



Major causes of organ condemnation and financial significance in cattle slaughtered at Jimma Municipal Abattoir, Southwestern Ethiopia

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Abstract

A cross-sectional study was conducted from November 2015 to April 2016 to identify the major causes of organ condemnation and to estimate the direct economic loss due to organ condemnation in cattle slaughtered at Jimma Municipal abattoirs. The study animals were selected using simple random sampling method. Antemortem inspection was carried out in the lairage and abnormalities encountered were recorded, followed by postmortem examination through their identification number to detect gross abnormalities and aesthetic reasons that rendered each organ. A total of 384 cattle were examined by ante-mortem and post-mortem examinations using standard examination procedures. Out of the total 384 randomly selected cattle subjected to ante mortem and postmortem examination, 274 (71.4%) were found to have various types of postmortem abnormalities. From the total organs examined, 151(39.3%) livers, 114(29.7%) lungs, 31(8%) hearts, 23(6%) kidneys were condemned as unfit for human consumption. Major pathological conditions that caused a total condemnation of organs were fasciolosis (20.6%), hydatidosis (26.7%), cirrhosis (9.9%), calcification (5.2%), emphysema (4.2%), congestion (7.3%), percarditis (3.1%), hydronephrosis (1.6%), atrophy (1.8%) and renal calculi (2.6%). Organ condemnation rates did not show significant difference ($P > 0.05$) among age group, breed and status of body condition. The financial loss due to edible organ and carcass condemnation was estimated to be 13,780.092 Ethiopian Birr. In conclusion, the observation of such a level of abnormalities and substantial economic loss with condemnation of affected organs warrants the institution of appropriate control measures.

Keywords: Abattoir, Cattle, Condemnation, Slaughtered, Economic loss, Jimma

Introduction

The livestock sub sector accounts for 40% of the agricultural gross domestic product (GDP) and 20% of the total GDP. Livestock and livestock products are the major foreign exchange earns. Abattoir data is an excellent option for detecting diseases of both economic and public health importance (Arbabi and Hooshyr, 2006; Abbuna *et al.*, 2010). Especially in ascertaining the extent to which human is exposed to certain zoonotic diseases in addition to estimating the financial implications of carcass condemnations (Jobre

et al., 1996). Surveillance at the abattoir allows for all animals passing in to human food chain to be examined for unusual signs, lesions or specific disease (Alton *et al.*, 2010).

Diseases cause extensive financial wastes as a result of direct and indirect economic loss is the major concern to livestock industry. In abattoirs of various locations, researchers indicated that hydatidosis is widespread in Ethiopia with great economic and public health

significance (Jobre *et al.*, 1996; Kebede, 2010). Major parasitic disease such as fasciolosis, hydatid cyst, cysticercosis and other causes like abscessation and cirrhosis are of great public health concern and cause significant economic losses by lowering productivity of cattle and condemnation of edible organs (Biu and Adindu, 2004; Chhabra and Singla, 2009). Studies conducted in different abattoirs of Ethiopia revealed that parasitic infection of livers, lungs (pneumonia), pericarditis and pyelonephritis are the major cause of organs condemnation (Asmare *et al.*, 2012).

Echinococcosis is a major public health problem in some countries and it may be emerging or re-emerging in some areas. Approximately 2 to 3 million human cases are thought to occur worldwide (CFSPH, 2011). Cysts or lesions of Echinococcosis multilocularis occur primarily in the liver and grow slowly but with eventual serious liver pathology and high risk of mortality if untreated. As well, the cysts occasionally rupture and cause severe allergic reactions in humans (OIE, 2004).

Fasciolosis is an important parasitic disease of domestic ruminants caused by two liver fluke species: The disease is responsible for considerable economic losses in the cattle industry, mainly through mortality, liver condemnation, reduced production of meat, milk, and wool, and expenditures for anthelmintics (Rahmet *et al.*, 2008). The purpose of meat inspection is to protect public health and to provide risk free products to the society. Also, it provides information that can be utilized for animal diseases control. Abattoir data is an excellent option for detecting diseases of both economic and public health importance (Arbabi and Hooshyar, 2006) especially in ascertaining the extent to which human is exposed to certain zoonotic diseases and estimating the financial implications of carcass condemnations (Jobre *et al.*, 1996).

Recently, several modern abattoirs like Helimex, Elfora, Metehara, Modjo and Luna have been established in Ethiopia. This increase number of abattoirs shows increase in demand of carcass and organs supply, but the supply is decreasing due to disease and production problems. In view of this, proper evaluation of economic losses due to organ condemnation resulting from various diseases at abattoirs is needed (Ezana, 2008).

Although various investigations have been conducted through abattoir survey to determine the prevalence and economic loss resulting from organ condemnation in Ethiopia, most of the surveys were focusing only

on parasitic cases such as hydatidosis and fasciolosis. According to the information gained from Jimma municipal abattoir, there is no registered information on cause of organ condemnation, its public health and financial significance in the study area. Therefore, this study was designed to quantify the rate, causes and economic loss of organ condemnation in a holistic manner at Jimma municipal abattoir.

Materials and Methods

Study Area

The study was conducted in Jimma municipal abattoir from November, 2015 to April, 2016. Jimma is a capital town of Jimma zone, which is 346 km far from Addis Ababa, to south western Ethiopia and Oromia regional state. The livestock population of is 2.5 million of which 45.6% cattle, 8.2% sheep, 4.5% goat, 2.95% horse, 0.9% donkey, 0.8% mules and 36.7% poultry. Jimma has an altitude of 880-3360 meters above the sea level (a.s.l) and between 7°23'-8°47'N latitude and 35°52'-37°30'E longitude with average annual rain fall 1500 with minimum and maximum of 1500ml and 2500ml respectively, and annual temperature 7°C-30°C (Tolosa and Tigre, 2007).

Study Population

The cattle destined for slaughter were all males originated from different parts of Jimma Zone. They were transported to the abattoir using vehicles and on foot. A total of 384 cattle destined for slaughter were inspected during Ante-mortem and post-mortem inspections with their specific identification numbers and recorded accordingly on a format prepared for this purpose.

Sample Size and Sampling Method

The sample size was determined by simple random sampling method using 95% confidence interval. To a date, there was no earlier work done on major causes of organ condemnation and its economic significance in cattle slaughtered at Jimma Municipal abattoir. Therefore, the sample size was determined by taking the prevalence of 50% for major causes of organ condemnation and its economic significance in cattle slaughtered at Jimma Municipal abattoir using the formula given by Thrusfield (2005). Thus, the minimum of 384 cattle are intended to be sampled.

$$N = \frac{1.96^2 (P_{exp}) (1 - P_{exp})}{d^2} = 384 \text{ Cattle}$$

Where:

N = sample size, P = expected prevalence, d = desired level of precision.

Study Design and Methodology

A cross-sectional study was conducted from November 2015 to April 2016 to identify the major causes of organ condemnation and to estimate the direct economic loss due to organ condemnation in cattle slaughtered at Jimma Municipal abattoir. A total of 384 cattle were examined by antemortem and postmortem examinations using standard examination procedures. The study animals were selected using simple random sampling method.

Ante-mortem Examination

Regular visits were made four days per week to Jimma Municipal abattoirs during the period from November, 2015 to April, 2016. During every visit, each animal were identified based on enumerated code given to the butcher shops before slaughter. The average numbers of animal's slaughtered at Jimma Municipal abattoir were 30 cattle per day. In the ante mortem inspection, pre-slaughter examinations of bovines were conducted at lairage and various information concerning age, body condition score and origin of each study animals were properly recorded. The age grouping was done based on dentition standard given by Pace and Wakeman (2003). Based on their dental eruption patterns, two conventional age groups were formed as young-adult (2 to 6 years) and adult were formed as young-adult (2 to 6 years) and adult (>6 years). Body condition scoring of the cattle was made based on the method described by Nicholson and Butterworth (1986). Each scoring were given number from 1(L-, very lean) to 9 (F+, very fat) and these scores finally included under three body condition scores, good, medium and poor.

Postmortem Examination

During Post mortem inspection, Liver, lung, heart, kidney were thoroughly inspected by visualization, palpation and making systemic incisions where necessary for the presence of cyst, parasite and other abnormalities. Pathological lesions were differentiated and judged according to guidelines on meat inspection for developing countries and classified into the following categories of judgment namely: approved as fit for human consumption, conditionally approved as

fit for human consumption, totally condemned as unfit for human consumption and partially condemned as unfit for human consumption (Getachew, 2008).

Assessment of Economic Loss

The analysis was based on annual slaughter capacity of the abattoir considering the market demand, average market price of each organ in Jimma town and rejection rate of each organ. Average market price was determined by interviewing personnel of the abattoir and butchers. The economic loss due to condemnation was estimated by the formula set by Ogunrinade and Ogunrinade (1980) as follows:

$$EL = srx \times Coy \times Roz$$

Where:

EL = Annual economic loss estimated due to organ condemnation

srx = Annual number of cattle slaughtered at the abattoir.

Coy = Average cost of each liver/lung/heart/kidney

Roz = Condemnation rate of each liver/ lung/ heart/kidney

Data Management and Analysis

All raw data generated from this study were coded and entered in Micro Soft Excel spread sheet for data analysis; SPSS software version 20 was used. Descriptive statistics was used to determine the level of condemnation defined as proportion of organs condemned to the total number of organs examined. The variations between condemnation rates, age and body condition scores were evaluated by Pearson's Chi-square(X^2). The results of this study was considered statistically significant (P 0.05).

Results

Antemortem Inspection

Antemortem inspection was carried out on all 384 cattle for the detection of any abnormalities encountered in Jimma municipal abattoir slaughter houses. A total of 74 (19.27%) cattle were found to have abnormalities listed bellow (Table 1). Respiratory sign, depression, lameness, leech infestation, tick infestation, emaciation, local swelling, branding and blindness were frequently observed in this species.

Table 1: Abnormal conditions encountered during antemortem inspection.

Abnormal conditions	No. of animal affected	Percentage (%)
Respiratory sign	8	2.08
Depression	6	1.56
Lameness	7	1.82
Leech infestation	8	2.08
Tick infestation	9	9.00
Emaciation	10	2.60
Local swelling	9	9.00
Branding	11	2.86
Blindness	6	1.56
Total	74	19.27

Postmortem Examination

All animals that had been examined by antemortem inspection were also subjected to postmortem examination. The overall prevalence of major organ condemnation in cattle slaughtered in Jima municipal abattoir was found 274 (71.4%) in the study area. During postmortem examination, out of the total 384 examined organs, 151(39.3%) liver, 114 (29.7%) lungs, 23(6%) kidneys and 31(8%) hearts were condemned due to various causes. Fasciolosis

79(20.6%) was found to be the main cause of liver condemnation followed by cirrhosis 38(9.9%), calcification and hydatid cyst respectively. The major causes of lung condemnation were hydrated cyst, congestion and emphysema accounting for 18.2%, 7.3% and 4.2% respectively. Hydrated cyst 19(4.9%) and pericarditis 12(3.1%) were main causes of heart condemnation. Renal calculi atrophy and hydronephrosis were the major causes of kidney accounting for 10(2.6%), 7(1.8%) and 6(1.6%) respectively (Table 2).

Table 2: Proportion of postmortem finding in organs with their rejection rate (n = 384).

Condemned Organ	N	Diseases condition	Condemnation (%)	Proportion (%)
Liver	151	Fasciolosis	79(20.6)	52.4%
		Hydatid cyst	14(3.6)	9.2%
		Calcification	20(5.2)	13.2%
		Cirrhosis	38(9.9)	25.2%
Lung	114	Hydatid cyst	70(18.2)	61.3%
		Congestion	28(7.3)	25.6%
		Emphysema	16(4.2)	14.1%
Heart	31	Hydatid cyst	19(4.9)	61.3%
		Pericarditis	12(3.1)	38.7%
Kidney	23	Atrophy	7(1.8)	30%
		Calculi	10(2.6)	43.3%
		Hydronephrosis	6(1.6)	26.7%

Condemnation proportion was higher in adult cattle 152(55.5%) followed by young 122 (44.5%). There was no statistically significant difference in frequencies of organs condemned between the two age categories ($\chi^2=2.144$; $P=0.143$) and among the body condition categories ($\chi^2 =5.143$; $P=0.742$). Condemnation

proportion was higher in body condition with medium 175(63.9%) and fattened cattle 99(66.1%). There was also no statistically significant difference in frequencies of organs condemned among body condition categories ($\chi^2=1.871$; $P=0.171$) (Table 3).

Table 3: Association of animal age and body condition score of specific organs (n = 384).

Variables		No. of slaughtered cattle	Positive (%)	X ²	P-value
Age	Young	162	122 (44.5%)	2.144	0.143
	Adult	222	152 (55.5%)		
BCS	Medium	237	175 (63.9%)	1.871	0.171
	Fat	147	99 (36.1%)		
	Total	384	274 (71.4%)		

Assessment of Direct Economic Loss

The slaughter rate of the Jimma Municipal abattoir was estimated to be 384 cattle during the study period. The annual estimated economic loss was found to be

13,961.86 ETB per annum (Table 4). Liver condemnation takes the higher proportion of all the losses accounting for 39.3% of all the losses followed by lungs, heart and kidney which constitute 29.7%, 8% and 6% of all the direct economic losses.

Table 4: The rejection rate and average price of organs condemned in Jimma municipal abattoir.

Condemned organ	Rate of condemned organ (%)	Average price in ETB	Total loss in ETB
Liver	39.3	70	10,563.84
Lung	29.7	17	1,938.82
Heart	8	25	768
Kidney	6	30	691.2
Total Price (Ethiopian Birr)			13,961.86

Discussion

Proper postmortem meat inspection is important to detect abnormalities (Gracey *et al.*, 1999). This study investigates the causes of organ condemnations and their associated financial losses in 384 cattle slaughtered at the Jimma Municipal Abattoir. This study showed that fasciolosis, hydatid cyst, liver cirrhosis, calcification, emphysema, congestion, hydronephrosis, atrophy and renal calculi were the major causes of organs condemnation in cattle slaughtered at Jimma Municipal Abattoir. From the total examined organs, 151(39.3%) livers, 114(29.7%) lungs, 31(8%) hearts and 23(6%) kidneys were condemned due to different pathological conditions. This finding is similar with the previous study reported Nebyou *et al.* (2014); Fufa and Debele (2013).

The condemnation rate of liver in this study was lower than the previous studies conducted by Nurit *et al.* (2012) from Kombolcha, Fufa and Debele (2013) and Genet *et al.* (2012) from Gonder with prevalence of 66.55%, 48.5% and 61.1%. But it was observed higher

than the reports of Yifat *et al.* (2011) from Gondar, Swai and Ulicky, (2009) in Hai, Tanzania and Abunna *et al.* (2010) Wolaita Sodo, Ethiopia, municipal abattoirs with a prevalence of 14% and 14.04 % and respectively. The rejection rate of lung in this study was higher than reports by Lati *et al.* (2015) of 16.47% at Nekemte and Alembrehan and Haylegebriel (2013) of 7.53% Adigrat municipal abattoir. However, it is relatively comparable with the report of Asmare *et al.* (2012) of 25.8% from Bahir Dar.

The condemnation rates of hearts 8% in the current study were higher than the rejection rate 3.71% by Shagaw *et al.* (2009) from Mekele municipal abattoir and 2.06% by Genet *et al.* (2012) from Gonder. The rejection rate of kidney in the present study was higher compared with the report of Fufa and Debele (2013) from sodo and Nebyou *et al.* (2014) from Nekemte with prevalence of 3.5% and 1.6% respectively. Variations in the condemnation rate of organs probably due to differences in agro-ecological conditions that favorable to the parasites, livestock management system and prevalence of diseases at the different study sites.

In the current study, hydatidosis was the leading disease which was recorded at the abattoir. It affected most of the visceral organs such as lungs, liver, heart and kidney. The overall prevalence of hydatidosis at Jimma abattoir was 26.82% and it occurred predominantly in the lung (18.2%), then liver (3.6 %) and heart (4.9%). This finding is relatively similar with the report of Nebyou *et al.* (2014) from Nekemte municipal abattoir. But this finding is higher than the report conducted by Elmahdi *et al.* (2004) (3%) and Regassa *et al.* (2009) (15.4%) from Sudan and Wolaita Sodo abattoirs respectively. It was lower than that reported by Moje *et al.* (2014) Kebede *et al.* (2009), Getaw *et al.* (2010), Regassa *et al.* (2010) and Borji *et al.* (2011) with a prevalence of 50.1, 46.8, 48.5, 52.7% and 82% from Shashamane, Debre-Markos, Adama, Hawassa and Greece respectively.

Fascioliasis was the leading disease of liver which was recorded at the abattoir, 20.6% of the animals' liver abnormalities were found to be caused by fascioliasis. This finding is lower as compared with the value reported by Tadele and Worku (2007) from Jimma, Nuritu *et al.* (2012), Swai and Ulicky (2009) from Tanzania and Kithuka *et al.* (2002) from Kenya and Phiri (2006) from Zambia with a prevalence of 63.89%, 36.06, 31.3, 38.2 %, and 37% respectively. But this report higher than the report of Lati *et al.* (2015) from nekemte and Alembrihan and Haylegebriel (2013) from Adigrat with the 12.17% and 9.26% respectively. These differences can be attributed to the difference in agro-ecological condition and strategic control of internal and control measures parasites in the areas. Apart from its veterinary and economic importance throughout the world, fasciolosis has recently been shown to be re-emerging and widespread zoonosis affecting a number of human populations (Esteban *et al.*, 2003 and Mas *et al.*, 2005).

Liver condemnation due to hydatid cyst (3.6%) in the present study is just compared with studies conducted by Alembrihan and Haylegebriel (2013) from Adigrat 3.62%. But extremely lower than the report by Mihret *et al.* (2013) 33.33% from Dire Dawa and by Zelalem *et al.* (2012) 31.7 % from Addis Ababa. Hydatid cyst found to be the main cause of lung condemnation with rate of 18.2% which is much lower than report of Genet *et al.* (2012) from Gondor, Getaw *et al.* (2020) from Adama and Regassa *et al.* (2010) from Hawassa with the report of 68.2%, 48.5% and 82%. But higher than the rejection rate reported by Fredrick *et al.* (2013) from Zambia and Elmahdi *et al.* (2004).

The current study shows the total condemnation heart is 8%. The main cause of heart rejection in this study was pericarditis and hydatid cyst which 3.1% and 4.9% respectively. This is extremely lower as compared with study by Genet *et al.* (2012) from Gonder abattoir with 78.1% and 9.4% respectively. However, it was higher than the report of Lati *et al.* (2015) and Nebyou *et al.* (2014) who recorded (0.69 and 0.9%) and 0.18% prevalence respectively in Nekemte Municipal Abattoir. The present study also showed that kidney resulting in considerable economical loss in cattle slaughtered was condemned due to hydronephrosis, atrophy and renal calculi with report of 6%, 7% and 10% respectively which is lower than the report of Fufa and Debele (2013) from sodo with report of and Genet *et al.* (2012). The difference in the rejection rate of organs with related to different causes may be due to the difference in the prevalence of the disease and variation in animal management system at different study site.

The total direct economic loss incurred due to condemnation of organs in active abattoir survey was 13,780.092 ETB. From this, 5,537.28 ETB and 2,626.176 ETB were recorded due to fasciolosis and hydatidosis respectively. This result is lower than the report of Hassan *et al.* (2012) from Iran, Genet *et al.* (2012) from Gondor and Yifat *et al.* (2011) from Gondor with the report of 13,880 USD, 21,565,889 ETB and 18,973.22 ETB respectively. Variations in the amount of economic lost in different abattoirs probably due to the differences in the prevalence of diseases, rejection rate of organs, slaughtering capacity of the abattoirs, local market price of organs and management of animals.

Conclusion and Recommendations

In the present study, it concluded that several disease problems were associated with the condemnations of organs in Jimma Municipal Abattoir, Ethiopia. From the total 384 examined cattle, 274 (71.4%) were found to have various types of postmortem abnormalities. The rates of condemnation of organs were higher in livers which was decreased in lungs, hearts and kidneys respectively. Major pathological conditions that caused a total condemnation of organs were higher in fasciolosis followed by hydatidosis, cirrhosis, calcification, emphysema, congestion, pericarditis, renal calculi, atrophy and hydronephrosis. Organ condemnation rates did not show significant difference ($P > 0.05$) among age group, breed and status of body condition. The financial loss due to edible organ condemnation was estimated to be

13,780.092 Ethiopian Birr. Thus, Proper meat inspections are essential to remove gross abnormalities from meat and its products in order to prevent the distribution of contaminated meat to the public.

Based on the above conclusion the following recommendation are required:

- ❖ Different strategies should be developed to minimize condemnation of organs due to the dynamic nature of the diseases.
- ❖ Bluchers should be aware about safe handling and transporting of slaughtered animals to prevent stress.
- ❖ Training should be offered to abattoir workers on ante-mortem and post- mortem inspection.
- ❖ Water supply and waste disposal systems should be given special attention by the abattoir personnel.

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