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Incidence of Bovine Cysticercosis in Kajiado County, Kenya

Kimari A.M

Senior Technologist, Department of Veterinary Public health, Pharmacology and Toxicology,
Egerton University, Kenya

Muleke C.I

Associate Professor, Department of Veterinary Pathology, Microbiology and Parasitology,
Egerton University, Kenya

Abstract:

*Bovine cysticercosis is a common zoonosis whose prevalence is estimated at 50 million cases of infestation worldwide with economic losses in Kenya amounting to \$1.289 million by 2003. This study investigated the incidence rate of bovine cysticercosis and taeniasis in Kajiado County and established cyst viability of isolated *Cysticercus bovis*. Method: A total of 468 carcasses from seven abattoirs were inspected according to Kenya Meat Control Act while cyst viability was tested using 40% Ox-bile diluted in normal saline. Results: An incidence rate of 2.56% for bovine cysticercosis and a cyst viability of 83% was recorded. Conclusion: The recorded incidence rate demonstrated that bovine cysticercosis is present in Kajiado County. Public health education on hygiene and strict enforcement of meat inspection rules and regulations are some of the measures that could curb the disease.*

Keywords: Bovine cysticercosis, *Cysticercus bovis*, zoonosis, incidence rate

1. Introduction

Bovine cysticercosis remains a significant challenge for socioeconomic development, public health, food safety, and a continuing threat to animal production on a global basis. Cattle production and marketing in Kajiado County is the main economic activity, with about 70% of the people depending on livestock and their products. However, the incidence rate of bovine cysticercosis in Kajiado County has not been documented so far leaving the county without the correct statistics. This zoonosis revolves between man (taeniasis) who is the definitive host and cattle (bovine cysticercosis) which are the intermediate host. When undercooked, infected beef is eaten by a human host the cyst excysts and the evaginated scolex attaches to the intestinal epithelium and develops to a mature tapeworm within 8-10 weeks. *T. saginata* can reach 5 meters long consisting between 1,000 to 2,000 proglottids each carrying 1,000 eggs and can have a lifespan of 25 years in a hosts' intestine (WHO/DFID-AHP 2005). *T. saginata* produces many gravid proglottids which break off singly, are transported via human feces and passed on to the environment.

The reported prevalence rates in many studies are the results of routine slaughterhouse inspection, which are an underestimation of the real prevalence by at least a 3-10 factor (Zdolec et al., 2012). Although meat inspection has 100% specificity, it has low sensitivity (11.5–15.6%), which increases the risk of potential exposure to consumers due to false negative meat inspection results (Fahmy et al., 2015). Proximity and close contact with animals, consumption of raw or poorly cooked meat, poor meat hygiene, and cultural practices are the main factors that expose the pastoralists to this disease (Swift et al., 1990; Zinsstag et al., 2006). The general ignorance of the pastoralists on associated zoonotic risk factors of bovine cysticercosis contributes to the ongoing epidemiological situation in Kajiado County as reported by Meiry et al., 2013.

2. Methods

2.1. Study Site

Kajiado County lies in the semi-arid and arid zones characterized by warm and hot climate with temperature mean of 25°C. The rainfall pattern is bimodal, with high average of 1,250mm and a low average of about 500mm per annum

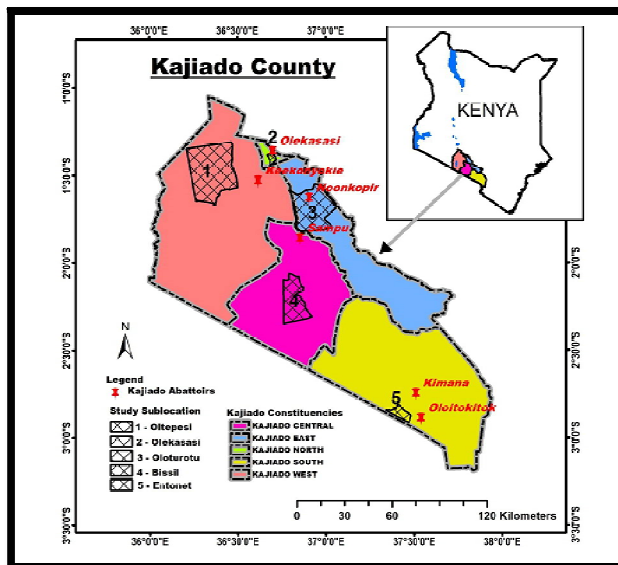


Figure 1: Map of Kajiado County and the Selected Abattoirs

2.2. Study Design and Study Animals

Seven abattoirs namely Kekonyokie, Bissil, Sampu, Olekasasi, Noonkopir, Kimana and Loitoktok in Kajiado County were selected for slaughterhouse survey depending on their daily kill and their distribution across the County. A total of 468 carcasses were inspected in a period that lasted for two months between May 2016 and June 2016.

2.3. Sample Size Estimation

Sample size was chosen using random sampling according to Slovin’s formula (Galero-Tejero 2011).

$$n = N / (1 + Ne^2)$$

Where:

$$n = 6000 / (1 + 6000 \times 0.0444^2),$$

$$n = 468.$$

The total number of carcasses to be sampled was divided among the seven abattoirs relative to their daily kill.

Post mortem inspection

All the carcasses underwent meat inspection according to Kenya Meat Control Act CAP. 356: 1973 Revised 2012. Macroscopically observed cysts were excised carefully with at least 3grams of adjacent tissues, packaged in polythene sample paper bags, transported to the laboratory in a cool box before being stored at 40C in a refrigerator. The samples were later transported to the parasitology laboratory in Veterinary Research Institute (VRI) in Muguga, Kenya for confirmation of cyst viability.

2.4. Cyst Viability

The cysts were carefully excised from the 3g beef sample collected from the carcasses without lancing through the cyst and immersed in 40% Ox-bile solution diluted in normal saline (NaCl2) solution in petridishes and incubated for 1-2 hours at 370C. They were observed under X10 and X100 of a microscope for evagination of suckers.

2.5. Data Management and Analysis

The abattoir survey results were recorded on a Microsoft excel spreadsheet and analyzed using SPSS version 20 software program.

3. Results

From table 1 below, out of the 468 carcasses inspected 12 were positive (Table 1) while the overall incidence rate of bovine cysticercosis was 2.56% between May 2016 and June 2016. The incidence rate of bovine cysticercosis was highest in Olekasasi in Kajiado North (9.090%) and lowest in Kajiado West and Kajiado South (0%) respectively. The calculated mean incidence fixed at zero gave a P- value of 0.000 which is P< 0.005. This implies that the mean incidence rate of bovine cysticercosis in carcasses slaughtered in selected abattoirs in Kajiado County is different from zero, and therefore the prevalence rate was significant.

Sub-County	Slaughter House	Positive Cases	Negative cases	Totals kill	Prevalence Rate
Kajiado Central	Bissil	3	145	196	1.53%
	Sampu	0	48		
Kajiado East	Noon-Kopir	6	143	149	4.03%
Kajiado North	Olekasasi	3	30	33	9.090%
Kajiado South	Kimana	0	24	30	0%
	Loitoktok	0	6		
Kajiado West	Keekonyokie	0	60	60	0%
Total N.		12	456	468	2.56%

Table 1: No. of Slaughters per Slaughterhouse and Calculated Prevalence Rates

Out of 12 cysts that were obtained from the slaughter houses, 10 were viable. The remaining 2 were found to be calcified which translates to 10/12 (83%) viability.

Predilection site	No. of cysts
Heart	2
Triceps muscles	7
Masseter	2
Liver	1
Total	12

Table 2: Distribution of Cysts in Carcasses

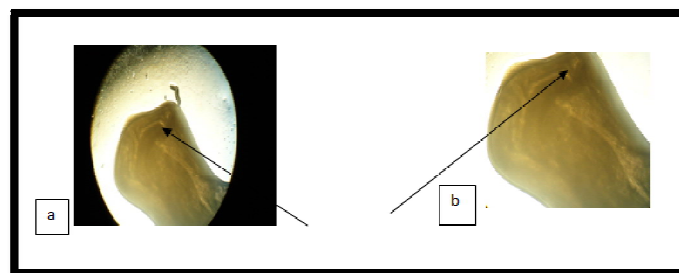


Figure 2: Suckers of Evaginated Viable Cysts

4. Discussion

Much study on prevalence rate of bovine cysticercosis through slaughter house survey has been conducted in many countries especially Ethiopia and Nigeria. However, little has been done in this country and more so in Kajiado County. Varying results have been recorded in different studies carried out in different countries and localities within the same country; for instance, out of the 468 carcasses sampled in this research, 12 were found to be positive which translates to 2.56% incidence rate. The results agreed well with results reported in Nyagatare slaughter house, Rwanda by Stampston et al., 2016 which recorded a prevalence of 3% while 2.59% was reported in Wolayta Sodo (Dawit et al., 2012). However, it was higher than 2% prevalence rate recorded in Gondar ELFORA in Ethiopia (Adem and Alemneh 2016) and lower than 3.6% in Jimma municipal abattoir (Gomol et al., 2011).

This implies that bovine cysticercosis was present in Kajiado County, Kenya although the rate may not be as high as reported in earlier studies. For instance, the Department of Veterinary services from 1954-1958 recorded a 20-35% prevalence rate according to Froyd 1960. The drop in bovine cysticercosis was associated with improved hygiene especially around the urban areas. However, the limited number of incisions prescribed by Kenya meat inspection act could lower the incidence rate in as much as its meant to protect gross mutilation of the carcass that predisposes it to bacterial infection. This has been proven by studies carried out elsewhere which demonstrated that cysts could be found in other sites such as diaphragm, liver, biceps, chuck, strip loin, full tenderloin, knuckle and back limbs which are not incised routinely (Lopes et al., 2011). This may have led to false negatives while in essence the carcass was infected. Opposition from some traders was also experienced during the slaughter house survey; for instance, traders opposed inspection of the masseter muscles citing the lowered quality of the head as had been reported in another study by Engdaw et al., 2015.

The low incidence rates were also associated with challenges encountered during the study which included the infrastructure and conditions in the slaughter house. It was noted that most slaughter houses conduct night slaughters under dim lighting and were highly congested especially at night. This hampered movement of the inspector, caused obstruction and therefore poor visibility as the incisions were being done. This lowered the sensitivity of the inspection procedure though very specific. This was observed in a research conducted in Kombolcha Elfora meat factory, Ethiopia by Jemal and Haileleu 2011. The slaughter facilities were mostly owned by private investors though inspection services were managed by the Ministry of Livestock Development and Fisheries. This brought conflict of interest between the business people and the management as reported by Garedaghi et al., 2011.

Cyst viability test showed 10/12 (83%) viability which was high compared to research undertaken elsewhere; for instance, 62.5% was reported in North Turkana, (Asaava et al., 2009), 70% by Getachew and Kumar 2013, while Emiru et al., 2015 reported a viability of 66.6%. The highest viable number was in Noon Kopir slaughter house which was relative to the high incidence rate in that slaughter house. Upon being tested, cysts were either calcified (degenerate) or viable. Viability of cysts simply translates to possible human exposure to infection with taeniasis if beef from such an animal is ingested raw or half cooked.

5. Conclusion

This study portrayed presence of the disease and this could delay attainment of zero prevalence of such zoonosis and the 'One Health Concept'.

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7. Compliance with Ethical Standards

Ethical clearance was acquired from Egerton University Ethical committee reference number (EU/RE/DVC/009)

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