

Major Causes of Organ Condemnation and Assessment of Its Financial Loss in Cattle Slaughtered at Bahir Dar Municipal Abattoir, Northwestern Ehtiopia

Kindenew Yalew Asmelash Tassew Kibeb Legesse*

Addis Ababa University, College of Veterinary Medicine and Agriculture, Department of Biomedical Sciences
P.O.Box: 34; Debre Zeit, Ethiopia

Abstract

A cross sectional study was conducted from November 2016 to May 2017 to identify the major causes of organ condemnation in cattle slaughtered at Bahir Dar municipal abattoir and to estimate the direct financial loss due to organ condemnation. Using systematic random sampling 768 cattle was selected. Out of the total 768 cattle examined by ante mortem inspection only 95(12.4%) encountered abnormalities. The major abnormal conditions encountered during ante mortem examination are nasal discharge 63(8.2%), ectoparasites 12(1.6%), emaciation 12(1.6%), lameness 6(0.8%) and local swelling 2(0.3%). Major diseases and/or pathological conditions that caused a total condemnation were fasciolosis (16.8%), calcification (11.5%), discoloration (7%), jaundice (3%), cirrhosis (1.7%) for liver ; abscessation (4.8%), congestion (9.5%), emphysema (4.8%), Hydatid cyst (2.6%), pneumonia (2.2%), for lung; atrophy (3.8%), nephritis (4.8%), renal calculi (2.1%), abscessation (0.8%), for kidney; pericarditis (2.3%), cysticercus bovis (2%), hydatid cyst (1.8%), for heart. During the study period 23,633.00 Ethiopian birr was estimated as a direct financial loss in the abattoir due to condemnation of edible organs. The current result suggests that a thorough investigation that leads to disease control strategy is required to reduce the financial loss and public health consequences.

Keywords: antemortem inspection, Bahir Dar, cattle, municipal abattoir, organ condemnation, postmortem examination.

1. INTRODUCTION

Ethiopia has a large livestock population in Africa, which is estimated to be around 34-40 million TLU out of which 17% and 12% of cattle and small ruminants, respectively, are found in Ethiopia (FAO, 2007). Hence, an increase in cattle production could contribute to the attainment of food self-sufficiency in the country particularly in response to protein requirement for the growing human population as well as to enhance the export earnings (FAO, 2007). Livestock and livestock products also constitute one of the major export resources of the country and play a vital role in the country's economy (ESTS, 1997).

Even though, the livestock sub sector contributes much to the national economy, its development is hampered by different constraints. These include rampant animal diseases, poor nutrition, poor husbandry, poor infrastructure, and shortage of trained man power and lack of government policies. In addition there are other constraints that hindered the potential of livestock production include; traditional management system, limited genetic potential, lack of appropriate disease control policy and veterinary services (PACE-Ethiopia, 2003).

Meat inspection is conducted in the abattoir for the purpose of screening animal products with abnormal pathological lesions that are unattractive and unsafe for human consumption (Nurit *et al.*, 2012). Abattoir meat inspection is essential to remove gross abnormalities from meat and its products, to prevent distribution of contaminated meat and to assist detecting and eradication of certain livestock diseases (Alemayehu *et al.*, 2013). Abattoir data is an excellent option for detecting diseases of both economic and public health importance (Abunna *et al.*, 2010). Abattoirs are also played an important role in examined for unusual signs, lesions or specific diseases surveillance of various diseases of human and animal health importance. Monitoring and other conditions at slaughter has been recognized as one way of assessing the disease status of herd, however this source of information is not fully exploited worldwide (Mellau *et al.*, 2010).

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 (Gracey *et al.*, 1999). Some zoonotic diseases detected during meat inspection include tuberculosis, cysticercosis, hydatidosis, leptospirosis, brucellosis and toxoplasmosis (Biffa *et al.*, 2010, Swai and Schoonman, 2012). The results of meat inspection at slaughterhouses with appropriate trends indicate possible risks due to unsafe meat obtained from cattle carcasses at the slaughterhouses. Such risks are eliminated by strict veterinary inspection of animals prior to slaughter as well as of meat and parenchymatous organs after slaughter. Slaughterhouses provide an excellent opportunity for detecting pathological lesions of both economic and public health importance (Ahmed *et al.*, 2013).

Some diseases affecting livestock lead to reduced productivity of animals and cause economic loss due to condemnation of carcasses and edible organs (Swai and Ulicky 2009, Fekadu *et al.*, 2012, Mandefro *et al.*, 2015). Due to these and related factors, each year significant economic losses result from condemnation of edible organs

and carcass were estimated from different abattoirs of the country (Genet *et al.*, 2012, Amene *et al.*, 2012.) . This production loss in the livestock industry is estimated at more than 900 million USD annually (Jobre *et al.*, 1996).

It is necessary to have clear information on major causes of organs and carcass condemnation at the abattoir. This is important in providing information on where and how to reduce the losses that may be caused by the various abnormalities (lesions/pathology). Various studies (Regessa *et al.*, 2013) were carried out in the country in this regard to know the causes and economic losses associated. However there is little information regarding to cause and associated economic loss in Bahir Dar municipal abattoir.

Therefore, this study was designed:

- To identify the major causes of organs and carcasses condemnation at Bahir Dar municipal abattoir and
- To assess the magnitude of direct financial losses.

2. MATERIALS AND METHODS

2.1. Study Area

The study was conducted from November 2016 to May 2017 at Bahir Dar municipal abattoir, which is located in Bahir Dar town, in Amhara Regional State which is located 565 kilometers from Addis Ababa, to the North western direction. It is located at an altitude of 1730 m.a.s.l, 11° 29'N latitude and 37° 29' E longitude. The mean annual rain fall is 1150 mm and the annual minimum and maximum temperature is 18°C and 34°C, respectively (TANA FORUM, 2015).

2.2. Study Design

A cross-sectional study was conducted in cattle slaughtered at Bahir Dar municipal abattoir.

2.3. Study Population

The study population constitutes of local breeds of cattle originating from different localities and districts around Bahir Dar (Debretabor, Simada, Estie, Adet, Gayent, Fogera and Dera) with an age group of young (under four years of age) and adult (from five to seven years of age) based on eruption of incisor teeth (Pace *et al.*, 2003).

2.4. Sampling and Sample Size Determination

Systematic random sampling technique was used to select the animals to be included in the sample. The required sample size was calculated based on the expected prevalence of 50%, absolute desired precision of 5% and at confidence level of 95% according to the formula provided by (Thrusfield, 2005). However, to increase the precision, the sample size was doubled consequently. The total sample size taken for the study was 768 cattle.

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

Where N = Number of sample size, P_{exp} = expected prevalence, d²

= Absolute precision, CI = Confidence interval (95%)

Therefore the sample size will be;

$$N = \frac{(1.96)^2 \times 0.5(1-0.5)}{0.05^2} = 384 \times 2 = 768$$

2.5. Active Abattoir Survey

2.5.1. Ante mortem examination

During ante mortem examinations, identity tag numbers were given to the selected animals and relevant information including origin, physical condition and health status were recorded. All animals that had been examined during ante-mortem inspection were all subjected to post-mortem examination. The judgments have also been passed based on the procedure given by (FAO, 2007).

2.5.2. Post mortem examination

Post mortem examination was conducted through visualization inspection, palpation and systematic incision of each visceral organ particularly the liver, lung, heart and kidney for the presence of cysts, various adult parasites and other abnormalities (Getachew *et al.*, 2010).

2.6. Assessment of Direct Financial Loss

Total number of cattle slaughtered, average current local market price and number of each condemned organ were used to estimate the economic loss represented by the cause related condemnations over the study period. Average current local market price of each organ was obtained from the butcherries in Bahir Dar town. Consequently the total economic loss will be calculated by the following formula set by (Ogunrinade and Ogunrinade, 1980).

$$DAL = \Sigma AC \times AP \times CR$$

Where DAL = Direct annual economic loss due to carcass condemnation

AC = Animal slaughter rate at the abattoir

AP = Average price of condemned carcass/organ at the market
 CR = Carcass condemnation rate at the abattoir

2.7. Data Analysis

Data collected during the study were entered into Excel spread sheet (Microsoft Excel 2007) and analyzed by statistical methods using SPSS version 20. Descriptive statistics were used to determine organ and carcass condemnation rates, defined as proportion of condemned organs to the total number of organs examined.

3. RESULTS

3.1. Abattoir Survey

3.1.1. Ante mortem inspection

During ante mortem inspection, out of the 768 examined cattle only 95 (12.4%) encountered abnormalities.

Table 1: Summary of abnormalities/conditions encountered during antemortem inspection.

Abnormality encountered	Young (n = 202) No. (%)	Adult (n = 566) No. (%)	Total (n = 768) No. (%)
Local swelling	0(0)	2(0.4)	2(0.3)
Nasal discharge	27(13.4)	36(6.4)	63(8.2)
Lameness	1(0.5)	5(0.9)	6(0.8)
Ectoparasites	3(1.5)	9(1.6)	12(1.6)
Emaciation	0(0)	12(2.1)	12(1.6)
Total	3 (15.3)	64(11.3)	95(12.4)

3.1.2. Postmortem examination

All animals that had been examined by ante mortem inspection were also subjected to postmortem examination. Out of the 768 cattle, 307 livers (40% of the total), 184 lungs (24% of the total), 88 kidneys (11.5% of the total), and 47 hearts (6.1% of the total) were condemned from gross abnormalities and found to be unfit for domestic markets and human consumption.

Table 2: Total number of animals slaughtered and rejection rate of specific organs

Age	Number of examined animals	Frequency of lesions and percentage of rejected organs; no. (%)			
		Liver	Lung	Kidney	Heart
Young	202	59(29.2)	56(27.7)	32(15.8)	13(6.5)
Adult	566	248(43.8)	128(22.6)	56(9.9)	34(6)
Total	768	307(40)	184(24)	88(11.5)	47(6.1)

Table 3: Summary of cause of liver condemnation and its rejection rates

Abnormality	Young(n = 202) No. (%)	Adult (n = 566) No. (%)	Total (n =768) No. (%)	Financial loss (ETB)
Calcification	17(8.4)	71(12.5)	88(11.5)	4, 840.00
Cirrhosis	0(0)	13(2.3)	13(1.7)	715.00
Discoloration	12(5.9)	42(7.4)	54(7)	2, 970.00
Fasciolosis	27(13.4)	102(18.0)	129(16.8)	7, 095.00
Jaundice	3(1.5)	20(3.5)	23(3)	1,265.00
Total	59(29.2)	248(43.8)	307(40)	16, 885.00

The major cause of liver rejection were found to be fasciolosis 16.8% followed by calcification 11.5% and discoloration which contributes about 7% from 307 condemned liver.

Table 4: Summary of cause of lung condemnation and its rejection rates

Abnormality	Young (n = 202) No. (%)	Adult (n = 566) No. (%)	Total (n = 768) No. (%)	Loss money (ETB)
Abscessation	13(6.4)	24(4.2)	37(4.8)	814.00
Congestion	21(10.4)	52(9.2)	73(9.5)	1, 60.000
Emphysema	13(6.4)	24(4.2)	37(4.8)	814.00
Hydatid cyst	6(3)	14(2.5)	20(2.6)	440.00
Pneumonia	3(1.5)	14(2.5)	17(2.2)	374.00
Total	56(27.7)	128(22.6)	184(24)	4, 048.00

Congestion, abscessation and emphysema were the major causes of lung rejection with a rate of 9.5%, 4.8% and 4.8% respectively.

Table 5: Summary of cause of kidney condemnation and its rejection rates

Abnormality	Young (n = 202) No. (%)	Adult (n = 566) No. (%)	Total (n =768) No. (%)	Financial loss (ETB)
Atrophy	14(6.9)	15(2.7)	29(3.8)	580.00
Nephritis	8(4)	29(5.1)	37(4.8)	740.00
Abscessation	4(2)	2(0.4)	6(0.8)	120.00
Renal calculi	6(3)	10(1.8)	16(2.1)	320.00
Total	32(15.8)	56(9.9)	88(11.5)	1,760.00

Renal problems were observed from the total examined kidneys. Out of 88 condemned kidneys nephritis was the major cause 4.8% followed by atrophy which contributes about 3.8% of the total.

Table 6: Summary of cause of heart condemnation and its rejection rates

Abnormality	Young (n = 202) No. (%)	Adult (n = 566) No. (%)	Total (n =768) No. (%)	Financial loss (ETB)
Pericarditis	6(3)	12(1.2)	18(2.3)	360.00
Hydatid cyst	5(2.5)	9(1.6)	14(1.8)	280.00
Cysticercus bovis	2(1)	13(2.3)	15(2)	300.00
Total	13(6.5)	34(6)	47(6.1)	940.00

The major causes of heart condemnation were found to be pericarditis, cysticercus bovis and hydatid cyst. Out of the total of 47 hearts condemned due to gross abnormalities; pericarditis contributes about 2.3% followed by cysticercus bovis accounting for 2%.

3.2. Assessment of Direct Financial Loss

A total of 307 livers, 184 lungs, 88 kidneys and 47 hearts were subjected for total condemnation. During the study period, the average market price of a 1 kg of cattle liver, lung, heart and kidney in Bahir Dar town was 55 ETB, 22 ETB, 20 ETB and 20 ETB respectively. The total direct financial loss incurred due to organs condemnation during active abattoir survey was estimated to be 23,633.00 Ethiopian birr.

Table 7: Findings of the study used in the direct financial loss assessment

Organ	Number of condemned organ	Total financial loss (ETB)
Liver	307	16, 885.00
Lung	184	4, 048.00
Kidney	88	1, 760.00
Heart	47	940.00
Total loss	626	23, 633.00

The most financial loss occurred due to condemnation of liver followed by lung which contributes 16,885.00 ETB and 4,048.00 ETB respectively.

4. DISCUSSION

During the ante mortem examinations, it was found that lameness and respiratory disorders were relatively the highest abnormalities encountered during the ante mortem inspection. According to the information obtained from the suppliers, most causes of lameness were trauma caused by inappropriate vehicles and loading and off-loading negligence during transportation to market places and to the abattoir a similar reason with Regessa *et al.* (2013). The respiratory signs such as presence of nasal discharge, coughing, sneezing were most probably related to stress due to lack of feed and water, immune suppression and overcrowding during transportation which was in line with (Getachew, 2008).

The most commonly encountered abnormalities during ante-mortem inspection, in the present study, were lameness, localized swelling, emaciation, nasal discharge and ectoparasites, 0.8%, 0.3%, 1.6%, 8.2% and 1.6% respectively.

This study showed that fasciolosis, calcification, congestion, discoloration, abscessation, emphysema, nephritis and atrophy were the major causes of organs condemnation in cattle slaughtered at Bahir Dar municipal abattoir. Out of the total 768 slaughtered cattle 40% liver, 24% lung, 11.5% kidney and 6.1% heart were rejected due of various types of lesions. The rejection rates of liver in this study were lower than Nurit *et al.* (2012) from Kombolcha and Amene *et al.* (2012) from Jimma municipal abattoirs who reported 66.55% and 64.4%, respectively. But it was higher as compared with studies conducted by Alembrihan and Haylegebriel (2013) which was 17.58% from Adigrat municipal abattoir, northern Ethiopia and Hassan *et al.* (2012) of 7.9% from Iran. The rejection rate of lung in this study was almost similar to the rate reported by Asmare *et al.* (2012) of 25.8% at Bahir Dar municipal abattoir. But it is higher than the rate reported by Atawalna *et al.* (2016) of 1.42% at the Bolgatanga municipal abattoir of Ghana. These differences may be due to the different geographical location and

prevailing climatic condition that may favor different disease conditions and lower than the reports by Amene *et al.* (2012) of 46.2% at Jimma municipal abattoir.

The main causes of organ condemnation during postmortem inspection were fasciolosis in the liver and hydatid cyst in the lung with the rate of 18.36% and 14.45% respectively *yalew et al.* (2015). In this study 40% of livers were condemned because of various abnormalities found during postmortem examination. Among the major causes of liver rejection, 16.8% prevalence of fasciolosis observed. These findings are almost similar to the report by Genet *et al.* (2012) of 16.64% from Gondar. The result of the present study is lower when compared with the prevalence of 20.8% and 29.6 % reported by *yalew et al.* (2015) from Dessie municipal abattoir and Mulat *et al.* (2012) respectively. The difference in the rejection rate of liver due to fasciolosis among this study and the above reports can be mainly attributed to the variation in the climatic and ecological conditions such as altitude, rainfall and temperature as well as the livestock management system among the study areas Manyazewal *et al.* (2014). The analysis of the result on the bases of age indicated the total liver rejection rate was higher in older animals and a significant difference was observed between the two age groups. This may be due to most of liver diseases are chronic and the older animals are mostly affected by many diseases Mesele *et al.* (2013).

In this study; congestion, abscessation and emphysema were the major causes of lung rejection with a rate of 9.5%, 4.8% and 4.8% respectively. Lung condemnation due to congestion according to the present finding was 9.5% which is relatively lower than the rate reported by Fufa and Debele (2013) they reported 10.65% from wolaita soddo municipality abattoir, southern Ethiopia. This much congestion was mostly attributed to improper stunning and bleeding methods Mukaratirwa *et al.* (2009). The rejection rate of lung due to emphysema was 4.8% which is higher than the rate reported by Alembrhan and Haylegebriel (2013) 1.61% from Adigrat municipal abattoir but lower than the rate reported by Amene *et al.* (2012) 6.77% from Jimma and Genet *et al.* (2012) 10.5% from Gondar abattoirs. In my study the condemnation rate of lung due to abscessation was 4.8% which is higher than the rate reported by Atawalna *et al.* (2016) 1.31% from the Bolgatanga municipal abattoir of Ghana. This difference may be due to the different geographical location and climatic condition of the country. In the present study, condemned lung by pneumonia was 2.2% comparable with Genet *et al.* (2012) who reported 2.45% from Gondar and lower than 8.8% reported by Raji *et al.* (2010) in cattle slaughtered at Zaria.

Emphysema and pneumonia could be due to exposure of cattle to bacterial or viral origin infections, stressor factors including exposure to dust and starvation. Moreover, penetration of lung by foreign body, adverse weather condition or accidental inhalation of liquid may cause pneumonia (Cadamus and Adesokan, 2010).

The most common abnormalities that cause kidney rejection were nephritis, atrophy and renal calculi which constitute 3.8%, 4.8% and 2.1% respectively from the total 88 condemned kidneys. The causes of kidneys condemnations in this study were similar to the rate reported by Meron *et al.* (2016). The rate of kidney rejection due to nephritis was almost similar to the rate reported by Meron *et al.* (2016) who reported 4.9% prevalence in the same abattoir.

Pericarditis, cysticercus bovis and hydatid cyst were the most common causes of heart condemnation which accounts 2.3%, 2% and 1.8% respectively. Those cause are in agreement with previous studies by Yifat *et al.* (2011) and Amene *et al.* (2012) from Gondar and Jimma abattoirs, respectively. The main cause of heart rejection in this study was pericarditis with a rate of 2.3% which is lower than the rate reported by Meron *et al.* (2016) who reported 4.9% prevalence from Bahir Dar but higher than 1.04% reported by Mellau *et al.* (2010) from Tanzania. This difference may be due to variation in animal management systems at different study time and study sites.

The total direct financial loss incurred due to condemnation of organs in active abattoir survey was estimated to be 23,633.00 Ethiopian birr. Similarly at Wolaita Soddo Municipal abattoir 24,340 ETB (24323.49 USD) was reported by Fufa and Debele (2013). However, 39,490.0 and 172, 664.09 Ethiopian birr were reported from Gondar by Genet *et al.* (2012) and Jimma municipal abattoirs by Amene *et al.* (2012), respectively. Higher financial loss in this study was encountered mainly due to fasciolosis (7, 095.00 Ethiopian birr) and calcification (4, 840.00 Ethiopian birr). Variations in the amount of financial loss 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 (Alembrhan and Haylegebriel, 2013).

5. CONCLUSION AND RECOMMENDATIONS

The present study revealed that fasciolosis, calcification, congestion, emphysema, abscessation, cysticercus bovis, pericarditis, pneumonia, cirrhosis, discoloration, jaundice, hydatid cyst, nephritis, atrophy and renal calculi were the major causes of organs condemnation in cattle at Bahir Dar municipal abattoir. This causes much considerable financial loss in cattle production. The organ condemnation rate determined by this study also incurred in substantial financial loss which is about 23,633.00 Ethiopian birr (ETB) during the study period. There was higher overall organ condemnation rate in adults than in young animals. Hence, this study is valuable for the country by providing information on disease conditions most frequently occurring in the study area and organs condemned by those lesions/disease conditions which have public health hazard and aesthetic value.

Therefore, based on the above conclusive remarks the following recommendations are forwarded:

- ❖ Different workshops should be prepared to enhance the awareness of the animal attendants, farmers, customers, abattoir workers and butchers pertaining the public health significance of the diseases, and proper disposal of condemned offal's and carcasses.
- ❖ The government should propose strategic disease control programs to alleviate financial losses, to improve meat quality and quantity and to avoid risk of contracting zoonotic diseases.
- ❖ Particular attention should be paid in the control and prevention of parasitic diseases, in the study area, around Bahir Dar.
- ❖ Further studies should be conducted especially to assess the indirect financial losses.

6. REFERENCES

- Abunna, F. and. Hordofa, D. (2013): Major Causes of Organ Condemnation for Cattle and its Financial Impact at Wolaita Soddo Municipality Abattoir, Southern Ethiopia. *Global Veterinaria* **11**: 730-734.
- Abunna, F. Asfaw, L, Megersa, B. Regassa, A. (2010): Bovine fasciolosis: Carpalogical, abattoir survey and its economic impact due to liver condemnation at Soddo Municipal Abattoir, Southern Ethiopia. *Trop. Anim. Health. Prod.* **42**:289-292.
- Ahmed, A. M, Ismail S.A.S, and Dessouki, A, A. (2013): Pathological lesions survey and economic loss for male cattle slaughtered at Ismailia abattoir. *Int. Food Res. J.* **20(2)**: 857-863.
- Alembrhan, A. and Haylegebriel, T. (2013): Major causes of organ condemnation and economic loss in cattle slaughtered at Adigrat municipal abattoir, northern Ethiopia, *Veterinary World* **6(10)**: 734-738.
- Alton, G. D, Lpeah D, Bateman K.J, and McNab, W.B, Berk O. (2010): Factors associated with whole condemnation rates in provincially inspected abattoir in Ontario 2001-2007: Implication for food animal syndromic surveillance. *BMC Vet. Res.* **6**:42.
- Amene, F. Eskindir, L. and Dawit, T. (2012): Cause, Rate and Economic Implication of Organ Condemnation of Cattle Slaughtered at Jimma Municipal Abattoir, Southwestern Ethiopia. *Global Veterinaria*, **9 (4)**: 396-400.
- Asmare, A., Biniyam, A. and Mersha, C. (2012): Major Causes of Lung and Liver Condemnation and Financial Impact in Cattle Slaughter at Bahir Dar Municipal Abattoir. *African J. Basic & Appl. Sci.*, **4 (5)**:165-171.
- Atawalna, J. M Gbordzi, B.O. Emikpe and Anyorigeyah T. (2016): Whole carcass and organ condemnation and their associated financial losses in Ruminants Slaughtered at the Bolgatanga Municipal Abattoir of Ghana. *Inter J Vet S.ci*, **5(1)**: 5-9.
- Biffa, D. Bogale, A and, Skjerve, E. (2010): Diagnostic efficiency of abattoir meat inspection service in Ethiopia to detect carcasses infected with *Mycobacterium bovis*: Implications for public health. *BMC Public Health* **10**:462 <http://www.biomedcentral.com/1471-2458/10/462>.
- Cadamus, S.I.B. A. Adesokan. (2010): Causes and implication of bovine organ /offal condemnation in some Abattoirs in Western Nigeria. *Tropical Animal Health and Production*, DOI, 10.1007/s 11250-009- 9334-7.
- Chhabra, M.B, and Singla, L.D. (2009): Food-borne parasitic zoonoses in India: Review of recent reports of human infections. *J. Vet.* **23 (2)**:103-110.
- ESTS, (1997): Integrating the sterile insect technique to eradicate tsetse from the southern rift valley of Ethiopia. Debre Zeit, Faculty of veterinary medicine, Addis Ababa University, DVM Thesis.
- FAO, (Food and Agriculture Organization). (2007): Manual on meat inspection for developing Countries. Animal and health production papers Food and Agriculture organization of the United Nations: Edited by: Dr. Bedru Hussen, Mekele University, February 2007, Mekele, Ethiopia.
- FAO, (Food and Agriculture Organization). (1995) : Manual of meat inspection for developing countries.
- Fekadu, A. E, Legesse and D, Tesfaye. (2012): The Cause, Rate and Economic Implication of Organ Condemnation of Cattle Slaughtered at Jimma Municipal Abattoir, Southwestern Ethiopia. *Global Veterinaria* **9**: 396-400.
- Genet, M. Tadesse, G. Basaznew, B. and Mersha, C. (2012): Pathological Conditions Causing Organ and Carcass Condemnation and Their Financial Losses in Cattle Slaughtered in Gondar, Northwest Ethiopia. *African J. Basic & Appl. Sci.*, **4 (6)**: 200-208.
- Getachew, A. Beyene, D., Ayana, D., Megersa, B. and Abunna, F. (2010): Hydatidosis: prevalence and its economic importance in ruminant slaughtered at Adama municipal abattoir Central Oromia, Ethiopia. *Acta Trop.*, **113**:221-225.
- Gracey, J.F. Collins, D.S. and Huey, R.J. (1999): Meat hygiene. 10th Edition, London. W. B. Saunders Company Ltd. pp: 758.
- Hassan, B., Mohammad, A. and Mehrab, K. (2012): a retrospective study of abattoir condemnation due to parasitic infections: economic importance in Ahwaz, southwestern Iran. *J. Parasitol.*, **98(5)**: 954-957.
- Jacob, L. (1979): Seminar for animal health officials. Ministry of agriculture and settlement, Animals and Fisheries authority. Addis Ababa, Ethiopia.
- Jobre, Y. Lobago, F. Tiruneh, R. Abebe, G. and Dorchies, Ph. (1996): Hydatidosis in three selected regions in Ethiopia: An assessment trial on its prevalence, economic and public health importance. *Rev. Med.*

- Vet.* **11**:797-804.
- Mandefro, A. Aragaw, K. Hailu, B. Alemayehu, G and. Chala, G. (2015): Major Cause of Organ and Carcass Condemnation and Its Financial Loss at Bishoftu Elfora Export Abattoir. **4**: 364-372.
- Manyazewal, A. Zeleke M.G, Tsegaye T. (2014): Economic Significance of Fasciolosis at Mettu Municipal Abattoir, Southwest Ethiopia. *J. Adv. Vet. Res.* **4**(2):53-59.
- Mellau LS, Longa HE, Karimuribu ED. (2010): A Slaughter house survey of liver lesion in slaughter cattle, sheep and goats at Arusha, Tanzania. *Vet. J.* **3**:179-188.
- Mellau, L. Nonga, H and. Karimurbo E. (2010): a slaughterhouse Survey of Liver lesion in slaughtered cattle, Sheep and Goats at Arusha, Tanzania. *Resear, J. Veteri. Sci.*, **3**: 179-188.
- Meron, A. Betelihem T. Solomon T. (2016): Major Causes of Organ and Carcass Condemnation in Cattle and Sheep Slaughtered at Bahir-Dar Municipal Abattoir, Amhara Regional State, Ethiopia. *Advances in Biological Research* **10** (5): 323-334.
- Mesele, A. Solomon T, Dessie S. (2013): Cystic Echinococcosis of Cattle in Jimma Municipal Abattoir, South West Ethiopia. *Glob.Vet.* **11** (6):771-775
- Mukaratirwa, S. B, M. Dzoma, C. Matongo and M. Nyahuma. (2009): some causes of organ and carcass condemnation in ostriches slaughtered at only ostrich abattoir in Zimbabwe. *International Journal of Poultry Science*, **8**: 1096-1099.
- Mulat, Basaznew, B. Mersha, C. Acheneff, M., Tewodros, F. (2012): Comparison of coprological and postmortem examination techniques for the determination of prevalence and economic significance of bovine fasciolosis. *J. Adv. Vet. Res.* **2**:18-23.
- Nurit, M, Zerihun H, Serkalem M (2012): Major Cause of Liver Condemnation and Associated Financial Loss at Kombolcha Elfora Abattoir, South Wollo, Ethiopia, *European J. Appl. Sci.* **4**(4): 140 - 145.
- Ogunrinade, A. and Ogunrinade, B.I. (1980): Economic importance of bovine fasciolosis in Nigeria. *Trop. Anim. Hlth. Prod.* **12**:155-160.
- PACE, Ethiopia. (2003): Experiences and the way forward on community based animal health service delivery in Ethiopia. Proceedings of a workshop held in Addis Ababa Ethiopia. **p.6**.
- Pace, Wakeman, D, L. and J. E. (2003): Determining the age of cattle by their teeth. CIR253. Florida Coop-erative Extension Service, Institute of Food and Agricultural Sciences. University of Florida, Gaines- ville, FL.
- Regassa, A. Moje, N. Megersa, B., Beyene, D. Sheferaw, D. Debele, D. Abunna, and F. Skjerve, E. (2013): Major causes of organs and carcass condemnation in small ruminants slaughtered at Luna Export Abattoir, Oromia Regional State, Ethiopia. *Preventive Veterinary Medicine* **110**: 139– 148.
- Swai, E. S. and Ulicky, E. (2009): An evaluation of the economic losses resulting from condemnation of cattle livers and loss of carcass weight due to Fasciolosis: a case study from Hai town abattoir, Kilimanjaro region, Tanzania. *Livestock Research for Rural Development* Volume 21, Article # 186. Retrieved September, 4, 2015, from <http://www.lrrd.org/lrrd21/11/swai21186.htm>
- Swai, ES and L, Schoonman. (2012): A survey of zoonotic diseases in trade cattle slaughtered at Tanga city abattoir: a cause of public health concern. *Asian Pac J Trop Biomed*, **2**: 55-60.
- Yalew, T. Zewdu M. and Wedajo M. (2016) : Major causes and abnormalities of organ condemnation and financial loss in cattle slaughtered at Dessie municipal abattoir North Eastern Ethiopia. *Journal of Veterinary Medicine and Animal Health.* **8**(7): 56-63
- Yifat, D. Gedefaw, D. and Dessie, S. (2011): Major Causes of Organ Condemnation and Financial Significance of Cattle Slaughtered at Gondar Elfora Abattoir, Northern Ethiopia. *Global Veterinaria*, **7** (5): 487-490.