

Analysis of the Knowledge, Attitudes and Practices of Populations in Four Villages of the *Boucle du Mouhoun* Region (Burkina Faso) Regarding *Taenia solium* Life Cycle

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Abstract

T. solium cysticercosis is a tropical neglected disease with a high impact on public health and agriculture. To better understand the socio-economical drivers of this disease, this study was carried out with the goal to analyze knowledge, attitudes and practices of populations of the *Boucle du Mouhoun* region in connection with the life cycle of *T. solium*. We carried out a knowledge-attitudes-practices (KAP) survey with 320 people in four villages. More than half of the interviewees (60.3%) have already seen pig's carcasses with the parasite cysts. Only two people know that the infestation is associated with the consumption of human faeces. In addition, 32.2% think that they can get sick by ingesting infested meat. Wells water is consumed by 62.8% of people and 75.1% of wells do not carry curbs. Moreover, 84.1% of concessions had latrines but 52.2% of the people practice open defecation. Pig meat is consumed by 80.6% of people and 30.9% have already consumed meat with cysts. This study shows that the transmission routes of porcine cysticercosis are not known and that the populations adopt attitudes and practices which allow the perpetuation of teniasis/cysticercosis in these villages.

Keywords

Taenia solium, Knowledge, Cysticercosis, Attitude, *Boucle du Mouhoun*

1. Introduction

In Burkina Faso, cysticercosis has been highlighted in humans in the *Boucle du Mouhoun* and Midwest region [1] [2] [3] [4] [5] and in pigs in the Midwest region [6]. This neglected tropical disease, due to the larval stage of *T. solium*, has pigs like its natural intermediate host, and human plays the role of definitive host but they sometimes can be an intermediate host [7]. In this disease, contamination of humans as a definitive host occurs during the ingestion of poor undercooked pork. Humans and pigs acquire the larval form of the worm by ingesting the eggs of the parasite or by consuming food or drinking water contaminated with the worm's eggs. It also has been demonstrated that carriers of adult tapeworms can get cysticercosis by retroperistalsis. On the epidemiological level, the existence of the disease is facilitated by poor hygienic conditions of populations but also the existence free roaming pigs [8] [9]. But the population's knowledge of cysticercosis transmission is associated with the reduction in the incidence of cysticercosis in pigs [10] [11]. On the other hand, practices such as open defecation, consumption of poorly cooked infected pork, and consumption of water from an unprotected source are factors that maintain and transmit the couple *T. solium* teniasis/cysticercosis in rural areas [7] [11]. It is clear that the knowledge, practices and attitudes of populations play an important role in the epidemiology of this disease. However, in the region of *Boucle du Mouhoun* in Burkina Faso, study focused on knowledge, practices and attitudes has only been carried out in Nayala province and to know more it is useful to extend this type of study in the other provinces to better appreciate the risk of maintenance of the disease and better define the control and prevention actions. Thus, this study proposes to assess knowledge, attitudes and practices of people from four villages of the province of Balés in Burkina Faso related to *T. solium* life cycle.

2. Area and Period of Study

This study was carried in the *Boucle du Mouhoun* region, specifically in the villages of Toné, Kabourou, Koumbia and Sadon Bobo (**Figure 1**) of the Fara commune. These villages are located at 60 km from national road 1 on the regional road 11 between *Poura carrefour* and the border with Ghana. Villages were randomly selected between villages with an important pig population according to data collected from veterinary services of this county. These villages were selected because of their strong animist populations with an important pig population except for Kabourou where we have many Muslims, with a little pig population. Concerning pig husbandry practices, it depends on the season. During the rainy season, pigs are tethered or kept in little houses. During the dry season, they roam free in villages. In villages, there are latrines but some people practice open defecation. The study was carried on January 2017.

3. Methodology

This study was a survey conducted in the form of interviews with a questionnaire

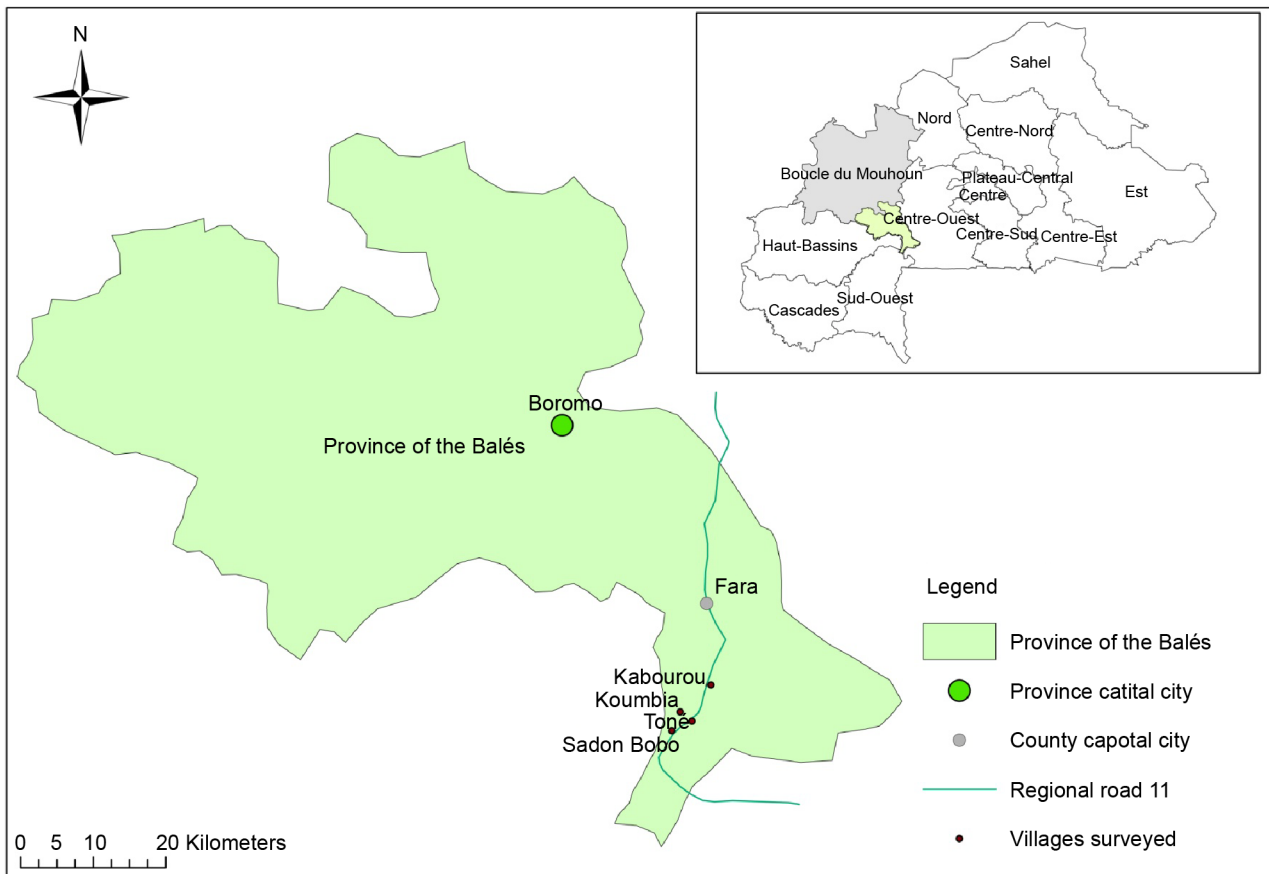


Figure 1. Location of the study area in the *Boucle du Mouhoun* region.

containing closed and open questions. The study involved 320 people (breeders and non-pig breeders) with 80 persons in each village. These individuals were randomly selected in households. Indeed, in each of the households encountered in the concessions, one person was selected and interviewed. Questions were focused on demographic characteristics of the respondents, their knowledges on *T. solium* cysticercosis and the practices and attitudes of the respondents in relation to the *T. solium* life cycle. Informations were also requested on the existence and type of pig farming near the respondent's household and the status of his family regarding epilepsy.

4. Ethical Considerations

In each village, the aims of the study and the use of the data collected were explained to each person chosen for the interview. After this information, we asked their opinion about their participation in the study and it was only with their consent that the questionnaire was administered to them. We also reassured people of the confidentiality of the information collected.

5. Statistical Analysis

The data was recorded on the Microsoft Excel 2007 spreadsheet and analyzed

using the R 2.13.0 software, which was used to calculate the descriptive statistics for each variable.

6. Results

6.1. Socio-Professional Data

In our study, men were slightly more represented than women, who represented only 45.6% of our sample, and 43.1% were pigs breeders. Nearly 90% of those interviewed had not attended school and 82.2% were animists. The majority of the sample was represented by people aged between 20 and 60 as shown in **Table 1**.

6.2. Knowledge of Cysticercosis

In the study area, all respondents have heard about the disease at least once and this disease even has names in local languages. In Toné, cysticercosis is referred to as “*Dabia*”, in Kabourou, Sadon Bobo is called “*Dah*” and in Koumbia it is called “*Zah*”. Moreover, the majority of interviewees (60.3%) (**Table 2**) had already seen a pig carcass infested but only two people (0.6%) knew that the disease was related to the consumption of human faeces. The remainder believed that the disease was transmitted to pigs from the screening residues of unboiled maize flour (6.0%); the consumption of river water (1.9%), acquired at birth (0.9%), divagation (0.3%), non-castration of pigs (0.3%), weight (0.3%) and 89.4% have no idea of the route of transmission. Regarding the sanitation of the infected meat, only two people (0.9%) said that the cooked meat becomes non-dangerous for the consumer. More than three quarters (87.5%) of the interviewees did not know a technique for sanitizing the meat and 10 people (3.1%) thought that the infested meat could not be sanitized. Interviewees stated that meat can be sanitized by boiling it with leaves of *Dyospyros mespilliformis*

Table 1. Breakdown of respondents by socio-professional variables.

Variable	Terms	Headcount	Percent
Gender	Female	146	45.6
	Male	174	54.4
Education level	Not enrolled	286	89.4
	Primary	20	6.2
	Secondary	14	4.4
Religion	Animist	263	82.2
	Christian	25	7.8
	Muslim	32	10.0
Age groups	Under 20 years	17	5.3
	20 - 40 years	111	34.7
	41 - 60 years	129	40.3
	More than 60 years	63	19.7
Pig breeding	Yes	138	43.1
	No	182	56.9

Table 2. Knowledge of cysticercosis by the populations of 4 villages of the *Boucle du Mouhoun* in Burkina Faso, 2017.

Variables	Modalities	n	Overall Percentage (%)	Percentage (%) in Each Village			
				Toné	Kabourou	Koumbia	Sadon Bobo
Already seen a slaughtered infected pig	Yes	193	60.3	61.3	72.5	50.0	57.5
	No	127	39.7	38.7	27.5	50.0	42.5
	All carcass	189	68.2	71.0	56.8	87.0	68.6
Location of cysts observed	Tongue	85	30.7	29.0	43.2	13.0	26.9
	Heart	3	1.1	0.0	0.0	0.0	4.5
	Yes	135	42.2	50.0	61.8	32.5	25.0
Is cysticercosis a swine disease?	No	13	4.1	5.0	0.0	0.0	11.3
	Don't know	172	53.7	45.0	38.7	67.5	63.7
Knowledge of contamination route of pigs	Yes	2	0.6	2.5	0.0	0.0	0.0
	No	318	99.4	97.5	100.0	100.0	100.0
	Yes	103	32.2	35.0	50.0	37.5	10.0
Risk of falling ill by eating infested meat	No	35	10.9	5.0	5.0	1.3	32.5
	Don't know	182	56.9	60.0	45.0	65.0	57.5
	Yes	2	0.6	1.2	1.2	0.0	0.0
Knowledge of infected meat remediation	No	318	99.4	98.8	98.8	100.0	100.0

(4.7%), potash (3.4%), traditional alcohol (0.6%) regardless of cooking level. Also, 77.8% of the interviewees did not know any technique for the recognition of infected live animals, while 9.4%, 0.6% and 0.3% respectively asserted that the infected animals had hypertrophied jaws, hypertrophied eyes and are skinny. Approximately 12% (11.9%) of our respondents used the palpation of tongue to identify infected lived animals. In addition, all the respondents stated that there is no relationship between epilepsy and porcine cysticercosis.

6.3. Attitudes and Practices of Populations in Relation with *T. solium* Life Cycle

Regarding the practices and attitudes of the populations, all the interviewees acknowledged the presence of pig breeding near their households and these pigs were free roaming during dry season. In addition, more than half (62.8%) of the respondents drank well water. Among wells from which water is consumed only 24.9% are protected by a curb. In addition, populations consumed untreated water from rivers and ponds (41.2%), and this consumption was mostly done during the rainy season. More than half of the interviewees (58.1%) said they consume raw vegetable products and only 26.3% still wash these products before consumption mainly with pump water (79.9%) and from wells (32.8%) were used for this wash (Table 2). Among people who consumed these products, 83.3%; 54.3%; 39.8% respectively consumed these products at home, in the gardens and at the market. In the villages, all interviewees reported that vegetable products are watered with water from rivers, ponds and wells dug in the gardens. In villages, latrines (74.4%) and bushes around villages (42.5%) were used as a place of defecation. When field work began, people said they defecated in the

bushes and 62.8%; 19.7%; 17.5% respectively sometimes, always and never digged a hole before defecating. After defecation, 44.7% of the interviewees admitted that they never wash their hands (Table 2). To clean up after defecation, the populations used wood (78.1%), tree leaves (73.7%), paper (44.7%) and water (43.1%). In the villages, children used households' surroundings (99.4%) and piggery (3.4%) as places of defecation. More than two-thirds (80.6%) of the interviewees consumed pork in the markets (91.9%), homes (94.2%) and at sellers of the village home (5.8%). Almost three-quarters (74.4%) of the interviewees often consumed uncooked meat (Table 3) and the preferred type of cooking was

Table 3. Attitudes and practices of the populations of the *Boucle du Mouhoun* (Burkina Faso) in relation with *T. solium* life cycle.

Variables	Modalities	Overall headcounts	Percentage (%)	Percentage (%) in each village			
				Toné	Kabourou	Koumbia	Sadon Bobo
Well water consumption	Yes	201	62.8	41.2	93.8	45	71.3
	No	119	37.2	58.8	6.2	55	28.7
Protection of the well with a curb	Oui	50	24.9	39.5	34.7	13.9	10.5
	Non	151	75.1	60.5	65.3	86.1	89.5
River water consumption	Frequently	14	7.1	18.2	74.7	5.6	12.3
	Sometimes	113	85.6	78.8	25.3	88.8	86.0
	Rarely	5	3.8	3.0	0.0	5.6	1.7
Consumption of raw vegetable products	Frequently	12	6.4	6.7	3.9	16.3	0.0
	Sometimes	158	85	91.1	80.4	69.7	97.9
	Rarely	16	8.6	2.2	15.7	14.0	02.1
Washing vegetable products	Always	49	26.3	22.2	13.7	20.9	48.9
	Sometimes	109	58.6	57.8	66.7	65.1	44.7
	Never	28	15.1	20.0	19.6	14.0	6.4
Water for washing vegetable products	Well	61	32.8	24.2	44.4	2.2	14.5
	River	32	17.2	25.8	11.1	04.4	7.3
	Pump	145	79.9	50.0	44.4	71.7	78.2
Existence de latrine in the household	Tap	10	5.3	0.0	0.0	21.7	0.0
	Yes	269	84.1	78.7	87.5	76.3	93.7
	No	51	15.9	21.3	12.5	23.8	6.3
Place of defecation in the village	Latrines	238	74.4	73.7	59.4	56.3	50.8
	Brousse du village	136	42.2	25.0	38.5	28.1	38.8
	Porcheries	32	10.0	1.3	2.1	15.6	10.4
Hand washing after defecation	No	143	44.7	37.5	42.5	47.5	51.2
	Always	10	3.1	14.0	2.2	4.8	0.0
	Sometimes	163	50.9	82.0	93.5	95.2	100.0
Pork consumption	Rarely	4	1.3	4.0	4.3	0.0	0.0
	Yes	258	80.6	86.3	58.7	82.5	95.0
	No	62	19.4	13.7	41.3	17.5	5.0
Consumption of meat with <i>T. solium</i> cysts	Yes	99	30.9	31.3	37.5	12.5	42.5
	No	221	69.1	68.7	62.5	87.5	57.5

boiled meat (99.2%); braised meat (15.5%) and baked meat (14.3%). During our survey, almost one third of the interviewees (30.9%) acknowledged that they had once consumed infected pork. In addition, 95.3% of interviewees said that pork sold in villages is sometimes inspected, while 3.1% and 1.6% respectively said it is sometimes and never inspected. According to the populations, the inspection is carried out at the dispensary level by the nurses.

6.4. Teniasis in Populations and Importance of Epilepsy

Among the interviewees, 7.5% found “whitish things, like pieces of leaves”, in their faeces, while 48.1% said they did not look at their stool after defecation. In addition, 10.3% said they had already found “these whitish things” in the faeces of a member of their household. Also, four interviewees often had epileptic seizures and 25.9% had a member of their household with these seizures, and respectively 51.2%; 22.6% and 13.1% of these patients developed their first seizures in adulthood, adolescence and childhood. The majority of people with epileptic seizures (68.9%) received traditional treatment, 16.7% received modern treatment; 4.4% had received modern and traditional treatment and 11.1% had no treatment.

7. Discussion

In this study, it was noticed that men were relatively more numerous in the sample compared to women, in comparison to the study by Ngowiu *et al.* [12] in the Boulkiemdé, Sanguié and Nayala provinces of Burkina Faso where 53.8% of the participants were women. This would probably be linked to the rural activities of women during our study period. During the survey, many women went early in the morning to look for firewood in the fields. In addition, 89.4% of those interviewed did not attend school. In Burkina Faso, 80.6% of the rural population over seven years has not gone to formal school [13]. Also, the majority of respondents (94.7%) were more than 20 years old. A similar finding was also made by Kungu *et al.* (2017) in Uganda where 98.4% of the sample were people over 20 years of age. This situation in our case is probably related to the fact that school children were in school during the survey hours and those out of school had either gone to the fields or followed cattle. Also in this study, the majority of interviewees (82.2%) were animists. In the study, 43.1% of the interviewees were pig breeders as in the study by Ngowi *et al.* (2017) where 46.9% of the participants were breeders. Among pig breeders, women were most important (68.9%) compared to men. This may be due to the fact that pig farming in rural areas is mainly female. According to FAO [14], in traditional rural areas, traditional pig farming is carried out mainly by women who use it as a means of generating income that they can freely dispose of in relation to other production (poultry and ruminants) which belong to the husband.

About their knowledge on *T. solium*, varied informations was noted. All respondents have already heard about the disease which has a denomination in lo-

cal languages. More than half (60.3%) have already seen a swine-infected carcass. In the provinces of Boulkiemdé, Sanguié and Nayala, 63.4% of people have already seen pigs carcasses infected by *T. solium* cysts [12]. However, the transmission routes and the methods of sanitizing the infested meat are unknown by the majority of people (99.4%). In the study of Ngowi *et al.* [12] in Burkina Faso, only 5.3% of people know that the infestation of teniasis is associated with the consumption of uncooked infected pig meat. Chacha *et al.* [15] in Tanzania and Ngowi *et al.* [12] in Burkina Faso found respectively, that 33.7% and 6.2% of the population know that porcine cysticercosis is linked to the consumption of human faeces by pigs. This lack of knowledge of the transmission of cysticercosis for the populations of our study area is dangerous as good knowledge of the transmission of *T. solium* to populations and pigs avoid people's behaviors that increase the risk of transmission to humans as well as to the pigs. Indeed, the lack of knowledge of populations on the epidemiology of porcine and human cysticercosis leads to behaviors that facilitate the transmission and maintenance of *T. solium* infections [16] [17]. This situation justifies the fact that 67.8% of the population does not know that the consumption of infected uncooked meat can make them sick. Thus, it appears that the population of the area is informed of the disease but the epidemiology remains unknown. This situation was also observed by Shey-Njila *et al.* [18] in Cameroon, but unlike our study, 28.6% of the population knew the relationship between teniasis in humans and cysticercosis. According to Ngowi *et al.* [10] and Garcia *et al.* [19], insufficient knowledge about the couple teniasis/cysticercosis makes controlling it difficult in endemic areas. In addition, Ngowi *et al.* [10] showed that education of the population was associated with a reduction in the incidence of porcine cysticercosis. It appears from this study that people are aware of the existence of cysticercosis but ignore its epidemiology and the potential risk of infestation of humans from infected pigs but also humans carrying the adult worm. So it is very important to carry out sensitization of local people on the transmission of *T. solium* to pigs and humans.

As people know less about the epidemiology of porcine and human cysticercosis, they adopt practices and behaviors that facilitate the transmission of cysticercosis. Indeed, all pigs reared in the study area roam free during dry season. This poses a risk of swine infestation where this type of breeding allows them to access to human faeces, which could facilitate the transmission and maintenance of cysticercosis [19]. However, studies have shown in Tanzania that whole-containment of pigs do not leads to significant decrease of seroprevalence compared to free roaming [20]. In addition, respectively, 15.9%; 42.2% and 10% of the population have no latrines; defecate in the open air and in the piggeries. In the Sanguié province of Burkina Faso, Ngowi *et al.* [12] found that 90.6% of the population did not use latrines for defecation. Also 99.4% of children defecated around households. Thus, wandering pigs will easily come into contact with these faeces, especially as these practices are associated with transmission of

cysticercosis [18] [21]. The role of open defecation in the transmission of human cysticercosis could be high because 62.8% and 41.2% of the population consume water from wells and rivers or ponds, respectively. Also among wells whose water is consumed, 75.1% have no curb. Thus, runoff water can transport *T. solium* eggs into these waters, which, as they are consumed untreated, may present a real source of transmission of human cysticercosis [7] [22] [23]. This risk can also come from gardens' products consumed raw without being washed and which are watered by the waters from these rivers and unprotected wells. The problem of runoff water could be especially severe during fieldwork, where the consumption of rivers and ponds is high. All interviewees said they defecated in the open air in the bushes with only 19.7% who were still digging a hole to defecate. After defecation in the bush, nobody washed their hands, but in the village, 44.7% do not wash their hands and among those who wash their hands none use soap. In their study in Uganda, Kungu *et al.* [11] found that 54.6% of the population wash their hands after defecation, 76.8% of which use soap. This low practice of hand washing after defecation shows that the risks of self-infestation by the eggs of *T. solium* are not minimal. This is justified because, according to the World Health Organization (WHO), measures such as hand washing with soap, latrines, and safe water are behaviors that limit the burden of infectious diseases such as teniasis/cysticercosis [24]. In addition, 80.6% of the interviewees attest to eat mainly boiled pigmeat (92.2%). Among people who eat pig meat, 74.4% and 30.9% said they often consume uncooked meat and meat with cysts. This presents a real risk of transmission of teniasis to *T. solium* as the main means of contamination remains the consumption of undercooked infected pigmeat [25] [26].

In our survey, we had a photo with ovigerous segments of *T. solium*, which allowed little confusion with other similar elements that could be found in the faeces of the populations. This study revealed that there are *T. solium* carriers in the study area that can sustain the existence of porcine or human cysticercosis. These probable carriers of *T. solium* do not only increase the risk of developing cysticercosis for them but are also sources of infestation for members of their households and nearby households [27]. They also play an important role in the infestation of pigs because according to Lescano *et al.* [16], pigs in concessions with a worm bearer or those within 50 m of a carrier are 3 times more likely to be infected than others located at more than 500 m, and seroconversion incidence is 11 times higher among the first compared to the latter group. Also in our study, we noted the presence of people developing epileptic seizures. According to various authors, epilepsy is a disease with multiple causes and may be due to a genetic predisposition, perinatal neurological disorders, strokes, head trauma, malaria, meningitis etc. [28] [29]. Nevertheless, studies have shown that neurocysticercosis and epilepsy are linked and the prevalence of neurocysticercosis among people with epilepsy can range from 11.1% to 45.2% in sub-Saharan Africa [30]. Thus, some people with epilepsy in the study area may have *T. so-*

lium cysts.

8. Conclusion

This study showed that porcine cysticercosis is a disease that people are aware of in the study area. However, they are unaware of human cysticercosis as well as the transmission of both human cysticercosis and porcine form. Given this insufficient knowledge, these populations develop practices that expose pigs and human to cysticercosis. Thus, this study could serve as a basis for defining the content of actions to sensitise people on this disease by guiding messages on the risks related to the consumption of infected or uncooked pig meat, open air defecation, consumption of well water, untreated rivers.

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