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Research Article

Prevalence of *Fasciola* Species in Lafia Modern Abattoir, Nasarawa State, Nigeria

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Abstract

Fasciolosis is an economically important parasitic disease of cattle caused by liver flukes of the genus *Fasciola*. This study determined the prevalence of *Fasciola* species among cattle slaughtered at Lafia Modern Abattoir, Nasarawa State, Nigeria. A total of 400 cattle were selected using systematic random sampling and examined for *Fasciola* infection. Ante-mortem and post-mortem inspections were carried out, during which livers and bile ducts were examined for pathological lesions and adult flukes. Recovered flukes were preserved and identified morphologically. In addition, fecal samples were collected and analyzed using the sedimentation technique for the detection of *Fasciola* eggs. Data were analyzed using descriptive statistics and chi-square tests at a 95% confidence level. Of the 400 cattle examined, 68 were infected, giving an overall prevalence of 17.0%. Female cattle (18.9%) and animals older than four years (22.5%) showed higher infection rates, although the differences were not statistically significant ($p > 0.05$). Moderate liver lesions were the most common (41.2%). Combined diagnostic methods yielded a higher detection rate (18.0%) than individual methods. The findings indicate that fasciolosis remains endemic in the study area, posing economic losses and potential public health risks. Improved control measures and routine surveillance are recommended.

Keywords: *Fasciola* Species; Prevalence; Cattle; Abattoir; Nasarawa State

Introduction

Liver flukes of the genus *Fasciola* have remained one of the most economically and medically important parasitic agents of mankind. Species of medical and veterinary importance include *Fasciola hepatica* (the sheep liver fluke) and *F. gigantica* (the cattle liver fluke). Both species have very similar life cycles involving the aquatic or semi-aquatic snail (*Lymnaeidae*) as the intermediate host and various herbivorous mammals, principally cattle, sheep, and goats as the definitive hosts. Sheep and cattle become infected when they ingest metacercariae while feeding on pasture or water. Parasites released from ingestion burrow through the gut wall into the peritoneal cavity, penetrate the liver parenchyma, and migrate to the bile ducts where they develop into adults [1].

Adult liver flukes feed on bile, blood, and liver tissue causing hepatic tissue damage, hyperplasia of bile duct epithelium, fibrosis, anaemia, poor body condition, weight loss, and reduced productivity. Infected animals also suffer economic losses due to reduction in meat and milk yield as well as condemnation of affected livers at slaughter. The annual economic loss due to fasciolosis has been

put at over US $3 billion [2]. Humans can serve as accidental hosts of *F. hepatica* and *F. gigantica* by ingesting metacercariae on water plants or water. Once ingested, the immature flukes migrate to the bile ducts where they mature and produce eggs that are passed with the feces to complete the lifecycle [1]. Human infection with *Fasciola* spp. known as fasciolosis has been recognized in association with socioeconomic losses [3].

Fasciolosis is common in Nigeria and several abattoir-based surveys have been conducted reporting varying prevalences in different regions of the country. Abattoir studies carried out so far have shown prevalence to range from 5% to 48% [4,5]. Ajibola., *et al*. [6] obtained a prevalence of 20% in 640 cattle slaughtered at abattoir in Ibadan, Oyo state of which *F. gigantica* was the most prevalent species isolated. Abdul-Rahman., *et al*. [7] reported higher prevalence of 42% among cattle examined at the modern abattoir of Niger State. Obialigwe., *et al*. [8] also recorded prevalence of 8.3% among cattle slaughtered at Jalingo Abattoir, Taraba State over a ten-year study period. However, infection was significantly associated with season of presentation and age of animals. Meta-analysis of fasciolosis in cattle using forty abattoir-based surveys carried out across Nigeria by Adamu., *et al*. [9] put the overall pooled estimate at 29% (95% CI: 21 - 38%), concluding that fasciolosis is endemic in Nigeria.

The disease also has public-health and food-safety dimensions as investigations of meat-hygiene practices in Nigerian abattoirs have linked poor hygiene practices and poor inspection services to potential dissemination of meat-borne diseases of public-health importance [10]. The Lafia Modern Abattoir in Nasarawa State capital serves a host of communities within and outside the state capital. Reported conditions of the abattoir include insanitary environments, unhygienic meat inspection services, poor water supply, open secretion of wastes into the open environment by cattle owners before and after slaughter of their animals, among others [11]. A recent report by Daily Trust quotes the Managing Director of Nasarawa State Abattoir Service as saying "looking at the way cows are slaughtered here gives a false picture. The environment is filthy and unfit to serve as a standard abattoir…" Conditions such as these could aid persistence and spread of parasites, hence there is need for epidemiological data from the abattoir [11].

Although abattoir surveys have been conducted in many parts of Nigeria to determine the prevalence of various pathogens and parasites, there is lack of or no documented report of *Fasciola* spp. in cattle slaughtered at the Lafia Modern Abattoir. Thus, this study aims to determine the prevalence and species composition of *Fasciola* spp. in cattle slaughtered at Lafia Modern.

Aim of the Study

This study aims at determining the prevalence of *Fasciola* infection in cattle slaughtered at the Lafia Modern Abattoir, Nasarawa State. In particular, the research aims at determining animal level risk factors in relation to infection including age, sex, breed, condition of body, source or zone of origin, and season. It also seeks to outline the anatomy of the liver lesions and the extent of the lesions of infected cattle. Besides, the research will be directed at the morphological diagnosis of recovered *Fasciola* spp., and where time and resources are available, molecular confirmation will be proposed. Lastly, the study aims to present evidence-based suggestions that will be used to control the *Fasciola* infection and also raise the standards of meat-hygiene at the slaughterhouse.

Materials and Methods

Study area

This study was conducted at Lafia Modern Abattoir situated at Lafia, which is the capital city of Nasarawa State in North-Central Nigeria. Nasarawa State lies approximately between latitude 8°29′N and longitude 8°31′E. Nasarawa State is blessed with both pastoral and sedentary cattle rearing thus leading to emergence of the Lafia Modern Abattoir as the major hub for livestock trade and slaughtering business in the area. Pastoral cattle rearers bring their animals to cattle markets within and outside the state for sale or slaughter. The abattoir receives cattle from other states such as Kano, Niger, Kaduna, and states in the neighboring south-south region. Studies have shown that environmental sanitation, poor disposal of solid waste from abattoirs and run-offs from households affects activities of meat inspectors in some Nigerian abattoirs [10]. Daily Trust [11] and Nasarawa Eye [12] have also reported on deplorable conditions of waterways and open disposal of slaughter-house waste such as offal at Lafia Modern Abattoir. These conditions could aid transmission of zoonotic parasites including *Fasciola* spp. thus justifying the choice of this location for the study.

Study design

This study was carried out as an abattoir-based cross-sectional survey for the detection of *Fasciola* spp. in cattle slaughtered at Lafia Modern Abattoir. Cross-sectional studies have been used in previous surveys for prevalence of *Fasciola* spp. in abattoir cattle across Nigeria [13,14]. Cross-sectional study design was employed because it allows for determination of prevalence of infection and identification of risk factors among population at a given period.

Study period

The study was carried between January-November, 2025, this would cover both rainy and dry seasons. Rainfall is a key determinant of suitable habitats for intermediate hosts such as *Lymnaea* spp. Access to parasite-contaminated pasture is another important factor for acquisition of fascioliasis. Thus, conducting the survey over a long period that covers both seasons will allow for detection of seasonal variations if any and improves representativeness [15,16].

Target population

Animals presented for slaughter at Lafia Modern Abattoir over the study period constituted the study population. This included animals of different ages, sexes, and origins (both local farm livestock and animals from livestock markets across Nasarawa State and neighboring states) that are sold and passed fit for slaughter by veterinary officers on duty.

Sample size determination

The required sample size for this study was calculated using the standard formula for prevalence studies as described by Thrusfield [17]:

$$N = \frac{z^2 \times p \times (1-p)}{d^2}$$

Where:

N = Required sample size

Z = 1.96 (for 95% confidence interval)

P = Expected prevalence

d = Desired precision (0.05)

Based on previous studies in Nigeria reporting *Fasciola* prevalence between 10% and 20% [13,14,18], an expected prevalence (P) of 15% was used. Therefore:

$$N = \frac{1.96^2 \times 0.15 \times (1-0.15)}{0.05^2} = 196$$

To allow for clustering, potential non-response and seasonal differences in sampling fractions, this figure was inflated by ~25-50%. Hence, a total of 250 - 400 cattle were sampled during this study. This figure is similar to sampling numbers recorded in other abattoir-based surveys conducted elsewhere in Nigeria [16,19].

Sampling technique

Systematic random sampling was carried out, with a fixed number of cattle allocated each slaughter day according to abattoir throughput. Thus, every animal that presented to slaughter lines were sampled, ensuring a representative sample taken across days of the week and weeks of the month. Animal-level data including age, sex, breed, body condition score, source/zone of origin, and season of slaughter were recorded on a data sheet.

Data collection and parasitological examination

Following slaughter, gross pathological lesions suggestive of fascioliasis (e.g. fibrosis, thickened bile ducts, or adult flukes) were visually inspected and palpated on each liver. The bile ducts and the gall bladder were opened and adult *Fasciola* worms taken in labeled containers with 10% formalin to morphologically identify the worms by their shapes, sizes and coloration [19,20].

Taxonomic keys were used to identify *F. gigantica* and *F. hepatica* using morphological characteristics [13,21].

Post-mortem examination

Each sampled animal were subjected to ante-mortem inspection by veterinary officer, just before slaughter to ensure that only healthy looking animals were sampled. During this ante-mortem inspection data such as animal identification number, general appearance and any visible abnormalities were recorded before slaughter of each animal. After slaughter, post-mortem examination of liver along with bile duct of each sampled animal were examined

systematically for any gross pathological lesions associated with *Fasciola* infection. This included visual and palpatory examination of liver for enlargement, fibrosis, adhesions or nodules present; incision of bile ducts and gall bladder for evidence of thickening or presence of adult flukes and sectioning of liver parenchyma to recover embedded flukes if present. Any adult *Fasciola* worms recovered during post-mortem inspection were rinsed briefly in physiological saline, returned to labelled bottle and kept in 10% buffered formalin for morphological identification and 70% ethanol as appropriate. These procedures were based on standard abattoir survey guidelines developed by Zoological Society of Nigeria [22] and used previously in similar Nigerian abattoirs [14,16]. Severity of liver lesions (i.e. presence of flukes, fibrosis or both) was scored as mild, moderate or severe. Mild lesions had few flukes or mild fibrosis evident, moderate lesions had multiple flukes associated with thickening of bile ducts while severe lesions had extensive liver damage with marked fibrosis and large numbers of adult worms present.

Faecal sampling

Approximately 10 - 20g of fresh faeces were collected aseptically, directly from rectum of intestine of each sampled animal after evisceration. Each sample was transferred into labelled container to avoid cross contamination and placed into a cool box. All samples were transported to Parasitology laboratory for further analysis.

Sedimentation technique

Sedimentation technique was used for detection of *Fasciola* eggs in faecal samples since this is currently the most sensitive and reliable technique for detection of trematode ova [23]. Approximately 3g of faeces was emulsified in water and strained through a sieve to remove any coarse debris. Filtrate was left to sediment for 5 - 10 minutes before the supernatant was poured off. A drop of sediment was placed on a slide and covered with a coverslip. Examination was made under light microscope at ×10 objective followed by ×40 objective to look for the presence of characteristic *Fasciola* eggs (large, oval, operculated eggs that are yellow-brown in colour). Where laboratory facilities allowed, formol ether concentration technique was also performed as this increases the sensitivity of diagnosis. To reduce the risk of false negatives, both concentration and direct microscopy techniques were used as complimentary diagnostic methods.

Species identification using morphological features

Adult *Fasciola* species recovered were initially rinsed off in physiological saline, transferred to labelled slides and preserved in 10% buffered formalin for morphological examination. Species identification was based on standard taxonomic keys used to differentiate *F. gigantica* from *F. hepatica* [13,21]. Morphologically, *F. gigantica* had an elongated body when measured using ruler and appeared longer whilst *F. hepatica* appeared smaller and leaf-like.

Data analysis

Data were entered onto Microsoft Excel spreadsheet and imported into SPSS version 26.0 for analysis. Descriptive statistics were generated to determine overall and stratified prevalence. Associations between infection status and risk factors (animal-level factors) were tested using χ^2 tests or logistic regression, where appropriate at a 95% confidence interval. P-values < 0.05 were considered statistically significant.

Results

The study carried out on the Lafia Modern Abattoir examined a total number of 400 cattle over the study period in order to establish the prevalence of infection of *Fasciola* spp. Among them, 68 of the animals were positive, and the total prevalence rate is 17.0 (Table 1). This observation shows that there is moderate fasciolosis development in the slaughtered cattle in the study area keeping with the prevailing tendency of constant transmission and exposure to the infective stages of the parasite in the environment by grazing animals.

Parameter	No. Examined	No. Infected	Prevalence (%)
Total	400	68	17.0

Table 1: Overall prevalence of *Fasciola* species in cattle slaughtered at Lafia Abattoir.

Sex analysis showed that female cattle were slightly more prevalent (18.9) than male cattle (15.1) as indicated in table 2. Despite the fact that infection among females was more common, the two sexes were not significantly different (2 = 0.94, 1 = 1, p = 0.33). This implies that under the same grazing and management practices, both the male and female cattle are nearly equally exposed to *Fasciola* infection.

Sex	No. Examined	No. Infected	Prevalence (%)
Male	199	30	15.1
Female	201	38	18.9
Total	400	68	17.0
χ^2 = 0.94		df = 1	p-value = 0.33

Table 2: Sex-wise prevalence of *Fasciola* species in cattle.

Prevalence of *Fasciola* infection among study cattle as related to age is shown on table 3. Abattoir inspection revealed cattle younger than 2 years of age recorded the least prevalence (10.9%), animals between 2 and 4 years had a prevalence of 16.5% while those greater than four years of age had the highest prevalence (22.5%). Prevalence increased with increasing age probably because animals had longer periods of grazing contact with pasture vegetation contaminated with infective metacercariae and hence; had higher chances of infection. However, infection was not significantly different (χ^2 = 5.52, df = 2, p = 0.63) among age groups.

Age Group (Years)	No. Examined	No. Infected	Prevalence (%)
< 2	92	10	10.9
2-4	188	31	16.5
> 4	120	27	22.5
Total	400	68	17.0
χ^2 = 5.52		df = 2	p-value = 0.63

Table 3: Age-wise prevalence of *Fasciola* species in cattle.

Summary of *Fasciola* infection among slaughtered cattle according to severity of lesions is presented on table 4. Out of the 68 positive liver, 25 (36.8%) livers had mild *Fasciola* lesions (characterized by few flukes and little fibrosis), 28 (41.2%) had moderate lesions (characterized by presence of multiple flukes and bile ductular thickening), while 15 (22.0%) had severe lesions (characterized by extensive fibrosis). This trend shows that most infected cattle had moderate intensity of infection.

Diagnostic comparison of fasciolosis among cattle is shown on table 5. Post-mortem liver examination yielded a prevalence of 17.0% positive samples out of which 68 were positive for

Lesion Severity	Description	No. of Livers Affected	Percentage (%)
Mild	Few flukes or limited fibrosis	25	36.8
Moder-ate	Multiple flukes and bile duct thickening	28	41.2
Severe	Extensive fibrosis and numerous adult worms	15	22.0
Total	—	68	100.0

Table 4: Distribution of *Fasciola* infection based on severity of liver lesions.

Fasciola infection, 60 positive samples were detected using fecal sedimentation method which gave a prevalence of 15.0%. Combination of both post-mortem inspection and fecal sedimentation methods gave an overall prevalence of 18.0% indicating that dual approach increases sensitivity of detection. Generally, fasciolosis was detected among 72 out of 400 cattle slaughtered examined which is comparable with values reported in other parts of Nigeria.

Diagnostic Method	No. Examined	No. Posi-tive	Prevalence (%)
Post-mortem liver examination	400	68	17.0
Fecal sedimentation technique	400	60	15.0
Combined diagnostic result	400	72	18.0

Table 5: Prevalence of *Fasciola* species by diagnostic method.

Discussion

Overall, the pooled prevalence of *Fasciola* spp. infection was found to be 17.0% among 400 cattle slaughtered at the Lafia Modern Abattoir, Nasarawa State. This implies that fasciolosis caused by *Fasciola* spp. is an important parasitic disease problem of cattle slaughtered in Lafia Abattoir which can contribute to loss at meat inspection and risk humans who work at the abattoir or

consume contaminated meat. This finding is similar to the report of Adamu., *et al*. [9] who recently conducted a systematic review and meta-analysis on prevalence of fasciolosis in Nigeria and reported a pooled national prevalence of 29% (95% CI: 21-38%). Variation in prevalence could be due to difference in geographic location, diagnostic technique and cattle management adopted.

The prevalence value is also similar to the prevalence of 20% reported by Banwo., *et al*. [24] among cattle slaughtered at the Akinyele Central Abattoir, Ibadan, Nigeria. In that study, *F. gigantica* was the predominant species recovered (78.1%), with higher prevalence recorded during the rainy season (26.5%) compared to dry season (8.6%). This study however contrasts with the result of Obialigwe., *et al*. [8] who recently reported a lower prevalence of 8.29% among cattle slaughtered at the Jalingo Abattoir, Taraba State. This difference in prevalence may be due to good grazing management of cattle as well as the dry environmental condition in the area that may not be conducive for survival of intermediate hosts. Variations in geographical locations within Nigeria have consistently been reported by several authors and may be due to differences in climatic conditions, ecological factors, cattle breed and diagnostic techniques employed [9,25].

In relation to sex, the study observed a higher infection rate in female cattle (18.9%) compared to males (15.1%). However, this difference was not statistically significant (χ^2 = 0.94, df = 1, p = 0.33). This trend is consistent with the reports of Adamu., *et al*. [9] and Banwo., *et al*. [24]. The reason why females had higher prevalence than males could be due to longer contact period with grazing pasture since they are not confined to stall like their male counterparts. Also stress due to pregnancy and parturition may aid higher susceptibility to infection. But since cattle in the area are probably subjected to the same management system the difference was not significant.

Age related prevalence indicated cattle infected with *Fasciola* spp. increased with age; cattle less than 2 years of age had a prevalence rate of 10.9%, animals between 2 and 4 years old had a prevalence rate of 16.5% while cattle above four years recorded the highest prevalence rate of 22.5%. Again, there was no statistical difference (χ^2 = 5.52, df = 2, p = 0.63). This biological significance was however not surprising because infection increases with age because animals had higher chance of grazing contact over time and also ingestion of infective metacercariae from contaminated surface water. Previous studies have also reported the same observation that older animals were more susceptible to fasciolosis infection than their younger counterpart [8,19]. Very young animals hardly contact grazing pasture or drink contaminated water. These risk of infection could be minimized if cattle are administered with anthelmintics routinely and rotational grazing is practiced especially in older cattle.

Moderate *Fasciola* infection accounted for 41.2% of infected cattle, closely followed by mild infection 36.8% while severe infection recorded the least (22.0%) among positive cattle. This trend shows that infected cattle had a considerable damage on their liver. Banwo., *et al*. [24] also reported similar trend in their study. They observed that moderate infection was most predominant during slaughter surveys. Elelu and Eisler [25] reported that most infected animals that were slaughtered had either mild or moderate *Fasciola* lesions. Moderate to severe infection of cattle by *Fasciola* spp. usually leads to condemnation of liver at meat inspection thus causing major economic loss to livestock farmers and slaughter owners [25]. Lesions caused by *Fasciola* infection such as hepatic fibrosis and bile ductular thickening may also predispose animals to poor feed conversion, reduce body weight gain as well as loss of milk production [19].

In comparing diagnostic methods employed, post-mortem liver inspection recorded a prevalence rate of 17.0% where out of the 400 cattle sampled 68 were positive for *Fasciola* spp., fecal sedimentation technique recorded 15.0% positivity whereby out of the same population of 400 cattle sampled, 60 were positive for *Fasciola* spp. Combination of post-mortem inspection and fecal sedimentation technique gave an overall prevalence of 18.0%. This little difference recorded implies that use of one method may under estimate prevalence rate as compared to when dual diagnostic techniques are employed. This had been reported by Adamu., *et al*. [9] where they concluded that diagnostic technique plays a major role in prevalence obtained among different studies. Post-mortem inspection could only reveal chronic infections while patent infections are better diagnosed using fecal sedimentation since adult flukes would have to be present in the bile ducts to release eggs into the intestine.

Generally, the detection of fasciolosis among cattle at Lafia Abattoir indicates the possible presence of infected cattle

reservoirs around the location. This goes to say that environmental conditions in Lafia are still favorable for the survival of intermediate hosts especially during rainy season when water mostly stagnate allowing multiplication. Efforts should be intensified to control fasciolosis by routinely deworming cattle, providing good pasture drainage system and restricting movement of cattle to grazing in snail-infested pastures. Preventive measures such as abattoir hygiene and disposal of infected liver from abattoirs should also be practiced regularly. This will help in reducing contaminations of nearby water sources thus reducing risk of infection among animals and humans [25].

This study was limited in scope because it was cross-sectional and therefore seasonal prevalence could not be determined. Since only morphological identification of *Fasciola* was done, identification of species was not possible; whether *F. gigantica*, *F. hepatica* or hybrids cannot be confirmed. Molecular differentiation of the species should be done in future studies. Also multi-abattoir surveillance needs to be done in future.

Conclusion

This study show that fasciolosis caused by *Fasciola* spp. still affects cattle slaughtered at Lafia Abattoir which recorded a moderate prevalence rate of 17.0%. Sex and age of cattle were not found to be significantly associated with infection although trends from both categories shows risk factors that should be considered. Use of combination diagnostic technique increases sensitivity of detection. Preventive measures should be taken by routinely deworming cattle based on age and providing good environmental sanitation. Abattoir meat inspection should be strengthened.

Conflict of Interest

The authors declare no conflict of interest whatsoever as regard to this article.

Ethical Statement

Ethical approval was obtained from Institutional Animal Care and Use Committee (IACUC) of our place of research. Approval was also sought and obtained from Nasarawa State Ministry of Agriculture and Water Resources as well Nasarawa State Abattoir Management Committee.

The study made use of routinely slaughtered animal; hence no research animal was slaughtered. Consent was sought from the abattoir authorities and butchers prior to sample collection. All samples were disposed of after analysis following set guidelines and protocol to prevent environmental contamination and disease spread.

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