

# Prevalence of Porcine Cysticercosis and Farmer's Knowledge and Practices in its Prevention and Control in Mateete Town Council, Sembabule District

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**Abstract:** Porcine cysticercosis (PC) is an important zoonosis in many developing countries. Cysticercosis poses a serious public health concern causing economic losses to pig farmers. There is no available data on the prevalence, knowledge and practices towards the control and prevention of PC in Mateete Town Council. This was a cross-sectional study that aimed at determining the prevalence of PC that based on ante mortem and postmortem inspection in the slaughter slab and assessing the levels of knowledge and practices of pig farmers towards the control and transmission of PC in Mateete Town Council. A total of 105 pigs were examined for cysticercosis cyst at ante mortem and postmortem at the slaughter slab in Mateete Town Council and 250 open ended questionnaires were administered to pig farmers and face to face interviews and direct observations. Of the 105 pigs examined 65 were slaughtered in May and 40 in June 2022, all these were inspected and only 3 pigs' carcasses had the cysts (2.9%). The cysts were found under the tongue and in the gluteal muscles. The management systems were observed and that most pigs were intensively reared though semi intensive and free rang were also practiced where contamination of the vegetation with *T. solium* was possible. Thirty six percent (36%) of the respondents were knowledgeable and 64% not knowledgeable on prevention and control of PC. In addition, majority (59.6%) pig farmers had inappropriate practices on prevention control of PC. The toilet coverage was 79%, however 21% of the respondents had no toilets and could either go to open places or even farmlands and neighbors latrines to make calls. PC exists in Sembabule district at a prevalence of 2.9%. Therefore further studies should be out carried to determine prevalence of PC using better test methods like ELISA.

**Keywords:** Cysticercosis, Mateete, Sembabule

## 1. Introduction

Cysticercosis is a tissue infection with larval stage of pork tape worm, *Taenia solium* that results from ingestion of *T. solium* larvae oreggs (Buensalido, 2019). *Taenia solium* cysticercosis is among the neglected tropical diseases transmitted among humans and between humans and pigs. The disease is endemic in pig rearing and pork consuming communities (Gulelata et al, 2022).

*T. solium* uses humans as a definite host and the pig as the intermediate host. In humans, the disease is acquired through ingestion of parasite larval cyst in under cooked infected pork, or food and water contaminated with *T. solium* eggs. The larvae of the parasite may migrate causing infection in the skin, muscles, eyes and the central nervous system. Infection in the brain causes Nuerocysticercosis that manifests with epileptic seizures, headache, focal deficit, cranial and hypertension/ hydrocephalus (Bhattarai et al, 2012).

This disease has been observed in 30% of the epilepsy cases in many endemic areas where people and roaming pigs live in close proximity while in high risk communities, it's associated with as high as 70% of the epilepsy cases (WHO, 2022).

It's estimated that globally about 50 million people have Nuerocysticercosis and 50, 000 of these die annually (Boutella, 2014). In Sub Saharan Africa, 0.76-2.46 million people have epilepsy due to Nuerocysticercosis (Winkler,

2012). A study done in Uganda using an incidence perspective with 2010 as a reference year indicated that Nuerocysticercosis was estimated to cause more than 9000 new cases of epilepsy which eventually led to nearly 3000 deaths (Dupout et al, 2021).

The global burden of zoonotic cysticercosis in pigs is imprecise due to lack of routine surveillance data from animal populations in countries, particularly those countries where porcine cysticercosis is endemic and laboratory capacity is limited (WOAH, 2012). In Africa porcine cysticercosis has wide distribution of between 3 to 15% across different parts (Chembensofu et al, 2017). Porcine cysticercosis is considered one of the seven most neglected endemic zoonosis, presenting a complex life cycle. High prevalence rates in swine are found in African countries, Asia and of the America (WOAH, 2012). The implications of zoonotic porcine cysticercosis extend beyond animal health as it threatens the well-being of communities that rely on livestock for a livelihood (WHO, 2019). The majority of cases have been identified in developing countries where pigs are slaughtered under unhygienic conditions. It impairs communities through loss of work force due to illness, high costs of treatment and death of people.

In Uganda, agriculture is the backbone of the economy with livestock production as one of the major enterprises growing at 3% with enormous potential for production (NDP11 2015/2016-2019/20). Swine population in Uganda is estimated at 5.6 million pigs with growth rate of 37.2% and a per capita consumption of 3.4kg/year (MAAIF & Uganda

Bureau of Statistics 2017). Porcine cysticercosis is a neglected emerging, zoonotic parasitic disease of pigs and occasionally of other animals, posing great public health concern (Mwang'onde, 2012). Porcine cysticercosis is due to infection with the tape worm *T. solium* and the infective stage (larvae) are normally found in the active muscles of pigs such as tongue, intercostal muscles etc., and normally presents two conditions i.e. taeniasis and cysticercosis (Garcia, 2020). Neurocysticercosis is the most severe form of human infection by the larval of the parasite and causes neurological disorders. Cysticercosis, although normally clinically inapparent in pigs, is associated with significant economic losses due to carcass contamination and decreased value of pigs (WOAH, 2012) stage ingestion and digesting the eggs along with the parasitized vegetation. Humans acquire the infection when fed undercooked pork or raw, then *Cysticercus* migrate to the intestines and develop into adult tape worms which can persist so many years where routine deworming practices are considered as a luxury practice (Laranjo-González 2017). The disease is acknowledged by FAO and WHO as neglected disease accompanied by inadequate epidemiological data, its related to poverty, absence of latrines, as well as free access to roaming pigs, to human faces deposited in heaps and farmlands, are result of poor hygiene, and lack of effective strategies being adopted (Gulelat, Eguale et al. 2022).

## 2. Problem Statement

*T. solium* is a zoonotic parasite that causes both taeniasis and neurocysticercosis in humans (Nash, 2011). It is a neglected zoonotic parasitic disease of pigs, occasionally of other animals, posing great public health concern (Mwang'onde, Nkwengulila et al. 2012). Humans acquire the infection when fed on raw or undercooked pork. Then the cysts migrate to intestines and forms the adult tapeworm (Devleesschauwer et al., 2017). The disease has led to hospitalization of many people due to poor or wrong diagnosis (Tilli, 2020).

According to the District Health office, toilet coverage in Sembabule district stands at 60%. This clearly indicates that some people do open defecation thereby contaminating the environment. According to DVO Sembabule district, pork cysts are often reported by the veterinary officer in charge of Mateete Town Council during post mortem examination of carcasses. Hence, the study was undertaken to establish the prevalence and level of awareness about the control and prevention of the transmission of porcine cysticercosis.

## Justification

Porcine cysticercosis has continuously been reported and no study has ever been done in Mateete Town Council. The study established the prevalence of porcine cysticercosis in pig carcasses and level of knowledge and practices of pig farmers about porcine cysticercosis towards its control and prevention in Mateete Town Council, Sembabule District. The findings would help in formulating strategies and programmes for its control.

## Objectives

The general objective was to establish the prevalence of porcine cysticercosis in pigs slaughtered at Mateete Town Council and the level of awareness of farmers towards its control and prevention.

The specific objectives were to:

- 1) To establish the prevalence of porcine cysticercosis in pigs slaughtered in Mateete town council.
- 2) To establish farmers' Knowledge and practices related to control and prevention of porcine cysticercosis.

## Research Questions

- 1) What is the prevalence of porcine cysticercosis in pigs slaughtered in Mateete Town Council?
- 2) What is the level of awareness (Knowledge and practices) of pig farmers in Sembabule district regarding the prevention and control of porcine cysticercosis?

## 3. Materials and Methods

### Study area

The study was carried at Mateete Town Council, Sembabule District. Figure 1 shows the location of Sembabule District. The district is bordered by Mubende District to the North, Gomba District to the northeast, Bukomansimbi District to the East, Lwengo District to the South, Lyantonde District to the southwest, and Kiruhura district to the northwest. Sembabule District is composed of five sub-counties which include; Mateete, Rwebitakuli, Kawanda, Mijwala, and Lugusulu. There are three Town Councils which include Ntusi, Mateete and Sembabule. Mateete Town Council has a total of 1800 pigs distributed as follows: Kasaana ward-289, Kiwumulo ward-190, Mateete Central-107, and Mateete West-711 (Sembabule District Veterinary Report, 2021).

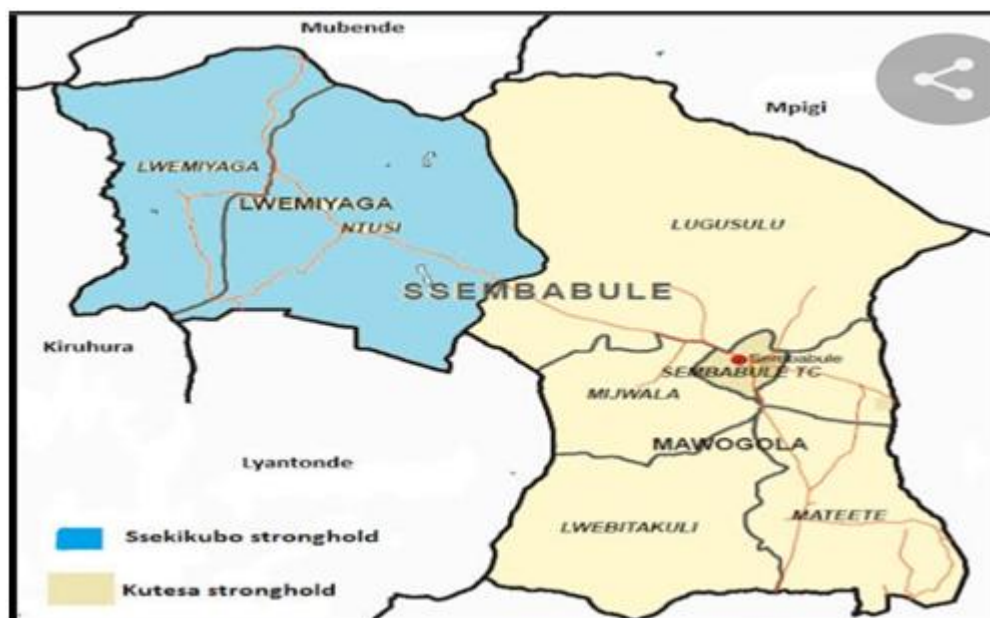


Figure 1: A map of Sembabule District showing sub-counties

### Study design

A cross-sectional study was conducted in Mateete Town Council. This Council was purposively selected due to its big number of small scale pig farmers and low toilet coverage. All pigs slaughtered on Mateete Town Council pig slaughter slab between May and June 2022 were inspected for cysts at postmortem. Quantitative data was collected on pigs slaughtered at the slab using a pre-designed form and from pig farmers using a structured questionnaire.

### Sample size for pigs' carcasses to be examined for cysts

All carcasses from pigs slaughtered on Mateete Town Council pig slaughter slab between May and June 2022 were considered in the study since the numbers slaughtered per week are small.

### Sample size for farmers to interview

The sample size was determined using a formula described by (Thrusfield, 2005) as follows:

$$n = \frac{Z^2 p (1-p)}{d^2}$$

Where,

n = was required sample size

p= the estimated prevalence

$\rho = (1-p)$  and

d = was permissible error of estimation at 95%CI

Therefore the sample size was determined using the above formula, and computations resulted in 384 respondents. However, a total of 250 respondents were interviewed due to resource constraints.

### Data Collection

A pre-designed form was used to collect data at the slaughter slab. This captured information on; the origin of pigs,

number slaughtered and number of carcasses with cysts at postmortem examination during the study period.

Questionnaires were administered to selected farmers in the five wards of Mateete Town Council, namely; Kiwumulo, Kasaana, Mateete North-West, Mateete Central and Mateete West. Face to face interviews were conducted. The questionnaire captured data on pig production systems, knowledge on the mode of transmission of *T. solium*, awareness of cysticercosis in pigs and latrine coverage.

### Measurement of Knowledge and Practices

Knowledge and practices were measured basing on the method used by (Koruk, 2011)) where the total score for assessing the level of knowledge and practices was obtained by calculating the percentage of correctly answered questions. For knowledge, those who scored 50% (average) and above were put in the category of knowledgeable farmers while those whose scores were below average were put in the category of not knowledgeable. Practices were categorized as good and poor; where the farmers who scored 50% and above were considered to have had good practices whereas those who scored below 50% had poor practices.

### Data management, Quality Assurance and Statistical Analysis

Data entries in Epi-Info were rechecked using original questionnaire response forms and errors corrected. Open ended questionnaires were coded for easy computer entry. Frequencies and tables were generated in Epi-info (Version 3.5.3). Cleaned data was exported from Epi-Info to Microsoft office Excel 2010 for coding and analysis.

Frequencies and percentages were computed. The data were presented in tables, pie-charts and graphs.

**Ethical Consideration**

The Commissioner Animal Health (CAH) provided a letter of introduction. A consent form was written to farmers introducing the trainee to them, informing them about the study to be undertaken, humbly requesting them to respond to the questions in the questionnaire and assuring them that data collected was basically for this study and would be kept confidential.

**4. Results**

**Prevalence of *T. solium* cysts in pig carcasses**

Table 1 shows the status of pigs examined. A total of 105 pigs were examined; 65 in May and 40 in June 2022. Three (2.9%) of the 105 carcasses examined had *T. solium* cysts

**Table 1:** Status of pigs' carcasses examined at postmortem for *T. Solium* cysts

Post mortem finding	Carcasses examined during the period		Total
	May 2022	June 2022	
Carcasses with cysts	2	1	3
Carcasses without cysts	63	39	102
Total	65	40	105
Prevalence (%)	3.1	2.5	2.9

**Socio-demographic characteristics of pig farmers in Mateete Town Council**

Of the 250 pig farmers who were interviewed, majority (149/250, 60%) of the participants were males and 40% (101/250) were female, many (51.6%) had not acquired any

formal, 24% had only gone to primary, 20% secondary and 4.4% had acquired higher education. Furthermore, 55% were Catholics, 40% Protestants and 4.8% were Muslims. The age distribution of respondents arranged between 20-70. years and most of the respondents were single with over 40%, 30% were married, 20% were widowers, and 10 % widows.

**Table 2:** Demographic characteristics of the respondents (pig farmers)

Variables	Responses	Frequency	Percentage
Age	20-30 years	130	52
	31-40 years	79	31.6
	41 years and above	41	16.4
Sex	Female	101	40
	Male	149	60
Marital status	Single	100	40
	Married	75	30
	Widow	25	10
	Widower	50	20
Religion	Catholics	138	55.2
	Protestants	100	40
	Muslims	12	4.8
Education	Primary	60	24
	Secondary	50	20
	Higher	11	4.4
	Not at all	129	51.6
Time spent in pig farming	Less than 2years	30	12
	2-5 years	95	38
	More than 5 years	125	50

**Management systems**

More than half (56%) of the farmers interviewed practiced intensive, 28% tethering while 16% had free range management systems.

**Knowledge about porcine cysticercosis**

Majority (83%) of the pig farmers had not heard about porcine cysticercosis not even from extension staff, radio stations or newspapers. Of the farmers who had heard about porcine cysticercosis, 76% didn't know how the disease is transmitted in pigs while 24% believed that the disease was acquired through eating contaminated feeds.

About 76.4% of the respondents didn't know porcine cysticercosis could affect humans, while 23.6% knew.

Among those who knew the zoonotic nature of porcine cysticercosis, 19% believed that it was transmitted through eating raw or undercooked pork, 19% said through poor sanitation practices while 36% didn't know. Of those who were aware that porcine cysticercosis is zoonotic, only 20.3% were aware that the disease could cause serious effect and among these, 41.7% said the health effect porcine cysticercosis causes was usual sickness, 41.7% were not sure while 16.6% said epilepsy.

Of the 250 pig farmers who were interviewed, 10% said they had heard about *T. solium* associated epilepsy and of these only 8% said they had family members or relatives who were suffering from epilepsy.

Most of the respondents (73%) did not know how the transmission of porcine cysticercosis to pigs could be

prevented, 27% said by use of drugs and none said through use of good pig management practices or Proper disposal of human wastes (feces).

About 32% of the respondents said that *T. solium* related cysticercosis could be prevented by maintenance of good sanitation and hygiene, 8% said by consumption of well cooked pork while 60 didn't know.

The average score of farmers' knowledge of porcine cysticercosis was 36%. This therefore meant that most (64%) pig farmers in Sembabule district were not knowledgeable about porcine cysticercosis

### Practices towards cysticercosis prevention and control in pigs

Eighty percent (80%) of the pig farmers interviewed ate pork and of these, 48% ate it any time it was available, 36% every day while 16% ate it only on occasions. A big proportion (76%) of the pigs slaughtered were never inspected by the Town Council veterinary staff. Those inspected (24%), carried a stamp MAAIF to show that they were examined and passed for human consumption. Most farmers (76%) reported that they would not be at risk of contracting porcine cysticercosis if the consumed uninspected pork.

Majority (79%) of the farmers had toilet facilities where they disposed their wastes. Ninety eight percent (98%) of these toilets were pit latrines while only 2% were for flushing. Of those farmers who had no toilets, 51.2% of the household had long calls in farmland, 28.8 % in open space while 19.2% used other peoples' latrines. A big percentage of farmers (80%) who had toilets, had hand washing facilities while 20% didn't have.

The average score for good practices toward prevention and control of porcine cysticercosis was 40.4%. This meant that majority (59.6%) of the pig farmers in Sembabule district used poor practices in the control and prevention of porcine cysticercosis.

## 5. Discussion

The need to carry out a study on porcine cysticercosis was based on the fact that published studies done in Uganda demonstrated the presence of the disease in eastern Uganda and Kyoga region but there was no documented information about it in Mateete Town Council. This study was therefore done to determine the prevalence, establish farmers' knowledge and practices towards prevention and control of porcine cysticercosis in Mateete Town Council, Sembabule district.

The overall prevalence of porcine cysticercosis in pigs slaughtered in Mateete Town Council between May and June 2022 was 2.9%. This was low when compared similar studies done in other parts of Uganda. A study done in L. Kyoga basin in Uganda reported a prevalence of 25.7% (Nsadha, 2014), while Waiswa (2009) in Kamuli and Kaliro districts reported an overall prevalence of 8.6%. Another study on control trial of Porcine Cysticercosis in Uganda

using a combination of TSOL18 vaccine and Oxfendazole by Nsadha (2021) specifically in Kamuli and Bukedea reported prevalence of 15.1% and 17.2% respectively before the trial. The big variation in prevalence results was could have been due to the difference in diagnostic methods used. In this study, cysts were identified during postmortem examination. However, some cases could have been missed.

In Mateete Town Council, although only 16% of the farmers free ranged their pigs and 28% tethered theirs, 56% intensively managed the herds. Most farmers reared exotic breeds of pigs which were; large white, land race, combrough and their crosses; others had the local breed while a few reared both exotic and local breeds. Surprisingly, more than half of the participants interviewed had not heard about porcine cysticercosis and those had heard about this disease, majority didn't know how it's transmitted to pigs. The biggest proportion of farmers didn't know that porcine cysticercosis was zoonotic in nature. Of the few farmers who knew that the disease is zoonotic, less than half could not tell how it's transmitted although a few believed that it could cause serious side effects in humans mainly epilepsy.

Even if some of the community members in Mateete Town Council were pig farmers, almost all participants in this study had not heard about *T. solium* associated epilepsy very had family members or close relatives suffering from epilepsy. Farmers had knowledge on prevention of porcine cysticercosis transmission to pig in that majority believe that the disease could be prevented through good hygienic practices like pig intensification, use of feeds free from fecal contaminants and proper disposal of human wastes. However, few farmers knew that PC could be prevented in humans through good sanitation practices and eating well cooked pork.

This study revealed that 64% of the farmers in Mateete Town council were not knowledgeable about porcine cysticercosis. Majority of the respondents had not heard about porcine cysticercosis and therefore had low knowledge on its transmission to pigs, its zoonotic nature and how it's transmitted to humans, serious public health effect and how its transmission to humans can be prevented. This could be due to low extension coverage on swine management and health. This finding is consistent with the studies done in Amuru in Northern Uganda (Alarakolet *et al.*, 2020) and in Tanzania where interviewees were not knowledgeable about porcine cysticercosis (Nyangi *et al.*, 2022).

Furthermore, the study showed 64% of the farmer used bad practices to control and prevent the transmission of PC. Although 80% of the pig farmers ate pork and the majority enjoyed it any time it was available, 76% of the pigs slaughtered and carcasses were not inspected. This meant that most slaughters were done in unauthorized places and carcasses carried to butcheries. For the few pigs slaughtered at slaughter slab in Mateete Town council, carcasses were inspected by the Town Council Veterinary staff and those passed for human consumption carried a stamp mark "MAAIF Pass". Although most of the pork was not inspected only 24 % of the respondent knew they were at

risk of getting infected with PC more so if they consumed under cooked pork.

Even if toilet coverage was reportedly high in the study area and stood at 79% which is the exact National coverage, the interviewer was not given opportunity to physically see them. Open defecation which is a predisposing factor to *T. solium* and other infections was still reportedly practiced especially in farm land and other open places. According to Nicholas Ngwili (2022), barriers to latrine use that promote open defecation and these include poor latrine designs, poor access paths, poor lighting and low state of maintenance and hygiene. Hand washing facilities used after visiting toilets were reported in most of the households. However, the researcher never had any opportunity to see any of the participants using them.

## 6. Conclusions

- Porcine cysticercosis exists in Sembabule district at a prevalence of 2.9%.
- There are knowledge gaps on porcine cysticercosis among farmers in Mateete Town Council.
- Pig farmers use bad practices which promoted the spread of porcine cysticercosis in pigs and humans.

## 7. Recommendations

- Further studies should be carried to determine prevalence of porcine cysticercosis using better test methods like ELISA.
- Sensitization of pig farmers and pork consumers should be done by the veterinary extension staff and public health officer in Mateete Town Council to ensure that community knowledge on PC increases. This will translate to a shift from poor to good practices desired in the prevention and control the transmission of PC.
- Farmers should be advised to confine their pigs to avoid contamination with human faces.

## 8. Challenges

- Respondents had a lot of expectations, when administering questionnaires.
- Some pig farmers were not cooperative and unwilling to take part in the training.

## 9. Limitations to the Study

- Lack of epidemiological data on porcine cysticercosis in Sembabule district.
- The postmortem method used to estimate the prevalence of PC in pigs slaughtered in Mateete Town council could not detect all cases with *T. solium*.
- The researcher was unable interview all participants as per the sample size computed due to limitation of resources.

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