

Original Research Article

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

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 or 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 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.

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*, *T. saginata*, *T. crassiceps*, *T. ovis*, *T. taeniaeformis*, *T. hydatigena*, *T. multiceps*, *T. serialis* and *T. brauni* [1]. *Taenia saginata* (*T. saginata*) and *Taenia solinum* (*T. solinum*) are the most common parasitic tapeworm with wide distribution in Latin America, Southeast and Africa [1,2,3]. These parasites 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 or pork [7], and can serve as the definitive host, intermediate host, or both [1].

Infection with the adult worm (reffered to as taeniasis) is usually asymptomatic, except for the passage of proglottids in the stool and active migration of the proglottids through the anus in the case of *T. saginata*. Mild symptoms including abdominal pain, diarrhea or constipation, nausea, decreased or increased appetite, and weight loss are common in infected subjects, most especially children. Unlike the proglottids of *T. solinum*, proglottids of *T. saginata* can occasionally travel to organs such as the appendix, uterus, bile ducts and nasopharyngeal passages, thereby causing appendicitis and cholangitis [1].

However, infection with the larva form of the worm (reffered 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 includes 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].

49

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

58 **Materials and Methods**

59 **Study area**

60 This study was carried out in Odeda local government area (LGA) of Ogun State, South
61 Western Nigeria. Odeda LGA is one of the twenty LGA in Ogun state. The area is located on
62 longitude 3.2833300, and latitude 7.3166700 with a projected population of 137,377 in
63 2014.

64 **Study design and target population**

65 This study is cross-sectional in design. Eight communities were randomly selected across the
66 LGA for the study. The public primary school located at the centre of each community was
67 used as a sampling point (Table 1). School-aged children resident in the community and
68 attending the school were randomly selected as study participants.

69 Table 1: List of rural communities surveyed in Odeda area of Ogun State.
70

SN	Communities Surveyed	Schools located at centre of the community	School enrollment	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

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72 **Ethics statement**

73 Ethics clearance was received from Federal University of Agriculture, Abeokuta ethics
74 review board and Department of Public Health and Disease control, Ogun state Ministry of
75 health. Field permits were also obtained from Ogun state Ministry of Education, Science and
76 Technology and Zonal Education Officer of Odeda local government area (LGA). Informed
77 consent were given by parents and guardians of selected children and children whose parents
78 consented were invited to participate in the study. Children assents were obtained verbally
79 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.

Sample size determination

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.

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.

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 $P \leq 0.05$.

Results

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.

128 **Table 2: Demographic information of surveyed children across selected communities**
129

	Communities								
	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)

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131 **Prevalence of Taeniasis among surveyed children across selected communities**

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

137 **Table 3: Prevalence of Taeniasis and other among surveyed children across selected**
138 **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)

139 **P value = 0.000**

140 **Prevalence of Taeniasis by demographic variables among surveyed children across**
141 **selected communities**

142 Table 4 shows the prevalence of taeniasis by demographic variables among the surveyed
143 children across selected communities. Of the 175 infected children, 91(52.0%) and
144 84(48.0%) were male and females respectively. However there exist no significant difference
145 ($P>0.05$) in infection by sex. Majority of the infected children, 95(54.3%) belonged to the
146 older age category (11-15 years) compare to their younger counterparts (5-10 years),
147 although significant difference do not exist between both age categories by infection status
148 ($P>0.05$). Children of literate mothers and fathers also had taenia infections more than those
149 of illiterate parents, although with no significant differences ($P>0.05$). By religion, taenia
150 infections were recorded more among children that are Christians, 95(54.3%) compared to
151 Islamic children 80 (45.7%), although significant differences do not exist between this two
152 groups ($P>0.05$).

153 **Table 4: Prevalence of Taeniasis by demographic variables among surveyed children**
154 **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									
Christinity	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 significant difference exists at $P \leq 0.05$

Intensity of Taeniasis among surveyed children across selected communities

An overall mean intensity of 0.3012 ± 0.02008 epg 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 ($P \leq 0.05$) exists between mean intensities for taenia infections across the surveyed communities.

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

Communities	Number Examined	Mean EPG $\pm$ 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 having the same superscript across column are not significantly different at $P \leq 0.05$

EPG: Egg per gram; SE: Standard Error

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 [15]. 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].

An overall prevalence of 40.9% recorded in this study is substantially higher compared to 8.40%, 30.3% and 38.0% earlier reported by Eke *et al.* [16], Kumar *et al.* [17] and Prasad *et al.* [18] 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 pork, especially when roasted, grilled or fried with minimal heat [19].

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 males were slightly more infected than

females in our study. This is in agreement with the findings other similar studies [12,16,20-22], but in contrast with that of Usip *et al.* [23] where females were more infected than male subjects.

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.* [16] also reported higher prevalence in older children when compare to younger ones.

Generally, pork meat is forbidden for Islamic believers unlike the children from a christenic background. This explains why more infection with taenia species were higher in the former group than the latter[1].

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.

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