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Prevalence and Associated Risk Factors of Soil-Transmitted Helminthiases among Primary School-going Children in Rarieda, Siaya County-Kenya

ABSTRACT

Soils Transmitted Helminthiases, abbreviated as (STH), are a group of chronic infections, typically very common or endemic in low income countries and are classified as Neglected Tropical Diseases (NTD). Despite the World Health Organization (WHO) laid down control strategies and goal to eradicate these infections by the year 2020, these infections continued to dominate in Sub-Saharan countries. This problem necessitated the need for this study. The primary objective was to assess prevalence of, and associated risk factors of STH among the school going children in Rarieda, a sub-county in Siaya County of Kenya. The study was expected to contribute to the overall theme of “Research for Better Health in East African Region”. The study population comprised of primary school going children, aged between seven and fifteen years old. A total sample size of three hundred pupils was randomly sampled from five primary schools across Rarieda. Data were collected between September and October 2018 and cross sectional study design was used. Before commencement of data collection exercise, ethical approvals were obtained from all the relevant authorities and pre-testing was done at Ruma primary school. Data was collected using structured questionnaires, Key Performance Indicators (KII) and Focused Group Discussions (FGD). The study established that there was high prevalence of STH among the school going children in Rarieda, with prevalence rate of 27.3 percent. The prevalence rate varied with socio-demographic characteristics of the pupils. It was high in boys than in girls, high in lower classes than in upper classes and high in Uyoma than in Asembo communities. It was also established that the knowledge level of the

25 pupils on STH was 43.02. The pupils were 46.2 percent at risk of STH with a great variance
26 noted between health practices at schools verses at homes.

27 **Keywords**

- 28 • Prevalence
- 29 • Associated Risk Factors
- 30 • Soil-Transmitted Helminthiases
- 31 • Primary School-going Children
- 32 • Neglected Tropical Diseases

33 **1.0 INTRODUCTION**

34 **1.1 Study Background**

35 Soil-Transmitted Helminthiases abbreviated as (STH), refer to the intestinal worms infecting humans and
36 are usually transmitted through contaminated soil, and, this type of helminth infection or helminthiases is
37 caused by different species of roundworms^{1,3}. It is usually referred to as Soil-Transmitted Helminthiases
38 because it is caused specifically by those worms which are transmitted through soil contaminated with
39 faecal matter ¹. The main types of STH include the ascariasis, hookworm, whipworm and *Strongyloides*
40 *stercoralis*, with the first three types being the most distinguished. STH is categorized as a Neglected
41 Tropical Diseases (NTD) which was launched in 2012 to be eradicated by 2020 in the world ¹.
42 Epidemiological distribution of STH is worldwide with approximately a third of the global population
43 infected with STH ¹. This means that about two billion people of the world total population are infected,
44 and about another four billion are at risk of being infected ¹. Infections are widely distributed in tropical
45 and subtropical areas, with the greatest numbers usually occurring in China, America, East Asia, and
46 sub-Saharan Africa, Kenya included ². Over 267 million preschool-age children and over 568 million
47 school-age children live in areas where these parasites are intensively transmitted, and are in need of
48 treatment and preventive interventions³. Generally, the infections are endemic in developing and low
49 income countries ¹. STH is transmitted by eggs that are passed in the faeces of infected people ^{1,3}. Adult
50 worms live in the intestine of human beings where they produce thousands of eggs every day. In areas
51 with poor adequate sanitation, the eggs contaminate the ground. Hookworm eggs hatch in the soil,

52 releasing larvae that mature into a form that can actively penetrate the skin. People become infected with
53 hookworm majorly by walking without shoes on contaminated soil ¹. There is no direct transmission of
54 these worms between persons, neither is there infection from fresh faeces ³. The degree of negative
55 symptoms is directly in relation to worm burden. Symptoms are evident and noticeable when infection is
56 high and severe ¹. Soil transmitted infections may cause several health issues such as abdominal pains,
57 diarrheal, rectal prolapsed, physical and cognitive growth retardation and protein loss to the infected ³.
58 Hookworms are major cause of chronic intestinal blood which causes anaemia in most cases. Soil-
59 transmitted helminths also cause appetite loss leading to reduction of nutritional intake in the body and
60 physical unfitness in human beings and in particular, *T. trichiura* can mostly causes diarrheal and
61 dysentery. They also contribute and prevent affected children and/or persons from going to school, work,
62 or fully participating in community development activities, thereby contributing to stigma and poverty ¹.
63 ³.For basic diagnosis, specific helminths can generally be identified from the faeces, and their eggs
64 microscopically examined and enumerated using faecal egg count method ². Control and prevention
65 strategies involve regular treatments, improving of sanitation, and health education and promotion ^{1,3}.

66 This research project was necessitated by high prevalence of STH among the school going children, and
67 the burden caused by these worms among the pupils. The primary purpose of this research project was
68 to provide statistical and epidemiological understanding of the prevalence and risk factors of soil-
69 transmitted Helminthiases in Rarieda, Siaya County. In justifying the need for the study, the researcher
70 noted that there was a serious need to carry out a study on STH with the primary school going children as
71 the study population because of the public health effects associated with these infections ^{1, 3}, the
72 vulnerability of pupils to STH infections ³, and also because of the fact that these infections have been
73 neglected ¹. In this study, new data were generated on the prevalence and risk factors of STH in Rarieda.
74 This in turn helped in better understating and decision making on the most appropriate prevention and
75 control strategies of soil transmitted worms.

76 With regular deworming, health education and promotion, and maintenance of hygiene and sanitation, we
77 shall indeed eradicate Soil-Transmitted Helminthiases from our community Rarieda, from our Country
78 Kenya, and even from the rest of East Africa as a whole. Public Health Officers (PHO) must take a fore

79 front role in appropriate policy formulations, implementations, and enforcements and lead all other health
80 care workers and the society at large in this noble exercise.

81 The primary objective of the study was to assess prevalence and associated risk factors of Soil
82 Transmitted Helminthiases among primary school going pupils in Rarieda, Siaya. Two important research
83 questions included: 1. what was prevalence and risk factors of soil-transmitted Helminthiases among the
84 primary school going children in Rarieda? 2. What was the level of knowledge on Soil-Transmitted
85 Helminthiases among the primary school going children in Rarieda?.

86 2.0 METHODOLOGY

87 2.1 Study Population and Area

88 This study was carried out in Rarieda. Rarieda is one of the six sub-counties of Siaya County, in the
89 former Nyanza province in the southwest part of Kenya ^{4, 5}. Siaya County covers a total area of
90 2,496.1km² with a total population of 842,304 as per the 2009 Kenya population census ⁶. Siaya county
91 borders Busia, Kakamega, Vihiga, Kisumu and Homabay counties. Apart from Rarieda, the other five
92 sub-counties in Siaya include Bondo, Ugenya, Alego, Gem and Ugunja ⁷. The main economic activities in
93 the area include food and cash crop farming, cattle rearing mostly in small scales, and fishing. Rarieda
94 Sub-County is made up of two communities namely Uyoma and Asembo. The sub-county is sub-divided
95 into five administrative areas, referred to as “wards” under the new Kenyan constitution promulgated in
96 2010 ⁷. During the time of the study, Rarieda had approximately one hundred and thirteen primary
97 schools with a total pupil’s population of about thirty-four thousand. The study population comprised of
98 primary school going children in Rarieda aged between seven and fifteen years old ⁷.

99 2.2 Study Design and Sample Collection

100 Descriptive cross-sectional study design was used in this study. Sample size was determined and
101 calculated using the Fisher’s Formula (1998). Three hundred school-going children, comprising of one
102 hundred and fifty boys and a similar number of girls were sampled for the study.

103 During the sampling, the study site (Rarieda) was first divided into five strata. These five strata were the
104 five administrative wards, three in Uyoma and two in Asembo^{7, 10}. One school was then sampled
105 randomly from each of the five wards. Sixty pupils in total, twelve per classes three to seven, were then
106 sampled from each of the five sampled schools.

107 2.3 Stool Examinations

108 Single stool samples were collected from each of the sampled pupils and analysed for STH eggs and
109 larvae by wet mounts. Kato-Katz technique was used for quantification of the worms. The selected pupils

110 were given a screw capped plastic sterile container bearing an inscription with name and age of child, to
111 collect the early morning stool on the day of selection into the study and explained regarding stool
112 collection which was to be at least two grams. The stool sample collected was then subjected to
113 microscopic evaluation^{12, 13, 14}. The direct wet smear was prepared by mixing a small amount of stool
114 (about 2 mg) with a drop of 0.85% NaCl; this mixture was to provide a uniform suspension under a 22- by
115 22-mm cover slip¹³. This was the cost effective routine microscopy examination of stool undertaken in the
116 study in the community. The laboratory analysis of the stools was done at Pap-Kodero Health Centre.
117 The health centre is owned and managed by the county government of Siaya.

118 **2.4 Pre-testing**

119 Pre-testing of the data collection tools was done at Ruma Primary school one week prior to the actual
120 data collection exercise. Data collection tools included the structured questionnaires for the primary
121 school going children, Focused Group Discussions (FGD) and Key Informant Interviews (KII). Pre-testing
122 also involved sample stool collection, examination and analysis.

123 **2.5 Statistical Analysis**

124 Data collected were entered into an excess sheet for analysis and correction of any errors. The first step
125 in quantitative data analysis was to identify the levels or scales of measurement as nominal, ordinal,
126 interval or ratio. This was to help determine how best to organize the data. The data was typically entered
127 into a spread sheet to check for the accuracy and any errors, and organized or “coded” in some way that
128 gave meaning to the data. They were then analyzed from the excel sheet and by use Statistical Package
129 for Social Science (SPSS- Version 20)¹⁵. The next step involved use of descriptive statistics to
130 summarize the data. The descriptive statistics that were used included the frequencies, percentages,
131 mean, median, minimum and maximum values, and range.

132

133 **3.0 RESULTS AND DISCUSSION**

134 **3.1 Results**

135 **3.1.1 Prevalence of SHT among the Primary School Going Children in Rarieda**

136 Prevalence of Soil-Transmitted Helminthiases among the primary school going children in Rarieda was
137 27.3 percent. Boys had a higher prevalence of STH (29.3 percent) than females that had prevalence of
138 25.3 percent. Boys tested positive of the STH from class three to seven were 12, 10, 8, 6 and 8
139 respectively while the total number of girls tested positive from class three to seven were recorded as
140 8,7,8,8, and 7 respectively.

141 In terms of prevalence by classes, and ages, it was determined that the prevalence in class three to
142 seven were 33.3 percent, 28.3 percent, 26.7 percent, 23.3percent and 25.0 percent respectively. The
143 prevalence therefore reduced with a rise in age and class. (Fig. 1)

144 **In terms prevalence of STH by wards**, it was noted that the prevalence of STH was highest in South
145 Uyoma ward (38.3 percent). It was followed by West Uyoma with a percentage prevalence of 33.3
146 percent, East Asembo (25 percent). West Asembo ward recorded the least prevalence with a percentage
147 of 16.7 percent while North Uyoma had a prevalence of 23.3percent. The mean prevalence in Uyoma was
148 31.7 percent whereas prevalence in Asembo was 20.8 percent.

149

150 **Table 1: Prevalence of STH by Ward, Type, and Class**

Variables	Frequencies	Percentage s	Chi-square (χ^2)	p-values
Class				
Standard 3	20	33.3	1.293	0.86262
Standard 4	17	28.3		
Standard 5	16	26.7		
Standard 6	14	23.3		
Standard 7	15	25.0		
Gender				
Males	44	29.3	0.439	0.50759
Females	38	25.3		
Community				
Uyoma	57	31.7	3.091	0.0787
Asembo	25	20.8		
Ward				
West Uyoma (Akuom)	20	33.3	6.415	0.17025
North Uyoma (Ochieng'a)	14	23.3		
South Uyoma (Ramoya)	23	38.3		
West Asembo (Mabinju)	10	16.7		
East Asembo (Ong'ielo)	15	25.0		
Type of STH				
Hookworms		53		
Roundworms		39		
Whipworms		8		

151

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153 **3.1.2 Knowledge among the Primary School Going Children**

154 The calculated average knowledge for the pupils was 43.02 percent. As far as each school was
155 concerned and as noted from table 1 above, the calculated level of knowledge on STH among the
156 primary school going children in Mabinju, Akuom, Ramoya, Ochieng'a and Ong'ielo primary schools were
157 43.9,37.3,30.4,48.2, and 34.6 respectively. The figure presented below showed that Ochieng'a primary
158 school pupils were the most knowledgeable on average on matters or questions asked related to STH.
159 Their average knowledge on STH was 48.2 percent. Average knowledge for primary school going
160 children in Mabinju primary school was 43.9% percent, Akuom primary (37.3%), Ong'ielo primary (34.6%)
161 and Ramoya primary school at 30.4 percent (Table 2).

162 Analysing by specific knowledge indicators and based on the figures above, most pupils had heard about
163 STHs at 73.7 percent. However, very few pupils, 36.4 percent, were able to demonstrate an
164 understanding of the prevention and control measures, tell the signs and symptoms (31.2 percent),
165 causes and risk factors (34.7 percent) or even tell the mode of transmission of STH (18.5 percent).

166

167 **Table 2: Knowledge on STH**

168

School	Had heard about STH		Knowledge on Signs and Symptoms		Know mode of transmission		Understand the causes and Risk Factors		Understand Prevention and Control Measures		Calculated Percentage Averages
	Numbers	Percentages	Numbers	Percentages	Numbers	Percentages	Numbers	Percentages	Numbers	Percentages	
	n=60		n=120		n=120		n=120		n=180		
Mabinju	48	80.0	45	37.5	29	24.2	47	39.2	70	38.9	43.9
Akuom	44	73.3	35	29.2	24	20.0	40	33.3	55	30.6	37.3
Ramoya	36	60.0	23	19.2	13	10.8	34	28.3	61	33.9	30.4
Ochieng'a	52	86.7	50	41.7	27	22.5	52	43.3	84	46.6	48.2
Ong'ielo	41	68.3	34	28.3	18	15.0	35	29.2	58	32.2	34.6
Percentage Average		73.7	31.2		18.5		34.7		36.4		43.02

169 **3.1.3 Risk Factors associated with STH Infections**

170 It was determined that the primary school **going** children in Rarieda were 46.2 percent at risk of being
171 infected with STH. The risk factors varied across the schools whereby Mabinju, Akuom, Ramoya,
172 Ochieng'a and Ong'ielo primary schools were 41.0, 50.7, 55.3, 37.9, and 45.9 at risk of STH respectively.
173 Pupils of Ramoya primary school were at the most risk of STH with a percentage of 55.3 percent. They
174 were followed by Akuom primary (50.7%), Ong'ielo primary (45.9%), Mabinju primary (41.0%) and at
175 Ochieng'a primary at 37.9 percent (Table 3).

UNDER PEER REVIEW

176 **Table 3: Risk Factors on STH**

177

School	Lack Toilets				Inadequate Hygiene & Sanitation Practice				Lack of Health Education and Promotion		Lack of Regular Deworming		Calculated % Averages		Percentage at Risk
	N=60				N=60				N=60		N=60				
	At school		At home		At school		At home								
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	
Mabinju	54	90.0	26.5	44.2	39	65.0	19.5	32.5	44.5	74.2	29	48.3	212.5	59.0	41.0
Akuom	45	75.0	23	38.3	38	63.3	20	33.3	33.5	55.9	18	30	177.5	49.3	50.7
Ramoya	41.5	69.2	18.5	30.9	31.5	52.5	16.5	27.5	37.5	62.5	15.5	25.9	161	44.7	55.3
Ochieng'a	55	91.7	30.5	50.8	44.5	74.1	24.5	40.8	38	63.3	31	51.7	223.5	62.1	37.9
Ong'ielo	51.6	84.3	27	45.0	38.5	64.2	21	35.0	35	58.3	22.5	37.5	194.6	54.1	45.9
% Average	82.0		41.8		63.8		33.8		62.8		38.7		53.8		46.2
% at Risk of STH	18.0		58.2		36.2		66.2		37.2		61.3		46.2		

178 The risk factor indicators included inadequate/lack of the following: toilets, hygiene and sanitation
179 practice, health education and promotion and deworming.

180 The greatest risk factor was that the pupils did not observe adequate health hygiene practice while at
181 home (66.2%). Lack of regular deworming programs followed as the second common risk factor at 61.3
182 percent while poor toilets coverage especially at homes was a third risk factor with a percentage of 58.2
183 percent. Lack of adequate health education and promotion and poor hygiene practice at school came
184 fourth and fifth with percentages of 37.2% and 36.2% respectively. The least risk factor recorded was in
185 regards to adequate toilets and pit latrines in schools. This was recorded at only 18 percent. The 18
186 percent was attributed to inadequate toilets compared to pupils population and the hygienic conditions of
187 some of the toilets. (Fig. 2).

188 Correlations between prevalence of STH and knowledge on STH and between prevalence of STH and
189 STH associated risk factors were calculated using the Pearson Correlation formula,

190

191 Correlation r ,

$$r = \frac{N\epsilon xy - \epsilon(x)(y)}{\sqrt{[N\epsilon x^2 - \epsilon(x)^2][N\epsilon y^2 - \epsilon(y)^2]}}$$

192 The calculated R values for correlation between prevalence of STH was knowledge on STH was $R = -$
193 0.7518 , while the calculated R values for correlation between prevalence of STH and STH associated risk
194 factors was $R = +0.8985$. Figure 3 gives an illustration of correlation between risk factor and prevalence
195 of STH. There was therefore, a strong negative correlation between prevalence of STH and level of
196 knowledge on STH.

197 On the other hand, there was a strong positive correlation between prevalence of STH and associated
198 risk factors, hence a conclusion that the prevalence of the STH was directly proportional to the level of
199 risk factors associated with it.

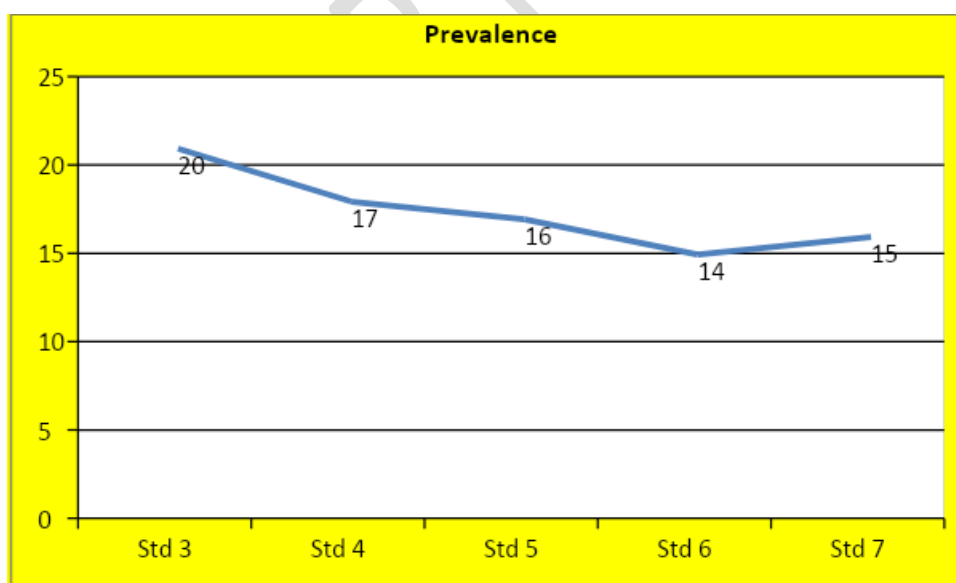
200 Most pupils were keen to practice health hygiene while at school than when they were at home. In all the
201 five schools, the level or percentage of health hygiene and sanitation practice was high while the pupils
202 were in schools than when they were at home. Using the Pearson's Correlation Formula, the value of R

203 was calculated as + 0.9675. There was therefore, a strong positive correlation between hygiene practice
204 at school and at home.

205 3.2 Discussion

206 3.2.1 Prevalence of Soil-transmitted Helminthiases

207 82 out of the total 300 pupils tested for STH infections were tested positive. This translated to prevalence
208 of 27.3 percent. The prevalence was found to be high in lower classes compared to upper classes with
209 class three, four and five having prevalence of 33.3 percent, 28.3 percent and 26.7 percent, respectively.
210 Standard seven had a prevalence of 25 percent while standard six had the least prevalence of 23.3
211 percent. This agrees to the research done in Ogun state in Nigeria which showed that the younger age
212 groups were more infected by STHs than older age groups¹³. According to this research done in Nigeria,
213 children of age group 5-7 had a prevalence of 33.3 percent whereas age group 14 years and above had a
214 prevalence of 26.8 percent¹³. Similarly, a research done in Nepal showed that prevalence of STH ranged
215 from 3.3 to 51.5percent with the highest prevalence of 51.4 percent recorded from Khokana community.
216 Rapid Assessment of Soil Transmitted Helminth (STH) Infections among School Girls in Odisha reported
217 that the prevalence of STH I girls was 29.3 percent⁹.



218

219

220 **Figure 1: Prevalence of STH by class**

221

222 As far **of** prevalence by community was concerned, 57 out of 180 pupils in Uyoma community had STH
223 infections translating to 31.2 percent whereas only 25 out of one 120 pupils (20.1 percent) in Asembo
224 were infected. Even though the difference between the two communities was not statistically significant,
225 **(p-value of .0787)**, it meant that STH prevalence in Uyoma was **high** than in Asembo. Chi-square tests
226 and calculations showed that the difference in prevalence of STH among the five schools were not
227 statistically significant, **(p-value of .17025)**. Similarly, there was no statistical significance on prevalence of
228 STH between the boys and girls with p-value calculated at .50759. However, it was noted that the
229 prevalence in boys (29.3 percent) was **high** than the prevalence in girls with a percentage difference of
230 four percent. This finding did not corroborate to the study done in Nepal in which it was found that the
231 prevalence in females was higher than the prevalence in males⁸. The difference in the finding of the two
232 studies was attributed to the fact that the study in Nepal included females and males of all age groups. It
233 attributed the high prevalence of STH to be **high** in females than boys due to the high roles **paled** by
234 females in the fields and gardens compared to males. However, this study in Rarieda only included boys
235 and girls of the primary school age, mostly between age groups of seven and fourteen. With a p-value of
236 **.86262** the **difference of prevalence among the classes** was however, not statistically significant. High
237 prevalence of STH on boys than girls in the sampled pupils was also attributed to their behaviours and
238 responsibilities brought by gender. Boys mainly walk and play **barefoot**, compared to girls. Boys are also
239 mainly responsible for looking after the animals in the open fields, and due to the **area type of soil, (mainly**
240 **clay soil in most areas)**, walking on shoes especially during rainy seasons is a big problem. On the other
241 hand, girls' main chores involve mainly working within their home compounds hence exposing them to
242 lesser risk of STH than boys. Low prevalence of STH among pupils of upper classes compared to lower
243 classes colleagues was attributed to two factors: maturity and learning pressure in upper classes.
244 Interventions for the control and prevention of STH must therefore, among other measures, focus on
245 health promotion and education, and must also focus on behaviour change such as encouragement of
246 the pupils wear shoes always when outdoors, washing of hands after toilets visitation, and even washing
247 of fruits before eating them.

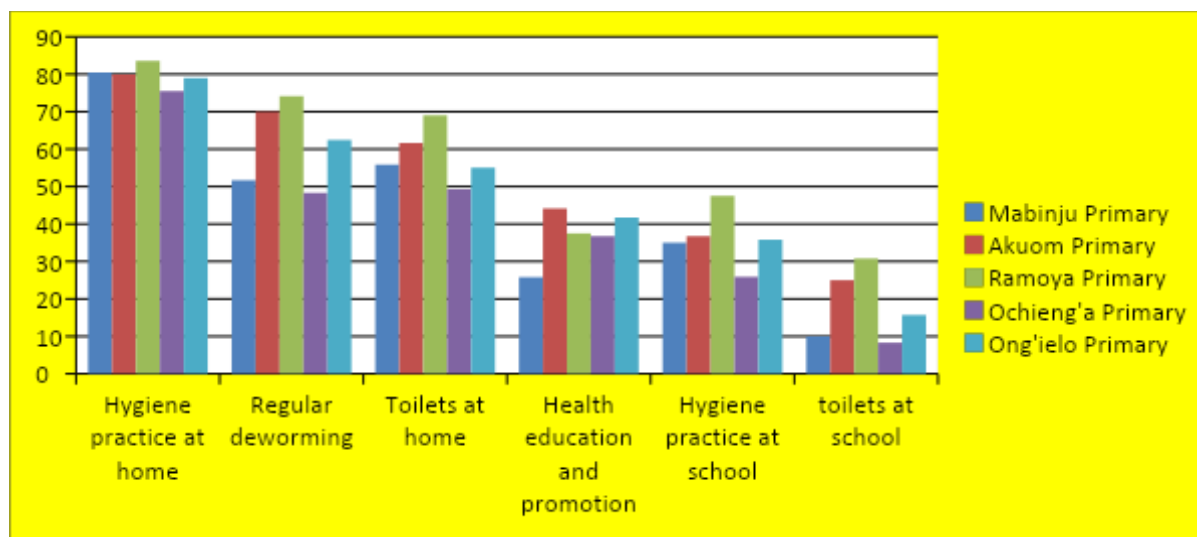
248 Based on the type soil transmitted helminthiasis, it was established that infestations by hookworms were
249 the highest at 53 percent followed by roundworms at 39 percent whereas infections by whip worms were
250 the least at only eight percent. These results were similar to the study in Nigeria, in which it was found
251 that *A. lumbricoides* was the most common STH at 29.3 percent while *T. trichiura* had the least
252 prevalence at 2.3percent^{4,8}. This implied that interventions for control and prevention of STH among the
253 community as much as it should focus on all types of worms, should pay much specific attention in *A.*
254 *lumbricoides*. This is because if *A. lumbricoides* alone can be eradicated, the prevalence of STH would
255 reduce by more than fifty percent.

256 High prevalence of STH in Rarieda was attributed to the climatic conditions in the area. According to
257 Akinola et al (2018), STH are prevalent in areas with favourable climatic and environmental conditions⁴.
258 The unhygienic eating habits, poor water supply, poor sanitation and personal hygiene conditions which
259 facilitate the transmission of STH could also have been a contributing factor for the high prevalence of
260 these worms¹³. The study findings were better than those reported by Osazuwa et al. in Nigeria in 2010
261 where parasitic infection was reported at nearly 80% and hookworm being 75 %. In an Indian study done
262 at Vellore in 2010 among school children in 6-14 years age STH prevalence was noted much less, that is,
263 7.8 percent, though hookworm rates were highest, that is, 8.4 percent. In that study residing in hut
264 (Katcha house) and open field defecation emerged as major risk factors for STH. This indicated that STH
265 was a pending public health preventable problem which is mainly because of food and hygiene habits.
266 School **going** children should be made conscious of these and appropriate health programs like Iron-Folic
267 Acid (IFA) and deworming should be rightly and stringently **being** implemented with regular monitoring to
268 address the problem of not just STH but associated problems of anaemia and underweight⁹.

269 **3.2.2 Risk Factors**

270 It was established that the pupils in Rarieda were 46.2 percent more likely to get infected with STH. In
271 terms of the individual risk factor indicators, it was established that 66.2 percent of the pupils did not take
272 seriously hygiene practices while at homes. This was quite high compared to only 36.2 percent of the
273 pupils who did not practice hygiene while at schools. On the issues of the toilets, 58.2 percent of the
274 pupils did not have access to good functioning toilets while at homes. This meant that the pupils were

275 most at risk of STH while at homes than while in schools. Only 62.9 percent of the pupils indicated that
 276 they received average health education and promotion programs. On deworming, only 38.7 percent
 277 received regular deworming as recommended by the WHO. This meant that up to 61.3 percent of the
 278 pupils in Rarieda were at risk of STH due to lack of deworming programs in schools.



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281 **Figure 2: Associated Risk factor of STH**

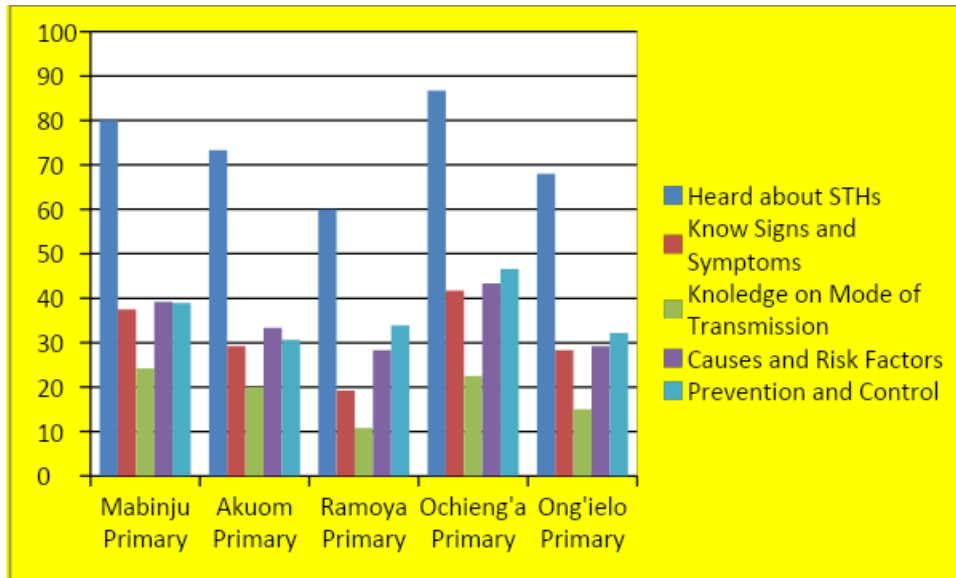
282 Calculations on correlation between risk factors associated with STH and prevalence of STH showed that
 283 there was a strong positive correlation, $R = + 0.8983$, between risk factors and the prevalence. This
 284 implied that any intervention that reduces the risk factors would definitely result in to the reduction of STH
 285 in the area, Rarieda Sub-County.

286 There were poor toilets and/or latrines coverage in Rarieda. Only 41.8 percent of the pupils sampled had
 287 access to toilets in their homes, implying that majority of them at 52.2 percent were at risk of STH
 288 infections due to lack of toilets. Most of the pupils, and their parents as well, did **fecesicate** in open fields.
 289 This situation was made worse by the fact that most pupils did not wear shoes to schools.

290 The results on the risk factors were in agreement with results from other studies previously done on the
 291 same or closely related topic. For example, Multivariable logistic regression analysis in the study of

292 Prevalence and risk-factors of soil-transmitted helminth infections in Nepal revealed that not using soap
293 for hand-washing was a significant risk factor for the prevalence of roundworm, hookworms and
294 whipworm^{4,8}. Similarly, not using sandals or shoes outside was a significant risk factor for the prevalence
295 of roundworm and hookworms^{4,8}. A study in Anhui Province in central China indicated that labouring
296 barefoot in farmlands was one of the risk factors for *A. lumbricoides* infection among local residents^{9,20}.
297 Moreover, as one of the poor hygiene behaviours, not wearing shoes outside or walking barefoot also
298 were the main risk factors for IHI among local population in poor communities in Nepal, Vietnam and
299 Ethiopia^{8,20}. An evaluation for the control program of STH infections in rural Malaysia and a systematic
300 review for STH infection around the world showed that wearing shoes outside was associated with
301 reduced odds of infection with any STH²⁰. Similarly, exposure to dirt, soil and improper hand washing
302 could cause the intensity of infections related to roundworm, hookworms and whipworm¹⁵. Health
303 education and promotion, regular deworming programs and even support from Non-Governmental
304 Organizations (NGO) and Community Based Organizations (CBO) was therefore necessary to support
305 the needy pupils acquire pair of shoes, and even support the families to build toilets.

306 Level of knowledge of the pupils was determined to be 43.02 percent and it was also determined that
307 there was a strong negative correlation, Pearson's correlation, R of negative 0.7518, between knowledge
308 about STH and prevalence of STH. This information implied that inadequate knowledge on STH was also
309 a risk factor. Interventions geared towards empowering the pupils with knowledge on STHs will have a
310 positive impact of reducing the prevalence of STHs in the Rarieda sub-county^{14,19}.



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312

313 **Figure 3: Knowledge on STH**

314

315 A limitation of the study was that this study being an academic research, there was time limitation as the
 316 study had to be completed within the stipulated academic duration. However, this was minimised by
 317 strictly working within the set time lines. Cooperation with my academic supervisors was highly adhered
 318 to.

319 **4. CONCLUSION**

320 From the study, it was concluded that the prevalence of STH among the primary school going children in
 321 Rarieda was high (27.3 percent). The pupils were 46.2 percent at risk of Soil-Transmitted Helminthiases.
 322 Lack of adequate knowledge on STH was also a risk factor for STH in Rarieda. Strong negative
 323 correlation between prevalence of STH and knowledge on STH and a strong positive correlation between
 324 prevalence of STH and associated risk factors of STH were noted.

325 **CONFLICT OF INTEREST**

326 The authors have declared that no conflict of interest exists.

327 **ASSENT, CONSENT AND ETHICAL APPROVAL**

328 The researcher sought approval to carry out this research project from all the relevant authorities. Upon
329 being cleared by the Mount Kenya University Schools of Public Health and Postgraduate studies; ethical
330 approvals were also sought and obtained from the Mount Kenya University Ethical and Research
331 Committee (MKU-ERC) , the National Commission for Science, Technology and Innovation (NACOSTI)
332 and the County government of Siaya^{6, 10}. The school heads of the selected schools, the area local Public
333 Health and education officers and the area local chiefs had to be officially informed and their approvals
334 sought before the start of the research. Since the study involved minors, that are pupils below eighteen
335 years of age, their head teachers, parents or guardians signed a minor's assent form on their behalf after
336 the pupils were fully informed of the all the information pertaining to the research, what was required or
337 expected of them and any potential risk the research may have posed to them.

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395

396 OPERATIONAL DEFINITION OF KEY TERMS

397 **Deworming** : Refers to giving of an anthelmintic drug to a human or animal to rid them
398 of helminths parasites, such as roundworm, flukes and tapeworm.

399 **Health promotion**: Refers to the activities of enabling people to take control and increase control over
400 their health and the health determinant.

401 **Hygiene and sanitation**: This refers to a set of personal practices and activities that contribute and
402 promote good health. It includes hand-washing, bathing and cutting hair and nails.

403 **Neglected Tropical Diseases**: Refers to a diverse group of tropical infections which are common in low-
404 income countries of Africa, Asia, and the Americas.

405 **Knowledge**: Refers to the facts, information, and skills acquired through experience or education; the
406 theoretical or practical understanding of a subject.

407 **Prevalence:** A statistical concept referring to the number of cases of a disease that are present in a
408 particular population at a given time.

409 **Regular Treatment:** Scheduled and continuous medical care given to a patient for an illness, injury.

410 **Risk factor:** Any attribute, characteristic or exposure of an individual that increases the likelihood of
411 developing a disease or injury (WHO, 2012).

412 **Soil Transmitted Helminthiases:** Refer to the intestinal worms infecting humans that are transmitted
413 through contaminated soil and, is a type of helminth infection caused by different species of roundworms.

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UNDER PEER REVIEW

416 **ACRONYMS AND ABBREVIATIONS**

417	CBO	Community Based Organization
418	CHV	Community Health Volunteer
419	CHRN	Community Health Registered Nurse
420	FGD	Focused Group Discussion
421	NGO	Non-Governmental Organization
422	GVT	Government
423	IFA	Iron-Folic Acid
424	IEBC	Independent Electoral and Boundaries Commission
425	KII	Key Informant Interview
426	Km ²	Kilometer squared
427	Mg	Milligram
428	ml	Milliliter
429	MKF	Mount Kenya University Foundation
430	MKU	Mount Kenya University
431	MKU-ERC	Mount Kenya University-Ethical & Research Committee
432	ml	Milliliter
433	MoE	Ministry of Education
434	MoH	Ministry of Health
435	MUK	Makerere University-Kampala (Kampala, Uganda)
436	NaCl	Sodium Chloride
437	NACOSTI	National Commission for Science, Technology and Innovation
438	NTD	Neglected Tropical Diseases
439	PHT	Public Health Technician
440	PHO	Public Health Officer
441	RCO	Registered Clinical Officer
442	RF	Risk Factor
443	SPSS	Statistical Package for Social Science

UNDER PEER REVIEW