

# ABATTOIR BASED PREVALENCE AND ASSOCIATED RISK FACTORS FOR *CYSTICERCUS BOVIS* AND ASSESSMENT OF COMMUNITY KNOWLEDGE, ATTITUDE AND PRACTICES AT MODJO MUNICIPALITY ABATTOIR, EAST SHOA ZONE, OROMIA, ETHIOPIA

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**ABSTRACT:** Bovine Cysticercosis remains a major public and animal health problem and it is a worldwide zoonotic disease which is very common in developing countries and endemic in central and East African countries like Ethiopia, Kenya and Zaire. A cross-sectional study was carried out from November, 2024 to September, 2025 on bovine cysticercosis at Modjo Municipal Abattoir with the objectives of estimating the prevalence of *Cysticercus bovis* (*C. bovis*), assessing some of the associated risk factors with the existence of the disease and assessing the community's awareness (KAP) level on the disease. A total of 384 animals those come from different area of the district were examined for the presence of *C. bovis* at Modjo municipal abattoir. Systematic random sampling technique was used to include those study animals from the study population presented for slaughter purpose to the abattoir. The examination was through incising into tongue, heart, liver, masseter muscle, brachial muscle and triceps muscles. All collected data were entered into Microsoft excel spread sheet, filtered and coded then analyzed by using SPSS Version 20 statistical software to see the associations between prevalence of the disease and independent variables which are study risk factors based on their Odd ratio and p-value. Out of the total 384 animals examined in this study, 28 were positive for *C. bovis*, yielding an overall prevalence of 7.3% (95% CI: 4.89-10.85). The highest prevalence (55.6%) was recorded in animals with poor body condition and the distribution of infection in cattle according to origin was highest in cattle from Koka (8.9%) followed by Adama (8.2%) and Maki (7.4%), respectively. The highest number of cyst were obtained from tongue of affected animals 9 (2.3%) and the lowest number from heart 4 (1.04%). Out of the 100 study participants, 82% said they had previously heard of taeniasis and 76% said they knew the cause of tape worm infection, while 24% said they didn't know the cause of taeniasis. Based on the findings of the research, appropriate preventive and control measures must be taken and awareness creation pertaining to the study area should be undertaken through appropriate media.

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**Key words:** Abattoir; Cross sectional; *C. bovis*; KAP; Modjo; Odd ratio; Prevalence.

## 1. INTRODUCTION

Ethiopia has the largest livestock population in Africa, possessing more than 70 million cattle, 42.9 million sheep, 52.5 million goats, 8.1 million camels, 7 million equines and 57 million chickens CSA (2021). With up to 45% of the country's overall GDP coming from agriculture and employing roughly 78% of the labor force, it serves as the economic backbone of Ethiopia (Martins, 2014).

Despite having the largest livestock population in Africa, the nation is not gaining from this industry because of a number of obstacles, such as widespread endemic disease brought on by viral, bacterial, and parasitic infestation, inadequate effective disease control policies, inadequate effective veterinary services, and inadequate government attention. One of the major obstacles to the sector's development has been livestock disease, which has reduced productivity and hampered animal traders (Jilo *et al.*, 2016). Taeniasis is a neglected tropical zoonosis in humans that has socioeconomic and public health problem (Cox, 2002).

*Bovine cysticercosis* in cattle is an infection caused by *Taenia saginata* with humans as the final host and cattle as the intermediate host. Infection of human by *Taenia saginata* occurs through ingestion of raw or under cooked meat

containing *Cysticercus bovis*; while, infection of cattle with bovine cysticercosis occurs through ingestion of *Taenia saginata*'s eggs (Dupuy *et al.*, 2014). *Taenia saginata*'s life cycle and transmission are most frequently observed in settings with under standard hygienic conditions, primitive cattle husbandry methods, and inappropriate meat inspection and control regulations (Urquhart *et al.*, 2013).

Although *C. bovis* cysts can be found throughout the carcass and viscera, their preferred locations include the masseter, tongue, heart, triceps, intercostal muscles, and the diaphragm, which are consumed at a raw level and pose risks to the public's health (Dorny *et al.*, 2009). The cysts are evident two weeks after infection at the earliest, but they are not infectious to humans until 12 weeks later, when they have grown to their full size of 1 cm (McGAVIN *et al.*, 2001). This parasite affects cattle of all ages, but young age groups are more vulnerable than the others (Gebretsadik *et al.*, 2016).

Taeniasis in humans and cysticercosis in cattle are frequent in Ethiopia due to the tradition of eating undercooked beef dishes such "kurt", "lebleb", and "kitfo" as well as the practice of defecating in open areas used for cattle grazing (Abunna, 2008). *Taenia* eggs are very resistant and are discharged from ruptured segments or passed in the feces. They are sub-spherical to spherical in shape and very resistant; they last for 6 months in pasture and vegetables, 5 weeks in water, 10 weeks in stool or hay, and 12 weeks in silage. Taeniid eggs have an oncosphere (hexacanth embryo) with three pairs of hooks, a thick, brown, radially striated embryophore or shell made of hooks, and an outer, oval, membranous coat, the real egg shell, that is shed from fecal eggs. These eggs are around 30-45 mm in diameter (Ballier and Mandal, 2012).

The inadequate of effective inspection at crucial control points in abattoirs, lack of awareness and knowledge regarding the mode of transmission and public health hazard of these diseases, as well as the prevalence of the habit of consuming raw meat both in rural and urban communities, could make the problem of food-borne parasitic zoonoses in Ethiopia even more problematic (Mulugeta, 1997). According to a number of reports in Ethiopia, people with low levels of formal education and those who had easy access to raw meat and meat products (butchers and abattoir workers) were reported to be more likely to contract parasitic zoonosis than people with better education and limited access to raw meat (Adugna *et al.*, 2012; Nigatu *et al.*, 2009).

### 1.1. Statement of the Problem

*Cysticercus bovis* zoonosis causes harm to the agricultural industry's economy and public health by reducing the number of producing animals owing to infection, lowering the quality of the produced goods, and condemning the affected organs. Despite its global distribution, the biggest numbers of tapeworm carriers are reported within communities in developing countries like Ethiopia. *T. saginata* taeniasis/cysticercosis continues to be a neglected zoonosis due to inadequate of information on the economic burden of bovine cysticercosis and taeniasis, the prevalence of other priority diseases, and limited resources (Jorga *et al.*, 2020).

The cultural habit of eating raw meat in form of "Kurt" meat cubes and "Kitfo" minced meat in Ethiopia, has favored the spread of this infection (Dawit, 2004; Abuna, 2006). Some patients lose their appetite due to taeniasis and thus lose weight. Sometimes, the gravid proglottids migrate to different organs such as the appendix, pancreatic duct, nasopharyngeal pathways and bile ducts producing obstruction and inflammation of the affected organs (Ortega, 2006).

Economic losses due to bovine cysticercosis are associated with total condemnation of carcasses with generalized infestation and reduced value of carcasses which are subjected to refrigeration, in addition to the cost of refrigeration and extra handling transport (WHO, 1995). It increasingly becomes important in view of the drastic measures and very strict regulations from importing countries on exporting countries. The treatment cost for human taeniasis and costs of manufacturing of drugs have significant contribution in estimation of economic loss (Ortega, 2006).

In the current study area, East Shoa Zone Modjo town, where cattle raising and marketing is the primary economic activity for the local farmers and livestock merchants, no research has been done on the prevalence of *Cysticercus bovis* and incidence of infection to date. However consumption of raw meat, or "Kurt," was increased and become a favorite dish than ever for all social classes in this district, whether they are aware of the Zoonosis parasite disease of *T. saginata* /bovine cysticercosis/. Although the incidence of the infection has been recorded by several authors in various locations at various periods, a recent updated report is crucial for ensuring surveillance as well as the public health and economic implications of the infection in this region (Ortega, 2010).

In the current study area most of the animals come to the abattoir were existed under extensive farming system which may have high occurrence of bovine cysticercosis due to grazing in areas contaminated by human excreta (open defecation) and drinking contaminated water due to existence of different industries and export abattoirs. The community has minimal awareness level on the occurrence of *bovine cysticercosis* in the country (Thomas, 2014).

## 1.2. Objectives

### 1.2.1. General objective

- ✓ To estimate the prevalence of bovine cysticercosis and assess its risk factors and to assess community knowledge, attitude and practices of *C. bovis* in Modjo town municipal abattoir, East Shoa Zone, Ethiopia.

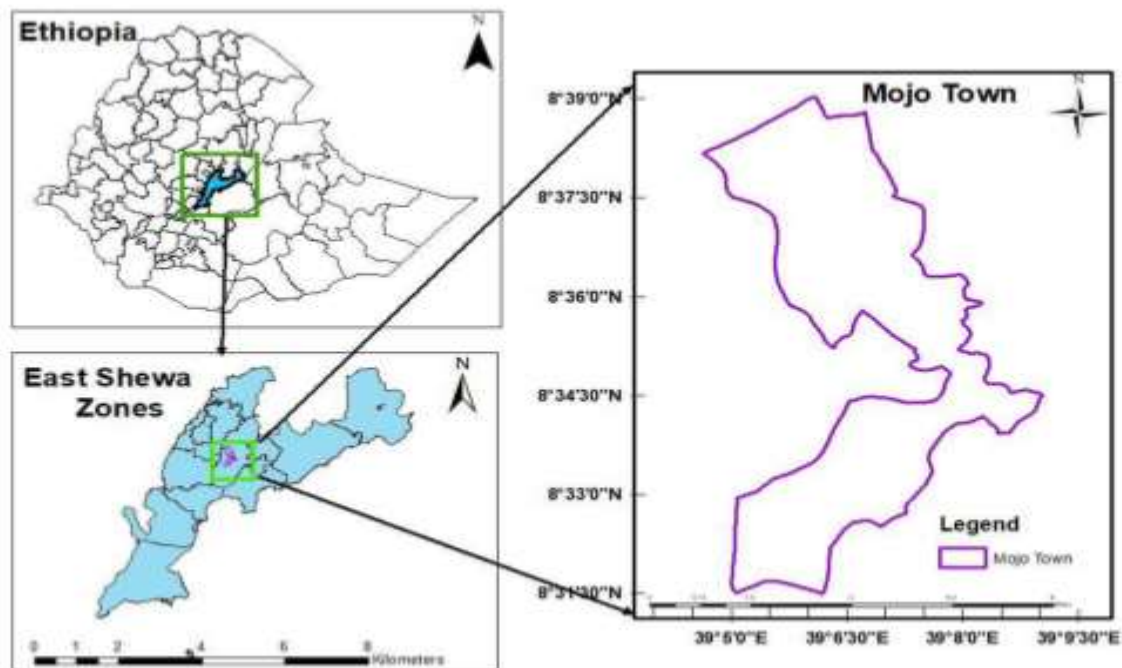
### 1.2.2. Specific objectives

- ✓ To estimate the prevalence of *C. bovis* in cattle slaughtered at Modjo town municipal abattoir, East Shoa Zone, Ethiopia.
- ✓ To identify the associated risk factors for *C. bovis* in cattle slaughtered at Modjo town municipal abattoir, East Shoa Zone, Ethiopia.
- ✓ To assess community knowledge, attitude and practices regarding *C. bovis* in the study area, East Shoa Zone, Ethiopia.

## 2. MATERIALS AND METHOD

### 2.1. Description of the Study Area

Modjo town is located in the East Shoa zone, Oromia regional state at a distance of 70 km from Addis Ababa (capital city of Ethiopia), and 25 km from Adama town (Figure 4). Modjo town has an altitude range of 1730–1890m above sea level and is characterized by its mean annual temperature of 16–17°C, and mean annual rainfall of 896mm. It has a latitude and longitude of 08° 37' North and 39° 07' East, respectively. According to the projection of Central Statistical Agency of Ethiopia carried out in 2015, the estimated population of the town was 43,500. The livestock population of the district includes 113915 cattle, 10775 of sheep, 9775 goats, 107184 poultry, 760 horses, 1090 mules and 3690 donkey (Modjo town Administration, 2025).



**Figure 1:** Map of the Study Area

Source: (GIS, Arc Map)

## 2.2. Study Design

A cross sectional study was conducted to estimate abattoir based prevalence and associated risk factors of bovine cysticercosis and assessment of community awareness level on the disease in Modjo Municipal Abattoir, East Shoa Zone, Oromia, Ethiopia.

## 2.3. Study Population and Period

The study population for the slaughterhouse-based survey comprised of all cattle (local and cross-bred) that come from different origins of the district to Modjo municipal abattoir for slaughter purpose and communities living in the town were participated in the study for the KAP study. The study was conducted between November, 2024 to September, 2025.

## 2.4. Study Animals

The study animals include local and cross breeds of cattle presented for slaughter from Modjo and its surrounding areas mainly from Bote, Koka, Adama, Bishoftu and Maki to Modjo Municipal Abattoir. From those animals which daily come to the Municipal Abattoir, study animals were systematically selected with sampling interval of 6 and inspected for *C. bovis* after slaughtered.

## 2.5. Sampling and sample size determination

Systematic random sampling method was employed for selecting animals from cattle slaughtered in Modjo Municipal Abattoir during the study period and simple random sampling method was used to select study participants for assessment of KAP. To calculate the total sample size, the following parameters were used: 95% confidence interval, 5% desired level of precision and 50% expected prevalence of bovine cysticercosis among cattle in the study area since there was no previous work in the study area, and the formula given by Thrusfield (2005) was used.

The sample size was calculated using Thrusfield's formula at 95% confidence level and 5% precision, resulting in 384 cattle. Accordingly,  $n = 1.962 * 0.5 (1 - 0.50) / 0.0025 = 384$  cattle were sampled. Whereas 100 study participants were included for KAP assessment in the study area calculated by Arshem formula,  $N = 0.25 / SE^2$  (Arshem, 2002).

## 2.6. Ante-mortem examination

Ante-mortem examination was conducted by visiting the abattoir two days a week mainly Tuesday and Thursday but also other days except Wednesday and Friday since on these days few animals were slaughtered to see the animals and recording appropriate factors. A total of 384 cattle were examined for the presence of disease or abnormality before they are slaughtered. The age, origin, sex, breeds, and body condition of each animal were assessed and recorded in data recording book prepared for this purpose. The body condition score of the animals were ranked as poor, medium, and good according to Nicolson and Butterworth (1986). Age of the animals was determined by dentition formula and categorized into three age groups (< 5, 5-10 and > 10 years) according to the method described by De Lahunta and Habel (1986).

## 2.7. Post-mortem examination

A total of 384 cattle were selected randomly from cattle presented for slaughter at Modjo Municipal Abattoir and examined for the presence of *C. bovis* following the routine meat inspection procedures. The post mortem inspection was carried out according to the guideline by Ministry of Agriculture (MoA, 1972). The post mortem examination for detecting *C. bovis* was conducted generally through visualization, palpation and two longitudinal ventral incision of the tongue from the tip of the root, one deep incision into the triceps muscles of both sides of the shoulder, deep incision into external and internal muscles of the masseter parallel to the plane of the jaw, longitudinal incision of the heart from base to apex, three parallel incisions into the long axes of the neck muscles on both sides as well as one extensive incisions on the diaphragm; visual examination, palpation and incision of liver and kidneys. Findings were registered according to the organs inspected.

## 2.9. Data management and analysis

All collected data were entered in to a computer on a Microsoft excel spreadsheet and analyzed using SPSS version 20 software program. The association between the risk factors and the outcome variables was assessed using chi-square ( $X^2$ ) test. The abattoir data were summarized and prevalence was calculated from the result. Anatomical distribution of *C. bovis* was also tabulated.

Descriptive statistics was used to present the frequency and percentage of the data regarding to *C. bovis*. Univariable and multivariable Logistic regression was used to investigate the association between the prevalence of *C. bovis* and risk factors. In case, univariable logistic regression was used to see the association between risk factors in which the

level of the risk factors for the occurrence of the parasite is compared with dependent variables using their odds ratio (OR) and P-value. The level with the lowest prevalence was used as the reference category for all risk factors. Statistical significance was considered at 95% CI with p-value less than 5% ( $p < 0.05$ ) and odd ratio greater than one ( $OR > 1$ ).

## 2.8. Expected Outcome

Upon the completion of this research work, the Prevalence and Risk Factors of *Cysticercus bovis* in Modjo municipal abattoir, East Shoa Zone, Oromia, Ethiopia, is known and free for readers as reference. Risk factors for *C. bovis* and community KAP were determined. The research work provides relevant information and recommendation essential to control and prevent the disease.

## 3. RESULT

### 3.1. Abattoir survey

#### 3.1.1. Prevalence of *Cysticercus bovis*

Out of the total 384 animals examined in this study, 28 were positive for *C. bovis*, yielding an overall prevalence of 7.3% (95% CI: 4.89-10.85). The prevalence in cattle from Adama, Bishoftu, Bote, Koka and Maki, was found to be 8.2%, 5%, 6.5%, 8.9% and 7.4%, respectively. Prevalence of *C. bovis* was seen to be higher in adult animals than young and in female animals than male. Among the body condition, the highest prevalence of 55.6%, was seen in the poor body condition animals and the distribution of infection in cattle according to origin was highest in cattle from Koka (8.9%) followed by Adama (8.2%) and Maki (7.4%), respectively.

**Table 1:** Prevalence of *Cysticercus bovis* in cattle in study area

| Variables             | Animal tested | Cases | Prevalence (%) | P- value      | Odd ratio (95% CI)   |
|-----------------------|---------------|-------|----------------|---------------|----------------------|
| <b>Breed</b>          |               |       |                |               |                      |
| Local                 | 350           | 26    | 7.4            | 0.741         | 0.78 (0.177, 3.433)  |
| Cross                 | 34            | 2     | 5.9            |               | Reference            |
| <b>Origin</b>         |               |       |                |               |                      |
| Adama                 | 49            | 4     | 8.2            | 0.876         | 1.11 (0.297, 4.151)  |
| Bishoftu              | 60            | 3     | 5              | 0.566         | 0.658 (0.158, 2.744) |
| Bote                  | 93            | 6     | 6.5            | 0.804         | 0.862 (0.267, 2.786) |
| Koka                  | 101           | 9     | 8.9            | 0.714         | 1.22 (0.416, 3.590)  |
| Maki                  | 81            | 6     | 7.4            |               | Reference            |
| <b>Sex</b>            |               |       |                |               |                      |
| Female                | 13            | 1     | 7.7            | 0.955         | 1.06 (.133, 8.475)   |
| Male                  | 371           | 27    | 7.3            |               | Reference            |
| <b>Age</b>            |               |       |                |               |                      |
| Young                 | 16            | 1     | 6.3            |               | Reference            |
| Adult                 | 268           | 27    | 10.1           | 0.000 (0.870) | 1.2 (.0151, 9.335)   |
| <b>Body condition</b> |               |       |                |               |                      |
| Poor                  | 18            | 10    | 55.6           | 0.000         | 2.3 (1.35, 5.672)    |
| Medium                | 30            | 11    | 36.7           | 0.205         | 0.46 (0.141, 1.522)  |
| Good                  | 336           | 7     | 2.1            |               | Reference            |

#### 3.1.2. Risk factors of *Cysticercus bovis*

Among the presumptive risk factors for *C. bovis* screened in this study animal body condition were found to be statistically significantly associated ( $p < 0.05$ ) with the occurrence of the cysts in the carcasses of the animals. As shown in table 4 the prevalence varies with body condition score.

### 3.1.3. Anatomical distribution of *Cysticercu bovis*

Anatomically, cysts of *C. bovis* were seen to be distributed in almost all organs (Tongue, Kidney, Liver, Heart and Muscles) of the slaughtered animals in the study area. The highest number of cyst were obtained from tongue of affected animals 9 (2.3%) and the lowest number from heart 4 (1.04%) from organs examined on post mortem examination of affected animals as depicted on table 2.

**Table 2:** Anatomical distribution of cysts with different organs, Modjo abattoir

| Affected Organs | Frequency | Percent    |
|-----------------|-----------|------------|
| Tongue          | 9         | 2.3        |
| Heart           | 4         | 1.04       |
| Liver           | 5         | 1.3        |
| Masseter Muscle | 5         | 1.3        |
| Kidney          | 5         | 1.3        |
| <b>Total</b>    | <b>28</b> | <b>7.3</b> |

## 3.2. Questionnaire survey

### 3.2.1. Socio-demographic characteristics of the respondents

This survey included 100 respondents from various occupations and educational levels, including civil servants, students, merchants, and farmers. The majority of study participants, 81 (81%), were male and 19 (19%) female. Most of the respondents were married 72 (72%), Christians 75 (75%), and own Livestock 69 (69%) (Table 3).

**Table 3:** Socio-demographic profiles of the respondents in the study area, Modjo town

| Variables              | Category       | No of respondents | Percentage (%) |
|------------------------|----------------|-------------------|----------------|
| Marital Status         | Married        | 72                | 72             |
|                        | Unmarried      | 28                | 28             |
| Livestock Ownership    | Yes            | 69                | 69             |
|                        | No             | 31                | 31             |
| Age in year            | 18-30          | 13                | 13             |
|                        | 31-45          | 40                | 40             |
|                        | 46-60          | 47                | 47             |
| Sex                    | Female         | 19                | 19             |
|                        | Male           | 81                | 81             |
| Educational background | Illiterate     | 14                | 14             |
|                        | Primary        | 23                | 23             |
|                        | Secondary      | 28                | 28             |
|                        | Diploma        | 15                | 15             |
| Occupation             | Degree         | 20                | 20             |
|                        | Gov't Employee | 46                | 46             |
|                        | Student        | 19                | 19             |
|                        | Merchant       | 18                | 18             |
| Religion               | Farmer         | 17                | 17             |
|                        | Christian      | 75                | 75             |
|                        | Muslim         | 25                | 25             |

## 3.3. Awareness Level of the Community on the Disease

### 3.2.2. Knowledge of the respondents about *Taeniasis* and *cysticercosis*

Out of the 100 study participants, 82% said they had previously heard of taeniasis and 76% said they knew the cause of tape worm infection, while 24% said they didn't know the cause of taeniasis. In terms of respondents' knowledge of the source of tapeworm infection, 60% claimed they were aware of the source, while 40% indicated they were not. Raw beef, raw milk, and polluted water were identified as potential sources of *Taeniasis* by 60%, 18%, and 19% of respondents, respectively while 3% didn't know the source. Forty seven percent of the respondents said they had



*Taeniasis* at least once in their lives, and all of them said they had noticed symptoms of the condition. Out of the total respondents, 92 said they don't recognize the tapeworm cyst if they see it in beef or organs, and 8% said they don't know which organ or muscle of cattle is the source of the cyst. Concerning the study respondents' knowledge of the source of cattle infection, the questionnaire results revealed that 18% do not know how cattle are infected, while 58% claimed that eating contaminated grass is the source of cattle infection (Table 4).

**Table 4:** Knowledge indicator variables on *teaniosis* at the study area

| Variables                                        | Category                    | Frequency (%) |
|--------------------------------------------------|-----------------------------|---------------|
| Have you ever heard about teaniosis?             | Yes                         | 82            |
|                                                  | No                          | 18            |
| Do you know the cause of tape worm?              | Yes                         | 76            |
|                                                  | No                          | 24            |
| What is source of tape worm?                     | Raw meat of cattle          | 60            |
|                                                  | Raw milk                    | 18            |
|                                                  | From polluted water         | 19            |
|                                                  | I don't know                | 3             |
| Have you suffered from teaniosis?                | Yes                         | 79            |
|                                                  | No                          | 21            |
| In which organ does the cyst teaniosis found?    | Tongue                      | 43            |
|                                                  | All organ                   | 34            |
|                                                  | I don't know                | 6             |
|                                                  | Muscle                      | 17            |
| Do you recognize cysts from meat?                | Yes                         | 92            |
|                                                  | No                          | 8             |
| How do animals get the cyst?                     | Drinking poor quality water | 18            |
|                                                  | Eating contaminated grass   | 58            |
|                                                  | I don't know                | 24            |
| Do butchers aware their customer on cyst or not? | Yes                         | 14            |
|                                                  | No                          | 86            |
| Did you observe any symptoms of tapeworm before? | Yes                         | 47            |
|                                                  | No                          | 53            |
| Symptoms you observed?                           | Abdominal pain              | 30            |
|                                                  | Decreased appetite          | 12            |
|                                                  | Excessive salivation        | 5             |
|                                                  | I don't know                | 53            |

### 3.2.3. Attitude of the respondents about *Taeniasis* and *cysticercosis*

The majority of study participants, 74%, believe tapeworm is a preventable disease, particularly by avoiding eating of raw meat (63%) and practicing good food hygiene (18%). However, the majority of respondents (86%) did not intend to stop eating raw meat, while 14% intended to do so. In terms of taenicial medicine preference, 26% of respondents said they prefer Albendazole as indicated on table 5.

**Table 5:** Attitude of the study respondents about *taeniasis* and *cysticercosis*

| Variables                                         | Category                    | Frequency (%) |
|---------------------------------------------------|-----------------------------|---------------|
| Do you think tapeworm infection can be prevented? | Yes                         | 74            |
|                                                   | No                          | 11            |
|                                                   | Don't know                  | 15            |
| If yes how it could be achieved?                  | Avoid eating raw meat       | 63            |
|                                                   | Avoid drinking raw milk     | 19            |
|                                                   | Drinking pure quality water | 18            |

|                                                                |                  |    |
|----------------------------------------------------------------|------------------|----|
| Do you intended to stop eating raw meat?                       | Yes              | 86 |
|                                                                | No               | 14 |
| Which food type do you prefer more?                            | Kikil            | 13 |
|                                                                | Kurt/Tire siga   | 34 |
|                                                                | Milasina sanber  | 10 |
|                                                                | Tibsi            | 28 |
|                                                                | Kitfo            | 16 |
| Do you think using spices is useful in prevention of tapeworm? | Yes              | 48 |
|                                                                | No               | 42 |
|                                                                | I don't know     | 10 |
| Do you think teaniosis can affect both human and animals?      | Yes              | 74 |
|                                                                | No               | 26 |
| Which taenicial drugs do you prefer?                           | Albendazole      | 26 |
|                                                                | mebendazole      | 21 |
|                                                                | I don't remember | 53 |

#### 3.2.4. Practice of the respondents about Taeniasis and cysticercosis

The respondents' experience with taeniasis and cysticercosis was assessed using ten questions. Ninety two percent of them said they had latrines at home, while, 8%, said they didn't. Despite the fact that 12% have used taenicial drugs one to three times in their lives, the majority of respondents, 14%, report that no family members have been affected. Approximately 37% of respondents said they obtained taenicial drugs from health stations and hospitals, while 51% obtained them from pharmacies. Although 32% of respondents have a family member who works in human or veterinary health care, 36% claim to have created awareness in the form of advice not to eat raw beef (Table 6).

**Table 6:** Practice indicator variables on teaniosis at the study area.

| Variables                                                            | Category              | Frequency (%) |
|----------------------------------------------------------------------|-----------------------|---------------|
| Is there any fammily member work in human or veterinary health care? | Yes                   | 32            |
|                                                                      | No                    | 68            |
| Do you have latrine at home?                                         | Yes                   | 92            |
|                                                                      | No                    | 8             |
| How many person infected from your family member?                    | None of my family     | 14            |
|                                                                      | One of my family      | 56            |
|                                                                      | Two of my family      | 24            |
|                                                                      | Above three           | 6             |
| How many times in your lifetime have you taken tape worm treatment?  | Once                  | 64            |
|                                                                      | Twice                 | 24            |
|                                                                      | Three times and above | 12            |
| Common traditional taenicial drugs?                                  | Hexo                  | 24            |
|                                                                      | Wogert                | 14            |
|                                                                      | Benzene               | 20            |
|                                                                      | Hanqu                 | 14            |
|                                                                      | I don't know          | 28            |
| From where do you get taenicial drugs?                               | Health station        | 28            |
|                                                                      | Hospital              | 9             |
|                                                                      | Pharmacy              | 51            |
|                                                                      | Herbal medicine       | 12            |
| Is there any complication of those drug?                             | Yes                   | 54            |
|                                                                      | No                    | 15            |
|                                                                      | I don't know          | 31            |
| Have you ever been advised not to eat raw beef?                      | Yes                   | 36            |
|                                                                      | No                    | 52            |
|                                                                      | Unknown               | 12            |
| Do you have sewage disposal system                                   | Yes                   | 73            |
|                                                                      | No                    | 27            |



#### 4. DISCUSSION

*Cysticercus bovis*/formerly known as Beef Measles/ causes small cysts in the muscles of cattle and their presence can lead to all or part of the carcass being condemned. Cattle get *Cysticercus bovis* from ingesting foodstuffs contaminated with eggs passed from humans. This study indicated that taeniasis is a problem among the resident of Modjo town and the surrounding areas due to the deep-rooted tradition of raw meat consumption which magnifies the public health hazards of taeniasis in the study area.

The prevalence of *T. saginata* varies from country to country and even differs within the same country from area to area. This could be due to many factors, such as variation in the habit of raw meat consumption, awareness of patients about the clinical pictures of the infection and variation in personal and environmental hygiene (Abate (2014). The infection prevalence of *T. saginata* cysticercosis was invariably high in those animals came from Koka and Adama towns compared to Maki town. This suggests wide occurrences of the infection throughout the study areas regardless of agro-ecological and socio- cultural differences (Agernesh, 2022).

The prevalence of bovine cysticercosis obtained in this study was 7.3%, which is relatively higher than the findings of Tolossa *et al.* (2009) 2.93%, in Jimma, Agernesh (2022) 3.1%, in Haik abattoir Northern Ethiopia, Nureddis and Frew (2012) 3.6% in Addis Ababa, Tembo (2001) 2.2%, Central Northern Ethiopia and Abate (20014) 2.5%, in Central Ethiopia, however it is comparable with Bacha (2020) 6.2%, in Western Wellega.

The result of present study was lower than the reports from Hawassa 26.3% (Abunna *et al.*, 2008), from different abattoirs in the country 30% (Solomon, 2012), Tanzania 27% (Over *et al.*, 2012), Opara *et al.*, (2012) in Nigeria 26.2% and (Over *et al.*, 2012) 38% in Kenya. Conversely, it is higher than prevalence reported from developed countries, such as 0.26% in Croatia (Zivkovic *et al.*, 2010), 0.48 to 1.08% in Germany (Abuseir *et al.*, 2012) and 0.9% in Cuba (Suarez and Santizo, 2013).

Thus, *T. saginata* /cysticercosis/ has more public health and economic significance in developing countries like Ethiopia compared with developed countries. Problems associated with poor sanitary infrastructure, low awareness and improper disposal of sewage are major factors for higher prevalence of cysticercosis in developing countries (Gebretsadik *et al.*, 2016). Accordingly, the lower prevalence of bovine cysticercosis in this study might be attributed to the variation in the personal and environmental hygiene, religion, culture of raw meat consumption and feeding habit of the population and their production system.

Whereas sex, origin, and breed had no significant impact on the probability of a person being infected by *T. saginata*. The possible suggestion for this could be, adult people had the habit of raw meat consumption than the younger population owing to the fact that children are not allowed to consume raw meat and adult individuals can financially afford consuming raw meat “Kurt or Kitfo” mainly at butcher houses (Abunna *et al.*, 2008).

Groups who had close contact with meat and meat products were infected more than those who had low access to meat and meat by products. The result of this study was in agreement with findings of Hailu (2005), Endris and Negussie (2011), Dawit (2004), Tembo (2001), Abunna *et al.*, (2008), Taresa *et al.*, (2011) and Tesfaye *et al.*, (2012) in Ethiopia and majority of researches in most countries. This is due to the fact that those who eat raw or undercooked meat had the chance of being easily infected with *Taenia saginata*. Those, who have low level of education, do not consider *Cysticercus bovis* is a disease, so that the prevalence of *Cysticercus bovis* was higher in this group than those in higher level of education.

Regarding the anatomical distribution of the cysts, in the present study the organs affected by cysts were tongue, masseter muscle, shoulder muscle, liver, heart, and kidney. These are frequently reported important predilection sites for *C. bovis*; a reason advanced for the frequent involvement of these muscles, being the increased blood supply due to frequent or continuous/rhythmic movement of the body parts (Gracey *et al.*, 1999).

This finding by active abattoir survey found that the anatomical distributions of *C. bovis* in the examined cattle organs varied. The most frequently affected organ was the tongue, with the highest number of cysts (9, 32.1%), followed by the masseter muscle, the liver and kidney (5, 17.9% each) and the heart muscle (4, 14.3%). These organ-specific figures agree with Teklemariam and Debash (2015) and Tesfaye *et al.*, (2020) who reported tongues

with the highest number of cysts. However, this organ-specific prevalence disagreed with Netsanet *et al*, (2020) who reported the liver with the highest cyst number, and Belachew and Ibrahim (2012) at Hawassa Municipal Abattoir, Mohamed *et al*, (2021) at Addis Ababa enterprise abattoir, who reported the triceps muscle to be the first to harbor *C. bovis*. The abattoir survey analysis indicated that there was a significant variation in the anatomical distribution of *C. bovis* in the inspected organs of slaughtered animals. This demonstrated that the tongue was the first ranked to confirm *C. bovis* at abattoirs. This variation might be due to the ability of the meat inspector to identify the cases, sample size, method of meat inspection, and several cuts.

Thus, the high prevalence in the present study might be attributed to the variation in the method and quality of meat inspection, human habit of raw meat consumption as well as personal and environmental contamination of the study areas. Furthermore, the study animals were from outside of the town and managed under extensive farming system, where contamination of grazing fields by human excreta is common, especially in animals came from Bishoftu and Koka where the higher prevalence of *C.bovis* was encountered. The study showed that the existence of higher prevalence of cysticercosis throughout the edible organs together with deep-rooted tradition of raw meat consumption, which magnifies the public health hazards of taeniasis in the study area.

In the present study consumption of raw or inadequately cooked beef was strongly associated with *T. saginata* infection which is supported by findings of previous researchers (Abunna *et al*. 2008; Bedu *et al*. 2011; Endris and Negussie, 2011; Megersa *et al*. 2010). It is, therefore, wise to focus strongly on those edible sites of the carcass used for the preparation of these traditional dishes.

Majority of study participants had previously heard of taeniasis and knew the cause of tape worm infection, while a few proportions didn't know the cause of taeniasis. In terms of respondents' knowledge of the source of tapeworm infection, high number of respondents claimed they were aware of the source. Raw beef, raw milk, and polluted water were identified as potential sources of *Taeniasis* and most of the respondents said that they had *Taeniasis* at least once in their live time, and all of them said they had noticed symptoms of the condition. This finding is comparable with the study report by Teklemariam and Debash (2015) in Batu.

Regarding attitude of interviewee, the majority of study participants believe tapeworm is a preventable disease, and it is possible to prevent particularly by avoiding eating of raw meat (63%) and practicing good food hygiene. They also preferred antihelminthics (albendazole) than others for its treatment. However, the majority of respondents did not intend to stop eating raw meat, and the drug of choice for taeniasis is niclosamide compared to albedazole. This is an indicator for their knowledge and attitude gap in the community in the area. Comaprable findings have been reported in Dessie area by Netsanet *et al*. (2020).

Regarding their practice, majority of respondents said that they had latrines at home. Despite the fact that some respondents have used taenicial drugs one to three times in their live time, the majority of respondents reported that no family members have been affected. Few of respondents said they obtained taenicial drugs from health stations and hospitals, while Majority obtained drugs from pharmacies. Eating raw meat is very common response in the study area regardless of educational background and work places. This result is in accordance with reports by Mohamed *et al*. (2021), Tesfaye *et al*. (2020) and Belachew. and Ibrahim (2012) in different parts of Ethiopia.

## 5. CONCLUSION AND RECOMMENDATIONS

This study revealed that *Cysticercus bovis* remains a significant public health and economic concern in Modjo municipality and its surrounding areas. The overall abattoir-based prevalence was found to be 7.3%, with higher infection rates observed in animals of poor body condition and those originating from specific areas such as Koka and Adama. Among the risk factors, sex, origin, body condition core and age of the animals were not significantly associated with the prevalence of *Cysticercosis bovis*. This implies that all animals without their status of sex, age, and origin were equally infected by *C. bovis*. The presence of cysts in edible organs like the tongue, liver, and muscles poses a substantial risk for transmission to humans, especially in communities where raw meat consumption is common. The KAP survey showed that while awareness of taeniasis was relatively high among community members, unsafe practices such as eating raw beef and poor hygiene remain prevalent. These findings underscore the need for a coordinated approach to reduce transmission risks and enhance public awareness about the zoonotic importance of *Taenia saginata* and its lifecycle.

Based on the findings of this study, it is recommended

- Attention should be given at Modjo abattoir especially in not to slaughter poor body conditioned animals.
- Awareness creation should be done on personal and environmental hygiene, means of disease transmission and on use of latrines by the community.
- There should be strong and close collaboration between medical and veterinary professionals on the issue of zoonotic *T. saginata* to reduce impact of the disease both in human and animals.
- Avoid eating of raw meat (Kurt, lebleb and kitfo) unless inspected and confirmed wholesome by experienced meat inspectors.
- Further research should be conducted on the epidemiology, KAP and control strategies of taeniasis and cysticercosis in the present study area to monitor progress.

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