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Assessment of causes of organ condemnations, financial losses and foetal wastage in cattle slaughtered at Bukoba Municipal abattoir, Kagera, Tanzania

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SUMMARY

Retrospective and prospective studies were carried out at Bukoba Municipal abattoir, Tanzania to identify causes of cattle organs condemnation and assess financial implications and magnitude of slaughter of pregnant cows and heifers. A retrospective study used data from 2011 to 2013 found that a total of 13,970 cattle were slaughtered and inspected. The prevalence of liver fasciolosis was 28.5%, lung congestion 10.2%, emphysema 5.1%, kidney haemorrhages 7.7% and hydronephrosis 4.3%. During a prospective study carried out in January 2014, post-mortem inspection of 692 cattle was done. The prevalence of liver fasciolosis was 37.6%, flabby heart 11.3%, emphysema 11.0% and lung congestion (6.6%). Value of condemned organs in one month of January 2014 was estimated to be Tanzanian shillings (TZS) 7,351 000 equivalent to US\$ 4,595. Estimated total of TZS 6,174 600 (US\$ 3,860) resulted from liver condemnations and TZS 6,092 400 (US\$ 3,808) from liver fasciolosis which is 82.9% of the total financial losses. Of all the 480 cows and heifers slaughtered, 75 (15.6%) were found to be pregnant. The high condemnation rates led to financial losses and some of the conditions are of zoonotic importance. The indiscriminate slaughter of pregnant animals is against animal welfare. Therefore, diseases surveillance and control measures need to be strengthened, and enforcement of legislation governing animal welfare to curb the slaughter of pregnant animals.

Keywords: Condemnation, financial losses, fasciolosis, abattoir, Kagera.

INTRODUCTION

Tanzania is endowed with abundant natural resources, which include land, forage and a large livestock resource base. Sixty million hectares of land are rangelands suitable for livestock grazing (Njombe and Msanga, 2008). The country has the largest cattle population in Africa after Ethiopia and North Sudan (MLFD, 2011). According to the Tanzania National Sample Census (2007/2008) of 2012, the total number of cattle in the Tanzania Mainland was 21,125,251. Cattle population in the

Mainland had increased by approximately 26% from about 15 million in 1995 to 21 million in 2008 which is an annual growth rate of 2%. On the other hand, according to the 2012 Population and Housing Census of Tanzania human population in the Mainland were 43, 625, 354 with an average annual intercensal growth rate of 2.7% from 2002 to 2012 (NBS, 2013). The population increase in Tanzania particularly in urban areas demands increased supply of animal protein of which the current output of livestock has

not been able to provide (Mellau *et al.*, 2011).

Bovine liver is one of the most commonly condemned organs during routine meat inspection (Kambarage *et al.*, 1995; Mellau *et al.*, 2011; Komba *et al.*, 2012; Nzalawahe and Komba, 2013). Such condemnations have been reported to cause enormous financial losses to meat traders and livestock industry at large. Mwabonimana *et al.* (2009) estimated annual economic loss at Arusha abattoir Tanzania due to fasciolosis liver condemnation to be US\$ 18,000. Similarly, Kamwela *et al.* (2013) reported monthly losses caused by liver condemnation due to fasciolosis amounting to TZS 5,894,400 at SAAFI abattoir and a total of TZS 5,376,000 at Sumbawanga Municipality abattoir in Tanzania. Elsewhere, Kithuka *et al.* (2002) reported up to 0.26 million US\$ losses attributable to fasciolosis-associated liver condemnations in cattle slaughtered in Kenya during the 10-year period. Similar loss records were observed by Denbarga *et al.* (2011) and Mohammed *et al.* (2012) in Ethiopia. Such losses constitute a substantial loss to the economy of slaughter stock owners as such an amount of money would have been harnessed into pro-poor livelihood improvement (Perry and Grace, 2009). Apart from liver, little attention is given in estimating the financial losses due to condemnation of other organs. Some of the surveys had been centered only on one or two organs. It is when the diseases affecting cattle are identified and their epidemiology understood that meaningful preventive and production plans can be formulated (Raji *et al.*, 2010).

The purpose of meat inspection is to protect public health and to provide risk free products to the society (Denbarga *et al.*, 2011). Animals sent for slaughter may harbour chronic or subclinical infections which are rarely detected in live animals

but are of economic and public health importance. Abattoirs and slaughterhouses can be sources of valuable information of diseases and conditions affecting animals including zoonoses (Mellau *et al.*, 2010). Gross pathological examinations in the slaughterhouse represent a useful tool for disease diagnosis and provide a snapshot of valid cross-section for what is happening in the livestock population (Phiri, 2006). The knowledge of the extent to which the public is exposed to zoonoses through meat consumption is useful in preventive medicine (Raji *et al.*, 2010). In addition, there have been some reports elsewhere (Mellau *et al.*, 2011; Zulu *et al.*, 2013; Ardo *et al.*, 2013; Maro, 2014) that pregnant animals are equally slaughtered as non pregnant ones and this is against animal welfare, causes losses to the farmers and generally it is not a good practice.

Therefore the main objective of this study was to assess the causes of condemnation and financial losses sustained by meat traders at Bukoba Municipal abattoir in Tanzania. The information resulting from this study would be vital for decision making in livestock development and public health at large.

MATERIALS AND METHODS

Study area and animals

The study was conducted at Bukoba Municipal abattoir in Kagera region, Tanzania. Bukoba municipality is located on the shore of Lake Victoria at latitudes 1° 6' 0" to 1° 8' 42" south of the equator and longitude 31° 16' 12" to 31° 18' 54" East of Greenwich. The human population of Bukoba Municipal council is 128,796 (NBS, 2012). The average cattle slaughter at Bukoba Municipal abattoir is about 17 cattle per day (BMC, 2013). The common breeds of cattle slaughtered are Ankole,

Boran and a few Tanzania short-horned Zebu.

Study design and data collection

The design of this study was retrospective and prospective type of observational study. The retrospective study used the three years data that were recorded between 2011 and 2013. The retrieved data includes number of cattle slaughtered and the disease conditions diagnosed for each organ condemned. The prospective study was conducted in January 2014 and involved active ante-mortem inspection of slaughter animals and post-mortem examination of meat. It also involved weighing of carcasses and some selected organs for use in financial evaluation of condemnations. Data related to diseases and pathological lesions, weight of organs, breed, sex, age and origin of cattle were also recorded. The age of cattle was estimated through dentition. The cattle origin was obtained from owner's history and movement permit. Post-mortem inspection was done by visual observation, palpation and incision of carcasses and organs with special attention to visceral organs as described by Gracey (1986) and FAO (1994). Determination of pregnancy was done through examination of uteri of all female cattle slaughtered and expressed as a percentage of total number of cows/heifers slaughtered.

Statistical storage and analysis

The collected data were entered in MS Excel 2007 spreadsheet and analysed using Epi-Info™ 7.1.2, Centre for Disease Control and Prevention (CDC), Atlanta, USA. A chi squared test was used to compare the proportions (%) of lesions at a critical probability of $P < 0.05$. Foetal losses were quantified as proportion (%) of the cows' uteri that were found with foetuses over the total number of cows that

were slaughtered during the prospective study. The financial losses due to condemnation of organs were worked out using total weight of condemned organs and market price of one kilogram of organ. The market prices of meat and offal were obtained through market survey from meat shops. The direct loss (DL) resulting from condemnation of each organ was calculated using the following formula: $DL = \text{Total weight of organ} \times \text{Price per kg of organ}$.

RESULTS

Results of retrospective study

A total of 13,970 cattle were slaughtered at the abattoir within a period of three years. The annual slaughter of cattle was 3,525 in 2011; 4,156 in 2012 and 6,289 in 2013 with the mean of $4,657 \pm 1,448$ cattle per year. The prevalence of diseases and pathological conditions in different organs and tissues are summarized in Table 1. The most prevalent conditions were fasciolosis (28.5%), lung congestion (10.2%) and kidney haemorrhages (7.7%). The peak period of fasciolosis cases were during July and August (Figure 1).

Results of prospective study

Number, biodata and foatal wastage of slaughtered cattle

A total of 692 cattle were slaughtered at Bukoba Municipal abattoir in January 2014. The breed of cattle mainly were Ankole (91.2%, $n = 631$), others were Boran ($n = 20$), Friesian ($n = 19$) and crosses of local and exotic breeds ($n = 22$). The age estimation was done to only 657 cattle. Cattle slaughtered with the age below 1.5 years were 31 (4.7%), 1.5 years to < 5 years were 393 (59.8%) and 5 years and above were 233 (35.5%). The majority of cattle (59.2%, $n = 365$) which were slaughtered originated from Nsheshe

livestock market in Bukoba district. Others came from livestock markets in Bukoba municipality (n=6), Bukoba rural district (n=25), Karagwe (n=44), Missenyi (n=84) and Muleba (n=93). It was not possible to establish the origin of 75 slaughtered cattle because the animals had no movement permits. The average carcass weight ranged between 65 kg and 290 kg with the mean weight of 122.8 ± 26.4 kg. Of the 692 slaughtered cattle, 480 (69.4%) were cows/heifers. A total of 75 (15.6%) slaughtered cows/heifers were found to be pregnant. Slaughtered cows/heifer: pregnant cow/heifer ratio was calculated to be 2.5 meaning that for every two to three slaughtered cows/heifers, one could be pregnant.

Table 1. Lesions and conditions observed in retrospective study period (2011 to 2013) (n=13,970)

Organ/ Tissue	Lesion/ condition	Number of cases (%)
Head	Abscess	224 (1.6)
	Cysticercosis	203 (1.5)
Livers	Fasciolosis	3,983 (28.5)
	Congestion	251 (1.8)
	Calcified cysts	419 (3.0)
	Necrosis	436 (3.1)
Kidney	Hydronephrosis	598 (4.3)
	Infarcts	399 (2.9)
	Nephritis	481 (3.4)
	Haemorrhages	1,082 (7.7)
	Congestion	893 (6.4)
Lung	Emphysema	710 (5.1)
	Anthracosis	610 (4.4)
	Congestion	1,423 (10.2)
	Abscess	326 (2.3)
	Pneumonia	417 (3.2)
	Oedema	594 (4.3)
Heart	Cysticercosis	240 (1.7)
	Fatty degeneration	489 (3.5)
	Pericarditis	268 (1.9)
Muscle	Cysticercosis	143 (1.0)
	Abscess	99 (0.7)
Lymphnode	Lymphadenopathy /Lymphadenitis	665 (4.8)
	Anthracosis	329 (2.4)
	Haemorrhages	355 (2.5)
	Pimpily guts	607 (4.3)
Intestine	Abscess	137 (1.0)

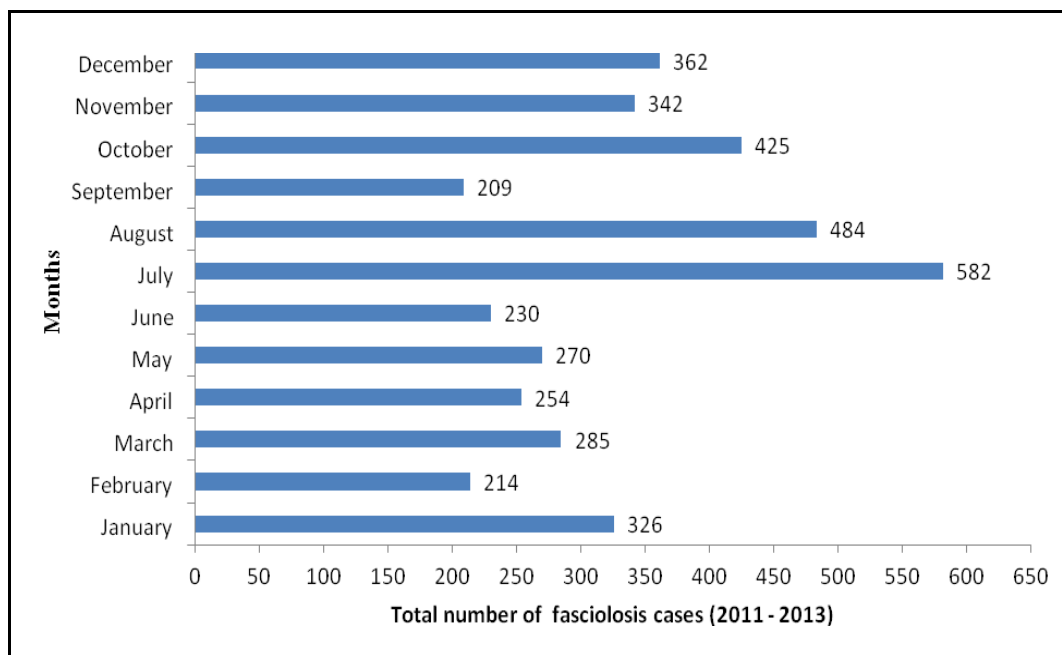


Figure 1. Total number of fasciolosis cases for each month recorded at Bukoba Municipal abattoir during the period of three years (2011 to 2013).

Prevalence of diseases/pathological conditions and financial losses due to organ condemnation of organs

The prevalence of liver fasciolosis was the highest (37.6%) of all the diseases/conditions observed followed by flabby heart condition (11.3%). Others were lung emphysema (11.0%) and lung congestion (6.6%) (Table 2). A total estimate of TZS 7,351,000 was lost by meat traders due to condemnation of organs from 692 cattle slaughtered during

the month of January 2014 (Table 2). Value of condemned organs in one month period was estimated to be TZS (Tanzanian shillings) 7,351,000 equivalent to US\$ 4,595. Estimated total of TZS 6,174,600 (US\$ 3,860) resulted from liver condemnations and TZS 6,092 400 (US\$ 3,808) from liver fasciolosis which is 82.9% of the total financial losses calculated. Assuming the same loss trend in the consecutive months an estimated total TZS 88,212,000 would be lost towards the end of 2014 calendar year.

Table 2. Financial losses due to condemnation of organs/tissues at Bukoba Municipal abattoir during the month of January, 2014

Organs/ tissue condemned	Causes of organs/tissues condemnations	Number of organs/tissues affected (%)	Estimated total weight of condemned organs/tissues (kg)	Average prices/kg of condemned organs/tiss ues (TZS)	Estimated total value due to condemnati on (TZS)
Livers	Fasciolosis	260 (37.6)	1,015.4	6,000	6,092,400
	Calcified cysts	2 (0.3)	4.8	6,000	28,800
	Abscess	6 (0.9)	3.9	6,000	23,400
	Fatty degeneration	1 (0.1)	5.0	6,000	30,000
Kidneys	Urolithiasis	6 (0.9)	2.6	6,000	15,600
	Hydronephrosis	31 (4.5)	12.9	6,000	77,400
Lungs	Pneumonia	3 (0.4)	7.5	4,000	30,000
	Emphysema	76 (11.0)	3.5	4,000	14,000
	Lymphadenitis	2 (0.3)	7.8	4,000	31,200
	Abscess	19 (2.7)	67.1	4,000	268,400
	Calcified cysts	1 (0.1)	0.0	4,000	0
	Congestion	46 (6.6)	163.5	4,000	654,000
	Lobular hepatization	1 (0.1)	4.3	4,000	17,200
	Oedema,	4 (0.6)	4.4	4,000	17,600
	Melanosis	1 (0.1)	2.6	4,000	10,400
	Heart and aorta	Flabbyness	78 (11.3)	0.0	6,000
Onchocercosis		3 (0.4)	2.8	6,000	16,800
Pericarditis		3 (0.4)	3.3	6,000	19,800
Spleens	Splenomegaly	1 (0.1)	1.0	4,000	4,000
Intestines	Pimply guts	7 (1.0)	0.0	4,000	0
Total			1,312.4		7,351,000

DISCUSSION

The purpose of this retrospective and prospective abattoir survey was to identify causes of organ and tissue condemnation in slaughtered cattle, to assess the associated financial losses and to establish the magnitude of slaughter of pregnant cattle at Bukoba Municipal abattoir. The results indicated that there were many pathological conditions which led to condemnation of different organs in particular livers, lungs and kidneys that caused high financial losses of up to TZS 7,351,000 just in one month. Nevertheless

the indiscriminate slaughter of pregnant animals represents a significant loss of animal protein, revenue, future herds and it is against animal welfare and drawback to the livestock industry. Therefore, it is emphasized to do routine disease surveillance in clinically normal animals to better determine the prevalence, possible financial impacts and public health consequences. Enforcement of existing animal welfare Act will help reduce foetal wastage caused by slaughter of pregnant animals.

The results of both retrospective and prospective studies showed that liver fasciolosis was the most prevalent and the major causes of condemnations in slaughtered cattle. An estimated financial loss as a result of condemnation of liver due to fasciolosis was TZS 6,092,640. This is a serious problem and where possible, some deliberate control measures need to be instituted. A study by Kambarage *et al.* (1995) in Morogoro Tanzania recorded liver as the commonly condemned organs. Similar findings were observed by Mellau *et al.* (2011); Komba *et al.* (2012); Nzalawahe and Komba (2013). The high prevalence of fasciolosis caused by *Fasciola* spp. in slaughter cattle at Bukoba abattoir may be linked with the existence of favourable conditions which supports the intermediate host snail *Lymnaea* spp. to survive and survival of metacercariae, the infective stage of *Fasciola* (Spithill *et al.*, 1999). Kagera region is endowed with high rainfall of up to 2000 mm per year which floods the valleys with water and leaves big swamps favourable for the intermediate host for *Fasciola*. When this is coupled with lack of strategic regime for deworming of cattle using fasciolicides like nitroxynil or oxcylozanide more cattle will keep on being infected with *Fasciola*. It was also observed that Friesian cattle slaughtered had significantly low proportion of fasciolosis compared to Ankole cattle. The differences in deworming and feeding management practices of the two breeds which favour more dairy cattle are the possible causes of higher prevalence of fasciolosis in Ankole than Friesian cattle. However, the finding is not conclusive due to small number of animals involved.

It was further observed that the prevalence of flabby heart condition was also high (11.3%) and ranked second of all the conditions observed in the prospective study. Flabby heart may be an end result of

Foot and Mouth Disease (Samanta and Maji, 2011), emaciation and other chronic diseases characterized by loss of weight like trypanosomosis, Contagious Bovine Pleuropneumonia (CBPP) (Kusiluka and Kambarage, 1996). When the heart is flabby, it warrants total condemnations which may cause losses to farmers and livestock traders. Nevertheless, during this study heart with such condition were passed for human consumption although such meat is of very low quality.

Lung congestion was the other main cause of organs condemnation at the abattoir. Congestion of lungs in cattle is associated with many factors. Improper stunning and bleeding is a common cause of lung congestions in most abattoirs (Abunna and Hordofa, 2013). However, stress factors such as exposure to dust or exhaustion during long treks of pastoral livestock may be another cause (Mellau *et al.*, 2010). Other factors that may cause lung congestion include poor housing, overcrowding and other stresses like cold, wind and rain. All these are known to predispose the cattle to opportunistic bacteria like *Pasteurella* spp. which are known to cause congestion of lungs and pneumonia (Blood *et al.*, 2007; Mellau *et al.*, 2010).

Lung emphysema was also prevalent lung condition which accounted up to 11.0% of condemnation rates. Short resting time before slaughter was the probable cause of lung emphysema in cattle (Abunna and Hordofa, 2013). Ruminants, particularly cattle, have a well-developed interlobular septa and lack of collateral ventilation make them more susceptible to interstitial emphysema (Mellau *et al.*, 2010). Emphysema in ruminants may also be associated with some disease conditions like East Coast fever which is rampant in Tanzania (Mellau *et al.*, 2010). In addition, obstruction to the air outflow or by

extensive gasping breathing during the slaughter process due to lack of stunning all can cause emphysema (FAO, 1994).

Lung abscesses (2.7%) and lung (bronchial, mediastinal) caseous lymphadenitis (0.3%) also contributed to lungs condemnation in prospective study and is suggestive of Bovine tuberculosis. The significance of this finding cannot be underestimated considering the zoonotic implication of the disease. This finding is inline with that reported by Mellau *et al.* (2011) in Arusha, by Swai and Schoonman (2012) and comparable with results obtained in Morogoro by Kambarage *et al.* (1995).

Slaughter of pregnant animals was also found to be a problem at Bukoba abattoir. It was observed that 15.6% of cows/heifers slaughtered during January 2014 were pregnant. This is a serious problem which needs immediate intervention for the advantage of livestock industry in Kagera region and Tanzania at Large. The prevalence of slaughter of pregnant cows and heifers observed during the current study is higher than the rate (8.6%) reported by Mellau *et al.* (2010) at Arusha abattoir, Tanzania. However, higher rates of slaughter of pregnant cows and heifers have been reported in different slaughterhouses in Tanzania which range between 23.7 and 54% (Assey *et al.*, 1998; Luwumba, 2011; Maro, 2014; Swai and Hyghaimo, 2014; Iloti, 2015; Tembo and Nonga, 2015). Elsewhere, Zulu *et al.* (2013) reported much high proportion (35.7%) of pregnant cows slaughtered in western province of Zambia. The foetal wastage is of great concern since it is against animal welfare and poses a significant threat to livestock production. Routine pregnancy diagnosis is recommended for animals intended for slaughter to avoid slaughter of pregnant animals and farmers and meat traders

should be educated to advocate behavioural changes (Ardo *et al.*, 2013).

Studies show that there are several reasons which cause farmers to sell for slaughter pregnant cows/heifers. Need for money by farmers which is accrued through selling of livestock to meet the household needs. Farmers go for the healthy animal with more weight and shining hair coat, so that the farmers can get good prices from the cattle traders as was reported by Taiwo *et al.* (2011) and Zulu *et al.* (2013). Unfortunately, if the animals are female the likelihood for pregnancy is high. Other reasons for selling cows and heifers include shortage of animal feed during dry season, outbreak of diseases, lack of awareness on pregnant animals, and lack of enforcement of legislation against slaughtering of pregnant cows/heifers (Idahor *et al.* 2009; Taiwo *et al.*, 2011; Zulu *et al.*, 2013; Fayemi and Muchenje, 2013).

Slaughter of pregnant animals is discouraged because calves are the life-line of the current and future herd of the nation. It is a violation of the provisions in the Animal Welfare Act in Tanzania (URT 2008) and Animal Disease Act of 2003 and its Ante and Post-mortem Inspection regulations of 2007 Section 6 (7), the quality of meat from pregnant animals is poor and pregnant cows have lower dressing percentage of up to 10% less compared to the non-pregnant cows/heifers (Wythes *et al.*, 1990; Tanzania Animal Disease Act of 2003; McKiernan *et al.*, 2007). Therefore, slaughter of pregnant animals should be strictly prohibited.

Local and Trans-boundary livestock disease control programmes should be instituted to minimise financial and economic losses due to diseases; to provide risk free products to the society and to create enabling environment for future export of livestock and livestock products.

The animal welfare law should be enforced to reduce foetal wastage caused by slaughter of pregnant animals.

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