

## ORIGINAL ARTICLE

# Knowledge, attitudes, and practices of abattoir workers about *Taenia solium* cysticercosis in the Eastern Cape Province, South Africa

Siziwe Sibutha<sup>1</sup>  | Charles Byaruhanga<sup>2</sup>  | Ishmael Festus Jaja<sup>1</sup> 

<sup>1</sup>Department of Animal and Pasture,  
University of Fort Hare, Alice, South Africa

<sup>2</sup>Department of Veterinary Tropical  
Diseases, Faculty of Veterinary Science,  
University of Pretoria, Pretoria, South  
Africa

## Correspondence

Ishmael Festus Jaja, Department of Animal  
and Pasture, University of Fort Hare, Alice,  
Eastern Cape, South Africa.  
Email: [ijaja@ufh.ac.za](mailto:ijaja@ufh.ac.za)

Assigned to Associate Editor Briana Wyatt.

## Abstract

The tapeworm, *Taenia solium*, is the cause of cysticercosis, a neglected zoonotic disease that poses a significant global threat to animal and public health. Data were collected between May and June 2024 using a structured, interviewer-administered questionnaire ( $n = 152$ ) comprising demographic items and sections on knowledge, attitudes, and practices. The knowledge section included basic conceptual questions such as “Have you ever heard about the word zoonosis?” and disease-specific items such as “*Taenia solium* can be contracted through the consumption of undercooked pork Yes or No?” Additional questions assessed recognition of cysts, understanding of transmission pathways, and hygiene and inspection practices relevant to daily work routines. This is important for disseminating knowledge about prevention measures among communities. Most respondents were unfamiliar with the disease, with only 12.5% ( $n = 19$ ) demonstrating a good understanding of the source and transmission of *T. solium*. The attitudes of the workers were negative or just moderate (63.2%), specifically toward hygiene in the abattoirs, personnel training, and the fate of infected carcasses. However, a good level of practice (90.2%) was achieved regarding sanitation and disposal of condemned carcasses, which can be attributed to management regulations rather than workers’ concerns. There is a need to enhance awareness among abattoir workers about the public health and economic consequences of *T. solium* infection, thereby improving their knowledge of the disease and its transmission. This can be beneficial to the rest of the community, especially pork consumers, in preventing the continuous spread of cysticercosis.

## Plain Language Summary

This research examined the level of knowledge among slaughterhouse workers in South Africa regarding *Taenia solium*, a tapeworm that can lead to severe illness

**Abbreviations:** KAP, knowledge, attitudes, and practice; PCC, porcine cysticercosis; TSCT, *Taenia solium* cysticercosis/taeniasis.

This is an open access article under the terms of the [Creative Commons Attribution](https://creativecommons.org/licenses/by/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2026 The Author(s). *Natural Sciences Education* published by Wiley Periodicals LLC on behalf of American Society of Agronomy.

in pigs and humans. Humans and animals contract infections by consuming food or water that contains the parasite's eggs. Given that abattoir workers frequently manage pork, they must understand how the disease transmits and the methods to avert it. To gain further insights, we distributed questionnaires to 152 employees in the Eastern Cape Province. Most of them had minimal knowledge about the disease, with only a few demonstrating a solid understanding. We additionally discovered that age, gender, or education did not influence their level of knowledge. The findings indicate a critical requirement for training initiatives to assist abattoir employees in comprehending and mitigating the transmission of this detrimental illness.

## 1 | INTRODUCTION

*Taenia solium* cysticercosis/taeniasis (TSCT) is a parasitic zoonotic disease that has detrimental effects on public health and the economy due to its effects on pig carcasses. It is the most common parasitic foodborne illness distributed worldwide (WHO, 2016). When pigs consume infectious parasite eggs released through the feces of individuals afflicted with *T. solium* tapeworms, they develop cysticercosis. This occurs either directly through coprophagy or indirectly through tainted water or feed (Kabululu et al., 2023). For smallholder pig production communities in the Eastern Cape Province of South Africa, the parasite presents a potentially dangerous agricultural issue, a risk to public health, and an economic loss (Sithole, Bekker, Tsotetsi-Khambule, et al., 2019). The disease is most prevalent in nations with low socioeconomic development, characterized by low standards of personal hygiene, poor environmental sanitation, inadequate pig husbandry, insufficient meat inspection, and limited knowledge of TSCT (Nyangi et al., 2022). Most pigs in African rural areas are raised using traditional methods, wherein they are either allowed to roam freely or kept during certain times of the day or season to safeguard crops, which facilitates direct contact with human fecal material (Kyvsgaard et al., 2007; Murrell & Dorny, 2005). In humans, *T. solium* causes taeniasis after consumption of raw or undercooked pork contaminated with mature cysts. Human cysticercosis can also occur when they occasionally become intermediate hosts by consuming water or food contaminated with *T. solium* eggs or by placing contaminated hands in their mouths (Van Damme et al., 2022). In this case, cysticerci settle in the central nervous system, causing neurocysticercosis, characterized by nervous symptoms, such as epileptic seizures and chronic headaches (Carabin et al., 2011; Murrell & Dorny, 2005).

Working conditions of abattoir workers involve frequent contact with animals or the infectious materials associated with them during slaughter, and therefore, this category of people represents a significant population at risk for both occupational and zoonotic diseases. Abattoir workers include

transporters, slaughtermen, carcass dressers, offal cleaners, handlers of skins and hides, cleaners, meat inspectors, and administrators. Various studies have been conducted about zoonotic diseases among abattoir workers around the world, for example, high prevalence of porcine cysticercosis (PCC) in slaughtered pigs: an abattoir study in Rwanda (Shyaka et al., 2024). The true prevalence was calculated to be 25%–43% in two abattoirs in southwestern Rwanda and 2%–3% in the rest of the country. Enzyme-linked immunosorbent assay and cysts were detected in 20/67 (30%) of carcasses, with >1000 cysts in 9/20 (45%) of infected pigs with polymerase chain reaction. In another study in Rwanda, abattoir workers demonstrated inadequate knowledge, unfavorable attitudes, and inappropriate practices and procedures regarding meat handling and compliance with slaughterhouse law (Ntivuguruzwa et al., 2021).

According to the International Task Force for Disease Eradication, *T. solium* cysticercosis is one of the six diseases that can be eradicated (Carabin & Traoré, 2014). To develop effective control or elimination strategies, it is crucial to consider the community's knowledge, attitudes, and practices (KAPs), including abattoir workers. With the correct information, people can be assisted in adopting preventive measures, such as treating tapeworm infections or implementing better sanitation and pig-rearing practices, which may reduce the spread of fecal-oral infectious diseases. When communities have a good scientific attitude, control or eradication actions are favored. However, information on KAPs about TSCT in many African nations is limited (Nyangi et al., 2022). Like many areas of sub-Saharan Africa, the Eastern Cape Province has areas with inadequate sanitation, and free-ranging pig rearing, which is conducive to the spread of *T. solium*, is common. This, together with limited access to veterinary and public health services, fosters conditions that favor *T. solium* transmission. It is essential to understand the perspectives and actions of individuals, such as abattoir workers, who are directly involved in pork value chains, as this has implications for interventions that may be either ineffective or unsustainable. As a result, examining the KAPs of slaughterhouse employees

in the Eastern Cape is warranted, as it provides essential information for crafting tailored strategies to enhance disease management, increase food safety, and contribute to the ultimate objective of eradicating *T. solium* cysticercosis.

To the best of our knowledge, no study has been conducted to assess the knowledge of abattoir workers in the Eastern Cape, South Africa. Therefore, there is no information on KAPs about TSCT in the area. Studies previously carried out in other places in the province were about consumer knowledge and practices on pork safety, pig husbandry, and health practices, and the ineffectiveness of meat inspection in the detection of *T. solium* cysticercosis in pigs slaughtered in abattoirs (Sithole et al., 2020), respectively. Thus, this study aims to determine the knowledge, attitude, and practices of *T. solium* cysticercosis among abattoir workers in the Eastern Cape Province, South Africa.

## 2 | MATERIALS AND METHODS

### 2.1 | Ethical considerations

Ethical clearance for this study was obtained from the University of Fort Hare Research and Ethics Committee (UFH-UREC) (reference number REC-270710-028-RA Level 01 for project number JAJ031SSIB01) before the commencement of the data collection. We also obtained written informed consent from managers of the participating abattoirs. The respondents signed the consent form before participating in the study.

#### 2.1.1 | Study area

The study was conducted from May to June 2024 in seven abattoirs in five district municipalities of the Eastern Cape Province: Buffalo City Metropolitan Municipality, Nelson Mandela Bay Metropolitan Municipality, Chris Hani District Municipality, Sarah Baartman District Municipality, and Amathole District Municipality. Seven abattoirs were randomly chosen in the research area (Figure 1). There were two types of abattoirs: high throughput ( $n = 5$ ; A1, A2, A4, A5, and A7), typically slaughtering more than 20 livestock units per species per day, and low throughput ( $n = 2$ ; A3 and A6), slaughtering up to 20 livestock units per day.

The Eastern Cape Province is the second largest province in South Africa, with a population estimated to be approximately 7,225,784 according to estimates of 2022 (Census, 2023). The province occupies 169,580 km<sup>2</sup> (13.9% of South Africa) of the country's total land area. Approximately 63% of the population lives in rural areas, with a high unemployment rate of 53.6% (Popoola et al., 2019). The province lies between 32° 0' 0" S latitude and 27° 0' 0" E longitude with an altitude of

### Core Ideas

- Abattoir workers play a crucial role in the detection and prevention of *Taenia solium* transmission due to their involvement in pork processing.
- Lack of formal training on zoonotic diseases and food safety presents a barrier to disease control.
- Targeted educational interventions are urgently needed to improve workers' understanding and practices related to *T. solium*, thereby reducing risks to public and animal health.

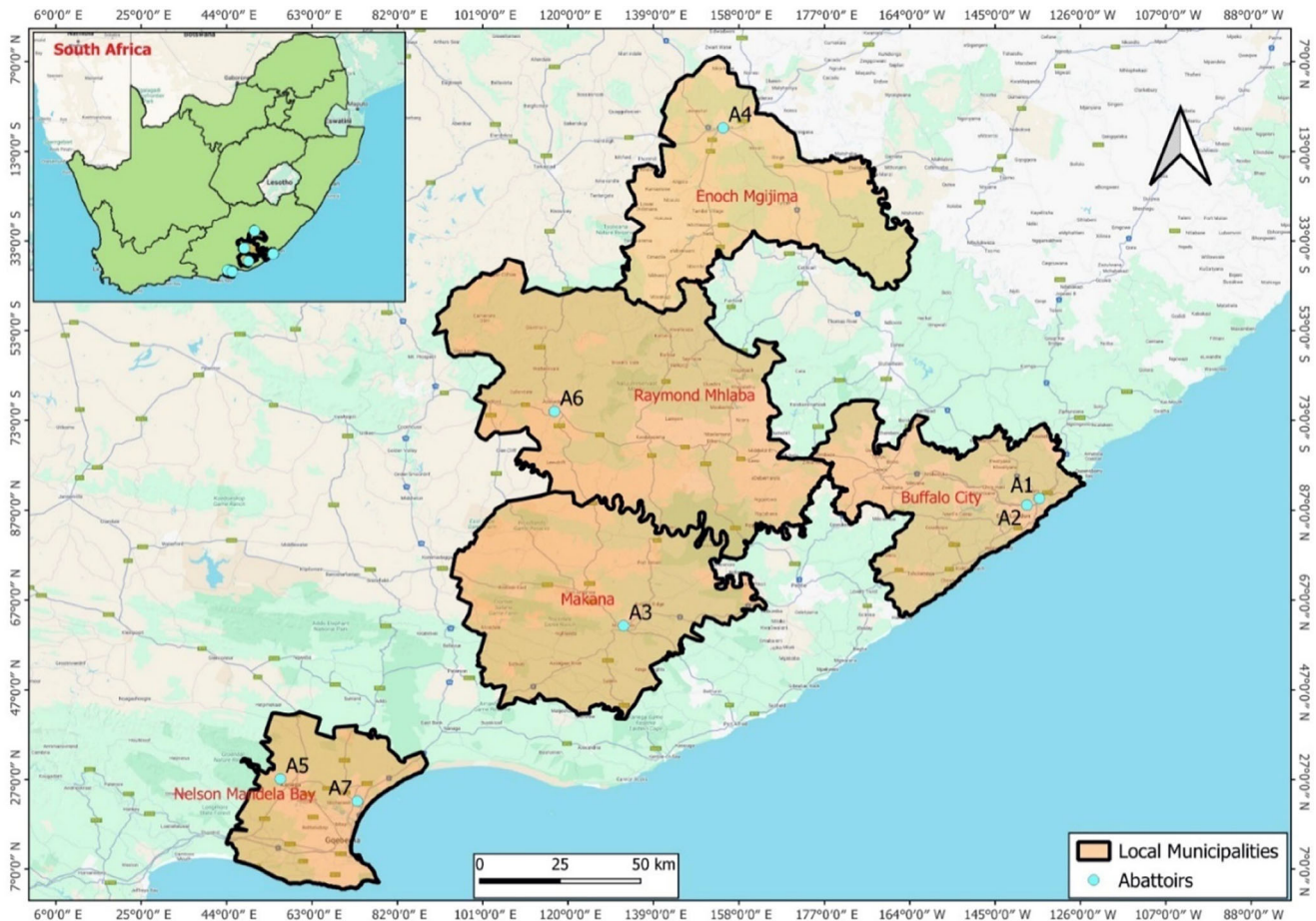
1939 m above sea level. The climate in the province is arid and semiarid, with a mean annual rainfall range of 550–700 mm and temperatures ranging from 24.5°C to 25°C (Ndhleve et al., 2017).

#### 2.1.2 | Study design and sample size

The inclusion criteria for participants in this study were (i) abattoir workers, (ii) volunteered to participate in this study, and (iii) understood either English or Xhosa. The sample size ( $n = 152$ ) was calculated using the single proportion formula ( $n = (Za/2)^2 * p (1 - p)$ ) with  $Za/2 = 1.96$  for a 95% confidence interval,  $p = 0.50$  as proportion of knowledge abattoir workers about *T. solium* cysticercosis was not known in the population (Mohd Yusof et al., 2018), and the precision was set at  $p = 0.08$ , with the addition of 1.5% nonresponse rate.

## 2.2 | Questionnaire interviews

This cross-sectional study involved face-to-face questionnaire interviews on *T. solium* cysticercosis with abattoir participants during their lunch break. The survey was modified from existing validated KAP tools and evaluated by the two project supervisors from the University of Fort Hare and the University of Pretoria to confirm content validity. The questionnaire was also pretested with three workers, whose recordings were excluded from the analysis. In this way, both peer review and field validation ensured that the designed questions were well understood by the participants, clearing any ambiguity and ensuring a smooth flow of content. Each participant's interview lasted 8–10 min. The questionnaire was designed in English and translated into the local language, Xhosa. The questionnaire consisted of 26 questions in total and was divided into four sections. Section one comprised demographic information. Section two comprised knowledge



**FIGURE 1** A map showing the different abattoirs in different local municipalities in the Eastern Cape Province, South Africa (right). Inset (top-left) is the map of South Africa on the African continent. The names of the study municipalities are shaded in brown colors, and the study abattoirs are indicated with light blue dots.

and awareness of the disease. Section three comprised attitudes toward the disease. Section four comprised practices among abattoir workers regarding *T. solium* cysticercosis.

### 2.3 | Performance score

There were 26 questions in the knowledge segment. Six questions aimed to address knowledge and awareness about zoonotic diseases, while 10 questions addressed the transmission mechanism of TSC, three questions addressed the knowledge of risk factors, and seven other questions addressed the knowledge of symptoms. The questions were “yes” or “no” design or with the multiple-choice questions with a scale of 0 (correct response) and 1 (incorrect response) to ensure a precise response. A participant’s overall score for the 26 knowledge questions varied from 7 to 23 points, depending on how many choices they chose. There were eight questions in the attitude section, each worth one point. “Yes” had a score of 1, and “No” had a score of 0. The five multiple-choice questions on general practice and the disease control strat-

egy included yes/no answers. An accurate response received a score of 1, whereas a false response received a score of 0. A modified Bloom’s cut-off point was applied to determine the overall score for each outcome, knowledge, attitude, and practice (Mohd Yusof et al., 2018; Wilson et al., 2023). The knowledge level was divided into three categories: low level (less than 60%; 0–15 points), moderate level (60%–79%; 16–20 points), and high level (80%–100%; 21–26 points). The attitude scores were divided into three groups: negative (less than 60%; less than or equal to 4 points), moderate (60%–79%; 5–6 points), and positive (80%–100%; 7–8 points). The practice level was then divided into three categories: good (80%–100%; 4–5 points), moderate (60%–79%; 3 points), and poor (less than 60%; 0–2 points).

### 2.4 | Statistical analysis

Raw data were recorded in Microsoft Excel, followed by cleaning and coding. All statistical analyses were performed using the IBM SPSS Statistics for Macintosh v26 (IBM).

Descriptive statistics, such as frequencies and percentages, were used to summarize the demographic variables and KAPs of the respondents. For the score, the ‘yes’ answers were coded as 0, and the ‘no’ answers were coded as 1. The scores were categorized as follows: for knowledge, into low, moderate, and high levels; for attitude, into negative, neutral, and positive; and for practice, into bad, moderate, and good practice, with different ranges of marks. Spearman correlation was used to assess the relationship between the scores, and the Kruskal–Wallis test was used to compare the scores. (Zulu et al., 2023). The association between overall knowledge, attitude, practice scores, and confidence was evaluated using Pearson’s correlation analysis. In cases where  $p \leq 0.05$ , the findings were considered significant. Cronbach’s alpha based on standardized items was generated to test reliability, which was 0.67.

### 3 | RESULTS

#### 3.1 | Demographic profile of the respondents

A total of 152 abattoir workers were interviewed, and of these, about 84.2% were male, while 15.8% were female. Most workers (48.0%) were aged 31–50 years, and the least were >50 years (11.2%) (Table 1). About 83.6% of the respondents were African, 13.2% were colored, and 3.3% were white. Most workers (77.6%) were in high-throughput abattoirs, while 22.4% were in low-throughput abattoirs. About three-quarters ( $n = 116$ , 76.3%) of the respondents had attended a zoonoses training. The largest groups were slaughterers and offal workers (32.9%), followed by hygiene control staff (17.1%), general workers (15.8%), supervisors and managers (10.5%), meat classifiers (9.2%), meat inspectors (7.2%), and meat packers (7.2%). With regard to routine health monitoring, almost half of the workers (49.3%) reported never undergoing medical check-ups. Among those who did, 21.1% received annual checks, 17.1% twice a year, 6.6% quarterly, and 5.9% monthly. Most respondents (76.3%) had never participated in any formal zoonosis training. Among the 23.7% who had received such training, the majority (20.4%) attended sessions conducted at their workplace. A smaller number were trained through government departments (2.0%) or online platforms (1.3%).

#### 3.2 | Source of information of the respondents

Most of the respondents’ sources of information were health care professionals or veterinarians (45.4%), followed by TV/radio, which is 16.4% (Figure 2).

#### 3.3 | Respondents’ knowledge of risk factors for *Taenia solium* cysticercosis

Most respondents (60.6%) knew how a zoonotic disease is transmitted, and about half (53.9%) thought that *T. solium* cysticercosis is a zoonosis. Half (49.3%) of the respondents did not know that pigs can acquire the disease through eating contaminated vegetables. More than three-quarters (78.9%) of the respondents mentioned that the purchase of meat from informal slaughter areas can increase the risk of exposure to taeniasis. About 65.8% mentioned that feeding condemned offal to animals is a risk factor for *T. solium* cysticercosis. Most respondents (77.6%) indicated that *T. solium* infection in humans could be acquired through consumption of undercooked pork, and 67.1% knew that humans can accidentally be infected by consuming infected vegetables (Table 2).

#### 3.4 | Respondents’ knowledge of symptoms of *Taenia solium* taeniasis/cysticercosis

The most frequently mentioned symptoms for *T. solium* infection in humans, as mentioned by the participants, were diarrhea (17%), nausea (16%), vomiting (16%), while other signs were abdominal discomfort (15%), seizures (13%), headache (12%), and oversleeping (11%) (Figure 3).

#### 3.5 | Respondents’ attitudes toward *Taenia solium* cysticercosis

Only 21.7% ( $n = 33$ ) of the respondents mentioned that abattoir workers have the right to consume the condemned meat, and about three-quarters (73.7%, 112/152) indicated that regular training on diseases such as *T. solium* cysticercosis is important. On the other hand, about a third of the abattoir workers (32.9%, 50/152) did not value the practice of washing hands before and after slaughtering (Table 3). A quarter of the interviewed abattoir workers thought that condemned meat is not a source of disease if consumed.

#### 3.6 | Respondents’ practices toward *Taenia solium* taeniasis/cysticercosis

Most respondents agreed that the practice of proper disposal of condemned carcasses/offal through burning and burial (90.8%) and the wearing of masks and gloves during slaughtering hours (94.7%) would help prevent the transmission of *T. solium* in humans and animals (Table 4). The majority also agreed that cleaning abattoir work surfaces can prevent or control the disease (98.0%), and most respondents (69.7%) also

TABLE 1 Demographic profile of the respondents ( $n = 152$ ).

Demographic characteristics	Category	Number	Percentage (%)
Gender	Male	128	84.2
	Female	24	15.8
Age	18–30	62	40.8
	31–50	73	48.0
	>50	17	11.2
Race	Black	127	83.6
	Colored	20	13.2
	White	5	3.3
Educational level	Primary	23	15.1
	Secondary	105	69.1
	Tertiary	24	15.8
Work experience at the abattoir	<1	29	19.1
	1–3	50	32.9
	>3	73	48.0
Work title	Supervisor and manager	16	10.5
	Slaughterer and offal worker	50	32.9
	Meat inspector	11	7.2
	Meat classifier	14	9.2
	Meat packer	11	7.2
	Hygiene control	26	17.1
	General worker	24	15.8
Local municipality	Buffalo City Metropolitan	75	49.3
	Makana	11	7.2
	Enoch Mgijima	26	17.1
	Nelson Mandela Bay	34	22.4
	Raymond Mhlaba	6	3.9
Name of abattoir	Abattoir one	19	12.5
	Abattoir two	56	36.8
	Abattoir three	11	7.2
	Abattoir four	26	17.1
	Abattoir five	17	11.2
	Abattoir six	6	3.9
	Abattoir seven	17	11.2
Abattoir type	High throughput	118	77.6
	Low throughput	34	22.4
Medical check-up	Never	75	49.3
	Monthly	9	5.9
	Quarterly	10	6.6
	Yearly	32	21.1
	Twice a year	26	17.1
Ever participated in a zoonosis training?	Yes	36	23.7
	No	116	76.3
If yes, where	No	116	76.3
	Online	2	1.3
	At work	31	20.4
	Government department	3	2.0

TABLE 2 Knowledge of risk factors for *Taenia solium* cysticercosis.

Variable	Category	Frequency (n = 152)	Percentage (%)
Have you ever heard about the word zoonosis?	Yes	30	19.7
	No	122	80.3
Zoonosis is an infectious disease that is transmitted between species from animals to humans.	Yes	92	60.5
	No	60	39.5
Do you think <i>Taenia solium</i> (pork tapeworm) is a zoonosis?	Yes	82	53.9
	No	70	46.1
Pigs acquire cysticercosis by ingesting contaminated vegetables.	Yes	77	50.7
	No	75	49.3
Pigs acquire cysticercosis by eating infected feces of a human infected with a tapeworm.	Yes	97	63.8
	No	55	36.2
Purchasing meat from informal slaughter markets can potentially cause <i>Taenia solium</i> .	Yes	120	78.9
	No	32	21.1
Pork tapeworm is transmitted through	Eating raw or undercooked infected pork	124	81.6
	Slaughtering pigs	20	13.2
	Pig sneezing	8	5.3
Indicate where cysts are found.	Lungs: Yes	59	38.8
	No	93	61.2
	Liver: Yes	122	80.3
	No	30	19.7
	Heart: Yes	18	11.8
	No	134	88.2
Indicate which animals are affected by <i>Taenia solium</i> cysticercosis.	Skin: Yes	20	13.2
	No	132	86.8
	Pigs: Yes	103	67.8
	No	49	32.2
Feeding condemned offal to animals is a risk factor for <i>Taenia solium</i> cysticercosis.	Goats: Yes	17	11.2
	No	135	88.8
	Sheep: Yes	42	27.6
	No	110	72.4
Taenia solium cysticercosis can be contracted through the consumption of infected vegetables.	Cats: Yes	13	8.6
	No	139	91.4
Feeding condemned offal to animals is a risk factor for <i>Taenia solium</i> cysticercosis.	Yes	100	65.8
	No	52	34.2
<i>Taenia solium</i> can be contracted through the consumption of undercooked pork.	Yes	118	77.6
	No	34	22.4
<i>Taenia solium</i> cysticercosis can be contracted through the consumption of infected vegetables.	Yes	102	67.1
	No	50	32.9

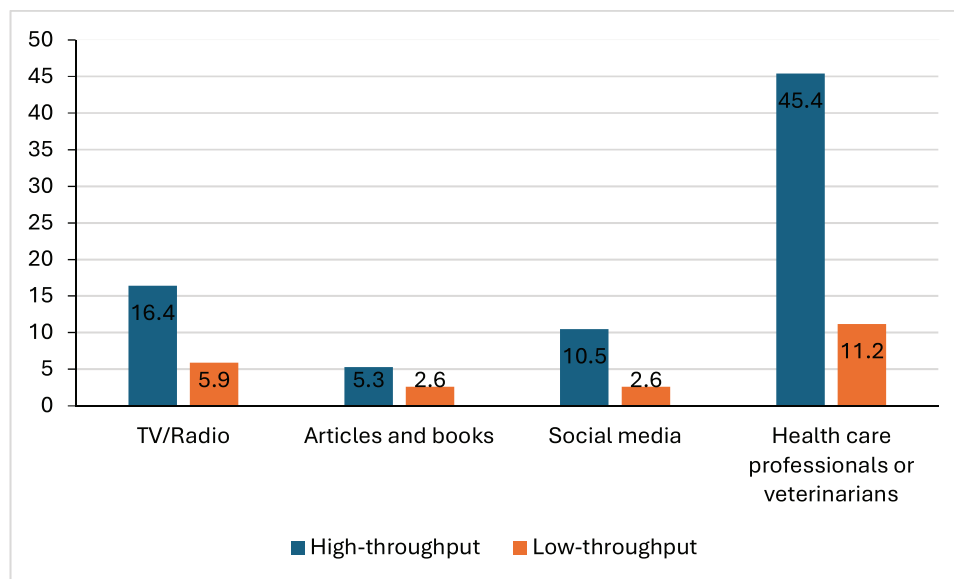


FIGURE 2 Respondents' source of information about *Taenia solium* cysticercosis in different abattoir categories.

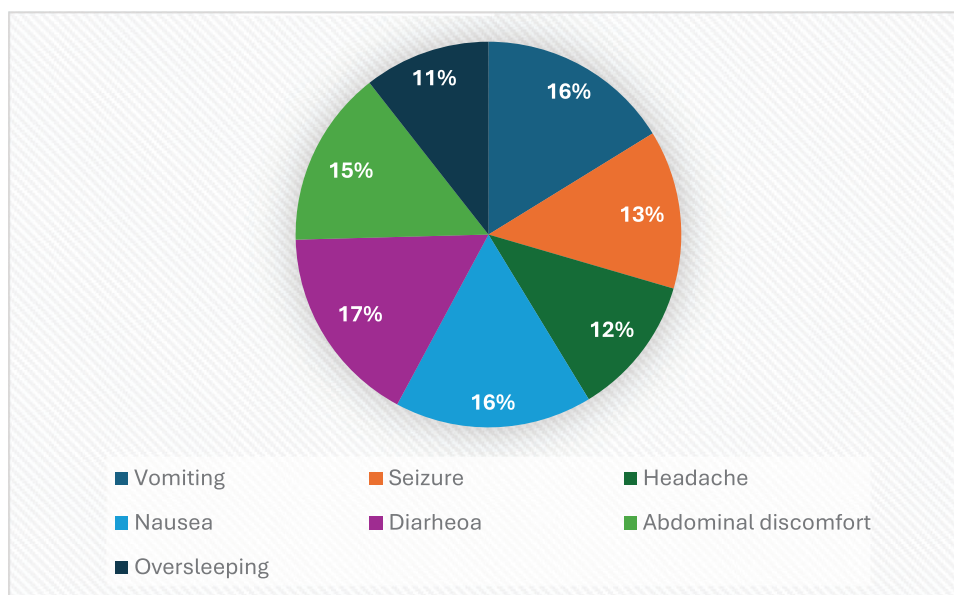


FIGURE 3 Respondents' knowledge of symptoms of *Taenia solium* cysticercosis. A total of 152 abattoir workers were interviewed.

TABLE 3 Respondents' attitudes toward *Taenia solium* taeniasis/cysticercosis.

Variable	Category	Frequency (n = 152)	Percentage
Washing hands before and after slaughtering is not important	Yes	50	32.9
	No	102	67.1
Regular training on diseases like <i>Taenia solium</i> cysticercosis is important	Yes	112	73.7
	No	40	26.3
Abattoir workers have the right to consume condemned meat	Yes	33	21.7
	No	119	78.3
Condemned meat is not necessarily bad meat to consume	Yes	38	25
	No	114	75

**TABLE 4** Practices of the respondents toward *Taenia solium* taeniasis/cysticercosis.

Variable	Category	Frequency	Percentage
Wearing masks and gloves during slaughtering hours is important in preventing the transmission of <i>Taenia solium</i>	Yes	144	94.7
	No	8	5.3
Washing your hands before and after handling meat is not important	Yes	46	30.3
	No	106	69.7
Good abattoir practices, such as cleaning work surfaces, can prevent or control the spread of <i>Taenia solium</i> disease	Yes	149	98.0
	No	3	2.0
The open disposal of condemned offal compromises the environment and then leads to the transmission of <i>Taenia solium</i> illness	Yes	138	90.8
	No	14	9.2

**TABLE 5** Bloom's cut-off categories for the total knowledge, attitude, and practice scores.

	Category	KAPs scores (%)	Number of respondents (n)	Percentage (%)
Knowledge	High level	21–26 (80%–100%)	19	12.5
	Moderate level	16–20 (60%–79%)	67	44.1
	Low level	≤15 (<60%)	66	43.5
Total			152	100
Attitude	Positive attitude	7–8 (80%–100%)	56	36.8
	Moderate attitude	5–6(60%–79%)	48	31.6
	Negative attitude	≤4 (<60%)	48	31.6
Total			152	100
Practice	Good practice	4–5 (80%–100%)	137	90.2
	Moderate practice	3 (60%–79%)	14	9.2
	Bad practice	<3 (<60%)	1	0.7
Total			152	100

asserted that washing their hands before and after handling meat is important.

### 3.7 | Knowledge, attitudes, and practice scores

Only a few respondents (19/154, 12.5%) had high-level knowledge about cysticercosis, while the rest (>80%) had moderate or low-level knowledge (Table 5). The frequency of positive, moderate, and negative attitudes of the respondent toward taeniasis/cysticercosis was similar (Table 5). However, all but 15 respondents (137/154, 90.2%) had good practices in the prevention and control of cysticercosis.

## 4 | DISCUSSION

In the current study, 80.3% of the respondents have never heard of the word zoonosis. This is unfortunate for people processing meat for human consumption. They need information so that they can protect themselves and the consumers. The

results also show that the abattoir workers had little knowledge of the zoonosis disease transmission. These results are in line with those from Pakistan (Bibi et al., 2023). The Xhosa-speaking inhabitants of the Eastern Cape Province have been found to have a high frequency of *T. solium* cysticercosis due to free-range pig husbandry and inadequate sanitation in most areas (Sithole et al., 2020). *T. solium* cysticercosis is an avoidable cause of epilepsy and seizures, and therefore, controlling *T. solium* transmission is necessary to lessen the incidence of epilepsy linked to cysticercosis.

There was a significant association between the work responsibility and the knowledge about *T. solium* taeniasis/cysticercosis. For instance, it was observed that supervisors and managers were generally more knowledgeable than lower categories of workers, which is in agreement with a previous study in India (Sankhyan et al., 2015). Control measures have been proposed regarding *T. solium* infections (Mendlovic et al., 2021), but still, these are unlikely to be effective without a significant increase in the understanding of the parasite and the illness it produces. Our findings about knowledge of symptoms for taeniasis/cysticercosis are similar to those of (Adesokan & Adeoye, 2019) in Nigeria who reported that

about 80.3% of respondents knew that cysts are found in the lungs, and in the present study, this was referred to in their local dialect (IsiXhosa) as “indzumba.” This may be because they see them when they slaughter. The respondents could tell that those were cysts but were not aware of the potential harm to health. They also indicated that they would eat pork with cysts, with a perception that this had no consequences. Considering this, it is recommended to utilize workshops, media, and veterinary extension since increased understanding has been connected to a lower incidence of *T. solium* infections. The findings also show that respondents were aware of the risk factors of the disease; however, the majority of the respondents were from the high-throughput abattoirs, a fact that may provide an advantage given that this category of abattoirs has better resources (personnel, equipment, and finances). The results are contrary to those observed in four districts in Tanzania, where the risk perception was particularly low (20.4%) (Nyangi et al., 2022). High-throughput abattoirs have resources to make their workers aware of zoonotic diseases, and also the experience can help them become familiar with what they see and work with everyday.

The findings show that most respondents have either moderate or low levels of knowledge about *T. solium* cysticercosis. Only a small proportion indicated a high degree of knowledge, implying that profound comprehension of the disease is restricted among abattoir workers. This is similar to a report from the Central and Southern zones of Tanzania, where most participants were unaware that human cysticercosis could lead to an epileptic state (Makingi et al., 2023). Abattoir workers are likely to be at higher risk of catching zoonosis due to a combination of poor animal husbandry, bad food consumption habits, and a lack of awareness and understanding about the disease. A KAP survey of the abattoir workers in Mukono and neighboring districts in Uganda also revealed a lack of understanding about zoonotic infections (Tumusiime et al., 2020). Contrary to other studies’ findings, a household survey revealed that farmers in Eastern and Western Uganda had a high knowledge performance score regarding the transmission of *T. solium* infections (Ngwili et al., 2022).

The attitude toward *T. solium* cysticercosis indicates that more than one-third of the participants had a positive outlook, which may reflect their knowledge of *T. solium* cysticercosis. Such positivity is encouraging since it suggests that the respondents are somewhat attentive. The results align with the study on KAPs regarding taeniasis in Pakistan (Bibi et al., 2023). Regular training on diseases like *T. solium* cysticercosis is crucial, according to most respondents. This indicates a high understanding of the need for continuing education in enhancing attitudes, knowledge, and maybe activities linked to the prevention and control of zoonotic diseases. In the current study, a significant proportion of the respondents anticipated that proper disposal of condemned offal through burning, and burial will help prevent the transmission of *T.*

*solium* in humans and animals, and good abattoir practices such as cleaning work surfaces can prevent or control the spread of the disease.

Adoption of practices targeted at interrupting the transmission cycle and lowering the incidence and frequency of illnesses may be hindered by low awareness and knowledge of *T. solium* infections and transmission, as reported previously (Ngwili et al., 2022). Furthermore, the result from the study shows no significant association between knowledge of *Taenia solium* and the respondents’ education level or gender. The good practices of abattoir workers are crucial, as routine inspections frequently overlook slightly infected carcasses. Recent data from Rwanda (Shyaka et al., 2024) indicate that traditional tongue palpation and post-mortem checks identified less than 50% of infected pigs, highlighting the necessity to enhance on-floor practices beyond mere knowledge. A cross-sectional study conducted at a prominent abattoir in Ibadan, Nigeria (Adesokan & Adeoye, 2019), uncovered concerning results, showing that none of the participants were aware that *T. solium* can lead to epilepsy in humans. Moreover, inadequate sanitation habits, such as open defecation, were notably linked to insufficient knowledge and hazardous practices. The research indicated that participants who bought pork from home-slaughtered animals were up to four times less likely to demonstrate good knowledge and ten times less likely to practice safely than those who purchased from official abattoirs. The lack of training on zoonotic diseases and food safety needs to be addressed to improve the low level of knowledge of abattoir workers, to raise awareness, and to prevent the continuous spread of the disease. The study emphasizes the need for improved training, regular health screenings, and the stricter enforcement of sanitary practices, mostly in low-throughput facilities where resources may be more limited.

## 5 | CONCLUSION AND RECOMMENDATION

The study revealed that a considerable portion of participants considers condemned meat suitable for eating, with numerous abattoir employees claiming their entitlement to eat this meat. This acceptance reflects a limited understanding of food safety standards, implying that although attitudes on condemned meat are generally positive, they do not align with recommended best practices for health and safety. There was no significant association of the variables considered with knowledge, attitude, and practices; it means that the poor or good practices are uniformly distributed regardless of job position, education status, or age, and this implies that practical training, workflow organization, and managerial oversight may have a greater impact than formal education or reliance on years spent at work in

promoting safe practices. Essential practices for workers comprise (i) effective segregation of “dirty” and “clean” areas with strict movement restrictions; (ii) regular use of personal protective equipment and hand/arm sanitation during task transitions; (iii) thorough sterilization of knives and tools between carcasses; (iv) methodical, risk-oriented examination of key sites (masseters, tongue, and heart) with distinct condemnation/retention choices and record-keeping; (v) prompt, safe elimination of condemned items to avoid unauthorized distribution; and (vi) maintenance of cold-chain integrity and traceability for swift back-tracing capability. Although observed practices may be satisfactory, and attitudes are positive, the respondents perceived condemned meat as not necessarily bad to consume and mentioned that abattoir workers have a right to eat it. This is alarming and suggests that they have a limited understanding of *T. solium*. The study revealed that some respondents regarded oversleeping as a symptom of TSCT.

Considering this, it is recommended to utilize workshops, media, and veterinary extension since increased understanding has been connected to a lower incidence of *T. solium* infections. Farmers and abattoir workers should get enough health education regarding the transmission cycle of *T. solium* and its prevention to restrict PCC transfer to effectively manage/control *T. solium* infections in pig-rearing endemic regions.

#### AUTHOR CONTRIBUTIONS

**Siziwe Sibutha:** Data curation; formal analysis; investigation; methodology; writing—original draft. **Charles Byaruhanga:** Supervision; validation; writing—review and editing. **Ishmael Festus Jaja:** Supervision; validation; writing—review and editing.

#### ACKNOWLEDGMENTS

We acknowledge the enumerators who helped us during data collection. We also acknowledge all the participating abattoirs and their workers for their generous assistance and collaboration throughout the survey. Ethical clearance for this study was obtained from the University of Fort Hare Research and Ethics Committee (UFH-UREC) (reference number REC-270710-028-RA Level 01 for project number JAJ031SSIB01) before the commencement of the data collection. Before distributing the questionnaire, each study participant gave their verbal consent, and participation in the study was entirely voluntary.

#### CONFLICT OF INTEREST STATEMENT

The authors declare is no conflicts of interest.

#### DATA AVAILABILITY STATEMENT

Data are available upon reasonable request.

#### ORCID

Siziwe Sibutha  <https://orcid.org/0009-0000-5196-5476>

Charles Byaruhanga  <https://orcid.org/0000-0002-5368-6400>

Ishmael Festus Jaja  <https://orcid.org/0000-0002-9310-6511>

#### REFERENCES

- Adesokan, H. K., & Adeoye, F. A. (2019). Porcine cysticercosis in slaughtered pigs and factors related to *Taenia solium* transmission amongst abattoir workers in Ibadan, Nigeria. *Pan African Medical Journal*, 32, Article 145. <https://doi.org/10.11604/pamj.2019.32.145.10695>
- Bibi, S., Kamran, M., Ahmad, H., Bibi, K., Naqvi, S. K. U. H., Zuo, Q., Shah, N. A., & Cao, J. (2023). Knowledge, attitudes and practices regarding taeniasis in Pakistan. *Diseases*, 11(3), 95. <https://doi.org/10.3390/diseases11030095>
- Carabin, H., Ndimubanzi, P. C., Budke, C. M., Nguyen, H., Qian, Y., Cowan, L. D., Stoner, J. A., Rainwater, E., & Dickey, M. (2011). Clinical manifestations associated with neurocysticercosis: A systematic review. *PLoS Neglected Tropical Diseases*, 5(5), e1152. <https://doi.org/10.1371/journal.pntd.0001152>
- Carabin, H., & Traoré, A. A. (2014). *Taenia solium* taeniasis and cysticercosis control and elimination through community-based interventions. *Current Tropical Medicine Reports*, 1(4), 181–193. <https://doi.org/10.1007/s40475-014-0029-4>
- Census. (2023). *Statistical release* (Vol. 3). [www.statssa.gov.za](http://www.statssa.gov.za)
- Kabululu, M. L., Johansen, M. V., Lightowlers, M., Trevisan, C., Braae, U. C., & Ngowi, H. A. (2023). Aggregation of *Taenia solium* cysticerci in pigs: Implications for transmission and control. *Parasite Epidemiology and Control*, 22, e00307. <https://doi.org/10.1016/j.parepi.2023.e00307>
- Kyvsgaard, N. C., Johansen, M. V., & Carabin, H. (2007). Simulating transmission and control of *Taenia solium* infections using a Reed-Frost stochastic model. *International Journal for Parasitology*, 37(5), 547–558. <https://doi.org/10.1016/j.ijpara.2006.11.018>
- Makingi, G., Ngowi, B., Mkupasi, E., Wilson, C., Winkler, A. S., Nzalawahe, J., & Ngowi, H. (2023). Community health-education intervention trial against human *Taenia solium* taeniasis/cysticercosis in central and southern zones of Tanzania. *Pathogens*, 12(7), 955. <https://doi.org/10.3390/pathogens12070955>
- Mendlovic, F., Fleury, A., & Flisser, A. (2021). Zoonotic Taenia infections with focus on cysticercosis due to *Taenia solium* in swine and humans. *Research in Veterinary Science*, 134, 69–77. <https://doi.org/10.1016/j.rvsc.2020.11.015>
- Mohd Yusof, A. M., Rahman, N. A. A., & Haque, M. (2018). Knowledge, attitude, and practice toward food poisoning among food handlers and dietetic students in a public university in Malaysia. *Journal of Pharmacy and Bioallied Sciences*, 10(4), 232–239. [https://doi.org/10.4103/jpbs.JPBS\\_141\\_18](https://doi.org/10.4103/jpbs.JPBS_141_18)
- Murrell, K. D., & Dorny, P. (2005). *WHO/FAO/OIE guidelines for the surveillance, prevention and control of taeniasis/cysticercosis* (Vol. 4). OIE (World Organisation for Animal Health), WHO (World Health Organization), FAO (Food and Agriculture Organization). <http://www.oie.int>
- Ndhleve, S., Nakin, M. D. V., & Longo-Mbenza, B. (2017). Impacts of supplemental irrigation as a climate change adaptation strategy for maize production: A case of the Eastern Cape Province of South

- Africa. *Water SA*, 43(2), 222–228. <https://doi.org/10.4314/wsa.v43i2.06>
- Ngwili, N., Thomas, L., Githigia, S., Johnson, N., Wahome, R., & Roesel, K. (2022). Stakeholders' knowledge, attitude, and perceptions on the control of *Taenia solium* in Kamuli and Hoima Districts, Uganda. *Frontiers in Veterinary Science*, 9, Article 833721. <https://doi.org/10.3389/fvets.2022.833721>
- Ntivuguruzwa, J. B., Michel, A., Byaruhanga, C., Gashururu, R., Kolo, F. B., & vanHeerden, H. (2021). Awareness and occupational exposure to Brucellosis and other zoonotic diseases among abattoir workers in Rwanda. *Research Square*. <https://doi.org/10.21203/rs.3.rs-1012737/v1>
- Nyangi, C., Stelzle, D., Mkupasi, E. M., Ngowi, H. A., Churi, A. J., Schmidt, V., Mahonge, C., & Winkler, A. S. (2022). Knowledge, attitudes and practices related to *Taenia solium* cysticercosis and taeniasis in Tanzania. *BMC Infectious Diseases*, 22(1), Article 534. <https://doi.org/10.1186/s12879-022-07408-0>
- Popoola, O. O., Monde, N., & Yusuf, S. F. G. (2019). Perception and adaptation responses to climate change: Smallholder livestock farmers in Amathole District Municipality, Eastern Cape Province. *South African Journal of Agricultural Extension*, 47(2), 46–57. <https://doi.org/10.17159/2413-3221/2019/v47n2a502>
- Sankhyan, P., Gupta, S., & Singh, G. (2015). Knowledge about, attitudes towards, practices regarding *Taenia solium* cysticercosis among people attending an epilepsy clinic in India. *International Journal of Epilepsy*, 2(1), 6–10. <https://doi.org/10.1016/j.ijep.2015.03.003>
- Shyaka, A., Rujeni, N., Kanyamibwa, E. I., Kagabo, G., Fèvre, E. M., & Quinnell, R. J. (2024). High prevalence of porcine cysticercosis in slaughtered pigs in Rwanda: An abattoir survey. *PLoS Neglected Tropical Diseases*, 18(10), e0012598. <https://doi.org/10.1371/journal.pntd.0012598>
- Sithole, M. I., Bekker, J. L., & Mukaratirwa, S. (2020). Consumer knowledge and practices to pork safety in two *Taenia solium* cysticercosis endemic districts in Eastern Cape Province of South Africa. *BMC Infectious Diseases*, 20(1), Article 107. <https://doi.org/10.1186/s12879-020-4839-9>
- Tumusiime, D., Mugabi, K., Nakanjako, G., Namayanja, J., Ademun, A., Ndyababo, S., Ayebazibwe, C., Nizeyimana, G., Okuthe, S., & Magona, J. (2020). Level of disease risk knowledge among abattoir workers in Mukono and neighbouring districts, Uganda. *International Journal of Biology Sciences*, 2(2), 8–17. <https://doi.org/10.33545/26649926.2020.v2.i2a.47>
- Van Damme, I., Pray, I., Mwape, K. E., Trevisan, C., Coudenys, F., Mubanga, C., Mwelwa, C., Vaernewyck, V., Dorny, P., O'Neal, S. E., & Gabriël, S. (2022). Movements of free-range pigs in rural communities in Zambia: An explorative study towards future ring interventions for the control of *Taenia solium*. *Parasites and Vectors*, 15(1), Article 150. <https://doi.org/10.1186/s13071-022-05264-0>
- WHO. (2016). *Taenia solium Taeniasis/cysticercosis diagnostic tools report of a stakeholder meeting* (Vol. 4). <https://www.cabdigitallibrary.org/doi/full/10.5555/20163387967>
- Wilson, C., Nonga, H. E., Mdegela, R. H., Churi, A. J., Mkupasi, E. M., Winkler, A. S., & Ngowi, H. A. (2023). Knowledge, attitudes and practices regarding porcine cysticercosis control among smallholder pig farmers in Kongwa and Songwe districts, Tanzania: A cross-sectional study. *Veterinary Parasitology: Regional Studies and Reports*, 44, 100912. <https://doi.org/10.1016/j.vprsr.2023.100912>
- Zulu, G., Mwape, K. E., Welte, T. M., Simuunza, M. C., Hachangu, A., Mutale, W., Chembensofu, M., Sikasunge, C. S., Phiri, I. K., & Winkler, A. S. (2023). Community knowledge, attitudes and practices related to *Taenia solium* taeniosis and cysticercosis in Zambia. *PLoS Neglected Tropical Diseases*, 17, e0011375. <https://doi.org/10.1371/journal.pntd.0011375>

**How to cite this article:** Sibutha, S., Byaruhanga, C., & Jaja, I. F. (2026). Knowledge, attitudes, and practices of abattoir workers about *Taenia solium* cysticercosis in the Eastern Cape Province, South Africa. *Natural Sciences Education*, 55, e70038. <https://doi.org/10.1002/nse2.70038>