

Original Research Article

“STUDY ON MAJOR CAUSES OF ORGAN CONDEMNATION AND ECONOMIC SIGNIFICANCE IN CAMELS SLAUGHTERED AT JIGJIGA MUNICIPAL ABATTOIR, ETHIOPIA.

ABSTRACT

A cross-sectional study was conducted between March to August 2021 with the aim of determining the prevalence of causes of organ condemnation with associated potential risk factors and estimating the magnitude of the direct economic losses from rejected organs. A total of 432 camels slaughtered at Jigjiga Municipal Abattoir were randomly selected; 180 (59%) male, 103 (81%) female, and in age 102 (60.7%) young, 181 (68.6%) adult, and in body condition score; poor 41 (9.6%), medium 98 (81.6%), and good 144 (53.3%). Based on origin of the animal, 16 (22.2%), 20 (34.5%), 3 (23.1%), 19 (29.7%), 29 (19.7%), 16 (20.5%) from Jigjiga, Dahagbur, Kabridahar, Fik, Babile, Shinile were detected one or more pathological signs respectively. During antemortem examination 140 (32.36%) camels showed various abnormalities. Including localized lesions 52 (12.03%), local swelling 18 (4.16%), lacrimation 17 (3.93%), nasal discharge 15 (3.47%), rough hair coat 13 (3.00%), lameness 12 (2.77%), depression 8 (1.85%) and blindness 5 (3.57%). Upon postmortem inspection, the overall prevalence was 504 (29.1%); 254 (58.7%) lungs, 203 (46.9%) liver, 40 (9.25%) heart, 7 (1.6%) kidneys were condemned. Some of the major cause of lung condemnation were due to 103 (23.8%) hydatid cyst, 68 (15.7%) emphysema, and 48 (11.1%) pneumonia. Liver rejection were due to 77 (17.8%) hydatid cyst, 25 (5.8%) calcification, 82 (19.0%) cirrhosis. Heart condemnation were due to 9 (2.1%) calcified cyst, 4 (0.9%) pericarditis, 13 (3.0%) hydatid cyst. Kidney rejection rate were caused by 3 (0.7%) hydatid cyst, 4 (4.0%) hydronephritis. There was statistically significant between body condition score, and sex of the animal with the rate of organ condemnation ($P < 0.05$). While, age and origin of the animal were not statistically significant with the prevalence of organ condemnation ($P > 0.05$). In lung hydatid cyst with the aspect of age and body condition score were statistically significant ($P < 0.05$). While sex and origin of animal were not statistically significant ($P > 0.05$) with the rate of lung condemnation. Lung and liver were most commonly condemned organs followed by heart and kidney in camel slaughtered at Jigjiga Municipal Abattoir. The financial loss due to edible organs condemned in this study was estimated to 158,236.78 ETB/ 3,425.038 USD. Therefore, appropriate strategies should be established for prevention, and control of this level of condemnation rate of

Comment [A1]: I would suggest a structured abstract. With background, methods, results and conclusion as sub topics

Comment [A2]: Body Condition Score should be Good, Fair and Poor

organs and to sustain the massive monetary loss caused by the rate of organs condemned in the studied area.

Keywords: *Antemortem, Camel, economic loss, Ethiopia, Jijiga, Rejection rate*

1. INTRODUCTION

World camel population number estimated to be 35 million heads (FAO, 2019), most of which are in Ethiopia, Somalia, Niger, Kenya, Chad, Mali, Mauritania and Pakistan. Five bordering countries - Somalia, Ethiopia, Kenya, Sudan, and Djibouti hold 84% of African and more than half of the world's camel population (Mwinyikione *et al.*, 2016). Ethiopia is an agrarian country with huge livestock population in Africa possessing over 4.5 million heads of *Camelus dromedarius*, based on several more reliable and recent surveys for the Afar, Somali and Borena regions in the country (Shapiro *et al.*, 2017).

Meat is the main source of protein for man it should be clean and free from diseases of particular importance to the public such as tuberculosis (TB), hydatidosis, cysticercosis and fasciolosis (Sirak, 1991). Meat is condemned at Municipal Abattoir to break the chain of some zoonoses which are not transmitted to man directly via meat like hydatidosis and other important diseases of animals such as fasciolosis (Arbabi *et al.*, 2006; Fufa *et al.*, 2010).

Meat inspection at the abattoir is a crucial need for food safety and disease control. It is one of the most widely implemented and longest-running systems of surveillance that involve the screening of animals and meat for wholesomeness for human consumption (Stärk, 2014). Similarly, abattoir meat inspection is essential to remove gross abnormalities from meat and its products to prevent distribution of contaminated meat and to assist in detecting and eradication of certain livestock diseases (Alemayehu *et al.*, 2013).

The result of meat inspection at Municipal Abattoirs with appropriate trends indicate possible risks due to unsafe meat obtained from camel carcasses at the Municipal Abattoirs. Such risks are eliminated by strict veterinary inspection of animals prior to slaughter as well as of meat and parenchymatous organs after slaughter. Municipal Abattoirs provide an excellent opportunity for detecting pathological lesions of both economic and public health importance (Ahmed *et al.*, 2013).

Despite, safety and hygiene of meat and its products has become the most important concern of the

consumers and producers. Some microbial pathogens have been causing severe complications in animals as well as in humans. Therefore, comprehensive inspection at ante mortem in the lairage as well as at post-mortem examination, carcass and offals in Municipal Abattoir should be considered very important (Boughatta and Salehi, 2014).

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; Equare *et al.*, 2012).

Animal diseases are considered as a major health problem and cause a significant economic loss in countries where livestock production is an important segment of the agricultural practice (Amene, 2012). For instance, diseases in camels cause considerable economic losses due to the condemnation of edible organs/decreased meat and milk production (Romazanov, 2001). The main causes of organ condemnation during post-mortem inspection are diseases originated by parasites, bacteria and viruses. Flukes in liver and hydatid cyst in lung, liver and kidney, are mainly involved (Mezegebu, 2003).

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). Cystic 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).

For calcified cysts it has a gritty sound upon incision with knife and when observed grossly the cyst is white or grey and irregularly rounded and frequently honey combed. Hydatid cyst contains semisolid material on which there may be deposition of calcium salt to form calcified cyst. Hydatidosis caused by the metacestode of Echinococcus granulosus is a widely spread parasitic zoonosis that had caused public health problems in many countries (M. Ansari-Lari, 2005; Mellau, 2010).

Most of the studies conducted in Jigjiga Municipal Abattoir have focused only on specific diseases such as fasciolosis and hydatidosis. As a result of this, there is no complete information about causes of organ condemnation at Jigjiga Municipal Abattoir.

.Inlinewiththis,itwouldbeessentialtohavecomprehensiveinformationonoccurrenceofvarious diseases and causes of organ rejection and their financial loss to establish appropriatestrategyforprevention and controls.

1.1. Objectives

1.1.1. General Objective

- Todeterminetheoverallprevalenceandcausesoforgancondemnationwithrespecttoassociated factorsin camels slaughteredat JigjigaMunicipalAbattoir.

1.1.2. Specific Objectives

- To identifythedifferentcauses oforgancondemnationincamelslaughteredatJigjigaMunicipalAbattoir.
- Toassessand estimatetheannual financialimpactofthecondemnedorgans.

2. MATERIALSANDMETHODS

2.1. StudyAreaandperiod

The study were conducted on Jigjiga town. Jigjiga is the capital city of the Somali RegionalState which is found on the Eastern part of Ethiopia (Figure 1) about 630 km and 105 kmaway from Addis Ababa and Harar towns respectively. Human population size of Jigjiga isestimated about 763,509. Jigjiga is situated at an altitude ranging from 1,660 to 1,710 meterabove the sea level at geographic coordinates of approximately 9⁰20' North latitude and45⁰56' East longitude. The climate of Jigjiga is semi-arid type which is characterized by hightemperature and low rainfall. The mean annual temperature and mean annual rainfall is about22⁰C and 543mm respectively. Farming system of the area includes mixed crop livestockproduction. Thevegetationoftheareaincludesdifferentplantswheresorghum,maize,barley,wheat, and bean arethe most important agriculturalcrops(CSA, 2012).



Figure 1: Map of study area Jigjiga, Eastern Ethiopia

Source: (Theme Grill, 2021)

2.2. Study Population

The study population was *Camel dromedary* slaughtered at Jigjiga Municipal Abattoir from different sources were

included Jigjiga, Degahbur, Kabridahar, Fik, Babile, and Shinile. Slaughtered animals were both male and female. Simple random sampling method was used as a sampling technique. All camels presented for slaughter during the investigation period were sampled for this epidemiological study. Mostly, extensive management care was practiced to camels slaughtered but sometimes special care was given for fattening purpose.

Comment [A3]: From different sources including;

Comment [A4]: spelling

2.3. Study design

A cross-sectional study was conducted from March to August 2021 to determine the prevalence of major causes of organ condemnation and economic significance in camels slaughtered at Jigjiga Municipal Abattoir. During the period of study, four visits per week were made purposively out of 7 slaughter days in a week. Camels were selected by simple random sampling per visit 9 animals were recorded at a day. The first animals were selected randomly and the rest with equal intervals and were subjected for both ante-mortem and detailed post-mortem inspections.

Comment [A5]: re-write for clarity. Was this really a cross sectional study.?

2.4. Sampling Method and Sample Size Determination

By using simple random sampling methods and 95% confidence interval with required 5% precision, the sample size was determined by the formula of Thrusfield, and Christley (2018).

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

Where; n = required sample

size P_{exp} = expected

prevalence = required

precision

The expected prevalence is 50% with the required precision (d) of 5% (0.05). By substituting the value in the above formula, we get the sample size:

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

$$(0.05)^2$$

$$=384$$

Therefore the calculated sample size was 384 camels, but 48 samples were added with the intention of maximizing the accuracy, and increasing the precision level and the calculated sample size was 432 camels.

Comment [A6]: How did you arrive at the figure of 48?

2.5. Study Methodology

2.5.1. Antemortem Examination

Pre slaughter examinations of camel were conducted in the lairage by grouping the animals based on their age body condition score and place of origin. Antemortem inspections were conducted on individual animals while the animals entering into the lairage and after they entered into the lairage in mass. Both sides of the animals were inspected at rest and in motion. Moreover, the general behavior of the animals, nutritional status, cleanliness and signs of diseases or abnormalities were recorded according to the procedures by (Gracey, 1999). Pathological lesions were differentiated and judged according to the guideline of meat inspection for developing countries (FAO, 1994). The age, sex and body condition of each individual animal was identified and recorded. The body condition scoring for camels was conducted based on the guidelines given by (Faye *et al.*, 2001). The scoring was conducted by looking at the back and flank and then classified as poor (0 and 1), medium (2 and 3) and good (4 and 5).

2.5.2. Postmortem Examination

Postmortem Examination were conducted based on the guidelines set on manual on meat inspection for developing countries (FAO, 1994). Accordingly, the liver, lung, heart, and kidney were examined through visualization, palpation and systematic incision for any pathological lesion(s).

2.6. Economic Loss Analysis

To analyze financial loss due to organ condemnation, the average annual slaughter capacity of the abattoir, the average market price of each organ in Jigjiga city and the rejection rate of each organ were used. The average market price was also determined by interviewing different butchers. The financial loss due to the condemnation of organs was estimated by the formula given by Ogunrinade (1980) as follows;

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

Where EL = Annual economic loss estimated due to organ condemnation. $\sum sr_x$ = Annual camels slaughter rate of the abattoir.

Comment [A7]: Did you use an average price per unit weight or was the price uniform across all the butcheries?

Coy=Averagecostofeachcamel liver/lung/heart/kidney.

Roz =Condemnationrateofeachcamelliver/lung/heart/kidney.

2.7. Data Management and Analysis

The data collected were entered into the Microsoft excel 2010 spreadsheet and analysed by using the SPSS version 20. The data were summarized as a table and Chi-square (X^2) test were used to compare prevalence among sex, age, and body condition, and origin. In all cases, 95% confidence intervals and ($P < 0.05$) were to be considered as statistically significant.

3. RESULTS

Out of the 432 camels inspected at antemortem 140 (32.4%) camels were found to have abnormalities (Table 1). Age wise the selected animals were divided into young (168) of less than 7 years and adult (264) of 7 or above years. Slaughtered animals were male (305) and Female (127). In body condition score of animals it were reclassified into Poor (42), Medium (120) and Good (270). All slaughtered animals were marked for identification purpose and code was given. The most common abnormalities encountered during antemortem examination; localized lesions 52 (12.03%), local swelling 18 (4.16%), lacrimation 17 (3.93%), nasal discharge 15 (3.47%), rough hair coat 13 (3.00%), lameness 12 (2.77%), depression 8 (1.85%) and blindness 5 (3.57%). All these abnormalities were considered mild and approved for slaughter purpose.

Comment [A8]: Use proper scoring scale

Comment [A9]: Is this necessary? The study is about causes of organ condemnation and associated economic loss

Table 1: Abnormal conditions encountered during antemortem inspection

Comment [A10]: Improve the appearance of the table

Abnormal conditions	No. of animals of		
	Affected	No. of Positive camels	%
Localized lesions	52	12.03	40.62
Localized swelling	18	4.16	14.00
Lacrimation	17	3.93	13.28
Nasal discharge	15	3.47	11.70
Rough hair coat	13	3.00	10.15
Lameness	12	2.77	9.37
Depression	8	1.85	6.25

Blindless	5	1.15	3.90
Total	140	32.4%	100%

3.1. Overall prevalence

The postmortem examination were performed for all slaughtered camels (n=432) with overall prevalence of (29.1%). From the total organs examined 254(58.78%) lungs, 203(46.97%)liver, 40(9.24%) heart and 7(1.88%) kidneys were rejected as unfit for human consumption based on their gross pathological findings (Table 2). Slaughtered animals were both male

e (305) and Female (127). Out of the 432 inspected lungs a total of (254) were rejected for having gross abnormalities; hydatid cyst (23.84%), emphysema (15.74%), pneumonia (11.11%), calcified cyst (5.32%), and abscess (2.77%). Similarly a total number of (203) livers were condemned for having different abnormalities; cirrhosis (18.98%), Hydatid cyst (17.82%), calcification (5.78%), and discoloration (4.39%). From the total camels slaughtered (40) hearts were rejected for various abnormal conditions; adhering (3.24%), hydatid cyst (3.00%), calcified cyst (2.08%), and pericarditis (0.92%). In case of kidney (7) were not approved for finding gross pathological signs; hydronephritis (0.92%), and hydatid cyst (0.69%).

Comment [A11]: What is the denominator?

Table 2: Causes of Organ condemnation and their percentage%

Organ	Causes	Number condemned	Percent (%)
Lung	Hydatid cyst	103	23.8
	Emphysema	68	15.7
	Pneumonia	48	11.1
	Abscess	12	2.8
	Calcified cyst	23	5.3
Liver	Hydatid cyst	77	17.8
	Calcification	25	5.8
	Discoloration	19	4.4
	Cirrhosis	82	19.0
Heart	Calcified cyst	9	2.1
	Pericarditis	4	0.9
	Hydatid cyst	13	3.0
	Adhesion	14	3.2

Kidney	Hydatidcyst	3	0.7
	Hydronephritis	4	0.9
Total		504	116.6

3.2. Risk Factors and Rate of Prevalence of Organ Condemnation in Camels

3.2.1. Prevalence of each organ condemnation in relation with age variable

From the total of 432 head of camel examined, 283(65.5%) animals had one or more than one type of pathological condition that led to visceral organ condemnation. Out of which 211(48.8%) lungs, 152(35.2%) livers, 40(9.3%) hearts and 7(1.6%) kidneys were condemned or rejected as unfit for human consumption according to age.

Table 3: Distribution of number and age of camels slaughtered and organ rejection rates

Age category	Camel slaughtered	Number (%) of organ condemned			
		Lung	Liver	Heart	Kidney
Young	168	75(44.6%)	50(29.8%)	13(7.7%)	1(0.6%)
Adult	264	136(51.5%)	102(38.6%)	27(10.2%)	6(2.3%)
Total	432	211 (48.8%)	152(35.2%)	40(9.3%)	7(1.6%)

3.2.2. Prevalence of organ condemnation in relation with sex variable

Cause of organ condemnation with the respect to sex revealed that higher prevalence in female 103(81%) than male 180(59%) camels but highly statistically significant difference was recorded ($P < 0.05$) (Table 4).

Table 4: Distribution of number and sex of camels slaughtered and organ rejection rates

Variable	Category	No. Rejection rate (%)	X^2	P-value
	inspected			
Sex	Male	305	180(59)	19.36
	Female	127	103(81)	
Total		432	283(65.5)	0.000*

3.2.3. Prevalence of age variable with rejection rate in relation

Regarding the age of animals higher prevalence was recorded in adults 181(68.6%) than young 102(60.7%) animals but no statistically significant between age and cause of organ condemnation rate ($P > 0.05$) (Table 5).

Table 5: Prevalence of rejection rate in relation to age

Variable	Category	No. inspected	Rejection rate (%)	X^2	P-value
Age	Young	168	102(60.7%)	2.79	0.094
	Adult	264	181(68.6%)		
Total		432	283(65.5)		

3.2.4. Prevalence of Body condition score with rejection rate

Related to body condition the highest prevalence was in poor with the percentage 41(97.6%) followed by medium 98(81.6%) and good 144(53.3%) body condition scores. There was statistically significant between rejection rate and the body condition score of animals. ($P < 0.05$).

Table 6: Prevalence of rejection rate with the respect of Body condition score

Variable	Category	No. observed	Rejection rate (%)	X^2	P-value
Body Condition	Poor	42	41(97.6)	50.75	0.000*
	Medium	120	98(81.6)		
	Good	270	144(53.3)		
Total		432	283(65.5)		

3.2.5. Prevalence of rejection rate in relation to origin

Based on origin of the animal the highest prevalence is under 20(34.5%) Dagahbur, followed by 19(29.7%) Fik, 3(23.1%) Kabridaher, 16(22.2%) Jigjiga, 16(20.5%) Shinile, then 29(19.7%) Babile. There was no statistically significant ($P > 0.05$) (Table 7).

Table7:Prevalenceofrejectionratewithaspect ofanimalOrigin

Variable	Category	No. observed	Rejection raten(%)	X ²	P-value
Origin	Jigjiga	72	16(22.2)	6.77	0.238
	D/hbur	58	20(34.5)		
	Kebridaher	13	3(23.1)		
	Fik	64	19(29.7)		
	Babile	147	29(19.7)		
	Shinile	78	16(20.5)		
Total		432	103(23.8)		

3.2.6. Prevalence of hydatid cyst on lung of camels slaughtered at Jigjiga Abattoir in relation to risk factors

In context of age, sex, body condition score, and origin to prevalence of hydatid cyst on lung the adults 82(31.1%) had highest prevalence than the the young 21(12.5%) animals and there was statistically significant ($P < 0.05$). And in sex aspect Female 27(21.3%) animals had lower prevalence than male 76(24.9%) animals and there was no statistically significant ($P > 0.05$). And in body condition score Poor 17(40.5%) animals had highest prevalence followed by Medium 34(28.3%) and Good 52(19.3%) animals and statistically significant ($P < 0.05$). And also in animal origin Babile 29(19.7%) has lowest prevalence followed by Shinile 16(20.5%), Jigjiga 16(22.2%), Kabridahar 3(23.1%), Fik 19(29.7%), and Degahbur 20(34.5%) and there is no statistically significant ($P > 0.05$).

Table8:Distribution of hydatid cyst with the aspect on age, sex and body condition

Variable	Category	observation	Rejectionraten (%)	χ^2	P-value
Age	Young	168	21(12.5)	19.4	0.000*
	Adult	264	82(31.1)		
Sex	Male	305	76(24.9)	0.66	0.416
	Female	127	27(21.3)		
BCS	Poor	42	17(40.5)	10.85	0.004*

	Medium	120	34(28.3)		
	Good	270	52(19.3)		
Origin	Jigjiga	72	16(22.2)		
	D/habur	58	20(34.5)	6.77	0.238
	K/Dehar	13	3(23.1)		
	Fik	64	19(29.7)		
	Babille	147	29(19.7)		
	Shinille	78	16(20.5)		
Total		1728	412(23.8)		

**Significancedifferencewereobserved*

3.3. EstimationofDirectannualEconomiclosses

The average mean annual camel slaughtered at JigjigaMunicipal Abattoir was estimated to be 9,125 heads; rate of condemnation of the current study were 254(58.7%), 203(46.9%),40(9.25%), 7(1.6%) lung, liver, kidney and heart respectively. The total annual loss wascalculated158,236.78 ETB/ 3,425.038 USD (1USD=46.20 ETB).

Table9:Estimateddirectannualfinancialloss

Organs

Total No. of Condemned Organs Condemnation	Rejection rate%	Average Financial lost	price in ETB	ETB	
Lung	254	58.7%	9,125	140	16,231.439
Liver	203	46.9%	9,125	1,500	138,948.863
Heart	40	9.25%	9,125	150	2,740.462
Kidney	7	1.6%	9,125	100	316.017
Total	504	116.6%			158,236.78ETB

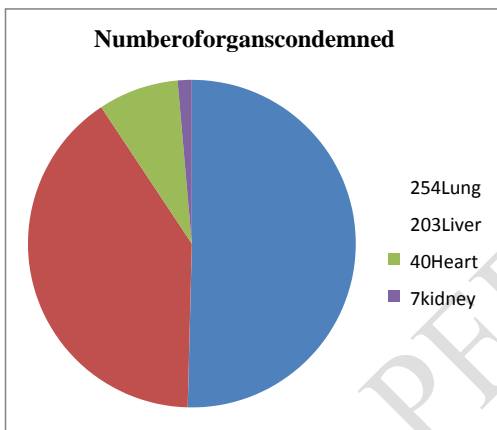


Figure 2: Total Number of organs condemned during study period in Jigjiga Slaughter House (n=432).

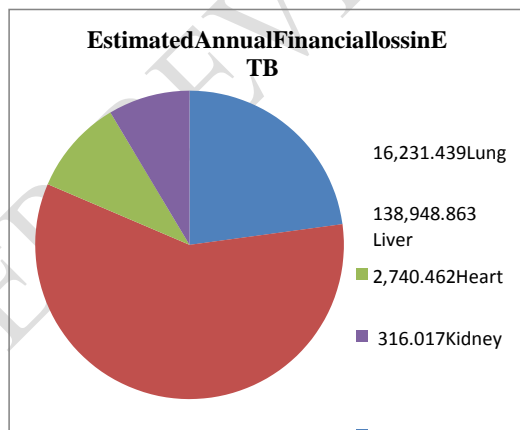


Figure 3: Estimated annual loss in Jigjiga Municipal Abattoir with annual slaughter capacity.

4. DISCUSSION

The present study, the most commonly encountered abnormalities during antemortem inspection were Localized lesions 52 (12.03%), Local swelling 18 (4.16%), Lacrimation 17 (3.93%), Nasal discharge 15 (3.47%), Rough hair coat 13 (3.00%), Lameness 12 (2.77%), Depression 8 (1.85%) and Blindness 5 (3.57%). With an overall prevalence of 140 (32.4%). Localized lesion was the highest in prevalence than the others and blindness was the least variable during assessment of antemortem examination.

In this study, out of 432 inspected camels 504 organs were condemned with the

Comment [A12]: Improve on the english

overall prevalence 504 (29.1%). This finding is relatively very closer than the findings of 28.6%, 28.3% Nejash and Walkite, (2018), Shitaye *et al.*, (2016) in Dire dawa municipal abattoir, and Hawassa municipal abattoir respectively. This result is much lower than 55.21% who reported by Teddy *et al.*, (2018) from Arba Minch municipal abattoir. However, this finding is considered relatively higher than the findings of 23.3%, 24.9%, 20.7%, Tenaw *et al.*, (2015), Jemalo *et al.*, (2018), Wale *et al.*, (2017) in Akaki Abattoir Addis Ababa, Assella municipal abattoir, Jimma municipal abattoir respectively. Moreover this output had much higher than the findings of 17%, 17.5%, 14.7%, 14.%, 13.85%, 13.5%, 12.3%, 4.7%, Shitaye *et al.*, (2016), Shitahun *et al.*, (2018), Fufa and Debele (2013), Amare *et al.*, (2017), Yalew *et al.*, (2015), Jatenie, *et al.*, (2014), Wondemagegnehu *et al.*, (2017), Alembrhan and Haylegebriel (2013) in Addis Ababa municipal abattoir, Hawassa municipal abattoir, Wolaita Sodd municipal abattoir, Gondar municipal abattoir, Dessie municipal abattoir, Adamu municipal abattoir, Wolaita Sodd municipal abattoir, Adigrat municipal abattoir respectively. This variation in prevalence could be due to differences in animal husbandry system, backyard slaughtering of animals, lack of proper disposal of infected carcass and the presence of stray dogs and their relations with animals Mesele *et al.*, (2013).

Sex-related distribution of organ condemnation and rejection rate in this study stated that higher prevalence in female 103 (81%) than male 180 (59%) camels. This finding in agreement with reports showed female has higher prevalence (63.95%) than male (41.05%) Male 84 (21.81%) female 301 (78.18%) Nejash and Walkite, (2018), Tenaw, *et al.*, (2015), from Dire dawa municipal abattoir, and Akaki abattoir respectively. On contrary, this result was in disagreement with the findings of Shitahun, *et al.*, (2018) who reported Male 249 (57.3%) animals had higher prevalence than the Female 9 (2.1%) in Addis Ababa abattoir

Enterprise. Similarly, report from Teddy *et al.*, (2018) stated there is slightly higher prevalence in male 206 (55.5%) than in female cattle 6 (46.1%). Sex was statistically significant different with prevalence of organ condemnation rate ($P < 0.05$) This variation in prevalence rate might be due to physiological and hormonal effect among animals Mokhtaria *et al.*, (2018).

In context of age this current study revealed that low prevalence was recorded in young 102 (60.7%) than in adult 181 (68.6%) animals. This result agreed with the findings of Assefa *et al.*, (2017) who reported young 51 (4.9%) animals had lower prevalence than adults 211 (19.6

%) from Addis Ababa abattoir Enterprise. Similarly a report of Teddy *et al.*, (2018) was stated slightly higher prevalence in males 206 (55.5%) than in female 6 (46.1%) from Jimma Municipal Abattoir. There was no statistically significant difference ($P > 0.05$). The highest infection rate in adult animals than younger ones might be due to the decreased immunity in older animals than younger ones Bhaskararao, (2003).

In this study the prevalence of organ condemnation with aspect of body condition score of the animal higher prevalence was recorded in poor 41 (97.6%), followed by medium 98 (81.6%), and good 144 (53.3%). This finding is in line with the report of Asmare *et al.*, (2012) which was expressed that higher prevalence in poor 47 (29.7%), Medium 67 (38.3%), and good 15 (29.4%) from Bahir dar municipal abattoir. This result is similar also to the report of Wondemagegnehu *et al.*, (2017) Poor 48 (39.34), medium 50 (24.87), good 16 (18.82) from Wolaita Sodo municipal abattoir. However, this disagreed with the observations of Shitahun *et al.*, (2018) who referred higher prevalence in good 247 (56.9), than medium 8 (1.8), than poor 3 (0.69) from Addis Ababa municipal abattoir. Body condition score was statistically significant with rate of organ condemnation ($P < 0.05$). This variation may be due to when animals suffer shortage or scarcity of nutrition, their immunity compromised. Hence, possibly this can be accounted for the higher prevalence in poor body conditioned animals Mekuria *et al.*, (2013).

In the current study prevalence of organ rejection rate with respect of animal origin was relatively higher from Dagahbur 20 (34.5%) followed by Fik 19 (29.7%), Kabridaher 3 (23.1%), Jigjiga 16 (22.2%), Shinile 16 (20.5%), then Babile 29 (19.7%). This finding is in disagreement with the report of Nejashand Walkite, (2018).

This finding agreed with the report of lowland has higher prevalence than midland and highland Alemayehu *et al.*, (2013) in Luna Export abattoir. While, This result disagreed with the report of Yalew *et al.*, (2015) high prevalence rate for highland than midland and lowland from Dessie municipal abattoir. For origin there was no statistically significant difference ($P > 0.05$). The difference in the prevalence of different places in this study may be due to the difference in management practice, environment factors and climate variation and husbandry action.

In the present study disease encountered during postmortem examination were hydatid cyst, emphysema, pneumonia, abscess, and calcified cyst in lungs with prevalence rate (58.7%). Hydatid cyst, calcification, discoloration, and cirrhosis in liver with the rate of (46.9%). Calcified cyst, pericarditis, hydatid cyst, and adhesion in heart (9.25%). Hydatid cyst, and hydronephritis in kidneys (1.6%) among all these the most pathological findings in slaughtered camels at the abattoir were lung lesions with total number of (254) lungs followed by (203) liver, (40) heart, and (7) kidneys.

The overall prevalence of this study of hydatid cyst in lungs (23.8%) and in liver (17.8%). This finding is relatively closed with reports of (18.7%), (16.62%), (18.86%) of Dawit *et al.*, (2018), Tenaw *et al.*, (2015) Moges *et al.*, (2001) respectively. This result was lower than the report of (28.6%) lung (28.2%) that followed by liver (21.2%) by (Mersha *et al.*, 2014) Jemalo *et al.*, (2018) in Dire Dawa, and Assella municipal abattoir respectively. This result much lower than with the report of Haimanot *et al.*, (2015) (73.75%) liver, (14.34%) lungs. Similarly, lower than the report (35.25%) by (Ahmadi *et al.*, 2005) in Iran and (32.85%) by (Mohamed *et al.*, 2010) in Saudi Arabia in lung on other hand, this finding had higher prevalence of camel hydatidosis reported (4.5%) by (Woubet *et al.*, 1987) in Harar municipal abattoir, Ethiopia. And Hydatid cyst was most frequently reported abnormalities with present in this study due to its size, blood supply and availability of oxygen supply (Urquhart *et al.*, 1996).

On this study the prevalence rate of pneumonia and emphysema were 48 (11.11%), 68 (15.7%) respectively. This findings agreed with the report of (16.88%) Pneumonia and it was disagreed (5.63%) for the Emphysema by Haimanot *et al.*, (2015) from Dire dawa municipal abattoir. Similarly, the result was disagreed with the report of (6.77%) Emphysema by Ame ne *et al.*, (2012) from Jimma municipal abattoir. However, this outcome much lower than the report of (43.75%) Emphysema by Seboka, (2008) from Addis Ababa Abattoir. This result higher than (3.33%), (6.0%) pneumonia by Jemalo *et al.*, (2018), Casdamus and Adeskan, (2009) from Asselle municipal abattoir, and from Nigeria. The variations of the infection rates could be due to the variations in the temperature, environmental conditions and the nature of the pasture and the way of rising and grazing of these animals. The prevalence may however vary from country to country or even within a country. Generally the variation in prevalence rate among different

geographical locations could be ascribed to the strain differences of *Echinococcus granulosus* that exists in different geographical locations and different species of livestock McManus *et al.*, (2006).

For liver condemnation rate of this study revealed 203(46.9%); 77(17.8%) hydatid cyst, 25(5.8%) calcification, 19(4.4%) discoloration, 82(19.0%) this study is indicated that hydatid cyst was the most pathological lesion cause of liver condemnation where as the whole frequency of liver condemnation is similar to the report of 46.2% Asmare *et al.*, (2012) in Jimma municipal abattoir and its closely related to the report 43.95% by (Nigatu *et al.*, 2015) in Addis Ababa abattoir. This finding also higher than the reports of (29.7%) report of Asmare *et al.*, (2012) in Bahir dar municipal abattoir and (8.83%) by Tenaw *et al.*, (2015) in Akaki Abattoir, (31.1%) Denberga *et al.* (2011) in Gondar ELFORA abattoir (31.1%) Yifat *et al.* (2011) in Gondar ELFORA abattoir and (17.58%) Alembrhan and Haylegebriel (2013) in Adigrat abattoir. And also (40.9%) Jemalo *et al.*, (2018) in Assella Municipal Abattoir. And Fufa and Debele (2013), Ojo (1996) in which they reported 39.68% 20.28% in Nigeria and Wolaita Soddo municipal abattoir respectively. These findings are much lower than the reports of (66.55%) Nurit *et al.*, (2012) from Kombolcha Municipal Abattoir and 61.1% Genet *et al.*, (2012) from Gondar municipal abattoir. 59.37%, of Bedaso *et al.*, (2020) in Adama municipal abattoir. These differences within the country are attributed mainly to variations in the ecological and climatic conditions such as altitude, rainfall, and temperature, although differences in livestock management system and the ability of the inspector to detect the infection may play a part Amare *et al.*, (2017).

The rate of heart condemnation of this finding were 40(9.25%); 14(3.2%) Adhesion, 13(3.0%) hydatid cyst, 9(2.1%) calcified cyst, 4(0.7%) pericarditis. This result is similar with the report of 8%, 7.86% by Ahmed *et al.*, (2013), % by Nigusu *et al.*, (2015) in Ismailia Abattoir, and Addis Ababa abattoir respectively. This finding is higher than reports of 1.55%, 4.43%, 3.71%, 1.0%, 0.44%, Bosenu *et al.*, (2015), Yalew *et al.*, (2015) Shegaw *et al.*, (2009) Yifat *et al.*, (2011), Amene *et al.*, (2012) from Addis ababa Akaki abattoir, Dessie municipal abattoir, Mekelle municipal abattoir, Gondar municipal abattoir, Jimma municipal abattoir respectively. This finding is closely related to the report of 3.1% on hydatid cyst However on the other hand is higher than 4.9% on pericarditis Wale *et al.*, (2017) in Jimma municipal abattoir. And also This result in line with the report of 2.3% hydatid cyst and in higher than

in 2.2% pericarditis by Jemalo *et al.*, (2018) from Assella municipal abattoir. On contrary, higher prevalence were reported 11% by Amene *et al.*, (2012) in Jimma Municipal Abattoir. This result disagreed with the report of 10.67%, hydatid cyst 4.2% pericarditis Haimanot *et al.*, (2015) from Dire Dawa municipal abattoir. This finding much higher reports were recorded 36% in pericarditis by Kamarage *et al.*, (2000) from Gondar ELFORA Abattoir. 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 Jatenie *et al.*, (2014).

In this present study the prevalence rate of condemnation in kidneys 7(1.66%); hydatid cyst 3(0.7) and hydronephritis 4(0.9%). This finding is closer than the report of 1.8% Nejash and Walkite, (2016) from Dire Dawa municipal abattoir. This finding higher than the report of 0% Bosueta *et al.*, (2015) in Addis Ababa Akaki. However, this result lower than the report of 6.5%, by Shitaye *et al.*, (2016) from Hawassa municipal abattoir. This result was seen to be close than the report of 0.1% hydatid cyst by Jatenia *et al.*, (2014) from Adama municipal abattoir. This finding much lower than with the report of 21.43% hydronephritis by Haimanot *et al.*, (2015) from Dire Dawa municipal abattoir. Variation in the proportion of organs condemned due to gross pathological changes may be due to differences in agro-ecological condition of the animal environment that could be favorable to the causative agent, livestock management system and improper disposal of condemned organs Shitaye *et al.*, (2016).

The financial losses incurred in this study estimated as a result of organ rejection was 158,236.78 ETB/3,425.038 USD. This result was inline with the reports of 3,535,937.50 ETB/ 153,736.41 USD Bedaso *et al.*, (2020) from Adama municipal abattoir. This finding of the current study was lower than the reports of 1,839,760.00 ETB/99,446.49 USD, 182,448.9 ETB/8365.38 USD by Biressaw and Deneke (2017), Jemalo *et al.*, (2018), Dire Dawa municipal abattoir, and Assella municipal abattoir respectively. On contrary this finding was higher than the reports of 122,617.70 ETB/6,288.08 USD, 80,470.37 ETB/3,688.988 USD, Yalew *et al.*, (2016), Nejash and Walkite (2018) from Dire Dawa municipal abattoir, and from Dissie municipal abattoir. Variations in the amount of economic 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 current study deals with diseases caused by organ condemnation and their extensive financial impact. This study revealed an overall prevalence 29.1%. Lung was the mostly condemned organ in this study with the reason of hydatid cyst, emphysema, pneumonia, abscess and calcified cyst. The second organ was liver by cirrhosis hydatid cyst, calcification, and discoloration. In heart it was rejected by hydatid cyst, adhesion, calcified cyst, and pericarditis. In kidney it was condemned by hydatid cyst and hydronephritis. 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 and affected meat were condemned and rendered as unpassed for human consumption. Lack of knowledge about the diseases caused by organs to condemn and economic impact. Inappropriate disposal of abattoir materials were sustained the occurrence of the disease in the study area. Only pathognomic lesion were used as diagnose. Lack of well trained inspectors at abattoir and community awareness for the meat borne diseases. Pets were not restricted for the entrance of abattoir. There is no direct estimation on economic loss caused by rejection rate of organs in this slaughterhouse. Based on these conclusions the following recommendations are forwarded:

- Proper meat inspection was recommended for determining the diseases and reduce public hazards.
- Public awareness should be given to avoid eating of raw meat/organs hence for effective disease control.
- Immediate, safe and controlled elimination of all condemned abattoir materials and the sale of contaminated offal as pet's feed should be prohibited by law.
- On farm animal health management could reduce financial loss and increase economic return from the sector.

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Comment [A13]: Was there any result to conclude on the fact that inappropriate disposal of abattoir materials led to the sustained occurrence of the disease?

Comment [A14]: Was there a survey that was conducted among the inspectors to gauge their knowledge?

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