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Research Article

Epidemiological Study on Bovine Hydatidosis in North Kordofan State, Sudan

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ABSTRACT

Across sectional study was conducted from March to May 2012 to estimate the prevalence and assess contribution of major risk factors for the occurrence of hydatid cysts infection on 244 cattle slaughtered at Elobied abattoir in North Kordofan state, Sudan. The overall prevalence of bovine hydatid cysts infection was 2.5%. Risk factors such as age (χ^2 = 2.420, P-value = 0.120), breed (χ^2 = 2.561, P-value = 0.278) and the disposal of affected organs (χ^2 = 1.100, P-value = 0.294) showed statistically significant association (P-value ≤0.30) with the occurrence of hydatid cysts. However, risk factors such as sex, body condition, presence of dogs and the origin of animals didn't show statistically significant association with the occurrence of hydatid cysts. In the multivariate analysis, the age (Exp (B) = 10.27, P-value= 0.036) was found to be the only statistically significant risk factor. For the location of hydatid cyst in visceral organs, the lung was found to be the most affected organ. By microscope examination of hydatid cyst, showed that 85.3% cysts were sterile and 14.7 % cysts were calcified, no fertile cyst was observed.

Key words: Hydatid cyst, Bovine, Prevalence, Risk factors, Abattoir, Sudan

INTRODUCTION

Hydatidosis is achronic cyst-forming parasitic helminthic disease of human beings as well as et aldomestic and wild ungulates. It is caused by infection with the larval (metacestode) stages of dog tapeworms belonging to the genus *Echinococcus* (family Taeniidae) and is also referred to as echinococcosis (Craig *et al.,*2007*)*.In human these tapeworms cause condition known as hydatid disease. Where cysts of great size may develop and cover long period post-infection (Shakespeare*,* 2001). On the other hand, sheep, goats, cattle, camel, buffaloes, pigs and donkeys have been repeatedly found infected with hydatid cyst (Oryan *et al.,* 1994). Cystic echinococcosis is endemic and is maintained in three distinct cycles, livestock/dog domestic cycle, desert cycle between dogs and camels andcylvatic cycle between wild carnivores and wild ruminants (Dalimi *et al.,*2002).In humans, the disease is initially without any symptoms until gradually the cyst increased in size, causing local pressure effects. In animals, the disease does not produce any clinical signs and is usually only discovered during meat inspection at the slaughterhouse where the affected viscera (mainly liver and lungs) are condemned (Eddi *et al.,* 2004). Prevention of both cystic echinococcosis and alveolar echinococcosis focuses primarily on veterinary intervention to control the extent and intensity of infection in definitive host population which may indirectly be approached by controlling the prevalence in animal intermediate host (Gottstein, 2003). The objectives of this study are to estimate the prevalence of bovinehydatidosisand to investigate the risk factors associated with the disease in North Kordofan, Sudan.

MATERIALS AND METHODS

Study area

The study was conducted at Elobied abattoir in North Kordofan. North Kordofan lies in arid and semi-arid zones between Latitude 11.15-16.45 N and longitude 27-32.15 E. It also includes desert climate zone on the far northern parts and more humid climate to South. The northern parts of North Kordofan State lie in the desert and semi-desert and May and June are the hottest months and December to February are the coldest months. In general two air movements affect the climate of the area. Avery dry movements from the north reaching its southern limit in mid-winter and amajor air flow of maritime origin that

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carries moisture, enters from the south and brings rains. The state covers an area of 25 million hectares out of which 14.5 million hectares are rangeland. The livestock population, mainly cattle, sheep, goats and camels are about 6894425 heads. The major cash crops are Sesame, Karkade, Watermelon, Groundnut, Gum Arabic and vegetables. Major tribes are Bederia, Shiweihat, Kababish, Kawahla, Hamar, Dar Hamid, Jawama and Maganeen (Goma, 2008).The animals examined in this study came from three regions in the Sudan. These regions are Darfur, Kordofan and White Nile.

Study design

A Cross-sectional study was conducted at Elobied abattoir on three randomly selected days Sunday, Tuesday and Thursday. Animals in these days were selected by systematic random sampling method. From each five animals we selected one animal for examination (Martin *et al.,* 1987).

Sample size

The sample size was calculated according to (Thursfield, 2007) by considering 3.84% expected prevalence (Elmajzoob, 1989). And 5% accepted error at 95% confidence interval using this formula: N=1.962 *Pexp (1-Pexp)/d2; where, N=required sample size; Pexp=expected prevalence; d=desired absolute precision. The small sample size calculated (61) was multiplied by 4 to increase precision of the results (Thursfield, 2007).

Ante –mortem examination

Ante-mortem inspection recommended by Gracey (1986) was utilized. Regular visits were made by the investigator to conduct ante -mortem examination of slaughter animals. A total of 244 cattle were examined. During the ante-mortem inspection, the age, sex, breed, origin and body condition of each animals were determined. The age of animals was determined by Incisors of animal teeth. The body condition of each animal was assessed and recorded depending on their body condition score and was ranked as poor or good. Animal origin was also recorded as state, from which the animal came.

Post -mortem examination

Post-mortem inspection procedures recommended by Food and Agricultural organization (1994) were used during study. During the post mortem examination, visual inspection, palpation and systemic incision of each visceral organs were performed particularly the liver, lungs, kidneys, heart and spleen. In parallel, the following data were recorded: Serial number, date, infection, infected organ, number of cysts and size of cyst. The infected organs were collected in polyethenebags and taken to Elobied hospital laboratory to conduct cyst count, cyst size, cyst fertility and viability of protoscoleces.

Examination of cysts

Infected organs were transported to the laboratory of Elobied hospital and further analysis to determine the state of the cysts was performed. The fertility of cysts was examined microscopically. Each cyst was cut-opened with scissor and the content of the cyst was poured into a clean Petri dish. A drop of cyst fluid was put in a clean slide and then examined under the microscope (40×) for the presence of protoscolices. The viability of protoscolices was determined by flame cell motility. The cyst which contained no protoscolices as well as suppurative, calcified, or degenerated was considered as unfertile cyst. Whenever and wherever the cysts were present, they were removed and incised. The shrunk, evacuated, pus formatted cysts were classified as degenerated cysts, while the solid and sands contained ones were considered as calcified cysts, while the fluid filled one and had no protoscolices by direct microscopic examination were considered as sterile cysts. Hydatid fluid was aspired from the cysts by syringe and the volume of cysts was estimated by measuring this fluid (Daryani *et al.,* 2007)

Statistical analysis

All data collected were entered into Microsoft excel spreadsheet. For analysis of the data SPSS version 16 was used. Data was analyzed descriptively in the first step, using the frequency table and cross tabulation. Then the association of the different variables with the prevalence of bovine hydatidosis at the cow level was analyzed using a Chi-squared test. The level of significance was set at P-value ≤0.3. For the investigation of the association between the probabilities of occurrence of hydatidosis in response to potential individual and hygienic risk factors, multivariate analysis was performed in which logistic regression model was used. The strength of the association between the risk factors and the prevalence of bovine hydatidosis was analyzed using the odds ratio and the level of significance was set at P-value ≤0.05.

RESULTS

The overall prevalence of bovine hydatidosis was 2.5%. As shown in Table (1) the prevalence of hydatid cysts infection according to age of cattle was: 4.4% in animals more than 5 years and 1.2% in animals less or equal to 5 years. The distribution of the hydatid cysts according to the area (states) of cattle was: 3.4% in Darfur, 1.35% in Kordofan and zero in White Nile. As for body condition the prevalence was: 2.58% in good body condition and zero in poor body condition. Regarding distribution by sex, the prevalence of hydatid cysts was: 3.03% in male and 1.26% in female. Also prevalence between hydatidosis and presence of dogs was: 2.85% in presence of dogs and 1.44% in absence of dogs. The prevalence between hydatidosis and breed of animals was: 8.33% in fuga, 2.56% in Baggara and zero in Kenana. Also distribution of hydatidosis when affected organs not disposed properly was 2.89% and zero when affected organs disposed properly. In the univariate analysis using chi-square test, risk factors such as age (χ^2 = 2.420, P-value = 0.120), breed (χ^2 = 2.561, P-value = 0.278) and the disposal of affected organs (χ^2 = 1.100, P-value = 0.294) showed statistically significant association with the occurrence of hydatid cysts. However, risk factors such as sex, body condition, presence of dogs and origin of animals didn't show statistically significant association with the occurrence of hydatid cysts.In the multivariate analysis, the age (Exp (B) = 10.27, P-value= 0.036) was found to be the only statistically significant risk factor

Table 1: Univariate analysis for risk factors of bovine hydatidosis in 244 cattle slaughtered at Elobied slaughterhouse by using the chi-square ($\chi^{2)}$ test.

Risk factor	No. inspected	No. affected (%)	d.f	χ^2	p- value
Origin			2	1.600	0.449
Darfur	145	5 (3.4%)			
Kordofan	74	1 (1.35%)			
White Nile	25	0 (0.0%)			
Age			1	2.420	0.120*
>5 years	89	4 (4.4%)			
≤5 years	155	2 (1.2%)			
Body condition:			1	0.318	0.573
Poor	12	0 (0.0%)			
good	232	6 (2.58%)			
Sex:			1	0.693	0.405
Female	79	1 (1.26%)			
male	165	5 (3.03%)			
Presence of dog:			1	0.409	0.523
Yes	175	5 (2.85%)			
No	69	1 (1.44%)			
Breed:			2	2.561	0.278*
Fuga	12	1 (8.33%)			
Kenana	33	0 (0.0%)			
Baggara	199	5 (2.56%)			
Disposal of affected organs:			1	1.100	0.294*
Yes	37	0.0 (0.0%)			
No	207	6 (2.89%)			

*Significant at p-value ≤ 0.3

Table 2: Multivariate analysis ofhydatidosis and potential risk factors in 244 cattle slaughtered at Elobied slaughterhouse, North Kordofan

Risk factor	No. tested	Positive (%)	Exp (B)	P. value	95% CI
Age:					
>5 years	89	4 (4.49%)	10.270	0.036*	1.163- 90.663
≤ 5 years	155	2 (1.29%)	Ref.		
Breed:					
Fuga	12	1(8.33%)	0.0	0.998	0.00 -0.00
Baggara	199	5 (2.51%)	0.369	0.402	0.036- 3.797
Kenana	33	0 (0.0%)	Ref.		
Disposal of affected organs:					
No	207	6 (2.89%)	0.00	0.998	0.00 - 0.00
Yes	37	0 (0.0%)	Ref.		

*Significant at p-value ≤ 0.05.

with bovine hydatidosis (Table 2). Our study showed that the lung was the most affected organ (84.6%) followed by the liver (15.4%). No cysts were observed in heart orperitoneum. Microscopic examination of the 13 cysts revealed that, 12 cysts (85.3%) were sterile and one cyst (14.7%) was calcified cyst. No fertile cysts were observed in this study, we also found that cyst volume greater than 3 ml were 5 cysts (38.3%), less or equal 3 ml were 8 cysts (61.7%) (Table 3).

DISCUSSION

The current study indicated a prevalence of bovine hydatidosis of2.5% in Elobied slaughterhouse, North Kordofan, Sudan.The prevalence of bovine hydatidosis reported in this study is in close agreement with the results of various researchers (Ibrahim *et al.,*2011; Mohamadin and Abdelgadir , 2011; Elmahdi *et al.,* 2002) in different regions of Sudan. However, the prevalence in the present study was found to be lower than those reported incentral, western and southern Sudan (Omer *et al.,* 2010) and in Southern Darfur state (Mohammed, 1992). The prevalence in the current study is similar to prevalence reported from Iran (Darani *et al.,* 2003), Iraq (AL-KhamesI and AL-Hadithi, 2011) and Tanzania (Nonga and Karimuribo, 2009).The prevalence in this study is lower than the prevalence in other studies in Ethiopia (Formsa and Jobre, 2011), (Gebremeskel and Kalayou, 2009), (Terefe *et al.,* 2012) and (Gebretsadik *et al.,*2010), in Mauritania (Salem *et al.,*2011), Iran (Dryani *et al.,* 2006), in Uruguay (Hernanadz *et al.,* 2011) and Saudi Arabia (Ibrahim, 2010). On the other hand the prevalence of hydatied cyst infection in this study is higher than the prevalence in other studies in Saudi Arabia (Shalaby *et al.,* 2011), in Ethiopia (Fikire *et al.,* 2012) and in Tanzania (Swai and schoonman, 2012). The difference in hydatidosis prevalence rate between countries could be associated with different factors like control measures put in place, the level of community awareness about the disease, education and economic status of the population, the farming community ,variation in the temperature, environmental conditions, the nature of the pasture and the way of raising of these animal , levels of exposure and the maturity and viability of eggs (Njoroge *et al.,* 2002; Bardonnet *et al.,* 2003; Azlaf and Dakkak, 2006). In the present study, the age as risk factor has significant

Table 3: Distribution of hydatid cyst infection, volume and fertility in 244 cattle slaughtered in Elobied slaughterhouse, North Kordofan.

variable	Total Number	(%) Percentage
Organ:		
Lung	11	84.6
Liver	2	15.4
Cyst volume:		
>3 ml	5	38.3
≤ 3 ml	8	61.7
Fertility:		
Sterile	12	85.7
Calcified	1	14.3

statistical association (p-value = 0.03) with bovine hydatidosis, and this result was in close agreement with the results reported by Estatgil and Tuzer (2007) and Rinaldi *et al.* (2008). In our study the variation in fertility, sterility and calcification may be related to strain difference and genotype of infection strain that affects the fertility rate of cysts in the intermediate hosts and there-by the infectivity of strain for the subsequent infection and this result was in line with studies conducted by McManus (2006) and Mwambete *et al.,* (2004). Also in this study the high number of cysts in lung may be due to relatively softer consistency of lung compared to liver.This result was in agreement with findings of Getaw *et al.,*(2010).Also this study indicated that lung harbours large number of small cysts, the higher proportion of small cyst may indicate late infection of animal as result of heavy rainfall and continuous grazing in the previous raining season or due to immunological response of the host which might preclude expansion of cyst size, this result is consistent with the findings of Fikire *et al.,* (2012).

Conclusion

- The output of this study indicates that the overall prevalence of hydatid cyst was: 2.5.
- Significant association was observed between hydatidosis and the age of animals, breed of animals and disposal of affected organs. For the location of hydatid cyst in visceral organs, the lung was found to be the most affected organ, with the prevalence of 84.6% and 15.4% in liver. By microscope examination of hydatid cyst, showed that 85.3% cysts were sterile and 14.7% cysts were calcified, no fertile cyst was observed.

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