



PREVALENCE OF CYSTICERCOSIS IN PIGS SLAUGHTERED IN JALINGO, NIGERIA



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Abstract: The study was conducted to determine the prevalence of *Taenia solium* cysticercosis in Jalingo, capital city of Taraba State, northern Nigeria. A total of 323 pigs were examined daily for six consecutive weeks at three most popular pork markets (Dorowa, Kasuwan-Bere and Mile-six) located in Jalingo metropolis. The overall prevalence was 4.95%. The highest prevalence was from Mile-six, where 216 slaughtered was 5.09%. In Kasuwan-Bere and Dorowa, 63 and 44 pigs slaughtered were examined and had the prevalence of 4.76% and 4.55%, respectively. A one-way analysis of variance (ANOVA) was carried out to ascertain the infection rates at the three sites. There was no significant difference ($P > 0.05$) in prevalence of infection. There was however, a significant difference ($P < 0.0096$) in infection by sex. Male pigs (4.02%) had higher prevalence than the sows (0.93%). Metacestodes showed higher preference for the heart, muscles and tongue. Only in one case was the intestinal wall found to be infected. The study has a lot of health implications on the residents of the metropolis, because, a large proportion of them depend on pork as their main animal protein source. The results also portend great economic loss by the pig farmers, who are mostly peasants. In addition the farmers stand the risk of infection with cysticercosis and could also serve as carriers of cysts and eggs. There is therefore, an urgent need for health education on the zoonotic nature of the disease by veterinarians and other Public Health stakeholders in the study area.

Keywords: *Taenia*, cysticercosis, metacestodes, zoonosis, cyst, pork, sow

Introduction

The potentially disastrous impact of emerging and re-emerging zoonoses on human health is a growing concern around the globe (Schneider, 2005 in, Weka *et al.*, 2013). Pork represents 39% of the world's total meat consumption, as compared to 26.5% for beef and 28% for poultry, but its per capita intake varies widely among countries and regions, ranging from 2 kg per year in many African countries to 60 kg in Germany and Spain (Gidey *et al.*, 2014). According to Weka *et al.* (2009), the pig population of Nigeria is 3.4 million. In the swine industry, the sustainable development of this sector is faced with a number of constraints, prominent among which is the diseases caused by intestinal parasites (Sowemimo *et al.*, 2012).

Parasites of pigs and their potential to infect humans have recently become major issues among the public because of reported outbreaks of water-borne parasitic diseases such as *Giardia lamblia* and *Cryptosporidium* spp. (Olso and Guselle, 2000). The larval stages (metacestodes) of *Taenia solium* form distinctive pearly-white cysts (cysticerci) and the infection in man and pig is called cysticercosis (Chennuru, 2013).

Porcine cysticercosis refers to as an infection of pigs with the larval form of *Taenia species*. *Taenia solium*, *T. saginata asiatica*, and *T. hydatigena* are the *Taenia species* that can infect pigs (Ngowie *et al.*, 2013). Eating infected raw or undercooked pork, beef or dog meat can cause people to become infected with the adult tapeworm form of the parasite (*Taeniasis*). If humans come into contact with infected human stool and accidentally ingest the eggs develop into the larval form of the tapeworm, which targets the muscles, eyes and most commonly the brain (Neurocysticercosis), manifesting as cysts. This may occur through direct contact with a tapeworm carrier's infested stool, by putting contaminated fingers in the mouth, or through ingestion of water or foods that have become contaminated with the infected faeces (Karshima *et al.*, 2013; Kaze and Gam, 2013). The life cycle of *T. solium*

includes pigs as the normal intermediate hosts, harboring the larval vesicles or cysticerci, and humans as the definitive host, harbouring the adult form or tapeworm (taeniasis) (Hector *et al.*, 1998). Pigs become infected by the ingestion of eggs of *T. solium* during scavenging that are present in the stools of human beings who are the definitive host of *T. solium* (Chennuru, 2013).

Since the prevalence of cysticercosis in pigs can be an indicator of the presence of the disease in man, especially when transmission factors are favourable and since the prevalence in humans has not yet been determined in the whole of Jalingo, it will be worthwhile to carry out a survey for human cysticercosis in this town. Gastrointestinal parasitism in swine affects swine's performance in terms of efficient feed conversion, poor growth rate, reduced weight gain and the condemnation of affected organs after slaughter (Nsoso *et al.*, 2000; OIE Terrestrial Manual, 2014).

Cysticercosis has been designated as a "biological marker" of the social and economic development of a community (Carpio *et al.*, 1998; Sarti *et al.*, 1994; Mawanjali *et al.*, 2013). Cysticercosis/taeniasis caused by *T. solium* is considered to be one of the most globally important parasitic zoonoses due to its impact on both agriculture and public health as a serious constraint to human and livestock health and productivity. Infestations with the larval stage of some species of *Taenia* are not only of public health importance, but also of veterinary significance because they cause high economic losses (Thompson, 1995). Economic loss due to infestation may include lower production and even death of the animals in some cases (Radfar *et al.*, 2005). *T. solium* cysticercosis in humans may result to disability in neurocysticercotic patients, leading to lower manpower (Ngowi *et al.*, 2013). Though the life cycle cannot be maintained in regions that have adequate sanitation and good animal husbandry practices, these regions are still vulnerable, owing to migration of people from highly endemic regions carrying infections (taeniasis) of the adult stage (Karshima *et al.*,

2013). In the developing countries of West and Central Africa as well as Latin America, the disease causes annual economic losses estimated at 25 million Euros and 164 US dollars, respectively Karshima *et al.*, 2013).

Geographical distribution

Taenia solium is endemic in many less developed countries, both in highlands and tropical areas of Central and South America and non-Muslim populations of Asia and Africa (Garcia & Del Brutto, 2000). While *T. saginata asiatica* is currently known to be limited to Asia, *T. solium* and *T. hydatigena* have a worldwide distribution (Ngowi *et al.*, 2013; Braae *et al.*, 2015). On the African continent, however, *T. solium* ('pork tapeworm') is the most important species of *Taenia* economically and for public health (Ngowi *et al.*, 2013). Karshima *et al.* (2013) stated that millions of people worldwide are infected with this condition. However, Eddi, *et al.* (2003), were more specific and reported that approximately 2.5 million people worldwide carry *T. solium* tapeworm and not less than 20 million people are infected with *T. Solium* metacestode and 50,000 die of neurocysticercosis annually.

Control of cysticercosis has been achieved in developed countries through improved hygiene, sanitation and properly maintained commercial piggeries. However, in developing countries including Nigeria the disease is highly endemic in all areas where pigs, cattle and Dogs raising are practiced (Kaze and Gam, 2013). Ante-mortem diagnosis, based on clinical signs is usually not possible because clinical symptoms are not well defined in pigs (Chennuru, 2013). Diagnosis of swine cysticercosis can be made ante mortem by palpation of the tongue. The mouth is opened and gagged by a piece of wood and the tongue pulled out and examined visually and by palpation of the ventral surface for evidence of cysticerci (Boa *et al.*, 2002).

The *Taenia solium* taeniasis/cysticercosis complex constitutes an important health problem and a serious socio-economic obstacle for pig breeders in many African countries (Assana *et al.*, 2013). The rapid expansion of pig farming and pork consumption is raising concern in Nigeria, as it is bound to exacerbate the problems related to *T. solium* cysticercosis, not only in rural areas where most pigs are reared, but also in urban areas where infected pork can be consumed, and human carriers of the parasite can infect other people. Only few data are available about the prevalence of adult tapeworm carriers(taeniosis) who are the source of the cysticercosis in humans and pigs because of lack of a simple and sensitive dianostic test which is able to distinguish eggs of *T. solium* and *T. saginata* (Assana *et al.*, 2013).

Materials and Methods

This study was conducted in Jalingo, the Taraba State Capital. The town is located at latitude 8°52'59" North and longitude 11°22'00" East and an altitude of about 202 m above sea level. As at the 2006 National Census, the population of the town was estimated to be about 118,000. The study sites were; Dorowa, Kasuwan-Bera and Mile-Six markets. These are the only major sites where pork is available in Jalingo metropolis. The sites were visited daily for eight weeks (April to May 2015). Post-mortem examination was carried out. Lesions suspected to be larval forms of *Taenia solium* metacestodes were identified and closely monitored. The age of the animal, organ location of cyst, sex and location from which the animal was brought to the slaughter slab were recorded. Total number of animals slaughtered on each day of

inspection (whether infected or not) were also recorded. One-way analysis of variance (ANOVA) was used to analyse the data obtained from these readings, using Microsoft Office Excel, 2010 version.

Results and Discussion

A total of 323 pigs were examined for presence of *Taenia solium* metacestodes during the period of the study (Table 1). Of this number, 218 (67.5%) were males, while 105 (32.5%) were females. *Taenia solium* metacestodes were found in 13 (4.02%) males and 3 (0.93%) females, making a total of 16 infected pigs, and a prevalence of 4.95%. A one-way analysis of variance was used to compare the prevalence among the three study sites. The value showed that the prevalence was not statistically significant (P>0.05) at F (1, 4) = 0.1337. The highest prevalence, however, was from Mile six market where 216 pigs were examined during the period of the study, 11 were positive for cysticercosis, of which 8 (3.70%) were males and 3 (1.39%) were females. Next was Kasuwan-bera, where 63 were examined, 3 (4.76%) were positive for cysticercosis and all pigs positive for cysticercosis were males (Table 1). Dorowa market had the least prevalence. Of the 44 pigs examined during the period of the study, 2 (3.17%) were positive for cysticercosis. Here also, all the positive pigs were males (Table 1). The difference in the prevalence of cysticercosis in Dorowa, Kasuwan-bera and Mile six markets was not statistically significant (p>0.05). The difference between the prevalence of cysticercosis among male and female pigs was statistically significant (p<0.05).

Table 1: Prevalence of cysticercosis in pork samples from Jalingo, Taraba State

Market		No. of pigs examined	No. of infected pigs	Prevalence (%)
Mile Six	Males	143	8	3.70
	Females	73 (33.8%)	3	1.39
	Total	216 (100%)	11	5.09
K/Bera	Males	44 (69.8%)	3	4.76
	Females	19 (30.2%)	0	0.00
	Total	63 (100%)	3	4.76
Dorowa	Males	31 (70.5%)	2	4.55
	Females	13 (29.5%)	0	0.00
	Total	44 (100%)	2	4.55

Table 2: Summary of the distribution of pigs by age

Age (Months)	No. of pigs examined	No. of non-infected pigs	No. of infected pigs
6 – 10	184	178 (96.7%)	6 (3.3%)
11 – 15	105	98 (93.3%)	7 (6.7%)
16 – 20	27	25 (92.6%)	2 (7.4%)
21 – 25	7	6 (85.7%)	1(14.3%)
Total	323	307 (95.0%)	16 (5.0%)

Out of the 323 pigs that were examined, 184 (57.0%) were 6 – 10 months old, of which 6 (3.3%) were positive for cysticercosis. 105 (32.5%) were 11 – 15 months old, of these, 7 (6.7%) were positive. 27 (8.4%) were 16 – 20 months old, of which 2 (7.4%) were infected, and 7 (2.2%) were 21 – 25 months old, of these, 1 (14.3%) was positive (Table 2). This shows that pigs 21 – 25 months old had the highest prevalence, while those that were 6 – 10 months old had the lowest. There was however no significant difference (p>0.05) in prevalence between the age groups. The economic importance and public health threat posed by *Taenia solium* cysticercosis has been identified (Secka *et al.*, 2010). It has also been shown that it is endemic to

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developing countries of Africa, Asia and Latin America (Eshitera *et al.*, 2012). The overall prevalence of 4.95% shown by this study using post-mortem meat inspection is lower than the 14.4% reported in Zuru, Kebbi State of Nigeria (Gweba *et al.*, 2010), 6.26% reported in Ibi Local area of Taraba State (Karshima *et al.*, 2013), and the 32.8% reported by Eshitera *et al.* (2012) in Home Bay District, Kenya. Although the prevalence is lower than the reports of other authorities mentioned above, the ability of *Taenia solium* metacestode to invade human tissues causing ocular and neuro-cysticercosis is a rising concern in Sub-Saharan Africa (Karshima *et al.*, 2013).

Poor hygienic practices in pig pens, free roaming of pigs, open defaecation by humans, and improper dumping of carcasses, dung and offal of other animals are possible explanations for the occurrence of cysticercosis in pigs. However, the lower prevalence shown in this study may be as a result of increased awareness of cysticercosis among the locals. In addition, the butchers reported to have carried out ante-mortem inspection by tongue palpation before buying the pigs. This could be the most important contributing factor to the low prevalence recorded in this study. There was, however, no report of any pig that was positive by ante-smortem observation and rejected by the butchers, during the period of this study. The higher rate of infection in males may be because males are capable of roaming farther than the females, hence, a higher chance of coming in contact with other infected pigs, open human faeces and infected carcasses. However, this could have been because more males were examined during the studies.

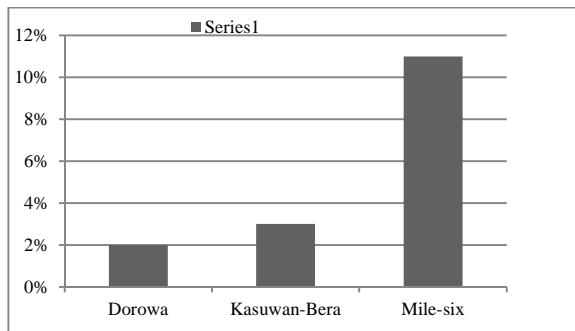


Fig. 1: Prevalence of cysticercosis in pork samples from Jalingo, Taraba State

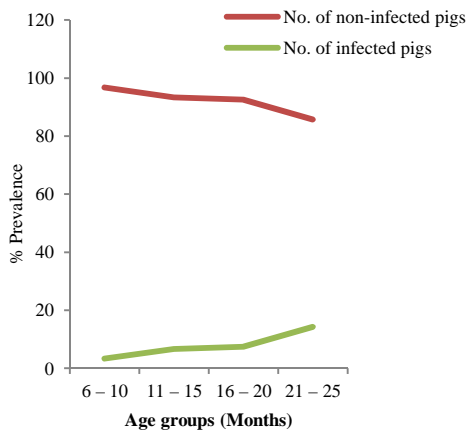


Fig. 2: Percentage prevalence of cysticercosis by age

Taenia solium metacestodes were only found in the heart, muscles (Plates 1 & 2) and tongue, with only a single case of infection of the intestinal wall. This may be an indication that the above sites are the major predilection sites of the parasite. This further makes it difficult for ante-mortem inspection of cysticercosis. There was no significant difference between the prevalence of cysticercosis across the different age groups. This may be because; younger pigs are usually active and may easily be infected, as well as older pigs. It may however, be due to the fact that the number of younger pigs that were slaughtered was higher than older ones.



Plate 1: Muscles of pig's armpit with metacestodes



Plate 2: Pig's heart with metacestodes

Tongue palpation in which the pigs are considered positive for infection if cyst-like nodules are either seen or felt on palpation, have been used in several studies to establish prevalence, but this method, though highly sensitive, has comparatively lower sensitivity, which is not always desirable (Gonzalez, 1990; de Aluja *et al.*, 2008). The result in this study agrees with the above point as pigs were inspected by tongue palpation by the butchers before purchasing.

Conclusion

The study has revealed that knowledge exists about the presence of cysts in Jalingo, as butchers and meat sellers have taken measures to ensure that pigs suspected to be

infected with *Taenia solium* cysticercosis are not slaughtered and sold. However, it was observed, during the study that pigs with mild infections were not usually totally condemned, but meat sellers washed the meat with lime and still sold them. It is thus, imperative that more awareness needs to be created on the dangers of consuming pork infected with cysticercosis.

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Conflict of Interest

The authors declare that there was no conflict of interest.

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