East African Journal of Arts and Social Sciences, Volume 7, Issue 1, 2024
Article DOI : https://doi.org/10.37284/eajass.7.1.1783


**East African Journal of Arts and Social Sciences**
eajass.eanso.org
**Volume 7, Issue 1, 2024**
**Print ISSN: 2707-4277 | Online ISSN: 2707-4285**
Title DOI: https://doi.org/10.37284/2707-4285

EAST AFRICAN NATURE & SCIENCE ORGANIZATION

*Original Article*

# Socio-Demographic Factors Influencing Knowledge, Attitude, and Reported Practices Regarding Taenia Solium Cysticercosis Taeniasis in Tanzania

*Chacha Joseph Nyangi[1,3*], Christopher Mahonge, PhD[2], Helena Aminiel Ngowi, PhD[3], Andrea Sylvia Winkler, PhD[4], Ayubu Jacobo Churi, PhD[5] & Ernatus Martin Mkupas, PhD[3]*

[1] Department of Food Science and Technology, Mbeya University of Science and Technology, P. O. Box 131, Mbeya, Tanzania.
[2] Department of Policy, Planning and Management, Sokoine University of Agriculture, P. O. Box 3035 Morogoro, Tanzania.
[3] Department of Veterinary Medicine and Public Health, Sokoine University of Agriculture, P. O. Box 3021 Morogoro, Tanzania.
[4] Centre for Global Health, Department of Neurology, School of Medicine and Health, Technical University of Munich, Munich, Germany & Department of Community Medicine and Global Health, Institute of Health and Society, University of Oslo, Oslo, Norway.
[5] Centre for Information and Communication Technology (CICT), Sokoine University of Agriculture,P. O. Box 3000 Morogoro, Tanzania.

[*] Author for Correspondence ORCID ID: hhttps://orcid.org/0000-0002-9543-9758; Email: Nyangichacha@yahoo.com

**Article DOI : https://doi.org/10.37284/eajass.7.1.1783**

**Date Published:**

*04 March 2024*

**Keywords**:
*Taenia Solium Cysticercosis, Knowledge, Attitude, Practices, Socio-Demographic Factors, Tanzania.*

## ABSTRACT

Taenia solium Cysticercosis/Taeniasis (TSCT) is a neglected zoonotic disease with significant public health and socio-economic impacts. TSCT is endemic in areas with low socio-economic development. This study examined the influence of socio-demographic factors on community knowledge, attitude, and practices regarding TSCT control in Mbulu, Mpwapwa, Mbinga, and Rungwe districts of Tanzania. The study employed a cross-sectional design, and. data were collected using a questionnaire, which was administered to 483 randomly selected households in the study districts. In addition, qualitative data were collected using key informant interviews (KIIs) from 38 purposively selected respondents and 12 focus group discussions (FGDs). Quantitative data were analysed in SAS 9.4 using binary logistic regression with education, location, gender, age, occupation, source of income, the duration of residence (years), savings and credits cooperative society (SACCOS) membership, and household size included in the model as predictors of knowledge, attitude, and/or practices related to TSCT control. The qualitative data were analysed in ATLAS.ti 8. Findings show that respondents with post-primary education were more likely to have heard of tapeworm ($P = 0.0071$), be aware of T. solium transmission ($P = 0.0396$), aware of T. solium health effects ($P = 0.0212$), and be be knowledgeable on human cysticercosis (HCC) health effect ($P = 0.003$) compared to respondents with no formal education. With regard to practices, respondents from Mpwapwa district were more likely to report washing their hands with soap before eating ($P = <0.0001$). It is, therefore, recommended that strategies involving health education intervention should consider the inclusion of socio-demographic, cultural, economic, and location factors for effective and sustainable control of the parasite.

 

Article DOI : https://doi.org/10.37284/eajass.7.1.1783

**APA CITATION**

Nyangi, C. J., Mahonge, C., Ngowi, H. A., Winkler, A. S., Churi, A. J. & Mkupas, E. M. (2024). Socio-Demographic Factors Influencing Knowledge, Attitude, and Reported Practices Regarding Taenia Solium Cysticercosis Taeniasis in Tanzania. *East African Journal of Arts and Social Sciences*, *7*(1), 96-112. https://doi.org/10.37284/eajass.7.1.1783

**CHICAGO CITATION**

Nyangi, Chacha Joseph, Christopher Mahonge, Helena Aminiel Ngowi, Andrea Sylvia Winkler, Ayubu Jacobo Churi and Ernatus Martin Mkupas. 2024. "Socio-Demographic Factors Influencing Knowledge, Attitude, and Reported Practices Regarding Taenia Solium Cysticercosis Taeniasis in Tanzania". *East African Journal of Arts and Social Sciences* 7 (1), 96-112. https://doi.org/10.37284/eajass.7.1.1783.

**HARVARD CITATION**

Nyangi, C. J., Mahonge, C., Ngowi, H. A., Winkler, A. S., Churi, A. J. & Mkupas, E. M. (2024) "Socio-Demographic Factors Influencing Knowledge, Attitude, and Reported Practices Regarding Taenia Solium Cysticercosis Taeniasis in Tanzania". *East African Journal of Arts and Social Sciences*, 7(1), pp. 96-112. doi: 10.37284/eajass.7.1.1783.

**IEEE CITATION**

C. J., Nyangi, C., Mahonge, H. A., Ngowi A. S., Winkler, A. J., Churi & E. M., Mkupas "Socio-Demographic Factors Influencing Knowledge, Attitude, and Reported Practices Regarding Taenia Solium Cysticercosis Taeniasis in Tanzania". *EAJASS*, vol. 7, no. 1, pp. 96-112, Mar. 2024.

**MLA CITATION**

Nyangi, Chacha Joseph, Christopher Mahonge, Helena Aminiel Ngowi, Andrea Sylvia Winkler, Ayubu Jacobo Churi & Ernatus Martin Mkupas. "Socio-Demographic Factors Influencing Knowledge, Attitude, and Reported Practices Regarding Taenia Solium Cysticercosis Taeniasis in Tanzania". *East African Journal of Arts and Social Sciences*, Vol. 7, no. 1, Mar. 2024, pp. 96-112, doi:10.37284/eajass.7.1.1783.

## INTRODUCTION

*Taenia solium* Cysticercosis/Taeniasis (TSCT) is a neglected zoonotic disease with significant public health and socio-economic impact worldwide (WHO, 2015a). TSCT was ranked first on the global scale of food-borne parasites (FAO and WHO, 2014). *Taenia solium* is endemic in many countries with poor socioeconomic status, especially in Africa, Asia, and Latin America (Coral-Almeida et al., 2014; Okello and Thomas, 2017). TSCT is a preventable disease that can be eradicated and which affects more than 50 million people around the world (Eddi et al., 2003; WHO, 2013). About 50 thousand people die every year as a consequence of neurocysticercosis (NCC) (Román et al., 2000; WHO, 2015a). A study conducted in Tanzania in 2012 reported an economic loss of 5 million USD annually due to NCC-related epilepsy and nearly 3 million USD due to PC for the year 2012 (Trevisan et al., 2017).

The life cycle of *T. solium* involves pigs, which are the principal intermediate hosts of the parasite, though humans may also act as accidental intermediate hosts being infected with the larval stage of *T. solium* through ingesting infective eggs (Kraft, 2007; Gabriël et al., 2017). In the intestine, the *T. solium* egg releases an embryo, which migrates primarily to the muscles and other tissues, where it matures into a larval stage commonly known as cysticerci (Murrell, 2005). The development of larvae in the central nervous tissues leads to neurocysticercosis (NCC) resulting in epileptic seizures, severe chronic headaches, focal deficits, or death of infected individuals (WHO, 2015b). Humans (definitive host) acquire tapeworm in the small intestine, leading to taeniasis following ingestion of raw or undercooked infected pork (Gabriël, et al., 2017). After about two months, the tapeworm matures and starts producing eggs, thus completing the life cycle (Gabriël et al., 2017). Eggs of *T. solium* may be passed with human faeces and become a source of infection to pigs and humans if the faeces are not properly disposed of. There is limited information on the influence of socio-demographic factors on knowledge, attitude, and practices regarding TSCT in Tanzania.

Knowledge may encourage people to become accustomed to TSCT control strategies, like the necessity for treatment of taeniasis or improved sanitation, hygiene, and good pig-management practices towards control of faecal–oral transmission of several other diseases (Sarti et al., 1997; Ngowi et al., 2008, 2011; Wohlgemut et al., 2010; Alexander et al., 2012; Mwidunda et al., 2015; Carabin et al., 2018; Vaernewyck et al.,

Article DOI : https://doi.org/10.37284/eajass.7.1.1783

2020). The population knowledge, attitude, and practices (KAP) are vital in instituting effective control strategies for various infections (WHO, 2008). However, there is still limited data on the influence of socio-demographic factors on the KAP of populations on TSCT in endemic areas (Ngowi et al., 2011; Chacha et al., 2014; Mwidunda et al., 2015).

Although interventions to control *Taenia solium* cysticercosis taeniasis have been implemented in Tanzania, the disease remains prevalent, and knowledge about the disease and its control practices in communities is inadequate. Therefore, this research aimed to investigate the influence of socio-demographic factors on community knowledge and practices regarding TSCT control in Tanzania. This study assessed the influence of different socio-demographic factors on KAP to prevent or control TSCT in Tanzania.

## THEORETICAL FRAMEWORK

The study was guided by the Health Belief Model (HBM) (Champion and Skinner, 2008) and the Socio-Ecological Model (SEM) (Kilanowski, 2017; Nji et al., 2021). The HBM suggests that people's health-related behaviours are influenced by their beliefs about the severity of the disease, their susceptibility to the disease, the perceived benefits of taking preventive measures, and the barriers to taking preventive measures (Townsend and Foster, 2011). The SEM, on the other hand, emphasises the influence of social and environmental factors on health behaviours. The SEM suggests that health behaviours are shaped by the interaction between the individual, the social environment, and the physical environment.

The HBM was used to explore the factors that influence community knowledge and practices regarding TSCT control (Champion and Skinner, 2008). The model suggests that community members' perceptions of the severity of the disease, their susceptibility to the disease, the perceived benefits of taking preventive measures, and the barriers to taking preventive measures influenced their knowledge and practices regarding TSCT control (Champion and Skinner, 2008). For example, community members perceive TSCT as a severe and life-threatening disease, so they are more motivated to take preventive measures such as proper sanitation and hygiene practices to prevent infection.

The SEM was used to explore the social and environmental factors that influence community knowledge and practices regarding TSCT control (Nji et al., 2021). The model suggests that the community's social norms, values, and beliefs, as well as the physical environment, influence their knowledge and practices regarding TSCT control (Townsend and Foster, 2011; Nji et al., 2021). For example, some communities value cleanliness and hygiene; as such, they are more likely to engage in practices such as proper disposal of human waste, which can prevent the spread of TSCT (Kilanowski, 2017; Nji et al., 2021).

Therefore, the Health Belief Model and the Socio-Ecological Model were used to explore the influence of socio-demographic factors on community knowledge and practices regarding TSCT control in Tanzania. The models provide a theoretical framework for understanding the factors that influence community knowledge and practices regarding TSCT control and guide the development of interventions to improve community awareness and prevent the spread of the disease.

## MATERIALS AND METHODS

### Description of the Study Area

The study was conducted in four districts, namely Mbulu (Manyara region), Mpwapwa (Dodoma region), Mbinga (Ruvuma region), and Rungwe (Mbeya region), between August 2018 and October 2021. The districts were purposely selected due to their popularity in small-scale pig rearing and reported disease endemicity (Ngowi et al., 2004, 2008, 2009; Boa et al., 2006; Mwidunda *et al.*, 2015; Shonyela *et al.*, 2017; Mwang'onde *et al.*, 2018).

### Sample Size Estimation

For the quantitative study, the sample size was estimated using the formula by Fisher et al.

 

Article DOI : https://doi.org/10.37284/eajass.7.1.1783

(1991). The assumed prevalence of 50% of TSCT was used in the computation of the minimum sample size required for this study.

$$n = \frac{z^2 pq}{d^2}$$

Where: Zα = standard normal deviation = 1.96; p = estimated prevalence. = 0.5 (50 %); q = (1 − p) = 0.5; d = (Precision) = 0.05

$$n = \frac{1.96^2 * 0.5 * 0.5}{0.05^2} = 385\, respondents$$

We added 25 per cent to account for a design effect and yielded a total number of 480 households.

**Selection of Study Villages and Households**

Eight villages were purposively selected from four wards in the four districts based on the numbers of small pig-keeping households. In the quantitative component, a simple random sampling technique was applied to select the households from each village. Equal numbers of households were selected from each hamlet. The household heads were interviewed in each household; in the absence of the household head, an adult household member was interviewed using a structured questionnaire. The participants for the qualitative part were purposively selected.

**Data Collection**

The study adopted the mixed methods approach whereby both qualitative and quantitative data were collected for triangulation purposes to increase the reliability and validity of findings (CDC, 2013).

***Household Survey***

A questionnaire that included knowledge attitudes and practices (KAP) of pig and non-pig farmers was administered to the participants from each of the selected households. The questionnaire comprised both closed- and open-ended questions relating to socio-demographic factors and knowledge of *T. solium* taeniasis/cysticercosis (TSCT), its transmission, symptoms, prevention, treatment, attitude, and practices towards TSCT (Supporting file 1).

***Focus Group Discussions (FGDs)***

A purposive sampling technique was used to select participants for FGDs, i.e. village health committee (VHC) and science subject teachers from primary and secondary schools. The FGDs were led by a trained moderator who was fluent in Kiswahili, the national language, using the FGD guide (supporting file 2). In addition to audio recording, the discussions were also recorded in a notebook. This provided an opportunity for the note-takers to also record non-verbal responses, including gestures and other non-verbal information. Two FGDs were conducted in each village; the plan was to conduct 16 FGDs (2 FGDs in each village). We ended up with 14 FGD as two villages had no active VHC; of the 14 FGDs conducted, we ended up with 12 FGD as two were of poor audio quality and had to be rejected during transcription. Participants were asked to attend a specially arranged session of one to two hours for FGDs. Each FGD contained a minimum of 6 and a maximum of 12 participants.

***Key-Informant's Interviews (KIIs)***

A purposive sampling technique was used to select key informants, i.e. livestock/veterinary officers, health officers/practitioners, community development officers, environmental and sanitation officers, ward education officers, district education officers (primary and secondary school), heads of primary and secondary schools, and local government leaders including village leaders. A total of 38 KIIs were conducted in eight villages from the four districts using a KIIs guide (supporting file 3). The guide was used to explore insights into the real issues regarding factors influencing the transmission, signs/symptoms, control, and treatment of TSCT infection from the key informants. Discussions were recorded in a digital voice recorder upon their consent.

***Quality Assurance***

Questionnaire enumerators were trained on the use of the data collection tools the KoboCollect

Article DOI : https://doi.org/10.37284/eajass.7.1.1783

(Humanitarian Response, 2015). This application was installed on tablets and was pre-tested in a village far from the study villages before the commencement of the study. Field team leaders and enumerators were also engaged in reviewing the data collection tools to correct any inconsistencies that could arise.

## Data Analysis

### *Quantitative Data Analysis*

From the KoboCollect data collection app, the data were exported to MS Excel and analysed in Statistical Analysis System (SAS®) version 9.4 (SAS Institute Incorporation, USA). Binary logistic regression was used to assess the influence of socio-demographic factors on KAP regarding TSCT. A *P* value of <0.05 was considered to be statistically significant.

### *Qualitative Data Analysis*

The audio-recorded KIIs and FGDs were transcribed verbatim into MS Word documents. They were then translated into English by two independent researchers and compared for consistency. To improve interpretation reliability, the written transcripts were reviewed independently by the same two researchers to ensure the consistency of the transcripts against the audio files and to ensure the accuracy of the transcribed files before their analysis. The analysis of the KIIs and FGDs transcripts was carried out in ATLAS.ti 8 for Windows (Scientific Software Development GmbH, Berlin, 2019). The content and thematic analyses were conducted to identify emerging themes. The process of analysis involved familiarisation with the data, development of initial codes based on the research questions and issues emerging from data, refinement of codes, and their allocation to broad themes.

### *Variables Analysed*

During statistical analysis (binary logistic regression), both independent and dependent variables were used.

The dependent variables were;

Knowledge

Attitude,

Practices.

The Independent variables were sex (male and female); district/location (Mbulu, Mpwapwa, Rungwe, and Mbinga); educational level (no formal education, primary education, and post-primary education); age in years (16-35, 36-55 and more than 55); occupation (livestock keeping, livestock keeping and business, farming and livestock keeping); The main source of income categorised as (farming, farming and livestock keeping, farming and business); Average household size was (1-2, 3-4, and above 4 members); period of residence in years was (1-5, 6-10, and > 10 years); Savings and Credit Cooperative Society (SACCOS) membership categorised as (yes and no).

Whereby the reference categories were set as follows; *Education level*, the reference category was no formal education; *Household size*, the reference category was 1-2 household members; *Age group*, the reference category was above 55 years; *Gende*r, the reference category was female; *Occupation*, the reference category was livestock keeping and business; *The main source of income*, the reference category was farming and business; *Period of residence* in a village, the reference category was period of 1-5 years; *SACCOS membership*, the reference category was no; *District/location*, the reference category was Rungwe district.

## RESULTS

### Social Demographic Characteristics of Respondents

A total of 483 respondents were interviewed, out of whom 52% were male. Of these, approximately 88% reported having lived in their village for more than 10 years, most of whom had been born and raised in the same village. Almost half (47%) were in the age of 36-55 years, followed by 30% who were 16–35 years, while about 23% were above 55 years. The majority (80%) of the respondents had completed primary school

 

Article DOI : https://doi.org/10.37284/eajass.7.1.1783

education. The main occupations of 79% of the respondents were farming and business. The main source of income for about 87% of the respondents was farming, with about 76% keeping pigs.

### Socio-Demographic Factors Associated with Respondent's Knowledge of Tapeworm

Respondents with post-primary education, OR 12.326 (95% CI: 1.456-104.332, *P* = 0.0212) were 12.326 times more likely to be aware of the health effect of tapeworm infection compared to those with no formal education). Respondents from Mpwapwa district, OR 18.766 (95% CI: 2.189-160.890, *P* = 0.0075) were 18.766 times more likely to be aware of the health effect of tapeworm infection compared to those from Rungwe district (*Table 1*). This study revealed that educational level, district of residence, age, period of residence, household size, savings and credits cooperative society (SACCOS) membership, sex, the main source of income, and occupation were important determinants of KAP regarding TSCT.

**Table 1: Socio-demographic factors associated with respondent's knowledge of tapeworm**

| Independent variables | B | SE. | Wald $\chi^2$ | p-value | ORs |
|---|---|---|---|---|---|
| **Knowledge of tapeworm (*T. solium*)/taeniasis** | | | | | |
| Intercept | -0.6670 | 1.2007 | 0.3086 | 0.5785 | - |
| Primary school education | 1.8796 | 1. 0161 | 3.4221 | 0.0643 | 6.551 |
| Post-primary school education | 2.5117 | 1.0897 | 5.3124 | 0.0212* | 12.326 |
| SACCOS membership | -1.5364 | 0.3447 | 19.8735 | <.0001* | 0.215 |
| Mbulu district | 1.3742 | 0.8408 | 2.6712 | 0.1022 | 3.952 |
| Mpwapwa district | 2.9320 | 1.0963 | 7.1529 | 0.0075* | 18.766 |
| Mbinga district | -0.3903 | 0.3432 | 1.2934 | 0.2554 | 0.677 |
| Period of residence (6-10 years) | 2.3456 | 1.2332 | 3.6178 | 0.0572 | 10.439 |
| Period of residence (>10 years) | -0.4727 | 0.6011 | 0.6184 | 0.4316 | 0.623 |
| ***Note:*** *Wald chi² (8) = 43.5829, Prob < 0.0001, significant at P< 0.05, c-statistic=82%, H-L (p = 0.8975). The dependent variable in this analysis is the* ***health effect of tapeworm*** *coded so that 0 = No and 1= Yes.* | | | | | |
| **ORs knowledge of the risk of tapeworm infection** | | | | | |
| Intercept | -2.0985 | 0.2939 | 50.9936 | <.0001 | - |
| Mbulu district | -0.2041 | 0.4431 | 0.2121 | 0.6451 | 0.815 |
| Mpwapwa district | 0.9089 | 0.3646 | 6.2141 | 0.0127* | 2.482 |
| Mbinga district | 0.8176 | 0.3708 | 4.8622 | 0.0275* | 2.265 |

***Note:*** *Wald chi² (3) = 12.8368, Prob = 0.0050, significant at P< 0.05, c-statistic=62%, H-L (p = 1.0000). The dependent variable in this analysis* ***is the knowledge of the risk of tapeworm infection*** *and, coded so that 0 = no and 1= yes.*
*Odds ratios (ORs) were estimated using the maximum likelihood method.*
**Statistically significant at P< 0.05, H-L = Hosmer and Lemeshow Test.*

Qualitative data supported these findings in terms of the level of education. There was mixed information among the participants regarding *T. solium* transmission as well as awareness of the health effects as echoed during KII by a district education officer for primary school education from Mbulu district who said: "Yes, I was taught in Primary school, it is a flatworm with segments (KII, Mbulu district 17/12/2018)."

This was further echoed by FGDs from primary and secondary school teachers in one of the villages in Mpwapwa, who said:

> *"What we know is that when they enter the human body, they stay in the small intestine and absorb nutrients, and they have segments that detach and get out with faeces"* (KII, Mpwapwa district, 18/02/2019).

The knowledge regarding tapeworm transmission was echoed during KIIs, as exemplified by the following quotations:

> *"I have also heard from our livestock extension officer that the human consumption of undercooked meat infected with T. solium can cause the disease and that humans can*

 

Article DOI : https://doi.org/10.37284/eajass.7.1.1783

> *also be infected through drinking contaminated unboiled water* (KII, Mbulu district, 17/12/2018)."

> *"Tapeworm can be transmitted through improperly cooked pork* (KII, Mpwapwa district, 18/02/2019)."

On the other hand, low knowledge of the transmission of the tapeworm was also noted: "I don't know the transmission of tapeworm to a human being" (KII, Mpwapwa district, 18/02/2019)."

FGD participants with VHC at Masieda village in Mbulu district agreed that they did not know how tapeworm is transmitted to human beings. On the other hand, FGD participants with VHC at Mpuguso village in Rungwe district revealed that they had heard that tapeworm could be transmitted through eating improperly cooked pork, especially roasted meat, as it does not cook well. These are surprising findings as the former village had received health education on TSCT approximately 15 years ago, while we have no knowledge of the latter district being educated on this.

Mpwapwa district respondents, OR 18.766 (95% CI: 2.189-160.890, *P* = 0.0075), were 18.766 times more likely to be aware of the health effect of a tapeworm on humans compared to Rungwe district respondents. Mpwapwa district respondents OR 2.482 (95% CI: 1.214-5.071, *P* = 0.0127) were 2.482 times more likely to be at risk of tapeworm infection than Rungwe district (*Table 1*).

These results were further confirmed during KIIs. For example, the following statement was captured:

> *"Eating infected pork may lead to the development of adult tapeworm and may later lead to mental and growth retardation to under-five children, as well as anaemia and malnutrition*" (Medical doctor, 18/02/2019)."

The influence of locations on the knowledge regarding tapeworm/taeniasis could also be linked to the economic status and activities of the population from the study districts, as well as different government interventions on deworming, as narrated by one of the health-care KIIs.

> *"We also have a campaign for Neglected Tropical Diseases (NTD) where, after every 6 months, we administer praziquantel, albendazole, and erythromycin; this is a national campaign where we are required to administer those drugs every 6 months*" (KII, Mpwapwa district, 18/02/2019)."

Respondents with post-primary education, OR 13.267 (95% CI: 0.860-204.611, P = 0.0640) were 13.3 times more likely to be aware of the HCC transmission mode than those with no formal education, although the P-value was not statistically significant (see Table 2). Respondents with primary school education OR 0.749 (95% CI: 0.057- 9.771, P = 0.8256) were 0.749 times less likely to be aware of the health effect of HCC compared to those with no formal education, although the P-value was not statistically significant (see Table 2). Respondents with post-primary education, OR 62.231 (95% CI: 3.909-990.744, P = 0.0034) were 62.231 times more likely to be aware of the health effects of HCC compared to those with no formal education (*Table 3*). It was further revealed by a village leader in Mpwapwa district who said:

> *"Here, people with low knowledge eat pork with the cysticerci, even when meat inspectors have ordered condemnation"* (KII, Mpwapwa district, Village leader 18/02/2019)."

Respondents from Mbulu district OR 3.034 (95% CI: 1.225-7.513, *P* = 0.0165) were 3.034 times more likely to be aware of the risk of eating infected pork than those from Rungwe District (see *Table 4*). While Mpwapwa district respondents OR 1.978 (95% CI: 0.134-0.866, *P* = 0.0237) were 1.978 times less likely to be able to identify cysticerci in infected pork than those from Rungwe district (see *Table 5*). Male respondents OR 2.106 (95% CI: 1.150-3.855, *P* = 0.0158) were 2.106 times more likely to identify cysts than female respondents. Respondents with

Article DOI : https://doi.org/10.37284/eajass.7.1.1783

more than 10 years of residents in the village OR 4.682 (95% CI: 1.803-12.160, *P* = 0.0015) were 4.682 times more likely to identify cysticerci in infected pork than those with <5 years of residents (*Table 5*).

**Table 2: Knowledge of human cysticercosis transmission (n = 483)**

| Independent variables | B | SE. | Wald $\chi^2$ | p-value | ORs |
|---|---|---|---|---|---|
| Intercept | -15.7961 | 174.1 | 0.0082 | 0.9277 | - |
| Primary education | -0.2887 | 1.3103 | 0.0485* | 0.8256 | 0.749 |
| Post-primary education | 2.5853 | 1.3958 | 3.4305 | 0.0640 | 13.267 |
| Mbulu district | 12.1131 | 174.1 | 0.0048* | 0.9445 | 0.670 |
| Mpwapwa district | 15.7553 | 174.1 | 0.0082* | 0.9279 | 257.307 |
| Mbinga district | 10.0729 | 174.1 | 0.0033* | 0.9539 | 0.001 |

***Note:*** *Wald chi² (5) = 17.4327, Prob < 0.0037, significant at P≤ 0.05, c-statistic=92%, H-L (p = 0.9462). The dependent variable in this analysis is* ***the knowledge of HCC transmission*** *and coded so that 0 = no and 1= yes.*

**Table 3: Knowledge of human cysticercosis health effect (483)**

| Independent variables | B | SE. | Wald $\chi^2$ | p-value | ORs |
|---|---|---|---|---|---|
| Intercept | -2.0261 | 1.3831 | 2.1461 | 0.1429 | - |
| Primary school education | 2.3138 | 1.2733 | 3.3023 | 0.0692 | 10.113 |
| Post-primary education | 4.1309 | 1.4121 | 8.5579 | 0.0034* | 62.231 |
| Mbulu district | -1.7429 | 0.6188 | 7.9329 | 0.0049 | 0.175 |
| Mpwapwa district | 2.0808 | 1.3700 | 2.3067 | 0.1288 | 8.011 |
| Mbinga district | -1.2824 | 1.6377 | 0.6131 | 0.4336 | 8.011 |

***Note:*** *Wald chi² (5) = 21.1689, Prob = 0.0008, significant at P< 0.05, c-statistic=78%, H-L (p = 0.8881). The dependent variable in this analysis is* ***the knowledge of the HCC health effect*** *and, coded so that 0 = no and 1= yes.*

**Table 4: Knowledge of the risk of eating infected pork (n = 483)**

| Independent variables | B | SE. | Wald $\chi^2$ | p-value | ORs |
|---|---|---|---|---|---|
| Intercept | -2.7903 | 0.3894 | 51.3471 | <0.0001* | - |
| Mbulu district | 1.1098 | 0.4627 | 5.7532 | 0.0165 * | 3.034 |
| Mpwapwa district | 0.6731 | 0.4877 | 1.9052 | 0.1675 | 1.960 |
| Mbinga district | -0.5683 | 0.6406 | 0.7872 | 0.3749 | 0.566 |

***Note:*** *Wald chi² (3) = 11.8671, Prob =0.0079, significant at P< 0.05, c-statistic=66%, H-L (p = 1.000). The dependent variable in this analysis is* ***the awareness of the risk of eating infected pork*** *and, coded so that 0 = no and 1= yes.*

**Table 5: Knowledge of respondents on identifying cysticercosis in pork (n = 483)**

| Independent variables | B | SE. | Wald $\chi^2$ | p-value | ORs |
|---|---|---|---|---|---|
| Intercept | 0.8757 | 0.6664 | 1.7267 | 0.1888 | - |
| Mbulu district | 0.3394 | 0.5399 | 0.3952 | 0.5296 | 1.404 |
| Mpwapwa district | -1.0755 | 0.4754 | 5.1191 | 0.0237* | 1.978 |
| Mbinga district | -1.5745 | 0.4633 | 11.5485 | 0.0007* | 4.891 |
| Sex (male) | 0.7447 | 0.3085 | 5.8260 | 0.0158 * | 2.106 |
| Age group 16-35 years | -0.7662 | 0.4325 | 3.1387 | 0.0765 | 0.465 |
| Age group 36-55 years | 0.1828 | 0.4290 | 0.1816 | 0.6700 | 1.201 |
| Period of residence (6-10 years) | 0.4762 | 0.7160 | 0.4423 | 0.5060 | 1.610 |
| Period of residence (>10 years) | 1.5437 | 0.4870 | 10.0485 | 0.0015* | 4.682 |

***Note:*** *Wald chi² (8) = 45.8532, Prob <0.0001, significant at P< 0.05, c-statistic=77%, H-L (p = 0.2018). The dependent variable in this analysis is* ***the knowledge of respondents on identifying cysticerci in pork*** *and coded so that 0 = no and 1= yes.*

*Odds ratios (ORs) were estimated using the maximum likelihood method.*

**Statistically significant at P< 0.0; H-L = Hosmer and Lemeshow Test*

 

Article DOI : https://doi.org/10.37284/eajass.7.1.1783

### *Knowledge of Porcine Cysticercosis (PCC) that was Assessed Using Binary Logistic Regression*

Respondents from Mbulu district OR 4.561 (95% CI: 2.495-8.337, P<0.0001) were 4.561 times more likely to be aware of PCC transmission compared to those from Rungwe district. Respondents from Mbinga district OR 0.344 (95% CI: 0.166-0.712, P=0.0040) were 0.344 times less likely to be aware of PCC transmission measures. While respondents from Mbinga district OR 5.877 (*P*<0.0001), were 5.877 times more likely to be aware of the PCC control measures compared to those from Rungwe district. The respondents lived in their respective villages for more than ten years, OR 4.682 (95% CI: 1.138-4.785, *P* = 0.0207), were 4.682 times more likely to be aware of the PCC health effect compared to those from Rungwe district (*Table 6*).

**Table 6: Binary logistic regression analysis of knowledge on porcine cysticercosis (PCC)**

| Independent variables | B | SE. | Wald $\chi^2$ | p-value | ORs |
|---|---|---|---|---|---|
| **Knowledge of porcine cysticercosis transmission methods** | | | | | |
| Intercept | -1.875 | 0.2972 | 39.7961 | <.0001 | - |
| SACCOS membership | 0.6133 | 0.2919 | 4.4138 | 0.0356 | 1.846 |
| Mbulu district | 1.5175 | 0.3077 | 24.3138 | <.0001* | 4.561 |
| Mpwapwa district | 0.9341 | 0.2998 | 9.7102 | 0.0018* | 2.545 |
| Mbinga district | -1.0661 | 0.3708 | 8.2667 | 0.0040* | 0.344 |
| Sex | 0.8842 | 0.219 | 16.3069 | <0.0001* | 2.421 |
| *Note: Wald chi2 (5) = 58.3861, Prob <0.0001, significant at P< 0.05, c-statistic=72%, H-L (p = 0.4761). The dependent variable in this analysis is PCC transmission methods and coded so that 0 = no and 1= yes.* | | | | | |
| **Knowledge of porcine cysticercosis control measures (PCC)** | | | | | |
| Intercept | -0.462 | 0.4158 | 1.2348 | 0.2665 | - |
| Livestock keeping | -0.1561 | 0.4977 | 0.0984 | 0.7537 | 0.855 |
| Farming and livestock-keeping | 0.9972 | 0.4127 | 5.839 | 0.0157* | 2.711 |
| Mbulu district | -1.137 | 0.2747 | 17.1333 | <0.0001* | 0.321 |
| Mpwapwa district | 0.8611 | 0.2895 | 8.8468 | 0.0029* | 2.366 |
| Mbinga district | 1.7711 | 0.3547 | 24.93 | <0.0001* | 5.877 |
| *Note: Wald chi2 (5) = 18.3285, Prob 0.0026, significant at P< 0.05, c-test = 61%, H-L (p = 0.7663). The dependent variable in this analysis is PCC control measures and coded so that 0 = no and 1= yes.* | | | | | |
| **Knowledge of porcine cysticercosis health effect** | | | | | |
| Intercept | -0.2045 | 0.3817 | 0.2869 | 0.5922 | - |
| Sex (male) | 0.3856 | 0.1949 | 3.9132 | 0.0479* | 2.106 |
| Age group 16-35 years | -0.7662 | 0.4325 | 3.1387 | 0.0497* | 0.465 |
| Age group 36-55 years | 0.1828 | 0.429 | 0.1816 | 0.67 | 1.201 |
| Period of residence (6-10 years) | 0.4762 | 0.716 | 0.4423 | 0.506 | 1.61 |
| Period of residence (>10 years) | 1.5437 | 0.487 | 10.0485 | 0.0207* | 4.682 |

*Note: Wald chi2 (3) = 28.2239, Prob <0.0001, significant at P< 0.05, c-test = 67%, H-L (p = 1). The dependent variable in this analysis is the PCC health effect coded so that 0 = no and 1= yes.*
*Odd ratios (ORs) were estimated using the maximum likelihood method.*
**Statistically significant at P< 0.0; H-L = Hosmer and Lemeshow Test*

### Attitude Related to TSCT as Reported by Respondents in the Study Districts

Regarding the respondent's attitude of being at risk of acquiring tapeworm, respondents from Mbulu district, OR 0.514 (95% CI: 0.205-1.289, P = 0.1561), were 0.514 times less likely to be aware of being at risk of acquiring tapeworm compared to respondents from Rungwe district. Respondents from Mpwapwa district, OR 2.561 (95% CI: 1.113-5.892, P = 0.0269), were 2.561 times more likely to be aware of being at risk of acquiring tapeworm compared to those from Rungwe district. The respondents from the Mbinga district, OR 3.312 (95% CI: 1.364-8.040, *P* = 0.0081), were 3.312 times more likely to be aware of being at risk of acquiring tapeworm compared to those from Rungwe district (*Table 7*).

 

Article DOI : https://doi.org/10.37284/eajass.7.1.1783

**Table 7: Attitude related to TSCT as reported by respondents in the study districts**

| Independent variables | B | SE. | Wald $\chi^2$ | p-value | ORs |
|---|---|---|---|---|---|
| **The attitude of being at risk of acquiring tapeworm** | | | | | |
| Intercept | -0.869 | 0.3304 | 6.9172 | 0.0085* | - |
| Mbulu district | -0.6649 | 0.4687 | 2.0121 | 0.1561 | 0.514 |
| Mpwapwa district | 0.9405 | 0.4251 | 4.895 | 0.0269* | 2.561 |
| Mbinga district | 1.1975 | 0.4525 | 7.0046 | 0.0081* | 3.312 |
| *Note: Wald chi2 (3) = 22.3081, Prob<0.0001, *significant at P< 0.05, c-test=69.3%, H-L (p = 0.8218). The dependent variable in this analysis is at risk of acquiring tapeworm and coded so that 0 = negative attitude and 1 = positive attitude.* | | | | | |
| **The attitude of being at risk of acquiring HCC** | | | | | |
| Intercept | -2.5649 | 1.0377 | 6.109 | 0.0134* | - |
| Mbulu district | 0.5281 | 1.1249 | 0.2204 | 0.6387 | 1.696 |
| Mpwapwa district | 1.0609 | 1.1758 | 0.8141 | 0.3669 | 2.889 |
| Mbinga district | 2.6827 | 1.1459 | 5.4812 | 0.0192* | 14.625 |
| *Note: Wald chi2 (3) = 13.0130, Prob<0.0046, *significant at P< 0.05, c-test 72%, H-L (p = 0.8894). The dependent variable in this analysis is at risk of acquiring HCC and coded so that 0 = negative attitude and 1 = positive attitude.* | | | | | |
| **The attitude of whether it is safe to eat pork infected with cysticerci** | | | | | |
| Intercept | -3.3586 | 0.5086 | 43.6051 | <.0001* | - |
| Mbulu district | 1.6781 | 0.5667 | 8.7691 | 0.0031* | 5.355 |
| Mpwapwa district | 1.2415 | 0.5873 | 4.4689 | 0.0345* | 3.461 |
| Mbinga district | 0.5683 | 0.6406 | 0.7872 | 0.3749 | 1.765 |

*Note: Wald chi2 (3) = 11.8671, Prob = 0.0079, *significant at P< 0.05, c-test=66.1%, H-L (p = 0.8914). The dependent variable in this analysis is if it is safe to eat pork infected with cysticerci and coded so that 0 = negative attitude and 1 = positive attitude.*
*Odd ratios (ORs) were estimated using the maximum likelihood method.*
**Statistically significant at P< 0.05.*
*H-L = Hosmer and Lemeshow Test*

The qualitative data further confirmed the results from the household survey as echoed by one of the community development officers during IDI, who said: “We are at risk as it may come from eating undercooked infected pig meat” (KII, Mbulu district 17/12/2018).

The risk of acquiring tapeworm was also realised during FGD with science subject teachers from one of the wards in Mpwapwa district, with the group agreeing that those who allow their pigs to roam free subject the pigs to free open defecation around the village, which is a risk factor for PCC and hence to Tapeworm infection to human being (FGD, Mpwapwa district 17/02/2019).

Respondents from Mbinga district, OR 14.625 (312 (95% CI: 1.364-8.040, *P* = 0.0192) were 14.625 times more likely to be aware of the risk of acquiring HCC compared to those from Rungwe district (*Table 7*).

Qualitative data were further confirmed during KIIs as quoted from this statement from the headmaster of one of the secondary schools confirming that students are at school while in school.

> *“I think they are at risk because we are using tap water, which is not 100% safe; when they are in school, they drink untreated water, though sometimes we treat the water with chlorine in the reservoir tank, but it is not always”* (KII, Mpwapwa district 18/02/2019).

> *This was also echoed by one of the ward education officers from Mbulu district who remarked: “One of the risk factors is water; water they are using in surroundings is not safe, and this can lead to intestinal worm infection in one or another way”* (KII, Mbulu district 17/12/2018).

The risk of acquiring HCC was also realised during FGDs with science subject teachers from

 

Article DOI : https://doi.org/10.37284/eajass.7.1.1783

one of the wards in Rungwe district, with the group agreeing that: Although they put clean and safe water in a large bucket for students to drink, some of them still drink water from the trench that flows from the river" (FGD, Rungwe district 14/06/2019). This was also agreed during FGDs with science subject teachers in Mbulu districts, where a group agreed that:

> *"Students are at risk of acquiring HCC the school environment is not friendly at all, for example, most children when visiting toilets, they don't wash their hands, and some are using papers other are using water to clean their private parts"* (FGD, Mbulu district 17/12/2018).

While respondents from Mbulu, OR 5.355 (95% CI: 1.764-16.261, *P* = 0.0031) and those from Mpwapwa district, OR 3.461 (95% CI: 1.095-10.940, *P* = 0.0345) were 5.355 and 3.461 times more likely to be aware that it is not safe to eat infected pork and instead it should be condemned compared to those from Rungwe district (*Table 7*).

These results were further confirmed by qualitative data, as echoed during KII by the headmaster of one of the secondary schools from Mpwapwa district.

> *"I remember once LFO condemned the pig meat in Chimaza village and told villagers that the meat is not safe, but they dig out and eat that meat; I think two children died, villagers believe that the deaths were caused by witchcraft"* (KII, Mpwapwa district 17/02/2019)

This was further realised during FGDs with a village health committee from one of the villages in Mpwapwa district, with the group agreeing that:

> *"Pig meat from the slaughter slab is usually inspected and confirmed to be safe for human consumption. But if the meat is not from the slaughter slab and it was not inspected and confirmed to be safe by the Livestock extension officer, I can't eat that meat* (FGD, Mpwapwa district 18/02/2019).

**Practices Related to TSCT as Reported by Respondents in the Study Districts**

Regarding the practice of washing hands with soap after defecation, respondents with post-primary education, OR 6.589 (95% CI: 2.691-16.131, P<0.0001), and primary school education, OR 4.117 (95% CI: 2.150-7.883, P<0.0001) were 6.589 and 4.117 times more likely to report washing their hands with soap respectively compared to those with no formal education. While the respondents keeping livestock, OR 0.193 (95% CI: 0.056-0.666, *P* = 0.0092) and those engaged in farming and livestock keeping, OR 0.288 (95% CI: 0.096-0.864, *P* = 0.0264) were 0.193 and 0.288 times less likely to wash their hands with soap respectively than those engaged in livestock keeping and business (*Table 8*).

Concerning the practices of hand washing with soap before eating, male respondents, OR 1.838 (95% CI: 1.223-2.762, *P* = 0.0034), were 1.838 times more likely to wash their hands than female respondents. Respondents with post-primary education, OR 6.118 (95% CI: 2.384-15.698, *P* = 0.0002), and those with primary school education, OR 4.764 (95% CI: 2.278-9.962, P<0.0001) were 6.118 and 4.764 times more likely to wash their hands respectively before eating than those with no formal education. And those from Mpwapwa district, OR 3.802 (95% CI: 2.114-6.839 *P*<0.0001), were 3.802 times more likely to wash their hands than those from Rungwe district (*Table 8*).

Regarding the treatment of drinking water, respondents in Mbulu district, OR 0.477 (95% CI: 0.278-0.820, *P* = 0.0073), and Mpwapwa district OR, 0.433 (*P* = 0.0027), were 0.447 and 0.433 times less likely to treat drinking water respectively comparing to those from Rungwe district (*Table 8*).

 

Article DOI : https://doi.org/10.37284/eajass.7.1.1783

**Table 8: Practices related to TSCT as reported by respondents in the study districts**

| Independent variables | B | SE. | Wald $\chi^2$ | p-value | ORs |
|---|---|---|---|---|---|
| **Practice washing hands with soap after defecation** | | | | | |
| Intercept | 0.7113 | 0.6308 | 1.2718 | 0.2594 | - |
| Primary school education | 1.4150 | 0.3315 | 18.2237 | <0.0001* | 4.117 |
| Post-primary education | 1.8854 | 0.4568 | 17.0342 | <0.0001* | 6.589 |
| Livestock keeping | -1.6438 | 0.6311 | 6.7851 | 0.0092* | 0.193 |
| Farming and livestock-keeping | -1.2460 | 0.5610 | 4.9323 | 0.0264* | 0.288 |
| SACCOS membership | -0.6194 | 0.2170 | 8.1454 | 0.0043* | 0.538 |
| *Note: Wald chi² (5) = 32.7891, Prob=0.0001, *significant at P< 0.05, c-test=64%, H-L (p = 0.8218). The dependent variable in this analysis is **washing hands with soap after defecation** and coded so that 0 = No and 1= Yes.* | | | | | |
| **Practice of washing hands with soap before eating** | | | | | |
| Intercept | -0.3953 | 0.7011 | 0.3179 | 0.5729 | - |
| Mbulu district | 0.8775 | 0.2934 | 8.9459 | 0.0028* | 2.405 |
| Mpwapwa district | 1.3356 | 0.2995 | 19.8816 | <0.0001* | 3.802 |
| Mbinga district | 0.1464 | 0.2910 | 0.2532 | 0.6148 | 1.158 |
| Primary school education | 1.5612 | 0.3764 | 17.2062 | <0.0001* | 4.764 |
| Post-primary education | 1.8112 | 0.4808 | 14.1898 | 0.0002* | 6.118 |
| Sex | 0.6086 | 0.2078 | 8.5782 | 0.0034* | 1.838 |
| SACCOS membership | -0.6788 | 0.2595 | 6.8428 | 0.0089* | 0.507 |
| Livestock keeping | -1.9815 | 0.6413 | 9.5462 | 0.0020* | 0.138 |
| Farming and livestock-keeping | -1.7311 | 0.5632 | 9.4483 | 0.0021* | 0.177 |
| ***Note:** Wald chi² (9) = 67.0543, P<0.0001, *significant at P< 0.05, c-statistic = 73%, H-L (0.5804). The dependent variable in this analysis is **washing hands with soap before eating** and coded so that 0 = no and 1= yes.* | | | | | |
| **Practice of treatment of drinking water** | | | | | |
| Intercept | -0.2829 | 0.1836 | 2.3726 | 0.1235 | - |
| Mbulu | -0.7400 | 0.2761 | 7.1862 | 0.0073* | 0.477 |
| Mpwapwa | -0.8377 | 0.2792 | 9.0058 | 0.0027* | 0.433 |
| Mbinga | -0.0048 | 0.2608 | 0.0003 | 0.9853 | 0.995 |
| ***Note:** Wald chi² (3) = 16.0666, P = 0.0011, *significant at P< 0.05, c-statistics=60%, H-L (p = 1). The dependent variable in this analysis is the **treatment of drinking water** coded so that 0 = No and 1= Yes* | | | | | |
| **The practice of pig rearing system** | | | | | |
| Intercept | -0.2283 | 0.4631 | 0.2430 | 0.6220 | - |
| Mbulu district | -2.3426 | 0.3120 | 56.3766 | <.0001* | 0.033 |
| Mpwapwa district | 0.4336 | 0.3525 | 1.5127 | 0.3102 | 0.219 |
| Mbinga district | 0.3172 | 0.3415 | 0.8626 | 0.3530 | 1.373 |
| Livestock keeping | -2.6342 | 0.7041 | 13.9978 | 0.0002* | 0.072 |
| Farming and livestock-keeping | 1.5496 | 0.4148 | 13.9566 | 0.0002* | 4.710 |

***Note:** Wald chi² (5) = 126.5137, P < 0.0001, *significant at P< 0.05, c-statistic = 81%, H-L (0.9576). The dependent variable in this analysis is the **pig rearing system** coded so that 0 = free range and 1= confinement/tethering*
*Odd ratios (ORs) were estimated using the maximum likelihood method.*
**Statistically significant at P< 0.05; H-L = Hosmer and Lemeshow Test*

This was also echoed by an academic staff of one of the secondary schools in Mpwapwa district during a KII session who remarked:

> *"During the tea break, we have people selling bites at school and, since we do not have running water, when students are hungry, they buy and eat buns without washing their hands; this puts them at risk of intestinal worm infection."* (KII, Mpwapwa district, 18/02/2019)."

This was further confirmed by a livestock field officer during a KII in one of the villages in Mpwapwa district:

 

Article DOI : https://doi.org/10.37284/eajass.7.1.1783

> *"During the rainy season, major diseases are amoeba and cholera; this is due to the reason that many people do not use toilets and also don't wash their hands after visiting toilets and before eating*" (KII, Mpwapwa district, 18/02/2019)."

The importance of washing hands was realised during FGDs with science subject teachers from one of the wards in Mbulu district, with the group agreeing that: "if one visits the toilet, she/he should wash hands with soap and should not put hands in the mouth before they are washed".

Qualitative data confirmed these findings in terms of the treatment of drinking water, as illustrated by the following quote from one of the district officials in Mbulu district.

> *"Humans can also become infected through drinking contaminated untreated water; usually water is contaminated by T. solium eggs through practising open defecation; all these can lead to human beings becoming infected with epilepsy and visual impairment, leading to blindness"* (KII, Mbulu district, 17/12/2018)."

## DISCUSSION

The limited general knowledge, attitudes, and good practices may obstruct efforts to control and eliminate TSCT. The findings from this study revealed that the majority of the respondents were aware of PCC, with about 50% being specifically aware of *T. solium.* On the other hand, very few were aware of HCC. Education level and district of residence were the main factors that influenced KAP relevant for the control of TSTC as they were found to influence most of the aspects assessed. Respondents with tertiary education were more likely to have heard of tapeworm, be aware of tapeworm transmission, HCC transmission, HCC health effects, wash hands with soap after toilet use, and treat drinking water compared to those with no formal education. The results are comparable to those reported in Kenya, where an increase in participants' education increased understanding of the relationship between epilepsy and *T. solium* (Wohlgemut et al., 2010). Similar observations have been reported the influence of education on hand-washing practise Pedro et al. (2008). Also, it was observed that education alone could directly influence an individual's ability to recognise and take action towards disease preventive measures (Yuan et al., 2005).

The respondents in Mpwapwa and Mbulu districts had better knowledge of many aspects of TSCT than other districts, while respondents in Mbulu district reported poor practices in more aspects than the rest of the districts. Respondents from Rungwe district had a positive attitude towards the risk of tapeworm infection and being at risk of HCC while having the negative attitude that it is safe to consume infected pork compared to the other two districts. The influence of location on the KAP regarding TSCT is not known and may be linked to activities of the population from the study districts, as well as different government interventions such as the National Campaign for the Neglected Tropical Diseases (NTD). For example, a National campaign for the eradication of schistosomiasis in Tanzania through a mass drug administration (MDA) campaign of praziquantel was reported to have an effect on the prevalence of taeniasis and PCC (Braae et al., 2016).

The results from this study revealed that males were more likely to identify the cysticerci in pork and tell the health effects of HCC transmission PCC transmission. Also, are reported to exercise hand washing with soap before eating compared to female respondents. Most males are responsible for pig slaughtering and selling pork; probably, this exposes them to information regarding TSCT compared to women. It could also be because women are particularly disadvantaged due to the social and economic priority granted by the wider society to men, sometimes not allowed to participate in various social activities involving men and schooling. The results are contrary to other studies that reported that females were slightly more likely to wash their hands than males (Pete, 1986) and that women wash their hands more frequently than males (Edwards et al., 2002). This contradiction may be due to the fact

 

Article DOI : https://doi.org/10.37284/eajass.7.1.1783

that the two studies cited above actually observed the hand washing practice, compared to this study, which relies only on a questionnaire survey, KII, and FGD.

This study revealed that age was associated with knowledge regarding TSCT, as young respondents between 16-35 years old and between 36-55 were less likely to identify cysticerci in pork compared to people >55 years old. This may be because older people have more exposure and attend more training regarding TSCT and other hygienic practices than young respondents.

This study revealed that occupation could also influence KAP regarding TSCT. Respondents who were farming and keeping pigs were more likely to know PCC control measures, less likely to report washing hands with soap after toilet use, and more likely to report confining their pigs compared to those engaged in both pig keeping and other businesses. This is likely the case because those engaged in more than one business are interacting with people from other villages and sometimes travel far from their village for business; this gives them more access to information than those keeping livestock or keeping livestock and farming as sole occupation. It was also found that respondents keeping livestock were less likely to report washing their hands with soap before eating compared to those engaged in both livestock keeping and other businesses. This may be due to the exposure those doing other businesses (in addition to keeping pigs) had over those keeping livestock only. It is also possible that those engaged in other businesses had sound financial resources regularly to enable them to afford to acquire water and soap for cleaning and sanitation, among other good practices.

## CONCLUSION

The study reveals that socio-demographic factors may influence knowledge, attitude, and practices regarding TSCT control. Education level was the main factor, among others, that significantly contributed to the overall models that determined knowledge, attitude, and practices towards TSCT control. It is, therefore, necessary to scale up the efforts in knowledge sharing with the public on transmission, TSCT signs/symptoms, control, treatment and prevention in Tanzania, preferably in a One Health approach, for the control and eradication of TSCT. The findings from this study may influence the design of health education packages that may help reach some of the goals specified in the WHO roadmap for neglected tropical diseases 2021–2030. It is further recommended that strategies involving health education intervention should consider the inclusion of socio-demographic, cultural, economic, and location factors for effective and sustainable control of the parasite.

## ACKNOWLEDGEMENTS

This study was fully funded by the German Federal Ministry of Education and Research under

CYSTINET Africa project number 01KA1618. We would like to thank Ms Domina, Mramba, Mr Christopher Mkono, and Mr Kinyara Lulandala for their support during the fieldwork. We also thank all household heads for the questionnaire survey and the participants in the FGDs and KIIs for their kind support and cooperation during the survey.

## REFERENCES

Alexander, A.M., Mohan, V.R., Muliyil, J., Dorny, P., & Rajshekhar, V. (2012). Changes in knowledge and practices related to taeniasis/cysticercosis after health education in a south Indian community. *Int. Health*, 4 (3), 164–169.

Boa, M.E., Mahundi, E.A., Kassuku, A.A., Willingham, A.L., & Kyvsgaard, N.C. Epidemiological survey of swine cysticercosis using ante-mortem and post-mortem examination tests in the southern highlands of Tanzania. (2006). *Vet. Parasitol.*, 139 (1–3), 249–255.

Braae, U.C., Magnussen, P., Harrison, W., Ndawi, B., Lekule, F., & Vang, M. (2016). Effect of National Schistosomiasis Control Programme on Taenia solium taeniosis and porcine

 

Article DOI : https://doi.org/10.37284/eajass.7.1.1783

cysticercosis in rural communities of Tanzania. *PAREPI*, 1 (3), 245–251.

Carabin, H., Millogo, A., Ngowi, H.A., Bauer, C., Dermauw, V., Koné, A.C., Sahlu, I., Salvator, A.L., *et al.* (2018). Effectiveness of a community-based educational programme in reducing the cumulative incidence and prevalence of human Taenia solium cysticercosis in Burkina Faso in 2011–14 (EFECAB): a cluster-randomised controlled trial. *Lancet Glob. Heal.*, 6 (4), e411–e425.

CDC. (2013). National HIV Behavioral Surveillance System in Men Who Have Sex with Men - Round 4: Formative Research Manual.

Chacha, M., Yohana, C., & Nkwengulila, G. (2014). Indigenous knowledge, practices, beliefs and social impacts of porcine cysticercosis and epilepsy in Iringa Rural. *Int. J. Infect. Dis.*, 21 (December), 178.

Champion, V. L. & Skinner, C. S. (2008). *The Health Belief Model Model: In Health Behaviour and Health Education-Theory, Research, and Practice* (Karen Glanz, B. k. Rimer, & K. Viswanath (eds.); 4th editio, pp. 45–62). Jossey-Bass A Wiley Imprint 989 Market Street, San Francisco.

Coral-Almeida, M., Rodríguez-Hidalgo, R., Celi-Erazo, M., García, H.H., Rodríguez, S., Devleesschauwer, B., Benítez-Ortiz, W., & Dorny, P. (2014). Incidence of Human Taenia solium Larval Infections in an Ecuadorian Endemic Area: Implications for Disease Burden Assessment and Control. *PLoS Negl. Trop. Dis.*, 8 (5).

Eddi, C., Nari, A., & Amanfu, W. (2003). Taenia solium cysticercosis/taeniosis: potential linkage with FAO acti v ities; FAO support possibilities, 87, 145–148.

Edwards, D., Monk-Turner, E., Poorman, S., Rushing, M., Warren, S., & Willie, J. Predictors of hand-washing behavior. (2002). *Soc. Behav. Pers.*, 30 (8), 751–756.

FAO & WHO (2014). Multicriteria-Based Ranking for Risk Management of Food-Borne Parasites. Rome, Italy.

Fisher, A.A., Laing, J.E., Stoeckel, J.E., & Townsend, J. (1991). *Handbook for family planning operations research design. 2nd ed. TT*.

Gabriël, S., Dorny, P., Mwape, K.E., Trevisan, C., Braae, U.C., Magnussen, P., Thys, S., Bulaya, C., *et al.* (2017). Control of Taenia solium taeniasis/cysticercosis: The best way forward for sub-Saharan Africa? *Acta Trop.*, 165, 252–260.

Humanitarian Response (2015). Kobo Toolbox. [Internet]. *Ocha.* Avaiable from: https://www.humanitarianresponse.info/fr/applications/kobotoolbox

Kilanowski, J. F. (2017). Breadth of the Socio-Ecological Model, Journal of Agromedicine, 22:4, 295-297, Kilanowski, J. F. Breadth of the Socio-Ecological Model. *Journal of Agromedicine*.

Kraft, R. (2007). Cysticercosis: An emerging parasitic disease. *Am. Fam. Physician*, 76 (1).

Murrell, K. (2005). Epidemiology of Taeniosis and Cysticercosis. *In*: KD. Murrell, J.. Allan, G. Avila, J. Brandt, D. Correa, O.H. Del Brutto, P. Dorny, A. Flisser, H.H. Garcia, S. Geerts, A. Ito, N.C. Kyvsgaard, P. Maravilla, D.P. McManus, H., & Meinardi, eds. *WHO/FAO/OIE guidelines for the surveillance, prevention and control of taeniosis/cysticercosis. Paris: World Health WHO/FAO/OIE*. OIE, 12, rue de Prony, 75017 Paris, France: WHO/FAO/OIE, 73–92.

Mwang'onde, B.J., Chacha, M.J., & Nkwengulila, G. (2018). The status and health burden of neurocysticercosis in Mbulu district, northern Tanzania. *BMC Res. Notes*, 11 (1).

Mwidunda, S., Carabin, H., Matuja, W., Winkler, A., & Ngowi, H. A. (2015). School based cluster randomised health education intervention trial for improving knowledge

 

Article DOI : https://doi.org/10.37284/eajass.7.1.1783

and attitudes related to Taenia solium cysticercosis and taeniasis in Mbulu district, northern Tanzania. *PLoS One*, 10 (2), 1–17.

Ngowi, H.A., Carabin, H., Kassuku, A.A., Mlozi, M.R.S., Mlangwa, J.E.D., & Willingham, A.L. (2008). A health-education intervention trial to reduce porcine cysticercosis in Mbulu District, Tanzania. *Prev. Vet. Med.*, 85 (1–2), 52–67.

Ngowi, H.A., Kassuku, A.A., Maeda, G.E.M., Boa, M.E., Carabin, H., & Willingham, A.L. (2004). Risk factors for the prevalence of porcine cysticercosis in Mbulu District, Tanzania. *Vet. Parasitol.*, 120 (4), 275–283.

Ngowi, H.A., Mkupasi, E.M., Lekule, F.P., Willingham, I.L., & Thamsborg, S.M. (2011). Impact of farmer education on their knowledge, attitudes, and practices in southern Tanzania: A case for Taenia solium control1. Ngowi HA, Mkupasi EM, Lekule FP, Willingham IL, Thamsborg SM. Impact of farmer education on their knowledge, attitudes, and pr. *Livest. Res. Rural Dev.*, 23 (1), 1–8.

Ngowi, H.A., Mlangwa, J.E.D., Mlozi, M.R.S., Tolma, E.L., Kassuku, A.A., Carabin, H., & Willingham, A.L. (2009). Implementation and evaluation of a health-promotion strategy for control of Taenia solium infections in northern Tanzania. *Int. J. Heal. Promot. Educ.*, 47 (1), 24–34.

Nji, T.M., Piotrowski, P., Nnamdi Dum-Buo, N., Fung, E.G., Dean, L., Theobald, S., Thomson, R., Wanji, S., & Ozano, K. (2021). Eliminating onchocerciasis within the Meme River Basin of Cameroon: A social-ecological approach to understanding everyday realities and health systems. *PLoS Negl Trop Dis.*, 15(6): e0009433.

Okello, A., & Thomas, L. (2017). Human taeniasis: Current insights into prevention and management strategies in endemic countries. *Risk Manag. Healthc. Policy*, 10, 107–116.

Pedro, M.L., Carlos, C.A., Moisés, T., Yuri, B., Rosario, J., & Cabrera Lilia Prácticas. (2008) Conocimientos Actitudes sobre la Hidatidosis Humana en Poblaciones Procedentes de Zonas Endémicas. *Rev Gastroenterol Perú*, 28, 43–49.

Pete, J.M. (1986). Handwashing practices among various school age students. *Health Educ.*, 17 (6), 37–39.

Román, G., Sotelo, J., Del Brutto, O., Flisser, A., Dumas, M., Wadia, N., Botero, D., & Cruz, M. (2000). A proposal to declare neurocysticercosis an international reportable disease. *Bull. World Health Organ.*, 78 (3), 399–406.

Sarti, E., Flisser, A., Schantz, P.M., Gleizer, M., Loya, M., Plancarte, A., Avila, G., & Allan, J. (1997). Development and evaluation of a health education intervention against Taenia solium in a rural community in Mexico. *Am. J. Trop. Med. Hyg.*, 56 (2), 127–132.

Shonyela, S.M., Mkupasi, E.M., Sikalizyo, S.C., Kabemba, E.M., Ngowi, H.A., & Phiri, I. (2017). An epidemiological survey of porcine cysticercosis in Nyasa District, Ruvuma Region, Tanzania. *Parasite Epidemiol. Control*, 2 (4), 35–41.

Townsend, N., & Foster, C. (2011). Developing and applying a socio-ecological model to the promotion of healthy eating in the school. *Public Health Nutrition*, 16(6), 1101–1108

Trevisan, C., Devleesschauwer, B., Schmidt, V., Winkler, A.S., Harrison, W., & Johansen, M.V. (2017). The societal cost of Taenia solium cysticercosis in Tanzania. *Acta Trop.*, 165, 141–154.

Vaernewyck, V., Evans, K.M., Mubanga, C., Brecht, D., Sarah, G., & Trevisan, C. (2020). Effects of 'The Vicious Worm' educational software on Taenia solium knowledge among key pork supply chain workers in Zambia. *PLoS Negl. Trop. Dis.*, 14 (10), 1–16.

 

Article DOI : https://doi.org/10.37284/eajass.7.1.1783

WHO. (2008). Advocacy, communication and social mobilisation for TB control; a guide to developing knowledge, attitude and practice surveys. WHO/HTM/STB/2008.46

WHO. (2013). Regional Strategic Plan for Neglected Tropical Diseases in the African Region 2014–2020 Regional Strategic Plan for Neglected Tropical Diseases in the African Region 2014-2020. Brazzaville.

WHO.(2015a). Assembling a framework for intensified control of taeniasis and neurocysticercosis caused by Taenia solium: Report of an informal consultation. World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland.

WHO. (2015b). Taenia Solium Taeniasis / Cysticercosis Diagnostic Tools, (December), 1–26.

Wohlgemut, J., Dewey, C., Levy, M., & Mutua, F. (2010). Evaluating the efficacy of teaching methods regarding prevention of human epilepsy caused by Taenia solium neurocysticercosis in Western Kenya. *Am. J. Trop. Med. Hyg.*, 82 (4), 634–642.

Yuan, L.P., Manderson, L., Ren, M.Y., Li, G.P., Yu, D.B., & Fang, J.C. (2005). School-based interventions to enhance knowledge and improve case management of schistosomiasis: A case study from Hunan, China. *Acta Trop.*, 96 (2–3), 248–254.