Original Research Article

PREVALENCE AND RISK FACTORS ASSOCIATED WITH *TAENIA SAGINATA* INFECTION IN THE RURAL COMMUNITY OF FARTA WOREDA, NORTHWEST ETHIOPIA

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Abstract: Introduction: *Taenia saginata* (*T. saginata*) is an adult cestode intestinal parasite by which human beings are infected when they consume raw beef. Infection with this parasite is highly prevalent in sub-Saharan Africa and Ethiopia is one of the heavily affected countries.
Objective: To assess the prevalence and risk factors associated with *T. saginata* infection in the rural community of Farta woreda, Northwest Ethiopia.
Method: A community-based cross-sectional study was undertaken for this study. Multistage and systematic random sampling was used to get the total sample size of 846 participants. A pre-tested and structured interview was used to collect data. The data was entered and SPSS statistical software to analyze the date by using multivariate logistic regression.
Results: The study showed that prevalence of *T. saginata* infection was 26.6%. The habit of consuming raw beef (Adjusted Odds Ratio/AOR= 6.2, 95% CI 4.07, 8.3), duration of time before consuming salted dried raw beef (AOR=6.8, 95% CI 1.98, 9.5), gender (AOR=0.54, 95%CI 0.68, 0.77) and knowledge about *T. saginata* infection (AOR= 0.013, 95% CI 0.01, 0.32) were significantly associated with the prevalence of *T. saginata*. However, other factors including practice of eating salted beef, age and educational background did not show significant association with the prevalence.
Conclusion: The prevalence of *T. saginata* infection found in this study was high (26.6%) in the rural community of Farta woreda. Furthermore, important public health factors of the disease (including raw beef eating practices and knowledge about *T. saginata* infection) have been also been revealed which could be useful for the government and other responsible bodies working in disease prevention and control activities.

Key words: *T.saginata*, prevalence, risk factors, Farta Woreda.

1. Introduction
The parasitic disease taeniasis is universally distributed in low income countries as well as in high income countries even though the former face a very high burden. It's caused by infection with *Taenia saginata*, an adult cestode intestinal

parasite, by which human beings are infected when they consume raw beef [1]. Usually, the patients are asymptomatic, but in severe infections accompanied with symptoms like nausea, abdominal discomfort, epigastric pain, diarrhea, excessive appetite or loss of appetite, weakness, loss of weight and intestinal blockage. However, when a person is infected with cysticerci, various clinical signs may occur depending on the location of the cysts in the organs, muscles or subcutaneous tissues [2].

As per an estimate, 50 million cases of such infection occur worldwide with 50,000 people dying from this problem annually .The infection is particularly highly prevalent in Africa, Latin America, and Asia as well as in some Mediterranean countries; among which about 40% live in Africa. The highly endemic areas include the Central and Eastern African countries including Ethiopia, Kenya, and Zaire [3]. In East African counteries prevalence rate of 30% to 80% have been noted. In many eastern countries, this consitutes a serious but sometimes less recognized public health problem [4].

Ethiopia is one of the heavily affected countries with taeniasis [6]. In most of the Ethiopian communities, the habit of eating raw meat such as *"Kurt" and "Kitffo"* is the cause of *T. saginata* infection. Furthermore, defecation in open grazing lands facilitates the spread of T. saginata infection in the community [5]. The prevalence of *T. saginata* infection in Ethiopia is reported to be up to 70% of the population. In addition to varous associated factors, this wide prevalence is also attributable to the low availability of taenicides and the use of herbal drugs could not eliminate this parasite from human population [6, 7]. A study conducted in Jimma, for instance, showed the prevalence of the disease was 56.7% a and out of this group, 95% of the positives were found as they use modern drugs while only 5% of them use traditional herbal drugs [8].

FAO contributed to a number of initiatives including the establishment of a Global Campaign for Combating Cysticercosis (GCCC). This initiative envisages the establishment of an International Cysticercosis Coordinating Center (ICCC) and regional working groups for cysticercosis in the different endemic regions of the world, modeled on the Cysticercosis Working Group in Eastern and Southern Africa. One of the aims was to promote awareness and stimulate mobilization of resources for research and control of cysticercosis [9].

T. saginata infection is one of the zoonotic diseases that have got low level of attention from public health researchers and others concerned bodies. However, such kind of disease should have got enough consideration since the chance of recurring is high as evidenced by the current high prevalence despite all efforts being done. In Ethiopia, despite there were studies conducted in relating to *T. saginata* infection, their focus was mainly on institution based rather than to assess public health important of *T. saginata* infection throughout the community. Thus, this study was designed with an attempt to overcome the research gap on the current realities of *T.saginata* prevalence and associated risk factors for this neglected disease in the rural community of Farta woreda, North West Ethiopia.

5. Materials and Methods

5.1. Study design

A cross-sectional descriptive study was used to assess the prevalence and factors associated with *T. saginata* infection from the selected nine Kebeles.

5.2. Study area and period

The study was conducted from April 2014 up to July 2014 in the rural community of Farta Woreda, which is one of the thirteen woredas of South Gondar Administrative Zone. In the Woreda, the population of Debere Tabor town is 232,018 and the population of the rural community is 203, 181. The majority of religion practiced in the area is Ethiopian Orthodox Christianity with about 96 % while about 2.54% of the population is Muslim (ANRS Geographical data base, 2007).

5.3. Target population and study population

All the people living in the rural communities of Farta woreda were the target population. All the people who have been living in the nine Kebeles

selected randomly from entire forty-three kebeles in the rural communities of Farta Woreda were considered as the study population as shown below on Figure 1.

5.4. Sample population, sampling unit and study units

All individuals who were above 18 years old age in the selected Kebeles were sample population. Those households selected by systemic random sampling were sampling units and the study units were individuals in the selected households.

5.5. Sample size calculation and sampling procedure

The required sample size of the study participants was determined by single population proportion formula as given below.

$$n = \frac{(Z_{\alpha/2})^2 \, P \, (1-P)}{d^2} = \frac{(1.96)^2 \, (0.05)(0.05)}{(0.05)^2} = 384$$

Assumptions;

n = the number of households to be interviewed

Z = standardized normal distribution value for the 95% confidence interval (CI), which is 1.96

P = 50% (expected prevalence of *T. saginata* infection)

d = the margin of error is taken as 5%

Since multistage sampling technique was used, the sample size was multiplied by the design effect to get the final sample size. By taking the design effect as two, the required sample size was calculated to 768. Considering 10% non-response rate, the final sample size was 845.

Multistage sampling technique was used to select the study participants. Nine Kebeles were selected by random sampling technique from all the Kebeles. Households from each Kebele were proportionally selected every k^{th} (16th) interval by systematic random sampling technique. If there were more than one individual within the same house, lottery method was used to select the respondents to be included in the study.

5.6. Variables

The independent variables considered were socio-demographic variables (educational back ground, gender, age, marital status and occupation), behavioral variables (habit of consumption raw beef, habit of consuming dried raw beef, practice of salting raw beef and duration of time before consuming salted dried raw beef) and knowledge about *T. saginata* infection. The dependent variable considered in this study was prevalence of *T. saginata* infection.

5.7. Data collection and quality assurance

A questionnaire was developed according to the objectives of the study. It's prepared in English and translated to the local language Amharic. During preparation and translation of the questionnaire, great effort was made to make it precise and easy understandable.

Data was collected on face to face interview using the structured and pre-tested questionnaire after getting their pre-informed consent for voluntary response. The data collectors and supervisors listen, read and write Amharic (local language) very well. Data collectors and supervisors have knowledge of the communities' cultural background. During training of data collectors and supervisors, due attention was given to the purpose and scope of the study, how to approach the respondents and how to conduct the interview. All interviewees were assured for confidentiality.
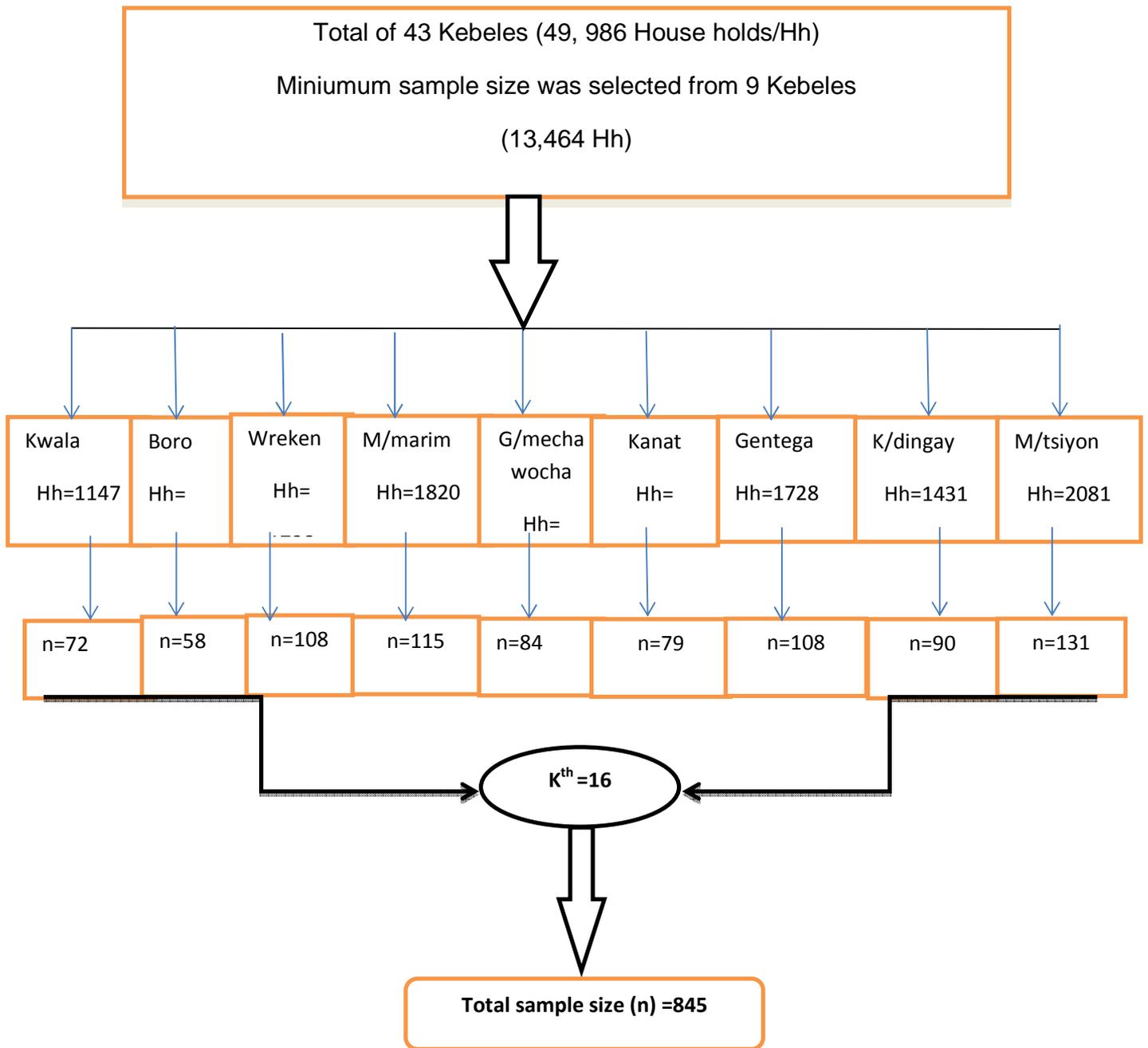
Figure 1. Schematic presentation of sampling procedure and sample size

For reliability (quality) of questionnaire, pretests were performed in 30 persons among the individuals outside the study site before doing the actual data collection. The questionnaires were revised in the light of pretest results. The whole process of interview was closely monitored by the researchers to ensure clear understanding of the questions. Every day after data collection, questionnaires were reviewed and checked for completeness by the supervisors and principal investigator and the necessary feedback was offered to data collectors in the next morning.

5.8. Data management and analysis

The structured interview questionnaire response of each respondent was recorded on perform tally sheets and preliminary analysis was done in Microsoft Excel. The questionnaire data were also summarized and analyzed using SPSS version 20 to assess the prevalence and factors association with *T. saginata* infection among different respondents by means of binary and multivariate logistic regression. In all the statistical tests a confidence level of 95% and $p < 0.05$ was considered significant.

6. Ethical approval

The proposal was reviewed and approved by the Institutional Review Board (IRB) in Bahir Dar University jointly with Gamby Collage of Medical Science. Permission to conduct this study was obtained from Farta Woreda administrator and Woreda Health Office. All selected participants were communicated about the study in order to obtain their written consent before administering questionnaires. Participants were also informed that they have full right to discontinue or refuse to participate in the study. They were also informed that all data obtained from them would be kept confidential. Each respondent was informed about the objective of the study in that his /her full and honest response would contribute necessary information for policy makers and other concerned bodies for the prevention and control of the disease.

7. Results

A total of 846 individuals whose age was 18 and above years participated in the questionnaire interview. Out Of these, 68(8%) responded or filled inconsistently and were excluded from the analysis. Hence, the response rate was 92% and the final analysis of data was made based on 778 completed questionnaires.

8.1. Socio-demographic characteristics of the respondents

There were 778 subjects in selected nine study Kebeles within the rural community of Farta woreda. Age of the subjects varied from 18 to 67 years. The mean (±SD) age of the respondents was 35.83(±11.44) years. There were 470 male (60.4%) and 308 female (39.6%) respondents. Regarding to their marital status, the majority of study participants were married 762(97.9%) and 16(2.1%) were widowed. With regard to their educational back ground, 678(87.2%) were unable to read and write while the remaining 100(12.7%) were able to read and write (without formal education). Concerning their occupation, 721 (92.7%) were farmers and 57 (7.3%) were merchants.

8.2. Habit of raw beef eating practices and knowledge about T.saginata infection

With regard to the habit of consuming raw beef, 425(54.6%) of the study participants do consume raw beef and 353(45.4%) had never consumed raw beef. On the other hand, 528(67.9%) of the respondents had never consumed dried raw beef and 250(32.1%) had the habit of consuming dried raw beef. Among those subjects who admitted consuming dried raw beef, 110(44%) were practicing salting and the rest 140(56%) were not practicing salting. Out of the 110(44%) respondents who claimed salting, 45(40.5%) usually consume salted dried raw beef before two weeks and the remaining respondents 65 (59.5%) were consuming salted dried raw beef after 2 weeks.

Table: 1. Selected Socio-demographic characteristics of respondents

Characteristics	Number (n)	Percent (%)
Gender		
Male	470	60.4
Female	380	39.6
Age (Mean ± SD, 35.84±11.44)		
18-40	531	68.3
41-67	247	31.7
Marital status		
Married	762	97.9
Window	16	2.1
Educational back ground		
Unable to read and write	678	87.2
Able to read and write (no formal education)	100	12.8
Occupation		
Farmer	721	92.7
Merchant	57	7.3

Concerning about knowledge about *T. saginata* infection, the majority of the respondents 640(82.3%) don't have knowledge about *T. saginata* infection and 38(17.7%) claimed have knowledge about *T. saginata* infection. Among those who have knowledge about *T. saginata* infection, the majority 121(88.9%) acquired the information from health professionals while 15(11.1%) of subjects acquired the information from mass media.

Table 2. Raw beef eating practices and knowledge about T . saginata infection in this study

Variables	Number (n)	Percent (%)
Habit of consuming raw beef		
Yes	425	54.6
No	353	45.4
Habit of consuming dried raw beef		
Yes	250	32.9
No	528	67.9
Method of preservation		
Salting	110	44
Not salting (open air drying)	140	56
Duration time before to consume salted dried raw beef		
Before two weeks	45	40.5
After two weeks	69	59.5
Knowledgeable about T. saginata infection		
Yes	138	17.7
No	640	82.3

8.3. Factors associated with prevalence of T. saginata infection

The effects of different independent variables were tested for their association with the prevalence of *T. saginata* infection by logistic regression analysis.

8.3.1. Socio-demographic determinants

This study demonstrated that there were significant associations between the prevalence of *T. saginata* infection and predictor variables gender, age and educational back ground. Male study participants were found to be two times more likely infected by *T. saginata* infection than female subjects (Crude Odds Ratio/COR: 1.86 and 95%CI: 0.38, 0.77) and subjects whose age group were from 40-67 was more likely to be infected by *T. saginata* infection than subject whose age group were from 18-40 (COR: 1.484 and CI: 1.062, 2.073). Similarly, individuals who are unable to read and write were more likely to be infected by *T. saginata* infection than subject who can read and write (COR: 2.509 and 95%CI: 1.442, 4.365) in this study. Whereas, occupation and marital status of subjects didn't show significant associations in this study as shown below on Table 3.

Table 3. Socio-demographic determinates for the prevalence of *T. saginata* infection in this study.

Variables	Prevalence of *T. saginata*		COR (95% CI)
	Yes	**No**	
Gender			
Male	148(31.4%)	322 (69.6%)	1.86(0.38, 0.77)*
Female	61(19.8%)	247 (79.2%)	1
Age			
20-40	130(19.6%)	531(79.1%)	1
41-67	79 (31.9%)	168 (68.15%)	1.45 (1.04, 2.02)*
Educational back ground			
Unable to read and write	192(29%)	469(71%)	2.408 (1.4, 4.13)*
Able to read and write	17(17%)	100(83%)	1
Marital status			
Married	203(26.6%)	559(74.4%)	0.6 (0.59, 4.6)
Widowed	6(37.5%)	10(63.5%)	1
Occupation			
Farmer	196(27.2%)	525(62.8%)	1.26 (0.66, 2.39)
Merchant	13(22.8%)	44(77.2%)	1

Note: * COR values indicate significant associations.

8.3.2. Behavioral determinates and knowledge about T saginata infection

Habit of consuming raw beef is found to be one of the most important predictors to the prevalence of *T. saginata* infection (COR=4.75, and 95% CI: 3.5, 8.45) which indicates that subjects who consume raw beef are 5 times more likely to be infected by *T. saginata* infection than subjects who do not consume raw beef. Similarly, the habit of consuming dried raw beef is found to have significant association for the prevalence of *T. saginata* infection (COR=1.45 and 95% CI: 1.04, 2.02) in this study.

The practice of salting of raw beef before consumption was significantly associated with the prevalence of *T. saginata* infection in this study (COR=2.59 and 95% CI: 1.46 4.59). The duration of time before to consume salted dried raw beef was also found to have significant association with the prevalence of *T. saginata* infection in between subjects who consume salted dried raw beef before 2 weeks versus subjects who consume salted dried raw beef after 2 weeks. (COR=3.62 and 95% CI: 1.38, 9.51).

Similarly, individuals who do not have knowledgeable about *T. sginata* infection were 3 times more likely infected by *T. saginata*

infection than knowledgeable subjects (COR= 3 and 95% 1.76, 2.56) in this study as shown below on Table 4.

Table 4. Association of behavioral determinants and knowledge about *T saginata* infection for the prevalence of T. saginata infection in this sstudy.

Variables	Prevalence of *T. saginata* infection		COR (95% CI)
	Yes	No	
Habit of consuming raw beef			
Yes	166(39%)	259(61%)	4.62(3.18, 6.71)*
No	43(12.2%)	310(87.8%)	1
Habit of consuming dried raw beef			
Yes	80(32%)	170(68%)	1.45(1.04, 2.02)*
No	129(24.4%)	399(66%)	1
Practice of salting raw beef			
Yes	23(20.9%)	87 (79.1%)	1
No	57 (40.7%)	83(60.3%)	2.59(1.46, 4.59)*
Duration of time before consuming salted dried raw beef			
Before two weeks	5 (33.3%)	30(66.7%)	3.62(1.38, 9.51)*
After two weeks	8(12.1%)	58(77.9%)	1
Knowledge about T. saginata infection			
Knowledgeable	17(14%)	121(86%)	1
Not knowledgeable	190(30%)	450(70%)	3 (1.76, 5.13)*

Note: * COR values indicate significant associations.

8.4. Multivariate analysis

Variables that were significantly associated at the bivariate analysis were further examined in the multivariate logistic regression to see their relative effects on the prevalence of *T. saginata* infection.

The prevalence of *T. saginata* infection kept on significant association with habit of consuming raw beef, duration of time before consuming salted dried raw beef, gender and knowledge about *T. saginata* infection. But the rest of the variables did not show significant association. Subjects who have habit of consuming raw beef were 6 times more likely to contract *T. saginata* infection than those who do not consume raw beef (AOR=6.2, 95%CI 4.07, 8.3). Similarly, duration of time to consume salted dried raw beef before 2 weeks versus after 2 weeks in subjects has showed strong association with the prevalence of *T. saginata* infection in this study (AOR=6.8, 95%CI 1.98, 9.5). Knowledge about *T. saginata* infection showed protective effect to contract *T. saginata* infection in subjects (AOR=0.013, 95%CI 0.00, 0.327). Simlarly, gender has also shown protective effect for *T. saginata* infection in that females appear to be less likely get exposed to *T. saginata* infection than males in this study (AOR=0.062, 95%CI 0.006, 0.645).

Even though educational back ground, age, habit of consuming dried raw beef and practice of salting raw beef were found to have significant association with the prevalence of *T. saginata* infection in the bivariate analysis, their association lost its significance in the multivariate analysis of this study as shown below on Table 5.

Table 5. Multivariate analysis for factors associated with prevalence of T. saginata infection in this study.

Variables	Prevalence of *T. saginata* Infection		COR (95%CI)	AOR (95%CI)
	Yes	**No**		
Habit of consuming raw beef				
Yes	166(39%)	259 (61%)	4.62(3.18, 6.71)	6.2(4.07, 8.3)*
No	43(12.2%)	310(87.8%)	1	1
Habit of consuming dried raw beef				
Yes	80(32%)	170(68%)	1.45(1.04, 2.02)	2.2 (0.86.3.45)
No	129(24.4%)	399(66%)	1	1
Practice of salting raw beef				
Salting	23(20.9%)	87(79.1%)	1	1
No salting	57 (40.7%)	83(60.3%)	2.59(1.46, 4.59)	3.24(0.95, 7.4)
Duration of time before consuming salted dried raw beef				
Before two weeks	5 (33.3%)	30(66.7%)	1.45(1.04, 2.02)	6.8(1.98, 9.5)*
After two weeks	8(12.1%)	58(77.9%)	1	1
Knowledge about *T.saginata* infection				
Knowledgeable	19(14%)	119(86%)	0.33(0.19, 0.56)	0.013(0.0,1 0.32)*
Not Knowledgeable	190(30%)	450(70%)	1	1
Gender				
Female	148(31.4%)	322 (69.6%)	0.062 (0.006, 0.64)	0.54(0.38,0.77)*
Male	61(19.8%)	247 (79.2%)	1	1
Age				
18- 40	130(19.6%)	531(79.1%)	1	1
41-67	79 (31.9%)	168 (68.15%)	1.45 (1.04, 2.02)	1.037 (0.22, 4.89)
Educational back ground				
Unable to read and write	192(29%)	469(71%)	2.408 (1.4, 4.13)	1.56(0.098, 25.1)
Able to read and write	17(17%)	100(83%)	1	1

Note: * values of AOR indicate significant associations.

9. Discussion

The current study indicated the existence of high prevalence of *T. saginata* (26.6%) infection in Farta woreda. The result observed in this study is very high as compared with those studies reported in high income countries including USA, Canada, Australia and South America which was as high as about 0.5% only [10]. The differences in the prevalence of this parasitic disease can be attributed for the cultural difference especially the habit of consuming raw beef *('kitffo' or 'kurt')* in Farta Woreda and the low level of knowledge about *T. saginata* infection in the Woreda. However, the value observed in this study is lower than prevalence of *T. infection* repored previously in different parts of Ethiopia including Jimma (56.7%) [14], Shire Indassilasise (55.1%) [11]

and Wolaita soddo (44.4%) [13]. This may be due to differences in sample size, nature of study areas and the period that the studies were conducted.

Regarding factors associated with *T. saginata* infection, the study found that the habit of raw beef consumption is one of behavioral variables that showed significant association with prevalence of *T. Saginata* infection. Subjects who consume raw beef were 6 times more likely infected by *T. saginata* than those who do not consume raw beef in this study and this finding was consistent with other studies that were conducted in Zeway (11 times), Sebeta (9 times), Jimma (4 times), Shire indessilasie (3.47 times) and Wolita sodo (6.9 times) [13-17].

This study also revealed that gender has significant association with prevalence of *T.*

saginata infection. Females appear to be less likely get exposed to *T. saginata* infection than males (AOR=0.062, 95%CI 0.006, 0.645). This finding is consistent with similar studies that were conducted in other parts of Ethiopia including Shire Indisilassie and Sabeta [11, 15]. This gender difference in *T. saginata* infection may be due to differences in the frequent consumption of raw beef with local drinks such as *"Tella"* and *"Tejj"* among men than women in the area.

This study also illustrated a wide variation in prevalence of *T. saginata* infection between knowledgeable and non-knowledgeable individuals about this parasitic disease. Knowledgeable subjects have protective effect to *T. saginata* infection than subjects who have no knowledge about *T. saginata* infection and this finding was also similar with other studies that were conducted in other parts of the country including Wolita Soddo and Jimma [13, 14]. Knowledgeable subjects are expected to have awareness about *T. saginata* infection which in turn are more likely not to consume raw beef and seek modern health care may attribute for the low prevalence of this disease in these individuals.

This study also found that there is an association between duration of time before consuming salted dried raw beef and prevalence of *T. saginata* infection. Subjects who consume salted dried raw beef before two weeks were seven times more likely infected by *T. saginta* compare to those who consume after two weeks which may indicate that the period of salting to consume raw beef should be for more than 2 weeks. Because merely mincing and/ or practice of salting raw beef for less time has no valuable effect to kill the larval stage (viable cysticerci) from the beef.

11. Conclusion

The prevalence of *T. saginata* infection has found to be high in Farta Woreda. The habit of consuming raw beef without salting and drying it for more than two weeks is the main factor revealed to expose for *T. saginata* infection. Similarly, men were found more likely to be exposed to *T. saginta* infection than women and people who don't have knowledge about *T.*

*saginat*a infection were highly exposed to the infection. Awareness should be created for the community (in the area) about eating habits of raw beef, transmission and treatment options of *T. saginata* in addition to the need of appropriate meat inspection regulations.

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