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Prevalence of *Cystircercus Cellulose* Infection Among Pigs Slaughtered in Arapai Market- Soroti District

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ABSTRACT

This study was designed to establish the prevalence of *Cysticercus cellulosae* infection by postmortem examination of pigs slaughtered at Arapai market from May to June 2018. *Cysticercus cellulose* is a zoonotic infection maintained by a pig-human cycle. Examination involved visual, palpation and incision. Out of 111 pigs examined, 9 were positive for *Cysticercus cellulosae*, representing a prevalence of 8.1%. A 95% confidence level and P-value < 0.05 was considered significant in all analysis. Odds ratio was used to evaluate association between variables (sex, breed and affected organs). Less males (n=48) than females (n=63) were examined but more males (5) than females (4) were infected with a prevalence of 4.5 %(n=48) and3.6 %(n=63) respectively. According to breed, the local breeds had the highest prevalence of 6.3% (n=80) whereas the crosses had a prevalence of 1.8% (n=31). The tongue and thigh muscles both had a prevalence of 6% and 2.7% respectively. In conclusion the prevalence of 8.1% reveal that the human population in Arapai is at a risk of getting infected and proved an economic threat, therefore I recommend, proper human waste disposal by use of pit latrines, proper management systems, confinement of free-ranging pigs and massive treatment with albendazole and oxfendazole.

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Background

Pig production is increasingly becoming an important economic activity in Uganda, with the pig population increasing in the last three decades from 0.19 million to 3.6 million [1]. In comparison to other animal rearing enterprises, pig production requires minimal inputs and relatively smaller space [2]. which makes pig farming popular. It is thus not surprising that more than 1.1 million families (about 18% of the total households) in Uganda own pigs [3]. Rapid increase in pig production is as a result of increase in consumption of pork within the country, driven not only by population growth but also by a combination of rising income and changing preferences associated with urbanization. 44% of world meat protein consumption is derived from pork and pork products. Uganda is having the highest per capita consumption of pork in sub-Saharan Africa, with an estimate of 3.4 kg/person/year [4]. Yet programs promoting pig production are not emphasizing proper management and public health concerns [3].

Cysticercus cellulosae infection caused by the metacestodes (cysticerci) of the cestode Taenia solium is endemic in Uganda [5]. *Cysticercus cellulosae* is a zoonotic infection that is maintained by a pig-human cycle in the ecosystem. The infection is contracted by pigs when they either ingest human faeces containing infective eggs or when fed on feeds contaminated with *t. solium* eggs [6]. In areas where open defecation is done, the faeces containing the infective eggs are consumed directly by pigs and the lifecycle is perpetuated [7]. When people consume raw or inadequately cooked pork from infected animals, the larval cysts will develop into the adult stage tapeworm in their intestines where gravid proglottids containing infective eggs detach from the adult tapeworm and are excreted in the faeces [8].

Humans can also act as an aberrant intermediate host for *t. solium* if there is fecal-oral contamination with the infective eggs, in such cases the larval stage can be found in human muscle, heart, eyes, skin or central nervous system causing human cysticercosis [9]. Adult *t. solium* infestation in humans is associated with subclinical conditions of malnutrition due to larval migration through the tissues [10]. Human NCC may manifest with headaches, blindness, hydrocephalus, chronic meningitis and dementia [11].

NCC contributes to epilepsy in regions where pigs are free-ranging and hygiene is poor [12]. *Cysticercus cellulosae* infection is an emerging and expanding zoonosis in Africa [13]. Some studies done reveal the following prevalence.

In Nigeria 8.7%, Ethiopia 1.4%, Zambia 6.3% reported 9%, 15% and 3% in three places, in Tanzania the prevalence was 17.4% and in Uganda a study was done in kamuli and kaliro the prevalence was 8.5% [14-16]. *Cysticercus cellulosae* is globally recognized as a zoonosis of serious economic importance in many African countries [11]. In Uganda *C. cellulosae* is endemic and it's a socio-economic challenge associated with backyard pig-keeping practices. Occurrence of *C. cellulosae* in pigs poses a health and economic threat to the public and leads to economic loses especially to the farmers and those who trade in the enterprise. Thus, a need to determine the prevalence of *Cysticercus cellulosae* infection. With limited information on its prevalence in Arapai there was a need to carry out this research to determine its prevalence in Arapai market.

Statement of the Problem

T. solium is a zoonotic parasitic disease that is maintained by the pig-human cycle and is perpetuated where open defecation is

common and pigs are kept under free range system. Since pigs are scavenging animals, and humans are the final hosts of *T. solium* in which the adult tape worm matures and sheds its eggs in human excreta which when poorly disposed contaminants feeds, water and when pigs ingest these it contracts the infection. In Uganda studies on prevalence of *C. cellulosae* in pigs in kaliro and kamuli reveal prevalence of 8.5% [5]. And because farmers in Arapai rear pigs on small scale and on free range, they are prone to the infection. The problem on the ground in Arapai is that farmers are not aware of the occurrence, prevalence and magnitude of *C. cellulosae*. The occurrence of this infection in pigs is a constraint to pig production and to the economy and in a long run causes neurocysticercosis in humans which is life limiting. The low output from pigs resulting from *C. cellulosae* infection leads to a need to find out the prevalence of *C. cellulosae* infections in pigs. Therefore, there is need for better data on this neglected zoonotic disease in Uganda, with a particular emphasis on prevalence in pigs.

Overall Objective
To determine the prevalence of *C. cellulosae* infection in pigs slaughtered in Arapai market, Soroti district, Uganda.

Objectives of the Study
To determine the prevalence of *C. cellulosae* infection amongst sex and breeds of pig slaughtered in Arapai market.
To determine the most affected organ in pigs slaughtered in Arapai market

Research Questions
Which sex and breed of pigs slaughtered in Arapai market is the most infected With *C. cellulosae*?
Which organ was the most affected among the pigs slaughtered in Arapai market?

Justification
Pigs play an important role in the livelihoods of smallholder farmers in sub-Saharan Africa (Ikwap et al., 2014) providing subsistence as meat, income from sales and a safety net of capital assets to face risks in harsh environment and to a lesser extent as manure for crop production. Pork is the most popular meat consumed in the world today with 44% of world meat protein consumption derived from pork and pork products (Ikwap et al., 2014). To improve pig production and reduce animal protein deficit, knowledge on the prevalence of *Cysticercus cellulosae* infection should be found out and presented to different stakeholders [8]. *Cysticercus cellulosae* is a neglected zoonotic parasite causing epilepsy and severe headaches in humans and substantial economic losses to pig farmers in endemic areas [16].

It has been ranked highest on the global scale of food borne parasitoses by the world health organization (who 2014) which considers *Cysticercus cellulosae* infection an eradicable disease based on its simple life cycle and availability of a powerful and inexpensive disease control tools (Marshall & Meritxell. 2017). No documentation has been made regarding the prevalence of Cysticercus cellulosae among pigs slaughtered at Arapai market, yet production is not at its best and continues to deteriorate. Such information is necessary to get a better understanding of the pig industry and how this parasitic condition which affects productivity can be prevented.

Therefore, finding out the prevalence of *Cysticercus cellulosae* can enable stakeholders put preventive and control measures in place to improve production and productivity of pigs in Arapai sub-county as well as preventive measures to break the pig-human cycle of the parasite

Significance
The research findings will cause awareness among the pig keeping community in Arapai Sub County and Soroti district about prevalence of *C. cellulosae* which will help in implementation of measures to reduce, control and prevent the transmission of C. cellulosae infection among pigs. The research study will also provide information to stakeholders and veterinarians to look forward towards prevention and control of *C. cellulosae* infection in pigs

Chapter Three: Methodology

Study Area
The study was carried out in Arapai market from May to June to determine the prevalence of *Cysticercus cellulosae* infection in pigs.

Study Design
A cross sectional study was conducted at Arapai market between May and June to determine the prevalence of *Cysticercus cellulosae* infection in pigs slaughtered

Post-Mortem Examination
Visual examination, palpation and incision of organs such as the tongue, thigh muscles and liver was done. The heads of slaughtered pigs were set aside and the tongue fully extended and examined on both the dorsum and ventrum before incision. Thigh muscles were deeply incised on both front and hind legs.

Sampling Method and Sample Size Determination
Convenient Sampling method was used and the sample size was determined using the formula recommended by (thrushfield 2005). The level of confidence was 95% and an expected prevalence of 8% since, it was reported in kamuli and kaliro. Therefore,

$$n = \frac{1.96^2 * P\text{exp}\ (1\text{-}P\text{exp})}{d^2}$$

Where: n = required sample size
P exp= expected prevalence
d = desired absolute precision
$n = 1.96^2 \times 0.08 \times 0.91/0.05^2 = 111$.

Data Collection
The sex, breed, affected organs and results of pigs examined were recorded in a data collection sheet.

Data Presentation
The data collected has been presented using tables.

Data Analysis
The collected data was entered in Microsoft excel base system and analyzed using Odds Ratio. Odds Ratios were used to evaluate the association between variables (breed, affected organs and sex). The odds ratio was used because it is one of the statistical software used to analyze cross sectional studies.
A 95% confidence interval and P-value less than 0.05 (at 5% level of significance) was considered significant in all analysis.

Chapter Four: Results

Overall Prevalence
Out of 111 pigs examined 9 were found positive for *Cysticercus cellulosae* indicating an overall prevalence of 8.1%.

Table 1: Showing Total (overall) Prevalence in all Pigs Slaughtered at Arapai Livestock Market

Outcome	Frequency	Prevalence (%)
Positive	9	8.1
Negative	102	91.9
Total	111	100

Prevalence According to Sex and Breed

Table 2: Showing Prevalence of C. Cellulose According to Breed and Sex of Pigs

Variable	Category	no of pigs sampled (n=111)		Prevalence (%)	OR (95%, C.I)	P-value
		Negative	Positive			
Breed	Local	73	7	6.3	1	
	Crosses	29	2	0.9	0.31(0.0066,2.5884)	0.4289
Sex	Male	43	5	4.5	1	
	Female	59	4	3.6	0.58(0.10,2.8995)	0.4968

C.I = Confidence Intervals and OR= Odds Ratios.

Prevalence According to Organs Affected

Table 3: Showing Prevalence of C. Cellulosae According to Organs Affected

Variable	Category	No of pigs sampled (N=111)		Prevalence (%)	OR (95%, C.I)	P-value
		Negative	Positive			
Organ(s)	Thigh	0	3	2.7	1	
	Tongue	0	6	6	1(0, infinite)	0.60494

C.I = Confidence Intervals and OR= Odds Ratios.

Chapter Five: Discussion

The study revealed an overall prevalence of 8.1 %, this was similar to the prevalence of 8.5% reported in kamuli and kaliro districts [5]. The prevalence of *C. cellulosae* was almost similar to that of kaliro and kamuli possibly because of related cultural and social practices though its slightly lower possibly because of the fact that some of the pigs slaughtered at Arapai market originate from distant places and are bought and sold by middlemen who probably carry out pre-transit lingual examination of the pigs before delivery [17]. Also, the pit latrine coverage in Soroti was 71% and this could have contributed to a slightly lower prevalence of C.cellulose than in kaliro and kamuli (Uganda Bureau of Statistics 2009).

According to sex, less males (n=48) than females (n=63) were examined though more males were positive with a prevalence of 4.5% as compared to 3.6% in females. This differs from results from Nigeria where females were seen to be more infected than males [18]. This is possibly because of the male sharing practice where males are shared among farmers for breeding purposes, during this practice males are moved long distances which increases their exposure .Also males are left to roam freely unlike females which are at times tethered to allow heat detection. They are also tethered towards the end of gestation period and after parturition to prevent them from delivering in unknown places and bushes which exposes piglets to predators, thieves and unfavorable conditions.

Local breeds were more infected with a prevalence of 6.3% and the crosses had a prevalence of 1.8%. All breeds are susceptible to the infection but the observed difference in prevalence rate could probably be because of the fact that local breeds depend entirely on free- range scavenging for food unlike crosses which are either provided or supplemented with feeds and their movement is partially controlled due to fear of them acquiring infections since they are not very resistant to the local disease challenge and conditions unlike the local.

According to organs affected the study results show that both the tongue and thigh muscles were affected with *Cysticercus cellulosae*. This was so because these organs consist of active muscles which are preferred sites by the cysticerci. The study results are in line with those of from Nigeria who found out that more and viable cyst were found in the tongue [18].

Chapter Six: Conclusions and Recommendations

Conclusion

The prevalence of *Cysticercus cellulosae* in pigs slaughtered at Arapai market, Soroti district was 8.1 %. The study results showed that male and local pigs were more affected than females and crosses respectively. *Cysticercus cellulosae* being a zoonotic infection, these study results reveal that the human population in Arapai is at a risk of getting infected. Therefore, this neglected zoonotic disease has caused great economic loss due to condemnation of affected carcasses at Arapai market.

Recommendations

Effective control program through deworming should be implemented. Confinement of pigs to prevent continuous transmission of *Cysticercus cellulosae* . Vaccination of pigs with crude extracts of *T. solium* metacestodes and oncosphere antigens, massive treatment of pigs with drugs such as albendazole and oxfendazole and public education about health and economic impacts of *Cysticercus cellulosae*. Proper management practices should be encouraged by the respective programs. All these will help reduce the economic losses resulting from condemnation of carcasses

A study to find out the risk factors contributing to the occurrence of Cysticercus cellulosae infection among pigs slaughtered at Arapai market.

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