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Prevalence and Risk Factors of *Fasciola* eggs in Cattle in the White Nile State, the Sudan

Abdel Haleem Hassan, Yassir Adam Shuaib, Siham Elias Suliman and Mohamed Abdelsalam Abdalla

College of Veterinary Medicine, Sudan University of Science and Technology, P.O. Box 204, Hilat Kuku, Khartoum North, the Sudan
*Corresponding author: E-mail:salamaa2000@sustech.edu, Mobile: +249 912 943 128

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ABSTRACT

A cross sectional study was conducted from July to September 2015 in El-Dueim slaughterhouse, the White Nile state, the Sudan, to estimate the prevalence of *Fasciola* species and their eggs in the livers and feces of cattle and to investigate potential risk factors associated with them. The liver inspection during post-mortem examination and sedimentation technique were used. The overall prevalence's of Fasciola species and their eggs were 43.4% (n= 92; 95% CI from 36.73 to 50.07) and 72.6% (n= 92; 95% CI from 66.6 to 78.6), while prevalence by risk factor category, ranged from 23.6% to 78.0% and from 60.0% to 90.0% respectively. Body condition (x^2=45.0, *p-value*=0.001), grazing (x^2=5.49, *p-value*=0.019), and presence of snail (x^2=36.3, *p-value*=0.001) were associated with detection of *Fasciola* in the livers of slaughtered cattle in the univariate analysis. The same risk factors, excluding grazing, were also associated with the detection of the eggs of *Fasciola* in the feces. Cattle with poor body condition and in presence of snails were at higher risk of finding the worm and eggs in their livers and feces in comparison to the reference category of the same risk factor in the multivariate analysis. It can be concluded that the liver flukes and their eggs are prevalent in the White Nile state. Therefore, the use of and the limnetic by cattle farmers from is recommended as a prophylactic measure.

INTRODUCTION

Fascioliasis is one of the most prevalent helminthic diseases throughout the world (Okewole *et al*., 2000). It has the widest geographic distribution than any emerging vector-borne zoonotic disease

(Mas-Coma *et al*., 2009). Fascioliasis is caused by *Fasciola hepatica* and *F. gigantica* (Vercruysse and Claerebont, 2001). The parasite is transmitted by ingestion of the metacercaria (WHO, 1999). Although, the parasite infests sheep and cattle which are the definitive hosts. Humans can become accidental host (Usip *et al.,* 2012), the worms are hermaphroditic, and have similar life cycles. They cause similar clinical manifestations in animals. Climatic diversities are important to the development of the snails which act as intermediate hosts for *Fasciola* species. It is established that areas with only one Fasciola species are distinct from local and zonal areas where both Fasciolids co-exist (Amor *et al*; 2011).This study was conducted to estimate the prevalence of bovine fascilosis in White Nile state and to investigate risk factors associated with it.

MATERIALS AND METHODS

Study area: This study was carried out in El-Dueim slaughterhouse which is located in El-Dueim town, the capital of the White Nile state. The town is located in the northern part of the state which lies between the latitudes 12°N and 13.3°N and the longitude 31°E and 33.3°E.

In the slaughterhouse both cattle and small ruminants are slaughtered and processed in a separate hall. Ante-mortem and post-mortem examinations are conducted by veterinarians. Animals slaughtered in El-Dueim slaughterhouse are only for local consumption.

Study design and sampling: A cross-sectional study was carried out in the period between July and September 2015. The animals were selected by random systematic sampling.

Sample size*:* The total number of cattle was collected based on the formula given by Martin *et al*., (1987).

$$n= 4PQ/L^2$$

Where

n =number of animals to be sampled.

P =expected prevalence of fasciolosis, which was estimated by Nada (2015) 3.5%. .

Q =1-P

L =allowable error

Accordingly, n was calculated to be 212.This number was multiplied by 2 in order to increase precision (Thursfield, 2007).

Ante-mortem and post-mortem examinations: The ante-mortem and post-mortem examinations were carried out according to the method described by Thornton's and Gracey (1981).

Liver inspection: The entire surface and both sides of the liver were inspected visually and thoroughly were palpated in a bright area under sufficient light. The liver was incised and the hepatic lymph nodes as well. Additionally, the bile duct was incised in both directions and its contents were examined.

Sedimentation method: Eggs of *Fasciola* worms were detected by also using the sedimentation method, in which 2 to 3 grams of feces were put in a mortar and emulsified with 42 ml of tap water and then were grounded with pestle and mixed well. The suspension was then poured through a tea sieve into a beaker to remove the large particles of the feces. The sieved suspension was poured in a centrifuge tubes and then centrifuged at 1500 rpm for two min. The supernatant was poured off and the sediment re-suspended in water and centrifuged at 1500 rpm for two min. This step was repeated four times till the supernatant fluid become clear. A bit of the deposit was taken and smeared on slide, then covered by slide cover, *Fasciola* eggs were examined for under light microscope.

Statistical analyses: The collected data were manipulated first on an excel sheet and then the statistical analyses were done using the Statistical Package of Social Science (SPSS) version 16.0.

RESULTS

Prevalence of Fasciola Adult and eggs: The overall prevalence of *Fasciola* worms in the liver of slaughtered cattle was 43.4% (n= 92; 95% CI from 36.73 to 50.07) and the eggs in the feces of the investigated cattle was 72.6% (n= 92; 95% CI from 66.6 to 78.6). Furthermore, the prevalence of liver flukes categorised by risk factor, ranged from 23.6% to 78.0% (95% CI from 15.66 to 88.15) and the fecal samples with detectable eggs was ranged from 60.0% to 90.0% (95% CI from 50.85 to97.35) which there is no statistical significant variances was observed, except the factor associated with good or poor body condition and the presence or absence of the snail intermediate host (Tables 1-2).

Table 1: Prevalence of liver flukes in cattle by risk factors at El-Dueim slaughterhouse, White Nile state and univariate analysis (from July to September 2015)

Risk factors	No. tested	No. positive	%	95% CI	df	χ^2	*p-value*
Origin							
White Nile	146	60	41.0	33.02 - 48.98[a]	1	1.00	0.315
Kordofan	66	32	48.5	36.44 - 60.56[a]			
Sex							
male	136	60	44.1	35.76 - 52.44[a]	1	0.08	0.780
female	76	32	42.1	31.00 - 53.20[a]			
Breed							
Kenana	134	52	38.8	30.55 - 47.05[a]	1	3.10	0.080
Baggara	78	40	51.2	40.11 - 62.29[a]			
Age							
≤2	126	48	38.0	29.52 - 46.48[a]	1	3.55	0.059
>2	86	44	51.1	40.54 - 61.66[a]			
Body condition							
Good	148	42	28.3	21.04 - 35.56[a]	1	45.0	0.001
Poor	64	50	78.0	67.85 - 88.15[b]			
Treatment							
Yes	104	46	44.2	34.66 - 53.74[a]	1	0.06	0.810
No	108	46	42.6	33.27 - 51.93[a]			
Grazing							
Close	38	10	26.3	12.30 - 40.30[a]	1	5.49	0.019
Open	174	82	47.1	39.68 - 54.52[a]			
Present of Snail					1		
No	110	26	23.6	15.66 - 31.54[a]		36.3	0.001
Yes	102	66	64.7	55.43 - 73.97[b]			

Different superscripts indicate significant difference at $p \leq 0.05$,
* = risk factor with variable that has expected count less than 5 or with constant variable thus no chi square was calculated

Table 2: Prevalence of Fasciola species eggs in the feces of cattle by risk factors at El-Dueim slaughterhouse, White Nile state and univariate analysis (from July to September 2015)

Risk factors	No. tested	No. positive	%	95% CI	df	χ^2	*p-value*
Origin							
White Nile	146	104	71.2	63.85 - 78.55[a]	1	0.47	0.50
Kordofan	66	50	75.8	65.47 - 86.13[a]			
Sex							
male	136	96	70.6	62.94 - 78.26[a]	1	0.8	0.37
female	76	58	76.3	66.74 - 85.86[a]			
Breed							
Kenana	134	94	70.0	62.24 - 77.76[a]	1	1.14	0.30
Baggara	78	60	77.0	67.66 - 86.34[a]			
Age							
≤2	126	90	71.4	63.51 - 79.29[a]	1	0.23	0.63
>2	86	64	74.4	65.18 - 83.62[a]			
Body condition							
Good	148	96	64.9	58.00 - 71.80[a]	1	14.9	0.001
Poor	64	58	90.0	82.65 - 97.35[b]			
Treatment							
Yes	104	72	69.2	60.33 - 78.07[a]	1	1.2	0.27
No	108	82	76.0	67.95 - 84.05[a]			
Grazing							
Close	38	28	73.6	59.58 - 87.62[a]	1	0.03	0.87
Open	174	126	72.4	65.76 - 79.04[a]			
Present of Snail					1		
No	110	66	60.0	50.85 - 69.15[a]		18.4	0.001
Yes	102	88	86.2	79.51 - 92.89[b]			

Different superscripts indicate significant difference at $p \leq 0.05$,
* = risk factor with variable that has expected count less than 5 or with constant variable thus no chi square was calculated

Table 3: Multivariate associations of risk factors with liver flukes in cattle at El-Dueim slaughterhouse, White Nile state (from July to September 2015)

Risk factors	No. tested	No. positive	%	Exp(B)	95% CI	*p-value*
Breed						
Kenana	134	52	38.8	ref		
Baggara	78	40	51.2	1.20	0.36-4.00	0.760
Age						
≤2	126	48	38.0	ref		
>2	86	44	51.1	1.70	0.75-3.86	0.200
Body						
condition	148	42	28.3	ref		
Good	64	50	78.0	5.96	2.70-13.2	0.001
Poor						
Grazing						
Close	38	10	26.3	ref		
Open	174	82	47.1	1.02	0.33-2.60	0.876
Present of						
Snail	110	26	23.6	ref		
No	102	66	64.7	4.60	1.4-14.9	0.012
Yes						

Table 4: Multivariate associations of risk factors with Fasciola species eggs in the feces of cattle at El-Dueim slaughterhouse, White Nile state (from July to September 2015)

Risk factors	No. tested	No. positive	%	Exp(B)	95% CI	*p-value*
Body						
condition	148	96	64.9	ref		
Good	64	58	90.0	4.20	1.5-11.4	0.006
Poor						
Present of						
Snail	110	66	60.0	ref		
No	102	88	86.2	3.50	1.1-10.7	0.032
Yes						

Association with risk factors: As Table 1 and 2 depicted, body condition (x^2=45.0, *p-value*=0.001), grazing (x^2=5.49, *p-value*=0.019), and presence or absence of snail (x^2=36.3, *p-value*=0.001) were associated with detection of the worms in the liver of slaughtered cattle in the univariate analysis. The same risk factors, excluding grazing, were also associated with the detection their eggs in the feces of the investigated cattle.

By using multivariate analysis some risk factors showed association with the detection of the worm in the liver of slaughtered cattle and also with eggs in the feces of the investigated cattle in the multivariate analysis (Tables 3-4). These included poor body condition and presence of snails.

DISCUSSION

Bovine fasciolosisis usually characterized by a chronic, subacute or acute inflammation of the liver and bile ducts, accompanied by submandibular oedema, anaemia, anorexia, general intoxication, and death (Magaji *et al.*, 2014). In the present study the prevalences of *Fasciola* worms in the liver and their eggs in the feces of the investigated cattle were higher than the findings of Ammar (2013) who reported a lower prevalence of worms of 10.0% (n=40) in West Omdurman slaughterhouse, Khartoum State. Our findings were also higher than the prevalence reported in Sokoto Metropolitan Abattoir, Sokoto, Nigeria which was 27.7% (Magaji *et al.*, 2014). Moreover, it is higher than the ones reported at different areas in Ethiopia (Mihreteab *et al.* 2010, Rahmeto *et al.* 2010, Yemisrach and Mekonnen 2012, Mult *et al.* 2012, Asressa *et al.* 2012, Kassaye *et al.* 2012, and Gebretsadik *et al.* 2012), in Tanzania by Mellau *et al.* (2010), and in Brazil by Alves *et al.* (2011). On the other hand, it was lower than the reports from Nigeria (Oyeduntan *et al.*, 2008; Ozung, *et al.*, 2011; Olusegun *et al.*, 2011), Egypt (Kuchai *et al.*, 2011), and Turkey (Yildirim *et al.*, 2007). The differences in prevalence among geographical locations could mainly be attributed to the variation in the climatic and ecological conditions such as altitude, rainfall and temperature (Mungube *et al.*, 2006). In the univariate analysis, only body condition, grazing, and presence or absence of snail was associated with detection of the worms in the liver and their eggs in the feces. However, origin of the animal, its sex, breed, age and whether it received a dose of an anthelmintic treatment did not have influence in the prevalence of the worms or their eggs. Yildirim *et al*. (2007) observed that age of animal had no effect on bovine fasciolosis and the rate of infection was 87.2% in the age group ≥6 years, 79.5% in between 3-5 years and 51.6% in age group ≤2 years.

In Ethiopia, the prevalence was higher in adult when compared to young (Yemisrach and Mekonnen, 2012).

Origin of animal did not influence in the prevalence of fasciolosis and the percentage of positive cases from the White Nile area was 41.0% and from Kordofan area was 48.5%. Conversely, Ammar (2013) was reported different prevalence from different parts of the Sudan; 0.0% in Khartoum state, 27.3% in Blue Nile state, 38% in White Nile state, 0.0% in Darfour state, 0.0% in Kordfan state, and 50.0% in Algdarif state. In Zimbabwe, the higher prevalence was found in the watering areas compared to the flat areas (Pfukenyi *et al*., 2006). In Egypt, the prevalence was higher in relatively low land areas as compared to high altitudes (Kuchai *et al*., 2011). In kordofan there are hafeers in which water can stay from one rainy season to the next one. This provides an excellent niche for the intermediate host and hence the preserve of the parasite in nature just like in the While Nile state.

The results of this study showed that the prevalence in Baggara breed and in Kenana breed cattle is statistically similar and the breed factor has not a significant effect. The results of these study were not in agreement with Ammar (2013) who compared between Ethiopian, Sudanese, and cross cattle slaughtered in the Sudan and also with the findings of Kato *et al*. (2005) and Sanchez *et al.* (2002) those observed that the prevalence was higher in Japanese native cattle than in Friesian or Jersey cattle and in Spain the prevalence was higher in cross breed cattle than that in autochthonous Rubia Gallega Friesianor and Brown Swiss cow in Japan.

In the present study multivariate analysis showed that there was significant associated with Fasciolosis and present of snail, also there was significant associated with Fasciolosis and body condition.

It can be concluded that the blood sucker parasite, the liver flukes and their eggs were prevalent in the liver of the slaughtered cattle and in feces in El-Dueim slaughterhouse, the White Nile state. Body condition, grazing, presence of snail, and presence of water body were associated with the disease in the univariate analysis. The use of anthelmintics by cattle farmers from period to period is recommended as a prophylactic measure but also how to correctly use these chemicals and the hazards that might possibly arise to animals and consumers if not appropriately used should be explained.

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