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Pathological findings of condemned bovine liver specimens and associated economic loss at Nyabugogo abattoir, Kigali, Rwanda

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ABSTRACT

There are no published abattoir bovine hepatic lesion prevalence studies in cattle in Rwanda. This study estimated that 12.3% of the livers (n = 4751) examined at Nyabugogo slaughterhouse in Kigali were condemned. Condemnation prejudiced the nation of 3492.00 kg of meat with attendant economic losses of US$8932.40 during the study period. Risk factors for these lesions were also assessed. Male and female animals from 11 districts were used in this study. Hepatic lesions were higher in females (14.6%; n = 1494) than in males (11.1%; n = 3257). About 78.7% of the condemnations were due to fascioliasis, followed by abscesses (5.7%), hepatitis (5.3%), cirrhosis (4%) and other lesions (6.3%). Female animal livers showed more fascioliasis and abscesses (82.2% and 9.5%) than male animal livers (73.3% and 3.3%). The highest rate of condemnation was observed from Kayonza (40.2%; n = 413) and the least was from Gakenke district (0.9%; n = 1031). Cattle from the Eastern Province showed significantly ($P < 0.05$) higher prevalence of condemnations (26.8%) than the rest of the provinces. Liver specimens of animals below 3 years and above 6 years of age had a significantly higher ($P < 0.05$) condemnation rate (14.4%) (n = 3000 and n = 769) than the 3–6 year age-group at 4.1% (n = 982). We conclude that fascioliasis was responsible for a significant proportion of the liver condemnations at Nyabugogo slaughterhouse. Being a zoonosis, we recommend an epidemio-surveillance, implementation of control measures and anthelmintic resistance investigation for fascioliasis in Rwanda.

1. Introduction

The liver is one of the most important organs in the animal's body. It is the principal organ of metabolism for many endogenous and exogenous substances and as a result, is one of the frequently affected organs in a diseased body (Alawa et al., 2011; Sohair and Eman, 2009).

The liver is susceptible to a wide range of metabolic, toxic, microbial and circulatory insults (Bal et al., 2004). The main causes of liver condemnation during post-mortem inspection are diseases caused by parasites mainly *Fasciola spp*., bacteria and viruses (Mohammed et al., 2012; Radostits et al., 1994; Mas-Coma et al., 2005).

Due to its large regenerative capacity, the liver from clinically healthy animals in tropical and subtropical countries tends to show a spectrum of disease and pathological conditions at slaughter (Abunna et al., 2010; Mohammed et al., 2012; Raji et al., 2010; Alawa et al., 2011).

Fascioliasis is one of the major diseases responsible for direct and indirect economic losses in livestock production, particularly cattle (Abutarbush, 2010; Mcdowell and Rafati, 2014; Dietrich et al., 2015). High prevalence is reported in areas surrounding inland water bodies such as dams or large ponds in which snails, particularly *Lymnaea* species are found (Sissay et al., 2007).

Bovine liver telangiectasis, a focal dilation and congestion of a group of hepatic sinusoids, is the most common liver lesion in cattle in different countries world-wide. The condition is mainly associated with a number of liver diseases including liver flukes (Doustar et al., 2011).

The prevalence of liver lesions is unknown in Rwanda as there is no published reports on this subject. Therefore, an important objective for this study is to reveal the nature and estimated frequency of hepatic lesions in slaughtered cattle at Nyabugogo abattoir in

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Kigali. In addition, risk factors and economic losses associated with the occurrence of these lesions will be assessed.

2. Materials and methods

2.1. Geographical study area

The study was carried out at SABAN-Nyabugogo abattoir located in the commercial zone of the north-western part of Kigali. The abattoir is divided into two parts; one for bovine and the other for small ruminant processing.

2.2. Experimental animals

The slaughtered cattle were brought from the Northern Province (Rulindo, Gakenke, Gicumbi), Eastern Province (Nyagatare, Kayonza, Gatsibo, Bugesera, Kirehe), Southern Province (Ruhango, Kamonyi) and the Western Province (Ngororero).

2.3. Study design

A cross-sectional study was carried out at SABAN Nyabugogo abattoir. The study was conducted from March to May 2013. The sampling involved all bovines brought to the abattoir during the period of study.

2.4. Meat inspection

Routine meat inspection was carried out by meat inspectors under the supervision of registered veterinarians. The study involved 4751 cattle slaughtered at SABAN-Nyabugogo abattoir in Kigali. All inspected carcasses were tagged and the same identification number was given to the corresponding offal.

2.5. Macroscopic examination of the liver and economic loss estimate

All the livers were examined for abnormalities in colour, smell, size, sharpness of edges, smoothness of surfaces and organ consistency in a systematic manner. All bile ducts were incised transversely as well as longitudinally to check for the presence of parasites or other lesions. Hepatic lymph-nodes were examined and incised. A digital camera was used to record macroscopic hepatic lesions.

The economic estimate was estimated by multiplying the total weight of the condemned meat by the prevailing price per kg of liver at the time of the study. The total weight of condemned liver was obtained by multiplying the number of condemned liver specimen by the average weight of a normal liver (6 kg).

2.6. Data analysis

Demographic and epidemiological data were analysed using descriptive statistics. Categorical variables were described using percentages. Bi-variate analysis for cause of liver condemnation (risk factors) was performed using Pearson's χ^2 test. *P*-values ≤ 0.05 were considered significant. All the collected data was entered and managed in MS Excel and later SPSS version 16.1.

2.7. Ethical considerations

Ethical approval for this study was obtained from the research committee of the School of Animal Sciences and Veterinary Medicine, College of Agriculture, University of Rwanda. Meat inspection was performed under the supervision of a qualified and registered veterinarian who carried out routine ante-mortem and post-mortem inspection. In addition, written consent was also obtained from slaughterhouse owners prior to the commencement of the study.

Table 1
Prevalence of liver condemnations according to district.

District	Number of animals slaughtered	Number of livers condemned at slaughter	Rate of liver condemnation within district (%)
Eastern Province			
Kayonza	413	166	40.2
Nyagatare	673	203	30.2
Gatsibo	341	82	24.0
Bugesera	192	18	9.4
Kirehe	181	14	7.7
Northern Province			
Gicumbi	129	9	7.0
Rulindo	1180	36	3.1
Gakenke	1031	9	0.9
Southern Province			
Kamonyi	176	11	6.3
Ruhango	215	10	4.7
Western Province			
Ngororero	220	24	10.9
Total	4751	582	–

Table 2
Occurrence of liver condemnations according to province.

Province	Number of animals slaughtered	Number of livers condemned at slaughter	Rate of liver condemnation within province (%)
Eastern Province	1800	483	26.8
Northern Province	2340	54	2.3
Southern Province	391	21	5.4
Western Province	220	24	10.9
Total	4751	582	–

Table 3
Occurrence of liver condemnations according to sex of slaughtered animal.

Sex	Number of slaughtered animals	Number of condemned livers at slaughter	Percentage condemned (%)
Males	3257	363	11.1
Females	1494	219	14.6
Total	4751	582	12.3

3. Results

3.1. Overall prevalence of hepatic lesions in livers condemned at slaughter

As shown in Table 1, 582 livers representing 12.3% of all the livers (n = 4751) inspected were condemned in slaughtered animals from all the districts. The highest rate of condemnations was found in animals from Kayonza (40.2%; n = 413); Nyagatare (30.2%; n = 673); and Gatsibo (24.0%; n = 341). The lowest rate of liver condemnations was found in animals from Gakenke (0.9%; n = 1031). At the provincial level liver condemnations were significantly higher ($P < 0.01$) in animals from the Eastern province (26.8%; n = 1800) compared to those from the Northern (2.3%; n = 2340), and Southern provinces (5.4%; n = 391). Condemnations from the Western province (10.9%; n = 220) were also significantly lower ($P < 0.05$) than those from the Eastern province (Table 2).

Table 3 shows that 11.1% of the livers from all the slaughtered males (n = 3257) were condemned and 14.6% of the livers from all the slaughtered females (n = 1494) were condemned. Statistical