

1 **Epidemiology of Intestine Polyparasitism among Primary School Pupils in Awe, Awe Local**
2 **Government Area, Nasarawa State, Nigeria**

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5
6 **ABSTRACT**

7 Faecal samples were collected from 494 school children 200 (76.92%) boys and 189 (80.76%)
8 girls and examined by using direct smear, formalin-ether administration techniques socio-
9 economic personal hygiene, environmental and demographic information were collected by
10 using pre-tested questionnaire. In the overall 78.74 of the children were found to be infected by
11 at least one parasite species of these 12.24% had multiple parasites the overall prevalence
12 infection were *Trichuris trachiura* (0.20%), *Ascaris lumbricoides* (48.58%), Hookworm
13 (5.26%), *Entamoeba histolytica* (6.27%), *Entamoeba coli* (5.66%) and *Ascaris lumbricoides* + *E.*
14 *histolytica* (7.48%) respectively. Parasitic infections between males and females showed
15 significant differences in all the sexes ($P < 0.01$). The percentage prevalence of *Ascaris*
16 *lumbricoides* was high in between 7 – 8 years and >12 years for other intestinal parasites, no
17 specific age relationship was established among the children. Findings from this study showed
18 that using an unsafe water supply as a source for drinking water, presence of other family
19 members infected with intestinal parasitic infections (IPI), not washing vegetables before
20 competition, absence of toilet in the house, not wearing shoes when outside, not cutting nails
21 periodically and not washing hands before eating were significant risk factors associated with
22 intestinal multiple parasites among these pupils.

23
24 **Keywords:** Intestinal parasites infection, Primary school children, Awe.

25
26 **INTRODUCTION**

27 Parasitic infestation greatly affects the health and socio-economic status of individuals and
28 communities. They weaken the individuals and infestations. Furthermore, anaemic persons are
29 more likely to respond slowly to treatment, develop the serious disease and eventually become
30 poor mothers and child, since they are generally weak.

31 In humans, intestinal parasites are often spread by poor hygiene related to faeces, contact with
32 animals or poorly cooked food containing parasites. The major groups of parasites include
33 protozoans and parasitic worms (Helminthes) of these protozoans including *Cryptosporidium*,
34 *microsporidium* and *Isospora*, *Entamoeba histolytica*, *Balatidium coli*, *Giardia lamblia* etc, each
35 of these parasites can cause, infection at the same time. Intestinal helminthic parasite, are worms
36 that are found in the body lumens of the gut (Agbolade *et al.*, 2004). These intestinal parasites

Comment [NPR1]: The number are not correct 200 + 189 are 389 not 494

Comment [NPR2]: %?

Comment [NPR3]: *Ascaris*

Comment [NPR4]: Delete

Comment [NPR5]: *P italic*

Comment [NPR6]: Reference?

Comment [NPR7]: 74 words from the same reference is very large. The format of reference is APA and the Journal specify Vancouver system

37 are amongst the most prevalent human infections affecting approximately one-quarter of the
38 world's populations, mainly school children due to their poor hygienic nature or poor sanitary
39 conditions coupled with their voracious eating habits (WHO, 2002).

Comment [NPR8]: APA system

40 Human, get the parasites through the mouth from uncooked or unwashed hand, food,
41 contaminated water or hands or by skin contact with larva infection soil. There is general
42 acceptance that severe intestinal parasite is likely to result in failure and poor growth in children
43 (Crompton and Nesheim, 2002), vitamin A deficiency (Al-Mekhlafi *et al.*, 2010), iron deficiency
44 anaemia (Faustini, *et al.*, 2006) and poor educational performance (Haque *et al.*, 2003). Recent
45 studies highlighted the impact of polyparasitism on the host immunity and showed that intestinal
46 parasites are associated with higher infections relative to infection with a single parasite
47 (Shokhana, *et al.*, 2004, Gibson *et al.*, 2011).

Comment [NPR9]: APA system

48 In some persons, intestinal parasites do not cause any symptom or the symptoms may come and
49 go common signs and complaints include cramping, abdominal pain, coughing bloating and
50 diarrhoea. In more serious cases skin-itching, fever, nausea, vomiting or bloody stools may
51 occur. However, because many parasitic infections especially those of helminthes are usually
52 asymptomatic or produce only mild symptoms, they are often neglected until serious
53 complications or chronic clinical symptoms appear (WHO, 2002).

Comment [NPR10]: APA system. Review writing

54 In Nigeria many intervention schemes which were attempted to control these infections did not
55 yield many successes, many are still heavily infected particularly children (Ijagbone and
56 Olagunju, 2006). Because of the negative socio-economic impact of these parasitic infections on
57 infected humans, efforts would be made to reduce their epidemiological state among pupils. The
58 study was, therefore, carried out to determine the prevalence of the intestinal parasitic infections
59 and to investigate its associated risk factors among Awe school children.

Comment [NPR11]: Review writing

60 **MATERIALS AND METHODS**

61 **Study Area**

62 This research was carried out in Awe Local Government Area of Nasarawa State Nigeria. Awe is
63 located in the southern part of Nasarawa State on latitude 8° 31' N and longitude 7° 31' E. Its
64 location linked Awe and Keana Local Government Area in the East and West respectively. The
65 mean monthly temperature in this area ranges between 30°C in March and 25°C December. The
66 mean annual rainfall is about 1270 – 1540mm received over six to seven months (April –
67 October) of the rain season, with five months of the dry season. The main socio-economic
68 activities of the people are farming, trading and some are in public services.

69



70

71 **Figure 1:** Map of Nasarawa State showing study area

Comment [NPR12]: Reference of the map?

72 **Ethical Clearance**

73 The protocol for this study was approved by the local education authority and the primary
74 schools intended to be used. The approval was on the agreement that participants anonymity
75 must be maintained and good laboratory practices quality control ensured and every finding
76 would be treated with the utmost confidentiality and for this research only. Participants were
77 fully informed on their right to withdraw without any constraints.

Comment [NPR13]: What Bioethics Committee reviewed and approved the study? The authors obtained the consent form from 'parents and announce from the children?

79 Study Design

80 The study on intestinal polyparasitism was carried out over a period of four months (February to
81 May 2018) among 494 primary school children between 6 – 13 years of age in Awe west, Awe
82 east, Awe central and Isilamiyya primary school of Awe Local Government Area, from which
83 we randomly selected 123 children per school. The 494 children (247 boys and 247 girls) they
84 were all given registration number on a card which the enclosed with their stool samples in
85 disposable polythene bags supplied to them. The fresh faecal samples were immediately moved
86 to the general hospital laboratory in Awe.

Comment [NPR14]: How was the technique to move the fecal samples? Freeze? How time from collection of sample and arrive to laboratory?

87 Microscopy Examination of Stool Sample

88 Freshly voided stool samples were examined for blood, colour, consistency and mucus. Direct
89 smear was used for the analysis of the faecal sample for parasites. The diagnosis was based on
90 the identification of the characteristics protozoan cysts and helminthes ova with a compound
91 microscope using x_{10} and x_{40} objective (Cheesbrough, 1992).

Comment [NPR15]: What es the study design?

Comment [NPR16]: Detail technique to differentiate among parasites

Comment [NPR17]: Apa system

92 The faecal samples that were negative for direct smear were washed prior the concentration
93 procedure saline and iodine preparation were made from the deposit on a clean grease-free slide
94 and examined for cysts and helminthes ova with a compound microscope using x_{10} and x_{40}
95 objectives.

Comment [NPR18]: What was the sample size, calculation? What was the statistical analysis?

96

97 **RESULTS**

98 A total of 494 fresh faecal samples were collected between the ages of 6 – 13 years, which
99 consist of 260 boys and 234 girls from the four primary schools in Awe town out of the total
100 samples, 389 (78.74%) were infected, 200 (76.92%) boys and 189 (80.76%) girls were infected.
101 Table 1 shows the occurrence of intestinal helminthes infection according to sex, being higher in
102 girls than boys.

Comment [NPR19]: Here table 1

103 Table 2 states the prevalence rate of infection based on age with the percentage prevalence of
104 infection was high with (82.03%) in pupils between 8 – 9 years of age and decreased with
105 (74.59%) in pupils between ≥12 years of age.

Comment [NPR20]: Here table 2

106 Table 3 showed the prevalence rate of *Entamoeba histohytica* 31 (6.27%), *Entamoeba coli* 28
107 (5.66%), *Ascaris lumbricoide* 240 (48.58%), trichiuristrichuria 1(0.20%), hookworm 26 (5.26%),
108 and mixed infection are *Ascaris lumbricoides* and *Entamoeba histolytica* recorded 37 (7.48%) in
109 the study. The pupil's t-test analysis of the parasitic infection between the boys and girls recorded
110 a significant difference between the sexes (P<0.01).

Comment [NPR21]: How the authors differentiate E. histolytica from E. dispar? Using optical microscope is not possible

Comment [NPR22]: Italic

111 **Table 1: Prevalence of intestinal parasite according to sex**

Schools	Male			Female			Total		
	No. examine	No. infection	% prevalence	No. examine	No. infection	% prevalence	No. examine	No. infection	% prevalence
Awe central pri. sch.	102	93	91.17%	90	88	97.77	192	18	94.27
Awe south pri. Sch.	54	39	70.32%	52	43	82.69	106	82	77.35
Sangari pri. Sch.	52	37	71.15%	48	37	77.08	100	74	74
Emirs palace pri sch.	52	31	59.61%	44	21	47.72	96	52	54.16
Total	260	200	76.92	234	189	80.76	494	389	78.74

112

113

114 **Table 2: Prevalence of intestinal parasite infection among primary school pupils by age**

Age (years)	No examine	No infected	% prevalence
6 – 7	124	101	81.45%
8 – 9	128	105	82.03%
10 – 11	120	92	76.66%
>12	122	91	74.59%
Total	494	389	78.74%

115
116 **Table 3: Frequency of species of intestinal parasites among pupils**

Species	No. examine	No. positive	% positive
<i>Entamoeba histolytica</i>	494	31	6.27%
<i>Entamoeba coli</i>	494	28	5.66%
<i>Ascaris lumbricoides</i>	494	240	48.58%
<i>Trichuris trichuria</i>	494	1	0.20%
Hookworm	494	26	5.26%
Co-infection			
<i>Ascaris lumbricoides</i> + <i>Entamoeba histolytica</i>	494	37	7.48%
Total	2964	363	12.24%

117
118 **DISCUSSION**

119 Intestinal parasitic infestation remains major health problems globally particularly among rural
120 children in developing nations. The common intestinal parasites recorded in this research include
121 hookworm, *Trichuris trichuria*, *Ascaris lumbricoides*, *Entamoeba histolytica*. The infection rate
122 of the intestinal parasites in a primary school in Awe town showed that there was consistently
123 higher infection among the 494 school children examined. The participating children were
124 positive for at least one parasite species with *Ascaris lumbricoides* infection is the most common
125 (48.58%) in these children, followed by *Entamoeba histolytica* (6.27%), *E. coli* (5.66%) and
126 hookworm (5.26%) infection, which was in contrast to the findings made among school children
127 in a study by World Health Organization (WHO, 2002). On the other hand, the prevalence in this
128 study was higher compared to the findings of (Chukwuma, *et al.*, 2009) who showed a
129 prevalence of 13 (5.9%) among primary school children in Ebenebe town, Enambra state,
130 Nigeria, this was due to poor hygienic conditions of the school environment. The result of this
131 study is also in agreement with the prevalence recorded by (Omah, *et al.*, 2014) who showed a
132 prevalence of 286 (29.24%).

133 This study has revealed that parasitic infestation increased progressively with age pupils aged
134 between 6 – 7 had (81.45%), 8 – 9 (82.03%), 10 – 11 (76.66%) and >12 (74.59%), this could be
135 due to random selection of pupils for treatment of parasitic infection. The infestation of
136 hookworm was 5.26%, this could be due to the poor toilet facilities. The pupils were found
137 defecating in their backy and bases around the school premises thereby littering the environment
138 with faecal matters which were likely to contain intestinal parasites including hookworm ova.
139 The children most often move barefooted in their environment exposing themselves to infect
140 with infective hookworm larva.

141 Generally, this prevalence has been attributed by several authors to improper hygiene, poor
142 sanitation and agricultural habits, the physical and chemical composition of the soil and degree
143 of human exposure (Ugbomoiko, *et al.*, 2006). In this research, the female had the highest
144 prevalence of (97.77%) compare to their male counterpart with about (91.17%). There was no
145 significant difference observed in infection among the gender group ($P>0.05$). The risk of eating
146 soil (geophagy), licking of fingers and drinking well or tank water were significantly high risks
147 for *A. lumbricoides* and *T. trichiura* infection and hookworm which was only associated with
148 walking barefooted.

149

150 CONCLUSION/RECOMMENDATION

151 The findings from this research revealed that *Entamoeba histolytica*, *Ascaris lumbricoides*,
152 *Trichuris trichiura*, Hookworm were more common in Awe, Nasarawa State, Nigeria. This was
153 due to the poor state of hygiene and high rate of carriers among the school children. Screening,
154 deworming and improved sanitation by the provision of modern toilet facilities, health education

Comment [NPR23]: How the authors measured this, to arrive at this conclusion? I cannot find that authors collected data about hygiene and how differentiate of carriers and not carriers?

155 by enlightenment campaigns, school-based health programme would go a long way in reducing
156 infections.

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Comment [NPR24]: APA. Change to Vancouver