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Prevalence of Human Taeniasis in Odeda Area of Ogun State, Nigeria

H. O. Mogaji[1*], A. A. Adeniran[1], M. T. Fagbenro[1], D. B. Olabinke[1], E. M. Abe[2] and U. F. Ekpo[1]

[1]Department of Pure and Applied Zoology, Federal University of Agriculture, Abeokuta, Nigeria.
[2]National Institute of Parasitic Disease and Control, China Centre for Disease Control, P.R. China.

Authors' contributions

This work was carried out in collaboration between all authors. Authors HOM and UFE conceptualized the study and wrote the protocol. Field works and laboratory analysis were carried out by authors HOM, AAA, MTF and DBO. Authors MTF, HOM and EMA did the statistical analysis and literature searches while author MTF wrote the first draft of the manuscript. All authors contributed to the final draft and approved its submission.

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ABSTRACT

This study investigated the prevalence of taeniasis among school-aged children in Odeda area of Ogun state, Nigeria. Four hundred and twenty-eight school-aged children were recruited and demographic information were obtained using a simple questionnaire. Faecal samples were also collected, processed using ether concentration method and examined for ova/proglottids of *Taenia spp* under a light microscope. Data obtained were analysed using IBM SPSS 20.0 statistical software. Of the 428 (100%) children, 226 (52.8%) were females and 202 (47.2%) were males. By age category, 238 (55.6%) of the children were within age category 11-15 years, while 190 (44.4%) belonged to the younger age category (5-10 years). Children who were from a christian family 236 (55.1%) were more in numbers compared to children 192 (44.9%) from an islamic parental background, and majority of the children recruited into the study had parents who can read and write. An overall prevalence of 175 (40.9%) was recorded for taeniasis. Although significant difference donot exist (P>0.05) between *Taenia spp* infection and demographic variables, the

**Corresponding author: Email: mogajihammed@gmail.com;*

overall prevalence reported portrays a serious public health problem that requires urgent attention. There is thus a need for more full-scale investigation of *Taenia spp* prevalence in Nigeria, in the phase of planning for appropriate prevention and control strategy.

Keywords: Taeniasis; children; prevalence; Odeda; Nigeria.

1. INTRODUCTION

Taeniasis is a neglected zoonotic disease caused by segmented parasitic tapeworms belonging to family Taeniidae, and subclass Cestoda. Certain identified *Taenia spp.* includes *Taenia solium*, *Taenia saginata*, *Taenia crassiceps, Taenia ovis*, *Taenia taeniaeformis, Taenia hydatigena, Taenia multiceps*, *Taenia serialis, Taenia asiatica*, and *Taenia brauni* [1]. *Taenia saginata (T. saginata)* and *Taenia solium (T. solium) are* the most common parasitic tapeworm, with wide distribution in Latin America, Southeast Asia and Africa [1,2,3].

T. saginata and *T. solium* have an indirect life cycle, cycling between a definitive and an intermediate host, and are prevalent in areas where poverty, poor sanitation and intimate contact between human and livestock, most especially pigs is common [4,5,6]. Humans acquires infection when they consume raw or minimally cooked infected beef (in case of *T. saginata*), or infected pork (in case of *T. solium*), and they serve as the definitive host for both and intermediate host for *T. solium* [7].

Although infection with adult *T. saginata* / *T. solium* (a condition referred to as taeniasis) are asymptomatic, infected children could present mild symptoms such as abdominal pain, diarrhea, constipation, nausea, decreased or increased appetite, and weight loss [1]. However, infection with the larva of *T. solium* (a condition referred to as cysticercosis) is symptomatic, with symptoms varying with the location and number of larvae. Most symptoms are result of either inflammation during larval degeneration or a mass effect from the parasite. Common symptoms include chronic headaches, seizures, nausea, vomiting, vertigo, ataxia, confusion or other changes in mental status, behavioral abnormalities, progressive dementia, and focal neurologic signs [1]. The most serious form of cysticercosis is neurocysticercosis which occurs as a result of events such as blockage of the cerebrospinal fluid by a floating larva [8]. The proportion of neurocysticercosis among people with epilepsy has been found to be more than 29% in endemic countries [9].

In Nigeria, prevalence of human taeniasis have been little investigated as compared to other protozoan and helminths parasites such as *Ascaris lumbricoides*, *Trichuris trichiura*, hookworm, *Entamoeba spp* among others [10,11]. Few epidemiological studies within the country have reported the prevalence of taeniasis among their subjects [12,13,14]. Nevertheless, taeniasis prevalence and intensity data in human populations are needed as the disease is becoming increasingly recognized as a serious and emerging threat of public health concern [2]. This study therefore investigated the prevalence and intensity of taeniasis in some rural communities in Odeda area of Ogun state, Nigeria.

2. MATERIALS AND METHODS

2.1 Study Area

This study was carried out in Odeda local government area (LGA) of Ogun State, South Western Nigeria. Odeda LGA is one of the twenty LGA in Ogun state. The area is located within longitude 2°45¹00 ″E and 3°55¹00 ″E and latitude 7°01¹00 ″N and 7°18¹00 ″N, with a projected population of 137,377 in 2014.

2.2 Study Design and Target Population

This study was cross-sectional in design, involving eight communities across the LGA. A public primary school in each of the community was randomly selected, and used as a sampling point (Table 1). School-aged children resident in the community and attending the school were recruited as study participants.

2.3 Ethics Statement

Ethics clearance was received from Federal University of Agriculture, Abeokuta ethics review board and Department of Public Health and Disease control, Ogun state Ministry of health. Field permits were also obtained from Ogun state Ministry of Education, Science and Technology and Zonal Education Officer of Odeda local government area (LGA). Informed consent was given by parents and guardians of selected

Table 1. List of rural communities surveyed in Odeda area of Ogun State

SN	Communities surveyed	Schools located at centre of the community	School enrolment	Number of school-aged children sampled
1	Osiele	St. Mary primary school Osiele	628	43
2	Aaya	Community primary school Aaya	196	40
3	Obantoko	OLG primary school Obantoko	915	51
4	Orile Ilugun	St. James primary school Orile	492	61
5	Alabata	OLG primary school Alabata	425	55
6	Ijemo Fadipe	St. Anthony primary school Ijemo	245	58
7	Obete Akanbi	Baptist Day primary school Obete	138	64
8	Olugbo	St. Saviours primary school Olugbo	444	56
	Total		3483	428

children and children whose parents consented were invited to participate in the study. Children assents were obtained verbally and documented through a child assent form. Also, since the study was undertaken during class time at participating schools, authorizations from schools' headmasters were also sought in advance and only schools with such authorizations were approached for enrolment.

2.4 Sample Size Determination

Using the method of [15], the total number of children attending the public primary schools selected in each study community was used to determine the required sample size for the study. Considering a 95% confidence interval, an average of 45 school-aged children was required for the study per community from a total of 3483 enrolled school-aged children (Table 1).

2.5 Data and Stool Sample Collection

Children's general demographics (name, date of birth, sex of the child and literacy of parents) were obtained using a well structured questionnaire. A single faecal sample was collected from each child and taken to the Parasitology unit laboratory of the Department of Pure and Applied Zoology, Federal University of Agriculture Abeokuta within two hours of collection for preparation and analysis using Sodium acetate acetic acid formalin concentration method (SAF-Ether). Two slides each of one gram of stool was prepared accordingly and examined for ova or proglottids of *taenia* spp. *Taenia* eggs or proglottids were counted and the mean number of egg per one gram (EPG) of stool were recorded to determine infection intensities.

2.6 Statistical Analysis

Data obtained were entered by a researcher into Microsoft office Excel spreadsheet 2007 and verified for accuracy (compared with data in questionnaires) by a different researcher. Data were cleaned by checking for errors and missing values. Statistical analyses were done using IBM, SPSS Statistics version 20 (IBM. Somers, NY). Descriptive statistics for continuous variables and frequency (proportions) for categorical variables were used to describe the characteristics of the study population. Prevalence and intensity calculations of taeniasis were also made. Mean Egg per gram (EPG) of *Taenia spp* found was computed following logarithmic transformation of the raw EPG data. Prevalence and intensity estimates were cross tabulated with demographic data, and associations were determined using Pearson Chi square test. Analysis of variance (ANOVA) was used for comparing intensity estimates among surveyed communities. Significances was set at $P \leq 0.05$.

3. RESULTS

3.1 Demographic Information of Surveyed Children across Selected Communities

Table 2 shows the demographic information of surveyed children across the selected communities. Of the 428 children recruited into the study, 226(52.8%) were females and

202(47.2%) were males. By age category, 238 (55.6%) of the recruited children belonged to age category 11-15 years, while 190 (44.4%) belonged to the younger age category (5-10 years). Children who were from a christian family were more in numbers in the study 236(55.1%) compared to children 192(44.9%) from an islamic parental background. In addition, majority of the children recruited into the study had parents who can read and write.

3.2 Prevalence of Taeniasis among Surveyed Children across Selected Communities

An overall prevalence of 40.9% was recorded for taeniasis among the 428 children examined. Infection was highest among residents of Olugbo community 39(69.6%), followed by Obantoko community 31(60.8%), Aaya community 23(57.5%) and least prevalence was recorded at Alabata 5(9.1%). There exist significant differences (P<0.05) in the prevalence of taeniasis across the eight communities surveyed.

3.3 Prevalence of Taeniasis by Demographic Variables among Surveyed Children across Selected Communities

Table 4 shows the prevalence of taeniasis by demographic variables among the surveyed children across selected communities. Of the 175 infected children, 91(52.0%) and 84(48.0%) were male and females respectively. However there exist no significant difference (P>0.05) in infection by sex. Also, majority of the infected children 95(54.3%), belonged to the older age category (11-15 years) compared to their younger counterparts (5-10 years), with no significant differences (P>0.05). Children of literate mothers and fathers also had taenia infections more than those of illiterate parents, although with no significant differences (P>0.05). By religion, taenia infections were recorded more among children that are Christians 95(54.3%), compared to Islamic children 80 (45.7%), however there was no significant difference between both (P>0.05).

3.4 Intensity of Taeniasis among Surveyed Children across Selected Communities

An overall mean intensity of 0.3012±0.02008epg was recorded for taeniasis during the study. Olugbo community had the highest intensity for taenia infections with 0.5491epg, followed by Obantoko with 0.4559epg, Obete Akanbi with 0.4172epg, Aaya with 0.3604epg, Ijemo Fadipe with 0.2420epg, Orile Ilugun with 0.2164epg, Osiele with 0.0723epg and the least was recorded in Alabata community with 0.0624epg. Significant differences (P≤0.05) exists between mean intensities for taenia infections across the surveyed communities.

4. DISCUSSION

In most developing countries, livestock including pigs and cows are of great economic value as they serve as good source of protein, vitamins, minerals and fat [16]. However, the role of this livestock as an intermediate host in the transmission of *Taenia* infections cannot be ignored. Taeniasis have serious adverse health implications in humans and as well reduces the market value of pigs and cows, thus becoming an infection of both public health and agricultural importance [9].

Studies on human taeniasis are very limited in Ogun State, Nigeria. To the best of our knowledge, this is the first survey estimating the prevalence of human taeniasis in Odeda area and presumably other areas of Ogun State. An overall prevalence of 40.9% was recorded. This is substantially higher, compared to 8.40%, 9.6% and 14.3% reported by Eke et al. [17], Weka et al. [18] and Edia-Asuke et al. [19] in Nigeria. This prevalence is also higher than those reported in the studies of Kumar et al. [20] in Himalayas and Prasad et al. [21] in India, with prevalence rates of 30.3% and 38.0% respectively. Provision of improperly cooked beef and pork on exposed trays outside school premises after learning hours and also within communities by food vendors at night is a common characteristic of most rural communities in Nigeria [14]. Infections therefore could have been acquired from consumption of this locally-made available beef and/or pork, especially when roasted, grilled or fried with minimal heat [22].

The desire to consume half grilled or roasted beef and pork is usually more pronounced in males and this might be a probable reason why they were more infected than females in our study. This is in agreement with the findings other similar studies [12,19,23-25], but in contrast with that of Usip et al. [26] where females were more infected than male subjects.

Table 2. Demographic information of surveyed children across selected communities

	Comunities								
	Osiele NE (%)	**Aaya NE (%)**	**Obantoko NE (%)**	**Orile Ilugun NE (%)**	**Alabata NE (%)**	**Ijemo Fadipe NE (%)**	**Obete Akanbi NE (%)**	**Olugbo NE (%)**	**Total NE (%)**
Sex									
Male	9(20.9)	19(47.5)	24(47.1)	25(41.0)	31(56.4)	31(53.4)	36(56.2)	27(48.2)	202(47.2)
Female	34(79.1)	21(52.5)	27(52.9)	36(59.0)	24(43.6)	27(46.6)	28(43.8)	29(51.8)	226(52.8)
Total	43(100)	40(100)	51(100)	61(100)	55(100)	58(100)	64(100)	56(100)	428(100)
Age									
5-10	9(20.9)	21(52.5)	17(33.3)	43(70.5)	21(38.2)	29(50.0)	29(45.3)	21(37.5)	190(44.4)
11-15	34(79.1)	19(47.5)	34(66.7)	18(29.5)	34(61.8)	29(50.0)	35(54.7)	35(62.5)	238(55.6)
Total	43(100)	40(100)	51(100)	61(100)	55(100)	58(100)	64(100)	56(100)	428(100)
Religion									
Christainity	27(62.8)	23(57.5)	29(56.9)	44(72.1)	25(45.5)	37(63.8)	18(28.1)	33(58.9)	236(55.1)
Islam	16(37.2)	17(42.5)	22(43.1)	17(27.1)	30(54.5)	21(36.2)	46(71.9)	23(41.1)	192(44.9)
Total	43(100)	40(100)	51(100)	61(100)	55(100)	58(100)	64(100)	56(100)	428(100)
Mother literacy									
Yes	37(83.7)	31(77.5)	44(86.3)	35(57.4)	22(40.0)	50(86.2)	1(1.6)	49(87.5)	268(62.6)
No	7(16.3)	9(22.5)	7(13.7)	26(42.6)	33(60.0)	8(13.8)	63(98.6)	7(12.5)	160(37.4)
Total	43(100)	40(100)	51(100)	61(100)	55(100)	58(100)	64(100)	56(100)	428(100)
Father literacy									
Yes	39(90.7)	30(75.0)	48(94.1)	41(67.2)	27(49.1)	52(89.7)	6(9.4)	52(92.9)	295(68.9)
No	4(9.3)	10(25.0)	3(5.9)	20(32.8)	28(50.1)	6(10.3)	58(90.6)	4(7.1)	133(31.1)
Total	43(100)	40(100)	51(100)	61(100)	55(100)	58(100)	64(100)	56(100)	428(100)

NE: Number Examined

Table 3. Prevalence of Taeniasis among surveyed children across selected communities

Communities surveyed	**Number examined**	**Number infected (%)**
Osiele	43	8(18.6)
Aaya	40	23(57.5)
Obantoko	51	31(60.8)
Orile Ilugun	61	23(37.7)
Alabata	55	5(9.1)
Ijemo Fadipe	58	20(34.5)
Obete Akanbi	64	26(40.6)
Olugbo	56	39(69.6)
Total	428	175(40.9)

P value = 0.000

Table 4. Prevalence of Taeniasis by demographic variables among surveyed children across selected communities

	Comunities surveyed								
	Osiele NI (%)	**Aaya NI (%)**	**Obantoko NI (%)**	**Orile Ilugun NI (%)**	**Alabata NI (%)**	**Ijemo Fadipe NI (%)**	**Obete Akanbi NI (%)**	**Olugbo NI (%)**	**Total NI (%)**
Sex									
Male	1(12.5)	13(56.5)	17(54.8)	9(39.1)	4(80.0)	12(60.0)	14(53.8)	21(53.8)	91(52.0)
Female	7(87.5)	10(43.5)	14(45.2)	14(60.9)	1(20.0)	8(40.0)	12(46.2)	18(46.2)	84(48.0)
Total	8(100)	23(100)	31(100)	23(100)	5(100)	20(100)	26(100)	39(100)	175(100)
P value	0.701	0.184	0.166	0.819	0.264	0.468	0.748	0.201	0.098
Age									
5-10	3(37.5)	10(43.5)	14(45.2)	14(60.9)	1(20.0)	9(45.0)	13(50.0)	16(41.0)	80(45.7)
11-15	5(62.5)	13(56.5)	17(54.8)	9(39.1)	4(80.0)	11(55.0)	13(50.0)	23(59.0)	95(54.3)
Total	8(100)	23(100)	31(100)	23(100)	5(100)	20(100)	26(100)	39(100)	175(100)
P value	0.202	0.184	0.026**	0.200	0.380	0.581	0.533	0.409	0.647
Religion									
Christainity	2(25.0)	13(56.5)	18(58.1)	17(73.9)	2(40.0)	12(60.0)	6(23.1)	25(64.1)	95(54.3)
Islam	6(75.0)	10(43.5)	13(41.9)	6(26.1)	3(60.0)	8(40.0)	20(76.9)	14(35.9)	80(45.7)
Total	8(100)	23(100)	31(100)	23(100)	5(100)	20(100)	26(100)	39(100)	175(100)
P value	0.014**	0.884	0.829	0.809	0.797	0.663	0.457	0.233	0.768
Mother literacy									
Yes	7(87.5)	19(82.6)	24(77.4)	10(43.5)	4(80.0)	16(80.0)	0(0.0)	34(87.2)	114(65.1)
No	1(12.5)	4(17.4)	7(22.6)	13(56.5)	1(20.0)	4(20.0)	26(100)	5(12.8)	61(39.9)
Total	8(100)	23(100)	31(100)	23(100)	5(100)	20(100)	26(100)	39(100)	175(100)
P value	0.315	0.368	0.022**	0.088	0.05**	0.320	0.404	0.913	0.369
Father literacy									
Yes	8(100)	17(73.9)	28(90.3)	12(52.2)	3(60.0)	18(90.0)	1(3.8)	36(92.3)	123(70.3)
No	0(0.0)	6(26.1)	3(9.7)	11(47.8)	2(40.0)	2(10.0)	25(96.2)	3(7.7)	52(29.7)
Total	8(100)	23(100)	31(100)	23(100)	5(100)	20(100)	26(100)	39(100)	175(100)
P value	0.748	0.853	0.152	0.05**	0.609	0.950	0.209	0.809	0.613

*** Values were significantly different at P≤0.05*

Table 5. Intensity of Taeniasis among surveyed children across selected communities

Communities	Number examined	Mean EPG ± SE
Osiele	43	0.0723±0.02546[a]
Aaya	40	0.3604±0. 06042[bc]
Obantoko	51	0.4559±0.06112[cd]
Orile Ilugun	61	0.2164±0.04107[ab]
Alabata	55	0.0624±0.02833[a]
Ijemo Fadipe	58	0.2420±0.04938[b]
Obete Akanbi	64	0.4172±0.06814[cd]
Olugbo	56	0.5491±0.05781[d]
Total	428	0.3012±0.02008

Mean values with same superscript across column are not significantly different at P≤0.05
EPG: Egg per Gram; SE: Standard Error

Other factor such as increased mobility in children have been reported as a risk factor in the transmission and acquiring of helminths infections [14], this is not uncommon for taenia infections and could explain the reason why the older children surveyed had more taenia infections in our study. Older children have increased affinity of moving around more than younger children and this increased mobility exposes them to vendors of improperly processed roasted, grilled or fried beef/pork. Findings of Eke et al. [19] also reported higher prevalence in older children when compare to younger ones.

Although antibody-detecting techniques are considered as appropriate screening tool for the presence of disease in a population because they indicate prior exposure to the disease agent. The prevalence recorded in our study using microscopic methods remains very high when compared to other studies that employed antibody-detection techniques [18-21]. This huge prevalence reflects the level of endemicity of the disease in the study area and as well the need for urgent pragmatic approach to curtail it.

5. CONCLUSION

The prevalence reported for taeniasis in this study portrays a serious public health challenge that requires urgent approach. There is a need to develop effective and innovative tools for behavioural changes in the control and prevention of this disease. Furthermore, full-scale investigations on taenia prevalence in Nigeria is needed in the phase of planning for appropriate prevention and control strategy.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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