MAJOR METACESTODES OF CATTLE SLAUGHTERED AT ASSOSA TOWN ABATTOIR AND COMMUNITY AWARENESS ABOUT MODE OF TRANSMISSION OF ZOONOTIC CESTODES IN BENESHANGUL GUMUZ, WESTERN ETHIOPIA

Asmamaw Aki * and Robel Tesema

*Assosa Regional Animal Health Diagnostic and Research Laboratory, P.O.BOX 326, Cell phone +251902330029, asmamawaki@gmail.com

ABSTRACT: A cross-sectional study was conducted to assess the prevalence and associated factor of major metastases in slaughtered cattle and its community knowledge about mode of transmission of zoonotic cestodes at Assosa town Municipal Slaughter house. Out of (N= 384) bovine examined, 157 (40.88%) cattle were positive for Metacestodes, of which 116 (30.20%) and 41 (10.67%) were infected with Hydatid cyst and Cysticercus bovis, respectively, with different organ distribution. The highest prevalence of hydatid cysts was observed in lung (50.86%), followed by liver (35.34%). While the highest prevalence of Cysticercus Bovis was detected in tongue (33.33%) followed by (24.39%) masseter and (21.95%) shoulder. Besides this,out of 116 hydatid cyst identified, the proportion of small, medium, and large cyst were 70.68%, 21.55% and 7.75%, respectively. While 70.73%, 21.95% and7.31% were small, medium and large C. bovis cyst size. In this study, animal origin, sex, age and body conditions of animals were significantly associated with metacestodes ($p<0.05$). The questionnaire survey indicated that there is knowledge, attitude and practices gap that predispose the communities to metacestodes infection. Backyard slaughtering habit, improper disposal of condemned organs, and wastes were cause of transmission of methods. The findings of this study indicated that bovine hydatidosisis and cysticercosis were highly prevalent in slaughtered animals in the study abattoir. Meanwhile, the close association of people with dogs especially children who can easily acquire this disease may further exacerbates the risks indicating very low knowledge of the local community on the way of transmission of the diseases as well as predisposing risk factors. Therefore, implementing public education and control strategies targeting both the parasites and the intermediate hosts are recommended. And also the presence of prevalent metacestodes which have significant impact on the health and production of the cattle in the study area. Therefore, Control of the parasite directed both in the intermediate and definitive host should be carried out.

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Key words: *Assosa town; C. bovis; metastases; Hydatid cyst; prevalence; abattoir.*

1. INTRODUCTION

1.1.Back Ground

Taeniasis and hydatidosis are parasitic zoonoses that present major public health problems in lower income countries (Gebretsadik, 2016). Bovine cysticercosis refers to the infection of cattle with metacestodes of the human tapeworm Taenia saginata Bovine cysticecrosis is a major problem for producers in sub Saharan Africa. The clinical effect of cysticercosis on infected animal is generally not significant, however, in addition to the effect on human health, economic losses may be high due to the condemnation of heavily infected carcasses and the necessity to freeze or boil infected meat, restriction of export and herd quarantine. Hydatidosis is a zoonotic infection caused by adult or larval stage of cestode belonging to the genus Echinococcus. Hydatid disease (Hydatidoisis is characterized by cyst containing numerous tiny protoscolices that most often develop in the liver and lungs and also develop in the kidney , spleen, nervous tissue, bone and other organs(Kaleab, 2019).

The nation's domestic meat consumption of about 45% comes from cattle, which generates export income mainly from the sale of live animals. In foreign trade, although the country is ideally placed to export live animals to the big markets of the Middle East and substantial markets of North and West Africa, export earning is relatively low. This is mainly due to the presence of a number of unimproved animal health problems, among which, Taenia saginata (T.

saginata) or Cysticercus bovis (C. bovis) is one that remains a major public and animal health problem(Chiesa , 2011).

As parasites, flatworms have extended their global presence by taking advantage of the adaptations of many diverse invertebrate and vertebrate hosts. Many parasitic forms are host-specific and many of these are site specific within or on their host. Contemplate on the biodiversity of vertebrates; consider that many platyhelminths use one or more intermediate hosts and one may just begin to grasp the diversity of parasitic flatworms. From the microscopic interstitial free-living species that live between particles of mud to the enormously long tapeworms of blue whales, an estimate of 100,000 extant species, of which only about 20,000 have been formally described, still seems conservative when we consider the hosts and habitats yet to be surveyed. Even among those hosts and habitats already surveyed, many of the smaller parasitic species seem to have been overlooked and new species from commonly collected hosts are not un common (Ezeddin, 2016).

Animal diseases are one of the most important constraints to increase productivity of food animals in all parts of the world. Parasitism is one of the major problems that affect the productivity of livestock worldwide. Among many parasitic problems of domestic animals, tapeworms are an economically important intestinal parasites found all over the world, which have infected human beings for thousands of years. Bovine cysticercosis is a disease that affects the muscle of cattle and is caused by the metacestode stage of the human intestinal cestode, T. saginata. It is cosmopolitan in its distribution and it occurs in developing as well as in developed countries. The adult Taenia infection in man is referred to as Taeniasis and that due to the larval stage cysticercosis (Tadesse , 2014).

The distribution is associated with economic conditions, religious beliefs and close proximity of humans to cattle in utility function. T. saginata is wider in developing countries where hygienic conditions are poor and where the inhabitants traditionally eat raw or insufficiently cooked meat. The infection is also a problem in developed countries where undercooked beef steak is consumed. It is important to note that eggs have been demonstrated to survive almost all stages of sewage treatment. It is significant; to that even the high standard of meat inspection in abattoirs of highly developed countries that are expected to identify measly beef carcasses has not succeeded
(Gebretsadik, 2016).

Cestodes of the family Taeniidae infect dogs and humans as the definitive host and are transmitted to a wide range of intermediate host species where they cause Hydatidosis, and Cysticercosis, respectively. Among the parasitic diseases metacestode of Taenia saginata and Echinococcus granulosus are the most important ones because they have economic as well as public health significance (Regassa *et al*., 2009; Abunna *et al*.,, 2008). Metacestode of taeniasis and echinococcosis prevalence are considered to be higher in developing countries because of poor sanitation, traditional cattle husbandry systems and inadequate meat inspection facilities (6Dorny *et al*., 2000)

In the past zoonotic diseases were limited to populations living in low- and middle-income countries, but the geographical limits and populations at risk are expanding and changing because of increasing international markets, improved transportation systems, and demographic changes. Most parasitic zoonoses are neglected diseases despite causing a considerable global burden of ill health in humans and having a substantial financial burden on livestock industries. Although the global burden for most parasitic zoonoses is not yet known, the major contributors to the global burden of parasitic zoonoses are toxoplasmosis, food borne trematode infections, *cysticercosis, echinococcosis,* leishmaniasis and zoonotic schistosomasis (Torgerson and Macpherson, 2011).

The problem of food borne parasitic zoonoses could be further complicated in Ethiopia by lack of efficient inspection at critical control points in abattoirs, lack of awareness and knowledge on the mode of transmission and public health hazard of these diseases as well as due to presence of widespread habit of raw meat consumption both in rural and urban communities. A number of reports in Ethiopia indicated that, certain groups who had easy access to raw meat and meat products (Butchers and abattoir workers) and those people with low level of formal education were reported to be more infected with parasitic zoonosis than those who had low access to raw meat and those with better education. This implies that the frequency of raw beef consumption is higher in these groups of people (Nigatu*et al.,* 2009; Adugna*et al.,* 2012).

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metacestode of Taeniasaginata and Echinococcusgranulosus are the most important ones because they have economic as well as public health significance (Regassa *et al.*,2009; Abunna*et al.*,2008).

Hydatidosis and Taeniosis are parasitic zoonoses that present major public health problems in lower income countries and some industrialized countries (Mehrabani *et al.,* 2019; Utulas*et al.*,2024; Dorny*et al*.,2024). Metacestodes of *taeniasis and echinococcosis* prevalence are considered to be higher in developing countries because of poor sanitation, traditional cattle husbandry systems and inadequate meat inspection facilities (Dorny*et al.*,2021).

C. Echinococcosis is a neglected tropical disease, which affects the poorest population living in remote, rural areas, urban slums and in conflict zones. It has an important public health importance and can cause substantial economic losses (WHO, 2016). As the case with other neglected tropical diseases, echinococcosis has a low profile and status in public health priorities. The WHO estimates that about one billion people are affected by neglected tropical disease (Heath *et al.,* 2024)

Hydatid cyst is the metacestodes of the tapeworm *Echinococcusgranulosus*. Adult worms have been reported to be found in small intestines of dogs and wild carnivores like the wolf and fox. Infested carnivores eliminate eggs with their faeces. Herbivores (intermediate host) become infested with the eggs on account of having fed on contaminated pastures (Craig PS *et al.*,2019) Man is infected incidentally up on ingestion of infective eggs in contaminated water, vegetables and other food or through direct contact with dog. Possible intermediate hosts for Cysticercus cerebralis are sheep and goats, for cysticercusbovis are cattle and buffalo, and for hydatid cysts, domestic ungulates and man act as an intermediate host (Tariku *et al*., 2019).

Adult cestodes live attached deep inside mucosal crypts of definitive hosts small intestine of dogs. The parasite is 3 to 6 mm long. It has 22 large hooks and 18 small hooks on scolex and usually has three proglottids, of which only the last is gravid (Kedir.,2024). The gravid proglottid contains several hundred eggs, detaches from strobila is expelled with feces, and distintegrates in the environment. Each egg contains an embryo (oncophere) with six hooks (hexacanth), Which is infective when ingested by intermediate host and continue its development. Intermediate hosts are sheep, goats, bovine, swine, equine, camelids, canids and man. The most common localization of these cysts in the intermediate hosts are the liver (in about two-thirds of the cases) and the lungs (in about fourth of the cases). On rare occasions they may become situated in some other organs such as the kidneys, spleen, bones and brain (Nigus A *et al*., 2021).

In animals, the disease does not produce any clinical signs and is usually only discovered during meat inspection at the slaughterhouse where the viscera (mainly liver and lungs) are condemned (Muluneh *et al*.,2019).

Bovine cysticercosis refers to the infection of cattle with metacestodes of the human tapeworm (Gutema, 2020; Abera, 2022). Ingested eggs develop into cysticerci, which can often be detected during meat inspection at the routinely inspected localization sites of the parasite, including heart, skeletal muscle and diaphragm (WHO, 2022). Most incidents in cattle arise as a result of direct exposure to proglottids shed from farm workers, but there have been some reports of large scale outbreaks resulting from sewage-contaminated feed or forage (Joshua *et al.,* 2022).

Human beings are the obligate final host and become infected by ingesting beef having the parasite that has been inadequately cooked or frozen. Taeniasaginata occurs in the small intestine of human and the metacestode *(Cysticercusbovis*) is found in cattle (Aragaw *et al*., 2017). The life cycle and transmission of *T. saginata* occurs most commonly in environments characterized by poor hygiene, poor sanitation, poor livestock husbandry practices and inadequate meat inspection and control and also where inhabitants 2 traditionally eat raw or insufficiently sun cured or cooked meat (Fanta ., 2020; Veronique *et al*., 2018).

Both bovine *cysticercosis and hydatid* cysts are considered as an important public health and economic problem in most developing countries including Ethiopia (Abunna*et al.,* 2007). Hydatidosis is considered as one of the world's most geographically wide spread zoonotic diseases. The pathogenecity of hydatidosis heavily depends on the extent and severity of infection and the organ on which it is situated. The occasional rupture of hydatid cysts often leads to sudden death due to anaphylaxis, hemorrhage and metastasis (Marriott *et al.,* 2010).

Hydatid disease in human is a very serious disease and no person should consider theme selves immune from this

disease. The disease is caused by hydatid cyst growing in the body and the sites commonly infected in human are liver, lungs and peritoneal cavity (Habtamu *et al*., 2024). The most serious consequence of hydatid disease is when the cyst ruptures and causes anaphylactic reactions, which may be fatal (Tesfaye *et al*., 2024).

Taenia saginata infestation in human is accompanied with mild symptoms ranging from nausea, abdominal discomfort, epigastric pain, diarrhea, vitamin deficiency, excessive appetite or loss of appetite, weakness and loss of weight to digestive disturbances and intestinal blockage (Heyong, 2024).

1.2.Statement of the Problem

The larval stage of tapeworms generally, focuses on the significance health and economic impacts they cause in both humans and animals, particularly in regions with endemic infections. These impacts include morbidity, production losses, increased veterinary costs, mortality economic losses due to meat condemenations, and public health concerns related to zoonotic. Metacestodes like taenia solium cause disease such as cysticercus (infections in the brain, muscles and other organs and echinicoccus) hydatid disease, cysts in the liver, lung and brain. These diseases can lead to seven health complicatiin and disability (Samuel *et al*., 2024). Traditionally, consumption of raw or under cooked meat, poor hygiene and sanitation, lack of education regarding prevention of tapeworm infection, poor husbandry practices (poor livestock management practices) were major factors contributing the problems (Kedir, 2024).

Different studies were reported by different authors: prevalence of Taeniasis was 64.2% (Abunna *et al.*, 2007) and 50.6% (Regassa, *et al.*,2009) while that of *Cysticercosis* were 26.25% (Abunna *et al.*,2008) and 11.33% (Regassa, *et al.*,2009). On the other hand, Jobire *et al*. (Jobre*et al.*,1996) found prevalence of 46.5%, 25.7% and 24.3% of hydatid cyst in cattle slaughtered in Ethiopia; DebreZeit, South Omo and Gonder, respectively. While Regassa, *et al. (*2009) reported the prevalence to be 15.42% at Wolaita Soddo.

Additionally, several studies have reported the prevalence of *major metacestod* in abattoirs in Ethiopia (Moje*et al.*, 2014; Abunna *et al.*, 2008; Fromsa and Jobre, 2011; Hiko *et al.*, 2018).
In Ethiopia, abattoir based studies conducted on EC in various parts pof the country showed that prevalence of hydatidiosis ranging from 11.3 to 63 at Hara (Lemm *et al*., 2014) in bovine and 4.4% and 18.8% in sheep at Gondar (Tamene, 1986), 51% in cattle; 44% in Arsi; 30% in Borena, 85% in Jimma and 67% in Miesa were also reported by Hika *et al*., (2018).

According to Grace *et al*. (2012), Ethiopia ranks second in Africa in terms of the health burden of zoonotic illnesses. It has been observed to have a significant frequency of infections in humans with bovine cysticercosis in several zones of agro-climate. Numerous research on Taenia saginata cysticercosis and taeniosis have been carried out in various Ethiopian locations over the past few decades, using various sampling techniques and frequently subpar diagnostic approaches, with varying degrees of success. Human taeniosis prevalence estimates derived from meat inspection reports range from 1.2% (Dima, 2023) to 32.2% (Biza, 2018).

Prevalence estimates derived from questionnaires have been found to range from 19.0% (Bekele *et al*., 2016) to 89.41% (Tembo, 2001). About 45% of the meat consumed domestically in the country is produced by cattle, which mostly sell live animals for export. Even though the nation is well-positioned to export live animals and animal products to the sizable markets in North and West Africa as well as the Middle East, export earnings are still not very high. This is mostly because there are still a lot of unresolved animal health issues. Cysticercus bovis (C. bovis) or *Taenia saginata (T. saginata*) is one that continues to be a serious issue for animal and public health (Biruk, 2017), thus there needs to be enough focus on increasing exports abroad. According to Mohammed *et al*. (2021) inadequate cleanliness, insufficient meat inspection and control procedures, and poor animal husbandry practices are all to blame for Ethiopia's high prevalence of bovine cysticercosis. In addition raw meat consumption habit of our community is high.

Even though some studies were conducted on the prevalence of cysticercosis and hydatidosis, there is lack of adequate information on the status of these *metacestodes*in the study area which necessitated this study. This study underlines the implications of the diseases status to the country and globally owning to increased human movement and livestock trade. Despite the foregoing studies, the disease has not been well investigated, and information on its prevalence and cyst characterization is still inadequate, particularly at

Assosa town, abattoir. Furthermore, having sufficient information regarding the disease's prevalence, identification of cyst viability and fertility in the research area is critical for developing an appropriate preventative and control approach.

1.3 The objectives of the Study

1.3.1 General Objective

- To determine the prevalence, identification of cystic viability, fertility of *major metacestodes* from cattle Slaugtered at Abattoir and to assess community knowledge about mode of transmission of zoonotic cestode at study area.

1.3.2 Specific objectives

- To determine the prevalence, *of major metacestodes* from cattle slaughtered at *Assosa* Abattoir and risk factor.
- To identify viability, fertility and organ distribution, of *major metacestodes* at *Assosa* abattoir.
- To assess community knowledge about mode of transmission of zoonotic cestodes at study area.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in cattle, Slaughtered at Assosa Municipal abattoir, BenishangulGumuz Regional State, western Ethiopia. Nowadays, Assosa town is the capital city of BenishangulGumuz Regional State. The town has changed its administrative structure to two districts (district-1 and district-2). Each district as five "ketenas". According to BGRSMSC (2020), the town is located at 10º 00'and 10º 03' north latitude and 34º 35' and 34º 39' east longitude. The total population of the town is 62,632 of which 32, 100 are male and 30,532 are female (projection made for the CSA, 2020). The total area of the town is 2361.34 hectares with an altitudinal difference that ranges between 1461- 1641 meters above sea level (BGRSEIB, 2020). The mean annual temperature of Assosa town ranges from a minimum of 14-33^{0}C. However, there is a slight variation of temperature by month. February to May is the hottest months while November to December is the cold months.) The total amount of rain fall recorded at Assosa town during the last nine months of (2020) is 1,119 mm (BGRSMSC, 2020). The rainy season starts in March and extends to November with the highest concentration in June, July, and August. The population size of different livestock species in Assosa town are cattle 569, goat 1545, sheep 739, poultry 17676 donkeys 122, and pig 8 total 20,659 livestock populations are found in the town (ATAOA, 2020).

Figure 1: Administrative map of Assosa town (ATAO, 2021).

2.2 Study population

The study population were animals, which were presented to Assosa municipal abattoir for slaughter, which were zebu cattle originated from boundaries region. Animals which were presented to Assosa slaughter house for slaughter was local zebu cattle bought or originated from Banbasi district, Abrahamo and Ura market, and Oromia region (neibouring region) .

2.3 Study Animals

All local cattle that originated from neighboring localities or regions driven to *Assosa slaughter house*,for slaughter were included. Consequently, all male and female cattle was subjected for the study and age of the animals were grouped based on dentition. So that, those which have not erupted permanent incisor teeth, were classified as young, while those with pair or more permanent incisor teeth erupted was classified as adult (Alemu and Merkel , 2008). Animals which were coming to Assosa abattoir for slaughter were the study population. Animals were originated form Oromia, Ura, Abrahamo and banbasi districts. The origin of animals was obtained from merchants that supply animals to the abattoir.

2.4 Study Design and Sample Size Determination

A cross-sectional study was carried out from October 2024- April 2025. Simple random sampling technique was employed to select the study animals. The total number of cattle required for the study was calculated based on the formula given by (Thrusfield , 2005). Since there is no enough previous studies, about the disease, 50% expected prevalence were taken, with 5% desired level of precision and 95% of confidence interval was used to calculate the sample size using the following formula.

$$N=\frac{1.962 \times Pexp\ (1-Pexp)}{d2}$$

Where N= Sample size
Pexp= expected prevalence
d= desired absolute precision
Then by taking Pexp=50% and d=5%
N =1.962 x 0.5(1-0.5)/0.052
N=384.

Whereas, a questionnaire and retrospective type of study was based on the formula recommended by Arsham (Arsham H, 2002) N= $0.25/SE^2$, 0.25=SD, SE=5%), N=100, Where N=sample size, SE=standard error assuming the standard error of 5% at a precision level of 0.05 and the confidence interval of 95% accordingly, 384 animals was needed to be sampled. The sample size for the questionnaire survey was expected to be 100 for study area.

2.5 Study Methods and Sample Collection procedures

2.5.1 Ante mortem Inspection

A unique number was written on each study animal. The animals' ages, sexes, and body condition scores and origin of animals was noted. The study animals were rated for body condition using the following criteria: poor (hide bound with obvious bony prominences and deep sunk tail base), medium (ribs and other bony prominences noticeable on visual inspection but have fair fleshy background on palpation), or good (bony structures observable only on palpation). This classification was based on (Neary and Yager's, 2002) methodology.

According to DeLahunta and Habel (1986), the teeth of the study animals were used to assess their age. The age of the animal was estimated by looking to the dentition pattern of the animals (DeLahunta and Habel, 1986). Based on this, study animals was classified as < 5 year and >5 year. Animal origins were categorized into Banbasi, Abrahamo, Ura, Oromia region and from Unknown districts.

2.5.2 Post Mortem Inspection

During meat inspection, carcasses and their respective organs were carefully examined in accordance to the procedures of the Ethiopian Ministry of Agriculture Meat Inspection Regulation (1972) for the detection of C. bovis and C. Echinococcous. Samples collected from each positive organ were transported to Assosa University, College of Agriculture, and Natural Resources, Veterinary Science, Department of Veterinary Parasitology Laboratory for confirmation of cyst viability and fertility. The cysts were incubated at 37°C for 1-2hrs using 40% ox bile solution diluted in saline solution.

During meat inspection, each organ of an animal was strictly and separately examined to avoid mixing up of organs. The butcher and meat inspector also gave due attention to avoid mixing up of organs from different animals. On visiting days of each abattoir all slaughtered cattle was examined. Postmortem examination was conducted thorough visual inspection, palpation and systemic incision of each visceral predilection sites such as heart, tongue, masseter muscle, diaphragm, neck muscle, thigh muscle, spleen, liver and lung were being inspected carefully for the presence of *metacyst* of *C. bovis and C. Echinococcous*(Singh BB *et al*.,2014).

During the postmortem examination of *C. Echinococcous*, visual inspection, palpation and systemic incision of each visceral organs was performed particularly the liver, lungs, kidneys and heart. In parallel, serial number, date, infection, infected organ and number of cysts was recorded. Infected organs was collected in polyethene bags and taken to Assosa university veterinary laboratory to conduct cyst count, cyst fertility and viability of protoscoleces.The infected organs from positive animal will be collected; the total number cyst was counted per infected organ and recorded. The size of the diameter of hydatid cyst, was measured and classified as large (>10cm), medium (5 - 10cm) and small (Diameter (Kebede N *et al.*,2009).

2.5.3 Laboratory Examination

At the end of the examination, the cysts were collected properly labeled and the recovered cysticercus was separated with the surrounding tissue. All the positive samples was transported for Laboratory confirmation of cyst viability and fertility. The cysts were incubated at 37°C for 1-2hrs using 40% ox bile solution diluted in saline solution. Then, the scolex was examined under microscope by pressing between two glass slides. The cysts were regarded as viable if the scolexe vaginated.

Individual cysts were grossly examined for any evidence of degeneration and calcification. For the case of hydatid cysts, individual cysts was carefully incised and examined for protoscolices and fertility. Then, fertile cysts were subjected to viability test. A drop of the sediment containing the protoscolices was placed on the microscope glass slide and covered with cover slip and observed for amoeboid like peristaltic movements with (40X) objective. For clear vision, a drop of 0.1% aqueous eosin solution was added on microscope slide with the principle that viable protoscolices should completely or partially exclude the dye while the dead ones take it up (Macpherson *et al*., 1985).

2.5.4 Questionnaire Survey

Identification of respondents for questioner survey was based on random selection of volunteers who reside in Assosa town. By using the formula given by Arsham (2002), (0.25/SE2SE=5%), the sample size for the questionnaire survey was expected to be 100 respondents. The selection was irrespective of age, sex, religion and working conditions. Accordingly, 100 volunteer respondents were asked for study area. The questions were constructed in English, but during the interviews, the interviewers were translating the questions into Amharic and Arabic language for the respondent.

2.6 Data Management and Analysis

Data obtained from abattoir, Laboratory and questioner survey was collected and stored in to the Microsoft Excel spreadsheet and after coding, data was subjected to descriptive statistics and chi-square in order to assess the magnitude of the difference of comparable variables using SPSS version 20 software. Statistically significant association between variables is considered to exist if the p- value is less than 0.05.

2.7 Ethical Consideration

Ethical clearance letter was obtained from Assosa University College of Agriculture and Veterinary Science (CAVS) ethical review board. Verbal consent was agreed with the Assosa Administrative town and Assosa Slaughter House(Abattoir). During the study and interview with the respondents, voluteerness and consents of the participants were asked and acknowledged first. The entire moral, cultural, religious values of the community were respected. The confidentiality of information and privacy of participants during sample collection and interview was protected. Access to confidential records and computer files were privatized.

3. RESULTS OF MAJOR METACESTODES

3.1 Prevalence of Bovine Metacestodes

Both metacestode of the Taeniasis and echinococcosis are downgrading and responsible for lowering the quantity and quality of animal commodities. Out of (N=384) bovine examined N=157 (40.88%) were found to harbour hydatid and cysticercus bovis cysts. Among this, the overall prevalence of Cysticercosis in cattle slaughtered at Assosa Municipal abattoir was 10.67%, and hydatidiosis prevalence was 30.20%, which was significant ($p<0.05$). There was significant association ($P<0.05$) between metacestode prevalence and risk factor of animal origin, organ categories, age, body condition and sex ($P < 0.05$) (Table 3).

Table 3. Major Metacestod *C. bovis and Hydatid cyst* in slaughtered cattle atAssosa abattoir

Parasites spp	N=384	No. positive	Proportion	Prevalence (95%CI)
C. bovis	100	41	41	10.67
Hydatid cyst	284	116	40.84	30.20
Total	384	157	40.88	40.88

3.2 Organ and tissue Distribution of metacestodes

Majority of lung is found to be the commoniest hydatidiosis affected organ, followed by liver, heart and kidney are the affected organs. Whereas, the highest, prevalence of Cysticercus bovis was Tongue (36.58%), followed by 24.39% in massetor, 21.95% in shoulder, 14.63% in Diaphragm, and 2.43% in heart, which was significant ($P<0.05$)(Table 3).

Table 4. Organ and tissue distribution of metacestodes at Assosa Abattoir

Organ Inspected for Hydatidiosis(%)		Organ inspected for C. bovis	
Organ affected	**%**	Organ affected	%
Lung	59(50.86)	Tongue	15(36.58)
Liver	41(35.34	massetor	10(24.39)
Heart	10(8.62	Diaphragm	6(14.63)
Kidney	6(5.17	Shoulder	9(21.95)
		heart	**1(2.43)**
Total	**116**		**41**

3.3 Hydatid cyst

Higher hydatid **cyst occurrence** was recorded (34.55%) in greater than 5 years' age while (3.50%) in less than five years' age group of cattle which was significant ($P<0.000$; OR=2.56' Z=5.36). Higher hydatidcyst occurrence was recorded in cattle with poor (55.88%) followed by medium (31.53%) and good body condition scores (11.84%)($P<0.05$; OR=1.21; CI=1.01, 1.44). Based on the origin of cattle, majority of hydatid cyst occurrence was recorded in Oromia (36.11%)**, 30.62% in Urea, and followed by 4.16% in other areas** (Table 5). In majority of animals harboring hydatid cyst, the cysts had the tendency to be located more in **lungs (50.86%) and liver (35.34%**), followed by heart (8.62%) and (5.17%) (Table 5).

Table 5. **Factors associated with the occurrence C. echinococcous/hydatidiosis/**

Factors	Categories	N=384	Prevalence (N=116, %)	OR	95%CI	Z	P value
I.	Hydatidiosis						
Sex	Female	**332**	**95(28.61)**	**1.52**	**1.16-1.98**	**3.06**	**0.002****
	Male	**52**	**21(40.38)**				
Age	<5 years	**57**	**3(5.260)**	**2.56**	**1.81-3.62**	**5.36**	**0.000****
	>5years	**327**	**113(34.55)**				
BCS	Good	**152**	**18(11.84)**	**1.21**	**1.01-1.44**	**2.14**	**0.033***
	Medium	**130**	**41(31.53)**				
	Poor	**102**	**57(55.88)**				
Origin	*Ura*	**160**	**49(30.62)**	**1.48**	**1.21-1.82**	**3.85**	0.000**
	Oromia	180	65(36.11)				
	Others	**24**	**2(9.52**				

3.4 Cyst characterization of Hydatid Cyst

From the total 116 hydatid cyst collected at the abattoir during postmortem examination and subjected to sterility and viability testing, 69(59.48%) of them were fertile, and 47(40.51%) were non-fertile; out the fertile cysts, 50 (72.46%) were viable and 19(27.53%) non-viable; again, among the non-fertile, 32(68.08%) sterile and 15(31.91%) calcified (Table 6).

Table 6. **Fertility and viability status of hydatid cyst in different organs (N=384) organs inspected**

Inspected Organ	**Fertility 69(59.48%)**		**Non fertility 47(40.51%)**		**No.(%) of positive organs**
	Viabile	non viabile	Sterile	Calcified	
Lung	29	6	21	3	59 (50.86)
Liver	17	8	7	9	41(35.34)
Heart	3	3	2	2	10(8.62)
Kidney	1	2	2	1	6(5.17)
Total	**50 (72.46%)**	**19 (27.53%)**	**32(68.08%)**	**15 (31.91%)**	**116**

As indicated in Table 7, majority of the viable cysts were recorded in lung (49.2%), liver (36.58%), heart (30%), and followed by kidney (16.66%).

Table 7. Proportions of Viable and non- viable C bovis in different organs inspected

Organs	No. of cysts	**Viable cysts**		Non -viable cyst	
		Viable cysts	**Proportions (%)**	**non- viable**	Proportion (%)
Lung	59	29	49.2%	6	10.16%
Liver	41	17	36.58%	8	19.51%
Heart	10	3	30%	3	30%
Kidney	6	1	16.66%	2	33.33%
Total	116	50	43.10%	19	16.37%

Table 8. Proportions of Non fertility/ sterility/ C bovis in different organs inspected

Organs	No. of cysts	Non - fertility/ sterility	
		non - fertile/ sterile cysts	Proportions (%)
Lung	59	21	35.59
Liver	41	7	17.07
Heart	10	2	20
Kidney	6	2	33.33
Total	116	**32**	25.39

In line with non-fertility (sterility), higher non fertile (sterile) C. bovis proportional prevalence (35.59%) was recorded in lungs followed by kidney (33.33%), (20%) heart, 17.07% in liver (Table 8).

3.5 Distribution and Cyst size of Hydatid cysts

The Distribution of cystic echinoccocus in lung, liver, heart and kidney, was found to be 50.86 %, 35.34%, 8.62% and 5.17 % respectively. From the total of 116 cysts counted, 70.68% (82), 21.55% (25) and 7.75% (9) were small, medium, and large, respectively (Table 9).

Table 9. **Distribution and size of Bovine Hydatid cysts observed in different organs at Assosa municipal abattoir.**

Organ	Large		Medium		Small		Prevalence (N=116, %)	
	No.	%	No.	%	No.	%	No.	%
Lung	3	33.33	14	56	42	51.21	59	50.86
Liver	3	66.66	7	28	31	37.80	41	35.34
Heart	1	11.11	3	12	6	7.31	10	8.62
Kidney	2	22.22	1	4	3	3.65	6	5.17
Total	9	100	25	100	82	100	116	100

3.6 Occurrence of Bovine Cysticercus Bovis (Taenaisis) in slaughtered animals

The overall prevalence of Cysticercus bovis among cattle slaughtered and examined at Assosa municipality abattoir was found to be 10.67% (41/384). There was significant association (P <0.05) in C. bovis prevalence and risk factor such as in organ categories, age factor, sex, origin, and body conditions (P<0.05). Higher Cysticercosis (taeniasis) occurrence was recorded 40/327(12.23%) in greater than five years age followed by 1/57(1.75%) in young age group of cattle which was significant (P<0.05; CI= 0.24-0.50 ; OR=0.35). Higher cyst occurrence was recorded in cattle with poor (20.58%) followed by medium (10.76%) and good body condition scores (3.94%), which was significant (P<0.05). Based on the origin of cattle, Cysticercus bovis occurrence was 12.77% in Oromia, 10.62% in urea, 4.16% in other areas(Table 9), the association was significant (P<0.05). In majority of animals harboring C. bovis, the cysts had tendency to be located more in tongues (36.58%) , massetor (24.39%) and shoulder (21.95%), followed by diaphragm (14.63%) and lowest in (2.43%) in the present study(Table 10)

Table 10. Factors associated with the occurrence Cysticercus bovis (Taeniasis)

Factors	Categories	N=384	Prevalence (N=41, %)	OR	95%CI	Z	P -value
II.	Cysticercosis (Taeniasis)						
Sex	Female	**332**	**34(10.24)**	**0.36**	**0.26-0.50**	**6.11**	**0.002****
	Male	**52**	**7(13.46)**				
Age	<5 years	**57**	**1(1.75)**	**0.35**	**0.24-0.50**	**5.77**	**0.000****
	>5years	**327**	**40(12.23)**				
BCS	Good	**152**	**6(3.94)**	**0.39**	**0.30-0.51**	**6.80**	**0.000****
	Medium	**130**	**14(10.76)**				
	Poor	**102**	**21(20.58)**				
Origin	***Banbasi***	**160**	**17(10.62)**	**0.379**	**0.28-0.49**	**7.05**	0.000**
	Oromia	180	23(12.77)				
	Others	**24**	**1(4.16)**				

3.6.1 Characterization of Cysticercus bovis

From the total 41Cysticercus bovis collected at the abattoir during postmortem examination and subjected to sterility and viability testing, 30(73.2%) of them were fertile, and 11(26.82%) were non-fertile; out the fertile cysts, 19 (63.33%) were viable and 11 (36.66%) non-viable; again, among the non-fertile, 8(72.7%) sterile and 3 (27.3%) calcified (Table 11).

Table 11. Bovine C.bovis : Cyst fertility and Viability in different organs at Assosa at municipal abattoir

Inspected Organ	Fertility 30(73.2%)		Non fertility 11(26.82%)		Total
	Viabile	non viabile	Sterile	Calcified	
Tongue	8	4	2	1	15
Massetor	3	2	4	1	10
Diaphragm	3	2	1	0	6
Shoulder	5	2	1	1	9
heart	0	1	0	0	1
Total	**19(63.33%)**	**11 (36.66%)**	**8(72.72%)**	**3 (27.3%)**	**41**

Described in Table 12, majority of the viable cysts were recorded in heart(100%), diaphragm (83.33%), massetor (80%), tongue (66.66) and shoulder (66.66%)

Table 12. Proportions of Viable and non- viable C bovis in different organs inspected

Organs	No. of cysts	**Viable cysts**		Non -viable cyst	
		Viable cysts	**Proportions (%)**	**non- viable**	Proportion (%)
Tongue	15	8	53.33	4	26.66
massetor	10	3	30	2	20
diaphragm	6	3	50	2	33.33
shoulder	9	5	55.55	2	22.22
heart	1	0	0	1	100
Total	41	19	46.34	11	26.82

Table 13. Proportions of non-fertility/ sterility/ of C bovis in different organs inspected

Organs	No. of cysts	Non- fertile/ sterile cysts	Proportions (%)
Tongue	15	2	13.33
Massetor	10	4	40
Diaphragm	6	1	16.66
Shoulder	9	1	11.11
Heart	1	0	0
Total	*41*	*8*	*19.51*

3.6.2 Distribution and size of Cysticercus bovis/ Taeniasis/

The distribution of cysticercus bovis (Taeniasis) in Tongue, massetor, Diaphragm, shoulder, and heart muscle was found to be 36.58%, 24.39%, 14.63%, 21.95%, and 2.43%, respectively. From the total of 41 cysts counted, 70.73 % (29), 21.95% (9) and 7.31% (3) were small, medium and large, respectively (Table 14).

Table 14. Distribution and size of Bovine Cysticercus bovis observed in different organs at Assosa municipal abattoir.

Organ inspected	Large		Medium		Small		(Prevalence, %)		p -value
	No.	%	No.	%	No.	%	No.	%	0.000
Tongue	2	66.66	3	33.33	10	34.48	15	36.58	
Massetor	0	0	2	22.22	8	27.58	10	24.39	
Diaphragm	0	0	2	22.22	4	13.79	6	14.63	
Shoulder	1	33.33	2	22.22	7	24.13	9	21.95	
Heart							1	2.43	
Total	3	100	9	100	29	100	41	100	

With regards to communitity knowledge about transmission on zoonotic metacestodes, majority 76% of respondents have dog ownership while 24% of them did not have dog ownership in the Assosa Administrative town. *54% of community in the Assosa twon did not tie or not keep their dog in –house and 92% of* them didn't share house for their dogs. 98% of the participants indicated that as the Assosa administrative town community feed uncooked visceral organs to their dog which might be risk of dog of contracted parasitism.

Consistently, 95% of the interviewer respondents noticed as their was hand washing practices after touching dogs as well as feces. 80% of the respondents didn't deworm and vaccinate their dogs so that their should be risk of zoonotic parasitism and transmission of disease to humans, due to the host factors. Consistently, 93% of the society in the Assosa town, had knowledge as the dog could transmitted disease to humans. 65% of respondent participants had the knowledge as the dog could transmit disease to humans through different transmission modes. 89% of the Assosa twon society did not have knowledge as the tapeworm was from dog that transmit to human and 95% of respondents had no knowledge of cestodes and hydatidiosis.

Besides this, 79 % of respondents observed as they were latrine near the grazing areas of cattle, that could contaminated the cattles by hydatidiosis as well as Taeniasis and also 75% of the respondents, didn't know as the animals gets the cysts from contaminated grass, feces, contaminated water and feeding.65% of the respondent interviewers noted that, the society had knowledge on the transmission of disease by eating uncooked meat and viscera while 35% of them did not know.

97% of the Assosa town society noted as meat inspection done when they slaughter cattle at home.70% of the participant interviewer did not heard of Taenia saginata, while the rest didn't. 67% of the respondents said as cooking of meat thoroughly to prevent the transmission of tape worm was important. 64 % of respondents' indicated as they did not advised in the past not to eat raw beef meat and 69% of them, did not recognized the tapeworm infective form in meat. Similarly, 83% of respondents did not consumed of never tasted raw cattle meat used to eat kurt. And 78% of respondents were believed that butchers inform their customers on whether the meat is infected or not.

65% of respondents knew Backyard and home cattle slaughter tradition in Ethiopia is one of the major factors for the high prevalence of human tapeworm infection in the Country.52% of interviewers believe that Institution of a nationwide and rigorous (through) meat inspections procedure helps to dramatically reduce tapeworm infection prevalence in Ethiopia. 71% participants believe that prohibition of backyard and home slaughter cattle is one of the perquisites if a rational control of taeniasis/cysticerosis is envisaged (Contemplated) in Ethiopia.
89%of respondent participants noted as intend to stop eating raw and/or under cooked cattle meat just because of the zoonotic tapeworm infection.

Table 15. Questionnaire survey on community knowledge and attitudes in Assosa twon

Questionnaire items	Categories	Response rate (N=100, %)
Dog ownership	Yes	76 %
	No	24%
Do you tie up your dog?	Yes	46%
	No	54%
Do you share your house with dogs?	Yes	8%
	No	92%
Do you feed uncooked visceral organs of cattle to your dog?	Yes	98%
	No	2%
Do you have Hand washing practice after contact with dog, dog feces soil?	Yes	95%
	No	5%
Are you Deworming and vaccinate your dogs?	Yes	20%
	No	80%
Do you have Knowledge ,Dogs can transmit disease to humans?	Yes %	93%
	No	7%
Do you have Knowledge on the transmission of disease from dogs to human?	Yes	81%
	No	19%
Do you have Knowledge on the transmission of disease by eating uncooked viscera?	Yes	65%
	No	45%
Knowledge on dog tapeworm?	Yes	11%
	No	89%

Knowledge on Zoonotic Cestodes hydatidosis?	Yes	5%
	No	95%
Are there any latrines in the areas where cattle are grazed?	Yes	79
	No	21
Animals get the cyst from contaminated grass, Feces, contaminated water and feeding?	Yes	25
	No	75
Knowledge on the transmission of disease by eating uncooked meat and viscera?	Yes	65
	No	35
Is meat inspection done when you slaughter cattle at home?	Yes	97
	No	3
Have you ever heard of T. saginata/ hydatidiosis? before?	Yes	30
	No	70
Do you think it is important to cook meat thoroughly to prevent the transmission of these tapeworms?	Yes	67
	No	33
Have you ever been advised in the past not to eat raw beef meat ?	Yes	46
	No	64
Do you recognize the tapeworm infective form in meat?	Yes	31
	No	69
Do you Consumption of Never tasted raw cattle meat used to eat kurt?	Yes	17
	No	83
Do you believe that butchers inform their customers on whether the meat is infected or not ?	Yes	78
	No	22
Do you know Backyard and home cattle slaughter tradition in Ethiopia is one of the major factors for the high prevalence of human tapeworm infection in the Country?	Yes	65
	No	35
Do you believe that Institution of a nationwide and rigorous (through) meat inspections procedure helps to dramatically reduce tapeworm infection prevalence in Ethiopia?	Yes	52
	No	48
Do you believe that Prohibition of backyard and home slaughter or cattle is one of the perquisites if a rational control of taeniasis/ cysticerosis is envisaged (Contemplated) in Ethiopia?.	Yes	71
	No	28
Do you intend to stop eating raw and/or under cooked cattle meat just because of the zoonotic tapeworm infection?	Yes	89%
	No	11%

4. DISCUSSION

Bovine metacestodes had impacts on livestock and also had a zoonotic and socio economic importance. It has been reported to be wide spread and a common disease in Africa (FAO, 2005). Ethiopia also shares the problem of parasitism on livestock production in the tropics. Bovine cysticercosis usually does not cause much morbidity or mortality among cattle, but it does cause serious economic problems in the endemic areas due to the condemnation of meat or down grading of carcasses (Wanzala *et al* 2003) contributing to constraint in food security and safety.
Both metacestode of the Taeniasis and echinococcosis are downgrading and responsible for lowering the quantity and quality of animal commodities. Out of 384 bovine examined 157 (40.88%) were found positive for Metacestode. Among this, the overall prevalence of cysticercosis in cattle slaughtered at Sherkole Municipal abattoir was 10.67%, and hydatidiosis prevalence was 30.20%. This findings were comparable with Getachew *et al*., (2022) revealed that, 51.3% of metacestode prevalence in slaughtered cattle at Jimma municipal abattoir South west Ethiopia.

The overall occurrence of Cystic echinococcosis (CE) in cattle slaughtered in Assosa abattoir during the study period was 30.20%. This CE prevalence aligns with the results reported by Kebede *et al.* (2009a, 2009b) 34.5% in Bahir Dar, 52.69% Regassa *et al*. (2010) 52.69% in Hawassa, Nuraddis *et al*. (2017) 63.7% in Asella, Kebede and Mekonnen (2020)) 40.2% in Dodola.

However, the present CE findings were higher (30.20%) as compared to the findings of Kebede *et al*. (2009a, 2009b)

who found a prevalence of 16% in Wolita Sodo, Assefa and Tesfaye (2014) with 18.61% in Adigrat, as well as Alebie *et al*. (2016) with a prevalence of 17.97% in Debrezeit. In addition, the present CE prevalence was greater than the previous works reported by Bezuayehu *et al*. (2014)11.3% in Harar; Ochi *et al*. (2016) 3.99% in Juba, South Sudan; Abera and Teklebran (2017) 11.21% in Wolayta; Akeberegn *et al.*, (2017) 6.5% in Debre Berhan.

With regards to Cyst fertility and sterility, in the present findings, 69(59.48%) of them were fertile, and 47(40.51%) were non-fertile. 50 (72.46%) were viable and 19(27.53%) non-viable. Consistently, 32(68.08%) sterile and 15(31.91%) calcified were recorded in the Assosa local municipal abattoir. 50.86%, 35.34%, 8.62%and 5.2% of Cystic echinoccoccus prevalence was recorded in offals of lung, liver, heart and kidney respectively.

With regards to hydatid cyst viability test of the cysts, lung harbored the highest number of viable cysts (49.2%) followed by liver (36.58%), heart (20%), and kidney (16.66%). The lower occurrence of hydatid cyst in the present study might be due to poor visualization facilities where there is frequent interruption of power, inspection conducted in poor light or not at all due to darkness that the haydatid cyst could pass the inspection unnoticed. Furthermore, backyard slaughter is practiced in the area reducing the number of animals brought to slaughter in the abattoir. During backyard slaughter infected organs are left unburied in the field accessed for dogs and other carnivores which favor the transmission cycle of cystic echinococcosis. The culture and tradition of inhabitants in the study area favor the keeping of dogs in periurban are as (urban and rural households) often in close association with the family and farm animals. Almost all cattle owners, shepherds and urban dwellers keep at least a dog to safeguard their properties from wild carnivores and thieves. These in the areas studied are considered to be conducive to the maintenance and further propagation of cystic echinococcosis (Kebede *et al.,* 2010).

Higher infection of cystic echinococcosis was registered in adult cattle (> 5 years) 34.55% compared to young cattle (less than 5 years) 3.50 % with variable number of hydatid cysts observed among different organs examined which was significantly associated($P<0.05$; OR=2.56; Z=5.36). This is in line with the reports of Zewdu *et al.*, (2010) 22.91% old and 6.78% adult; Mandefro *et al.* (2019) 66.1% old and 29.5% adult; Akeberegn et al. (2017) 8.71% old and 2.8% adult; Kebede and Mekonnen (2020) 43.4% old and 19.0%. The higher CE prevalence in older cattle than the younger ones might be due to the persistence prolonged exposure to E. granulosus s.l. eggs, the development of hydatid cysts and reduced immune status as a result of longer exposure time to the eggs of the parasite in old than younger cattle.

Higher cattle hydatid cyst occurrence was recorded in poor body condition (55.88%) and medium (31.53%) and good body condition scores (11.84%), which was significant ($P<0.05$; OR=1.21; CI=1.01, 1.44).this result is in agreement with the findings of Melaku *et al.* (2012) and Bezuayehu *et al.*, (2014)**.**

Based on the origin of cattle boughted from slaughtered cattle occurrence of bovine hydatid cyst was higher in oromia town compared to the other Banbasi and other nearby woredas study districts due to the fact that the municipality of Assosa twon, was frequently using annual dog vaccination, KAP awareness to community, and stray dogs management program to reduce rabies outbreak in the district. This might have resulted in reducing contamination of pasture by stray dogs.

In the current study cystic echinococcosis was frequently encountered in the lungs (50.86%), liver (35.34%), heart (8.62%) and kidney (5.2%). This is explained by the fact that lungs and livers possess the first great capillaries sites encountered by the migrating echinococcus oncosphere (hexacanth embryo) which adopt the portal vein route and primarily negotiate hepatic and pulmonary filtering system sequentially before any other peripheral organ is involved (Kebede *et al*., 2009a, 2009b).

In addition, the lungs were mostly affected than any other organ this is most probable due to the fact that ruminants are slaughtered at older age. During this period the liver capillaries are dilated and most cysts directly pass to the lungs. Additionally, it is possible for the hexacant embryo to enter the lymphatic circulation and be carried via the thoracic duct to the heart and lungs in such a way the lungs may be infected before or instead of the liver (Tigre *et al*., 2016; Romig *et al.,* 2017). This finding can also be explained by the species causing CE in cattle. Usually *E. ortleppi* which uses cattle as the main intermediate host, occurs predominantly as fertile cysts in cattle lungs (Romig *et al.,* 2017). E. ortleppi is rare in Ethiopia but has been reported in pig, sheep and cattle (Tigre *et al*., 2016; Terefe *et al*., 2019; Aregawi *et al*., 2024).

In the current study, the predominant size of the hydatid cysts was seen to be small. The high proportion of small cysts may indicate late infection of the animals due to immunological response of the host which might preclude expansion of cyst size. The fertility rate of cysts was higher in lungs than liver due to softer consistency of lung tissue which allows easier development of the cysts and favors their fertility rate (Getaw *et al.,* 2010). The economic loss due to cystic echinococcosis in the current study was the sum of direct economic loss, the loss associated with condemned organs and the indirect economic loss that is the loss associated with reduced carcass weight.

The prevalence of C. bovis among the carcasses inspected at Assosa municipal abattoir was 10.67% which is in agreement with the findings of Tegegne *et al*. (2018) (8.97%) in Kombolcha, Moje et al. (2014) (10.1%) at Shashamanne; Kebede et al. (2009) (7.5%) and Regassa et al. (2009) (11.3%) both at Wolaita Soddo abattoirs.11.3% prevalence from Wolita Soddo and 7.5% from Addis Abeba by Regassa *et al*. (2009) and Kebede et al. (2009a) respectively.

On the other hand this finding was slightly higher than the 2.58% in Bahir Dar (Birhanu M et al., 2013). 2.98% from Nekemte (Abunna *et al*.,2011). 4.4% from Jimma (Megressa *et al.,* 2010).

Besides this, as compared to present findings, lower prevalence of C. bovis were registered by Tamirat *et al*. (2018) (4.2%) at Bahir Dar, Ibrahim and Zerihun (2012) (3.6%) at Addis Ababa abattoir, Taresa et al.(2011) (3.65%) at Jimma, Dawit (2004) (4.9%) at Gondar, Megersa *et al*. (2010) (4.4%) at Jimma and Bedu *et al*. (2011) (3%) at Zeway. However, higher C. bovis was reported by Abunna *et al*. (2008) (26.25%) at Hawassa.
As compared to the present findings, lowers cysticercosis prevalence was reported, from Bedelle municipality abattoir 2% (Kano *et al*.,2018), 2.6% around Batu (Addisu *et al*., 2015), and 1.7% from Shashemene (Moje *et al*., 2014). Conversely, the current finding lower than previous findings conducted in Southern Ethiopia 26.25% (Belachew, 2012) and also in Hawassa municipal abattoir (22.9%) (Tesfaye B. 2019) and in Northwestern Ethiopia (18.49%) (Kebede N *et al*., 2008). But this study is relatively higher than study conducted in Croatia (0.11%) (Zdolee N *et al*., 2005) and South Africa (0.2%) (Dzoma *et al*., 2011). This could be due to better application of public health extension education (developing the habit of using a toilet) and meat inspection techniques.

However higher prevalence were also reported by Abunna *et al*. (26.25%) (Abunna *et al*., 2008) in Hawassa, southern Ethiopia.

These variations in the reported prevalence from different areas could be attributed to the real differences in the prevalence of C. bovis from area to area within a country (Wanzala W et al.2003). Difference in raw meat consumption habit, dose and viability of eggs and/or larvae consumed at different places (Scandrett *et al*., 2009). Additionally, as gross mutilationlowers the marketability of carcasses and introduces contamination, in some cases owners do not allow multi incisions for the detail postmortem examination. This difference in the number of incisions made during inspection from abattoir to abattoir could result in this difference (Wanzala *et al.,* 2003).

The observed difference among these studies could be explained with the agro-climatic conditions of the study areas, the number of incision made during inspection, the ability of the meat inspector to identify the C.bovis, habit or culture of raw meat consumption, sample size and sampling method, level of environmental contamination with the eggs of *T. saginata*, dose and viability of egg consumed (Scandrett *et al.,* 2009). Low infection among the inspected animals in the present study area could be due to limited number of incisions made on the predilections sites. This may in turn lead to missing of infected animals as the sensitivity of detecting the parasite will decline with limited number of incisions (Wanzala *et al*., 2003). The presence and number of cysts in any given site varied greatly among animals and demonstrate the absence of any true predilection sites for C. bovis (Scandrett *et al*., 2009).

Higher Cysticercus bovis occurrence was recorded 40/327(12.23%) in adult age (greater than 5 years old), while 1/57(1.75%) in young age group of cattle which was significant (P<0.05). This findings were comparable with the findings of Getachew et al., (2022) in Jimma municipal slab house, who reported14.32% of metacestodes in less than 5 years old and 36.97% in greater than 5 years old.
Higher cyst occurrence was recorded in cattle with poor (20.58%) followed by medium (10.76%) and good body condition scores (3.94%), which was significant (P<0.05).It was comparable with the reports of Mesfin and Nuraddis (2012) (good=22.0% and medium=24.0%) and also agreed wth with the report of Abdulaziz et al., (2016) (good=7.0% and medium=15.9%). But higher as compared, with the study reported by Addisu and Wondimu (2015) (good=1.9%

and medium=5.8%). The reason behind low prevalence in good body condition than medium body condition might be due to the fact that most of the animals slaughtered in the abattoir were brought from fattening systems of the individual farmer, in which animals from such farms were less exposed to eggs of *T. saginata* as they graze on relatively clean defined pasture land; tying system to the pegs and intensive feeding system in the house for fattening purpose and use of anthelminthic drugs.

With regard to the origin of animals, based on the origin of cattle, the higher prevalence was 12.77% in Oromia, followed by 10.62% of cysticercus bovis recorded in Banbasi town, and then 4.16% in near woredas , which was significant (P<0.05), the study districts due to the fact that the abattoir of Assosa town was frequently using strychnine poisoning to remove stray dogs in a program to reduce rabies outbreak in the district as well as there was annually mass dog vaccination in the district. This might have resulted in reducing contamination of pasture by stray dogs. This variation of prevalence could be associated with their geographical differences and likely associated with the number of animals brought to the abattoir

From the total 41 Cysticercus bovis collected at the abattoir during post mortem examination and subjected to sterility and viability testing, 30(73.2%) of them were fertile, and 11(26.82%) were non-fertile. Similarly, 19 (63.33%) were viable and 11 (36.66%) non-viable. Again, among the non-fertile, 8(72.72%) were sterile and 3 (27.3%) were calcified.

With regards to cysticercus bovis viability test of the cysts, shoulder harbored the highest number of viable cysts (55.6%) followed by tongue (53.33%), diaphragm (50%), massetor (30%) and heart (0%).

The present study showed that tongue, massetor, Diaphragm, shoulder and heart were the predilection sites for the cysts of Cysticercus bovis which is similar to the results of Megerssa et al. (2010). This is explained by the fact that lungs and livers possess the first great capillaries sites encountered by the migrating cysterci oncosphere (hexacanth embryo) which adopt the portal vein route and primarily negotiate hepatic and pulmonary filtering system sequentially before any other peripheral organ is involved (Kebede et al., 2009a, 2009b).Regarding the anatomical distribution of the cysts, many researchers come up with different results like Abunna et al.(2008) and Getachew (1990) reported triceps as being frequently affected by the cyst, while Mulugeta (1997) found as heart as a preferable organ. However, the present study showed that the most frequently affected organ with the highest number of cysts was the tongue which is in agreement with different studies conducted in different parts of the country (Hailu, 2005; Bedu *et al*., 2011).

In line with Cysticercus bovis viability test of the cysts, tongue harbored the highest number of viable cysts (42.1%)followed byshoulder (26.32%), Diaphragm and massetor (15.78%),and heart (0%).However, the present finding was less than the findings of Lielt *et al*. (2015) and Dejene *et al*. (2017). It was also greater than the finding of Bekele *et al*. (2010) (42.9%). This findings implies, the method of meat inspection, the ability of the meat inspector to identify the cases, difference in the management, sample size and sampling method, the number of cuts, and other factors can contribute for the variation of prevalence of bovine cysticercosis and backyard slaughter is practiced in the area reducing the number of animals brought to slaughter in the abattoir. During backyard slaughter infected organs are left unburied in the field accessed for dogs and other carnivores which favor the transmission cycle of cysticercosis.

The culture and tradition of inhabitants in the study area favor the keeping of dogs in periurban are as (urban and rural households) often in close association with the family and farm animals. Almost all cattle owners, shepherds and urban dwellers keep at least 1 dog to safeguard their properties from wild carnivores and thieves. These in the areas studied are considered to be conducive to the maintenance and further propagation of cysticercosis (Kebede *et al.*, 2010).

In this study, higher respondents of male (58%) was more risk of zoonotic metacestodes as compared to female(42%).This findings were agreed with the reports of Kifle and Shiret (2015) in Debrebrhan, Abdulaziz *et al.*, (2016) in Halaba Kulito, Dawit *et al.*, (2012) in Wolaita Soddo and Tegegne et al., (2018) in Kombelcha but disgreed with that of Lielt *et al*., (2015) in Bishoftu. This higher prevalence in males could be due to the habit of males consume frequently raw beef at outdoor than females in the study area leading to higher exposure of C. bovis and males usually consume raw meat more often than females while practicing backyard slaughtering. The present study also revealed that the prevalence of T. saginata was significantly associated with different age groups of respondents (p<0.05).

The aged groups of greater than 35 years old had infection rate of (48%) while 16-25 years old age respondents had (44%) higher infection rate compared to those respondents between the age group of 25-35 years (8%). This agreed with that of Lielt *et al.,* (2015) in Bishoftu, Dawit et al., (2012) in Wolaita Soddo and Kifle and Shiret (2015) in Debrebrhan. But, this study disagreed with that report of Tegegne *et al.*, (2018) in Kombolcha. This could be explained by the fact that elderly have higher chance to consume C. bovis infected raw meat in different occasions including cultural ceremonies where raw meat is served as one of the major food items while younger, in generally, have no such access.

In this study there was statistically significance difference between proportions of taeniasis in different age, educational levels, occupation, residence, latrine availability, marital status, religion. However; sex and raw meat consumption habit was non significant ($p>0.05$). Previous reports from Ethiopia indicated that consumption of raw or inadequately cooked beef was strongly associated with T. saginata infection. In this study from 32 respondents who ate raw or inadequately cooked beef 13(40.62%) acquired T. saginata, confirming that 'kurt, kitffo and dullet' are all sources of viable cysts of the parasite, as found in previous studies (Endris, J. and Negussie, H. (2011), Bedu, H., *et al*.,2011, Megerssa, B. *et al.*,2010; and Abunna, F., *et al.,* 2008). It is therefore good to focus strongly on those edible parts of the carcass used for the preparation of these traditional dishes during meat inspection and public education.

52 % of the Assosa administrative twon society had the habit of consuming raw meat which has risk of zoonotic meta cestodes, while the rest eat meat by cock and use beef. Higher respondents indicated as metacestodes was the risk to iliterate (34%) followed by primary level (28%), secondary (24%), and college(14%) . 80% of the respondents in the community use toilet properly while 20 % did not use properly , that might contaminated others by the Taeniasis/ hydatidiosis.

In case of educational level similar findings were reported in other studies in different year (Megerssa, B *et al.,* 2016; Addisu, D. and Wondimu, D. (2015) and indicating insignificant infection rate among the various educational statuses. However, disagreed with studies reported in Hawassa town (Mesfin, B. and Nuradddis, I. (2012)) and in Southwest Shoa zone of Oromia Region (Adugna, T *et al*.,2013). This could be due to the long-time cultural habit of eating raw meat particularly that of 'kurt' and 'kitifo' in any social groups including those of the educated and even in the medical and veterinary professionals..

The questionnaire survey indicated that hydatidosis is not familiar to the communities in the study areas, as the majority of the respondents reported that they did not hear or aware about hydatidosis. This is consistent with other studies in Tanzania, majority of the respondents respondents have not aware of (Ernest *et al.,* 2009) hydatidosis and in Iran found that very low level of knowledge about hydatidosis in the pastoralist. Higher proportion of the respondents closed contact with non- dewormed dogs. The close association of people with dogs especially children who can acquire this disease when they are still young and signs come later in life further exacerbates this factor. Similar results reported in Tanzania, many households (89.1%) had dogs which did not deworm regularly and managed under free-range system (Ernest *et al.,* 2009). This idea was supported by (Gathura and Kamiya, 1990) that they reported with high incidence rate in the northern (higher contacted of dogs) than in the southern Kenya due to cultural difference.

Backyard slaughter of small ruminants and disposal of raw condemned organs through offering to dogs were the common practice, a situation which may lead to the increased environmental parasitic load. Similar results were observed in Tanzania, majority of community had their dogs managed freely with feed raw condemned materials to their dogs (Ernest *et al.,* 2009).

In this study, only a small proportion of the participants had an awareness of echinococcosis. This is lowcompared to with the work of Tigre (2012) who reported that 32.2% of the study participants had an awareness of echinococcosis. The variation in the level of awareness could be due to the difference in the study groups, where the previous study was conducted only on butchers and abattoir workers who might be familiar with the problem unlike our study groups which incorporates a variety of respondents. The awareness level of participants in this study was similar to that reported by (Kebede *et al.*2010) and (Zelalem, 2012) who indicated an awareness level of 0 and 8% of the households had awareness about zoonotic echinococcosis, respectively. The lower level of awareness about echinococcosis could also be due to the longer incubation period of the disease in humans, in which it takes up to 30 years to manifest clinical signs (CFSPH, 2011).

In this study, 76 % of the participants owned dog(s) and 24 % of them said they let their dogs freely roam outside their compound. The presence of large numbers of non-restricted dogs plays a crucial role not only in transmission of rabies but also in contaminating the environment with tapeworm eggs which could subsequently infect humans. Among the dog owners, 95.71% of them reported that they fed offal to their dogs regardless of the safety status of the offal. Feeding the viscera of infected slaughter animals to dogs was reported to facilitate the transmission of the cattle strain of Echinococcus granulosus and this was suggested to consequently increase the risk that humans will become infected (Moro and Schantz, 2009).

5. CONCLUSION AND RECOMMENDATIONS

Bovine Cysticercosis and hydatidiosis was an important zoonotic disease. The occurrence of the diseases both in human and animals were high and poor slaughter processes and meat handling and processing seem to aggravate the situation. Both the abattoir and the questionnaire surveys showed that bovine cysticercosis and hydatidiosis were important parasitic diseases in Assosa Administrative town Slaughter house, and adjoining areas in terms of its public health implications. Animal organ distribution of the cyst incurred a health risk from a public health point of view. Variable knowledge by community of the associated risk shows the need for community education as awareness creation regarding the disease condition, consumption of raw meat, application of environmental hygiene and other associated risk factors to minimize the impact of Taenia saginata/bovine cysticercosis and hydatidiosis in the study area. 10.67% of C. bovis and 30.20% of hydatid cyst prevalence were investigated in the area**.** Tongue, massetor, shoulder, heart and diaphragm were the major organs harboring C. bovis than other visceral organs and most of the cysts were found to be fertile (viable). Besides this, hydatid cyst was prevailing in liver, lung kidney and heart and most of the cyst were fertile (viable).

Among the study variables considered, sex, age, body condition and origin of animals were identified as important risk factors for the occurrence of cysticercosis and hydatidiosis in the cattle. Furthermore, occurrence of fertile cysts both in C bovis and hydatid cyst, in examined organs were high suggesting that cattle play an important role in the life cycle of this serious zoonosis and the presence of potential risks of transmission to other intermediate hosts.

Recommendations

Based on the above conclusions, the following recommendations will be forwarded

- Avoid of raw meat consumption habit due to risk of Taeniasis and hydatidiosis
- Public education to create awareness on its transmission methods
- Break lifecycle reflects the circulation of cysticercosis and hydatidiosis in cattle and human,
- Control of pasture, sewage contamination by human infected feces
- Awareness should be created in the public with regard to the zoonotic importance of bovine cysticercosis and the risk of raw meat consumption.
- Strict routine meat inspection of slaughtered animals should be carried out.
- The community should be intensively encouraged for construction of simple toilet to minimize contamination of pasture with human stool, so that the cycle of T. saginata interrupted cystic ecchinoccocosis.
- Establishment of policy on dog keeping and handling including registration, treatment and elimination of stray dogs,
- To break the life cycle, feeding of infected or undercooked offal to dogs and canine species should be avoided and prevent their access to condemned organs from abattoirs. All infected visceral organs should be buried.
- Awareness creating programs should be given for butchers, abattoir workers and dog owners as to the dangers of hydatidosis to human and animal health.
- Promoting construction of abattoirs with their appropriate disposal pits
- Moreover, close integration between medical and veterinary service is reliable to reduce the impact of the taeniasis in both human and cattle population in Assosa town and its adjoining area.
- Imposing legislative measure will put an end to back yard and roadside slaughter practices, construction of slaughter houses with adequate killing facilities and conducting an obligatory meat inspection services and institution of subsidiary operation by the government.

- ❖ The existing slaughter house should be properly fenced and access to offal by carnivore must be denided. That local slaughter houses should also have offal disposal pits which are deep and dog proof. In the meat factory effective supervision of disposal of condemned offlals appears necessary.
- ❖ Further detailed investigation of the basic local epidemiological factors governing the dissemination of echinocoscosis must be carried out.
- ❖ Infected meat and meat products must undergo the proper process of freezing, boiling or destruction based on the intensity of infection with cyticerci.
- ❖ Offal's found infected with the cyst must be properly disposed via through burying or incineration.
- ❖ Improve the working conditions of meat inspectors and up-grade their skills.
- ❖ Detailed meat inspection is suggested.
- ❖ Further studies should be conducted in other neighboring administrative zones.

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