

Original Research Article

Soil Transmitted Helminthes; prevalence, perception and determinants among primary school children in rural Enugu State, Nigeria

Abstract:-

Aim: The study was to explore parents' knowledge and practice of deworming as well as prevalence of STHs and potential benefit of deworming among primary school children.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: Selected public primary schools in Enugu state, Nigeria, between January and June 2013.

Methodology: Pupils and their parents eligible for voluntary participation were selected and studied. Parents were interviewed using questionnaires. Pupils stool were analyzed at baseline and after 3 months following deworming. Level of significance was at $p \leq 0.05$

Results: It was based on 859 pupils and 410 parents. The mean age of pupils was 9.50 ± 2.10 . Males > females. The mean age of parents was 30.47 ± 5.47 . Farming 166(40.49) and trading 120(29%) were their predominant occupation. At baseline 220(25.6%) of the pupil were infested; Ascaris 111(12.95%), hookworm 42(9.7%), mixed infection 9(4.1%) and protozoa 20(2.4%). Three months following deworming 24(2.8%) were infested; Ascaris 9(1.0%), and hookworm 8(0.9%) no mixed infection, protozoa 8(0.9%). There were significant difference in worm infestation at baseline and 3 months following deworming ($p < 0.001$) Majority of their parents have heard of worm infestation 364 (88.8%), knew about deworming 261(63.7%), knew abdominal discomfort 247(67.9%) and eating without gaining 191(52.5) as features of worm

infestation, stated that worm can be contacted by walking barefoot 89(24.5%) and through eating sweet foods 158(43.3%). About 27(13.5%) stays over a year before deworming their children. There were no significant association between socio-demographic variables of pupils, their parents, mean knowledge and practice of deworming with worm infestation in pupil.

Conclusion: Knowledge and practice on worm infestation and deworming were fairly good among the respondents studied. Prevalence of worm infestation in this study was low. Deworming marginally reduced worm infestation.

Keywords:-worm infestation, deworming, knowledge, practice, prevalence, worm infestation

INTRODUCTION

Worm infestation has plagued humans for centuries now.[1] This predates the era of our earliest recorded history and still poses a great threat to global health. Ova of intestinal helminths can be found in the mummified feces of humans dating back thousands of years.[2-4] The ancient writings of Hippocrates, Egyptian medical papyri, as well the Bible abound with many of the characteristic clinical features of helminth infestations.[2-4]

It is one of the leading Neglected Tropical Diseases due to its low mortality irrespective of its high morbidity even when compared with the so called “the big three,” including HIV/AIDS, tuberculosis, and malaria.[5] The diseases caused by helminthes infestation receives less than 1% of global research dollars,[4] no established control programme and even when it exists no major funding agency supporting it. The global burden of disease caused by these intestinal nematodes is estimated at 22.1 million disability adjusted life years (DALYs) lost to hookworm, 10.5 million to *A. lumbricoides*, 6.4 million to *T. trichiura*, giving a combined total of 39 million life

years.[6] The disease burden is as great as those of tuberculosis (34.7 million DALYs) or malaria (46.5 million DALYs).[5]

Worm infestation is not confined to certain geographical areas of the world but world-wide with increasing number of cases being reported from Europe and the USA.[7] However, Intestinal helminth infestations are prevalent in most developing communities.[8] It is estimated that over one billion people living in developing regions of sub-Saharan Africa, Asia, and the Americas are infested with one or more helminthes[5,9] especially the very poor ones plagued with other diseases and living on less than two US dollars per day. It causes about five hundred thousand to one million deaths annually.[9] School-age children (including adolescents) and preschool children for reasons not well understood, compared with any other age group harbor some of the most intense infestations. Of 246 children, aged 7–12 years, attending school in rural Guatemala, 91% carried *Ascaris lumbricoides* and 82% carried *Trichuris trichura*. [10] In Madagascar, a study revealed prevalence of 93% for *Ascaris lumbricoides*, 55% for *Trichuris trichiura* and 27% for Hookworm.[11] Findings have shown that about 50% of school children in semi-urban communities were infected by one or more helminths, the most prevalent STH being *Ascaris lumbricoides* (47.6%). [1] Studies in Nigeria reported prevalence levels of between 17.8 to 87% in various parts of the country.[12-16]

These infestation produce adverse effects on health, growth, and learning ability with diminished physical fitness as well as impaired memory and cognition.[17-19] These adverse health consequences combine to impair childhood educational performance, reduce school attendance and subsequent productivity.[20] As Soil Transmitted Helminths (STHs) affect education and health it thus directly and indirectly has a negative impact on economic growth. Studies have

shown that infestation with hookworm during childhood is associated with a 43% reduction in future wage-earning capacity.[4,21] While the Soil Transmitted Helminths promote poverty, poverty also promotes Soil Transmitted Helminths infestations. This is evidenced by the fact that places where STH infestations are endemic, afflicting much of the population, are also places where people lack sanitation systems, latrines, with dirty flooring in houses and walk with bare foot (lack shoes). In pregnancy, worm infestation are also important diseases causing neonatal prematurity, reduced neonatal birth weight, and increased maternal morbidity and mortality.[22]

As some developing countries like Nigeria tend to make progress in achieving the Millennium Development Goal (MDG) 4 with goal to reduce child mortality and target to reduce by two-thirds the under-five mortality rate (U5MR) between 1990-2015 through successful vaccination programs,[23] these immunized children face new and continuing threats to their health. These affect their physical development and may also prevent them from taking full advantage of their opportunity for formal school education.[24]

Although the World Health Organization (WHO) recommends deworming of school-age children as a feasible and cost-effective control strategy,[9] there is no policy-backed approach for helminth control in Nigeria. Ideally, we should have a functional school health programme in all our schools, that would include deworming and health education. However, in practice, we find out that they are almost non-existent, especially in our rural schools. Even where there is one, it is usually physical examination and treatment of minor ailments that are established without deworming and focused health education.[25] This study would explore the parents

87 knowledge and practice of deworming as well as prevalence of STHs and potential benefit of
88 making deworming a routine in our primary schools.

89 **METHODOLOGY**

90 **2.1 Setting**

91 The study was carried out in selected public primary schools in rural Enugu state. Enugu state
92 is located in the southeast geopolitical zone of Nigeria with a total population of 4,881,500
93 people within a total area of 7,618 sq. km [26]. Politically, the state is divided into three
94 senatorial district (Enugu East, Enugu North and Enugu west). The state has three urban centres;
95 Enugu, Nsukka and Orji River. The people are of Igbo ethnicity and are predominantly
96 Christians. The predominant occupations include farming, trading and civil/public servants.

97 **2.2 Study design**

98 This was a descriptive Cross sectional study using interviewer administered Questionnaire for
99 the parents or caregivers' of the pupil to know their socio-demographic factors, knowledge, and
100 practice of deworming of their children. The pupils were equally dewormed and their worm
101 infestation ascertained before and after 3 months following deworming.

102 **2.3 Sampling technique**

103 The multistage sampling technique was employed. In stage one, two out of three senatorial zones
104 were selected by simple random sampling (Enugu North and Enugu West). Stage two, one Local
105 Government Areas (LGAs) one from each selected senatorial zone was selected by simple
106 random sampling (Nsukka LGA from Enugu North and Ezeagu LGA from Enugu West); and

107 stage three, the communities in which the study schools are sited equally were selected by simple
108 random sampling from the selected LGAs (Obukpa from Nsukka LGA and Mgbagbu Owa from
109 Ezeagu LGA). Four (4) schools with about 450 pupils each from a particular community were
110 studied.. Every pupil in the selected schools was studied.

111 **2.4 Sample size**

112 This was determined using minimum sample size formula for descriptive study in population >
113 10,000 (adding power component). The prevalence of helminth infection was taken as 54.2%,
114 from studies in different parts of the country.[13-16] Attrition rate of 10% was added. A total of
115 859 pupils with their corresponding 410 parents/caregivers were studied.

116 **2.5 Study participants**

117 These comprised pupils irrespective of their age and their parents in selected government
118 approved (public) primary schools as they harbor most of these parasites.

119 **2.6 Study instrument**

- 120 1. Questionnaires: interviewer administered (for the pupils' parents or caregivers)
- 121 2. Laboratory kit including Universal bottle used to collect stool samples and Brine for stool
122 analysis
- 123 3. Laboratory form for parasitology/microbiology.
- 124 4. School records: attendance registers to aid in making sure that adequate sample size was
125 studied and in labeling their names and numbers on the bottle for easy identification.

5. Checklist: Inspection of compound looking out for type of sewage and waste disposal, condition of the structure and sanitary nature, adequacy in terms of number and separate for sexes, water supply for washing hands after using the toilets or urinals, hand towel for cleaning hands and the surroundings of the entire compound.

6. Anthelmintics (Albendazole, a brand from FAMZY pharmaceuticals with trade name AXITOL) were provided for all pupil. The administration of the drugs was supervised by the teachers or by their parents at home (for parents who objected to their wards being given medication in school). In such cases the pupils later brought the empty sachets to school for confirmation. Any complaint following the drugs was reported to the teachers by either the pupil or their parents and this was well documented by the research assistants

2.7 Data analysis

Data were collated and analyzed using Statistical Packages for Social Sciences (SPSS) version 18. Chisquare (Pearson and McNemar) as a statistical test of association or significance was used to measure associations and significance on the effects of the different variables on the observed worm infestation among the school children. The level of statistical significance was at 0.05. In course of the study, the proportions were graded as: Good = 70% to 100%; Fair = 50% to 69%; and Poor = less than 50%.

2.8 Ethical consideration

Ethical clearance was sought from the Health Research and Ethical Committee of University of Nigeria Teaching Hospital (UNTH), Ituku Ozalla. Permission was also sought from the LGAs Educational Authority (LGEA) and the Parents Teachers Association (PTA) of the respective

147 primary schools. Furthermore, informed consent was obtained from the pupils'
148 parents/caregivers. The pupils were informed of the study, during which their cooperation were
149 sought. Confidentiality was maintained in the entire study. The pupil and teachers benefitted
150 from deworming.

151 **RESULTS**

152 Table 1 shows mean age (standard deviation) of the pupil was 9.50(2.10). Slightly higher
153 proportion were males 452 (52.62%). The predominant age range for parents and caregivers
154 studied was 25 to 34 years (70.24%). Their mean age (standard deviation) was 30.47 (5.47)
155 years. Over 80% of studied parents or caregivers were female. Over 80% had primary education.
156 Farming 166(40.49) and trading 120(29%) were the predominant occupation. About 75% of
157 respondents were married and lives with husband. Majority (57.32) of the respondents have 1 to
158 2 pupils in the school.

159 Table 2 shows that about 62.0% stays in 1 to 3 room apartment. While 50.73% uses bush
160 method, 3.42% uses pit latrine for sewage disposal. Sources of water supply were similar about
161 20.0%.

162 Table 3 shows that 220(25.6%) of the pupil were infested with the predominant worm being
163 Ascaris (roundworm) 111(12.95%) followed by hookworm 42(9.7%) at baseline. Among those
164 infested 9(4.1%) had mixed infection. Majority of pupil in both groups were not infested. In
165 addition 20(2.4%) had protozoa infestation. Following deworming and waiting period of 3
166 months, 24(2.8%) were infested. Ascaris and hookworm infestation dropped to 9(1.0%) and
167 8(0.9%) respectively. None had mixed infection however 8(0.9%) still had protozoa infestation.

168 There were significant difference in worm infestation at baseline and 3 months following
169 deworming ($p < 0.001$)

170 Table 4 shows that majority of their parents have heard of worm infestation 364 (88.8%) and
171 261 (63.7%) knew about deworming. About 247(67.9%) of the parents knew abdominal
172 discomfort as a feature while 191(52.5) identified that the pupil infested with worm eat without
173 gaining weight. Most of them also had poor knowledge of other features of worm infestation
174 including, diarrhea, coughing and rashes. Majority of the parents has poor knowledge ($< 50\%$) of
175 mode of transmission of worm with just 89(24.5%) of their parents knowing that worm can be
176 contacted by walking barefoot and 158(43.3%) believing that that it can be contacted through
177 eating sweet foods. They have a fair correct knowledge of ways to prevent worm infestation like
178 washing foods properly 230(63.2%). However 244(67.0%) stated that it can be avoided by
179 avowing sweet foods. About 134 (36.8%) and 132 (36.3%) heard from their parents and health
180 staff respectively while 235 (64.6%) stated that it affects all ages.

181 Table 5 shows that of those who knew about deworming, 200(76.6%) have been deworming
182 their children. While 114 (57.0%) have been deworming their children more than twice yearly,
183 27(13.5%) stays over a year before deworming their children. Of those who knew of deworming
184 but have not been practicing it, 37 (60.7%) never deemed it necessary as they believe their
185 children were not infested, while 4 (6.6%) tried it before and their children complained after the
186 drugs.

187 Table 6 shows that there were no statistically significant association between socio-
188 demographics of pupil with worm infestation; age in categories ($\chi^2 = 1.821$, $p = 0.424$) and sex
189 ($\chi^2 = 0.593$, $p = 0.601$). Equally there were no statistically significant association between socio-

demographics of their parents with worm infestation; age in categories ($\chi^2 = 1.971$, $p = 0.579$), sex ($\chi^2 = 1.110$, $p = 0.292$), educational level ($\chi^2 = 2.732$, $p = 0.435$), occupation ($\chi^2 = 4.273$, $p = 0.370$), marital status ($\chi^2 = 0.002$, $p = 0.969$) and number of children of school age ($\chi^2 = 0.011$, $p = 0.918$).

Table 7 shows that there were no statistically significant association between environmental variables of their parents with worm infestation; number of apartments ($\chi^2 = 0.841$, $p = 0.359$), sewage disposal method ($\chi^2 = 1.864$, $p = 0.601$) and source of water ($\chi^2 = 1.917$, $p = 0.590$).

There was also no statistically significant association mean knowledge ($\chi^2 = 0.327$, $p = 0.578$) and practice of deworming ($\chi^2 = 1.450$, $p = 0.249$)

Table 1: Socio-demographic and environmental characteristics of pupils and their parents

Socio-demographic characteristics	Frequency	Percent
PUPIL		
n = 859		
Age in categories(Years)		
5-9	521	60.65
≥ 10	338	39.35
Mean(SD)	9.50(2.10)	
Sex		
Male	452	52.62
Female	407	47.38
PARENT/CAREGIVER		
n = 410		
Age in categories(Years)		
15-24	46	11.22
25-34	288	70.24
35-44	76	18.54
Mean(SD)	30.47(5.47)	
Sex		
Male	77	18.78
Female	333	81.22
Educational level		
No formal education	71	17.32
Primary	191	46.59
Secondary	116	28.29
Tertiary	32	7.80

Occupation		
Petit farmer	166	40.49
Artisan	38	9.27
Trader	120	29.27
C/P servant*	35	8.54
Housewife	51	12.44
Marital status		
Married with spouse*	304	74.15
others*	106	25.85
Number of school age children		
1-2	235	57.32
≥3	175	42.68

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201 *Civil/Public servant

**married and lives with spouse

202 **Table 2: Environmental variables of parents**

Environmental variables of parents	Test statistic χ^2	p value
Number of apartments		
1-3 rooms	252	61.46
➤ 3 rooms	158	38.54
Sewage method		
Bush	208	50.73
Pit	178	43.42
Water closet	14	3.42
Bucket & Stream	10	2.44
Source of water		
Borehole	110	26.83
Stream	109	26.59
Pipe borne water	84	20.49
Rain/well/Tankers	107	26.10

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209 **Table 3: Distribution of STH among pupil**

Prevalent Soil Transmitted Helminth	Frequency n = 859	Percent
BASELINE(Before deworming)		
<i>Ascaris lumbricoides</i>	111	12.95
Hookworm*	42	9.7
<i>Trichuris trichiura</i>	4	0.8
<i>Strongyloides stercoralis</i>	10	2.3
Mixed	9	4.1
Total infested	220	25.6
Protozoa**	20	2.4
AFTER 3 MONTHS OF DEWORMING		
<i>Ascaris lumbricoides</i>	9	1.0
Hookworm*	8	0.9
<i>Trichuris trichiura</i>	3	0.4
<i>Strongyloides stercoralis</i>	4	0.5
Mixed	0	0.0
Total infested	24	2.8
Protozoa**	8	0.9
Comparison worm Infestation at baseline and 3 months following deworming		
Baseline	220	25.6
3 months following deworming	24	2.8
McNemar χ^2 p < 0.001		

210 **Hookworm*** (*A. duodenale* & *N americanus*)

211 **Protozoa**** (*Entamoeba histolytica* and *Giardia lamblia*)- coincidental finding

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219 **Table 4: Knowledge of features of worm infestation, mode of transmission and prevention**

Variables	Frequency n = 410	Percent
Ever heard of worm infestation	364	88.78
View about severity of worm infestation	297	72.44
Knowledge about deworming	261	63.66
Features of worm infestation#	n= 364	
Abdominal discomfort/pain	247	67.86
Eating without gaining weight	191	52.47
Diarrhea	122	33.52
Coughing	68	18.68
Rashes	43	11.81
Mode of transmission#	n= 364	
Drinking water	203	55.77
Flies that perch on food	160	43.96
Eating sweet food eg banana,	158	43.41
Contaminated hand to mouth	169	46.43
Walking barefoot	89	24.45
Ways of prevention#	n= 364	
Washing food items properly especially ones taken raw	230	63.19
Washing hands after defecating	223	61.26
Avoiding sweet/sugarly foods eg banana	244	67.03
Source of knowledge(First)	n= 364	
Parents	134	36.81
Health staff	132	36.26
Friends/Neighbors	58	15.93
Social media/gathering. Eg church	40	10.99
Age infested most	n= 364	
All age	235	64.56
Children only	98	26.92
Adult only	31	8.52

220 #multiple choice

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226 **Table 5: Practice of de-worming of their parents**

Variables	Frequency n = 410	Percent
Those that have been practicing deworming*	n = 261	
Yes	200	76.63
No	61	23.37
If yes, frequency of deworming n =200	n = 200	
≥ 2 times yearly	114	57.00
Once yearly	59	29.50
> 1 year before deworming	27	13.50
If No, reason for not practicing it	n = 61	
Never deemed it necessary as my children are not infected	37	60.66
Cost of the drugs	12	19.67
Cannot see the drugs to buy	8	13.12
Tried it and my child had problem after the drug	4	6.56

*Number that knew about deworming

231 **Table 6. Associations between pupils and their parents' socio-demographic characteristics**
 232 **with worm infestation among pupil.**

Variables	Worm infestation (n=859)		Test statistic χ^2	p value
	Yes freq(%)	No freq(%)		
PUPIL				
Age in categories(Years)				
5-9	134(25.72)	387(74.28)	1.821	0.424
≥ 10	86(25.44)	252(74.56)		
Sex				
Male	111(24.56)	341(75.44)	0.593	0.601
Female	109(26.78)	298(73.22)		
PARENT/CAREGIVER				
Age in categories				
15-24	20(23.80)	64(76.20)	1.971	0.579
25-34	155(25.58)	451(74.42)		
35-44	36(24.83)	109(75.17)		
>45	9(37.50)	15(62.50)		
Sex				
Male	35(22.29)	122(77.71)	1.110	0.292
Female	185(26.35)	517(73.65)		
Educational level				
No formal education	39(22.54)	134(77.46)		

Primary	104(25.74)	300(74.26)	2.732	0.435
Secondary	63(26.03)	179(73.97)		
Tertiary	14(35.00)	26(65.00)		
Occupation				
Petit farmer	81(24.25)	253(75.75)		
Artisan	24(32.88)	49(67.12)	4.273	0.370
Trader	61(23.28)	201(76.72)		
Civil/public servant	22(26.19)	62(73.81)		
Housewife	32(30.19)	74(69.81)		
Marital status				
Married & with spouse	166(25.58)	483(74.42)	0.002	0.969
Others	54(25.71)	156(74.29)		
Number of children of school age				
1-3	195(25.56)	568(74.44)	0.011	0.918
>3	25(26.04)	71(73.96)		

Table 7: Associations between Environmental variables of parents, mean knowledge and practice of deworming with worm infestation among pupil

Variables	Worm infestation (n=859)		Test statistic χ^2	p value
	Yes freq(%)	No freq(%)		
Number of apartments				
1-3	129(24.53)	397(75.47)	0.841	0.359
>3	91(27.33)	242(72.67)		
Sewage disposal method				
Pit	116(27.55)	305(72.45)	1.864	0.601
Bush	91(23.39)	298(76.61)		
Water closet	7(26.92)	19(73.08)		
Bucket & Stream	6(26.09)	17(73.91)		
Source of water				
Borehole	66(28.33)	167(71.67)	1.917	0.590
Stream	52(22.71)	177(77.29)		
Pipe borne water	43(25.75)	124(74.25)		
Rain/well/Tankers	59(25.65)	171(74.35)		
Mean knowledge score				
Good	106(25.5)	314(74.5)	0.327	0.578
Poor	114(25.95)	325(74.05)		
practice of deworming				
Good	84(26.45)	235(73.55)	1.450	0.249
Poor	136(25.35)	404(74.65)		

244 DISCUSSION

245 Age distributions of the children showed that over half of pupil are of age range 5 to 9 years with
246 mean age of 9.50 ± 2.10 . This is in line with expected age for those in primary school. Males
247 were slightly higher than females. A study on primary school enrollment and gender gap of rural
248 households' children in south western Nigeria, the probit model predicted a gender gap of
249 12.56% in favour of boys. Most of the gap is due to differences in the ways households perceive
250 male and female children.[27] Other factors are Nigerian tradition'- a tradition that attaches
251 higher value to male than female. Girls are always the disadvantaged. They stay at home to take
252 care of the young ones or domestic works while the boys seen as future heirs in the house are
253 given every opportunity and support to excel in life.

254 About two thirds of their parents are in age range 25 to 34 years. This is expected as those in
255 rural areas marry earlier than their urban mates who will prefer to have established means of
256 livelihood and its attendant stress before settling down with marriage. The literacy level among
257 the parents was good compared with the Nigerian national average for adults aged 15-24years
258 and above (65% for females and 78% for males).[26] This is good for the pupil and communities
259 as educated or well informed mothers are well correlated with the wellbeing, progress and
260 development of their children.[26,28] Unsurprisingly, there are no government establishment,
261 factories/industries nor agencies where they can work to earn living so making them take to what
262 is readily available, subsistence farming and petty trading. About two third of parents were
263 married and lived with their husband. This may be partly because of high esteem the Igbos
264 placed on marriage as an institution and less pressure on marriages in rural settings. Majority of
265 the parents have 2 or 3 pupil in the school. It may due to the fact that the parents are young and
266 of reproductive age from the age distribution above.

267 While 50.73% uses bush method, 3.42% uses pit latrine for sewage disposal. Sources of water
 268 supply were similar about 20.0%. The proportion is good for a typical rural setting in Nigeria
 269 and may contribute to the low prevalence of helminthes in the study population. About 25.6 % of
 270 pupil were infested with the predominant worm being *Ascaris* (roundworm) followed by
 271 hookworm at 13.0% and 9.7%. Coincidentally 2.4% had protozoa in their stool. Local studies in
 272 Nigeria on patterns of helminth infection in Enugu and another on intestinal parasite infection in
 273 Ishiagu, Abia state had similar finding of total 23.6% *Ascaris* 8.7%, *Trichuris trichura* 3.1%, and
 274 total 34.7% *Ascaris* 17.80%, Hookworms 14.80% *Entamoeba histolyca* (3.70 %) and *Trichuris*
 275 *trichiura* (2.3 %).[12,29] Other studies outside Nigeria on prevalence, distribution and risk
 276 factors of intestinal helminthic infestation in district Bagh (Azad kashmir)[30] and on intestinal
 277 helminthic infections among school children in Kathmandu Valley[31] equally had similar
 278 findings of total (21.7%) *Ascaris* (51.72 %) hook worms(0%). *Hymenolepis nana* (27.59 %).
 279 *Entrobis vermicularis* (13.79 %), *trichuris* (3.45 %) and total (34%) *Trichuris trichiura* (55%),
 280 *Ascaris lumbricoides* (26%), Hookworms (12%), *Hymenolepisnana* (5%) and *Strongyloides*
 281 *stercoralis* (2%). While some studies had a high total prevalence of 82.4%,83.3% and
 282 94.30%[14,32,33] others had low total prevalence of 16.9% and 11.8%.[34,35]

283 Among those infected, 4.1% pupil had mixed infection. This is in variance with findings in other
 284 studies which found mixed infections of 56.7%, 37.5%, 11.8%, 1.9% and
 285 1.54%.[14,16,29,36,37] Majority of pupil in both groups were not infected. This is expected as
 286 most parents are learned and had fair to good knowledge about worm infestation and deworming
 287 with prevailing fair environmental condition in terms of sewage disposal and water source and
 288 supply.

289 Following deworming, the worm infestation dropped marginally to 2.8%. This is in agreement
290 with findings of study conducted in Akoko-Edo Local Government Area of Edo State which was
291 statistically significant $\chi^2 = 13.92$, $p < 0.05$).[33] This shows that deworming alone reduced the
292 worm infestation. A similar study in Gaza strip of Palestine study in which the children were
293 divided into two groups the first group received treatment only but the second group received
294 treatment and health education post intervention prevalence of intestinal parasites declined from
295 21.5% to 5.1%. Ratio was 3.4% in group which received treatment only and 1.62% in second
296 group which received treatment and health education. ($p = 0.001$).[38]

297 Majority of their parents had heard of worm infestation (88.8%) and de-worming (63.7%). Most
298 parents had fair knowledge of features of worm infestation including; eating without gaining
299 weight diarrhea, coughing rashes and fair knowledge abdominal discomfort as a feature in both
300 groups. Majority of the parents had poor knowledge ($< 50\%$) of mode of transmission of worm
301 with just 24.5% of their parents knowing that worm can be contacted by walking barefoot. They
302 had an average good knowledge (about 60.0%) of ways to prevent worm infestation even though
303 (67.0%) stated that it can be avoided by avoiding sweet foods. A good proportion has been
304 deworming their children. This is good and may have contributed to low prevalence of STHs
305 from this study.

306 Neither age in categories nor sex of the pupil showed a statistically significant association with
307 worm infestation in both group. Age range 5-9 was infected most. A study among Children in
308 Delta State, Nigeria showed highest prevalence in age group 5-7 years which supports the
309 finding while another study on among children of Kupwara district, Kashmir, India(a prospective
310 study) showed that children in the age group of 8-11 years were mostly infected (26.92%)
311 followed by the 4-7-year age group (24.03%) and 12-15-year age group (20.19%).[36]

312 Males and females were almost equally infested (M:F 24.6% : 25.4%). Studies had similar
 313 findings of prevalence 35.55 % for males, 33.47% females³⁸ and 49.5% for males and 50.5% for
 314 females.[31] Some other studies showed differences in sex related prevalence with males more
 315 than females (M>F) 76.6%: 63.6%[36] and 18.3%: 15.5%[34] while females had higher 76
 316 (55.47%) compared to the males with the rate of 49 (39.84%) in a study in Ozubulu, Anambra
 317 State.[16]

318 Age of parents did not show any association with worm infestation. Though most parents were
 319 females there were still no significant association and this is supported by study on prevalence,
 320 distribution and risk factors of intestinal helminthic infestation in district Bagh (Azad Kashmir)
 321 where gender of parents seems to play no role.[30] Over 80% of parents in both groups had at
 322 least primary education. While similar studies supports the findings that educational standard did
 323 not reduce positive rates of infection[30] others refute it showing that low educational level is
 324 associated with worm infestation.[14,39] The finding may likely be due to the fact that majority
 325 had formal education which would directly and indirectly influence their knowledge, attitude and
 326 practice on worm infestation as well as deworming.

327 The parents were mainly farmers and traders. Though there was no association in this study,
 328 some studies associated parents occupation with worm infestation such as farmers[16,33] keeping
 329 of pigs.[39] This is expected as such work involves coming in contact with soil and sewage
 330 which are either reservoir or source of worm transmission. These parents once infested have
 331 higher chance of transmitting it to their children. The study did not show any significant
 332 association between method of sewage disposal and sourcing water supply with worm infestation
 333 among the school children. There was no significant association between parents' source of
 334 knowledge, knowledge of worm infestation, features of worm infestation, mode of transmission,

age affected most, mode of prevention and practice as well as parents' knowledge of deworming and reasons for practice or non-practice of deworming with worm infestation in pupil. Studies done by other researchers showed significant associations between knowledge, attitude and practice. Such associations include: poor environmental sanitation.^{93,94-96} walking barefoot was the only risk factor for hookworm infection while licking of fingers as well as drinking from well and surface tank was risk factors for *A. lumbricoides* and *T. trichiura* infections.[40] Hookworm showed statistically significant associations with shoe wearing habit of school children.[41] Others are methods of anal cleaning, how compounds and latrines were maintained, methods of hand washing after latrine visits, as well as accessibility to water.[39]

CONCLUSION

Prevalence of worm infestation in this study was low compared to some studies in Nigeria, Africa and other parts of the world. The knowledge and practice on worm infestation and deworming were fairly good among the respondents studied. The school environment was equally poor with dilapidated toilet facilities in most schools. This is similar to findings in some other studies. Hygiene education was carried out occasionally by their teachers but there was very poor or absence of school health programme. Male children enrollment in school was slightly higher than their female cohorts at primary school from the study. Literacy level of the parents was generally good when compared to national average. Deworming marginally reduced the worm infestation. Socio-demographic factors of the school children as well as that of their parents did not influenced worm infestation among the pupil. Equally knowledge and practice on worm infestation of their parents did not influenced worm infestation among the pupil.

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