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# Occurrence of Bovine Cysticercosis among Cattle Slaughtered At Sokoto Modern Abattoir

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**Abstract:** A study on bovine cysticercosis was conducted at Sokoto modern abattoir with the main objectives of determining the occurrence of cysticercosis in slaughtered cattle. A total of 80 samples were collected each containing of Heart, Tongue, Lungs, Liver, Kidney, Diaphragm and Masseter and investigated appropriately for *Cysticercus* cyst. Out of the total 80 inspected animals, 7 animals had variable number of *Cysticercus bovis* giving an overall prevalence of 8.8%. Anatomical distribution of the cyst showed that the highest proportions of *C. bovis* cyst were observed in tongue, followed by heart, triceps and masseter muscle. The main reason for the cysticercosis is the primary host (Humans) depositing *T. saginata* eggs on vegetation and from where cattle contracted the disease during grazing.
**Keywords:** Bovin health, cysticercosis, *Teania saginata*, cestodes, abattoir etc.

## INTRODUCTION

It has been reported that Bovine slaughtered at Sokoto abattoir are heavily infected with intestinal helminth parasites [1].

Tapeworm infections have been recorded in history from 1500 B.C. and have been recognized as one of the earliest human parasite [2]. Cysts of *Cysticercus bovis* can be found anywhere in the carcass, meat and viscera [3]. Bovine Cysticercosis usually has no clinical signs associated with it; however, heavy infections may cause myocarditis and heart failure due to the pathology caused by developing cysts in the heart [4].

The distribution of *T. saginata* is wider in developing countries where hygienic conditions are poor and where the inhabitants traditionally eat raw meat or insufficiently cooked meat [5]. Forty percent (40%) of the cases were reported to occur in Africa [6]. The disease is relatively common in Africa, some parts of Eastern Europe, the Philippines, and Latin America. This parasite is found anywhere where beef is eaten, even in countries such as the United States, with strict federal sanitation policies. In the US, the incidence of infection is low, but 25% of cattle sold are still infected. The total global infection is estimated to be between 40 and 60 million. It is most prevalent in Sub-Saharan Africa and the Middle East [7].

It is associated with poor hygiene, economic condition and religious believes, close proximity of humans to cattle kept with little or no distinction between companion or utility functions [6]. Transmission of the parasite occurs most commonly in the environment characterized by poor sanitation, primitive livestock husbandry practice and inadequate meat inspection, management/control policies. [7].

Bovine cysticerosis is responsible for considerable amount of economic losses which can approach 30% when the loss in the carcass weight and the cost of freezing for the infected meat is considered [8]; as well as the health problems caused by the adult worms (due to infected meat consumption) in human gives rise to high medical costs [9]. Generally, the parameters to determined the loss by the disease are; prevalence rate, grade of the animal's infection, prices of cattle and treatment costs for detained carcass [10].

Here in Nigeria, a prevalence of 2.1% for the disease was reported in Bauchi Plateau Dada [11]. Another was reported in Maiduguri with a prevalence of 4.2% [12]. The disease causeses a huge economic loss to the cattle industry due to organ condemnation, ill health status and crucial death as well as human as consumer of cattle meat, therefore this study was carried out to reveal the status of this parasite in surrounding cattle population and possible risk factors on human health.

## MATERIALS AND METHODS

The study was conducted at Sokoto modern abattoir, located in the northan part of Sokoto city, runjin sambo market.

The climate in Sokoto is referred to as a local steppe climate. In Sokoto, the average annual temperature is 28.4 °C. The average annual rainfall is 629 mm. Sokoto is in the dry sahel surrounded by sandy savannah and isolated hills. The warmest months are February - April, where daytime temperature can exceed 45°C (113.0°F). Highest recorded temperature is 47.2°C (117.0°F) which is also the highest recorded temperature in Nigeria. The rainy season is June - October, during which rain showers are at a daily occurrences. From late October to February, during the cold season the climate is dominated by the harmmatan wind blowing sahara dust over the land. The dust dims the sunlight thereby lowering temperature significantly.

**Sample collection**

Cattle were presented to the abattoir for slaughtering, were randomly selected and routinely inspected for *T. saginata* cysticercosis. Animals slaughtered during this study were both male and female of local breed.

For this research work, a total number of 80 cattle were investigated. The organs checked for the presence of *Cysticercus bovis*, were- Heart, Tongue, Lungs, Liver, Kidney, Diaphragm, Masseter.

Before slaughtering and inspecting the animals, ante mortem inspection was carried out. Ante mortem examination on individual animals was done for the assessment of body condition, age, sex, breed and their place of origin. During post mortem inspection, palpation of the organs followed by incision was made to examine for the presence of *C. bovis*. Because of owners' discomfort on multiple incisions for the thorough examination of major muscles, only the masseters muscle and internal organs such as tongue, heart, liver, kidney, lung and diaphragm were used as indicators of the presence of cysts in the carcass. Careful examination on the carcass of study unit was made through palpation of the organs followed by incision as follows:

**Tongue**

The surface and substance of tongue was examined visually, followed by longitudinal ventral incision from the tip of the root.

**Masseter**

Extensive deep incision was made into external and internal muscles of masseters parallel to the plane of the jaw (parallel to the jaw bone from the lower jaw).

**Heart**

Visual inspection and longitudinal incision of the myocardium from base to apex was made.

**Diaphragm**

The muscles of diaphragm were examined visually and by making incision.

**Kidney, Liver and Lung**

Examination of kidney, liver, and the lung was also conducted accordingly by visualization, palpation and incision.

Cysts observed in theses organs were carefully dissected as described by Anon, [13], and numbers and nature of cysts in each organ was recorded for each animal. The nature of the cyst was recorded as calcified and viable by visual observation of its appearance, as Ashwani and Gebrehiwot, [14] dead degenerated or calcified *cystcerci* clearly form identifiable spots of white and have fibrotic lesions, while the viable *cysticerci* are pinkish-red in colour. Emerging data was analyzed and recorded.

**RESULTS**

A total number of 80 cattle were examined for the presence of *C. bovis* from the various parts where the cysts could be found. Out the 80 cattle, 69 were bulls 5 of which were positive. 2 of the 11 cows were also found positive. These corresponded to a relative prevalence of 7.2 and 18.2 percent for *C. bovis* in bulls and cows, respectively. There was a significant difference ($\chi^2_{(1)} = 4.840$, $p = 0.028$) in the percentage distribution of *C. bovis* in bulls and cows. The total prevalence of both cows and bulls was 8.8 percent (Table-1).

**Table-1: Prevalence of Bovine cysticercosis Based on Cattle's Gender/Sex**

| Sex | No of animals inspected | Number of positives | Prevalence (%) |
|---|---|---|---|
| Male | 69 | 5 | 7.2 |
| Female | 11 | 2 | 18.2 |
| Total | 80 | 7 | 8.8 |

Cattle between the ages of 1 to 3 months had the highest prevalence of 11.4 percent. The least prevalence (0.0%) was observed in cattle between age 7 to 13 months old. There was a significant difference ($\chi^2_{(3)} = 5.970$, $p < 0.001$) in the percentage prevalence of *Cysticercosis* across the different age groups of cattle that were examined (Table-2).

**Table-2: Prevalence of Bovine cysticercosis Based on Cattle's Age**

| Age | No of animals inspected | Number of positive | Prevalence (%) |
|---|---|---|---|
| 1-3 | 44 | 5 | 11.4 |
| 4-6 | 18 | 1 | 5.6 |
| 7-10 | 11 | 0* | 0.0* |
| 11-13 | 5 | 0* | 0.0* |
| 14-16 | 2 | 1 | 50 |
| Total | 80 | 7 | 8.8 |
| *p* value | | 0.102 | < 0.001 |

*these values were not included in the Chi squared calculations

Based on the origin of the cattle, the highest prevalence was recorded for Talatan Mafara with 33.3 percent of the cattle positive for infection with *cysticercosis*, while Sokoto city and Goronyo showed no infection at all and Ilella and Achida showed 11.8% and 9.0% prevalenve of disease. Comparison of the percentage prevalence of positive infections from these locations indicated that there was no significant difference ($\chi^2_{(3)} = 30.00$, $p < 0.001$) in the number of *cysticercosis* infections.

**Table-3: Prevalence of Bovine cysticercosis Based on Origin of Cattle**

| Origin | No of animals inspected | Number of positive | Prevalence (%) |
|---|---|---|---|
| Talatan Mafara | 9 | 3 | 33.3 |
| Sokoto city | 12 | 0* | 0.0* |
| Illela | 17 | 2 | 11.8 |
| Goronyo | 15 | 0* | 0.0* |
| Achida | 11 | 1 | 9.0 |
| Tangaza | 16 | 1 | 6.3 |
| *p* value | | 0.666 | < 0.001 |

*these values were not included in the Chi squared calculations

Cysts were found in tongue, heart, triceps and masseter muscles of the cattle examined. In 8.7 % of the cattle, cysts were found on the tongue, 7.5 % were observed on the heart muscle, 5.0 % in the triceps and 2.5% in the masseter muscle. Thus, tongue infection with cysts of *C. bovis* was most prevalent in the cattle examined. No cyst was observed from kidney samples. However, it was observed that the number of cysts found on the various organs varied. The mean number of cysts per infected organ in the examined cattle is given in Table-4. It can be seen that the masseter muscle had the highest mean number of cysts per organ while the tongue and heart had the least.

**Table-4: Distribution of *C. bovis* in Different Organs and Tissues of Affected Cattle**

| Organ affected | Number of positive | Prevalence of infection | Number of cysts recovered | Mean number of cysts/organ |
|---|---|---|---|---|
| Tongue | 7 | 8.7 | 23 | 4.00 |
| Heart | 6 | 7.5 | 17 | 4.00 |
| Triceps | 5 | 5.0 | 11 | 4.25 |
| Masseter | 2 | 2.5 | 7.5 | 5.50 |
| *p* value | 0.376* | | 0.058** | 0.759*** |

*$\chi^2_{(3)} = 3.105$, $p = 0.367$; **$\chi^2_{(3)} = 7.500$, $p = 0.058$; *** $\chi^2_{(3)} = 1.174$, $p = 0.759$)

## DISCUSSION

Cysticercosis occur most commonly in the environments characterized by poor sanitation, primitive livestock husbandry practice and inadequate meat regulatory bodies. 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 [15] contributing to constraint in food security and safety. The results of the present study also reflect both the economic and zoonotic importance of this disease, which is in agreement with the above statements.

The prevalence of *C. bovis* among the carcasses inspected at Sokoto modern abattoir was 8.8%. The result showed a slightly higher prevalence. This may be due to poor sanitary infra-structure, non-awareness about the disease and improper disposal of sewage in the study area. Earlier it was investigated that improper removal and treatment of sewage, application of sewage sludge to fields and faecal contamination of feed and/or water by farm employees, frequent defecation on pastures by homeless individuals are possible sources of infection in the developed countries [16, 17].

In this study, females were found to have the highest prevalence of *C. bovis* at 18.2%. The higher prevalence in cows is most probably due to the fact that cows are mostly kept for longer period of time because they are required to reproduce for maximum benefit for the owners, while males were sold for meat. Because of the extended period of grazing, cows have high tendency of being infected.

The study also showed the highest prevalence based on age to be 14 – 16 with a prevalence of 50% and the lowest to be 7 – 13 with no prevalence at all; this may be due to the sample size of that age group as only two samples were collected of that age group and by chance one of them was infected with cyst, a more clearer status was possible with larger number of samples from the same group. There is no direct correlation between the age of cattle and the number of infection seeing that age group 1 – 3 has higher prevalence than 7 – 13 and lower prevalence than 14 – 16.

Based on the organs or body parts, this study showed the tongue was most frequently infected organ among the cattle inspected with 8.7% of total animals found to be positive in this organ (the tongue). This is likely to be because the tongue is usually the first organ to come in contact with the parasite during cattle grazing. And also because the mode of infection is through ingestion, the tongue is almost always exposed to the parasite. Masseter muscle appears to be the least frequently infected among the cattle with 2.7% cattle being found positive.

This study revealed light infection among the inspected animals and this could be due to the practical limitations to the number of incisions allowed and many infestations could be undetected [15]. As gross mutilation lowers the marketability of carcasses and introduces contamination, owners do not allow multi incisions for the detail investigation. However, the present study showed higher prevalence than the findings of Dada [11] from Bauchi Plateau (2.1%), Biu [12] from Maiduguri (4.2%). Conversely, lower prevalence than this was reported from developed countries, such as 0.26% in Croatia [18], 0.48-1.08% in Germany, Abusier *et al*., [19] and 0.9% in Cuba [20]. Thus, *T. saginata* cysticercosis has more public health and economic significance in developing country like Nigeria compared with developed countries.

In this study, there is no association between, age, origin and the prevalence of Cysticercosis. One possible explanation for insignificance of variation might be due to the fact that most of the animals slaughtered in this abattoir had similar husbandry systems (the same type of livestock management) [21].

Regarding the anatomical distribution of the cysts in the intermediate host, many researchers come up with different results. Fufa [22] and Tembo [23] reported triceps as being frequently affected by the cyst. 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 the reports of Hailu [24], Bedu *et al.*, [25], Ahmed [26], and Amsalu [27], on their respective working sites. The variations in anatomical distribution depend on a number of factors, such as blood kinetics and animals' daily activities. Any geographical and environmental factors affecting blood kinetics in the animal affect the distribution of oncospheres as well and hence the predilection sites during meat inspection [28]. More importantly, most of these organs, except the lung and diaphragm, are consumed raw or undercooked and could be a potential public health hazard in contracting taeniasis, therefore based on this research, it is adviced to general public to cook beef meat thoroughly using pressure cooker or microwave oven and consuming raw or uncooked meat.

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