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**ORIGINAL RESEARCH ARTICLE**

# Parasitic causes of liver and heart condemnation and their economic effects in the Lake Victoria Basin: a retrospective abattoir survey in Kisumu Municipality, Kenya

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**Abstract.** Malnutrition is a major cause of human mortality in Sub-Saharan Africa and every effort must be made to conserve the available sources of protein for human use. Animals and especially livestock are a major source of the proteins but livestock production is hampered by such constraints as inadequate feed and various diseases. Parasitic diseases constitute a major impediment to livestock production owing to the direct and indirect losses they cause. For example, in Kenya fasciolosis leads to estimated losses at £7 million annually. However, these are conservative estimates since there are only a few studies on the epidemiology and economic importance of these parasites in Kenya. This study was undertaken to determine the causes of liver condemnation between 2003 and2008 and subsequent economic losses from fasciolosis using slaughter house data in Kisumu Municipality for the year 2007-2008. The role of muscular cysticercosis produced by larval forms of *Taenia saginata* as a cause of heart condemnation among slaughtered cattle was also included in this study. During 2003-2008, the percentage of cattle that had *Fasciola* infections ranged from 3% in 2003 to 7.13% in 2006. An average of 5.15% cattle was diagnosed with liver fluke infections every year. The proportion of livers condemned for liver flukes ranged from 39.2% in 2005 to 52.4% in 2004 with an average of 46.9% over the six year period. Other parasitic infections encountered in the liver were cystic echinococcosis, *Stilesia hepatica* and other parasitic cysts. In 2007 and 2008, the total monetary loss from liver fluke infections was USD 12,034 and USD 13,413 respectively. Losses from heart condemnations appeared relatively low compared to those of the liver but Muscular cysticercosis in cattle leads often to whole carcass condemnation. These losses can make a difference in the Lake Victoria Basin communities where malnutrition is prevalent and income per capita is low.

**Keywords:** Cattle; Liver; Heart; Parasites; Fasciola; Muscular Cysticercosis; Economic Losses.

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## Introduction

Malnutrition is a major cause of human mortalities in Sub-Saharan Africa (FAO, 2010) and every effort must be made to conserve the available sources of protein for human well being. Animals and especially livestock are a major source of these proteins but the efforts to increase the livestock production are hampered by many constraints such as inadequate feed availability and the various diseases prevalent in these tropical environments.

Parasitic diseases constitute a major impediment to livestock production in Sub-Saharan Africa owing to the direct and indirect losses they cause. For example, it has been estimated by Mukhebi et al. (1985) that in Kenya, returns could be increased by as much as 470% by controlling haemonchosis. On the other hand, fasciolosis in Kenya leads to losses estimated at £7 million annually, through a combination of poor productivity, death of stock, condemnation of infected livers and reduction in carcass quality (Harrison et al., 1996; Kithuka et al., 2005). However, these are conservative estimates since there are only a few studies on the epidemiology and economic importance of these trematode parasites in Kenya and other Sub-Saharan African countries. This study was undertaken to determine the causes of liver condemnation and subsequent economic losses from fasciolosis from various slaughter houses in Kisumu Municipality, Kenya.

## Materials and methods

*Retrospective slaughter house data*

Abattoir data was obtained from the District Veterinary Office, covering the period 2003 to 2008. The slaughter houses involved were all located within Kisumu District and are namely: Mambo Leo, Kiboswa, Rabuor, Otonglo, Daraja Mbili, Maseno and Kombewa/Holo. The monthly data gathered from each slaughter house covered type, number and sex of the animals, organ(s) condemned and reason for condemnation with special attention being given to the liver flukes and bovine muscular cysticercosis in the heart. In this report, only information with regard to cattle is considered. The value of the livers and hearts condemned was also given consideration: Value per kilogram of liver was estimated at 350 KES[US$ 4.5] and an average weight of 4 kg. For the heart, the price per kilogram was the same as that of the liver but the average weight was estimated at 0.75 kg. The exchange rate used was KES 77 to 1 United States Dollar (US$).

*Data summaries*

For each year, data was summarized to give the proportion of cattle livers infected with *Fasciola*, the proportion of livers condemned due to fasciolosis against other causes of organ condemnation. A similar analysis was done for the hearts condemned due to cysticercosis. An economic estimation was done for the losses due to liver and heart condemnation for years 2007 and 2008 where complete data was available.

## Results

*Cattle slaughtered, liver fluke infections against other infections*

In 2007 and 2008, a total of 12,332 and 10,509 cattle were slaughtered respectively. Of these, 664 and 738 livers were condemned in 2007 and 2008 respectively from various infections and conditions. The proportion of those condemned due to fasciolosis was 52.04% and 56.4% for year 2007 and 2008 respectively.

During the period considered (figure 1), the percentage of cattle that had *Fasciola* infections ranged from 3% (2003) to 7.13% (2006). On average, 5.15% cattle were diagnosed with liver fluke infections every year. On the other hand, the proportion of livers condemned due to liver fluke infections ranged from 39.2% (2005) to 52.4% (2004). The average over the six year period was 46.9%. Other parasitic infections and conditions encountered in the cattle livers were bacterial abscesses, *Stilesia hepatica* infections and other parasitic cysts, while in the lungs cystic echinococcosis and telangiectasia were the most common.

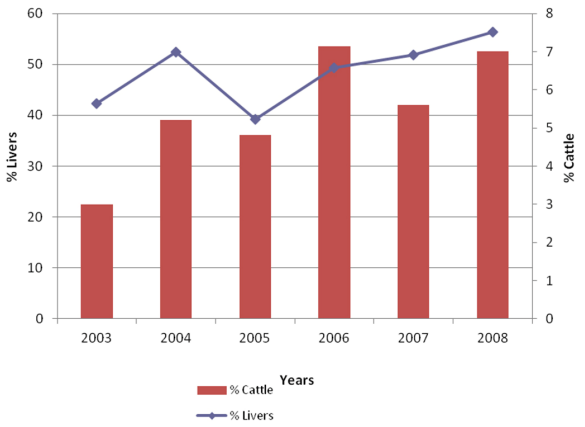


**Figure 1.** Percentage number of livers with Liver Fluke infection

*Monthly liver fluke infections*

The monthly average liver fluke infections are shown in figure 2. These ranged from a minimum of 4% in September to 8.9% in August. The months between January and July and October to December showed little variation within a narrow range of between 4.7 and 5.8%. There was no statistical significance in the peak (9%) recorded in August.

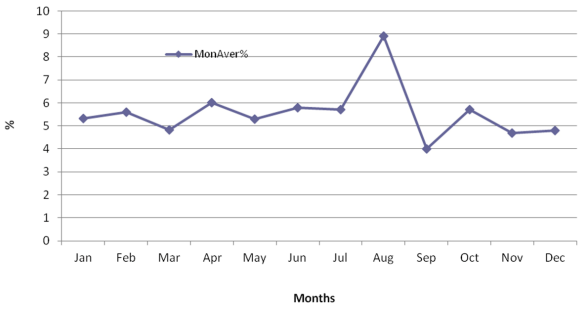


**Figure 2.** Monthly average [%] with liver fluke infections: 2003-2008

*Economic losses due to liver and heart condemnations*

In 2007, the total monetary loss from liver fluke infections was KES 926,600[US$ 12,034] while in 2008, this figure was KES 1,032,800[US$13,413]. On a monthly basis, the losses ranged from US$ 436 in February 2008 to US$ 13,413 in December of the same year (figure 3).

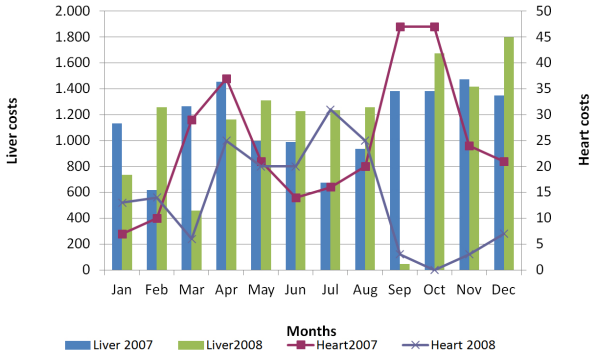


**Figure 3.** Economic losses [in USD] due to liver and heart condemnations in cattle slaughtered in Kisumu 2007-2008

During seven months of the year, the losses through the liver condemnations were higher in 2008 compared to year 2007.

Losses from the heart condemnations were not as high as those of the liver. In 2007 and 2008, the losses were KES 26,800[USD 348] and 10,780[US$140] respectively. In 2007, all months recorded losses from cases of bovine muscular cysticercosis while in 2008, some months had very low or no cases at all (as observed in October). Between January and August, losses from heart condemnation fluctuated between the two years without a clear difference but from August, losses were consistently higher in 2007 compared to 2008. This somehow coincided with the higher losses being recorded from liver condemnations.

## Discussion

Fasciolosis and paramphistomosis are two important parasitoses in farmed livestock all over the world where they cause huge losses to production (Mage et al., 2002; Wamae et al., 2004). Indeed, high prevalence of these two parasitic diseases has been observed in livestock from other parts of Kenya (Waruiru et al., 2000) and also Tanzania (Keyyu et al., 2005). The environment around Kisumu and the Lake Victoria Basin in general has plenty of water marshes which favor the presence of the water snails, the intermediate hosts for these trematodes.

Over the study period, the prevalence of *Fasciola* spp. in slaughtered bovine livers was estimated at 5.15% (range 3-7.13%). This is

slightly lower than that reported from a similar 3-year study in Arusha Municipality, Tanzania by Mwabonimana et al. (2009) where the average for the three years was 6.7% (range 3.8-8.6%). In the Arusha study, it was found that the rate of liver condemnation due to fasciolosis was higher (at a range of 50.2-60.9%) compared to Kisumu (where the range was 39.2-52.4%). The latter figures agree closely to those reported from Zimbabwe by Pfukeni and Mukaratirwa (2004) who recorded a prevalence rate of 37.1% for *F. gigantica*.

Consequently, the economic losses from fasciolosis in the liver appear to be higher in Arusha than those observed in Kisumu Municipality. These economic losses were estimated at US$ 18,000 in Arusha compared to the Kisumu's average of US$ 12,743 annually. In the Taveta Division of coastal Kenya, Mungube et al. (2006) recorded the total economic loss from liver condemnations due to *Fasciola* spp. between 1989 and 2004 as US$ 57,409. These losses, if contained, can make a difference in the lake basin communities where malnutrition is prevalent and income per capita is low (Kwena et al., 2003).

Human fasciolosis has been reported from different parts of the world (Torresi et al., 1996; O'Neill et al., 1998; Hughes et al., 2003). Infections are thought to be acquired from ingestion of infective metacercariae encysted on plants growing in water such as watercress (Hughes et al., 2003). In Kisumu Municipality there are a variety of water growing edible green vegetables and the possibility of human infections requires investigation especially considering that, sanitation in many parts of this Lakeside urban center is poor and drinking water at times subject to contamination by feces of animal origin including bovines. Though carcass condemnations due to *Schistosoma* spp. was not encountered, unpublished medical records show bilharziasis to be prevalent in this region.

There are no recent published records of economic losses caused by muscular cysticercosis of the heart from this part of Kenya. However, earlier reports of bovine cysticercosis conservatively estimated losses at approximately US$ 850,000 per year from condemnation, downgrading and refrigeration of carcasses (Onyango-Abuje et al., 1996).

Losses from heart condemnations appear low but it is important to remember that, cysticercosis is localized also in other tissues such as the skeletal muscles and those of the tongue, at times leading to whole carcass condemnation depending on the numbers present on any one carcass In addition, this cestode parasite is zoonotic causing infestations by *Taenia saginata* in humans. Thus, this tapeworm infestation has deeper and more implications to the economic losses than is reflected in this study. In order to appreciate the totality of economic losses obviated by the parasite infestation in livestock, a wider study among all domestic ruminants in advocated. The general trend in the data collected from 2003 to 2008 reflects an increase in the total numbers of condemned livers and cases of fasciolosis. This elicits the question of effectiveness of the control measures used and may call for a better understanding of the epidemiological factors relating to this parasite infestation.

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