

INVESTIGATION INTO MAJOR CAUSES OF ORGANS CONDEMNATION IN BOVINE SLAUGHTERED AT ADAMA MUNICIPAL ABATTOIR AND THEIR ECONOMIC IMPORTANCE

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Received: 29.08.2014; Accepted: 28.10.2014

ABSTRACT

A cross sectional active abattoir survey, which involved both antemortem and postmortem examinations, was conducted on 3675 cattle from November, 2013 to May, 2014 and retrospective with other area study. During antemortem inspection, out of 3675 cattle examined, 70 bovine (1.9%) showed various type of abnormalities. These included branding (20; 0.5%), blindness (10; 0.3%), salivation (4; 0.1%), hernia (2; 0.05%), lameness (31; 0.8%) and local swelling (3; 0.1%). During postmortem examination, out of total cattle examined, 25.7% liver, 24.8% lungs, 0.5% kidneys and 3.1% heart were condemned due to different causes. Distomatosis (9.6%) was the main reason for liver condemnation followed by hydatidosis (6.4%), calcification (7.0%) and cirrhosis (1.4%). Lung was condemned mainly due to hydatidosis (21.5%), pneumonia (1.8%), calcification (0.5%), distomatosis (0.35%), abscessation (0.2%), emphysema (0.2%) and others (0.1%). Main causes of heart condemnation was pericarditis 58 (1.6%) followed by *Cysticercus bovis* 34 (0.9%) and hydatidosis 9 (0.2%). Kidneys were mainly infected by *Cysticercus bovis* (0.08%) and hydatidosis (0.1%). Total direct and indirect economic losses incurred in active abattoir survey were 9814190 Ethiopian Birr (ETB) equivalent to US Dollar 490874.5. Therefore, cooperation between public health and official veterinary authorities is highly imperative to establish appropriate strategy for prevention and control of these diseases.

Key words: Cattle, organ condemnation, economic loss, rejection rate

The purpose of meat inspection is to protect public health, and to provide risk free products to the society. It also provides information that can be utilized for control of animal diseases (Gracy *et al.*, 1999). Abattoir data is an excellent option for detecting diseases of both economic and public health importance. Major parasitic diseases such as distomatosis, hydatidosis, calcification, bovine cysticercosis and other conditions such as abscessation and cirrhosis cause a significant economic loss by lowering the productivity of cattle and condemnation of edible organs (Biu and Adindu, 2004; Fekadu *et al.*, 2012; Equar *et al.*, 2012).

Several studies have been conducted through abattoir survey to determine the prevalence and economic losses resulting from organ condemnation in many abattoirs of Ethiopia (Arbabi and Hooshyar, 2006; Abunna *et al.*, 2010). However, most of these studies focused only on specific diseases such as distomatosis, hydatidosis and bovine cysticercosis. Hence, it would be essential to have information on occurrence of various other diseases, and their economic losses from different

parts of the country. Currently, there is lack of information on the various causes and economical losses due to organ condemnation in Adama district. Therefore, the present study was undertaken to obtain information on conditions leading to condemnation of carcasses and organs in cattle slaughtered at Adama municipal abattoir and to estimate their economic importance.

MATERIALS AND METHODS

The study was carried out at the Adama municipal abattoir from November, 2013 to May, 2014 on bovine subjected for human consumption. During the period of study, all carcasses and organs were examined. Percentage of organs condemned and percentage of total condemned were calculated using the following formula:

$$\% \text{ of organ condemned} = \frac{\text{number of named organs condemned for specific reason}}{\text{total of animals slaughtered}} \times 100$$

$$\% \text{ of total condemned} = \frac{\text{number of named organs condemned for specific reason}}{\text{total number of named organ condemned}} \times 100$$

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Study Area: Study was conducted at Adama abattoir. Adama is a town and separate woreda in Central Ethiopia. It is located in the Shoa Zone of the Oromia Regional state about 99 kilometers from Addis Ababa. This city has a latitude and longitude of 8°55'2 N and 39°27'2 E, respectively with an elevation of 1712 meters. The average annual temperature in this town is 20.5°C. Agricultural activities in this area are mainly mixed type with cattle rearing and crop production. Adama have about 229,000 human populations and 70,662 cattle population (Gizaw, 2005).

Study Animal: Study animals were bovine brought to Adama abattoir for slaughter from different Kebeles of Adama town. Each animal was given identification number on their gluteal area as they arrived at lairage before antemortem inspection.

Study Design: Study was conducted through active abattoir survey and retrospective with other area study from previous documents. A cross-sectional study design was employed for estimating the prevalence of parasitic and bacterial diseases and other visceral abnormalities. Following slaughter, visceral organs including liver, lungs, kidneys, heart and whole carcasses were carefully examined by inspection, palpation and incision for the presence of diseases and other abnormalities (Herenda *et al.*, 1994).

Sample Size Determination: Sample size for this study was determined using the formula described by Thrusfield (2005). Prevalence in a large (theoretically infinite) population at 95% confidence interval and 0.87% precision was considered. Since there was previous data on the prevalence of organs condemnation in the study area, 5% prevalence was taken for sample size determination.

$$N = 1.96^2 \times P_{exp} (1 - P_{exp}) / d^2 = 3675$$

Where: N=required sample size, P_{exp} =expected prevalence, d=desired absolute precision

Active Abattoir Survey: Prior to sampling, a code was also given on the skin, head, carcass, visceral organ and gastro intestinal tract (GIT) that corresponded to the code on live animal. During meat inspection, each organ of an animal was strictly and separately examined. A total of 3675 cattle were inspected during antemortem and postmortem examinations using standard examination procedures. During the antemortem examination, general behavior, signs of disease, nutritional status, cleanliness and any type of abnormalities were recorded (Getaw *et*

al., 2010). Judgment was also done based on the procedure given by FAO (1994). Postmortem examination was conducted through visualization, palpation and systematic incision of each visceral organ particularly liver, lungs, heart, kidneys and intestines for the presence of cysts, various adult parasites and other abnormalities (Getaw *et al.*, 2010). Predilection sites such as heart, liver, kidney, lung and carcass were thoroughly inspected for the presence of any disease that can lead to condemnation of the carcass. Meat inspection was done as per the procedures of Ethiopian Ministry of Agriculture Meat Inspection Regulation (1972). Heart, liver, lungs, kidneys and carcass of all slaughtered animals was assessed by visual inspection and palpation followed by one to three incisions.

Data Analysis: Collected data was coded and stored in MS Excel and then analyzed by STATA 11 for windows program (STATA Corporation, 2007) using SPSS version 15 software.

RESULTS AND DISCUSSION

Antemortem Examination: Of the 3675 cattle subjected to antemortem examination, only 70 bovine (1.9%) showed various type of abnormalities including branding, blindness, salivation, hernia and local swelling (Table 1).

Postmortem Examination: During postmortem examination, out of total organs examined, 944 (25.7%) liver, 911 (24.8%) lungs, 17 (0.5%) kidneys and 116 (3.1%) heart were condemned due to different causes (Table 2). Distomatosis (9.6%) was the main reason for liver condemnation (Fig. 1) followed by hydatidosis (6.4%), calcification (7.0%, Fig. 2) and cirrhosis (1.4%, Fig. 3). Main causes of lung condemnation were hydatidosis (21.5%, Fig. 4), pneumonia and calcification. In addition, abscesses, adhesions, cysticercosis, distomatosis etc. were also the causes for lung condemnation. Main causes of heart condemnation

Table 1
Abnormalities encountered during ante-mortem examination of cattle at Adama municipal abattoir

Abnormalities encountered during ante-mortem examination	No. of animal infected (%)
Blindness	10 (0.3)
Salivation	4 (0.1)
Hernia	2 (0.05)
Lameness	31 (0.8)
Local swelling	3 (0.1)
Total	70 (1.9)

Table 2
Causes and annual economic losses due to condemned organs in cattle at Adama municipal abattoir

Organs	Disease conditions	No of animals affected (%)	Annual infected animals	Economic loss (ETB*)
Liver	Abscess	22 (0.6)	132	9240
	Adhesion	18 (0.5)	110	7700
	Calcification	260 (7.0)	1544	108080
	Cirrhosis	53 (1.4)	309	21630
	Hydatidosis	237 (6.4)	1411	98770
	Distomatosis	354 (9.6)	2117	148190
	Total	944 (25.7)	5623	393610
	Normal	2738 (74.5)		
Lungs	Abscess	7 (0.2)	44	880
	Adhesion	2 (0.05)	22	440
	<i>Cysticercus bovis</i>	3 (0.08)	22	440
	Calcification	18 (0.5)	110	2200
	Distomatosis	13 (0.35)	88	1760
	Emphysema	8 (0.2)	44	880
	Hydatidosis	789 (21.5)	4741	94820
	Pneumonia	66 (1.8)	375	7500
	Others	5 (0.1)	22	440
	Total	911 (24.8)	5490	109800
	Normal	2761 (75.1)		
	Kidney	<i>Cysticercus bovis</i>	3 (0.08)	22
Hydatidosis		2 (0.05)	22	770
Others		12 (0.3)	66	2310
Total		17 (0.5)	110	3850
Normal		3658 (99.5)		
Heart	<i>Cysticercus bovis</i>	34 (0.9)	198	4950
	Hydatidosis	9 (0.2)	44	1100
	Pericarditis	58 (1.6)	353	8825
	Others	15 (0.4)	89	2225
	Total	116 (3.1)	684	17100
Normal	3559 (96.8)			

*ETB=Economic losses due to condemned organs in Ethiopian Birr

were pericarditis (1.6%) followed by cysticercosis (0.9%) and hydatidosis (0.2%, Fig 5) Adhesion of bovine heart (Fig. 6) was also other reason for heart condemnation. Kidney was mainly infected by cysticercosis (0.1%) and hydatidosis (0.1%).

Economic Losses

Direct Loss: Annual financial losses due to visceral organs condemnation were estimated from annual slaughter per annum, visceral organs condemnation rate and the current average price of the organs in Adama. Losses incurred were computed using the model:

$L = (N_i \times P_j)$ where L=total loss, N_i =Number of visceral organs condemned annually and P_j =Average price of visceral organs.

$L_i = N_i \times P_i = 5623 \times 70 = 393610$ ETB, where: L_i =

annual economical lose due to liver, N_i =total liver condemned annually and P_i =average price of liver

$L_l = N_l \times P_l = 5490 \times 20 = 109800$ ETB, where: L_l =annual economical lose due to lung, N_l =total lung condemned annually and P_l =average price of lung

$L_k = N_k \times P_k = 110 \times 35 = 3850$ ETB, where: L_k =annual economical lose due to kidney, N_k =total kidney condemned annually and P_k =average price of kidney

$L_h = N_h \times P_h = 684 \times 25 = 17100$ ETB, where: L_h =annual economical lose due to heart, N_h =total heart condemned annually and P_h =average price of heart

Total annual direct loss = $L_i + L_l + L_k + L_h$
= $393610 + 109800 + 3850 + 17100 = 524360$ ETB

Indirect Loss: Indirect annual economic losses due to carcass weight loss= $N_s \times C_i \times P_a$ (Polydorou, 1981).

where N_s =Total number of animals slaughtered and positive, C_i = Carcass weight lost in individual animals, P_a =Average market price of a kg of meat

$N_s=9834$, $C_i=6.3$ kg and $P_a=150$ ETB/kg

Indirect annual loss due to carcass weight loss= $9834 \times 6.3 \times 150 = 9293130$ ETB

Total annual economic loss (Indirect+Direct) from cattle slaughtered at Adama abattoir

= $524360 + 9293130 = 9817490$ ETB = 490874.5 USD.

The study showed that distomatosis, hydatidosis, cysticercosis, cirrhosis, calcification and adhesion were the major causes of condemnation of organs in cattle slaughtered at Adama municipal abattoir. This finding has variation with reports from different abattoirs of Ethiopia (Fekadu *et al.*, 2012; Shiferaw *et al.*, 2009; Denbarga *et al.*, 2011; Mohammed *et al.*, 2012; Asmare *et al.*, 2012 and Assefa and Tesfa, 2013). Rejection rate of the liver as observed in this study was lower when compared with the reports of Yifat *et al.* (2011) Mohammed *et al.* (2012) and Fekadu *et al.* (2012) who reported 31.1%, 66.55% and 64.4% condemnation rates, respectively. However, rejection rate was higher as compared to those reported by Oryan *et al.* (2012) and Borji *et al.* (2012) from Iran and Assefa and Tesfa (2013) from Adigrat municipal abattoir, Ethiopia.

This study showed that distomatosis was the main cause of liver condemnation, which was lower than that of earlier reports from Jimma abattoir (63.89%) by Tolosa and Tigre (2007), from Gondar (26.9%) by Denbarga *et al.* (2011) and from Kombolcha (36.06 %)

by Mohammed *et al.* (2012). Occurrence of bovine cysticercosis in this study was lower than that reported by Kumar and Berhe (2008), Fekadu *et al.* (2012), Khaniki *et al.* (2012) and Assefa and Tesfa (2013). Liver condemnation due to hydatidosis in the present study had the support of Berhe (2009), Fikire *et al.* (2012), Asmare *et al.* (2012) and Mihret *et al.* (2013).

Rejection rate of the lungs due to different conditions as observed in this study had the support of Asmare *et al.* (2012), Fekadu *et al.* (2012) and Assefa and Tesfa (2013). Condemnation rates of the kidneys in this study was lower than that reported by Shegaw *et al.* (2009), Fekadu *et al.* (2012) and Assefa and Tesfa (2013) municipal abattoir but was higher than that reported by Denbarga *et al.* (2011)). The present study also showed that kidneys were condemned due to *C. bovis* and hydatidosis which were similar with the observation of Denbarga *et al.* (2011) and Assefa and Tesfa (2013).

Similar conditions as observed in this study for rejection of heart were reported by Denbarga *et al.* (2011) and Assefa and Tesfa (2013). Main cause of heart rejection in this study was pericarditis. Mesele *et al.* (2012) reported that pericarditis, abscessation, and hydatidosis were the most common causes of heart condemnation at Gondar abattoir.

Variations in the rejection rate of organs may be probably due to differences in agro-ecological conditions of animal origin that could be favorable to the parasites, livestock management system and improper disposal of condemned organs that was eaten by stray dogs (final host of hydatid cyst). Differences in the rejection rate of organs with different causes may also be due to differences in the prevalence of the diseases and variations in animal management systems.

Total direct and indirect economic loss incurred in active abattoir survey was higher than the losses reported earlier (Denbarga *et al.*, 2011; Fekadu *et al.*, 2012; Mesele *et al.*, 2012). Higher loss in this study was encountered mainly due to distomatosis and hydatidosis, which accounted for 149950 and 195460 Ethiopian Birr, respectively and was higher than that reported by Assefa and Tesfa (2013) from Adigrat and Fekadu *et al.* (2012) from Jimma municipal abattoir. Variations in the economic losses in different abattoirs were 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 differences in the management practices of animals.

This study revealed that distomatosis, hydatidosis, bovine cysticercosis (caused by *Cysticercus bovis*), pneumonia, emphysema, cirrhosis, calcification, adhesion and abscessation were the major causes of organs condemnation in cattle which were subjected for slaughter in Adama municipal abattoir. All these diseases were responsible for high economic losses. The cooperation between public health officials and veterinary authorities is imperative to work together in order to prevent and control these diseases. Attention should be given to improve cattle management system. Treatment of animals with anthelmintics and grazing management of animals during dry season to avoid access of the animals to the parasitic eggs are important. In addition, strict and detailed meat inspection at the abattoir is recommended. Proper disposal of condemned organs must be practiced in order to break the life cycle of some of the parasitic zoonoses which are important from public health point of view.

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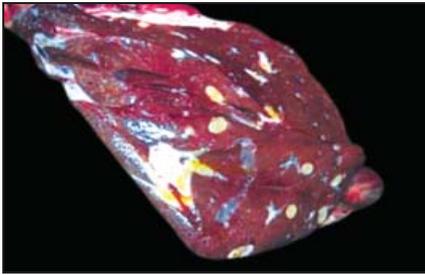


Fig 1. Distomatosis in liver in a cattle

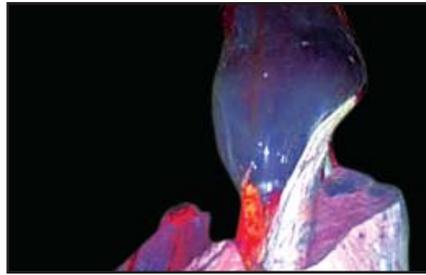


Fig 2. Calcification of liver in a cattle

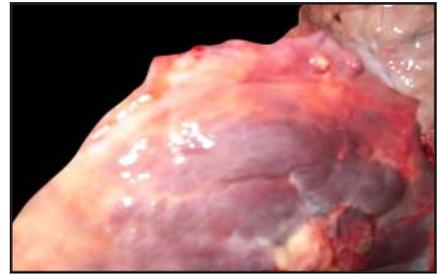


Fig 3. Cirrhosis of liver in a cattle

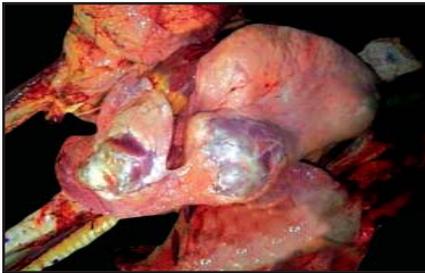


Fig 4. Hydatidosis on lung in a cattle

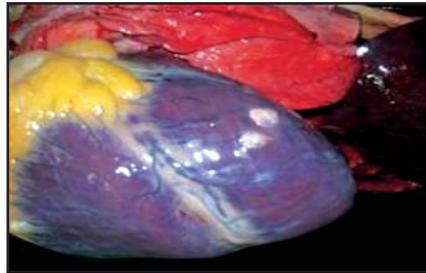


Fig 5. Hydatidosis on heart in a cattle



Fig 6. Adhesions of heart in a cattle

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