A Cross-Sectional Survey of Bovine Fasciolosis at Elkadaro Abattoir, Khartoum State, Sudan

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Abstract

A cross-sectional study was conducted from May to July 2011. The multivariate analysis exposed significant associations by postmortem examination: age >4 years (P= 0.000, OR= 18.5, 95

Index terms— fasciolosis, cattle, prevalence, risk factors, abattoir, khartoum, sudan.

1 I. Introduction

asciolosis is among the most neglected important tropical diseases. Although it has significant economic impact on livestock industry, particularly cattle and sheep and occasionally can infects human beings (CDC, 2013). Among the estimated 91.1 million humans at risk for infection worldwide, as many as 17 million may be infected (Tolan, 2011). However, the disease is also consider as one of the major parasitic diseases contributing to loss in productivity estimated at over 200 US$ million per annum worldwide (Sturat, 1998). The infection is due to the food-and water-borne route. The two species most commonly implicated, as the etiological agents of fasciolosis are F. hepatica and F. gigantica **??**CDC, 2013).

Sudan possesses one of the highest livestock populations in Africa but productivity is low as a result of diseases, malnutrition and other management problems. Fasciolosis is one of these diseases which is responsible for considerable economic losses in livestock production (Boray, 1985). The disease is proved to be endemic in certain districts that characterized by intensive sheep or cattle production, in addition to the existence of favorable habitats for the snails host, like: White Nile, Eljazeera and Sennar Author ? ?: College of Veterinary Medicine, Sudan University of Science and Technology, P.O. Box: 204, Khartoum north 13314, Sudan. e-mails: mohammed_bushra2000@yahoo.com, aamelfadil@yahoo.com regions (Ali, 1983). Another negative economic impacts on indigenous livestock result from inefficient conversion of feed, retarded growth, death, condemnation of infected livers, cost of preventive and treatment programs, reduced production, predisposition to other diseases, restricted use of infested lands and protein deficiencies among livestock dependant people (Saad, 2004).

Diagnosis is made serologically most often, although fecal examination for the eggs is fruitful if obtained when the adult worm is laying eggs (Tolan et al., 2011).

Therefore, the present study was designed to estimate the prevalence of bovine fasciolosis among cattle slaughtered at Elkadaro Abattoir, to identify potential risk factors associated with the occurrence of fasciolosis and to evaluate the accuracy of fecal examination.

2 II. Materials and Methods

3 a) Study Abattoir

Elkadaro Abattoir was designed for a processing capacity of 30 cattle per hour, with shifting work system every 10 hours (two shifts per day), in five days weekly. The abattoir was classified as code no.1, certified via O.I.E categories. The plant is situated within an open free disease area (recognized as free zone referring to O.I.E scientific terms). The main task of the abattoir is to process fresh and frozen meat, mainly for export orders. The abattoir is managed directly by the Federal Ministry of Animal Resources and Fisheries.

4 b) Duration of Study

A field investigation was launched in Sunday 21? May and completed in Saturday 23? July 2011.

5 c) Study Animals

According to the latest estimation of the livestock population in Khartoum State 2010, about 33800 of cattle are raised. The target animals were provided from different sites in and out of Sudan. The local cattle were fetched from: Nyala, Kordofan, Kosti, Kassala, Eljazeera, Khartoum and Upper Nile (South Sudan). While, the foreign ones were from Ethiopia (eastern neighboring country).

6 d) Sample Size Determination and Sampling Methods

The sample size was calculated using the formula: $4PQ/L^2$, given by (Martin et al., 1988) where: F Abstract- A cross-sectional study was conducted from May to July 2011. The multivariate analysis exposed significant associations by postmortem examination: age >4 years (P= 0.000, OR= 18.5, 95% CI= 3.1, 21.7), foreign breed (P= 0.000, OR= 77.6, 95% CI= 9.3, 81.6), light weight (P= 0.000, OR= 3.0, 95% CI= 1.9, 5.3), Ethiopian cattle (P= 0.000, OR= 76.1. 95% CI= 8.4, 83.7) and small size (P= 0.000, OR= 3.1, 95%CI= 1.9, 5.3). while, the coprology demonstrated significant associations among: age >4 years (P= 0.000, OR= 28.8, 95% CI= 3.9, 34.2), foreign breed (P= 0.000, OR= 94.4, 95% CI= 13.2, 102.6), light weight (P= 0.000, OR= 53.4, 95% CI= 7.1, 61.3), Ethiopian cattle (P= 0.000, OR= 60.2, 95% CI= 8.3, 70.1) and small size (P= 0.000, OR= 54.9, 95% CI= 6.3, 63.8). A higher prevalence was recorded by postmortem examination (X^2= 1.669, P= 0.000). This study determined the prevalence of bovine fasciolosis.

P? prevalence Q? 1-P L^2? allowable error, for systematic random sampling with 7.4% reported prevalence (Eldoush, 1995) and 3% allowable error. Accordingly, the sample size was determined to be 307.

The sampling procedure was carried out in such a way that from daily 120 slaughtered cattle, 10 were randomly selected. There are five slaughter days a week and accordingly, 50 cattle were examined weekly. Hence, 307 cattle were examined within two months of the study period. A fresh feces was collected instantly after slaughtering of the selected animals. Then livers were subjected to detailed postmortem examination.

7 e) Study Methodology

Coprology: Fecal samples for parasitological examination were collected directly from the rectum of each animal immediately after slaughter using disposable plastic gloves and placed in new plastic bags. Prior to slaughter, each selected animal was given an identification number. Then each fecal sample was clearly labeled with the cattle identification number. Samples were kept at the room temperature and examined fresh. In laboratory, coproscopic examinations were performed to detect Fasciola eggs using standard sedimentation technique as previously described (Coles, 1986).

Liver Inspection: Liver of each cattle was strictly examined for the presence of liver flukes separately to correlate the coprology and postmortem examination of each animal. Examination of livers for Fasciola was carried out immediately after removal of liver from abdominal cavity. The inspection was made according to the procedures certified by FAO (2003).

8 g) Data Management and Analysis

Both fecal examination and liver inspection results were recorded on specially designed forms and preliminary analysis was done in Microsoft Excel. The outcome variable was the cases of fasciolosis detected during routine postmortem inspection (positive or negative) and fecal examinations for Fasciola spp eggs (positive or negative). Descriptive statistics were carried out to summarize the prevalence and proportion of infection in each category of investigated potential risk factors. Univariate and multivariate logistic regression analysis were conducted to see the significance and strength of association between potential risk factors and the occurrence of the infection. 95% confidence interval and p-value (P=<0.05) were used to notice the significance of association. Also, Odds Ratios (Exp B) was employed to assess the strength and direction of this association using SPSS statistical software (SPSS 16.0).

9 III. Results

10 a) Abattoir (Postmortem) Prevalence

Of the total 307 slaughtered cattle that subjected to detailed postmortem examination at Elkadaro Abattoir, 31.6% (97/307) were found positive for fasciolosis (Table **??**). The highest prevalence was recorded in age greater than 4 years (44.5%), foreign breed (64.1%), light weight (47.4%), Ethiopian source (65.5%) and small size (47.8%) (Table **??**II).

11 b) Risk Factor Analysis for the postmortem results

The occurrence of fasciolosis significantly varied with age, breed, weight, source and animal size (P=<0.05). The likelihood of fasciolosis occurrence was significantly higher in age >4 years (P=0.000, OR= 18.5, 95% CI= 3.1,

21.7), foreign breed (P=0.000, OR= 77.6, 95% CI= 9.3, 81.6), light weight (P=0.000, OR= 3.0, 95% CI= 1.9, 5.3) Ethiopian source (P=0.000, OR=76.1, 95% CI=8.4, 83.7), Kassala source (P=0.027, OR= 1.6, 95% CI= 1.1, 3.1), small size (P=0.000, OR=3.1, 95% CI= 1.9, 5.3) (Table **??**II).

12 c) Prevalence by Coprology

Of the total 307 collected fecal samples 20.2% (62/307) were positive for coprological examination by sedimentation technique (Table **??**I). The highest prevalence was recorded in age >4 years (28.9%), foreign breed (42.1%), light weight (43.8%), Ethiopian source (43.0%) and small size (44.1%) (Table **??**V).

13 d) Risk Factors Analysis for the Coprological Results

The results of coprological examination revealed significant association (P=<0.05) between the occurrence of fasciolosis and the risk factors: age, breed, source, weight and animal size. The likelihood of fasciolosis occurrence was significantly higher in age >4 years (P= 0.000, OR = 28.8, 95% CI = 3.9, 34.2), foreign breed (P= 0.000, OR = 94.4, 95% CI= 13.2, 102.6), Ethiopian source (P= 0.000, OR = 60.2, 95% CI = 8.3, 70.1) light weight (P= 0.000, OR = 53.4, 95% CI= 7.1, 61.3) and small size (P= 0.000, OR = 54.9, 95% CI= 6.3, 63.8) (Table **??**V).

14 f) Sensitivity and Specificity of the Fecal Examination Method

One of the objectives of this study was to evaluate the accuracy of the direct coprological examination method, which is routinely employed at field to examine the presence of Fasciola species eggs in feces. The sensitivity and specificity of the method was computed by taking liver inspection at postmortem as gold standard for the diagnosis of fasciolosis. Kappa statistic was used to determine the degree of agreement between the two methods of liver fluke diagnosis. The kappa value was interpreted as: slight agreement (K <0.2); fair agreement (K= 0.2?0.4); moderate agreement (K= 0.4?0.6); substantial agreement (K= 0.6?0.8); and almost perfect agreement (K >0.8) (Thrusfield, 2005).

15 e) Difference in Prevalence between the Two Diagnostic Methods

Based on the proportions comparison test there was significant difference (X 2 =1.669, P=0.000) between fasciolosis prevalence estimated by coprology and postmortem examinations. Hence, in this study, higher prevalence of infection was observed by postmortem examination (31.6%) than by coprology (20.2%) (Table **??**).

16 f) The Sensitivity and Specificity of the Fecal Examination Technique Considering the Presence of Fasciola spp in the liver as a Gold Standard Test

As indicated in (Table **??**I), no animal that was positive with fecal examination and negative during postmortem examination. This revealed that postmortem examination was the golden test for diagnosis of fasciolosis when compared with coprology. The table set out the number of positive and negative tests in animals with and without flukes in their livers (Smith, 1995). The sensitivity and the specificity of fecal examination were found to be 63.9% and 100%, respectively. The calculated Kappa value (Kappa= 0.69) indicated substantial agreement between the two techniques.

17 IV. Discussion

Fasciolosis is a wide spread ruminant health problem and causes significant economic losses to the livestock industry in some areas in Sudan. The abattoir prevalence of fasciolosis obtained from the present study (31.6%) is very high compared to 7.4% (Eldoush, 1995) and nearly similar with 30% (Elmannan, 2001) and slightly lower than 34.4% (Abu-rigaila, 1983). These differences within the country could be attributed mainly to variations such as altitude, rainfall and temperature, although differences in livestock management system and the ability of the meat inspectors to detect the infection may playapart (Abu-rigaila, 1983). From African countries, a higher prevalence of 63.8% from Tanzania (Keyyu et al., 2006) and 53.9% from Zambia (Phiri et al., 2006) were reported. The observed prevalence may reflect suitable ecological and climatic conditions for the snail intermediate host in the areas from which the study animals came from.

Regarding the risk factors analysis, the results of this study indicate that the occurrence of fasciolosis in cattle varied with sex, age groups, breeds, weights, sources, size of animals and other diseases concurrent with fasciolosis.

The association between the occurrence of bovine fasciolosis and sex of the animals by both coprological and postmortem examinations revealed that the prevalence of Fasciola infection was found to be higher in males in

agreement with a previous report (Shiferaw et al., 2009). The significant effects of sex on the prevalence of bovine fasciolosis might be attributed to the management system in which males are kept outdoor while females are kept indoor at the beginning of lactation (Balock et al., 1985).

Higher Fasciola infection rate was recorded among older cattle (>4 years) with both postmortem and coprological examinations in agreement with a previous report (Andrade et al., 2002). The higher prevalence in older animals by both examinations could be associated with the degree of exposure to the parasite which is normally greater in old animals than young animals. In contrast to our finding, higher prevalence in young cattle than older ones has been reported (Mulugeta et al., 2011).

The current study determined a higher prevalence of Fasciola infection among Ethiopian zebu cattle by both postmortem and coprological examinations in agreement with previous reported (Kassaye et al., 2012) and (Chakiso et al., 2014) This might be attributed to the difference in resistance to parasitic infection between different breeds (Tasawar et al., 2007).

In this study a higher prevalence of fasciolosis was observed among Ethiopian source animals by postmortem and coprological examinations in consistence with another finding (Yilma et al., 2000). The higher prevalence of the disease among Ethiopian source animals could be associated with the existence of suitable ecological conditions for the intermediate snail host in the areas where animals graze (Abebe et al., 2010).

We determined a higher prevalence of Fasciola infection rate among light weight animals with both postmortem and coprological examinations in agreement with previous reports (Kassaye et al., 2012) and (Nega et al., 2012). This signifies that the light weight animals are more susceptible to the infection.

The results of our study also showed a higher infection rate among small size animals by postmortem and coprological examinations in agreement with a previous report (Bekele et al., 2012). This attributed to low resistance against the disease.

In this study the association between the occurrence of fasciolosis with concurrent infections with both coprological and postmortem examinations revealed that there is no significant difference between the concurrent infections with fasciolosis by both examinations.

The prevalence of fasciolosis reported by using coproscopy was lower than that obtained by the abattoir results indicating that the latter is more sensitive in detecting the disease. The detection of Fasciola eggs can be unreliable as the eggs are expelled intermittently, depending on the evacuation of the gall bladder (Briskey et al., 1998). Similar study suggested that about 36% infected animals may pass undetected with single fecal examination technique. This might be attributed partly to the fact that Fasciola eggs only appear in feces 8-15 weeks post infection, so most of pathological lesions had already occurred (Mulugeta et al., 2011).

The present sensitivity value (63.9%) is comparable to other reports: 65.9% from Ethiopia (Regassa et al., 2012) and 69% from Switzerland (Rapsch et al., 2006). The latter stated that traditional coproscopy can be very efficient if there is repeated sampling, resulting in sensitivity of approximately 92%. Therefore, worm counts at liver necropsy can only be considered as a gold standard if the livers are sliced and soaked. Even then very light or prepatent infections could still be missed, affecting the calculated sensitivity and specificity of the evaluated tests.

The current study revealed that the infection with fasciolosis varies according to different regions in Sudan and demonstrated that the disease had a high prevalence among Ethiopian cattle. It also elucidated that coprological examination for the parasite eggs has significant limitations in detecting the presence or absence of fasciolosis in animals. On the other hand, it has helped to illustrate the usefulness of meat inspection in monitoring disease situation and demonstrating possible long term trends. This study also showed that bovine fasciolosis is significantly associated with age, breed, weight, source and size of animal.

18 V. Acknowledgements

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1

		Khartoum, Sudan	
Disease	Frequency	Relative frequency (%)	Cumulative frequency (%)
Negative	210	68.4% (210/307)	68.4%
Positive	97	31.6% (97/307)	100%
Total	307		

Figure 1: Table 1 :

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Disease	Frequency	Khartoum, Sudan Relative frequency (%)	Cumulative frequency (%)
Negative	245	79.8% (245/307)	79.8%
Positive	62	20.2% (62/307)	100%
Total	307		

Figure 2: Table 2 :

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