SOIL TRANSMITTED HELMINTHS, PREVALENCE, INTENSITY, SOCIO-ECONOMIC AND HEALTH EDUCATION IMPACT AMONG PRESCHOOL AGE CHILDREN IN ELBURGON MUNICIPALITY, KENYA.

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Abstract

Soil transmitted helminths are a group of three intestinal parasites namely: Trichuris trichiura, Ascaris lumbricoides, and hookworm (Ancylostoma duodenale and Necator americanus). Intestinal parasitic infections cause major public health challenge with risk factors including: low socio-economic status, scarce primary health education, poor personal and environmental hygiene. This study was undertaken to determine the prevalence, intensity, socio-economic factors and control methods of soil transmitted helminths among preschool age children in Elburgon Municipality, Kenya. One seventy nine (179) stool samples from preschool age children were screened for the presence of helminth ova using Kato-Katz technique. Information on socio-economic factors and control methods was collected using a structured questionnaire from one twenty (120) households and analysed using Microsoft Excel descriptive statistical tool. The overall STHs infection prevalence in the study area was 154 (86%). Trichuriasis was the most prevalent 50.84%, Ascariasis 25.14% and hookworm 10.6%. Level of education of the mother and her occupation, as well as the level of education of the household head showed significant impact on the prevalence of STHs among PSAC in Elburgon Municipality. Health facilities were associated with STHs control. It was concluded that STHs prevalence among preschool age children in Elburgon Municipality was high. Based on this study, it is recommended that national intestinal helminths mass deworming campaigns should be extended to include preschool age children in endemic areas.

Keywords: Soil transmitted helminths, Prevalence, Socio-economic factors, Preschool age children.

INTRODUCTION

Soil transmitted helminths (STHs) are a group of three intestinal helminths considered as one disease under neglected tropical diseases (NTDs), (WHO, 2013). The helminths are Ascaris lumbricoides, Trichuris trichiura and Hookworm (Ancylostoma duodenale and Necator americanus). Over 2 billion people are infected with STHs worldwide. Ascariasis accounts for approximately 1.2 billion infections while trichuriasis and hookworm (Ancylostoma duodenale and Necator americanus) accounts for over 800 million and 740 million infections respectively (Albonico, et al., 2008) The greater burden of STHs infections is found in the tropical countries including Tropical South America, China, East Asia, and Sub-Saharan Africa (Saboya et al., 2013). Soil transmitted helminths are poverty related diseases that affect economically underprivileged populations living in third world countries. Among the three parasites discussed here, Ascaris lumbricoides is the most severe and is responsible for causing 60,000 children deaths each year, (Bethony, et al., 2006). Hookworm infections cause high anaemic morbidity observed in children with intestinal helminths infections (Bethony et al., 2006).

The World Health Organization (WHO) estimate that 42 countries in Africa are endemic of STHs parasites with 284 million cases occurring in both school age and preschool age children. These children require frequent chemotherapy (WHO, 2011).

The common strategy for controlling morbidity due to STHs infection is preventive chemotherapy (Koroma, 2010; Zhang, et al., 2007; Friedman et al., 2012). Use of drugs is effective although the strategy does not entirely prevent reinfection (Ziegelbauer, et al., 2012; WHO, 2012). Therefore, personal and environmental hygiene supplements chemotherapy in controlling STHs infections among the risk population. In addition to chemotherapy, other significant methods of controlling STHs intestinal worms include the general improvement of socioeconomic status, sanitary conditions of living environment and increased primary health education (Pullan, et al., 2011). The World Health Organizations recommends the use of integrated approach to controlling and preventing NTDs especially when designing programs to eliminate these infections (WHO, 2013).

The general control strategy of STHs requires direct and collective responsibility from stakeholders (Vera et al., 2005). Soil transmitted helminths control should incorporate diagnostic testing and effective treatment of infected individual at all levels of community structure (Pullan et al., 2011).

In Kenya, 9.1m people are at risk of STHs infections. Majority are children (Brooker, et al., 1999). The current STHs prevalence is directly associated with lack of case treatment, low household socio-economic status, poor personal hygiene and compromised living environment sanitation. The prevalence and distribution pattern indicate that children from low-income families living in poor hygiene environments always have a higher risk of infection, (Gunawardena, et al., 2008; Belyhun, et al., 2010). Clinical symptoms and morbidity from STHs manifests in children between 6-24 months of age. These intestinal parasites are also common in young mothers (Vera et al., 2005).

Preschool age children are not included in mass deworming campaigns aimed at controlling STHs infections in the country. Elburgon Municipality has a high population of preschool age children below five years not covered in the national school deworming program. Existing STHs control programs in Kenya lay emphasis on public school going children through targeted deworming campaigns. There is no effective strategy in place for control of STHs in the preschool age children. This study was undertaken to determine the prevalence, intensity, socio-economic factors and control methods of soil transmitted helminths among preschool age children in Elburgon Municipality, Kenya. The purpose...
of this study was to improve soil transmitted helminths control strategies among preschool age children in Elburgon Municipality Kenya, through public health education and treatment.

**STUDY AREA**

This study was conducted in Elburgon Municipality of Nakuru County, Kenya. Elburgon division occupies an area of 436 km² and is globally positioned at Latitude (DMS) 0° 18' 0S, Longitude 35° 49' 0E with 2423 meters Altitude. It has a total human population size of 90,000 with 20,000 households (Obiria, 2012). Most of the households are concentrated in semi-urban living area of the Municipality.

**METHODOLOGY**

**Study design and target population recruitment**

A cross-sectional survey involved a one-time interaction with the study population was undertaken in Elburgon Municipality. Random sampling was done at the study site to select household sampling units. Households with preschool age children below five years old were identified and included in the study. The target population recruited for this study was preschool age children below five years and who did not attend public primary schools. During sampling, those who had received STH treatment within three months prior to this study were not eligible for this study.

**Determining prevalence and intensity of STH infection among PSAC**

Fresh fecal samples were collected from 178 preschool age children below five years recruited in the study. Parents were provided with plastic stool caps and polythene bags and instructed on how to collect sufficient fecal sample from first health break. The use of polythene bags was to avoid stool contamination with soil during defecation. Collected stool samples were transported to the laboratory using a clinical cooler box packed with ice packs. Due to the need to process the stool immediately for egg count, manageable samples, (10 samples per day) were collected each day of the laboratory diagnosis.

**Faecal sample processing procedure**

The standard procedure for Kato Katz technique was used to confirm the presence of helminth eggs in faecal samples. Kato Katz is a laboratory method for preparing human stool sample prior to searching for parasite eggs. Specific parasite egg counts data were analysed using descriptive statistics and the results plotted in graphs. **Assessing the impact of socio-economic factors in STH infection among PSAC**

A structured questionnaire was administered to household representative (parents or guardian).

Measurable variables in the questionnaire were: Level of mother's education, level of household head education, mother’s occupation, and head of household occupation. Scores of the measurable variables were analysed using Microsoft Excel ANOVA to generate significance level.

**Assessing public health education on the control of STHs among PSAC**

A structured questionnaire was administered in the study area to household respondents to assess their knowledge of STHs. The measurable variables were: Sources of STH information (Health facility, community health worker, Radio/TV, Talk in the community). Data of the scores from the measurable variables in the questionnaire were tabulated and analysed using Microsoft Excel to generate by charts.

**ANALYSIS AND RESULTS**

**Prevalence and intensity of soil transmitted helminths**

Overall prevalence of STH in Elburgon Municipality was 86% of 179 PSAC sampled. Fourteen percent of 179 PSAC sampled were negative as per the fecal samples analyzed, Fig (1).

**Mixed STH parasite infection of PSAC participants**

Mixed parasite infection was evident in 28% of 179 PSAC participants based on the stool samples analyzed in Elburgon Municipality. A combination of *T. trichiura* and *A. lumbricoides* recorded the highest parasite prevalence, Fig (2).

**Specific STHs prevalence in Elburgon Municipality**

Specific STH parasite prevalence in Elburgon municipality indicated that *T. trichiura* was the most prevalent with 91 cases (50.84%), followed by *A. lumbricoides* with 45 cases (25.14%) and hookworm with 18 cases (10.06%) based on fecal samples examined. Hookworm prevalence of 10.97% was the lowest as compared to other helminths in the study.

**Mean Egg Per Gram (EPG) counts for STHs in Elburgon Municipality**

Mean EPG counts indicated that *A. lumbricoides* had the highest mean EPG. Parasitic burden describe the intensity of STH infection among the PSAC children living in Elburgon Municipality. *Ascaris lumbricoides* had the highest prevalence of parasite burden among preschool age children with heavy infection and had a mean of 34,851.7 EPG based on faecal samples. *Trichuris trichiura* and hookworm recorded a mean of 48.8 and 45.3 EPG of faeces respectively as shown in Table (1).
Table (1) Mean EPGs and STHs intensity in PSAC in Elburgon Municipality

<table>
<thead>
<tr>
<th>Helminths infection intensity</th>
<th>Parasite species</th>
<th>Mean EPG</th>
<th>Maximum</th>
<th>Light</th>
<th>Moderate</th>
<th>Heavy</th>
</tr>
</thead>
<tbody>
<tr>
<td>T. trichiura</td>
<td>48.8</td>
<td>144</td>
<td>91 (50.84%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>A. lumbricoides</td>
<td>34851.7</td>
<td>64824</td>
<td>6 (3.4%)</td>
<td>0 (0%)</td>
<td>39 (21.8%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Hookworms</td>
<td>45.3</td>
<td>120</td>
<td>18 (10%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

NB: EPG denotes eggs per gram, % denotes parasite specific prevalence

Socio-economic factors and STHs prevalence among PSAC

Socio-economic factors (level of education, occupation) among households in Elburgon Municipality showed significance of STH prevalence among PSAC in Elburgon Municipality. Mother’s education, father’s education and father’s occupation showed significant impact (P=0.05) in STHs prevalence among PSAC in the study area.

Impact of public health education on STH control

Information received from health facilities had the highest impact on STHs control within Elburgon Municipality as compared to interpersonal communication and community health workers, Fig(3).

DISCUSSION

This study was undertaken to determine the prevalence and intensity of STH infection among preschool age children in Elburgon Municipality. Overall prevalence of STH infection was 86% among PSAC. These results indicate that the prevalence of soil transmitted helminths among preschool age children in Elburgon Municipality is high. Based on stool sample examination, majority of children had an infection with T. trichiura, A. lumbricoides or hookworm (Ancylostoma duodenale and Necator americanus). Among the three common intestinal helminths in the study, T. trichiura had the highest prevalence as compared to A. lumbricoides and hookworm (Ancylostoma duodenale and Necator americanus), respectively. Ascaris lumbricoides had a higher intensity representing parasitic burden among patients. The overall high prevalence of STH in Elburgon Municipality among PSAC agrees with results of recent studies in a similar environment on children below five years in Webuye, Western, Kenya, which recorded an overall prevalence of 74.4%, (Obala et al., 2013). A similar study conducted in a similar location in Nyanza, Kenya but with older children of age between five years and nine years reported a minimum estimated prevalence of 68%, (Riesel et al., 2010; Odiere et al., 2011; Ng’etich et al., 2013). These results suggest that there is a general trend in soil transmitted helminths prevalence among preschool age children in semi urban households in similar towns in endemic areas. The common trend on STH infection in similar households is a result of common environmental conditions and similar socio-demographic statuses of patients, (Ezeagwuna et al., 2009).

Results from this study showed that T. trichiura was the most prevalent, (50.84%) parasite as compared to other STHs. These findings concur with national survey conducted in Philippines that compared STH prevalence in urban and rural villages, (Belizarov et al., 2013; Scolari et al., 2000). This result and reviewed data from various researches on comparison of STH infection between rural and urban dwellings suggest that T. trichiura is more prevalent in urban dwellings that rural villages, (Scolari et al., 2000). High prevalence of STH infections in endemic areas are usually associated with poor sanitation, indiscriminate raw sewage disposal and low household living standards, (Mwinzi et al., 2012).

Findings from this study showed that A. lumbricoides had the higher parasite intensity, >50,000, based on STHs egg per gram count. The findings concur with those of Chan et al., (1994), who reported that Ascaris spp. has a high egg laying fecundity, (Chan et al., 1994). High number of eggs per gram of sampled stool indicates high intensity of soil transmitted helminths. These results suggest that approximately 15% of human population with these intestinal helminths harbor heavy infection, (PAHO, 2011). In any given endemic area, observation in the proportion of individuals with heavy infection as compared to light and moderate infection create an over dispersed parasite burden trend, (Chan et al., 1994). The few individuals who harbor heavy infections suggest that, they are the population noted with develop morbidity associated with intestinal helminths.

Results from this study showed that the level of education of the mother and her occupation as well as the level of education of the household head showed significant impact on the prevalence of STHs among PSAC in Elburgon Municipality. The findings are similar to other studies elsewhere, which found that socio-economic factors influence the prevalence of STHs among preschool aged children in a given locality, (Ostan et al., 2007). The results suggests that lower socio-economic statuses such as unemployment, low education, poor living environment, living in overcrowded space and the general low family social statuses have been associated with high STH prevalence in both PSAC and SAC in intestinal parasite endemic areas, (Ostan et al., 2007).

This study found that information received form health facilities had highest impact on the control of STH within Elburgon Municipality. These results concur with health education research conducted in Peruvian Amazon, (Gyorkos et al., 2013). Therefore suggesting that health education from health facilities and chemotherapy is used in controlling STH among PSAC in Elburgon Municipality. Health facilities and related resources such as health care professionals play a key role in disease control, (Coulbaly, 2012).

Mass media did not provide public health education to Elburgon Municipality residents. These results do not agree with studies of the role of media exposure in Kenya in enhancing health education, (Schmidt et al., 2009). The findings suggest that many programs aired on radio about communicable diseases are usually those that campaign on larger diseases of public health importance such as malaria, tuberculosis, measles, sexual transmitted diseases and diarrhea. Intestinal helminths are neglected tropical diseases, which do not receive significant attention from the government bodies in charge of public health administration as well as funding bodies for disease control, (Schmidt et al., 2009; Aunger et al., 2010).

**Fig(3) Impact of source of public health education on the control of STHs**

**DISCUSSION**

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CONCLUSION
The overall prevalence of STHs in PSAC within Elburgon municipality was 86%, while the most prevalent specific parasite species were *T. trichiura* and *A. lumbricoides* as evidenced by the mean egg counts. Socio-economic factors (level of education, occupation) influenced the prevalence of STHs among PSAC in Elburgon Municipality. Health facilities provided significant public health education on the control of STHs in Elburgon Municipality.

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