OBSERVATIONS ON *TAENIA SAGINATA* CYSTICERCOSIS IN CATTLE SLAUGHTERED IN TANZANIA

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SUMMARY

Cysticercosis was detected in 52 (10.5%) out of 496 slaughtered cattle in the municipal abattoirs of Arusha, Dodoma, Iringa, Morogoro and Mpwapwa district in Tanzania during the period June, 1991 to November, 1991. The prevalence rates in the individual abattoirs were 16.7% (Arusha), 9.6% (Iringa), 8% (Dodoma), 7.6% (Mpwapwa) and 6.5% (Morogoro). The average cattle prevalence was 10.2%. Investigations at the sites routinely examined to search for *T. saginata* cysticercosis in 15 infected bovines at Morogoro abattoir, Tanzania, revealed that naturally infected zebu cattle harboured on average 40.3+/- 9.2 SD. cysticerci at the routine inspection sites. Relative concentration of cysts per site in percentage indicated the cysticerci were located preferentially in the following order: heart (29.5%); M. triceps brachii (26.5%); M. psoas (12.6%); the tongue (6.8%); and masseter muscles (6.3%). The heart was considered an important site to search for cysticerci of *T. saginata* due to relatively high concentration of cyst (29.5%) in that organ. Viable cysticerci of *T. saginata* were detected in 60% of the infected bovine carcass while 73.3% had degenerated cysts which posed both zoonotic threat and affect markertability of the meat. It was concluded that *T. saginata* cysticercosis is still a problem in Tanzania and recommended to intensify public health education to control human taeniasis and cysticercosis.

Key words: cattle, cysticercosis, *Taenia saginata*, Tanzania

INTRODUCTION

Taenia saginata cysticercosis is one of important parasitic zoonosis of cattle whose manifestation is less spectacular but cause considerable economic loss to the beef industry (Urquhart, 1961; Pawlowski and Schultz, 1972, Grindle, 1978). The parasitosis is worldwide in distribution, however, its prevalence seems higher in Africa and Asia than in other parts of the world (Urquhart, 1961; Froyd, 1965; Pawlowski and Schultz, 1972; Arambulo *et al.* 1976). According to Michell (1973), Africa is considered to be the most parasitized area.

Prevalence rates of *T. saginata* cysticercosis are mainly based on

routine meat inspection records (Pawlowski and Schultz, 1972; Michell, 1973). However, it has been found that routine meat inspection is not sufficiently reliable for the diagnosis of *T. saginata* cysticercosis due to low recovery rates, (Kyvsgaard *et al.* 1990) and irregular distribution of the cysticerci in the bovine tissues (Derwist *et al.* 1967; Juranek *et al.* 1976; McCool,1979; Walther and Koske, 1980). *T. saginata* cysticerci are most often located in the striated muscular tissues of cattle (Juraneck *et al.* 1979). However, they have also been found in non muscular tissues of cattle, such as the liver, lungs, spleen, lymph nodes, fascia and adipose tissues of cattle (Juraneck *et al.* 1976; Osiyemi, 1976; McCool, 1979; Nyaga & Gathuma, 1979; Kyvsgaard *et al.* 1990). When fully developed and viable, the parasite can be recognized in the host tissues as a small, translucent, colourless or pink coloured, ovoid, fluid filled bladder, measuring 8 x 5 mm, and contains a single grey coloured invaginated, unarmed scolex (McIntosh and Miller, 1960). Within the host the parasite may die and degenerate, and it is not unusual to find viable as well as degenerated or calcified cysts in the same host (Derwirst, *et al.* 1963; Froyd, 1964).

T. saginata cysticercosis is endemic in Tanzania. Urquhart (1961; quoted Report of Veterinary Services, 1958) reported prevalence of cysticercosis in Tanzania (by then Tanganyika) to be approximately 50%. Nadzafov (1975) reported prevalence of 5% at the main abattoir in Dar-Es-Salaam in Tanzania. Petrovic (1976) reported prevalence rate of *T. saginata* cysticercosis at Tanganyika Packers abattoir in Dar-Es-Salaam, Tanzania to vary from 2.6% to 26.9% with an average of 7.28%, among 163,546 slaughtered cattle consigned from different parts of the country.

This paper reports on a survey conducted in municipal abattoirs of some regions of Tanzania where slaughter cattle is raised so as to elucidate the prevalence of *T. saginata* cysticercosis in beef cattle from the local areas. At the same time determine the nature of the cysticerci and extent of parasitosis in naturally infected cattle in the region. Considering the importance of the sites legally recommended to search for *T. saginata* cysticeri in cattle in Tanzania (Tanganyika Govermment, 1962), the current study determined the concentration of cysts at these sites and their fate in affected carcasses.

MATERIALS AND METHODS

Abattoirs

Visits were made to municipal abattoirs in Morogoro, Arusha, Iringa, Dodoma and Mpwapwa districts during the period between June 1991 and November 1991. Before a visit was made to any of the abattoirs, applications were made to the Regional Livestock Development Officer(s) (RLDO) in the respective regions, Meat Inspector in charge of each abattoir. Each abattoir was visited separately for a few days at the time of slaughter and the total number of cattle slaughtered and inspected, together with total cases of *T. saginata* cysticercosis detected on that day was recorded.

The cattle slaughtered in the abattoirs were brought in by individual butchers who had purchased them from nearby cattle markets. The main breed of cattle slaughtered in those abattoirs was zebu.

Arusha abattoir was privately owned and the only one equipped with modern slaughter, and overhead dressing facilities. It slaughtered on average 35 cattle per day. Five visits were made to the abattoir whereby all slaughtered cattle were examined at each visit.

Dodoma abattoir slaughtered on average 70 cattle per day. The system of slaughter in that abattoir involved owners of the cattle restraining the animals in the slaughter hall, while bleeding and dressing was done on the floor, at the same place. The premise at Dodoma abattoir was very congested with persons and meat Two visits were made to Dodoma abattoir. Three meat inspectors were involved in that hall, and immediately a carcass was inspected and passed for human consumption the owner took away the passed carcass for retail sale. All bovine carcasses inspected at Dodoma abattoir while the author was around were taken as sample for the abattoir.

Mpwapwa district abattoir, in Dodoma region slaughtered on the average 10 cattle daily, and it was visited immediately after the two days at the municipal abattoir in Dodoma. Five visits were made to Mpwapwa abattoir and all animals slaughtered at the abattoir for the five days visits were taken as a sample for that abattoir.

Iringa abattoir slaughtered on average 28 cattle per day. Five visits were made to that abattoir and each time the carcasses of all slaughtered cattle were taken as a sample for the abattoir.

Morogoro abattoir slaughtered on average 35 cattle per day. Five visits were made to Morogoro abattoir and each day all the carcasses were taken as a sample for the abattoir.

It was not possible, at the abattoirs to trace the individual herd of origin for each cattle because the animals had no

recognizable herd codes.

Meat inspection procedure
Meat inspection in the abattoirs was conducted by Government employed trained meat inspectors who were supposed to follow the Tanzania Meat Hygiene Regulations, 1962 (Tanganyika Government, 1962). The regulations prescribe the inspection to include general visual examination of the dressed carcass and organs, palpation of special organs like the tongue, oesophagus, the heart, the spleen, the lungs, and the liver. Incisions are made through the outer and inner masticatory muscles, the tongue, the heart, *M. triceps brachii* in both arms, diaphragm pillars, the rump, brisket, fillet and the chuck on both sides of the carcass. During the meat inspection procedure, the author followed the meat inspector very closely to ensure any detected case of *T. saginata* cysticercosis to be recorded.

Examination of cysticerci of *T. saginata* in bovine carcasses.

Source of *T. saginata* infected materials;
Fifteen half carcasses of zebu cattle, which at meat inspection were observed to harbour cysticerci of *T. saginata* together with the corresponding hearts, heads, tongues and livers were acquired from Morogoro municipal abattoir in Tanzania.
The meat inspectors at the abattoir were requested to detain any carcass found to be infected with a cysticerci of *T. saginata*, so that the required samples could be purchased from the owners. The first carcass detected on each of the visits made to the abattoir was taken as a sample. The breed and sex of each individual animal detected to be infected with *T. saginata* cysts were recorded at the abattoir.

Slicing of tissues from carcasses and examination of cysts.
In a dissection laboratory the different muscle groups excised from the bones of each half carcass, masseter muscles and the tongues from the heads together with the hearts, and the livers were all sliced in strips not thicker than 0.5 cm to detect mature cysts. The number of detected cysticerci were counted and the viability of detected cysticerci were recorded separately for each tissue and individual carcass. Fully transparent cysts with a visible scolex were considered as viable, any other as degenerated. Confirmation of viability of cysticerci was done by placing intact enucleated cysticerci from the host capsule in 30% ox bile, diluted in normal saline in a petri dish, incubated at 37EC for one to two hours. Viable cysts evaginated within one to two hours of incubation and the motility of their suckers, examined under a dissection microscope was also used as a

confirmatory test for viability. At least two cysts from suspicious case of cysticercosis was tested for viability of the cysts and morphology of the scolices.

Data analysis

Prevalence rates of *T. saginata* cysticercosis were calculated from total number of cases detected over the number of animals examined during the visits to each abattoir. Comparison of the prevalence rates was done by X^2 test using Epi Info 6 statistical package. The frequencies of detecting cysticerci in the sites routinely examined during meat inspection were calculated from the numbers of carcasses which were detected to have at least one cysticercus in the site compared to all carcasses examined. Total cyst counts were obtained from doubling symmetrical sites of the examined half carcass. The cyst counts used in this report are only those recorded from sites commonly regarded as predilection sites for *T. saginata* cysticerci i.e masseter muscles, tongue, heart, *M. triceps brachii*, psoas and the liver.

The infected carcasses were categorized according to viability of cysticerci detected in each case.

RESULTS

A total of 52 cattle (10.5%) out of 496 were detected to be infected with cysticerci during slaughter in five abattoirs in four regions of Tanzania. The prevalence rates of *T. saginata* cysticercosis in the individual abattoirs are given in Table 1. The prevalence rates in the abattoirs ranged from 6.5% (Morogoro) to 16.7% (Arusha) with average prevalence rate for the cattle as 10.5%. There was no significant difference between the prevalence rates detected in the different abattoirs (X^2 8.48, df. 4 , P >0.05). The total number of cysticerci counted at the sites routinely examined for *T. saginata* cysticercosis in the infected carcasses was 604 and the average number of cysts per carcass from all inspection sites 40.3+/- 9.2 SD (n= 15) (Table 2). The heart harboured relatively higher concentration of cyst per site (29.5%) compared to the rest of examined sites (Table 2). The frequency of detecting cysticerci in the predilection sites of the carcasses were: masseter muscles 9/15 (60%); tongue 9/15 (60%); heart 12/15 (80%), *M. triceps brachii* 12/15 (80%) and liver was 8/15 (53.3%) (Table 2). The liver and the heart were the only two organs where solitary cysticerci were detected among the 15 carcasses, whereby all the cysts in that heart were all degenerated while those found in that liver were alive. Suspected viable cysts detected in the carcasses at Morogoro abattoir did not appear to have hooks when the pro scolices were examined under a stereo-microscope. Among the infected carcasses, 60% harboured viable cysticerci of *T. saginata* whereby 26.7% of carcass

Table 1: Prevalence rates of *Taenia saginata* cysticercosis in individual abattoir in respective regions of Tanzania.

Region	Abattoir	No of visits	Number of cattle slaughtered	cases of *T. saginata* cysticerci	Prevalence of *T. saginata* cysticerci (%)
Arusha	Arusha	5	138	23	16.7
Dodoma	Dodoma	2	37	3	8.0
	Mpwapwa	5	52	4	7.6
Iringa	Iringa	7	146	14	9.6
Morogoro	Morogoro	5	123	8	6.5
Total cattle	-	-	496	52	10.5

harboured viable cysticerci only, and 33.3% harboured both viable and degenerated cysts. The rest (40%) of the carcasses harboured only degenerated cysticerci (Table 3).

DISCUSSIONS

The results of the present study on *T. saginata* cysticercosis in four regions, Dodoma Iringa, Arusha and Morogoro of Tanzania, confirm that *T. saginata* cysticercosis is endemic in the country. Results from individual abattoirs recorded prevalence rates ranging from 6.7% to 16.7% which roughly corresponded to that determined by Petrovic (1976), however the figures were significantly lower than the figure of Urquhart, (1961). The prevalence rates recorded in the individual abattoirs (Table 1), differed from one abattoir to another.

Such differences have been reported by other authors in other parts of Africa (Belino, 1975; Cheruiyot, 1981). As mentioned, Arusha municipal abattoir recorded the highest prevalence of *T. saginata* cysticercosis (16.7%) as compared with results recorded from the other abattoirs (Table 1). The higher prevalence of *T. saginata* cysticercosis in Arusha could be a reflection of the human taeniasis status in the population in that region. The majority of natives who keep cattle in the Arusha region are Masais and Arushas, who keep

Table 2. Numbers and concentration of *T. saginata* cysticerci per inspection sites after slicing infected bovine carcasses from Morogoro abattoir, Tanzania.

Site routinely examined in bovine carcasses (n=15)	Number of *T. saginata* cysticerci detected	Mean +/- SD cysticerci per inspection site	Frequency of detecting cysticerci at site (%)	Relative concentration of cyst to all inspection sites (%)
masseter	38	2.5+/-3.3	9/15 (60)	6.3
Tongue	41	2.7+/-2.7	9/15 (60)	6.8
heart	178	11.9+/-13.3	12/15 (80)	29.5
M.triceps brachii	160	10.6+/-15.5	12/15 (80)	26.5
psoas	76	5.1+/-7.3	10/15 (66.7)	12.6
liver	111	7.4+/-13.1	8/15 (53.3)	18.3
Total Cysts	604		100	100
Mean carcass		40.3+/-9.2		

large herds of cattle and have the habit of eating rare beef as part of their culture. Furthermore they donot use toilets.

Data collected in Kenya by Froyd (1965), highlighted some of the reasons related to high prevalence rate of *T. saginata* cysticercosis and taeniasis in the rural areas of Africa. The reasons which were given for the high prevalence of taeniasis among the Masais of Kenya could hold true also for the Masais of Tanzania, because their culture and customs are largely the same until now.

When *T. saginata* cysticercosis is detected in the abattoirs in the developed countries, where the prevalence rate of *T. saginata* cysticercosis is very low, infected attendants of the cattle, sewage sludge or slurry on pasture, contaminated feed or water are some of the incriminated factors (Fewster, 1967; Slonka *et al.*, 1975; Fertig and Dorn, 1985; Ilsøe *et al.* 1990). Considering animal production systems in Tanzania, where pastoralism and nomadism are common practices, it may be extremely difficult to

Table 3. Classification of carcasses according to viability of cysticerci of *T. saginata* detected from 15 bovine half carcasses from Morogoro abattoir, Tanzania.

Viability of T. saginata cysts in carcasses	Number of carcasses habouring particular category of cysts	proportion of carcasses with particular category of cysticerci (%)
All cysticerci viable	4/15	26.7
Both viable and degenerated cysticerci	5/15	33.3
All cysticerci degenerated	6/15	40.0
At least viable cysticerci detected	9/15	60
At least degenerated cysticerci detected	11/15	73.3

trace exactly where the infected cattle picked the *T. saginata* eggs.

Most of the beef cattle produced in Tanzania are raised on extensive pastoral system where communal grazing is common practice. It is possible for one herdsman carrier of the tapeworm, *T. saginata* from one village to infect several cattle disregarding which village the cattle originate from, as long as communal grazing continues.

High prevalence rates of *T. saginata* cysticercosis in cattle had been suspected to be associated with tapeworms of wild carnivores in some parts of Africa (Sachs and Sachs, 1968), due to closer interaction of those animals in the environment where cattle are grazed. However, Gathuma and Mango (1976), found that wild carnivores did not have any significant role in the epidemiology of *T. saginata* cysticercosis in Kenya after examining 3584 cyst for hooks on scolices from 524 bovine carcasses from areas close to game reserves. Furthermore, Gathuma and Mango, (1976) found none of the 2968 normal cysticerci examined had hooks. This finding is similar to the current study where no hooks were observered in viable cysts detected in carcasses at Morogoro abattoir. Kenya and Tanzania are neighbouring countries, with almost similar types of wild carnivores and

cattle production systems. It could therefore be unlikely for wild carnivores to have any significant role in the epidemiology of *T. saginata* cysticercosis in Tanzania.

The present study shows that *T. saginata* cysticercosis is a significant, yet underestimated problem in Tanzania. Therefore more efforts are needed to intensify health education to the public on the methods of controlling human taeniasis and cysticercosis.

It is also recommended that prevalence rates of *T. saginata* cysticercosis recorded in the abattoirs should be taken seriously since they suggest presence of taeniasis in the human population where the cattle are raised. There might be possiblity of tracing cases of human taeniasis in relation to occurrence of *T. saginata* cysticercosis.

From the results on examination of *T. saginata* cysticerci in the tissues of infected bovine carcasses, the sites routinely examined during meat inspection had an average of 40.3+/- 9.2 SD (n= 15) could suggest that the lowest number of cyst tha carcasess with less than total of 31 cyst at the inspection site may be difficult to detected during routine meat inspection. That figure showed that most infected carcasses were lightly infected, based on Meat Hygiene Regulations in Tanzania (Tanganyika Government, 1962), that infected carcass are condemned on detecting over 10 cysticerci counted at the predilection sites. Some lightly infected carcasses are easily misdiagnosed during meat inspection. Besides these findings heart remains an important site to search for cysticerci of T. saginata due to the organ showing high frequency of being parasitized (12/15) and it harbored relatively more cysts 29.5% (mean 11.8) compared to other examined sites (Table 2). That finding was in agreement with a previous record in zebu cattle in Tanzania by Petrovic (1976).

It was evident in the present study that 73.3% of the infected carcasses harboured some degenerated cysticerci in the tissues (Table 3). Numerous degenerated or calcified cysts in the flesh of carcasses render the meat unwholesome, for aesthetic reasons, due to appearance of the affected meat or gritty sound which may be detected during consumption of the meat.

According to Geerts *et al.* (1980) meat with few dead and degenerated cysts may not have a zoonotic risk, however, the aesthetic effects of such meat could be of immediate concern to the consumers even if viable cysts have been killed by freezing or boiling.

Occurrence of solitary *T. saginata* cysts in the liver in the slaughter cattle as observed at Morogoro abattoir has been reported by other workers (Ginsberg and

Grieve, 1959; Belino, 1975; Nyaga and Gathuma, 1979). However isolated cysts of *T. saginata* in the livers of naturally infected bovines has triggered some discussion, as to whether the detected cysticerci are larval stage of another strain of the tapeworm, *T. saginata var. giraffe* as suggested by Price, (1961). From that finding more investigation would be required to establish the significance of that parasite in cattle.

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