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RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

Occurrence and seasonal predisposition of fasciolosis in cattle and goats slaughtered in Kasulu District abattoir, Western Tanzania

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Abstract

A 3 year study was conducted to estimate the prevalence of fasciolosis in cattle and goats slaughtered at Kasulu district abattoir. It involved 33 months (July, 2010 to March, 2013) retrospective data collected as abattoir records and three months (April, 2013 to June, 2013) prospective meat inspection by researchers, during which adult worm and egg samples were collected for morphometric identification. During the study period, a total of 8410 cattle and 8424 goats were slaughtered and inspected; out of which 6376 (76%) and 2295 (26%) were found to be infected with fasciolosis respectively. The study observed significant seasonal pattern of fasciolosis in cattle with higher prevalence observed during the dry season. Worm and egg identification suggested that *F. gigantica* was responsible for the infections in slaughtered cattle and goats. This is the first study to report the occurrence of fasciolosis in domesticated ruminants in western Tanzania and has established that fasciolosis is highly prevalent in cattle and goats. Effective control strategies need to be put in place focusing on both the parasite and the snail intermediate hosts.

Keywords: Fasciolosis; cattle; goats; Western zone; Tanzania

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Introduction

Livestock sector in Tanzania has substantial contribution to the economy (Njuki et al., 2011) and plays a crucial role in ensuring food security, providing households with employment, income and a source of wealth which tends not to lose value. It also provides draught power and manure both necessary for sustainable agriculture (United Republic of Tanzania (URT), 2006). Livestock diseases are recognized as among the constraints to the development of the livestock sector in Tanzania (Njombe and Msanga, 2005). Fasciolosis is among the diseases that impacts significantly in this sector in the country (Mahlau, 1970), as it is responsible for causing huge losses in livestock productivity that are attributed to poor growth, reduced milk production, loss of weight, liver condemnation at slaughter and death in cases of acute infection (Mungube et al., 2006; Swai and Ulicky, 2009). Both species of *Fasciola* have been reported in Tanzania, *Fasciola gigantica*, being the most common (Keyyu et al., 2006) while *Fasciola hepatica* has been reported to occur at Kitulo plateau in southern highlands of Tanzania (Walker et al., 2008).

Essentially fasciolosis has been divided into an acute and chronic form. Acute fasciolosis is more common in sheep and goats (Mungube et al., 2006). Clinically animals are characterized by anorexia, disinclined to move, distended abdomen which is painful to touch and sudden death (Soulsby, 1982). Chronic fasciolosis is the most common form in cattle and is the one detected during the course of meat inspection in the country (Hyera, 1984; Msanga, 1985; Kambarage et al., 1995; Nonga et al., 2009; Mellau et

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al., 2010; Swai and Ulicky, 2009; Komba et al., 2012), as it is characterized by hepatic fibrosis and hyperplastic cholangitis (Soulsby, 1982).

Hepatic fibrosis is caused by healing of the liver from traumatic destruction of liver parenchyma due to migration of immature flukes, while hyperplastic cholangitis is caused by the presence of adult flukes in bile ducts (Soulsby, 1982).

Abattoir records are widely used for the purpose of surveillance against animal and zoonotic diseases (Ogbaje et al., 2012). These records have been used in analysis of prevalence rate and the economic significance of fasciolosis in various sub-Saharan African countries (Pfukenyi and Mukaratirwa, 2004; Kanyari et al., 2012; Omoleye et al., 2012; Yohannes and Abebaw, 2012). In Tanzania, such abattoir surveys have been conducted in southern highlands zone (Hyera, 1984), Lake zone (Msanga, 1985) northern zone (Nonga et al., 2009; Swai and Ulicky, 2009; Mellau et al., 2010) and eastern zone (Kambarage et al., 1995; Komba et al., 2012). In western zone of Tanzania where eco-climatic conditions are conducive for the survival of snail intermediate hosts of *Fasciola* parasites (National bureau of statistics [NBS], 2008), no epidemiological studies have been conducted to estimate the extent of *Fasciola* infections in slaughter stocks.

The present study was therefore aimed at determining the occurrence of fasciolosis in animals brought for slaughter at Kasulu district abattoir. The generated information provides baseline data useful in designing effective control strategies of fasciolosis in western Tanzania.

Materials and Methods

Study area and animals

This study was conducted at Kasulu District abattoir in Kigoma region, western Tanzania. The District is found on the intermediate zone of Kigoma region, which lies between 1200 - 1500 metres above sea level with an annual rainfall of 850 mm to 1100 mm (URT, 1998). The zone is characterized by swampy areas which provide great potential for irrigations. Moreover, the district is located between 4˚25'0" S and 30˚19'60" E. According to the 2007/2008 livestock census (Kigoma region social-economic profile) the district had a total of 50,306 cattle, majority (98%) being of indigenous breeds, most of which are the long horned, Ankole type followed by the short horned, Tanzania Zebu. The remaining proportion is comprised of dairy cattle (NBS, 2008). The animals brought for slaughter at the abattoir are mostly obtained from the livestock markets within western zone regions that include Kigoma, Tabora and Kagera; and these markets mainly receive indigenous cattle breeds from the traditional management systems from the same regions (Mbonankila (Meat inspector); personal communication). However, capturing the origin of each slaughtered animal beyond the livestock markets was very difficult as there were no records.

Data collection

The study utilized meat inspection records available at Kasulu District abattoir for the period starting July, 2010 to March, 2013. The records were kept by qualified government employed meat inspectors as a component of the passive disease surveillance activity in the Ministry of Livestock Development and Fisheries. Retrieved information from the record books included the number of animals slaughtered in each month and animals found to have liver fasciolosis. Retrospective data were complemented with prospective data collected by researchers in the period from April, 2013 to June, 2013, for quality control purposes. During this period, livers were incised transversely on the ventral side in such a way that bile ducts were cut open in several directions. Adult *Fasciola* were recovered by squeezing the liver using thumbs. The worms were immediately cleaned using distilled water and subsequently measured using a ruler in millimeters for morphometric identification. The measurements included total worm length and width. Gallbladders from the same livers were incised to collect the bile which was further processed by sedimentation technique to recover the eggs. Recovered eggs were preserved in 80% alcohol and taken to the Parasitology Laboratory, Sokoine University for identification. Recovered eggs were stained with malachite green and their length and width measured using calibrated micrometer under the compound light microscopy using 10x and 40x objective. The obtained morphometric data of adult worms (Fig. 2) and eggs (Fig. 3) were compared with those described previously (Soulsby, 1982; Srimuzipo et al., 2000; Lotfy et al., 2002).

Statistical analysis

All retrospective meat inspection records from July, 2010 to March, 2013 and prospective data from April to June 2013 were analysed in this study. Collected data were validated in Microsoft Excel 2007 and imported into R® version 2.15.0 software for analysis. Cumulative monthly figures from July, 2010 to June, 2013 were combined and then grouped into seasons, dry (June–October) and wet (November–May). The overall, annual, monthly and seasonal prevalence of fasciolosis in cattle and goats were determined by computing descriptive statistics. Interspecies and seasonal variations in prevalence of fasciolosis were determined by Chi square test. The variations were considered significant at $P \leq 0.05$.

Results

A total of 8410 cattle and 8424 goats were slaughtered at Kasulu District abattoir in a three years period i.e., July, 2010 to June, 2013. Of the slaughtered cattle and goats, 6376 (76%) and 2295 (26%) were found to be infected with fasciolosis respectively. Twenty percent and 21% of the infected livers of cattle and goats respectively were totally condemned and for partly infected livers, infected parts were trimmed off and passed for human consumption. The observed difference in prevalence between the two species was statistically significant (p-value=0.00). The annual prevalence of fasciolosis ranged from 70 - 83% (76%) in cattle and 12-45% (26%) in goats (Table 1). There were variations in the cumulative monthly prevalence, the highest prevalence in cattle was observed in October (89.4%) and lowest in June (61.7%), while in goats the highest was in September (33.9%) and lowest in October (22.4%) (Fig. 1). Dry season was observed to have higher prevalence of fasciolosis as compared to wet season (Table 2). These seasonal variations were statistically significant in cattle (p-value=0.00023) but not for goats (p-value=0.1303).

A total of 50 adult worms and 50 eggs were subjected to morphometric identification. Measurements for the adult worms (Fig. 2) ranged from 27-49 (40.2) mm for length and 6-8 (7.2) mm for width at widest point; while those for eggs (Fig. 3) ranged from 135–184 (162.7) µm for length and 78-100 (88.4) µm for width. The above measurements suggested that the cause of fasciolosis in western Tanzania was probably *F. gigantica*.

Discussion

The observed overall prevalence of fasciolosis in cattle (76%) in this study was higher compared to those obtained in previous studies both in the country in Lake, Eastern and Northern zones (Msanga, 1985 (12%); Mwabonimana et al., 2009 (6.7%); Swai and Ulicky, 2009 (14.04%); Mellau et al., 2010 (7.5%); Komba et al., 2012 (17.6%) and elsewhere in other African countries (Pfukenyi and Mukaratirwa, 2004 (37.1%); Mungube et al., 2006 (26%); Gebretsadik et al., 2009 (24%); Yohannes and Abebaw, 2012 (35.2%); Omoleye et al., 2012 (14.5%). Similarly the reported prevalence of *Fasciola* infection in goats (26%) in this study was higher compared to the level (3.1%) obtained in a previous study in the Northern zone of the country (Nonga et al., 2009); and in a study conducted in a nearby country (6.6%) of Kenya (Mungube et al., 2006). The overall prevalence observed in this study both in cattle and goats were also higher when compared to results of previous studies based on faecal examinations (Keyyu et al., 2005; Mhoma et al., 2011). These observed variations might be associated with differences in eco-climatic conditions such as altitude, annual rainfall, presence of water bodies (rivers, lakes, irrigation canals, water reservoirs) and swampy grazing areas that have significant effect on the biology of the snail intermediate hosts (Malone et al., 1998; Pfukenyi et al., 2006).

Table 1: Annual prevalence of fasciolosis in cattle and goats slaughtered at Kasulu District abattoir from July, 2010 to June, 2013

Period	Animal species	Number slaughtered	Number infected (Prevalence)
July 2012-June 2013	Cattle	2983	2094 (70%)
	Goats	2286	772 (34%)
July 2011-June 2012	Cattle	2723	2249 (83%)
	Goats	2373	1064 (45%)
July 2010-June 2011	Cattle	2704	2035 (75%)
	Goats	3765	459 (12%)

Table 2: Seasonal prevalence of fasciolosis in cattle and goats slaughtered at Kasulu District abattoir from July, 2010 to June, 2013

Animal species	Season	Number slaughtered	Number infected (Prevalence)
Cattle	Dry (June-October)	4407	3415 (77.5%)
	Wet (December-May)	4003	2963 (74.0%)
Goats	Dry (June-October)	4227	1183 (28%)
	Wet (December-May)	4197	1112 (26.5%)

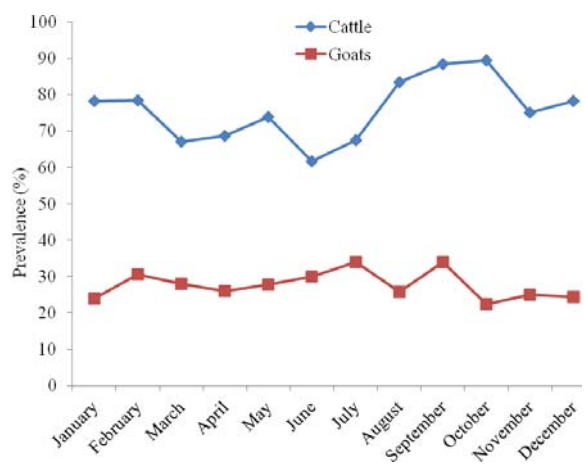

Fig. 1: Monthly prevalence of fasciolosis in cattle and goats slaughtered at Kasulu District abattoir from July, 2010 to June, 2013

The observed prevalence of fasciolosis in cattle (76%) in this study was significantly higher compared to the prevalence in goats (26%). Our findings are in concordance with what was previously reported in the country, northern zone (Nonga et al., 2009; Mellau et al., 2010) and elsewhere (Mungube et al., 2006). The observed interspecies difference in prevalence might be attributed to the fact that most *Fasciola* infections in goats assume an acute form characterized by high mortalities, hence large number of infected goats die at

the farm level and only a few develop chronic form of the disease which is detected at slaughter. Moreover, majority of subsequent *Fasciola* infections in cattle are chronic due to the development of acquired immunity that reduces migration of immature fluke's into the liver. Such phenomenon has not been described in small ruminants (Mungube et al., 2006).

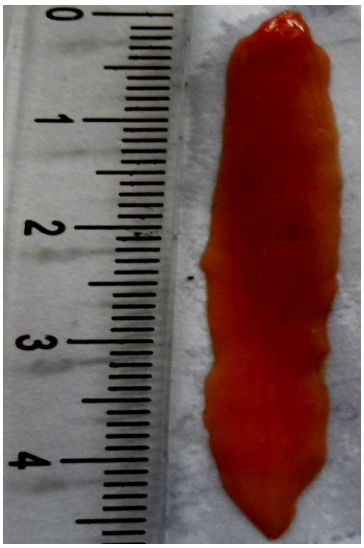

Fig. 2: Adult *Fasciola* (47 mm in length) recovered from an infected bovine liver

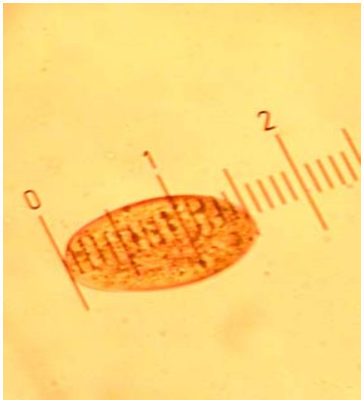

Fig 3: *Fasciola* egg (155 µm in length) recovered from gallbladder of infected liver viewed under compound microscope at 10x objective (each division represents 10µm)

Based on morphometric identification, our study and others conducted in northern and southern highlands zones of the country (Keyyu et al., 2005; Mwabonimana et al., 2009) incriminated *F. gigantica* as a cause of infections in goats and/or cattle. However, these measurements are not satisfactory to discriminate between *Fasciola* species, due to the presence of an overlap of adult worm and egg sizes of both of the species (Lotfy et al., 2002). Further characterization studies using molecular tools are required to confirm the *Fasciola* species.

This study has shown significant seasonal variations in occurrence of fasciolosis in cattle, as high number of cattle was detected to have fasciolosis during the dry season (77.5%) as compared to wet season (74%). The seasonal pattern of fasciolosis in cattle observed to be stable in the early wet (November, December and January) and decreasing until early dry season (June and July) and picked up in the mid and late dry season (August, September and October). The observed seasonal pattern of fasciolosis in cattle might be attributed to changes in eco-climatic conditions as during the dry season most of the water bodies dry up and the remaining few that are used as sources of drinking water for cattle contain high numbers of snail intermediate host. Previous studies in southern highlands of Tanzania (Kassuku et al., 1986; Makundi, 2001) have reported highest infection rates in the snail intermediate hosts to occur during the dry season, hence cattle are more exposed to *Fasciola* infections during this season compared to the wet season. Similar results showing large number of cattle with fasciolosis at slaughter during the dry season have been reported in northern Tanzania (Swai and Ulicky, 2009). These findings are in support of a previous epidemiological study in southern Tanzania which observed that *Fasciola* infections in cattle increased from early dry season and peaked up in the late dry season (Keyyu et al., 2005). Contrary to our and findings of another study, Nonga et al. (2009) detected a significantly higher liver infection of *F. gigantica* in cattle during the rainy season (8.4%) than in the dry season (6.1%). This might be attributed to different eco-climatic conditions between the study sites on snails' intermediate hosts.

Conclusion

This study showed that fasciolosis is highly prevalent among cattle and goats brought for slaughter at Kasulu district abattoir. Further studies on seasonal population and infection dynamics in snail intermediate hosts should be conducted in western Tanzania in order to generate epidemiological information that will be used by animal and human health professionals to design effective control strategies of fasciolosis involving both snails control and treatment of infected animals.

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