and Ethiopia (Abunna *et al.,* 2008; Okoli *et al.*, 2016), where older animals accumulate exposure to contaminated grazing environments. The sourcing of animals from both local

and neighbouring states (24–28%) further complicates the epidemiological picture, suggesting that abattoir findings reflect transmission dynamics across wider geographic networks, as similarly observed by Abah and Arene (2015).

Management practices documented in the survey offer plausible explanations for the high prevalence. Only 34.4% of respondents reported regular anthelmintic use, while 26.1% never deworm their cattle. Similar poor compliance with routine deworming has been reported in Bauchi and Plateau States (Pam *et al.*, 2013; Luka *et al.*, 2017). The reliance on surface water (rivers, ponds) and the widespread use of communal grazing lands, often contaminated with human faecal matter, provide optimal conditions for the persistence and spread of *Taenia* eggs. Comparable associations between open defecation, poor sanitation, and cysticercosis prevalence have been reported in Nigeria (Opara *et al.*, 2012) and Ethiopia (Kebede *et al.*, 2009).

Only 45% of respondents recognised the zoonotic potential of tapeworms, and nearly half reported consuming undercooked beef. Similar consumer practices were reported in Port Harcourt (Abah & Arene, 2015) and Enugu (Okoli *et al.*, 2016), where cultural preferences for suya (roasted beef) and other undercooked beef dishes were linked to continued human infection. The 33.5% household history of taeniasis and 46.3% consumption of undercooked beef in the present study highlight the strong human–animal transmission cycle that perpetuates the problem.

Encouragingly, the study revealed positive attitudes towards control, with more than 70% supporting strict meat inspection and preventive measures. This aligns with observations by Abunna *et al.* (2008) in Ethiopia and Opara *et al.* (2012) in Nigeria, where farmer and butcher willingness to adopt preventive strategies was reported, though often constrained by inadequate government support, poor enforcement, and limited training.

5.2 Conclusion

The findings of this study demonstrate a high prevalence rate (50.9%) which exceeds those reported in many abattoirs across Nigeria and East Africa, placing both consumers and stakeholders in the beef value chain at significant risk. The male-biased prevalence suggests that cattle trade practices and grazing patterns play a larger role in transmission than intrinsic biological susceptibility. From a public health perspective, the study confirms an ongoing zoonotic cycle between cattle and humans in Jalingo.

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