Original Paper

Prevalence of liver flukes in cattle at an abattoir in Wakiso District, Uganda

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ABSTRACT

Bovine fasciolosis is one of the most important parasitic diseases of cattle causing mortality and production losses in various parts of Uganda. However, little information is available about its prevalence in Uganda. A cross sectional study aimed at determining the prevalence of liver flukes in cattle was conducted between June 2015 and May 2016 at an abattoir in Wakiso District, Uganda. The study was based on post-mortem inspection of livers of slaughtered animals at Wakiso abattoir. Out of 287 livers inspected, 44 (15.0%) were positive for liver flukes. Risk factors such as season, breed and sex did not have significant effect on the prevalence of infections ($P > 0.05$). However, age and body condition showed significant association with the prevalence of infections ($P < 0.05$). That implied cattle of older age and poor body condition increased the risk of infection. Of the total livers examined, 75% had between 1 to 20 flukes, 20% had between 21 to 100 and only 5% had more than 100 flukes. In the present study, the prevalence of liver flukes was considerably lower compared to other previous studies in Uganda. We could not obtain detailed cattle and farm information. Further studies are necessary in order to investigate the difference of these results and to design effective control and treatment of infected cattle.

Key words : cattle, fasciolosis, post-mortem inspection, risk factors, Uganda.

1. INTRODUCTION

The livestock sector is one of Uganda's important growth sectors. It constitutes 17 percent of the agricultural GDP and is a source of livelihood to about 4.5 million people in the country. The 2008 national livestock census estimated the number of cattle at 11.4 million whereas the sheep, goats, pigs and poultry were estimated at 3.4 million, 8.5 million, 3.2 million and about 27.5 million, respectively [21]. In most parts of the world, fasciolosis caused by genus *Fasciola*, commonly known as liver flukes, are considered as one of the major reasons behind livestock production loss. Once ingested, the liver flukes migrate through the liver parenchyma to the bile ducts, leading to liver damage. Other subclinical and clinical cases of the disease usually result in decreased animal production,

secondary bacterial infections, fertility problems, loss of weight, poor carcass quality and great expenses with anthelminthics [16]. Furthermore, fasciolosis is known as zoonotic disease. An estimated 2.4 to 17 million people were infected in more than 51 countries [2, 12, 5] and 91 million were at risk worldwide [8].

Fasciolosis occurs mainly in cattle rearing areas of temperate climates, particularly in parts of Europe, China, Africa, Middle East, Central and South America [11, 12, 16]. At low and high altitude sites in Mount Elgon in Uganda, the prevalence of *Fasciola gigantica* by faecal egg detection was 43.7% and 1.1%, respectively, while by ELISA was 77.9% and 64.5%, respectively [4]. Additionally, as another previous report, the prevalence of *Fasciola* sp. in Kampala city abattoir in Uganda has been reported as 84% [7]. However, Uganda is still lacking in data on fasciolosis in cattle. No studies have

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been conducted on the prevalence of liver flukes at an abattoir in Wakiso district. Therefore, the purpose of this study was to determine the prevalence of liver flukes in cattle at an abattoir in Wakiso District that is next to Kampala. Furthermore, in order to obtain further information, we statistically surveyed the correlation between the prevalence and risk factors such as season, breed, sex and age.

2. MATERIALS AND METHODS

2.1 Study site

The study was conducted at an abattoir in Wakiso District. Wakiso is located on the Kampala-Hoima Highway, approximately 20 kilometers northwest of Kampala, the capital and the largest city of Uganda (Figs. 1 and 2). The coordinates of the town are 00 24 00N, 32 28 48E (Latitude: 0.4000; Longitude: 32.4800). Climate in Wakiso is warm and wet with relatively high humidity. It features two rainy seasons and dry seasons each year [21].

2.2 Study animals and sample size

The study was conducted on cattle slaughtered at Wakiso abattoir between June 2015 and May 2016. Abattoir sampling was conducted once or twice a week and the number of average slaughtered cattle was 5 per day. Samples were examined from randomly selected male and female cattle from different age groups. The sample size was calculated based on previous data showing that the existing prevalence of *F. gigantica*
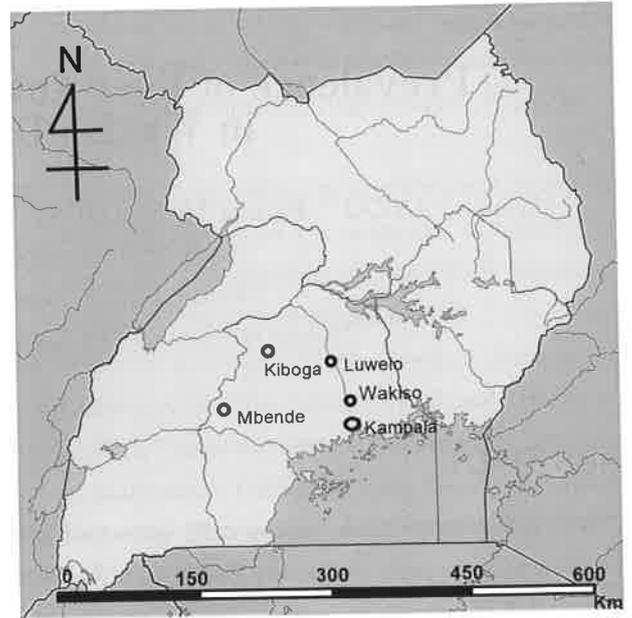

Fig. 1. Map of Uganda showing Wakiso district and suburbs.

is around 78% in lowland areas of Uganda [4]. The sample size was calculated using the formula given by Cochrane [20] ;

$n = \lambda^2 \, Pexp \, (1\text{-}Pexp)/d^2$

n = required sample size

λ = confidence level = 2

Pexp = expected prevalence

d = desired absolute precision formula

$n = 2^2 \times 0.78 \, (1\text{-}0.78)/0.05^2 = 275$

Thus, the minimum sample size required for this study was 275 cattle and eventually a total of 287 study

Fig. 2. The abattoir in Wakiso District.

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Fig. 3. Ankole cattle in Wakiso abattoir and thin cattle in poor body condition.

samples were collected. The study animals included indigenous Ankole, Zebu and Friesian cattle (Fig. 3). Cattle slaughtered in the abattoir were brought from different locations such as Kiboga, Luwelo, Mbende district, but the majority came from Kiboga district (Fig. 1). It was difficult to know precisely where the cattle came from because of a lack of reliable animal identification.

2.3 Study design

A cross sectional design was used in this study. The age of the cattle was estimated by observing the front permanent teeth after slaughter. Body condition scores (BCS) are excellent indicators of the nutritional status in cattle. BCS was used after some modification [3]. BCS ranges from 1 to 9, with a score of 1 being extremely thin and 9 being very obese. Areas such as the back, tail head, pins, hooks, ribs, and brisket of

cattle can be used to determine BCS. Cattle in thin condition (BCS 1-4) is angular and bony with minimal fat over the backbone, ribs, hooks, and pins. There is no visible fat around the tail head or brisket. When cattle are thin (BCS <4), they are not only reproductively inefficient, but they are more susceptible to health problems. Cattle in ideal condition (BCS 5-7) has a good overall appearance. Therefore, a score of less than 4 was designed as poor and more than 5 was designed as good.

2.4 Post-mortem examination

The liver of each slaughtered animal was carefully examined by visualization and palpation of the entire organ. Livers were laid out on a table and those were cut into 1-2 cm slices thick to count the presence of adult flukes (Figs. 4 and 5).

Fig. 4. Post mortem examination of a liver and liver flukes.

Fig. 5. A high number of adult flukes and calcified bile duct in the liver of infected cattle slaughtered at Wakiso District abattoir.

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2.5 Statistical Analysis

All data were coded and entered in Microsoft Excel 2010. Chi-square (χ^2) test and residual analysis were conducted to establish associations between fluke infection and sex, age, breed, BCS and season. Statistical significance was set at $P < 0.05$ to determine whether there is significant association between the parameters measured.

3. RESULTS

3.1 Prevalence of liver flukes

From a total of 287 adult cattle slaughtered during the one year study period, 44 (15%) animals were found to be infected with liver flukes. The highest prevalence was seen in May (29%) and of 17 samples, 5 samples were positive. The lowest was seen in March (0%) and of 23 samples, no sample was positive (Fig. 6). Out of 149 cattle examined during the dry season (June to August, December to February), liver flukes were detected in 24 (16%). Of the 138 cattle examined during the rainy season (September to November, March to May), 20 (14%) were positive for liver flukes. There was no significant association between infection rate and season ($P = 0.704$).

3.2 Prevalence of liver flukes by breed

Out of 287 cattle examined at Wakiso abattoir, 225 (78%) were Ankole, 49 (17%) were Friesian and 13 (5%) were Zebu. The prevalence of liver flukes was 31 (14%), 12 (24%) and 1 (8%), respectively. There was no significant difference in prevalence among the breeds ($P = 0.124$).

3.3 Prevalence of liver flukes by sex

Of the total sample, 152 of slaughtered cattle were male and 135 were female. The prevalence of liver flukes was 18 (12%) and 26 (19%) in male and female cattle, respectively.

There was no significant difference in prevalence between sexes ($P = 0.082$).

3.4 Prevalence of liver flukes by age

In total, 153 (53%) slaughtered cattle were less than 2 years old, 75 (26%) were 2 to 4 years old and 59 (21%) were more than 4 years old. The prevalence of liver flukes was 10 (12%), 19 (27%) and 15 (32%), for each age group, respectively. There was a significant difference in prevalence between the age groups ($P < 0.001$). That showed the old ones were more affected to infection compared to the young ones.

3.5 Prevalence of liver flukes by body condition score

Overall, 206 (72%) slaughtered cattle had a poor body condition, which means less than BCS4 and 81 (28%) were assessed to be in good condition, which means more than BCS5. The prevalence of liver flukes was 40 (19%) in cattle with a poor BCS and 4 (5%) in
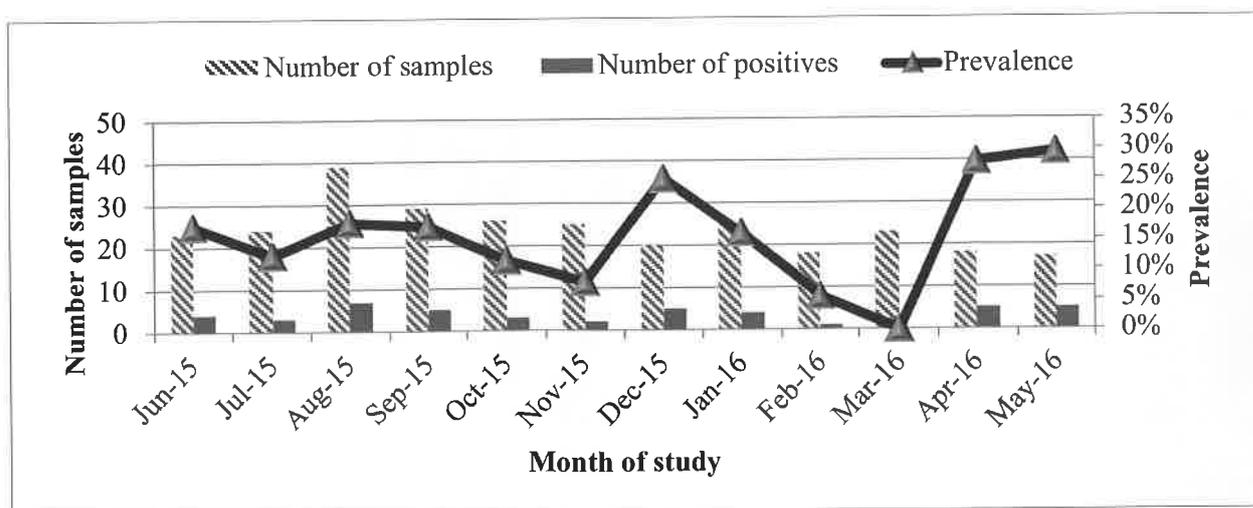

Fig. 6. Monthly prevalence of liver flukes in 287 cattle slaughtered at an abattoir in Wakiso District, Uganda between June 2015 and May 2016.

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Table 1. Result of liver flukes count in 44 infected livers in 287 cattle slaughtered at an abattoir in Wakiso District, Uganda between June 2015 and May 2016.

No. liver flukes found	Number of livers	Relative proportion (%)
1 ～ 20	33	75%
21 ～ 100	9	20%
100<	2	5%

those with a good body condition. There was significant difference in prevalence between the BCS (P =0.002).

3.6 Liver flukes count in the liver

The results of liver flukes count made on 44 infected livers are given in Table 1. Of the total livers examined, 75% had 1 to 20, 20% had 21 to 100 and only 5% had more than 100 flukes.

4. DISCUSSION

This study showed that the prevalence of liver flukes in cattle slaughtered at Wakiso abattoir was 15%. This prevalence was considerably lower when compared with the prevalence of 84% reported in Kampala in 2014 [7]. In Ethiopia, Kenya, Tanzania and Nigeria, previous reports reported the prevalence of 39.6%, 8.6%, 16.3% and 31.7%, respectively [5, 10, 12, 17]. These liver flukes prevalence variations might be attributed to the ecological and climatic differences between these localities. High rainfall provides good conditions for the survival of the intermediate host snail. Therefore, the prevalence of liver flukes depends on surroundings [1]. In addition, different management systems such as using anthelmintics could also cause variation in the prevalence of liver flukes, although it was difficult to confirm treatment history in this study.

The present study revealed that there is no significant difference (P >0.05) between the different seasons. Liver flukes can live for more than 1 year in cattle, producing eggs continuously. This complicates the determination of the major risk periods [19]. Breed specific distribution of the disease in cattle showed that there was no difference (P =0.124) in the prevalence in different breeds. This may mean that all breeds in this study were equally susceptible to liver flukes. Although females are supposed to be more infected due to stress

during pregnancy and parturition [6], both sexes were found equally susceptible in the present study. These results are in agreement with those of Maqbool et al. and Khan et al. [9, 13]. The present study also indicates that the highest infection rate was in older cattle (more than 4 years old), with a prevalence of 32%. It could be suggested that the higher prevalence in old cattle compared to young cattle might be because of physiological differences, such as depression of immunity by stress. In addition, old cattle have longer exposure to environment that intermediate host inhabit compared to young ones. The prevalence of liver flukes infection was higher in animals with poor body condition compared with those in good body condition (P =0.002). This could be because animals with poor body condition are usually less resistant to infection and are consequently more susceptible to infectious diseases [14, 15]. On the other hand, it is considered that infected cattle became to be a poor condition after infection. Regarding liver flukes counts in the liver, previous studies reported the presence of more than 50 flukes per liver indicates a high pathogenicity [11, 15]. Additionally, most of the studies in the world reported previously showed high burdens. In Iran, Nigeria and Zambia, mean fluke burdens of 68-100 were reported in cattle [18]. The present study implies low pathogenicity of liver flukes in the study area.

We consider that this study is valuable information to grasp the present situation of prevalence of liver flukes in Wakiso. As stated above, this date showed that low prevalence of liver flukes was observed compared with the prevalence reported by different researchers at Kampala in Uganda. It is considered that there is significant difference of the prevalence of liver flukes in different region in Uganda. However, we couldn't catch the detail information of cattle and farm such as where

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the cattle came from, status of anthelminthic usage and intermediate host situation, etc. Therefore, further detailed studies need to be conducted to generate a complete data set on the epidemiology of liver flukes in Uganda, to minimize the economic losses suffered by the livestock industry.

ACKNOWLEDGMENT

REFERENCES

1. Andrews, A. H., Blowey, R. W., Boyd, H. and Eddy, R. G. 2008. Bovine Medicine: Diseases and Husbandry of Cattle. 2nd ed., Wiley.
2. Bargues, M. D., Mangold, A. J., Munoz, A. C., Pointier, J. P. and Mas Coma, S. 1997. SSU rDNA characterization of lymnaeid snails transmitting human fascioliasis in South and Central America. *J. Parasitol.* 83 : 1086-1092.
3. Eversole, D. E., Browne, M. F., Hall, J. B. and Dietz, R. E. 2000. Body Condition Scoring of Beef Cows. Virginia Cooperative Extension Beef Publication.
4. Howell, A., Mugisha, L., Davies, J., La Course, E. J., Claridge, J., Williams, D. J. L., Hope, L. K., Betson, M., Kabatereine, N. B. and Stothard, J. R. 2012. Bovine fasciolosis at increasing altitudes: Parasitological and malacological sampling on the slopes of Mount Elgon, Uganda. *Parasite Vectors* 5 : 196-206.
5. Ibrahim, N., Wasihun, P. and Tolosa, T. 2010. Prevalence of bovine fasciolosis and economic importance due to liver condemnation at Kombolcha Industrial Abattoir, Ethiopia. *Intern. J. Vet. Med.* 8 : 21-26.
6. Jacob, S. K., Ramnath, V., Philomina, P. T., Raghunandhanan K. V. and Kannan, A. 2001. Assessment of physiological stress in periparturient cows and neonatal calves. *Indian. J. Physiol. Pharmacol.* 45 : 233-238.
7. Joan, N., Stephen, M. J., Bashir, M., Kiguli, J., Orikiriza, P., Bazira, J., Itabangi, H. and Iramiot, J. S. 2015. Prevalence and economic impact of bovine fasciolosis at Kampala City Abattoir, Central Uganda. *Br. Microbiol. Res. J.* 7 : 109-117.
8. Keiser, J. and Utzinger, J. 2009. Food-borne trematodiases. *Clin. Microbiol.* 22 : 466.
9. Khan, M. K., Sajid, M. S., Khan, Z. I., Iqbal, Z. and Iqbal, M. U. 2009. Bovine fasciolosis: prevalence, effects of treatment on productivity and cost benefit analysis in five districts of Punjab, Pakistan. *Res. Vet. Sci.* 87 : 70-75.
10. Kithuka, J. M., Maingi, N., Njeruh, F. M. and Ombui, J. N. 2002. The prevalence and economic importance of bovine fasciolosis in Kenyan analysis of abattoir data. *Onderstepoort J. Vet. Res.* 69 : 255-262.
11. Maclean, J. D., Cross, J. and Mahanty, S. 2006. Liver, lung, and intestinal fluke infections. In: Tropical Infectious Diseases-Principles, Pathogens and Practice. Guerrant, R. L., Walker, D. H., Weller, P. F. Eds. 3rd ed., Churchill Livingstone.
12. Malleu, L. S. B., Nonga, H. E. and Karimuribo, E. D. 2010. A slaughter house survey of liver lesions in slaughtered cattle, sheep and goats at Arousha Tanzania. *Res. J. Vet. Sci.* 3 : 179-188.
13. Maqbool, A., Hayat, C. S., Akhtar, T. and Hashmi H. A. 2002. Epidemiology of fasciolosis in buffaloes under different managemental conditions. *Vet. Arch.* 72 : 221-228.
14. Mihreteab, B., Haftom, T. and Yihenew, G. 2010. Prevalence and its economic loss due to liver condemnation at Adwa Municipal abattoir, north Ethiopia. Ethiop. *J. Appl. Sci. Technol.* 1 : 39-47.
15. Mulcahy, G., Joyce, P. and Dalton, J. P. 1999. Immunology of *Fasciola hepatica* infection. In: Fasciolosis, Dalton, J. P. ed., CAB International : 341-376.
16. Ortiz P. L. Jr. and Clarkson, C. M. J. 2000. Prevalence of helminthes infection in cattle on traditional, small-scale and large-scale dairy farms in Iringa district, Tanzania. *Vet. Res. Commun.* 93 : 121-134.
17. Ozung, P. O., Owai, P. U. and Oni, K. 2011. An assessment of the prevalence of fasciolosis of ruminants in Ikom abattoir of Cross River State,

Nigeria. *Cont. J. Vet. Sci.* 5：1-5.

18. Phiri, A. M., Phiri, I. K. and Monrad, J. 2006. Prevalence of amphistomiasis and its association with *Fasciola gigantica* infections in Zambian cattle from communal grazing areas. *J. Helminthol.* 80：65-68.

19. Ranget-Ruiz, I. J., Marquez-Izquierdo, R. and Bravo-Noguira, G. 1999. Bovine fasciolosis in Tabasco, Mexico. *Vet. Parasitol.* 81：119-127.

20. Thrusfield, M. 2005. Veterinary Epidemiology, 2nd ed., Blackwell Science, Oxford.

21. Ministry of Agriculture, Animal Industries and Fisheries (MAAIF) and Uganda Bureau of Statistics (UBOS). 2009. A summary report of the National Livestock Census, 2008. UBOS, Kampala.

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ウガンダ・ワキソ県の一と畜場における牛での肝蛭寄生率実態調査

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要　約

　2015 年 6 月から 2016 年 5 月、ウガンダのワキソ県にある一と畜場で牛での肝蛭寄生率の実態調査を実施した。本研究は、と体牛の肝臓を細切し、肉眼的に肝蛭の有無及び数を検査することにより行われた。合計 287 検体の肝臓が検査され、そのうち 44 検体から、肝蛭が検出された（寄生率 15％）。また、季節性（雨季と乾季）、種、年齢、性差及びボディコンディションスコア（BCS）といったリスク因子と寄生率との相関関係を調べた。季節性、種、性差と寄生率には、相関関係が認められなかった（$P > 0.05$）。しかし、年齢及び BCS と寄生率には、相関関係が認められた（$P < 0.05$）。つまり、年齢の高い牛及び BCS が低い牛の方が、寄生率が高いことを示していた。肝蛭の寄生数に関しては、75％が 1 から 20 虫体の間であったが、100 虫体を超える肝臓も認められた。本研究の結果は、先にウガンダのカンパラで行われた研究に比較して、肝蛭寄生率は低いものであったが、放牧地汚染及び感染個体を減らすためには、戦略的な予防治療策が必要であると思われた。

Key words：ウガンダ、牛、肝蛭症、と畜解体検査、リスク因子

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