Risk Factors associated with Intestinal Parasitic Infections on School Children in Thika District, Central Kenya

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SUMMARY

The effective prevention and control of intestinal parasitic infections requires the identification of risk factors that contribute to their transmission, among high risk groups.

Objectives: To determine the prevalence and associated risk factors of intestinal parasitic infections among school children in public primary schools in Thika district.

Methods: A cross-sectional study, involving 377 schoolchildren, was conducted in Thika District Central Kenya. Interviews, observation, and anthropometric indices assessment were used to identify the risk factors predisposing the children to infections with parasites. Stool specimens were examined using Katz method for helminthes and formal ether concentration techniques for protozoan infections. Data was analysed using SPSS version.

Results: Ten species of intestinal parasites were identified. *Ascaris lumbricoides* 74 (19.6%) and hookworm 50 (13.3%) while *Entamoeba histolytica* and *Entamoeba coli* were the common protozoa in the study area. A higher prevalence of *Ascaris lumbricoides* was reported among children in the slums. *Entamoeba histolytica* infection was associated with eating raw tubers and fruits ($p < 0.001$) in rural children. *Iodamoeba bustchili* infection was significantly associated with stunted children in rural children. Several factors contribute to high prevalence of intestinal parasites in school going children in Thika District.

Key Words: Risk factors, school-age, children, Anthropometrics indices

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Introduction

School age children are one of the groups at high risk for intestinal parasitic infections.

It is estimated that 400 million school children are infected with one or more intestinal parasites worldwide .This is often associated with poor growth, reduced physical activity, impaired cognitive function and learning ability [1, 17]. Effective control of intestinal parasitic infections depends on improvement in sanitation which is hindered by lack of resources. School based deworming programmes have been recommended as a cost-effective public health measure in less developed countries [24]. The World Health Organization (WHO) recommends baseline surveys in school children to determine the prevalence and intensity of infections [23]. In Cape Town, South Africa in 2005, prevalence trends indicated that infection was mainly through swallowing eggs and/or cysts on food or in water more than exposure to polluted soil [25].

In Kenya, surveys have been carried out to determine the prevalence and intensity of parasitic infection in different areas. In Mwea Division , in Central Kenya, prevalence of infection before mass chemotherapy was 47.4% for *Schistosoma mansoni,* 16.7% *for Necatus americanus,* 1.6% for *Ascaris lumbricoides* , and 0.8% for *Trichiuris trichiura*

[13] The prevalence of intestinal helminthic infections in schoolchildren in Babile town, Ethiopia, was not related to the availability, type and usage of latrines [15]. A higher prevalence of *Hymnolepis nana* was found among children with poor personal hygiene The prevalence of intestinal helminthic infections in schoolchildren in Babile town, Ethiopia, was not related to the availability, type and usage of latrines. A higher prevalence of *Hymnolepis nana* was found among children with poor personal hygiene. Prevalence of hookworm was significantly lower in children who wore shoes regularly. Children with stunted growth had a higher infection rate of *Hymenolepis nana* than children who are properly nourished [7].

Prevalence of *Ascaris lumbricoides* was significantly higher in children who did not wash hands before meals and after toilet visits, those who did not practise boiling drinking water, and the high number of those sharing latrines ($p<0.01$). It was significant at ($p<0.05$) for those who drew water from wells and without latrines ($p<0.05$) . Hookworm infection was high in children whose fathers' were peasant farmers ($p<0.05$). *Entamoeba histolytica* infection was significantly high in children who took unboiled water ($p<0.05$) and those in the rural school who ate raw tubers and fruits from streets ($p<0.05$). Although several studies have been conducted on the distribution and prevalence of intestinal parasites in Kenya, there are still several localities for which epidemiological information is not available. Therefore the objective of the present study was to assess the prevalence of parasitic infections and intensity of helminthes and associated risk factors among schoolchildren in four primary schools in Thika, Central, Kenya.

Material and Methods

The Study Area.

The study was carried out in Thika District, Central Province of Kenya. The District covers an area of 1,960.2 square kilometers. The district borders Nairobi City to the south, Kiambu District to the west, Maragwa District to the north and Machakos District to the east. There are six administrative divisions namely Thika municipality, Kakuzi, Gatanga, Kamwangi, Gatundu and Ruiru. It lies at an altitude of 1060 to 3550 meters above the sea level. The population of as per 2009 census is 223,861 people [10]. The district is densely populated but with diverse distribution varying from one division to the other and from region to region. Gatundu, Thika Municipality and Gatanga Divisions are most densely populated and lower parts of Ruiru and Kakuzi with least density. The district has a bi-modal rainfall pattern, with long rains occurring in the months of March and May and short rains in the months of October and November. Average rainfall ranges between 965mm and 2130mm. The eastern part is semi-arid region and receives low rainfall of 116mm and 965mm with mean temperature of 20°c.

There is some subsistence farming and large scale of pineapple and coffee farming. Thika is an industrial town and highly populated to provide both skilled and unskilled labour in the industries. A high percent of people live in shacks in densely populated Kiandutu slums without effective sanitation and more children can be infected with intestinal parasitic infections.

Study Population.

Primary school children aged between 6-15 years were randomly selected from four primary schools from urban, peri-urban, slum and rural areas; St Patrick (87), Athena (108), Kianjau (92) and Kathambara (90) respectively. Consent was obtained from parents through the headteacher, Ministry of Education and Ministry of Health before the study started. Individual consent was obtained from children along with their parental consent after explanation of the objectives of the study.

The questionnaire and family information

A pre-tested questionnaire based on known risk factors was developed and pretested. The questionnaire contained four sections: 1.**Socio-demographic data**: age, gender, residenceof each child, education and occupation of the parents or guardian.

2. **Behavioral characteristics**: wearing of shoes, eating raw tubers in farms, eating of fruits on the streets, washing of hands before meals and after visiting toilets. 3. **Water and sanitation**: source of water supply, boiling of drinking water. 4. **Toilet characteristics**: Toilet type, toilet slab, toilet sharing, number of families sharing toilets and whether their toilet overflows.

Parasitological examination.

The children were supplied with labeled plastic containers (polypots), a piece of wooden tongue depressor, and instructed to collect, stool samples the next day. All the specimens were checked for proper identification and quantity. Protozoa were examined using formal ether concentration technique. However, the results were recorded as positive or negative. Screening of infection for both soil transmitted helminthes and schistosomes was based on a single 47.1mg Kato-Katz smear [18] prepared from fresh stool samples. All the specimens were checked for their label, quantity, time and procedure of collection. Samples that complied with the study were examined first in the same day by Katz method to quantify the number of eggs per gramme of faeces for helminthes. Protozoa were examined using formol ether concentration technique. The examination of the stool sample was carried out at Thika level 5 hospital laboratory. To ensure consistency of the readings, second readings were performed in 10% of the slides randomly selected. Intensity of infections for each worm was classified according to the thresholds by the WHO expert committee [23] Students' weight and height were measured and compared to a standard population of WHO/NCHS normalized growth reference data recommended by WHO.

Data analysis

SPSS Widows version was used for data analysis. Wasting, stunting and underweight are defined as Z score values of less than −2 SD (Standard Deviation), which is below what is expected on the basis of the international growth reference scale [5]. P− values less than 0.05 were considered statistically significant.

Interpretation of the anthropometric indices was done following the Gorstein guideline

[8]. Weight –for− height (WHZ), which is used to identify children with wasted growth. Height−for− age (HAZ) and weight−for−age (WAZ) ratios were used to diagnose children with stunted and underweight growth.

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Results

A total of 377 children participated, provided proper stool samples and complete information. Among these, (43.8%) were males and (56.2%) females. Study subjects were taken from schools in four different localities; Peri−urban 108 (28.6%), Rural 90 (23.9%), Slum 92 (24.4%), Urban 87 (23.1%).

Six species of intestinal helminthes were identified with overall prevalence of 42 %. The Predominant helminthes and protozoa are as shown (Table 1).

Table I: Prevalence of parasitic infections in the different localities Prevalences of helminthes in specific schools

Parasite species	Peri−urban n=108 N0. (%)	Rural n=90 N0. (%)	Slum n=92 N0. (%)	Urban n=87 N0. (%)
*Ascaris lumbricoides**	12 (10.2)	24 (26.7)	25 (27.2)	13 (14.9)
Trichuris trichiura	10 (9.3)	3 (4.4)	4 (4.3)	5 (5.7)
Hookworm*	21 (19.4)	12 (20)	5 (5.4)	6 (6.9)
Schistosoma mansonii	1 (0.9)	1 (1.1)	5 (5.4)	3 (3.4)
*Enterobius vermacularis***	8 (7.4)	1 (1.1)	1 (1.1)	1 (1.1)
Hymenolepis nana	0 (0)	6 (6.7)	16 (17.4)	5 (5.7)
*Entamoeba histolytica****	16 (14.8)	20 (22.2)	18 (19.6)	1 (1.1)
Entamoeba coli	26 (24.1)	19 (21.1)	12 (13)	14 (16.1)
Giardia lamblia	9 (8.3)	6 (6.7)	5 (5.4)	6 (6.9

* The difference was statistically significant ($p<0.01$), ** The difference was statistically significant ($p<0.05$), *** The difference was statistically significant ($p<0.001$

Table (II) . Risk Factors Significant in the Four Localities; Peri-urban, Rural, Slum and Urban.

Risk Factors	χ^2 (df)	Significance
Mother occupation	198.8(3)	p<0.001
Father occupation	144.7(3)	p<0.001
Wearing Shoes to school	36.89(3)	p<0.001
Wearing Shoes to farm	9.03(3)	p<0.05
Wearing shoes to play	2.273(3)	p=0.518
Eating fruits/tubers	0.977(3)	p=0.807
Washing Hands before meals	10.555(3)	p<0.05
Washing Hands after toilet visits	35.702(3)	p<0.001
Source of drinking Water(Piped/well)	47.73(3)	p<0.001
Boiling of Drinking Water	64.77(3)	p<0.001
Type of latrines(Pit/Flush/Open fields)	41.01(3)	p<0.001
Latrine Floor(Wood floor/Concrete/floor)	110.5(3)	p<0.001
Toilet Sharing	18.36(3)	p<0.001
Toilet Overflow	39.39(3)	p<0.001

Risk factors Associated Overall Prevalence of *Ascaris lumbricoides* Infection in the population (Table iii)

Ascaris lumbricoides infection was not significantly associated with social demographic factors in the all the four schools, p>0.05. In the four schools, failure to wash hands before meals contributed significantly to *Ascaris lumbricoides* infection, (P<0.01). Children who did not wash hands before meals (41%) had *Ascaris lumbricoides* infection, while those who washed hands before meals and had infected were (15%), (p<0.01)). Children whose families had no toilets had high infection than those with toilets (p<0.01); Children whose toilet had wooden slab got more infected than those who used toilet that had concrete slab (p<0.001). Communal toilets had significant relationship with *Ascaris lumbricoides* infection (p<0.01).

Table iii: Risk factors associated overall *Ascaris lumbricoides* infection in the study population

Ascaris lumbricoides infection		
Risk factor	χ^2	**Signficance**
Behavioural factors		
Washing hands before meals	23.55	<0.01
Washing hands after toilet visit	14.47	<0.01
Boiling of drinking water	8.732	<0.01
Type of toilet		
Open Fields		
Flush toilets	10.998	<0.01
Pit latrine		
Toilet slab		
Wooden slab	16.005	<0.001
Concrete slab		
Boiling of drinking water	8.732	<0.01
Number of families sharing		
<5		
5-9	16.902	<0.01
>10		

Risk factors associated *Ascaris lumbricoides* infection in slum, urban and rural children

In the slum school, *Ascaris lumbricoides* infection was significantly higher in children who did not practice washing hands before meals, (p<0.01). A higher prevalence of *Ascaris lumbricoides* was found among slum children who had wood toilet slab (p<0.05) and shared toilets (p<0.05) than in the peri-urban and rural children. Prevalence of *Ascaris lumbricoides* in urban school was not related to type of toilet, toilet slab, toilet sharing and toilet overflow. In urban school, *Ascaris lumbricoides* infection was significantly associated with the habit of washing hands before meals, ($p<0.05$). Similarly, the overall prevalence of *Ascaris lumbricoides* infection was (30.4%) among children who did not wash hands after visiting toilets, and 14.7% who washed, ($P<0.01$). For specific schools, in the rural area, only failure to wash hands after toilets showed association with *Ascaris lumbricoides* infection, ($p<0.05$). The percentage of those who failed to practice washing hands after toilets and were infected was higher (68%), as compared to those who washed and were infected (22%).

Table iv: Risk factors associated *Ascaris lumbricoides* infection in slum, urban and rural children

Risk Factors and	*Ascaris lumbricoides* infection			
	Slum			
Risk factor	**Yes**	**No**	χ^2	**Significance p**
Behavioural factors	**n (%)**	**n (%)**		
Washing hands after toilet	5(22)	16(68)	13.674	<0.01
Toilet slab				
Wooden slab	20(27.4)			
Concrete slab	8(11)		6.298	<0.05
Toilet sharing	18(24)	37(51.1)	5.84	<0.05
	Urban			
Washing hand before meals	1(11)	12(35.7)	5.26	<0.05
	Rural			
Washing hands toilet visit	6(22)	18(68)	7.191	<0.05
	Rural			
Water source				
Piped water	4(15)		8.902	<0.05
Well water	8 (31)			

Among the socio-demographics characteristics of the population, fathers' occupation was significantly associated with hookworm infection in the children, ($p<0.05$). Children whose fathers were peasant farmers had the highest infection risk of 28%, casual labourers (12.2%) and small business at 11.3%. Children whose fathers were self employed and formally employed had the lowest risk. All the other socio-demographics characteristics of population were not significantly associated with hookworm infection ($p>0.05$). The habit of wearing shoes to the farm was not associated with hookworm infection, ($p=0.069$). Habit of wearing shoes to school or to playfield, eating of raw food and tubers, washing hands before meals and after visiting toilets were not associated with hookworm infection. Source of drinking water and boiling of drinking was not associated with hookworm infection ($p<0.05$). Hookworm infection was not significantly associated with the other socio-demographics, behaviour, water sources and toilet characteristics in peri-urban, rural and slum schools, ($p>0.05$). In the urban school, there was no significant association between hookworm infection and behaviour, water sources and, toilet characteristics. For *Enterobius vermacularis* and *Hymnolepis nana* the overall prevalences were very low and thus not possible to do statistical analysis on the data.

Infection with *Entamoeba histolytica* was significantly associated with occupation of child's mother, ($p<0.05$). Children whose mothers were peasant farmers and laborers were proportionately more infected (24.4% and 20% respectively) than those whose mothers were formally employed and in small business (10.5% and

9.1% respectively), ($p<0.05$). The habits of, washing hands before meals and after visiting toilets were not associated with *Entamoeba histolytica* infection ($p>0.05$). Eating raw food and tubers was associated with *Entamoeba histolytica*, p=0.06. Source of drinking water and surface water source were not significantly associated with *Entamoeba histolytica* infection. However, *Entamoeba histolytica* infection was associated with habit of drinking unboiled water, ($p<0.05$). Children whose families did not boil water were more infected (18.8%) than those whose families boiled water (8.9%) ($p<0.05$). *Entamoeba histolytica* infections were not significantly associated with toilet characteristics ($p>0.05$).

For specific schools, there was no significant association between *Entamoeba histolytica* infections with socio-demographics characteristics, behaviour, water sources and toilet characteristics in slum and urban schools, $p>0.05$. Washing hands before meals and after toilets were not significantly associated with *Entamoeba histolytica* infections, ($p>0.05$). However, eating of raw foods, tubers and fruits by rural children, was significantly associated with *Entamoeba histolytica* infections, ($p<0.001$). In the peri-urban school, wearing of shoes to school, to the farm, and playfields; washing hands before meals and after toilets, were not significantly associated with *Entamoeba histolytica* infections, ($p>0.05$).

Table v: Risk factors associated *Entamoeba histolytica* infection in overall population.

	***Entamoeba histolytica* infection**		
Risk factor		χ^2	**p**
Mother occupation	Overall	11.14	0.012
Boiling drinking water	Overall	6.289	0.024
Eating of fruits/tubers	Rural	18.37	0.014

Head of household, parents' education, and parents' occupation were not significantly associated with *Entamoeba coli* infections. In all the four schools, there was no relationship between socio-demographic factors and *Entamoeba coli* infections, $p>0.05$. In the slum school, there was significant association between failure to washing hands after toilets with *Entamoeba coli* infections, ($p<0.05$). More students (54.5%) of those who did not wash hands after toilets were infected and 36% of those who washed hands got infected. The source of drinking water for the family was significantly associated, ($p<0.01$), *Entamoeba coli* infections. Children from families that did not have piped or well water were significantly infected at 40.7% followed by 17% by those with piped water, and 12.7% of well water. As per individual schools, there was no association between the source of drinking water for the family and *Entamoeba coli* infections, ($p>0.05$). For specific schools, only in the slum school where the type of toilet was significantly associated with *Entamoeba coli* infections, ($p<0.05$).

Table vi : Risk factors associated *Entamoeba coli* infection in slum, rural and peri-urban children

	Entamoeba coli infection		
Risk factor	**locality**	χ^2	**Significance**
Eating of fruits/tubers	Slum	7.596	0.028
Washing hands after toilets	Slum	6.55	0.032
Toilet facility	Slum	6.631	0.0301
Source of water	overall	11.878	0.004

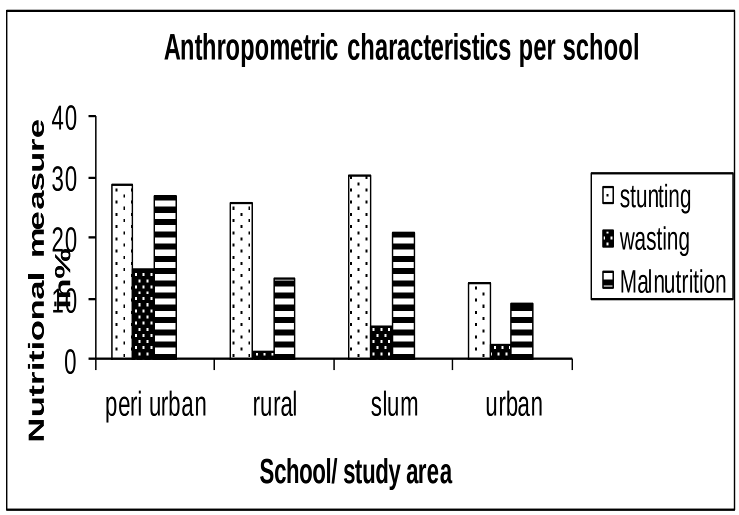
Anthropometric Nutritional Characteristics of the study population

Stunting (HAZ) was the predominant parameter manifested 24.7% (93 out of 376), followed by malnutrition (WAZ) 18.1% (68 out of 375), and wasting (WHZ) 6.4% (24 out of 375) . Stunting was significantly different in the four schools, ($p<0.05$). The slum school showed high prevalence of stunting with 30.4%, followed by peri urban with 28.7%, rural with 25.8% and urban with 12.6% ($p<0.05$). Wasting in children was significantly different across the study areas, ($p<0.001$). The peri urban school showed high prevalence of wasting with 14.8%, followed by slum with 5.5 %, urban with 2.3% and rural with 1.1% respectively. The rate of malnutrition was significantly different across the study areas, ($p<0.001$). Malnutrition was high in peri urban with 26.9 %, slum school (20.9%), rural with 13.5%, and urban with 9.2% (Figure 1).

Nutritional status in different schools.

The relationship between anthropometric scores and intestinal helminthic infections were analysed by cross tabulation. The overall prevalence of intestinal helminthic infections was not significantly associated with stunting, wasting and malnutrition ($p>0.05$). Similarly, there was no association between the anthropometric scores and helminthes infections in the specific schools ($p >0.05$). The overall prevalence of intestinal protozoa infections was significantly associated with stunting, ($p<0.001$). It was apparent that proportionately more children infected with protozoa were stunted. In specific schools, stunted children in peri-urban were significantly associated with protozoa infections ($p<0.05$) respectively. However, stunted children from the pei-urban, rural and urban schools did not show any association with protozoa infections ($p>0.05$). Wasting and malnutrition parameters were not significantly associated with protozoa infections ($p>0.05$).

Figure 1: Nutritional status in different schools



The education level of all the parents of the children did not contribute significantly to difference in the levels of parasitic infections. This is an indicator that academic knowledge did not translate into lower worm burdens. The children of literate parents had worm burdens similar to the children of illiterate. The education and occupation of people indicate the socio economic aspect of population. *Ascaris lumbricoides Entamoeba histolytica* and *Entamoeba coli* infection were not associated with socio-demorgraphic factors. This is contrary to popular believe that socio-economic status can be used as good predictor of intestinal helminthic infections [11, 12). However; going by specific schools, all the socio-demorgraphic factors had no effect on the prevalence of *Ascaris lumbricoides* infection.

However, the occupation of the father contributed significantly to the levels of infections associated with hookworms. Children whose fathers were peasant farmers had highest risk of infection. This could be because hookworm transmission is through penetration of larvae from the soils and children from such families get involved in farming activities. Mothers' occupation was not associated with hookworm infection. This was similar to the results observed by [14] that occupation is a good indicator of intestinal helminthiasis. For specific localities, urban area showed fathers' education contributing significantly to the level of infection associated with hookworm infection. This could be explained by correlating the father's education with other variables. The father's education correlated negatively with hookworm suggesting that as education levels increased the level of hookworm infection decreased. This was as a result of several underlying factors. These included the fact that such an educated man married an educated wife, had few children in his household and had a regular source of income. This is similar to the results observed by [14] that fathers' educational level is a good indicator of intestinal helminthiasis.

Overall Infection with *Entamoeba histolytica* was significantly associated with the occupation of the childs' mother, with children whose mothers were peasant farmers and labourer being more infected. This could be explained by correlating mothers occupation with other variables. Mothers who are peasant farmers and labourer are those of low socio-economic status and with poor sanitary and environmental conditions. *Ascaris lumbricoides and Entamoeba histolytica* are highly prevalent in the four schools studied and this indicate problems in basic hygiene and sanitation. In specific areas, children from slum recorded *Ascaris lumbricoides* infection associated with failure to wash hands before meals and after visiting toilets. This is similar to study done in Ethiopia [7] where higher rate of helminthes was reported in children who did not wash hands before meals. Use of water from well and other surface water led to higher infection of ascariasis than use of piped water; similar to school children in Ethiopia who had high prevalence [7] *Entamoeba coli* was significantly associated with source of drinking water. Failure to boiling of drinking water was associated with ascariasis and *Entamoeba histolytica* infections ($p<0.01$, $p<0.05$) respectvely. It seems that the habit of regular wearing of shoes had a significant contribution to the low prevalence of hookworm infections. Education on disease transmission and wearing of shoes may contribute to the prevention and control of hookworm and parasites with similar modes of transmission. Poor sanitary and environmental conditions are known to be relevant in the propagations of the infectious agents, [19].

In the slum school, wooden slab and latrine sharing were associated with higher *Ascaris lumbricoides* infection. *Ascaris lumbricoides* and *Entamoeba coli* infections were associated with the type of toilet and the type of toilet floor. Those without latrines had the highest risk of infection of the both parasites. Toilet slab (wood floor and concrete slab) and communal toilets contributed to *Ascaris lumbricoides* infection. In the slum school, wooden slab and latrine sharing were associated with higher *Ascaris lumbricoides* infection. Toilet characteristics from peri-urban, rural and urban areas did not show association with *Ascaris lumbricoides* infection .This conforms with study done in Brazil where children from poorer dwellings with lower sanitation and hygiene scores were at higher risk of infection than better off groups [6].Wooden latrines in the slum area were crude and difficult to clean, fitting the description of [4] as focal points of disease transmission.

The habit of eating raw tubers from the farm was significantly associated with *Entamoeba histolytica* infection in the rural area. Slum and the urban school did not have any significant association with the behaviour characteristic and did not have association with *Entamoeba histolytica* infection. *Entamoeba coli* was not associated with the socio-demographic, water and sanitation characteristics in the four localities. However, in behaviour characteristics, rural school children habit of eating raw tubers from farms and failure to wash hands after toilets contributed to *Entamoeba coli* infection. This may be because farming is more in rural area than in peri-urban, slum and urban and also due to poor level of hygiene practice. There was no significant association between *Entamoeba coli* and toilet characteristics in peri-urban, rural and urban school children. However, the slum school children showed significant association between *Entamoeba coli* infection and toilet characteristics. There was high infection in children with no toilet facilities than those who used toilets. The difference may be due to improper toilet facilities which require individuals to defecate in areas around their homes.

Most pupils were in age group 9-11 years (65%) because they enroll in class one at the age of 6 years and the study group were all in class three and four. The mean body weight mean was highest in the rural school followed by urban school. As observed in other studies, majority of children in these two schools could have come from better-off households, with higher socioeconomic (including purchasing power and schooling profiles than in peri-urban and slum children [21, 6] . Stunting was significantly different in children from the four categories of schools,

In agreement with study in Ethiopia [3] anthropometric scores were found to be independent of the overall rate of intestinal helminthic infections. However studies done in Mexican school children has shown a higher prevalence of overall helminthes infections in stunted children compared to those in normally nourished children [20]. Degree of stunting malnutrition and wasting was high in children from slum and peri urban which could be because of they come from families where the children are not assured of a daily solid meal. This could be explained by the fact that there were funded free school meals for all the children in the urban school while only those children who were orphans, and from single mothers were fed in slum school. These programmes provided a high calorie; protein rich lunch and this could have prevented their starving in spite of parasitic infections. The rural and peri urban schools did not have such programmes at the time of the study.

This study has analyzed the relationship between anthropometric scores and parasitic infection. The overall prevalence rate of intestinal helminthes infections was not different among children with or without stunting, wasting and underweight. A study done in Mexico a higher prevalence of overall helminthic infections in stunted children compared to those in normally nourished children. However, the overall prevalence of intestinal protozoa was associated with stunting. There was an association between *Iodamoeba bustchili,* infections and stunted children of peri urban school respectively. This organism is a commensal and could be it interferes with absorption hence stunting manifestation may occur. Whereas, urban, and slum schools there was feeding programs, there was none in the peri-urban school. This could be explained by the fact that underweight represents a state of acute malnutrition that can be corrected by food while stunting is an index of chronic malnutrition. Lack of adequate nutrients caused by high intensity infection in a critical period can prevent the normal growth in pre pubertal and pubertal children. Another contributing factor to growth failure is adverse emotional and social environment existing in families with the highest worm burdens and living in very miserable conditions [22]. Due to low number of positive cases, it was not possible to analyze the effect of other intestinal parasitic infections on the anthropometric scores of school children.

Conclusion

Intestinal parasitic infection is an important public health problem in Thika district, Kenya .It is evident slum residence has a number of risk factors based on lack of basic hygiene and proper sanitation that lead to transmission of intestinal parasitic infections. Though anthropometric parameters showed less relationship with infections, a high degree of stunting and malnutrition was noted in children slum and peri-urban. Interventions including mass deworming and health education on personal hygiene to the children and parents is required.

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