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Hydatidosis among ruminants slaughtered in Kafur Abattoir, Katsina State

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Abstract

Hydatidosis is an infection caused by the larval stage of *Echinococcus*. It is among the parasitic diseases that imperil livestock production. This study aims to determine the prevalence of hydatid cysts among ruminants slaughtered in Kafur Abattoir, Katsina State. Post-mortem examination of the visceral organs of 600 ruminants (200 cattle, 100 sheep and 300 goats) was carried out for six months (September 2022-March 2023). The overall prevalence of hydatid cysts was 144 (24%). The prevalence was 46 (23%) cattle, 14(14%) sheep and in 84 (28%) goat. The prevalence of hydatid cysts was significantly associated with goats (OR>1.0, 95% CI>1.0) while in cattle and sheep, it showed no association. The cyst diameter of <5cm was predominant (137 out of 278 cysts) while the cyst diameter of >10cm was the least abundant (32). The liver and lungs harboured the majority of the cysts recovered in the animals. In cattle, only the liver and lungs were infected; the liver, lungs and heart were infected in sheep while in goats all four organs were infected. The study showed a significant prevalence of hydatid cyst infection in the ruminants studied, suggesting the need for public health awareness and control of the disease.

Introduction

Hydatid disease is a cosmopolitan zoonosis caused by the larval stage of *Echinococcus* species. The two main types of hydatid disease are caused by *E. granulosus* and *E. multilocularis*. Cystic echinococcosis (CE) is the most common form, caused by the larval stage of *E. granulosus*. It is seen in most regions of the world, particularly the Mediterranean region, Africa and the Middle-east, and it is the most frequently encountered form of hydatidosis in humans (WHO 2021; Rezaei *et al* 2021). It is among the parasitic diseases that contribute greatly to drastic reduction in livestock production. Ahmed *et al* (2017), reported hydatidosis as a global animal health problem of increasing importance.

Dogs and other carnivores serve as the definitive hosts, while a variety of herbivores, such as domestic animals (sheep, goats, pigs, cattle, camels and horses) that coexist with dogs serve as the intermediate hosts and humans serve as accidental intermediate hosts (Eckert and Deplazes 2004; Regassa 2019). The symptoms of hydatid cysts in the liver are abdominal pain, nausea, and vomiting. If the lungs are affected, the symptoms include chronic cough, chest pain, and shortness of breath while other symptoms depend on the location of the hydatid cysts and the effect on the surrounding tissues. The liver and lungs are the organs in the intermediate hosts that are most frequently harmed, although other organs such as the spleen, kidney, and brain may also be affected (Botezatu *et al* 2018). Infective eggs from fodder are consumed by livestock, which then develop into larval stages (hydatid cysts) in various body organs. The cysts mature to a size where they may cause disease and symptoms in the hosts over several months, developing the germinal layer, an exterior laminated membrane (Bushura 2019; Lauren *et al* 2021). When viable hydatid cysts are consumed by the specific hosts and transform into adult worms, the life cycle is complete. Humans can become infected during the disease's natural transmission from predators to domestic animals by ingesting *Echinococcus* eggs in contaminated food or water or by coming into close contact with infected dogs.

Despite the extent of research on hydatidosis in many parts of the world, it is still a zoonosis of unrecognized importance. In Nigeria, a few research have been done on the prevalence of hydatidosis in cattle, a readily available and inexpensive source of meat, milk, skins, and farming tools (Kadim *et al* 2008; Tarefa, 2014). Studies by Ajogi *et al* (1995) and Okolugbo *et al* (2013) in Sokoto, Yakubu *et al* (2018) in Maiduguri, Luka *et al* (2020) in Kano and Okolugbo *et al* (2023) in Delta State were carried out on the prevalence of hydatidosis in different parts of Nigeria.

Globally, more than one million people are living with cysts of *Echinococcus* and many of these people may experience severe clinical symptoms, which are life-threatening if left untreated (Craig *et al* 2007).

Materials and methods

Study area

The study was carried out in Kafur Local Government Area in Katsina, State, Nigeria. Kafur occupies a land mass of 1,106 km^2. It is located on the coordinate 11°39′ 1″N and 7°42′19″E. The inhabitants are mostly Hausa and Fulani speaking people that constitute a population of 202,884 (NPC 2006). The area is characterized by mean temperature ranging between 35° and 39°C annually. The vegetation is dominated by

trees, shrubs and grasses. Majority of the indigenes are farmers, civil servants, butchers, and businessmen.

Study animals

This study was conducted on six hundred ruminants (200 cattle, 100 sheep, and 300 goats) slaughtered at Kafur Abattoir to determine the prevalence of CE from postmortem examination of visceral organs (liver, lungs, heart and kidney). The study considered the sexes, age groups and breeds of the animals. The animals were brought from different parts of northern Nigeria. On the average, 700 cattle, 100 sheep and 100 goats were slaughtered daily during the study period.

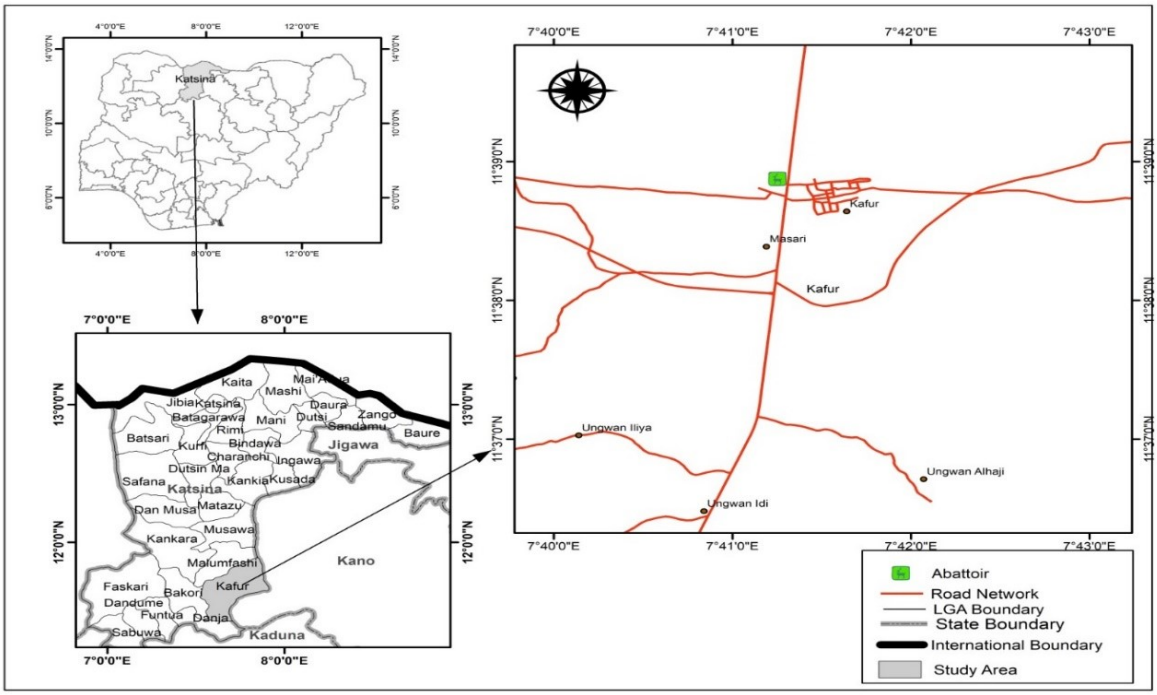

Figure 1. Map of Kafur Local Government Area showing the study site (GIS Federal University Dutsin-Ma, 2022)

Sample size

The sample size for this study was calculated by the formula of Thrushfield (1995) with a confidence interval of 95% and a desired absolute precision of 5%

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

Where N=Simple size
Z=Standard normal variance at 95% type error
z< 0.05=1.96
p=Expected prevalence
d = Desire absolute precision

$$N = \frac{1.96^2.0.5(1-0.5)}{0.05^2}$$

$$N = \frac{1.93(0.5)}{0.05^2}$$

$$N = \frac{0.97}{0.0025}$$

$$N = 388$$

The minimum sample size required for this study is 388. To increase the accuracy of the test, the size was increased to 600 (200 cattle, 100 sheep and 300 goats).

Post-mortem examination

The hydrated cysts identified from each organ and animal were counted and recorded. The diameter of the hydrated cyst was measured and classified as small (<5cm), medium (≥5cm), and large (>10cm) as described by Oostburg *et al* (2010). The samples were carefully labeled and stored in containers with 10% formalin. The samples were transported to Helminths Veterinary Laboratory at the Faculty of Veterinary Medicine, Ahmadu Bello University (ABU) Zaria for microscopic examination.

Microscopic examination of hydatid cysts

Microscopic examination of hydatid cysts was carried out following the routine procedure by Rabiu and Jegede (2010). The sample collected was examined for the presence of brood capsules and daughter cysts from the parent cyst. The parent cysts were carefully aspirated by the use of a syringe and the fluid collected was centrifuged at 5,000rpm for five minutes. Subsequently, a drop of the sediment was transferred to the slide and covered with a cover slip. The preparation was mounted on a microscope and examined at 100 and 400 magnifications as described by Ochei and Kolhatkar (2000).

Data analysis

Data collected were recorded and entered into a microsoft excel sheet. The data was analysed using SPSS 2.3 window software: The prevalence of hydatidosis in each slaughtered ruminant was computed and the distribution of hydatid cysts and cyst diameter in different organs were assessed for any effect on the prevalence of hydatidosis in the animals studied. Chi-square (χ^2) test was used to determine the associations between the various animals with the prevalence of hydatidosis. Statistically, a significant association

between variables was considered significant when the p-value was less than or equal to 0.05.

Results

Prevalence of hydatidosis in slaughtered ruminant animals at Kafur Abattoir, Katsina State

46 (23%) out of the 200 cattle examined were infected with hydatidosis. Out of 100 sheep and 300 goats examined, 14 (14%) and 84 (28%), respectively were infected. The overall percentage prevalence of hydatidosis for the 600 animals sampled was 144 (24%; Table 1).

Distribution of hydatid cysts and cyst diameters in infected ruminants

Table 2 shows the distribution of hydatid cysts and their diameters in infected ruminants. A total number of 103 cysts were encountered for cattle. Among these, 48 cysts had a diameter less than 5cm, 41 cysts had a diameter greater than 5cm, and 14 cysts had a diameter greater than 10cm. A total number of 31 cysts were found in the sheep examined. Out of these, 12 cysts had a diameter less than 5cm, 16 cysts had a diameter greater than 5cm, and 3 cysts had a diameter greater than 10cm. For the goats examined, a total number of 144 cysts were found.

Distribution of hydatid cyst diameter in different organs

Table 3 presents the distribution of hydatid cysts based on cyst diameter in different organs in the animal examined. The table provides information on the number of infected samples, as well as the distribution of cysts based on different diameter ranges, for each organ. Each infected ruminant had one or more hydatid cysts. For the liver, a total of 88 samples were found to be infected. Among these, 63 cysts had a diameter less than 5cm, 88 cysts had a diameter greater than 5cm, and 32 cysts had a diameter greater than 10cm. The total number of cyst counts in the liver was 183.

The total counts indicate that, across all organs, out of the 144 infected samples, 134 cysts had a diameter less than 5cm, 120 cysts had a diameter greater than 5cm, and 34 cysts had a diameter greater than 10cm. The total number of cyst counts for all organs combined was 278.

Distribution of hydatid cysts in different organs of cattle based on cysts diameter

Table 4 shows the distribution of hydatid cysts and their diameter in the different organs of cattle slaughtered in Kafur Abattoir. The liver had 68 cyst counts, among these 23 cysts had a diameter of less than 5cm, 35 cysts had a diameter greater than 5cm and 10 cysts had a diameter greater than 10cm. The lung had 32 cysts, among these 25 cysts had a diameter of less than 5cm, 6 cysts had a diameter of greater than 5cm and only one was recorded with a diameter of more than 10cm. No cyst was seen in the kidney and heart in all cattle slaughtered in the abattoir, the total cysts recorded in all the organs was 100 cysts.

Distribution of hydatid cysts in different organs of sheep based on cysts diameter

Table 5 presents the distribution of hydatid cysts based on diameter in different organs of sheep slaughtered at Kafur Abattoir. The results showed that the liver recorded the highest number of hydatid cysts with 33 cysts, followed by the lung with 7cysts and the heart has 5cysts, while none was recorded in the kidney. However, the overall cyst count in sheep was 45, of which 16 had cyst diameter of >5cm and 6 had cyst diameters >10cm.

Distribution of hydatid cysts in different organs of goats based on cysts diameter

Table 6 shows the distribution of hydatid cysts based on cyst diameter in different organs of goats. The liver had the highest number of cysts (89) followed by the lungs (45) and the heart with (2). However, the overall cysts count in goats was 144 cysts, cysts with a diameter of <5cm were the highest (77) while cysts >10cm was the least abundant (15).

Table 1: Prevalence of Hydatid cysts in slaughtered ruminant animals at Kafur Abattoir

Species	NE	NI	chi-square	p-value	OR (95% CI)
Cattle	200	46(23)	8,22	9.48 ns	0.9 (0.61-1.36) na
Sheep	100	14(14)			0.4 (0.25-0.84) na
Goats	300	84(28)			1.5 (1.07-2.27) sa
Total		144(24)			

Key: ns= not significant difference, sa= significant association, na=no association, NE=number examine, NI=number infected

Table 2: Distribution of hydatid cyst diameter obtained from ruminants slaughtered at Kafur Abattoir

Animal Species	Cyst Diameter			Total No. of Cyst Counts
	<5cm	≥5cm	>10cm	
Cattle	48	41	14	103
Sheep	12	16	3	31
Goat	77	52	15	144
Total	137	109	32	278

Table 3: Overall distribution of hydatid cysts based on cyst diameter in the deferent organs of ruminants

Organs	No. Infected	Cyst Diameter			Total No. of Cyst Counts
		<5cm	>5cm	>10cm	
Liver	88	63	88	32	183
Lung	43	63	18	1	82
Kidney	8	5	2	1	8
Heart	5	3	2	0	5
Total	144	134	120	34	278

Table 4: Distribution of hydatid cysts based on cyst diameter in different organs of cattle slaughtered at Kafur Abattoir

Organs	No. Infected	Cyst Diameter			Total No. of Cyst Counts
		<5cm	>5cm	>10cm	
Liver	31	23	35	10	68
Lung	7	25	6	1	32
Kidney	0	0	0	0	0
Heart	0	0	0	0	0
Total	38	48	41	11	100

Table 5: Distribution of hydatid cysts based on cyst diameter in different organs of sheep slaughtered at Kafur Abattoir

Organs	No. Infected	Cyst Diameter			Total No. of Cyst Counts
		<5cm	>5cm	>10cm	
Liver	13	5	12	6	33
Lung	6	2	3	0	7
Kidney	0	0	0	0	0
Heart	3	2	1	0	5
Total	22	9	16	6	45

Table 6: Distribution of Hydatid cysts based on cyst diameter in different organs of goats slaughtered at Kafur Abattoir

Organs	No. Infected	Cyst Diameter			Total No. of Cyst Counts
		<5cm	>5cm	>10cm	
Liver	44	35	40	14	89
Lung	30	36	9	0	45
Kidney	8	5	2	1	8
Heart	2	1	1	0	2
Total	84	77	52	15	144

Discussion

The prevalence of hydatid cysts was highest in the goats, followed by cattle and sheep. The trend of prevalence was relatively high compared with Belachew *et al* (2019), who reported the prevalence of hydatidosis as 21%, 19% and 16% in cattle, sheep and goats, respectively. It is also higher than the study carried out in Iran where prevalence of 17.9%, 3.1%, and 9.1% were reported for sheep, goats and cattle respectively (Mahdi *et al* 2013). However, the prevalence obtained in the present study was lower than the finding by Enerst *et al* (2009) in Tanzania, who reported the prevalence of hydatid cysts in slaughtered ruminants at 48% in cattle, 63.8% in sheep and 34.7% in goats. The variation in the prevalence of hydatid cyst infections among the ruminants slaughtered in different study areas could be attributed to the different types of animals reared in those areas. In some areas, cattle and goats are taken to far distances for rearing than sheep that remained more domesticated. The animals that were reared in far forest are likely to be more infected with the eggs of adult *E. granulosus* due to the presence of stray dogs. However, another factor that might contribute to the higher prevalence in cattle than sheep is that cattle are slaughtered at older age than sheep and this increases the risk of exposure to the eggs of *E. granulosus*, while sheep are slaughtered at relatively early ages. The overall prevalence of hydatid cysts in the study area was (24%). This is similar to the study carried out in Ethiopia that reported overall prevalence of hydatidosis in cattle as 20.5% (Abebe and Kumsa, 2013).

The highest cyst count was found in goats and sheep with smaller cyst diameters in the present study. This

observation is in agreement with the previous study by Belachew *et al* (2019), who reported cyst counts of 49.5%, 40.1%, and 10.4% in small, medium and large diameters, respectively. The observations of higher cyst counts in goats and sheep could be attributed to the fact that the majority of the animals slaughtered in the Abattoir were smaller ruminants. However, it could be also due to socio-economic status, as many butchers can afford to buy only smaller ruminants for slaughter due to the higher cost of bigger ruminants in the market. However, the economy also makes owners of ruminants dispose of young animals before they grow older to have money for upkeep. Therefore, the majority of ruminants slaughtered are usually goats.

In the present study, it was established that hydatid cysts occur predominantly in the liver and lungs of infected ruminants. This is in line with various studies that reported hydatid cysts as being commonly found in the liver and lungs (Rawat *et al* 2019; Getaw *et al* 2010). The result obtained from the study area also agrees with the report that the liver and lungs possess several capillaries encountered by migrating *Echinococcus* onchosphere, which takes the portal vein route before any peripheral organs are involved (Kebede *et al* 2009). However, the result also agrees with a report on the prevalence of hydatid cysts in domestic animals in Ethiopia, which showed that the lungs and liver were the most commonly affected organs by hydatid cysts in cattle, sheep and goats (Trappe *et al* 2011).

However, for cattle, the result shows liver and lungs are the only organs infected by hydatid cysts. This agrees with several findings around the globe (Mesay *et al* 2017; Yakubu *et al* 2018; Regassa 2019). In the case of sheep, the result indicates liver, lungs and heart are organs affected by hydatid cysts while in goats all four organs examined had hydatid cysts but the cysts were more predominant in the liver and lungs. This prevalence pattern is in agreement with Trappie *et al* (2011) that reported lungs and liver as the most commonly affected organs by hydatid cysts in cattle, sheep and goats.

Conclusion

A higher prevalence of hydatid cysts was recorded in goats and cattle. The overall prevalence of infection in this study revealed that the liver and lung harbour majority of hydatid cysts. The disease can cause a significant economic loss directly through organ damage and also indirectly by affecting human and animal health. Poor food hygiene and personal hygiene, especially those having close contact with infected ruminants, improper disposal of affected organs and lack of public awareness on control of the disease and its public health significance are the factors that can increase the transmission of the disease.

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Conflict of Interest

Authors declare that no conflicts of interest exist.

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