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EPIDEMIOLOGY OF INTESTINAL PARASITES AMONG MULTIPLE HOST SPECIES AT THE ABA ULTRA-MODERN ABATTOIR, NIGERIA

***CHUKWUEMEKA, B. C., AMADI, A. N. C. AND MAZI, D. E.**
Department of Zoology and Environmental Biology, College of Natural Sciences,
Michael Okpara University of Agriculture, Umudike
*Corresponding author: chilopez2000@gmail.com

ABSTRACT
Intestinal parasitic infections in livestock pose significant risks to animal health, productivity, public health, and the environment. This study examined gastrointestinal parasites in ruminants and amphibians at the Aba Ultra-Modern Abattoir. Fecal and soil samples were analyzed using formol-ether concentration and Baermann funnel techniques. A questionnaire was used to elicit the abattoir workers' knowledge and awareness of intestinal parasitic infections. Of the 350 fecal samples examined, 74.9% were infected. No infections were detected in amphibians, but infection rates in cattle (87.2%) and goats (87.5%) were statistically significant ($p > 0.05$). In cattle, Dictyocaulus viviparus (32.2%) and Bunostomum phlebotomum (21.7%) were the most common, followed by Toxocara vitulorum (14.7%), Strongyle egg (13.3%) and Fasciola gigantica (8.4%) while Moniezia benedeni (5.6%) and Nematodirus vitulorum (4.2%) had the least infections. In goats, Moniezia expansa (32.8%) and Nematodirus battus (23.5%) dominated, followed by Fasciola hepatica (14.3%), Taenia spp (12.6%) and Dicrocoelium dendriticum (10.9%) with Eimeria oocyst (5.9%) least prevalent. Single infections were more common than multiple infections in cattle (67.8%: 32.2%) and goats (68.6%: 31.9%). Soil analysis revealed 30 parasite eggs/cysts in cattle areas, with Ascaris lumbricoides (23.3%) and Taenia spp (20.0%) most frequent. In goats, 48 eggs/cysts were found, with Dicrocoelium dendriticum (18.8%), and Taenia saginata (18.8%) predominating. Amphibians had 18 eggs/cysts, with Schistosoma haematobium (27.8%) most common. A strong negative correlation ($R = -1.0000$) was observed in cattle infections, while goats showed a moderate negative correlation ($R = -0.611$). Most of the (58.7%) workers are aware that they are at risk of contracting the parasite from the abattoir. There is therefore need for integrated parasite management strategies to be employed in the abattoir.

KEYWORDS: *Abattoir, Intestinal parasites, Ruminants, Environment, Aba*

INTRODUCTION

Ruminants and amphibians represent two distinct yet ecologically significant groups of vertebrates that contribute profoundly to ecosystem stability and agricultural productivity. However, both groups serve as important reservoirs of gastrointestinal (GIT) parasites, which constitute a major threat to animal health, agricultural output, and environmental integrity. Ruminants such as cattle (*Bos taurus*), goats (*Capra hircus*), and sheep

(*Ovis aries*) are herbivorous mammals belonging to the suborder Ruminantia (order Artiodactyla), characterized by a complex four-chambered stomach that enables rumination and efficient digestion of fibrous plant materials. They are indispensable to food security and rural livelihoods, providing meat, milk, hides, and other animal products vital to human nutrition and economic sustenance, particularly in developing countries such as Nigeria. Despite their importance, gastrointestinal parasitism remains a critical constraint to ruminant production, resulting in substantial economic losses due to decreased feed efficiency, reduced weight gain, diminished milk yield, and impaired reproductive performance (Ademola and Onyiche, 2013; Taylor *et al.*, 2016). Common ruminant GIT parasites include nematodes such as *Haemonchus contortus*, *Ostertagia ostertagi*, and *Trichostrongylus* spp.; trematodes such as *Fasciola hepatica*; cestodes including *Moniezia* spp.; and protozoa such as *Eimeria* spp., all of which cause varying degrees of clinical and subclinical infections that adversely affect animal productivity and welfare (Dutta *et al.*, 2017).

Amphibians, on the other hand, are ectothermic vertebrates that occupy both aquatic and terrestrial habitats, making them critical indicators of environmental health and ecosystem balance. Species such as the African common toad (*Amietophrynus regularis*), which is widely distributed across Nigeria, play significant ecological roles in regulating insect populations and maintaining food-web dynamics (Ikechukwu *et al.,* 2021). Nonetheless, amphibians are also susceptible to a wide array of gastrointestinal parasites, including protozoa (*Ichthyophonus* spp.), nematodes (*Rhabdias bufonis*), trematodes (*Batrachocoelus nodulosus*), and cestodes (*Ophiotaenia* spp.), which may compromise their survival, reproductive success, and ecological function (Baker, 2019). The prevalence and diversity of these parasites are influenced by several environmental factors, including temperature, humidity, habitat quality, and anthropogenic disturbances such as pollution, deforestation, and habitat fragmentation, all of which affect parasite transmission dynamics within complex ecosystems (Altizer *et al.*, 2013; Tompkins *et al.,* 2011).

With increasing intensification of human activities such as livestock farming, deforestation, urban expansion, and abattoir operations, interactions between domestic animals, wildlife, humans, and the environment are becoming more frequent. These interfaces create favourable conditions for the persistence and cross-species transmission of gastrointestinal parasites and other zoonotic pathogens. Abattoir environments, in particular, serve as focal points for parasite transmission due to poor waste management practices, environmental contamination, and close contact between animals, workers, and surrounding wildlife (Ojo *et al.,* 2020). Consequently, understanding the epidemiological patterns of GIT parasites in multi-host systems is essential for developing integrated and sustainable parasite control strategies that align with the One Health approach, which emphasizes the interconnectedness of animal, human, and environmental health (WHO, 2017).

The present study therefore investigates the prevalence and environmental determinants of gastrointestinal parasites in ruminants (cattle and goats) and amphibians (toads) at the Aba Ultra-Modern Abattoir, Aba South Local Government Area, Abia State, Nigeria. The findings are expected to provide baseline epidemiological data that will inform evidence-based parasite control strategies, promote sustainable livestock management, and contribute to safeguarding public and environmental health against potential zoonotic risks.

STUDY AREA

The study was conducted at Aba Ultra-Modern Abattoir complex area which is situated in the southern part of Abia State, Nigeria, approximately at 5°5′58″ N latitude and 7°23′19″ E longitude. Aba is a major commercial and industrial center in the state. The topography of the area is characterized by lowland terrain with gentle slopes, and it is part of the Niger Delta region, known for its lush vegetation and numerous water bodies. The climate in Aba is tropical rainforest, with high rainfall throughout the year and distinct wet and dry seasons, peaking between April and October.

The study area encompasses the Aba Ultra-Modern Abattoir complex, a central slaughterhouse equipped with modern facilities for processing livestock, including cattle, goats, and other ruminants. The abattoir receives a substantial daily influx of ruminants for slaughter, making it a crucial location for researching the prevalence and impact of gastrointestinal parasites in these animals. These ruminants may originate from various parts of Abia State and neighbouring regions.

In addition to the abattoir, the study also involves surveying nearby amphibian habitats, such as ponds, streams, or wetlands, where amphibians like frogs and toads are found. These habitats play a vital role in understanding the environmental context of amphibian-parasite interactions.

Aba is a bustling commercial and industrial city, and the study area is influenced by various human activities, including urbanization, agriculture, and waste disposal, which can affect parasite transmission and environmental quality. Furthermore, the study area is in proximity to local communities whose livelihoods are closely tied to livestock farming and agriculture. The interactions between these communities and the abattoir are pertinent to the study's context and objectives.

Ethical Consent

The ethical approval for the work was sought from the Abia State Ministry of Health and Environment (Ref. No.: AB/MH/PRS/ECS/T.1/154) and the ethical committee of the department of Michael Okpara University of Agriculture, Umudike (Ref. No.: CREC/006.24).

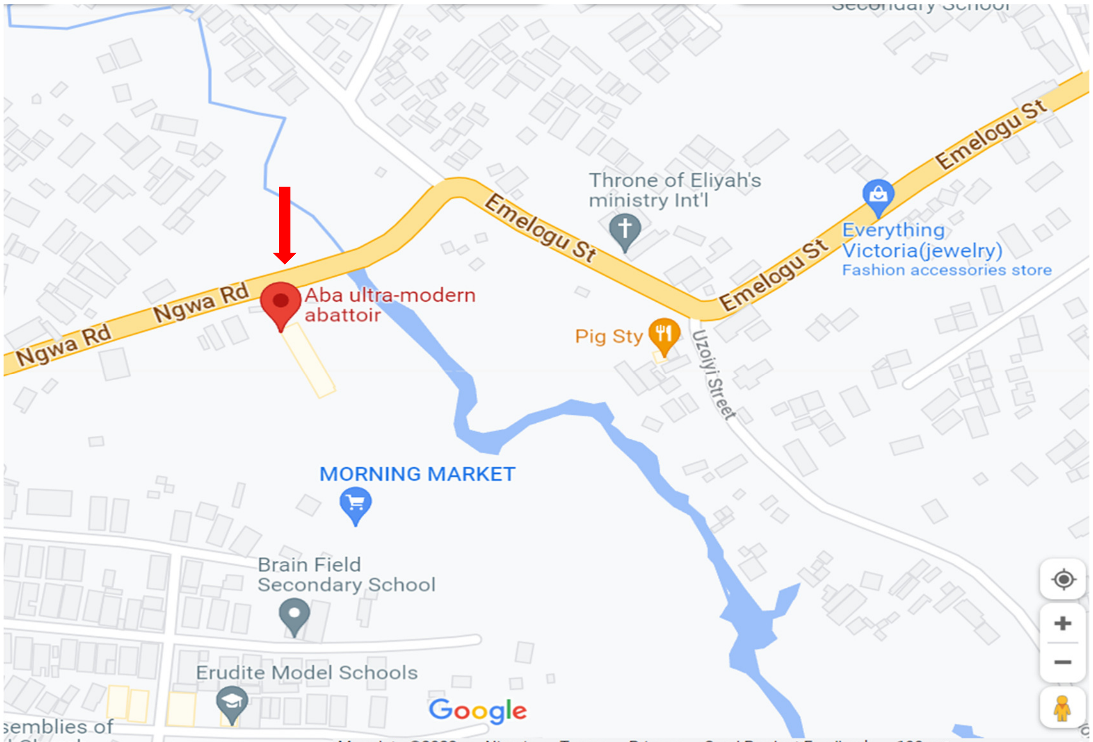

Fig. 1: Map showing the study area
Source: Google (2005)

MATERIALS AND METHOD

Sampling Techniques

A simple random sampling technique was employed for this study. This method allowed every animal and environmental sample (soil) within the study area an equal chance of being selected, thereby minimizing selection bias. The choice of this sampling approach ensured that the collected data accurately represented the overall population of ruminants and amphibians associated with the Aba Ultra-Modern Abattoir. By relying on randomness, the study maintained objectivity and improved the reliability of the results obtained from both animal and environmental samples.

Sample Collection

Fecal samples were collected from ruminants (cattle and goats) brought to the Aba Ultra-Modern Abattoir for slaughter. Each sample was obtained directly from freshly voided feces using sterile containers, which were properly labeled to avoid mix-ups. The collection process was random to ensure impartiality and representativeness of the sampled animals.

Amphibian specimens, particularly toads (*Bufo bufo*) were collected from various habitats within the abattoir vicinity, including moist soil areas and drainage sites, to capture ecological diversity and minimize sampling bias. Additionally, soil samples were obtained from different points within the abattoir environment to assess environmental contamination and the potential transmission of gastrointestinal parasites.

All collected samples were promptly transported to the Zoology and Environmental Biology Laboratory of Michael Okpara University of Agriculture, Umudike. In the laboratory, the samples were processed and examined microscopically for the presence of parasite eggs, cysts, and larvae following standard parasitological procedures.

Parasitological Analysis

About 1g of each of the feacal samples was emulsified in about 7ml of 10% formol water contained in a screw cap bottle using an applicator stick. The emulsified sample was sieved and its suspension collected in a beaker. The suspension was then transferred into a glass centrifuge tube (test tube) and about 3ml of diethyl ether was added into the tube. The tube was stoppered and vigorously shaken for 1 minute and then centrifuged immediately at 3000rpm for another 1 minute. An applicator stick was used to loosen the layer of the fecal debris from the side of the tube and the supernatant (containing ether and dissolved fat, fecal debris and formol water) were poured away leaving only the sediments. The deposit was resuspended by tapping the bottom of the tube with the finger after which it was transferred to a slide using the Pasteur pipette (18). The slide was then covered with a cover slip and examined under x10 and x40 objectives for the detection of parasite eggs and cysts.

Environmental Analysis

Environmental analysis of soil samples was conducted using the Baermann funnel technique, a standard method for detecting larvae and other stages of gastrointestinal parasites in soil. The procedure involved setting up small funnels fitted into holes of a test-tube rack, each connected to a short length of rubber tubing sealed at the end with a clamp. A piece of filter paper containing a portion of the soil sample was placed on the funnel mesh, after which clean water was carefully added until the soil was completely submerged. The setup was left undisturbed for several hours, and in some cases, overnight, to allow active parasite larvae and other motile stages to migrate out of the soil and settle at the bottom of the tubing.

After incubation, a few drops of the sedimented water were gently collected from the base of the tube by slowly releasing the clamp into a clean test tube. The collected suspension was allowed to sediment for approximately 10 minutes, after which the supernatant was decanted. A drop of the remaining deposit was then placed on a clean microscope slide and examined under a binocular light microscope at ×10 and ×40 magnifications to identify the presence of parasite eggs, cysts, larvae, or adult worms.

Questionnaire Survey Method

Data was collected from workers (which include butchers, meat vendors, and food stuff vendors) who are at the abattoir through structured questionnaire. The objective of the questionnaire survey method was to gather a comprehensive data from different people working close to the abattoir concerning intestinal parasites and the risk of contraction for staying close to the site. The following aspects was considered in the survey; general information, awareness on Parasite prevalence, awareness of the health implications with regards to intestinal parasites, control measures and practices, economic impact, satisfaction with the management practices, their length of stay in the dumpsite area and feedback and suggestions.

Data Analysis

Data were analyzed using SPSS version 21 statistical package. Descriptive statistics were used to summarize the data. Chi-square tests were used to assess the significance of relationships between categorical variables (e.g., the presence or absence of intestinal parasites in cattle, small ruminants, and amphibians). Correlation analysis (Pearson's or Spearman's) was used to examine the strength and direction of relationships between continuous variables, such as parasite load and environmental contamination levels. Statistical significance was considered when the p-value was less than 0.05.

RESULT

Table 1: Overall prevalence of gastrointestinal parasites in ruminants and amphibians found around the study area showing level of infection.

Ruminants	Number examined	Overall infection n N(%)	Single infection N(%)	Multiple infection N(%)
CATTLE	164	143(87.2)	97(67.8)	46(32.2)
GOAT	136	119(87.5)	81(68.6)	38(31.9)
TOAD	50	0(0.00)	0(0.00)	0(0.00)
P-VALUE		0.9836	0.000	0.001
TOTAL	350	262(74.9)	178(50.9)	84(24.0)

Table 2: Overall prevalence of gastrointestinal parasites in ruminants slaughtered at the study area showing level of infection.

Ruminants	Number examined	Overall infection N(%)	Single infection N(%)	Multiple infection N(%)
CATTLE	164	143(87.2)	97(67.8)	46(32.2)
GOAT	136	119(87.5)	81(68.6)	38(31.9)
		0.9836	0.9859	0.9768
TOTAL	300	262(87.3)	178(67.9)	84(32.1)

Table 3: Prevalence of gastrointestinal parasites in cattles slaughtered in the study area

Parasite species isolated	No. of samples Examined	No. of samples Infected (%)
Strongyle egg	164	19(13.3)
Toxocara vitulorum	164	21(14.7)
Fasciola gigantica	164	12(8.4)
Moniezia benedeni	164	8(5.6)
Bunostomum phlebotomum	164	31(21.7)
Dictyocaulus viviparus	164	46(32.2)
Nematodirus vitulorum	164	6(4.2)
TOTAL	164	143(87.2)

Table 4: Prevalence of gastrointestinal parasites in goat slaughtered in the study area

Parasite species Isolated	**No. of samples Examined**	**No. of samples Infected (%)**
Moniezia expansa	136	39(32.8)
Nematodirus battus	136	28(23.5)
Eimeria oocyst	136	7(5.9)
Fasciola hepatica	136	17(14.3)
Dicrocoelium dendriticum	136	13(10.9)
Taenia spp	136	15(12.6)
TOTAL	136	119(87.5)

Table 5: Level of environmental contamination of intestinal parasites of ruminants and amphibians in the study area

Parasites recovered	**Parasite forms recovered**		**Total (%)**
N = 10	Egg (%)	Cyst (%)	
CATTLE			
Taenia spp	6	-	6(20.0)
Toxocara vituloum	3	-	3(10.0)
Trichuris trichura	5	-	5(16.7)
Hookworm	4	-	4(13.3)
Fasciola gigantica	5	-	5(16.7)
Ascaris lumbricoides	5	2	7(23.3)
TOTAL	28	2	30
GOAT			
Taenia saginata	9	-	9(18.8)
Toxocara vitulorum	4	-	4(8.3)
Trichuris trichura	6	-	6(12.5)
Hookworm	8	-	8(16.7)
Fasciola spp	5	-	5(10.4)
Dicrocoelium dendriticum	9	-	9(18.8)
Eimeria oocyst	-	7	7(14.6)
TOTAL	41	7	48
TOAD N =5			
Schistosoma haematobium	5	-	5(27.8)
Entamoeba histolytica	-	4	4(22.2)
Ascaris lumbricoides	3	-	3(16.7)
Hookworm	4	-	4(22.2)
Entamoeba coli	-	2	2(11.1)
TOTAL	12	6	18

Table 6: Association between the numbers of recovered parasites of the same species found in the study area.

Parasites	No. of recovered parasites from the ruminants	No. of recovered parasites from the soil	Total
CATTLE			
Toxocara vitulorum	21	3	24(58.5)
Fasciola gigantica	12	5	17(41.5)
TOTAL	33	8	41
GOAT			
Taenia spp	15	9	24(29.3)
Fasciola hepatica	17	5	22(26.8)
Dicrocoelium egg	13	9	22(26.8)
Eimeria oocyst	7	7	14(17.1)
TOTAL	52	30	82
GRAND TOTAL	85	38	123

(R = -1.0000 for cattle and R = -0.611 for the goats).

Table 7: Distribution of the respondents by their socio-demographic characteristics

Characteristics	**No. of Respondent N = 75**	**Percentage (%)**
AGE		
≤ 20	18	24.0
21-30	22	29.3
31-40	17	22.7
41-50	10	13.3
>50	8	10.7
Total	75	100
SEX		
Male	18	24.0
Female	57	76.0
Total	75	100
MARITAL STATUS		
Single	38	50.7
Married	28	37.3
Divorced	9	12.0
Total	75	100
LEVEL OF EDUCATION		
Primary	8	10.7
Secondary	12	16.0
University	27	36.0
Polytechnic	12	16.0
None	16	21.3
Total	75	100
RELIGION		
Christian	56	74.7
Muslim	14	18.7
None	5	6.7
Total	75	100

YEARS OF STAY AT THE ABATTOIR		
From inception	59	78.7
Less than 2 years	16	21.3
Total	75	100

Table 8: Awareness on hazards/risk of parasitic infections associated with Abattoirs

CHARACTERISTICS	**NO OF RESPONDENT N = 75**	**PERCENTAGE (%)**
Are you exposed to any risk of intestinal parasitic infection for working at the Abattoir?		
Yes	44	58.7
No	19	25.3
Not sure	12	16.0
Total	75	100
Which of these hazards/risks are you ex1periencing for staying at the Abattoir?		
Odour	45	60.0
Fire	32	42.7
Smoke	64	85.3
Animals slaughtered at the abattoir	72	96.0
	48	64.0
Birds	70	93.3
Litters e.g animal carcasses and food	75	100
waster	32	42.7
Surface water contamination	0	0.0
All of the above	75	100
None of the above		
Total for each variable		
Animal waste and carcasses at the abattoir can breed flies, insect or worms, which can cause intestinal parasites?		
Yes	49	65.3
No	16	21.3
Not sure	10	13.3
Total	75	100
The waterside (Aba river) can be infected with intestinal worms from the animals?		
Yes	71	94.7
No	4	5.3
Not sure	0	0
Total	75	100

Table 9: Knowledge of the Workers towards Intestinal Parasites from Abattoirs.

CHARACTERISTICS	NO OF RESPONDENT N = 75	PERCENTAGE (%)
Have you heard about intestinal parasites or worms?		
Yes	75	100
No	0	0
Not sure	0	0
Total	75	100
Can one get intestinal worms from the Abattoir?		
Yes	66	88.0
No	5	6.7
Not sure	4	5.3
Total	75	100
If yes, how can one get it from the abattoir?		
Through under cooked meats and	41	54.7
vegetables	23	30.7
Insect bite	50	66.7
Poor hygiene	18	24.0
Bad habits such as walking around on bare foot	24	32.0
Juju and witchcraft	56	74.7
Animals slaughtered at the abattoir	38	50.7
Food	60	80.0
All of the above	0	0.0
None of the above	75	100
Total for each variable		
Have anybody been infected with it in your family before?		
Yes	48	64.0
No	22	29.3
Not sure	5	6.7
Total	75	100
What symptoms tell you that you have a parasite in your body?		
Fever	32	42.7
Diarrhea	52	69.3
Vomiting	44	58.7
Stomach ache	62	82.7
I don't know	26	34.7
All of the above	28	37.3
Total for each variable	75	100

DISCUSSION

The study revealed a high prevalence (74.9%) of intestinal helminths, all of which were detected in ruminant hosts. No infections were recorded among amphibians, resulting in a 0.0%. The 74.9% prevalence observed in ruminants in this study is higher than the 53.9% and 66.7% reported by Nzeako and Okorafor (2014) and Adewumi *et al*., (2022) in Ibadan and Lafenwa abattoirs, respectively. However, it is lower than the 87.41% and 81.64% reported by Okike-Osisiogu *et al*., (2016) and Dauda *et al*.,

(2022) in Aba and Abeokuta abattoirs, respectively. The present result is also comparable to the 70% prevalence documented by Bakre *et al*., (2020) in Igboora. Variations in prevalence across different locations may be attributed to factors such as geographical differences, environmental conditions, and seasonal variations at the time of study. This finding suggests that a large proportion of ruminants brought for slaughter are infected with one or more intestinal parasites. Among the infected ruminants, the distribution of single and mixed infections was also noteworthy. Approximately 68% of the infected animals harboured single parasite species, while 32% exhibited mixed infections involving multiple parasite species. This observation agrees with the findings of Eke *et al*., (2019), Biu *et al*., (2021), and Usman *et al*., (2016), who also reported mixed infections in ruminants examined in Minna Abattoir (Niger State), the University of Maiduguri Research Farm, and Katagum Abattoir (Bauchi State), respectively. In contrast to the high prevalence observed in ruminants, none of the toads examined in the study area showed evidence of gastrointestinal parasite infection, yielding a 0% prevalence rate. This marked difference in infection rates between ruminants and amphibians aligns with the observations of Amadi *et al*., (2018) in Umuahia South, Abia State, and Iyaji *et al*., (2015) in Anyigba, Kogi State, Nigeria. These studies similarly highlighted notable prevalence rates of gastrointestinal parasites among ruminants, emphasizing the varying susceptibility of different animal groups to infection. The significant disparity observed between ruminants and amphibians underscores the differing levels of susceptibility to gastrointestinal parasites among these species. While ruminants exhibited notably high infection rates and multiple species infections, the absence of gastrointestinal parasites in the examined toads indicates a lower susceptibility to such infections among amphibians in the same region. This difference may reflect inherent physiological or immunological adaptations in amphibians. Such insights are valuable for ecological and conservation efforts, as they highlight the need to consider host-specific factors when evaluating parasite dynamics and biodiversity (Hof *et al*., 2011).

The investigation of the prevalence of gastrointestinal parasites specifically among cattle slaughtered in the study area revealed an alarming 87.2% infection of the 164 samples examined for the various gastrointestinal parasites. This high prevalence aligns with the concerning rates of 74.3% and 74.0% reported in previous studies carried out by Yuguda *et al*., (2018) and Bisimwa (2018) in Bauchi state and Republic of Congo respectively but in contrast with the work of Biu *et al*., 2021 who found a prevalence of 47.0% in the University of Maiduguri research farm, thus emphasizing the pervasive nature of parasitic infections in cattle populations. *Dictyocaulus viviparus*, a lungworm, emerged as the most prevalent parasite, affecting approximately 32.2% of the sampled cattle. This high prevalence underscores the significant impact of this lungworm on the health and well-being of the cattle population within the study area. This finding corroborates previous research highlighting the clinical importance of lungworm infections in cattle and their substantial prevalence in various regions. This was in constrast with the findings of Usman *et al*., 2016 who reported *Ascaris* spp as the most prevalent parasite in Bauchi state. Following closely, *Bunostomum* spp., a hookworm, demonstrated a substantial infection rate of 16.10% among the sampled cattle. The considerable prevalence of this hookworm species indicates its substantial presence within the cattle population and its potential impact on cattle health and productivity. Similar observations regarding the prevalence of *Bunostomum* spp. have been documented in previous studies, signifying its persistence in causing parasitic infections in cattle (Eke *et al*., 2019; Biu *et al*., 2021; Usman *et al*., 2016).

The investigation of the prevalence of gastrointestinal parasites specifically among cattle slaughtered in the study area revealed an alarming infection 87.2% of the 164 samples examined. This high prevalence aligns with the concerning rates of 74.3% and 74.0% reported in previous studies carried out by Umar *et al*., (2018) and Bisimwa (2018) in Bauchi state and Republic of Congo respectively but in contrast with the 47.0% reported by Biu *et al*., (2021) from the University of Maiduguri research farm, thus emphasizing the pervasive nature of parasitic infections in cattle populations. *Dictyocaulus viviparum*, a lungworm, emerged as the most prevalent parasite affecting approximately 32.2% of the sampled cattle followed by *Bunostomiun spp* (21.7%) while least infection was observed in *Nematodirus vituloyum* (4.2%). This was in constrast with the findings of Biu *et al*., (2021) and Umar *et al*. (2018) who reported *Eimeria spp* (34.4%) and *Fasciola gigantic* (15.7%) as the most prevalent parasite in Maiduguri and Bauchi state respectively. This high prevalence underscores the significant impact of this lungworm and hookworm on the health and well-being and productivity of the cattle population within the study area. Additionally, other gastrointestinal parasites such as *Toxocara vitulorum* (14.7%), *Strongyle egg* (13.3%), *Fasciola gigantic* (8.4%) and *Moniezia benedeni* (5.6%) observed is in line with the findings of Barger and Kaplan, (2017). This can be attributed to environmental difference, difference in parasite management strategies, including targeted deworming, pasture management, and veterinary interventions. (Bricarello *et al.* 2023).

Out of the 136 goat samples examined, a remarkable 87.5% were infected with various gastrointestinal parasites. This high prevalence aligns with the findings of Opara *et al.* (2005), who also reported significant levels of parasitic infections among goat populations. Among the identified parasites, *Moniezia expansa*, a tapeworm species, was the most dominant, infecting 32.8% of the goats. The presence of *M. expansa* indicates its considerable impact on the health and productivity of goats within the study area. This observation is consistent with the report of Opara *et al.* (2005) in Owerri, who recorded *M. expansa* as the most prevalent parasite, with a higher rate of 50.0%. Following *M. expansa* was *Nematodirus* spp., a nematode genus, contributed 23.5% of the infections, while *Fasciola hepatica* (a liver fluke) was detected in 14.3% of the sampled goats. Other parasites, including *Taenia* spp. (12.6%), *Dicrocoelium dendriticum* (10.9%), and *Eimeria* oocysts (5.9%), were also present. Although these parasites exhibited lower individual prevalence rates, their combined effect significantly contributes to the overall gastrointestinal parasitic burden in goats. The results of this study are in agreement with findings by Isah (2019) in northern

Bauchi State, Nigeria, and Shykat *et al.* (2022) in Sylhet, Bangladesh, who reported prevalence rates of 48.0% and 35.38%, respectively. Variations in prevalence rates across different studies may be attributed to factors such as grazing and feeding habits, nutritional deficiencies, pasture management practices, immune status of animals, presence of intermediate hosts and vectors, the density of infective larvae or eggs in the environment, and favourable climatic conditions that support the development of helminth eggs into infective stages (Odoi *et al.*, 2007).

The analysis of parasite prevalence in soil samples based on their forms revealed that *Ascaris lumbricoides* had the highest occurrence (23.3%) among cattle, while *Taenia* spp. and *Dicrocoelium* eggs were the most prevalent parasites in goats, each with a rate of 18.8%. Among toads, *Schistosoma haematobium* showed the highest prevalence at 27.8%. The high prevalence of *A. lumbricoides* (39.1%) and *Taenia* spp. (3.1%) observed in this study aligns with the findings of Udoh *et al.* (2019) in Ile-Ife, Nigeria. The persistence of *A. lumbricoides* in the environment is likely due to its ability to withstand harsh conditions, allowing its eggs to survive for extended periods Mewara, *et al.* (2023). The presence of such parasites in soil serves as an important indicator of public health risk (Saathoff *et al.*, 2002). This finding also agrees with the reports of Ohaeri (2012), Usman *et al.* (2016), and Yahaya and Tyav (2014), who documented high prevalence rates of helminth infections among ruminants slaughtered during the rainy season in Umuahia (Abia State, Nigeria), Katagum (Bauchi state, Nigeria) and Wudil (Kano State, Nigeria), respectively.

The negative correlation observed between the number of recovered parasites of the same species from ruminant samples and those from environmental samples suggests that the infections were not acquired from the dumpsite. This finding may be explained by the relatively recent establishment of the abattoir, which has been in operation for less than three years. Additionally, since most of the animals were transported from different locations to the study site, it is plausible that they were already infected prior to arrival. This observation contrasts with the assertion by recent studies, such as Fasanmi *et al.* (2018), which noted that animal food products are frequently contaminated by microorganisms and parasites originating either from their natural habitat or from unhygienic handling during processing and slaughter. Meat quality control remains a critical public health measure aimed at regulating and monitoring extrinsic contaminants—including chemical residues, toxins, pathogenic microorganisms, and parasites—that pose serious health risks to consumers (Oladipo *et al.*, 2021). Furthermore, Bello and Oyedemi, (2009) emphasized that during livestock production, greater attention should be directed toward the interactions between animal husbandry practices and environmental conditions to minimize contamination by bacteria and parasites, thereby reducing associated health risks. Abattoir wastes are known to significantly pollute surrounding soil, air, and water bodies, thereby contributing to the transmission of waterborne diseases such as typhoid fever, dysentery, and diarrhea (Adeoye *et al.*, 2020; Okechukwu *et al.*, 2022).

The distribution of respondents by age revealed that most fell within the active working-age groups of 21–30 years (29.3%), below 20 years (22.7%), and 31–40 years (22.7%), indicating that the majority were young and within their productive years. At this stage of life, abattoir workers are expected to have some level of education and access to information on occupational health and safety practices, which can enhance their awareness of preventive measures against infections. This assumption aligns with Nigeria's Universal Basic Education (UBE) policy, which ensures at least primary-level education for all citizens. The mean ages of 34 and 37 years observed in this study further support this finding. Analysis of the respondents' educational background showed that most participants (36.0%) had attained at least one form of formal education. This level of literacy is expected to positively influence their understanding and implementation of workplace safety measures. In support of this, Olutegbe and Ikwuakam (2017) emphasized that educational certification and training programs are critical for promoting adherence to standard hygiene and safety practices among workers. Furthermore, the finding that the majority of respondents were Christians suggests that moral and ethical principles inherent in their faith could influence their work conduct and compliance with safety standards in the abattoir environment.

A significant proportion of respondents (58.7%) acknowledged that they were at risk of contracting intestinal parasitic infections through their work at the abattoir, which reflects the ongoing risk of occupational exposure. When asked about hazards encountered in their workplace, 42.7% identified multiple hazards, with nearly all respondents (96.0%) highlighting surface water contamination as the most serious. They noted that contamination largely resulted from animal slaughter activities and the improper disposal of litters such as carcasses and food waste. This finding corroborates the report of Sina *et al.* (2022), who identified abattoir waste discharge as a major source of water pollution and a risk factor for disease transmission in nearby communities. Additionally, most respondents (65.3%) recognized that animal waste and carcasses around the abattoir could attract flies, insects, or worms, all of which play roles in the transmission of intestinal parasites. An even higher proportion (94.7%) were aware that the Aba River, located adjacent to the abattoir, could be contaminated with intestinal worm eggs and larvae originating from animal waste. This observation aligns with the World Health Organization's (2015) report that in many developing countries, including Nigeria, abattoir effluents are often discharged directly into water bodies without treatment, contaminating sources used for washing meat and other domestic purposes.

All the respondents (100%) have heard about intestinal parasites, and majority (88.0%) were aware that such infections could be contracted from the abattoir environment. When asked about possible routes of transmission, 80.0% of the participants believed that infection could occur through multiple pathways, while 74.7% identified direct contact with slaughtered animals as a major source. Only a small proportion attributed infection to poor hygiene practices. Additionally, more than half of the respondents (64.0%) reported that at least one member of their household had previously suffered from an intestinal parasitic infection. The most commonly reported symptoms were stomach pain (82.7%), diarrhea (69.3%), and vomiting (58.7%). These findings suggest that although awareness about intestinal parasites is relatively high among abattoir workers and residents, there is still a critical need for continuous education and stronger enforcement of sanitary regulations to minimize environmental contamination and disease transmission. The respondents' level of knowledge aligns with recent studies which emphasize that public awareness and environmental hygiene are key to preventing the spread of parasitic infections associated with abattoir activities (Adenusi *et al.*, 2018; Odo *et al.*, 2020; Eze *et al.*, 2021). According to Opara *et al.* (2022), improving community knowledge and implementing strict environmental sanitation measures remain essential components in reducing the burden of intestinal parasitic diseases in abattoir settings.

CONCLUSION

The comprehensive investigation into gastrointestinal parasites among ruminants (cattle and goats) and amphibians (toads) within the study area has yielded significant insights. The prevalence of these parasites among slaughtered ruminants, particularly cattle and goats, underscores the substantial burden on livestock health. Contrasting susceptibility was observed between ruminants and amphibians, highlighting the varying degrees of infection among these animal groups. The environmental contamination by parasite forms recovered from the soil further emphasizes the potential risks and the need for comprehensive management strategies to address parasitic infections in both animals and their surroundings. These findings underscore the critical importance of continued monitoring, robust control measures, and interventions to mitigate the impact of gastrointestinal parasites on animal health and environmental contamination.

RECOMMENDATIONS

Based on the extensive findings from this study on gastrointestinal parasites in ruminants and amphibians, these recommendations are proposed:

- Regular Surveillance and Monitoring: Implement routine surveillance programs to continually monitor the prevalence of gastrointestinal parasites in ruminants and amphibians within the study area. Continuous monitoring will facilitate early detection, timely intervention, and better management of parasitic infections.
- Improved Livestock Management Practices: Emphasize the adoption of better livestock management strategies, including proper hygiene, quarantine measures for incoming animals, regular deworming, and strategic grazing practices. These practices can help minimize the spread and prevalence of gastrointestinal parasites in ruminant populations.
- Public Awareness and Education: Conduct educational campaigns targeting livestock farmers, veterinarians, and the general public to raise awareness about the risks posed by gastrointestinal parasites. Educating stakeholders about preventive measures and the importance of proper sanitation and hygiene practices is crucial in reducing infections.

- Environmental Sanitation: Implement measures to improve environmental hygiene and reduce the transmission of parasites. This may involve proper waste management, sanitation of grazing areas, and controlling factors contributing to soil contamination by parasites.
- Research and Development: Invest in further research to deepen our understanding of the epidemiology, life cycles, and resistance patterns of gastrointestinal parasites in both ruminants and amphibians. Such research could facilitate the development of more targeted and effective control measures.

By implementing these recommendations, it is possible to improve parasite management, safeguard animal health, reduce environmental contamination, and enhance overall public health in the study area.

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