

Study on the Prevalence, Major Causes of Organ Condemnation and Associated Economic Loss at Selamber Municipal Abattoir, Gamo Gofa Zone, SNNPR

Sitota Tesfaye and Abraham Zekewos

Jimma University College of Agriculture and Veterinary Medicine, Jimma Zone, Ethiopia

Abstract: A cross-sectional study was conducted from November 2016 to April 2017 to identify the major reasons of organ condemnation, to determine their prevalence and to estimate the direct economic loss due to organ condemnation in cattle slaughtered at Selamber Municipal abattoirs. Animals were selected using simple random sampling method. Ante-mortem 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 organs examined, 183 (47.62%) livers, 129 (33.57%) lungs, 28 (7.28%) hearts, 24 (6.24%) kidneys, 34 (8.85%) spleen and 14 (3.646%) different muscle were condemned as unfit for human consumption. Major pathological conditions that caused a total condemnation of organs were fasciolosis (21.16%), cirrhosis (10.15%), calcification (2.08%), emphysema (10.67%), congestion (5.2%), pericarditis (2.6%), nephritis (2.86%), atrophy (1.3%) and renal calculi 1.56%, splenomegaly (6.51%) and cystercosis (2.08%). Organ condemnation rates did not show significant difference ($P > 0.05$) among age group and status of body condition but significantly associated to the origin of animals. The financial loss due to edible organ and carcass condemnation was estimated to be 9284.75 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.

Key words: Abattoir • Cattle • Condemnation • Inspection • Economic loss • Selamber

INTRODUCTION

Ethiopia has the largest number of livestock population in Africa with an estimated 44,318,877 cattle, 24 million sheep and 18 million goats [1]. The livestock sub sector accounts for 40% of the agricultural gross domestic product (GDP) and 20% of the total GDP in Ethiopia. Livestock and livestock products are the major foreign exchange earns. Despite the number of population and expected income generation, their potential use is hampered by animal diseases, poor nutrition, poor husbandry, poor infrastructure and shortage of trained man power and other constraints [2]. Due to these factors, significant economic losses result from condemnation of edible organs and carcasses were estimated from different abattoirs of the country [3, 4].

Surveillance at the abattoir allows for all animals passing into human food chain to be examined for unusual signs, lesions or specific disease. Abattoir data is an excellent option for detecting diseases of both economic and public health importance [5, 6]. 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 [7, 8]. Each year a significant loss results from death of animals, inferior weight gain and condemnation of edible organs and carcass at slaughter. This production loss to the livestock industry is estimated to be more than 900 million USD annually [7].

Beef as one of the main components of human diet in Ethiopia and abattoirs play an important role in screening animal products with abnormalities and diseases that are not fit for human consumption [9]. Knowledge of specific causes of organs and carcass condemnation is very important to design and apply effective control measures, improve animal husbandry and avoid some losses related to preventable diseases [10]. Major parasitic diseases such as fasciolosis, hydatid cyst, cysticercus bovis and other causes like abscessation, bruise, emphysema, pericarditis, edema and cirrhosis cause significant economic loss by lowering the productivity and condemnation of edible organs [9, 11, 12]. 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 [13].

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 [14]. Cysts or lesions of Echinococcus 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 [15]. Fasciolosis is an important parasitic disease of domestic ruminants caused by two liver fluke

species, fasciola gigantica and hepatica. 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 [16].

Hence, it would be essential to have information on occurrence of various diseases/causes and their economic loss from different parts of the country to establish appropriate strategy for prevention and controls. Currently, there is lack of information on occurrence of various diseases/causes and their economical loss due to organ condemnation in Selamber city. Therefore, the objectives of this study were to identify the major causes of organ condemnation, to assess the prevalence and to estimate direct economic loss due to organ condemnation at Selamber municipal abattoir.

MATERIALS AND METHODS

Study Area: The study was conducted from November 2016 to April 2017 in Selamber municipal abattoir in the Kucha Woreda, Gamo Gofa Zone and SNNPR state (Figure 1). Kucha is one of the woredas in the southern nations and people's regional state of gammo gofa zone and is one of the fifteen woredas in the zone, located in the southwestern rift valley of Ethiopia. The major town in the woreda is Selamber and the woreda is bordered on

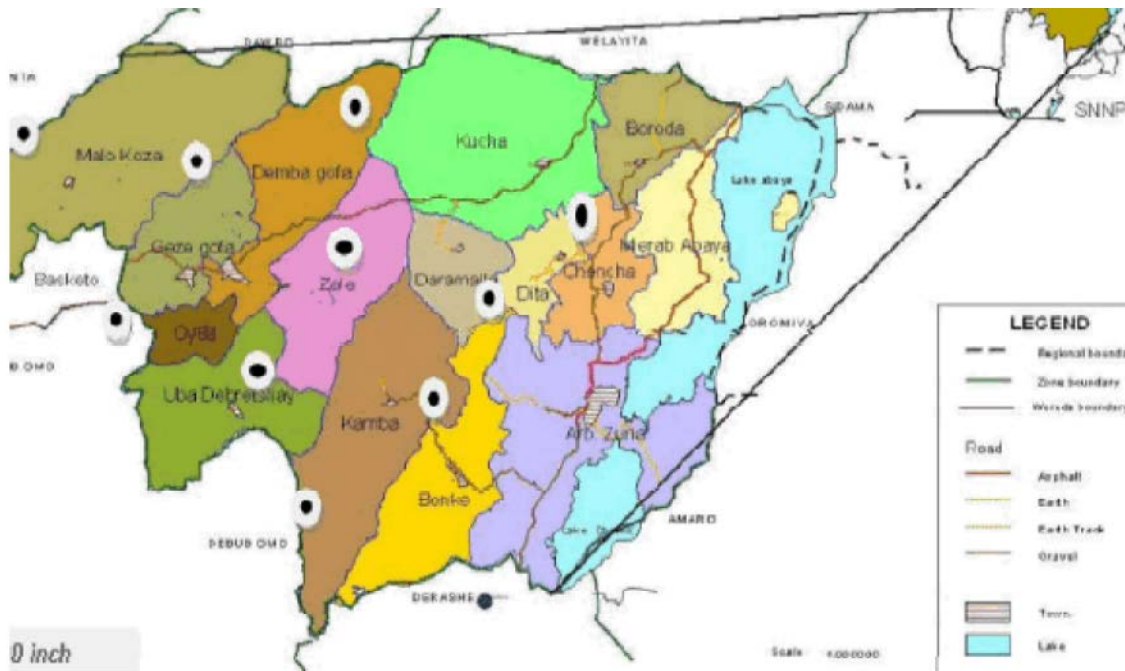


Fig. 1: Map of the study area
Source: [17]

the south by Dita and Daramalo, on the south west by Zala, on the west by Demba gofa, on the North West by Dawuro zone, on the north by the Wolaita zone, on the east by Boroda and on the south east by Chench. Kucha woreda is located at 6.5° latitude and 37 ° longitudes in the axis. Kucha woreda has a total population of 149,287, of whom 74207 are males and the remaining are females. The area has sub-humid climate with moderately hot temperature. The annual rain fall is estimated to range of between 900 up to 1800mm. Belg (Autumn) starts from January to April and have long rainy season, Maher (summer) occurs from June to September. The vegetation is dominantly covered by wooded grass land (WGL) especially along the side of grazing area draining lines and there is a high gallery forest along the rivers.

Study Population: The cattle destined for slaughter were all males originated from different parts of Kucha woreda and surrounding woredas and zones. They were transported to the abattoir with and without vehicles. 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 prevalence and causes of organ condemnation and its economic significance in cattle slaughtered at Selamber 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 Selamber Municipal abattoir using the formula given by Thrusfield [18]. 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 2016 to April 2017 to identify the prevalence, major causes of organ condemnation and to estimate the direct economic loss due to organ condemnation in cattle slaughtered at Selamber Municipal abattoir. A total of 384 cattle were

examined by ante-mortem and post-mortem examinations using standard examination procedures. The study animals were selected using simple random sampling method.

Ante-mortem Examination: Regular visits were made for four days per week to Selamber Municipal abattoirs during the period from November, 2016 to April, 2017. During every visit, each animal was identified based on enumerated code given to the butcher shops before slaughter. The average numbers of animal's slaughtered at Selamber Municipal abattoir were 20 cattle per day. In the ante-mortem inspection, pre-slaughter examinations of bovines were conducted at lairage. 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 [19]. Based on their dental eruption patterns, two conventional age groups 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 Butter [20]. Each scoring were given number from 1(L-, very lean) to 9 (F+, very fat) and these scores were finally included under three body condition scores (good, medium and poor).

Post-Mortem Examination: During post-mortem inspection Liver, lung, heart, kidney, spleen and muscle 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 [21].

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 Selamber 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 [22] as follows:

$$EL = \sum srx * Coy * Roz$$

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/ Spleen/ muscle

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

Data Management and Analysis: All raw data generated from this study were coded and entered in Micro Soft Excel spread sheet for data analysis. Analysis of data was performed using SPSS (2010). 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(χ^2). The results of this study were considered statistically significant ($P < 0.05$).

RESULT

As shown in the table below, from 384 cattle brought to slaughter house 163(42.4%), 51(13.3%), 246 (64.1%) were young in age, poor in body condition and originate from high land respectively.

Ante-mortem inspection was carried out on all 384 cattle for the detection of any abnormalities encountered in Selamber municipal abattoir slaughter houses. A total of 81 (21.09%) cattle were found to have abnormalities (Table 2). Respiratory sign, depression, lameness, tick infestation, emaciation, pale mucus membrane, rough hair coat, bruise and blindness were frequently observed in this species.

All animals that had been examined by ante-mortem inspection were also subjected to post-mortem examination. During post-mortem examination, out of the total 384 examined organs, 183 (47.62%) liver, 129 (33.57%) lungs, 24(6.24%) kidneys, 28(7.28%) hearts, 34(8.85%) spleen and 14(3.64) different muscle were condemned due to various causes (Table 3).

Condemnation proportion was higher in adult cattle 149(54.8%) and cattle from highland areas 153(71.5). There was no statistically significant difference (Table 4) in frequencies of organs condemned between the two age categories ($\chi^2=2.215$; $P=0.184$) and among the body condition categories ($\chi^2=6.326$; $P=0.128$). Condemnation proportion was higher in body condition with medium

Table 1: Descriptive statistics for age, body condition and origins of cattle (N=384)

Variables	No examined	Percent (%)
Age		
Young	163	42.4
Adult	221	57.6
BCS		
Poor	51	13.3
Medium	226	58.9
Good	107	27.8
Origin		
Highland	246	64.1
Lowland	138	35.9

Table 2: Abnormal conditions encountered during ante-mortem inspection.

Abnormal condition	No affected	Percent (%)
Respiratory sign	5	1.3
Depression	8	2.08
Lameness	9	2.34
Rough hair coat	11	2.86
Tick infestation	7	1.82
Emaciation	13	3.38
Bruise	12	3.12
Pale mucus membrane	10	2.6
Blindness	6	1.56

Table 3: Abnormal condition encountered during post-mortem examination (N=384).

Organ condemned	Causes of condemnation	No percent (%)	Condemnation rate (%)	
Liver	fasciolosis	83	45.35	21.16
	hydatidosis	15	8.19	3.90
	calcsification	8	4.37	2.08
	fasciolosis and haydatidosis	17	9.28	4.42
	cirrhosis	39	21.31	10.15
	abscess	12	6.55	3.12
	hepatitis	9	4.91	2.34
	total1	83	100	47.62
Lung	hydatidosis	31	24.03	8.07
	congestion	20	15.50	5.20
	emphysema	41	31.78	10.67
	pneumonia	37	28.68	9.63
	total1	29	100	33.57
Spleen	splenitis	9	26.47	2.34
	splenomegaly	25	73.53	2.60
	total3	4	100	4.94
Heart	pericarditis	10	35.71	2.60
	abscess	4	14.28	1.04
	hemorrhage	5	17.85	1.30
	edema	9	32.14	2.34
	total	28	100	7.28
Kidney	atropy	5	21.73	1.30
	caliculi	6	26.08	1.56
	hyderonephrosis	2	8.69	0.52
	nephritis	11	47.82	2.86
	total	24	100	6.24
Muscle	cystercosis	8	57.14	2.08
	bruise	6	42.86	1.56
	total1	4	100	3.64

Table 4: Distribution of causes of condemnation among risk factors (breed, age and body condition) in cattle slaughtered (N=384)

Variables	No examined	No affected	Percent (%)	χ^2	p- value
Age	young	163	124	45.2	0.184
	Adult	221	149	54.8	
Origin	highland	246	153	71.5	0.004
	Lowland	138	61	28.5	
BCS	poor	51	34	12.3	0.13
	Medium	226	178	64.2	
	Good	107	65	23.5	

Body condition score (BCS)

Table 5: The condemnation rates and average price of organs condemned (N=384)

Condemned	Organ rate of condemnation (%)	Average unit price (ETB)	Total loss (ETB)
Liver	47.62	35	6400.12
Lung	33.57	10	1289.08
Spleen	8.85	3	101.95
Heart	7.28	12	335.46
Kidney	6.24	25	599.04
Muscle	3.64	40	559.10
Total	107.2	65	9284.75

178(64.2%) and fattened cattle 65(23.5%). There was statistically significant association between the organ condemnation and origin of animal ($\chi^2=807$; $P=0.004$).

During the study One Ethiopian Birr is 22 USD.: As presented in Table (5), slaughter rate of the Selamber Municipal abattoir was estimated to be 384 cattle during the study period and the annual estimated economic loss was found to be 9284.75 ETB per annum.

DISCUSSION

Proper postmortem meat inspection is important to detect abnormalities [23]. This study investigates the causes of organ condemnations and their prevalence with their associated financial losses in 384 cattle slaughtered at the Selamber Municipal Abattoir. This study showed that fasciolosis, hydatid cyst, *Cysticercus bovis*, pneumonia, emphysema, hydronephrosis, cirrhosis, hepatitis, calcification, splenomegaly, nephritis and abscessation were the major causes of organs condemnation in Cattle slaughtered at Selamber municipal abattoir. This finding is similar with reports from different abattoirs in Ethiopia [3, 13, 24]. From the total examined organs, 183(47.62%) livers, 129(33.57%) lungs, 28(7.28%) hearts, 24(6.14%) kidneys, 24(8.85%) and 14(3.64%) muscle were major organs condemned due to different pathological conditions. This finding is similar with previous reports [25-27].

Major causes of liver condemnation were fascioliasis 83 (21.16%), hydatidosis 15 (3.9%) and cirrhosis 39 (10.15%). The condemnation rate of liver (47.62%) in this study was lower than the previous studies conducted by Nurit *et al.* [28] from Kombolcha and Genet *et al.* [4] from Gonder with prevalence of 66.55% and 61.1% respectively. It is clear that this study is higher than the report from Gondar [29], Hai [30], Tanzania [6], Wolaita, Sodo and Jimma municipal of Ethiopia [27], abattoirs with a prevalence of 26%, 14%, 14.04 % and 39.3 respectively. But it is in agreement with the study of Zelalem *et al.* [31] from Jimma and Fufa and Debele [26] from Sodo who reported prevalence of 46.58% and 48.5% respectively.

The rejection rate of lung in this study is higher than that was reported by Lati *et al.* [32] of 16.47% at Nekemte and Alembrhan and Haylegebriel [33] of 7.53% at Adigrat municipal abattoir. However, it is relatively comparable with the report of Asmare *et al.* [13] of 25.8% from Bahir Dar and Wale *et al.* [27] from Jimma. The condemnation rates of hearts 7.28% in the current study is higher than the rejection rate of 3.71% and 2.06% that was reported by Shegaw *et al.* [24] from Mekele municipal abattoir and Genet *et al.* [4] from Gonder. In the present study, condemnation of spleen resulted to considerable economical loss caused by pathological conditions like splenitis and splenomegaly. The rejection rate of this study 8.85% was in agreement with Shitaye *et al.* [34] 9.4% from Hawassa. The rejection rate of kidney 6.24% in the present study was higher compared with the report of Fufa and Debele [26] from sodo and Nebyou *et al.* [25] from Nekemte with prevalence of 3.5% and 1.6% respectively but was relatively in agreement with Wale *et al.* [27], from Jimma (6%). The rejection rate of muscle in the present study 3.64% is comparably higher than the reports of Rodriguez [35] and Huggies [36] with prevalence of 0.32 and 0.23% from Northern Ecuador and Swaziland respectively but lower than the report of Nebyou *et al.* [25], with prevalence of 6.7% from Nekemte. Variations in the condemnation rate of organs were probably due to differences in agro-ecological conditions that were favorable to the parasites, livestock management system, improper disposal of condemned organs and prevalence of diseases at the different study sites.

In the current study, Fascioliasis was the leading disease of liver which was recorded at the abattoir, 21.16% of the animals' liver abnormalities were found to be caused by fascioliasis that was closely in agreement with the report of Wale *et al.* [27], from Jimma (20.6%). This finding

is lower as compared with the value reported by Zelalem *et al.* [31], from Jimma [28], from Kombolcha [30], from Tanzania and Kithuka *et al.* [37] from Kenya and Phiri [38] from Zambia with a prevalence of 63.89%, 36.06, 31.3, 38.2 % and 37% respectively. But this report is higher than the report of Lati [32], from Nekemte and Alembrhan and Haylegebriel [33] 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 parasite and environmental management measures in the areas. Apart from its veterinary and economic importance throughout the world, fasciolosis has recently been shown to be reemerging and widespread zoonosis affecting a number of human populations [39, 40].

Liver condemnation due to hydatid cyst (3.9%) in the present study is just compared with studies conducted by Alembrhan and Haylegebriel [33] from Adigat 3.62% and Wale *et al.* [27], from Jimma 3.6%, but extremely lower than the report of Miheret *et al.* [41] from Dire Dawa who reported 33.33% and Zelalem *et al.* [31] from Addis Ababa who reported 31.7 % of hydatid cyst. Hydatid cyst also found to be the cause of lung condemnation with rate of 8.07% which is much lower than report from Gondor [4, 42] and that from Sodo [43] whom reported 68.2%, 48.5% and 82%. But higher than the rejection rate reported by Fredrick *et al.* [44] from Zambia and Elmahdi *et al.* [45] from Sudan.

The current study found a total condemnation of heart of 7.28%. The main causes of heart rejection in this study were pericarditis and Edema with 2.6% and 2.34% respectively. This is extremely lower (78.1 %) as compared with study by Genet *et al.* [4] from Gonder abattoir. However, it was higher than the report of Lati *et al.* [32] and Nebyou *et al.* [25] who recorded 0.69 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, nephritis and renal calculi with report of 0.52%, 1.3% 2.86% and 1.56% respectively which is lower than the report of Fufa and Debele [26] from sodo, [4] from Gonder and Wale *et al.* [27] from Jimma. 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. In the present study, condemnation of spleen resulted to considerable economical loss caused by pathological conditions like splenitis (2.34%) and splenomegaly (6.51%). The current findings is much lower

than the study reported by [26] from Wolaita Sodo with the condemnation rate of 53% and that of Shitaye *et al.* [34], from Hawassa.

The main causes of muscle condemnation were *C. bovis* and bruise which is in agreement with the study reported by Lati *et al.* [32] from Wollega. Organ condemnation rates did not show statistically significant difference ($P > 0.05$) with age and there was no statically significant difference ($p > 0.05$) between BCS and condemnation of organs. Condemnation rate of organs showed statistically significant difference between origins of animals ($p < 0.05$). The total direct economic loss incurred due to condemnation of organs in active abattoir survey was 9284.75 ETB. From this, 6400.12 ETB and 1289.08 ETB were recorded due to condemnation of liver and lung respectively. This result is lower than the report of Hassan *et al.* [12] from Iran [4] from Gondor and Yifat *et al.* [29] 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 RECOMMENDATION

In the present study, it could be concluded that several disease problems are associated with the condemnations of organs in Selamber Municipal Abattoir, Ethiopia. The rates of condemnation of organs were higher in a liver which was decreased in lungs, spleen, heart, kidneys and muscle respectively. Major pathological conditions that caused a total condemnation of organs were higher in fasciolosis followed by cirrhosis, calcification, emphysema, congestion, pericarditis, renal calculi, atrophy and hydronephrosis. Organ condemnation rates did not show significant difference ($P > 0.05$) among age group, origin and status of body condition. The financial loss due to edible organ condemnation was estimated to be 9284.75 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, different strategies should be developed to minimize condemnation of organs due to the dynamic nature of the diseases and butchers 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.

REFERANCES

1. Central Statistical Authority (CSA), 2008. Federal Democratic Republic of Ethiopia, Agricultural Sample Enumeration Statistical Abstract.
2. 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, pp: 6.
3. Amene, F., L. Eskindir and T. Dawit, 2012. Cause, Rate and Economic Implication of Organ Condemnation of Cattle Slaughtered at Jimma Municipal Abattoir, Southwestern Ethiopia. *Global Veterinaria*, 9(4): 396-400.
4. Genet, M., G. Tadesse, B. Basaznew and C. Mersha, 2012. Pathological Conditions Causing Organ and Carcass Condemnation and Their Financial Losses in Slaughtered in Gondar, Northwest Ethiopia. *African J. Basic (2012) & Appl. Sci.*, 4(6): 200-208.
5. Arbabi, M. and H. Hooshyar, 2006. Survey of Echinococcosis and Hydatidosis in Kashun Region, Central Iran. *J. Public Health*, 35: 75-81.
6. Abbuna, F., L. Asfaw, B. Megersa and A. Regassa, 2010. Bovine fasciolosis: Carpological, abattoir survey and its economic impact due to liver condemnation at Sodo Municipal abattoir, Southern Ethiopia. *Trop. An. Health. Prod.*, 42: 289-292.
7. Jobre, Y., F. Lobago, R. Tiruneh, G. Abebe and P.H. Dorchie, 1996. Hydatidosis in three selected regions of Ethiopia: An assessment trial on the prevalence, economic and public health importance. *Rev. Med. Vet.*, 147: 797-804.
8. Kebede, N., 2010. A retrospective survey of bovine hydatidosis in three abattoirs Amhara National Regional State, northwestern Ethiopia. *Trop. Anim. Health Prod*, 42(3): 323-325.
9. Alton, G., D. Lpeah, K. Bateman, W. Mc Nab and O. Berk, 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.
10. Edwards, D., K. Christiansen, A. Johnston and G. Mead, 1999. Determination of farm level risk for abnormalities observed during post-mortem meat inspection of lambs: a feasibility study. *Epidemiology and Infection*, 123: 109-119.
11. Biu, A. and J. Adindu, 2004. The prevalence of bovine hydatidosis in Maiduguri, Nigeria. *J. Life and Environmental Sci.*, 6(2): 360-362.
12. Hassan, B., A. Mohammad and K. Mehrab, 2012. A retrospective study of abattoir condemnation due to parasitic infections: economic importance in Ahwaz, southwestern Iran. *J. Parasitol.*, 98(5): 95.
13. Asmare, A., A. Biniyam and C.h. Mersha, 2012. Major Causes of Lung and Liver Condemnation and Financial Impact in Cattle Slaughter at Bahir Dar Municipal Abattoir. *Afr. J. Basic Appl. Sci*, 4(5): 165-171.
14. Center for Food Security and Public Health (CFSPH), 2011. Echinococcosis. Iowa State of University, College of Veterinary Medicine, Lowapp, pp: 1-14.
15. OIE., 2004. Manual of Diagnostic Tests and Vaccines for Terrestrial Animal. Available at: www.oie.int/en/international_standardsetting/terrestrial-manual/access-on-line/
16. Rahmeto, A., A. Fufa, B. Mulugeta, M. Somon, M. Bekele and R. Alemayehu, 2008. Fasciolosis: Prevalence, financial losses due to liver condemnation and evaluation of a simple sedimentation diagnostic technique in cattle slaughtered at Hawassa. Municipal abattoir, southern Ethiopia. *J. Adv. Vet. Res.*, 2(2012): 18-23.
17. Defaru, D. and A. Tuma, 2013. Land Use Patterns and its Implication for Climate Change: The Case of Gamo Gofa, Southern Ethiopia. *Int. J. Scie. Re. and Rev.*, 2(3): 155-173.
18. Thrusfield, M., 2005. Veterinary epidemiology, government department of Navy, Bureau 2 UK Black well science Ltd., pp: 182-198.
19. Pace, J.E. and D.L. Wakeman, 2003. Determining the age of cattle by their teeth animal science department institute of food and agricultural sciences (IFAS), pp: 312-348.
20. Nicholson, M.J. and M.H. Butter, 1986. A guideline to condition scoring of Zebu cattle. International Livestock Center for Africa, Addis Ababa, Ethiopia.
21. Food and Agriculture Organization (FAO), 1994. Manual of meat inspection for developing countries.
22. Ogunrinade, A. and B.I. Ogunrinade, 1980. Economic importance of bovine fasciolosis in Nigeria. *Trop. Anim. Health Prod.*, 12: 155-160.
23. Gracey, J.F., O.S. Collins and R.J. Huey, 1999. Meat Hygiene. 10 ed. London: Bailliere Tindall, pp: 190-678.
24. Shegaw, S., K. Ashwani and A. Kassaw, 2009. Organ condemnation and economic loss at Mekelle municipal abattoir, Ethiopia. *J. Haryana Veterinarian*, pp: 6(48): 17-22.

25. Nebyou, M., A. Debelo, K. Solomon and T. Tesema, 2014. Major Causes of Organs and Carcass Condemnation in Cattle Slaughtered at Nekemte Municipality Abattoir, East Wollega, Ethiopia, 13(3) :278-284.
26. Fufa, A. and H. Debele, 2013. Major Causes of Organ Condemnation for Cattle and its Financial Impact at Wolaita Soddo Municipality Abattoir, Southern Ethiopia. *Glob. Vet.*, 11: 730-734.
27. Wale, T., M. Tirfayehu and A. Assefa, 2017. Major causes of organ condemnation and financial significance in cattle slaughtered at Jimma Municipal Abattoir, Southwestern Ethiopia. *Int. J. Adv. Res. Biol. Sci.*, 4(2): 32-39.
28. Nurit, M., H. Zerihun and M. Serkalem, 2012. Major Cause of Liver Condemnation and Associated Financial Loss at Kombolcha Elmore Abattoir, South Wollo, Ethiopia. *Europ. J. Appl.Sci.*, 4(4): 140-145.
29. Yifat, D., D. Gedefaw and S. Desie, 2011. Major Causes of Organ Condemnation and Financial Significance of Cattle Slaughtered at Gondar Elfora Abattoir, Northern Ethiopia. *Iran Glob.Vet.*, 7(5): 487-490.
30. Swai, E.S. and E. Ulicky, 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. *Liv. Res for Rural Dev*, 21(186): 312-343.
31. Zelalem, F., T. Tadele, N. Zelalem, M. Chanda, Nigatu and G. Kebede, 2012. Prevalence and characterization of hydatidosis in animals slaughtered at Addis Ababa abattoir, Ethiopia. *J. Parasitol. Vector. Biol.*, 4(1): 1-6.
32. Lati, E., S. Biresaw, S. Berhanu and H. Eyob, 2015. Causes of organ condemnation, its public health and financial significance in Nekemte municipal abattoir, Wollega, Western Ethiopia. *J. Vet. Med. Anim. Health*, 7: 205-214. 7(6): 205-214.
33. Alembrhan, D. and T. Haylegebriel, 2013. Major causes of organ condemnation and economic loss in cattle slaughtered at Adigrat municipal abattoir, northern Ethiopia. *Vet. World*, 6(10): 734-738.
34. Shitaye, M., S. Tilaye and T. Fanos, 2016. Major causes of organ condemnation and associated financial loss in cattle slaughtered at Hawassa Municipal Abattoir, Ethiopia. *J. Vet. Med. Anim. Health*, 8(10): 150-156.
35. Rodriguez, H., 2003. Taeniasis-cysticercosis health in man and animals in the Sierra of Northern Ecuador. *Veterinary Parasitology*, 118: 51-60.
36. Huggies, G., 1993. Seroepidemiological study of *Taenia saginata* cysticercosis in Swaziland. *Research in Veterinary Sciences*, 55: 287-291.
37. Kithuka, J., M. Maingi and F. Njeruh, 2002. The prevalence and economic importance of bovine Fascioliasis in Kenya: an analysis of abattoir data, Ondestepoort, *J. Vet Res.*, 69: 255-62.
38. Phiri, A., 2006. Common conditions leading to cattle carcasses and offal condemnations at 3 abattoirs in Western Province of Zambia and their zoonotic implications to consumers. *J. of South African Veterinary Association*, 77: 28-32.
39. Esteban, J., C. Gonzalez, C. Curtale, A. Munoz and M. Valero, 2003. Hyperendemic fascioliasis associated with schistosomiasis in villages in the Nile delta of Egypt. *The text book of diseases of cattle, sheep, goats. American J. Trop. Med and Hygiene*, 69: 429-437.
40. Mas-Coma, S., M.D. Bargues and M.A. Valero, 2005. Fasciolosis and other plant born trematode zoonoses. *Int. J. Parasitol*, 35(11-12): 1255-78.
41. Miheret, M., M. Biruk, T. Habtamu and K. Ashwani, 2013. Bovine Hydatidosis in Eastern Part of Ethiopia. *MEJS*, 5(1): 107-114.
42. Getaw, A., D. Beyene, D. Ayana, B. Megersa and F. Abunna, 2010. Hydatidosis: prevalence and its economic importance in ruminants slaughtered at and other plant-borne trematode zoonoses. Adama municipal abattoir, central Oromia, Ethiopia. *Acta Trop*, 113: 221-225.
43. Regassa, A., F. Abbu, A. mulugeta and B. Megersa, 2009. Major Metacestodes in cattle at Wolaita Sodo municipal abattoir, Southern Ethiopia: Prevalence, cyst viability, organ distribution and socio-economic implications. *Trop An. Health and Production*, 41: 1495-1502.
44. Fredrick, B., S. King, B. John, M. Musso and M. Hetron, 2013. A Cross-Sectional Study Investigating Cystic Hydatidosis in Slaughtered Cattle of Western Province in Zambia. *ISRN Parasitological*, pp: 1-9.
45. Elmahdi, I., Q. Ali, A. Magzoub, M. Ibrahim, N. Saad and H. Romig, 2004. Cystic echinococcosis of livestock and humans in central Sudan. *Annals of Trop Medicine and Parasitology*, 98: 473-479.