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## Prevalence of *Cysticercus Bovis* at Nekemte Town Municipal Abattoir of East Wollega Zone, Western Oromia, Ethiopia

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### Abstract

A cross-sectional study was conducted from November 2022 to May 2023 G.C on cattle slaughtered in Nekemte municipal abattoir with the objective of determining the *C. bovis* in Nekemte municipal Abattoir and to conduct postmortem and Ante mortem inspection for bovine cysticercosis as well as the distribution of *C. bovis* in vital organ and its public health significance of bovine cysticercosis. A total of 403 carcasses were inspected and 8/403 (1.9%) were infected with *Cysticerci bovis*. The anatomical distribution of cysticerci were; 3/403 (0.74%) in tongue, 2/403(0.49%) in\ shoulder muscles, 1/403(0.24%) in masseter muscles, 1/403(0.24%) in heart, and 1/403(0.24%) in liver. The prevalence of cysticercosis varied significantly ( $P<0.05$ ) with sex, age, and origin of animals. The infestation varied significantly ( $P<0.05$ ) with sex, age, place of respondents, habit of raw meat consumption, religion, marital and educational status. This study indicated that the prevalence of bovine cysticercosis and public health significance in the area was well established. Therefore, the disease deserves due attention to safeguard the public and further promote beef industry in the country.

**Keywords:** Nekemte, Bovine, Cysticercosis, Prevalence, occurrence, taeniasis, Taenia.

### 1. Introduction

Ethiopia is one of the countries in Africa with huge livestock resources that play a crucial role in the livelihoods of the majority of Ethiopians. The cattle population for the country is estimated at 50.8 million out of which females constitute about 54.87 percent and the remaining 45.13 percent are males (CSA, 2010). Despite the huge resources, Ethiopia livestock productivity remains a below being adequate. The major biological constraints contributing to low productivity includes the low genetic potential of the animals, poor nutrition and prevailing disease like parasitosis (CSA, 2010).

Among the many prevalent livestock diseases parasitism represent a major drawback to livestock

development in the tropic in general and *Cysticercus bovis*, which is the larvae stage of the human tape worm, *Taenia saginata* causes significant economic losses to the beef industry and public health hazard (Pal, 2007). Bovine cysticercosis is a muscular infection of cattle by the larvae of the human intestinal cestode, *Taenia saginata*. The parasite is cosmopolitan in its distribution with varying of prevalence (Minozzo, et al., 2002).

Bovine cysticercosis refers to the infection of cattle with metacestodes of the human tapeworm (Wanzala et al., 2003). Ingested eggs develop into cysticerci, which can often be detected during meat inspection at the routinely inspected localization sites of the parasite, including, the skeletal muscle, heart and diaphragm. The matured cyst is grayish white vesicle about one cm in diameter. It is filled with fluid, in which the scolex is usually visible, like the adult parasite, it has no hooks and rostellium (Radostits et al., 1994; Gracey et al., 1999). Several authors reported that the metacestode of *T.saginata* is common in organs like the tongue, heart, masseter muscle, thigh muscle, shoulder muscle, liver, diaphragm, intercostals and kidney (Gracey et al, 1999). *C. bovis* is significant; too, 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 in eliminating this parasite (Florova, 1982; Symth, 1994). *Taenia saginata/Cysticercus bovis* is important from the standpoint of the health of cattle because of consequences for the meat supply and, more importantly, from the direct effects on the well-being of humans who, almost universally, consume beef as a source of protein and other minerals (Doyle, et al., 1997).

In Africa, inadequate health education and low availability of taenicides, are the major obstacles for the control of the disease (Pawlowski, 1996). The variations in the epidemiological patterns of Taeniasis/Cysticercosis throughout Africa are a reflection of the numbers and distribution of human and cattle populations (Harrison, et. al., 1996). In East African countries prevalence rates of 30 to 80% have been noted (Tembo, 2001). In many developing countries, this disease constitutes a serious but sometimes less recognized public health problem (Minozzo, et al. 2002)

In Ethiopia, the prevalence of *T. saginata/C. bovis* has been reported by a number of individuals. Florida in 1982 reported a prevalence of 100% which is the highest in Africa and also in the world. In some parts of Ethiopia, due to the habit of eating raw beef dishes such as court and kitffo that are served in raw or undercooked are the source of *T. saginata* infection in man (Teka, 1997). Tembo, (2001), reported prevalence of 89.41% in different agro-climatical zones of the country and she associated this high prevalence with the habit and/or culture of eating raw or undercooked beef. The prevalence of *C. bovis* in cattle reported by different individuals was 3.2% in different agro-climatic zones of the country (Tembo, 2001), 2.2-3.2% in Addis Ababa Abattoir (Teka, 1997), 19.4% in Bahir Dar Alemu(1990), 21.17% in Nekemte Ahmed(1990), 13.85% in Debre Zeit Belayneh (1990) and 9.67% in Gondar Demissie (1989). Among 1,042,390 slaughtered cattle in different abattoirs of the country 1,308 whole carcass, 32, 630 portions, 30,656 heart, 21,917 heads, 7,462 tongues, 2,798

livers, 348 lungs, 26 spleens 21 kiddies have been condemned (MOA, 1973). Because of this Low knowledge of community on *C. bovis* in Ethiopia including Oromia and to improve Poor community awareness, absence of prevention and eradication strategy on *C. bovis*.

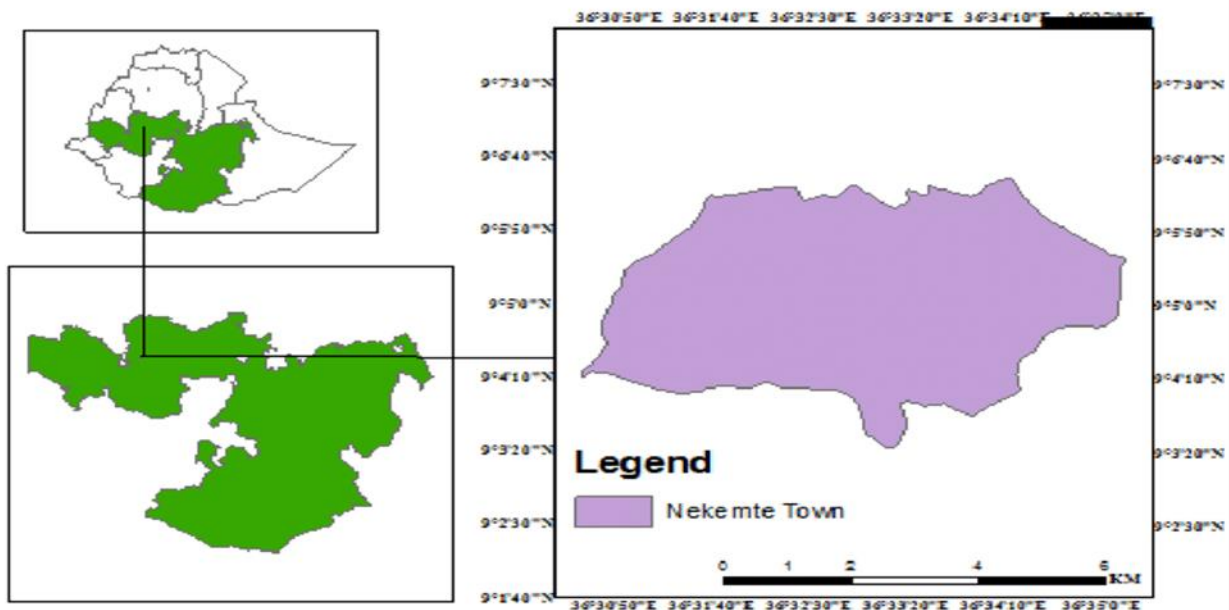
The objectives this thesis:

- To determine the prevalence of *C. bovis* in Nekemte municipal Abattoir.
- To Conduct postmortem and Antimortem inspection for bovine cysticercosis
- To investigate the prevalence of *C. bovis* at Nekemte Abattoir

**2. Materials and Methods**

**2.1 Study Area**

Study was conducted from November 2022 to May 2023 G.C at Nekemte Town. The study area located in East Wollega zone, Oromia regional state, western Ethiopia. This Town Administratively has seven sub city and found at a distance of 332 km from Addis Ababa to the west Ethiopia. It has a latitude and longitude of 9°5'N 36°33'E and elevation of 2123 m.a.s.l, a The mean temperature of the study area is between 33-35°C with more agricultural crops and livestock production (NMSA, 2013) The area receive long heavy rainfall June to September and short rain season from March-May The annual rainfall is 1100 mm Nekemte Town is bounded by Eat Wayu Tuka, North, Guto Gida, West Diga and south Guto Gida, district. Livestock population of the town are 29,150 Bovines, 2,340 Ovine, 2,833 caprine 3,037 Equines, 155,540 poultry and 850 Bee colonies (NTUAO, 2019). All the main purposes of the Abattoir are processing of one or several classes of livestock into fresh meat for human consumption, hygienic processing and storage of meat and edible by-products, exercise close control over environmental conditions at all stages of processing and breakdown the transmission of zoonotic meat borne diseases through meat inspection.



**Fig. 1:** Map of Study Area (Nekemte Town)

**2.2. Study Population**

The study was conducted in Nekemte town which was found in East Wollega zone of Oromia regional state, Ethiopia. The

403 cattle originated from neighboring marketing areas such as from Sassiga, Guto Gida, and Leka Dullacha woreda areas were selected and slaughtered at Nekemte municipal

abattoir. Then Ante mortem and postmortem examination of slaughtered cattle. Inspection was conducted to determine the presence of *C. bovis* distribution on the different vital organ.

### 2.3. Sampling Frame and Sample Size Determination

#### 2.3.1. Sample size determination

The study was cross sectional abattoir survey which includes cattle brought from different livestock markets to Nekemte municipal abattoir. The totals of 403 cattle were purposefully recruited for the study.

#### 2.3.2. Sample size

Since the approximate prevalence of the disease in the region/area/ was known, 15.5% expected prevalence and a 5% absolute level of precision was considered to calculate the number of animals to be sampled (Thrusfield, 1995). But according to Biranu (2017) were prevalence of *C. bovis* were reported in Nekemte abattoir 15.5%. However, the sample size was 31 multiply by 13 to increase our perception we doubled our sample and totally 403 samples was collected from Nekemte abattoir house. The sample size calculation formula:

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

d<sup>2</sup>

Where; n=Total number of sample size

P<sub>exp</sub> =Expected prevalence, d = Absolute precision (0.05).

### 2.4. Study Design and Methodology

#### 2.4.1. Ante mortem Examination

Three days visit per week was made for ante mortem and postmortem examination of slaughtered cattle. Age, breed, sex and body condition of each study animals was recorded on prepared format paper. Body scoring of the cattle was made based on the guideline provide by Nicholson *et al*, 1986. Each scoring were given number from 1(L-, very lean) to 9 (F+, very fat) and finally included under three body condition scores poor, medium and good. Age determination will carried by means of their dentition as described by Kelly (1975).

#### 2.4.2. Postmortem examination

To estimate the prevalence of Metacestodes a through meat inspection was be conducted on 403 heads of cattle slaughtered in Nekemte abattoir during the study period (September 2022 to Feb. 2023). During ante mortem

inspection, each of the study animals was be given an identification number and age, sex, breed and origin of the animals was recorded. An attempt was made to know the geographical origins of animals slaughtered and relate the findings to a particular locality ;most of them was originated from neighboring marketing areas such as from Sassiga woreda, Guto Gida Woreda and from Nekemte areas were selected and slaughtered at Nekemte municipal abattoir. In the abattoir, meat inspection was carried out on different organs of slaughtered animals, particularly lung, liver, kidney, spleen, heart and the muscles. Each organ was assessed by visual inspection and palpation and where necessary one or more incisions was be made in order to detect the Metacestodes. During postmortem inspection, meat inspectors made the incision according to MOA (2002).

### 2.5. Data Management and Analysis

Abattoir data was collected and data cleaning was done properly in the Microsoft excel sheet (V. 20). The outcome variables for the abattoir study were cases of metacestodes detected during routine post mortem inspection at Nekemte municipal abattoir. The statistical analysis was with STATA statistical software. Logistic regression was employed to analyses the association of the occurrence of the two diseases with the potential risk factors like origin, breed, body condition score and age using. Multivariate analysis for the risk factors during the study period was used in which the degree of risk factors association between the diseases occurrence and the risk factors were analyzed using odd ratios. Pharmaceutical inventory data were also coded and analyzed.

### 3. Result

#### 3.1. Prevalence of *C. bovis* According to Origin

In the present study, an overall prevalence of 1.9 % (p < 0.05) was determined by the visual meat inspection which out of 403 sampled animals 8 of cattle are positive of prevalence of *C. bovis* disease. A higher prevalence of 11% was observed in Arjo, Guto Gida (1.60%) when compared to Nekemte and Sassiga (0 %) but there was no statistical significant variation between the study districts. This indicated that all districts are found in the same ecological location (table1).

**Table 1:** Result of prevalence at district level.

No.	Origin	No. of sample	No. of Positive	Prevalence (%)	p- Value
1	Nekemte Town	10	0	0	.000
2	Guto Gida	183	3	1.63%	
3	Sassiga	7	0	0	
4	Leka Dullacha	80	1	1.25%	
5	Diga	104	2	1.92%	
6	Arjo	19	2	10.50%	
	<b>Total</b>	<b>403</b>	<b>8</b>	<b>1.9%</b>	

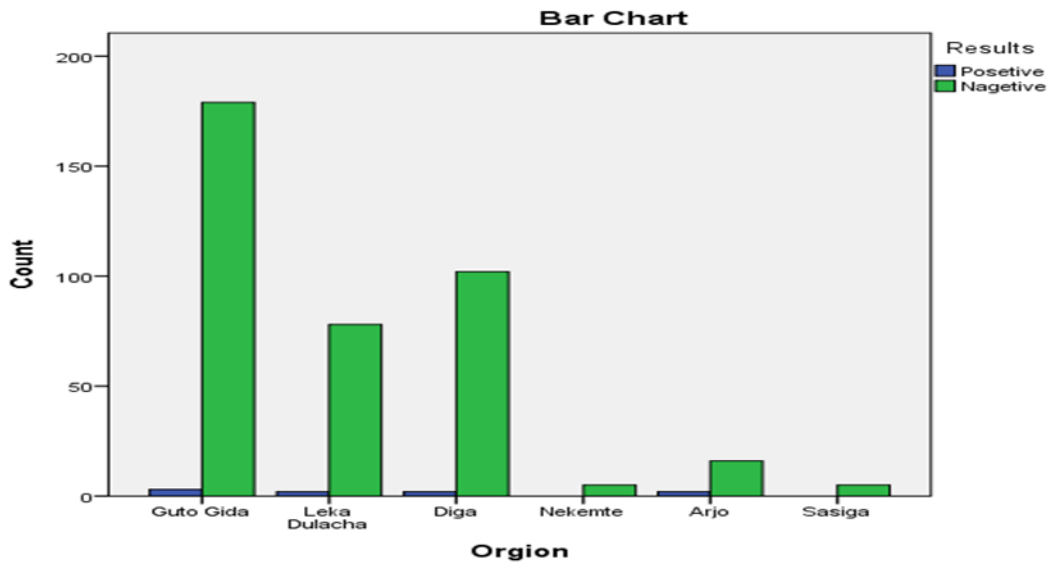


Fig. 2: prevalence of *C. bovis* in those districts.

**3.2. Prevalence of *C. bovis* According Intrinsic risk factors**

In this study when we determined by the visual meat inspection out of 403 sampled cattle 8 of them are positive of prevalence of *C.bovis* disease (Table 2). A higher prevalence of 1.9% was observed in male and lower one

0.69% in female as well as 14% in young and 2.01% in adult. When we compare depend on body condition 3.12% in medium, 2.50% in Good and 1.74% in very good. This indication show that there is no difference on susceptibility depend on sex, age and body conditions. (table2).

**Table 2:** Prevalence of *C. bovis* disease in age, sex, and body condition score by cross tabulation.

Variables	No. of animal tested	No. of Positive	Prevalence (%)	X <sup>2</sup> (P-value)
<b>Sex</b>	<b>403</b>	<b>8</b>	<b>1.9%</b>	<b>0.089</b>
Female	145	1	0.69%	
Male	259	7	2.7%	
<b>Age</b>	<b>403</b>	<b>8</b>	<b>1.9%</b>	<b>0.105</b>
2-3 years(young)	7	1	14 %	
>3years(adult)	397	8	2.01 %	
<b>BCS</b>	<b>403</b>	<b>8</b>	<b>1.9%</b>	<b>0.09</b>
Medium	32	1	3.12%	
Good	198	5	2.50%	
V. Good	172	3	1.74%	

**3.3. Prevalence of *C. Bovis* According to Vital Organs**

The distribution of *C.bovis* depend on vital organs are

ascending from 0.24% in liver, heart and masseter, in shoulder 0.49% and followed by 0.74 in tongue.

**Table 3:** Organ distribution of *C.bovis*.

Organs	No. of animals examined	No. of animals infected	Prevalence
Shoulder	403	2	0.49%
Masseter	403	1	0.24%
Tongue	403	3	0.74%
Heart	403	1	0.24%
Liver	403	1	0.24%
<b>Total</b>	<b>403</b>	<b>8</b>	<b>1.9%</b>

Cross-tabulation was used to screen all potential risk factors for statistical significance at (p<0.05).The risk factors (sex, age, and body condition score) that statistically significant in Cross-tabulation analysis were included in the model and analyzed together. Therefore, the final Cross-tabulation model analysis is result showed that sex, age, and Body condition score were statistically significant association with prevalence of *C.bovis* prevalence (P <0.05)(Table 3).

**4. Discussions**

The present study revealed that the overall prevalence of cysticercosis in cattle slaughtered at Nekemte municipality

abattoir was 1.9 %, which is comparable to with the findings of Tembo (2001) and Teka (1997), in which the prevalence was 2.2% and 3.2% respectively. The reason for the decreasing prevalence may be attributed to difference in improved quality of meat inspection and decreasing of consumption of raw meat. The conventional method of meat inspection is less sensitive to pick all animals that are infected with *Taenia saginata*, which allows transmission between man and cattle (Dorny, et al., 2002; Minozzo, et al., 2002). In this study only 8 animals were identified as infected with *C. bovis* out of 404 animals inspected at Nekemte Town municipality abattoir, cysticerci are easily

missed during inspection because the cyst may not be present on the routine cuts. According to Dorny *et al.* (2002) and Minozzo, *et al.*, (2002) 5-50 times higher prevalence rates could be found by complete slicing of the predilection site than routine inspection. According to experimental study conducted by Minozzo, *et al.*, (2002) 85.9% of *C. bovis* were found in the skeleton muscles that are not inspected during the routine inspection. The other reason is that postmortem inspection is less sensitive when the infection is at initial stage.

The results of this study confirm that, in spite of the time and effort taken by meat inspectors for looking for cysticerci at predilection sites, this method is less sensitive (Dorny, *et al.*, 2001; Minozzo, *et al.*, 2002). This is further complicated by the fact that live cysts are translucent and often pinkish in color and may therefore be less conspicuous in the meat than dead cysts that usually form white and fibrotic lesions (Onyango Abuje *et al.* 1996). The inefficiency of detecting infestations by classical meat inspection is one of the reasons for the persistence of the infection in the human population of Ethiopia. In Ethiopia bush defecation, habit of eating raw beef (kifto, Kourte, Gored-Gored) and village slaughter might have contributed much for the increase in prevalence of cysticercosis in cattle.

## 5. Conclusions and Recommendations

- The wide distribution of *Taenia saginata* *Cysticercus bovis* is associated with several factors including: raw and under cooked beef consumption, bush defecation and poor waste disposal, poor sludge and sewage treatment system, low level of public awareness and presence of backyard (village) slaughtering practices.
- Conventional meat inspection technique is less sensitive and time consuming, lightly infected carcasses can be easily missed and passed for human consumption thus the infection transmission is maintained between humans and cattle.
- Thus taeniasis /cysticercosis, remains a widespread zoonosis that affects human health and economy through condemnation, quality degradation of frozen beef, cost of refrigeration, cost of human therapy, lowering productivity of infected workers who may be absent from work or reduce their working efficiency by creating uneasiness.
- Therefore to reduce the transmission of taeniasis/cysticercosis health education, consumption of cooked meat, improved standards of human hygiene and to increase the diagnostic potential of the tests

## Abbreviations

C.bovis	<i>Cysticercus bovis</i>
CSA	Central Statics Agency
MOA	Ministry of Agriculture
MSO4	Magnesium Sulphate
NTUAO	Nekemte Town Urban Agriculture Office
OIE	Office of International Epizootic

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## Conflict Of Interest

The authors read and agreed on there is no conflict of idea on publishing this manuscript.

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