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Retrospective Study on Bovine Whole Carcass and Liver Condemnations with Their Associated Direct Financial Losses at The Kumasi Abattoir, Ghana

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ABSTRACT

Limited information exists in literature on the major reasons for whole carcass and organ condemnations in Ghana. A retrospective study spanning January 2002 to December 2013 was conducted at the Kumasi Abattoir to determine the pattern of bovine whole carcass, liver condemnation, and to estimate the direct financial loss. During the study period, a total of 1,047,633 cattle were slaughtered out of which 406 (0.04%) were condemned wholly. The reasons for condemnation were Tuberculosis 150 (36.95%), putrefaction 231 (56.90%), Cysticercus bovis 12 (2.95%), general bruising 6 (1.48%), jaundice 4 (0.98%) and gangrenous necrosis 3 (0.74%). The condemnation rate was highest in 2002 (11.3%) and lowest in 2005 (1.48%). The regional distribution of the condemned carcasses revealed the higher percentages in Upper East 58% and Upper West 36.5%. Condemnation due to putrefaction was highest in December whereas that of Tuberculosis was in July and August. Within the same period, a total of 37921 livers were condemned due to abscesses 18730 (49.4%), fasciolosis 18789 (36.4%), cirrhosis 2399 (6.3%), hydatidosis 1919 (5.1%), putrefaction 630 (1.7%), tuberculosis 124 (124%), hepatitis 99 (0.2%) and others conditions 231 (0.6%). The direct financial losses due to total carcass and liver condemnation were estimated to be GH¢1,668,524 and GH¢446,600 respectively, giving a total loss of GH¢2,115,124. The study revealed that tuberculosis, putrefaction, abscesses and fasciolosis were the major reasons for carcass and liver condemnation at Kumasi Abattoir with huge financial implications. Emphasis should be laid on effective meat inspection and standard animal husbandry health care to curtail these zoonotic diseases and associated financial loss.

Keywords: *Carcass, liver, condemnation, retrospective study, financial loss, cattle, abattoir.*

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INTRODUCTION

Developing countries have about two thirds of the world's livestock population but their meat and milk production has been reported to be less than a third of the world (Assefa and Tesfay, 2013). Of the world's cattle population of 1358 million, 76% are in the developing countries but the beef yield in the developed countries (91.1kg/animal/annum) is higher than in developing countries (28.7kg/animal/annum) (Richardson and Smith, 2006). This obvious mismatch may be associated with numerous constraints that hinder the potential of livestock production. Some of these constraints include; lack of appropriate disease control policy and veterinary services, traditional management system, lack of business attitude to livestock production and limited genetic potential. Because of these related factors, significant economic losses result each year from condemnation of whole carcasses and edible organs (Assefa and Tesfay, 2013; Teshager et al. 2013). To reduce the continual losses of annual livestock output of developing countries to disease (FAO, 1990), the need to enhance availability and quality of animal health services (Anteneh, 1989; Umali et al. 1994) cannot be overemphasized since the role played by the livestock subsector in the overall development of the agrarian-based economies of most developing countries is enormous (Umali et al. 1994).

The livestock subsector of Ghana which contributes only 1.7% of the agricultural GDP (GSS, 2013) has 1,454,000 cattle, 3,759,000 sheep, 4,855,000 goats, 536,000 pigs and 47,752,000 poultry with a total annual domestic meat production of 112,067 metric tonnes (MT), consisting of 19,990MT Beef, 16,914MT Mutton, 18,935MT Chevon, 18,026MT Pork and 38,202MT Poultry(MoFA, 2010). Ghana, a meat-deficit country imports about 70% of all meat consumed, a figure which has not changed since 1994 (Osei, 2012). The meat imports includes; 12,483.1MTBeef, 2,699.5MT Buffalo meat, 4,902.6MTChevon, 3,038.9MT Pork, 70,900.2MT Duck (MoFA, 2010). Ghana's population of about 25 million increasing from 6 million at independence at a rate of 2.4% per annum presents a prospect in spite of the challenges in the livestock subsector. A growing population coupled with increasing urbanization, increased literacy and improved revenue opportunities are the main driving forces behind the increased demand for a better life which results in increased demand for livestock products (Osei, 2012).

The slow growth rate of domestic livestock production in some West African countries including Ghana and the need to meet their per capita meat requirement attracts movement and trade of cattle within the sub-region resulting in undesirable practices including the slaughter of breeding stock and pregnant animals (Atawalna et al. 2013).

Meat, due to its nutritional value is considered as the protein of choice. However, beef, considered the most popular and cheap source of animal protein for the population has an excellent, good biological value proteins and a main source of many nutrients, especially B.vitamins, iron and zinc due to its high content myoglobin (Ahmed et al., 2012; Teye et al., 2012).With respect to meat consumption, the average Ghanaian consumes 9kg meat per annum, 20eggs per year and 5% are chronically malnourished in terms of protein (Osei, 2012).

The public health unit of the veterinary services department ensures the delivery of hygienically processed meat for public consumption while preventing the transmission of infectious and zoonotic diseases to humans (Ibironke and Fasina, 2010). Bovine tuberculosis is present in most African countries affecting human, domestic and wild animals and its detection in abattoir poses a great zoonotic challenge especially in poor resource settting where advanced diagnostic method may not be readily available (Ayele *et al*. 2004).

The largest visceral organ in the bovine, the liver which has numerous functions is a very rich source of vitamins and minerals. It is much sought for by consumers due to its palatability and ease of consumption (Ibironke and Fasina, 2010). However, it is one of the most commonly condemned visceral organs during routine meat inspection (Nurit et al. 2012).

Significant economic losses therefore result from condemnation of edible organs and whole carcasses from these related factors (Assefa and Tesfay, 2013). Condemnation of edible organs, carcasses, mortality and poor weight present a significant yearly economic loss with public health implications (Raji et al.2010; Ahmed et al. 2012; Genet et al., 2012).

Processed livestock at abattoirs to a large extent, represent a valid cross section of livestock population which could be an option for the detection of diseases of both economic and public health importance (Yifat et al. 2011). Hence documentation, collection and collation of data from abattoirs in an area over a period of time often highlight changes necessary in animal husbandry practices and diseases control (Phiri, 2006). The condemnation of an organ, carcass or part of carcass is often determined by observation, palpation, incision of each organ and carcasses, ante mortem sign and results of laboratory examination if any, especially in developing countries (Genet et al. 2012).

Numerous studies exist in literature on the major reasons for whole carcass and organs condemnation in Nigeria (Opara, 2005) while such studies in Ghana, only reveals diseases and quality of meat at some selected slaughter houses (Adzitey et al. 2011a; Adzitey *et al*. 2011b; Adzitey and Huda, 2012; Teye et al. 2012) with limited information on the pattern of diseases that leads to total carcass condemnation. This study therefore determines the pattern of diseases that leads to total carcass condemnation, the causes of liver condemnation and their direct financial implications..

MATERIALS AND METHODS

Study Area and Animals

The Kumasi Abattoir Company Limited (KALC) commissioned in 1998 is located at Ahinsan/Kaasi Industrial Area on 6°39'36.6°N Latitude and 1°36'15.4°W Longitude (Frimpong et al. 2012) in the Kumasi Metropolis of Ashanti Region, Ghana. It is one of the largest and the busiest abattoir in Ghana. It has a cattle market which receives cattle from most of the regions of the country (Northern, Upper East, Upper West Brong Ahafo, Ashanti and Eastern) including West Africa countries of Burkina Faso, Mali, Nigeria and Togo. Animals slaughtered at the abattoir include cattle, sheep, goats and pigs. Daily slaughter of cattle begins from 6.am to 2.pm from Sunday to Saturday (7days a week) with an average slaughter of about 250. The preference for fresh meat in Ghana makes the abattoir congested in the mornings to enable the butchers send their carcasses early to the market immediately after dressing. Slaughtered cattle include both males and females. Carcasses from the abattoir are meant for the Kumasi Metropolis and the adjoining districts such as Ejisu-Juaben, Asokore Mampong, Kwabre, Afigya Kwabre, Obuasi, Bekwai, Atwima Nwabiagya and Atwima Kwanwoma. Data collected at the abattoir is considered representative of the pattern of disease that leads to total carcass and liver condemnation in Ghana since it receives cattle from most regions of the country and some West Africa countries due to its geographical location.

Data Collection

A retrospective data covering periods from 2002-2013 in respect of total carcass and liver condemnation were collected and analyzed based on abattoir records available through the effort of Meat Inspectors (Public Health Officers) of the Veterinary Services Department (VSD) and records from the management of Kumasi Abattoir Company Limited (KACL). For all conditions, data prior to 2002 were not available. The public Health Unit of VSD kept accurate and reliable data from 2002 according to directives from the National Directorate of VSD of Ghana for disease reporting. Oral interviews were held with some butchers, cattle traders, Meat Inspectors and

Management staff of KACL. Daily visits were made to the abattoir between 1st January 2014 and 31st March 2014 to ascertain the current status and scope of the problem.

The average prevailing cost of a kilogram of liver, beef and cattle was obtained through interactions and discussion with butchers and cattle traders. The direct economic loss from liver and carcass condemnation was assessed by considering the overall average weight of a liver and the retail market price at the butcheries and the price of an average size bovine at the cattle market. Computation was done in terms of Ghana cedi (GH₵).

Data Analysis

Data was analysed using Excel 2010 and total direct financial loss was computed as described by Yifat et al. (2011)

$$L = (N_{ic} * P_{ic}) + (N_{il} * P_{il})$$

Where;

L= Total loss; Nic= Number of carcasses condemned; Pic= Average price of bovine; Nil= Number of livers condemned and Pil= Average price of liver

RESULTS

Carcass condemnation

During the study period (January 2002 to December 2013), a total of 1047633 cattle were slaughtered at the Kumasi Abattoir. Out of the total cattle slaughtered, 406 (0.04%) were condemned. The causes of condemnation were Bovine tuberculosis (BTB), putrefaction, Cysticercus bovis (C. bovis), general bruising, gangrenous necrosis and jaundice. The highest cause of condemnation was putrefaction (56.90%), followed by BTB (36.95%), C.bovis (2.95%), general bruising (1.48%), jaundice (0.98%), and gangrenous necrosis (0.74%) as shown in Table 1. High occurrence of putrefaction of and BTB were in 2009 and 2011 with the lowest in 2008 and 2010 respectively (figure 1).

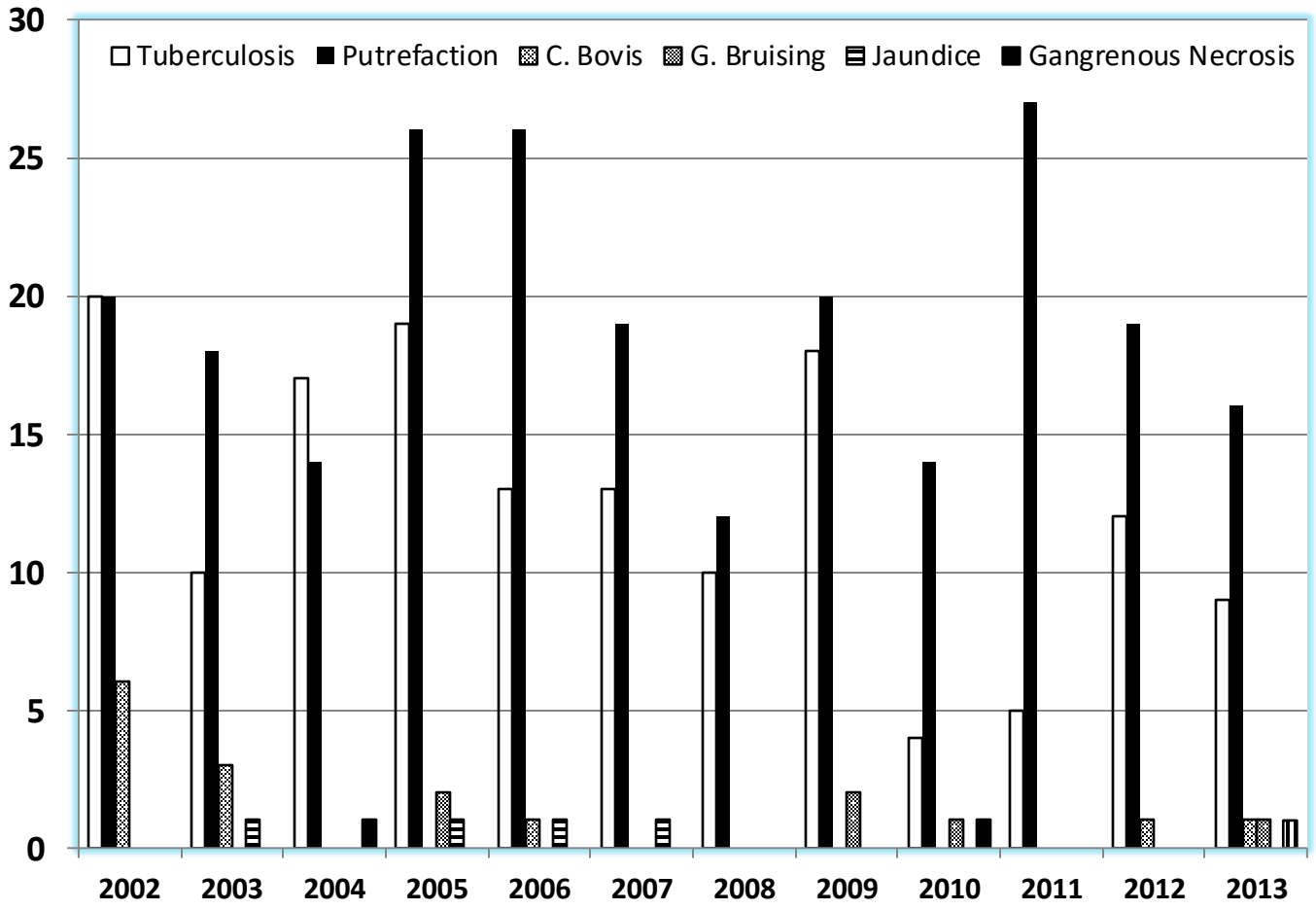


Figure 1:
Yearly condemnation of carcasses

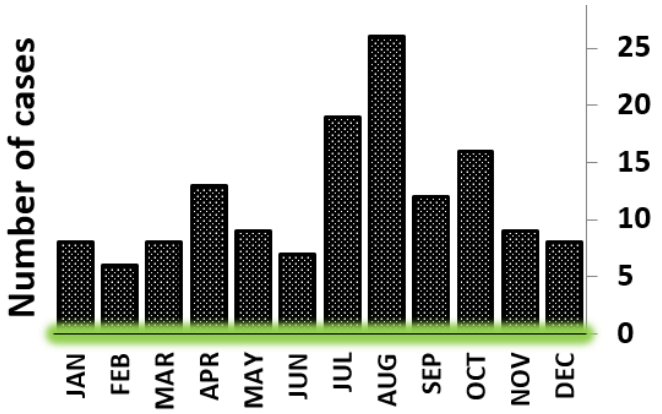


Figure 2:
Monthly distribution pattern of tuberculosis

The least cause of condemnation was gangrenous necrosis. August, followed by July showed the months with number of condemnation due to BTB and February being the month with the least (figure 2). Condemnation due to putrefaction was highest in December and least occurrence was in July (figure 3). Condemnation due to C.bovis was recorded only in the months of May, June, August, September, October and November with the highest of four in October and the lowest of one in May, June and August (figure 4).

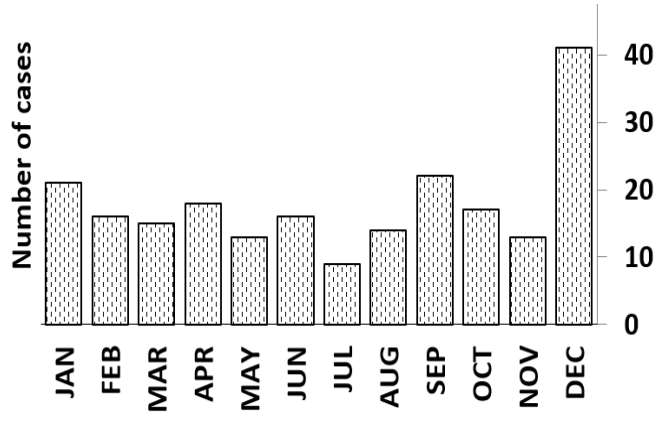


Figure 3:
Monthly distribution pattern of Putrefaction

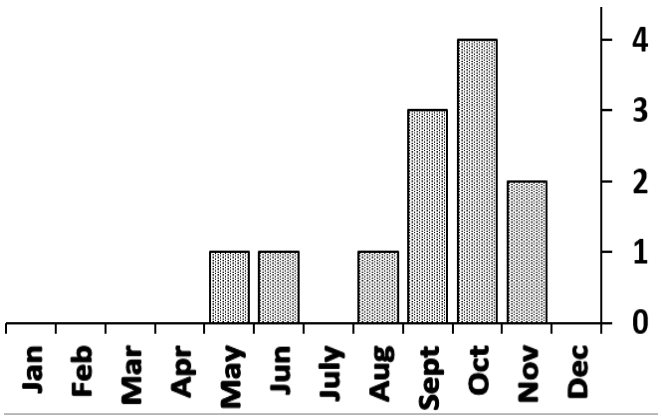


Figure 4:
Monthly condemnation pattern of Cysticercus bovis

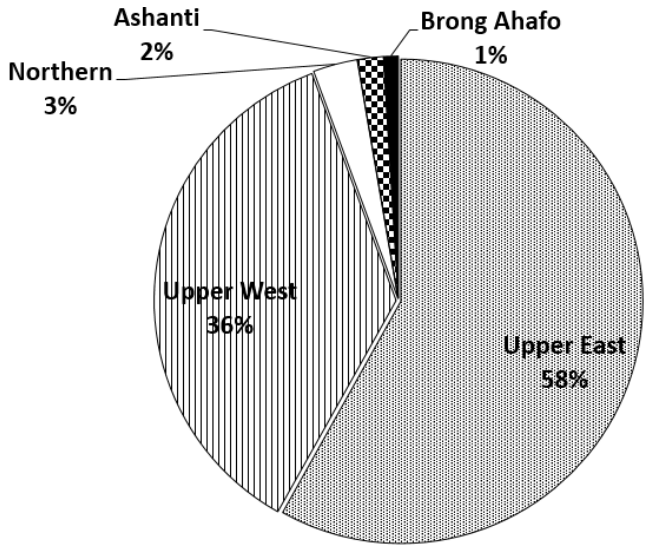
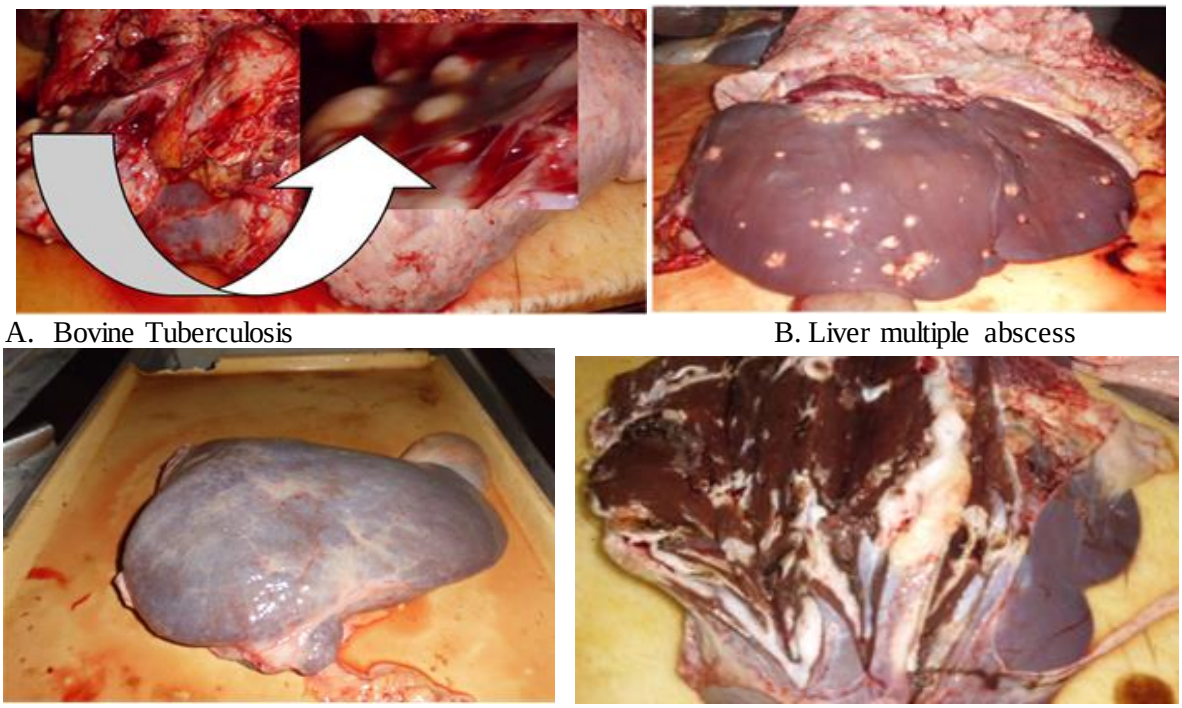


Figure 5:
Regional distribution of condemned carcasses

Figure 6:
Towns from which tuberculosis carcasses originated

Sources of condemned carcasses

Majority of the carcasses condemned came from the Upper East Region (58%), followed by Upper West Region (36%), Northern Region (3%), Ashanti Region (2%) and Brong Ahafo (1%) respectively (Figure 5).



A. Bovine Tuberculosis B. Liver multiple abscess

C. Liver cirrhosis D. Liver fasciolosis

Plate 1

Some gross pathological changes in liver condemned at Kumasi abbatoir. These results on liver condemnation bears little association to the actual number of livers affected with the various disease conditions as the livers are often not totally condemned in light infections but only the affected parts are trimmed off.

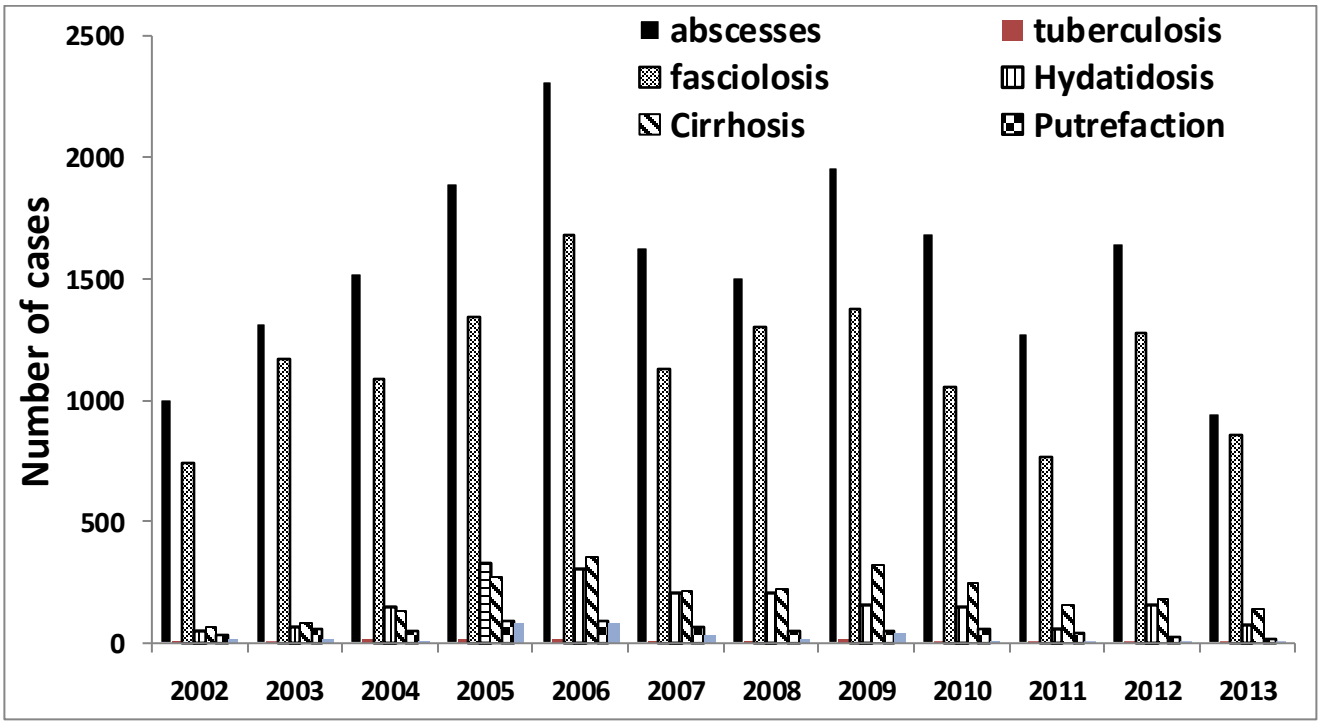


Figure 7:
Yearly liver condemnation

Bawku and Paga in the Upper East Region showed high figures of condemnation whereas high numbers of condemnation originated from Hamile and Tumu in the Upper West Region. Tuberculosis was the major cause of condemnation in carcasses originating from the Northern and Ashanti Regions and the only cause of condemnation from the Brong Ahafo.

Of the carcasses condemned due to BTB, 56.67%, 30.67%, 6%, 2.66% and 4% were from the Upper East, Upper West, Northern, Ashanti, Brong Ahafo Regions respectively. Towns in the Upper East Region (Paga and Bawku) and Upper West Region (Hamile and Tumu) which share border with neighbouring Burkina Faso showed higher figures of condemnation due to BTB (Figure 5). Condemnation due to putrefaction was 56.28%, 42.42%, 0.87% and 0.43% originated from Upper East, Upper West, Northern and Ashanti Regions respectively. Only Upper East and Upper West Regions showed cases of condemnation due to C. bovis and general bruising with100% condemnation due to gangrenous necrosis originating fromthe Upper East Region. Condemned carcassesdue to jaundice were originated from Upper East Region (75%) and Northern Region (25%).

Liver condemnation: Out of the total cattle slaughtered, a total of 37921 livers representing 3.6% were condemned. The lead cause of liver condemnation were abscesses (49.4%), fascioliasis (36.4%), cirrhosis (6.3%), hydatidosis (5.1%), putrefaction (1.7%), tuberculosis (0.3%), hepatitis (0.2%) and others (0.6%). Plate 1 shows some of the pathological conditions that led to liver condemnation. The highest occurrence of liver condemnation due to abscesses and fascioliasis was in 2005 and 2006 with the lowest in 2013 and 2002 respectively (figure 7). July and August recorded high number of condemnation due to abscesses whereas January and May recorded high numbers of condemnation due to fascioliasis.

Assessment of direct financial loss: The average price of a live bovine obtained at the cattle market at the Kumasi Abattoir was GH¢1100. This translates to an estimated financial loss of GH¢446,600 due to total carcass condemnation. On liver condemnation, information at the butcheries shows the price per kilogram of liver as GH¢11 and 4kg as the average weight of a liver. This gives the price of an average liver as GH¢44 with a direct financial loss of GH¢1,668,524. Therefore the total estimated direct financial loss is GH¢2,115,124 with an annual average loss of GH¢176,260.33.

DISCUSSION

This study reports the pattern of whole carcass and liver condemnation and their associated direct financial losses in slaughtered cattle in Kumasi abattoir, Ghana. This retrospective study spanned between January 2002 to December 2013. The rate of whole carcass condemnation within this period was found to be 0.04% with the major cause of condemnation being Putrefaction and Tuberculosis. This high number of carcass condemnation due to putrefaction (56.90%) which often occurred in December may be due to Christmas festivities when cattle traders are in a rush to take advantage of the market boom coupled with shortage of vehicles to transport cattle, often indulge in overcrowding which often lead to death of cattle during transit. This reason may account for higher number of cases of putrefaction from regions where animals were meant to travel over long distances and with obvious overloading especially those from the the Upper regions may result in suffocation and subsequent emergency slaughtering of such animals. This is in agreement with reports of other workers (FAO, 2001; Hannah et al. 2014) who indicated that transporting cattle for long distances without rest and at stocking densities exceeding the recommended numbers may result in compromised, down or dead cattle. Cattle slaughtered under emergency, enroute to the abattoir are brought undressed and may undergo putrefaction leading to condemnation as observed in this investigation.

Carcass condemnation due to bovine tuberculosis (36.95%) had a high frequency of occurrence in July and August which may be explained by the fact that the northern sector where most of the cattle are brought from, is transiting from the dry season with its attendant stress due to lack of pasture for the grazing cattle. The unavailability of feed during this period may lead to culling of immunosuppressed lean-looking cattle to sustain the farmers during the lean season, pay for the preparation of farms for the new cropping season and also to pay school fees for their wards since the academic year of most schools begin around this period. The fluctuations in the yearly BTB condemnation cannot be readily explained however the high percentage of condemnation due to BTB from the upper regions and towns (figure 5) bordering the neighbouring West Africa countries indicated that most of the tuberculosis infected cattle might have been imported from the sub region (Cadmus et al. 2008; Awah-Ndukum et al. 2012). The prevalence rate of 0.01% is less than other studies conducted by Damelash et al. (2008), (0.19%); Boukary et al. (2012), (0.13%); Boussini et al. (2012) and Phiri (2006) who reported a higher condemnation rate of 83.1% for BTB in Zambia. The rate would have been higher if it was based on BTB lesions detection rather than condemnation due to BTB as reported by Adu-Bobi et al. (2009) (7.9%-49%), Ghana; Cadmus et al. (2008) (4.3%), Nigeria; Tschopp et al. (2010), (0.9%), Ethiopia; Awah-Ndukum et al. (2012), (0.46%) Cameroon. The detection of BTB at the Kumasi abattoir could be associated with absence of BTB eradication program in Ghana especially those associated with thorough quarantine procedures at the country's entry points and the unchecked cause of BTB in live cattle in Ghana while traders often sell first cattle with poor body score. Jaundice and gangrenous accounted for less than 2% of total carcass condemnation but the pattern of condemnation could not be established.

At the Kumasi Abattoir, liver abscess, fascioliasis, bovine tuberculosis, cirrhosis, liver hydatidosis and hepatitis were the common causes of liver condemnation. This is in agreement with studies by other workers (Ibironke and Fasina, 2005; Bekele et al. 2010). The study also showed that abscess is the leading cause of liver condemnation which is in agreement with Ahmed et al. (2013) but is in contrast with other studies (Bekele et al. 2010; Ibironke and Fasina, 2010, Mohamed, 2013) which showed that fascioliasis was the lead cause of liver condemnation. Fascioliasis was the second cause of liver condemnation after abscess in this present study. The prevalence rate of 36.4% observed in this study is similar to other studies at Assela, Ethiopia 34.5% (Shiferaw et al. 2011), Namwala District, Zambia 35.7% (Munyeme et al. 2012) but a lower rate (25.2%) at Dussie Municipal abattoir Ethiopia (Belay et al. 2012). The prevalence of bovine fascioliasis at the Kumasi abattoir may be attributed mainly to ecological and climatic conditions such as altitude, rainfall and temperature in addition to stock management system at the areas from which the cattle were brought for slaughter. Most part of the year in the area

from which the cattle were brought from is dry and livestock graze around water bodies such as marshy lands, streams, rivers and ponds where the lymnae species, the intermediate host for fasciola thrives. The condemnation rate of 6.3% in respect of cirrhosis is lower than 10.4% rejection rate in slaughtered cattle at Zaria Abattoir (Raji et al. 2010) but higher than 3.5% at Gondar Elfora (Yifat et al. 2011). Also condemnation due to hydatidosis (5.1%) was higher than 3.7% at Gondar Elfora (Yifat et al., 2011) and but lower than 18.42% by AbebeFromsa et al. (2012). The reasons for higher figures of liver condemnation due to abscess and fascioliasis in 2006 could not be easily ascertained. Putrefaction, cysticercosis, hepatitis, jaundice, tumor, telangiectasis, bovine tuberculosis and congestion accounted for less than 3% of the total condemned livers.

The study showed that putrefaction and bovine tuberculosis (BTB) were the leading cause of carcass condemnation whereas abscess and fascioliasis were the leading cause of liver condemnation. Most of the condemned carcasses came from regions and towns bordering the Sahel Region of West Africa. Also cattle transported over long distances were prone to emergency slaughter leading to condemnation due to putrefaction. Lack of clear policies and implementation regarding control of zoonotic diseases especially bovine tuberculosis (BTB), hydatidosis, fascioliasis and Cysticercus bovis impedes control of diseases.

Estimated direct financial loss due to carcass and liver condemnation is GH¢446,600 and GH¢1,668,524 respectively, and total loss of GH¢2,115,124 with an average loss of GH¢176,260.33 per annum. The estimated direct financial loss is enormous but transcends financial loss alone since some of the causes of condemnation are zoonotic and are of both public and animal health concern.

It is therefore recommended that stakeholders such as government, farmers, veterinarians, cattle traders, butchers, abattoir personnel and transporters should take urgent integrated action through intensified quarantine of cattle at the country's entry points, establishment of rest stops for cattle, use of appropriate vehicles for transport of cattle to abattoir and prevention of disease through good management practices for livestock production. For the control of BTB, effective quarantine measures at the various borders to prevent the influx of numerous cattle from the neighbouring countries like Burkina Faso, Mali, Togo, Cote D'Ivoire and Niger into the country to reduce contact between cattle, thereby reducing transmission via aerosol. Test and Slaughter (T+S) policy should be designed and started as a major control measure to avert the spread of BTB infection.

Increasing consumer awareness should be made to protect humans from zoonotic diseases. Also control measures for zoonosis such as compensation schemes and vaccination programs should be put in place. The Ghana Veterinary Services Department should be resourced to improve farmers and public knowledge of animal diseases and encourage their participation in animal disease prevention and control activities. Qualified veterinary staff should be posted to slaughter houses to carry out routine meat inspection for the detection of diseases. Veterinarians and meat inspectors should not only take interest in carcass and organ condemnation, but educate cattle traders, butchers, consumers and abattoir personnel on the dangers of infection with diseases especially zoonotic diseases..

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