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# Regional Health Policies and Programs Regarding Plans and Implementation of Healthy Lifestyle Promotion and Intestinal Parasitic Infections Among the School Going Children in Meru County, Kenya

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## ABSTRACT

**Background:** Public Health Promotion aims to improve health by empowering people to control and improve their health. School-aged children are particularly affected, as they spend most of their time at home and school. In Kenya, the Kenyan government implemented a school deworming program in 2008, affecting 56.8% of school-aged children aged 5-14 years.
**Methods:** This study adopted a mixed methods design, specifically the convergent parallel mixed methods research design. Data was collected using questionnaires, key informants guide, observation and stool examination for intestinal parasitic infections which were administered to both the experimental groups and the control groups. Data analysis was carried out with the aid of SPSS version 26.0, using descriptive statistics to describe the characteristics of the studied population. Qualitative data was analyzed by thematic content analysis.
**Results:** The study found that 34.7% and 38.4% of respondents were aware of intestinal worms having helminthic and protozoan infections, respectively. However, there was no significant association between these two infections. All other variables had no statistical relationship with helminthic and protozoan infections. Additionally, 30.7% and 24.1% of respondents were aware of intestinal worms having protozoan infections, but no significant association was found. Hand washing with soap and water had a statistical relationship with protozoan infections.
**Conclusions:** Hand hygiene practices significantly reduced the prevalence of intestinal helminthic and protozoan infections in children. Factors contributing to this reduction include gender, healthy eating habits, proper nutrition, cooked food, and boiling water. Public health interventions were effective in reducing the prevalence of intestinal parasitic infections in the intervention group.

***Keywords:*** Hand hygiene, soil transmitted helminths, Disease outbreak, Handwashing facilities

## INTRODUCTION

Public Health Promotion aims to improve health by empowering people to control and improve their health. Intestinal parasitic infections, primarily caused by helminthic and protozoan parasites, affect over 2 billion people globally, with 24% of the population being affected. These infections are particularly prevalent in young children, particularly in agricultural countries, causing health issues such as pallor, torpidity, and developmental delays(1). In countries like the UK, USA, and Germany, less than 0.5% of children are infected, while in India, 12.5-67% of school-aged children are affected. In Zambia and Tanzania, studies have shown a high prevalence of helminth infections among school-going children, with A. lumbricoides and hookworms being the most prevalent(2–4). Despite the Kenyan government's School Health Programme, the prevalence of intestinal helminthic and protozoan infections remains high at 53.5% and 14.8%, respectively. Epidemiological surveys in Kenya's poor peri-urban and urban school children reveal a high prevalence of intestinal parasitic infections with Ascaris lumbricoides, Trichuris trichiura, Entamoeba histolytica, and Giardia lamblia(5). The Kenyan government's current strategy of mass drug administration to school-going children has been successful in mitigating transmission, but they are the most vulnerable age for these infections. The morbidity of helminths infection is high, and the numerical threshold at which worms cause disease in children has not been established(6). The Kenyan government has focused on de-worming through school programs to reduce/eliminate STH infections for children living in endemic communities, resulting in a reduction in the transmission of STH in preschool groups.

Intestinal parasitic infections are a significant public health concern in developing countries, with risk factors including living in rural areas, poor communities, poor sanitation, lack of clean water, and poor personal hygiene. School-aged children are particularly affected, as they spend most of their time at home and school. Intestinal parasitic infections are governed by behavioural, biological, environmental, socioeconomic, and health systems factors, including access to domestic and village infrastructure, economic factors, employment, and social factors(7). Parasitic infections are preventable and common among primary school children in communities with poor socioeconomic status and hygiene conditions. They cause nutritional problems, psychological and social wellbeing, and compromised mental development(3). In Kenya, the Kenyan government implemented a school deworming program in 2008, affecting 56.8% of school-aged children aged 5-14 years. However, children under five years are the most vulnerable to these infections, harboring high-intensity Soil Transmitted Hemolytic Infections (STH) infections(8,9). The numerical threshold at which worms cause disease in children is not established, as it is highly dependent on the host's nutritional status.

## MATERIALS & METHODS

This was an intervention study using mixed methods design with before and after assessments. Mixed methods research is a type of research in which a researcher or team of researchers combine elements of qualitative and quantitative approaches (for instance use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purpose of breadth and depth of understanding and corroboration. The intervention involved stool examinations to assess intestinal parasitic infections prevalence in both intervention and control sites. Infected children were treated with Albendazole suspension and tablets, and hand washing stations were established with poly pots. Health promotion programs were conducted, including training on personal hygiene, crop rotation, and environmental conservation. soap and detergent were provided for toilet cleaning, and proper hand washing training was provided to household members, especially children and caregivers with the training cascaded to other absent household members. The intervention aimed to prevent intestinal parasitic infections and promote hygiene. Qualitative methods (use of Key Informant

Interviews from sub county health facilities in-charge comprising senior subcounty public health officers and community health volunteer in each subcounty) of data collection that was carried out between December,2022 to May 2023. Systematic random sampling method was used among 11 sub counties in Meru County, with Igembe North, Buuri East Imenti North, Imenti Central, Tigania East, Tigania West as intenvention group and Buuri West, Igembe Central, Igembe South, Imenti South, Tigania Central as control group. Interviewer-administered structured questionnaires were used to collect quantitative data while Key Informant Guide was used to collect qualitative.

## STATISTICAL ANALYSIS

Quantitative data was analyzed using statistical package for social science (SPSS) version 26.0. Descriptive data was presented using frequencies, percentages, means and standard deviation while inferential statistics used chi-square test to measure association between independent and dependent variables. P values less than 0.05 were considered statistically significant.

## RESULT

### Socio-Demographic Characteristics of study respondents

The children age ranged from 5 years to 15 years, the findings showed that children in control group 63 (29.9%) were more than 13 years, and 49(23.2%) were between 5-7 years with 59(28.0%) being between 11-13 years in intervention group. Slightly more than half 110(52.1%) and 106 (50.2%) of children were females in control and intervention group respectively (Table 1).

**Table 1: Socio-Demographic Characteristics of study respondents**

| | | Control group | | Intervention group | |
|---|---|---|---|---|---|
| | | **Frequency** | **Percent** | **Frequency** | **Percent** |
| Child age | 5-7 years | 49 | 23.2% | 48 | 22.7% |
| | 8-10 years | 55 | 26.1% | 57 | 27.0% |
| | 11-13 years | 44 | 20.9% | 59 | 28.0% |
| | More than 13 years | 63 | 29.9% | 47 | 22.3% |
| Gender | Male | 101 | 47.9% | 105 | 49.8% |
| | Female | 110 | 52.1% | 106 | 50.2% |

### Regional health policies on healthy lifestyle promotion

Further analysis with an aid of chi-square test was carried out in order to establish association between regional health policies and programs and intestinal parasitic infections in control group. The Pearson chi-square in Table 4.6 shows that 35(34.7%) and 43(38.4%) of respondents were aware of intestinal worms had helminthic infection among control and intervention respectively, however, there was no significant association between aware of intestinal worms with helminthic infections in control ($\chi^2$=1.026; df 1; p=0.311) and intervention ($\chi^2$=0.355; df 1; p=0.511). Additionally, all other variables had no statistical relationship with helminthic and protozoan infections (Table 2).

**Table 2: Baseline Helminths Infection**

| | | Control | Statistics | Intervention | Statistics |
|---|---|---|---|---|---|
| | | **n (%)** | | **n (%)** | |
| Aware of any intestinal worms | Yes | 35(34.7%) | $\chi^2$=1.026; df 1; p=0.311 | 43(38.4%) | $\chi^2$=0.355; df 1; p=0.511 |
| | No | 31(28.2%) | | 42(42.4%) | |
| Provision of health promotions | Always | 10(26.3%) | $\chi^2$=6.972; df 4; p=0.137 | 11(26.2%) | $\chi^2$=6.299; df 4; p=0.178 |
| | Often | 12(25.5%) | | 15(36.6%) | |
| | Sometimes | 15(34.9%) | | 25(51.0%) | |
| | Rarely | 11(24.4%) | | 16(43.2%) | |
| | Never | 18(47.4%) | | 18(42.9%) | |
| Provision of health messages | Yes | 37(33.3%) | | 40(40.8%) | |
| | No | 29(29.0%) | $\chi^2$=0.460; df 1; | 45(39.8%) | $\chi^2$=0.022; df 1; |

| | | | | | |
|---|---|---|---|---|---|
| | | | p=0.498 | | p=0.883 |
| Certain critical times for washing hand | Yes | 33(30.0%) | $\chi^2$=0.175; df 1; p=0.676 | 44(44.4%) | $\chi^2$=1.342; df 1; p=0.247 |
| | No | 33(32.7%) | | 41(36.6%) | |
| Washing hands with water alone makes one clean | Yes | 28(27.2%) | $\chi^2$=1.570; df 1; p=0.210 | 48(44.9%) | $\chi^2$=1.889; df 1; p=0.169 |
| | No | 38(35.2%) | | 37(35.6%) | |
| Hand washing should be done using soap and water | Yes | 35(33.3%) | $\chi^2$=0.410; df 1; p=0.522 | 44(38.9%) | $\chi^2$=0.183; df 1; p=0.669 |
| | No | 31(29.2%) | | 41(41.8%) | |

Further analysis with an aid of chi-square test was carried out in order to establish association between regional health policies and programs and intestinal parasitic infections in control group. The Pearson chi-square in Table 4.7 shows that 31(30.7%) of respondents were aware of intestinal worms had protozoan infection in the control group as well 27(24.1%) of the intervention group, however, there was no significant association between aware of intestinal worms with protozoan infection in the control ($\chi^2$=0.300; df 1; p=0.584) and intervention group ($\chi^2$=1.761; df 1; p=0.184). Additionally, hand washing should be done using soap and water had statistical relationship ($\chi^2$=8.712; df 1; p=0.003) with protozoan infections (Table 3).

***Table* 3: Baseline Protozoan infections**

| | | Control n(%) | Statistics | Intervention n(%) | Statistics |
|---|---|---|---|---|---|
| Aware of any intestinal worms | Yes | 31(30.7%) | $\chi^2$=0.300; df 1; p=0.584 | 27(24.1%) | $\chi^2$=1.761; df 1; p=0.184 |
| | No | 30(27.3%) | | 32(32.3%) | |
| Provision of health promotions | Always | 10(26.3%) | $\chi^2$=3.024; df 4; p=0.554 | 15(35.7%) | $\chi^2$=2.248; df 4; p=0.690 |
| | Often | 15(31.9%) | | 9(22.0%) | |
| | Sometimes | 16(37.2%) | | 14(28.6%) | |
| | Rarely | 12(26.7%) | | 9(24.3%) | |
| | Never | 8(21.1%) | | 12(28.6%) | |
| Provision of health messages | Yes | 31(27.9%) | $\chi^2$=0.110; df 1; p=0.740 | 23(23.5%) | $\chi^2$=1.834; df 1; p=0.176 |
| | No | 30(30.0%) | | 36(31.9%) | |
| Certain critical times for washing hand | Yes | 31(28.2%) | $\chi^2$=0.059; df 1; p=0.808 | 25(25.3%) | $\chi^2$=0.680; df 1; p=0.410 |
| | No | 30(29.7%) | | 34(30.4%) | |
| Washing hands with water alone makes one clean | Yes | 26(25.2%) | $\chi^2$=1.317; df 1; p=0.251 | 30(28%) | $\chi^2$=0.001; df 1; p=0.980 |
| | No | 35(32.4%) | | 29(27.9%) | |
| Hand washing should be done using soap and water | Yes | 31(29.5%) | $\chi^2$=0.038; df 1; p=0.845 | 22(19.5%) | $\chi^2$=8.712; df 1; p=0.003 |
| | No | 30(28.3%) | | 37(37.8%) | |

On observation, in intervention and control areas, there were some knowledge on how and when to wash hands and intestinal worms that are transmitted by unhygienic hands, however, provision of health messages not fully given to the communities. This was further confirmed in the KII where one reported:

“The communities in this locality are never taught on how to wash hands, intestinal worms, and even enough running water are not available.” (KII 1).

None of the schools had participated in health education days as confirmed in KII:

“We have never had any health education days. Some of the requirements indicated in the school policy are never really followed up. We do not even have health clubs, that plays role in reduction of intestinal worms within households” (KII 5).

**The effects of interventions on intestinal protozoan infections**

In the intervention group, the overall prevalence of protozoan infections reduced from 28.0% to 14.7% before and after intervention respectively. In the control group the overall prevalence of intestinal protozoan infections reduced from 28.9% to 28.4% before and after intervention respectively as (Figure 1).

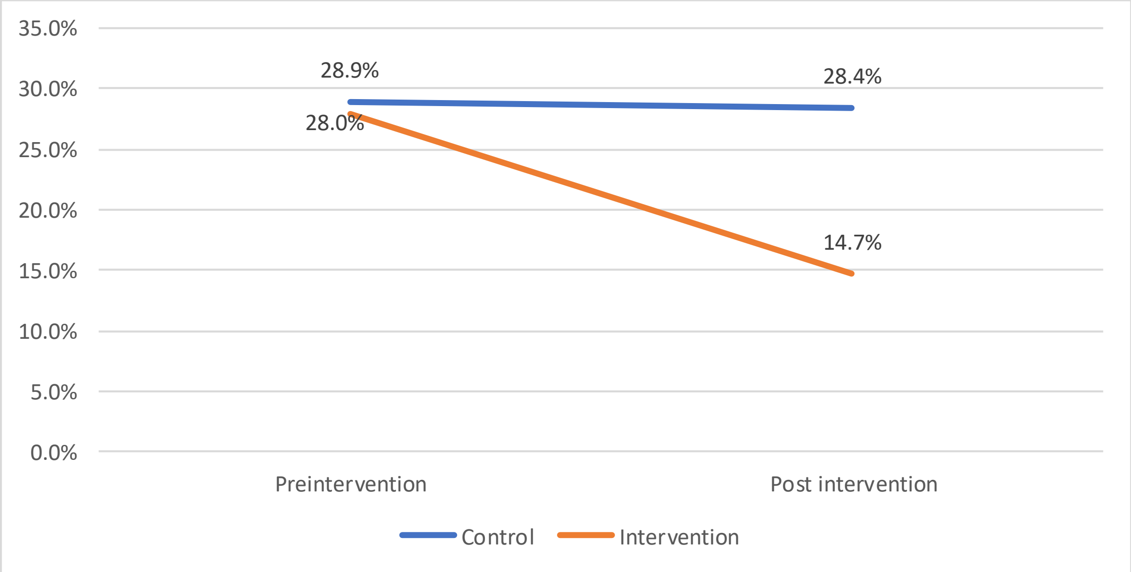


**Figure 1: The effects of interventions on intestinal protozoan infections**

## The effects of interventions on intestinal helminthic infections

In the intervention group, the overall prevalence of helminthic infections reduced from 40.3% to 13.7% before and after intervention respectively. In the control group the overall prevalence of intestinal helminthic infections increased from 31.3% to 37.0% before and after intervention respectively (Figure 2).

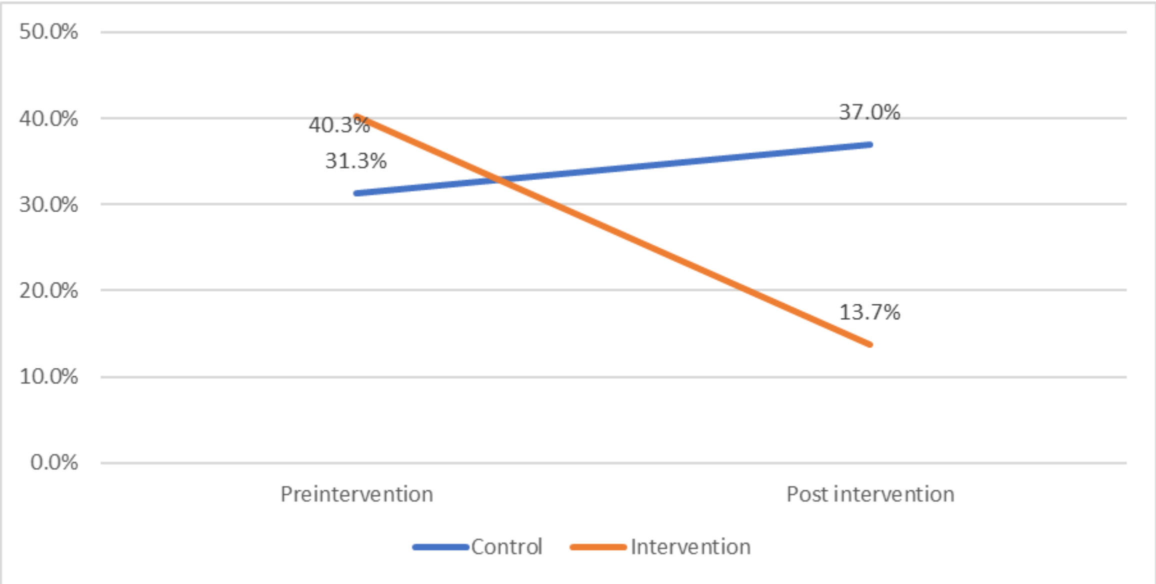


**Figure 2: The effects of interventions on intestinal helminthic infections**

## Types of Intestinal Parasitic Infections in Intervention Group

In the intervention group, there was a general reduction in the prevalence of all the types of intestinal parasites infections. The *ascaris lumbricoides* reduced from 34.9% to 10.0% (Table 4.10) before and after intervention respectively and this was statistically significant ($\chi^2$=7.986; df 1; p=0.018). The prevalence of *Ecoli*, *Entamoeba histolytica*, and *Giardia lamblia* had significant reduction (Table 4).

**Table 4: Types of Intestinal Parasitic Infections Intervention Group**

| | | Preintervention | Postintervention | |
|---|---|---|---|---|
| | | **n (%)** | **n (%)** | **Significance** |
| Helminthic infections | Hookworms | 5(5.8%) | 1(3.3%) | p=0.074 |
| | A. lumbricoides | 30(34.9%) | 12(10.0%) | $\chi^2$=7.986; df 1; p=0.018 |
| | Taenia spp | 26(30.2%) | 8(16.7%) | $\chi^2$=3.950; df 1; p=0.053 |
| | Trichuris trichiura | 19(22.1%) | 6(7.0%) | $\chi^2$=1.866; df 1; p=0.062 |
| | Pinworm | 6(7.0%) | 3(1.0%) | p=0.088 |
| Gross infection levels | | 85(40.3%) | 29(13.7%) | $\chi^2$=10.216; df 1; p=0.007 |
| Protozoan infection | E coli | 29(50%) | 18(16.2%) | $\chi^2$=6.041; df 1; p=0.004 |
| | E. histolytica | 22(37.9%) | 17(13.6%) | $\chi^2$=8.000; df 1; p=0.001 |
| | Giardia lamblia | 7(12.1%) | 4(6.3%) | p=0.010 |
| Gross infection levels | | 59 (28.0%) | 31 (14.7%) | $\chi^2$=14.997; df 1; p=0.0001 |

## Types of Intestinal Parasitic Infections in Control Group

In the control schools there was an overall reduction of the prevalence of intestinal helminthic infections with reduction in hookworm from 5.6% to 5.2%, Trichuris trichiura from 25.4% to 20.8% and pin worm from 18.3% to 11.7% before and after intervention as summarized in Table 4.16. however, there was an increase in ascaris lumbricoides from 25.4% to 31.2% and Taenia spp from 25.4% to 30.8% respectively. An association in the prevalence pre and post intervention was not statistically significant. On protozoan infections, the prevalence of Ecoli and giardia lamblia reduced from 55.7% to 50.8% and 21.3% to 14.8% respectively. However, Entamoeba histolytica increased from 23.0% to 34.4% before and after intervention (Table 5).

**Table 5: Types of Intestinal Parasitic Infections in Control Group**

| | | Preintervention | Postintervention | |
|---|---|---|---|---|
| | | **n (%)** | **n (%)** | **Significance** |
| Helminthic infections | Hookworms | 4(5.6%) | 4(5.2%) | p=0.324 |
| | A. lumbricoides | 18(25.4%) | 24(31.2%) | $\chi^2$=1.542; df 1; p=0.105 |
| | Taenia spp | 18(25.4%) | 23(30.8%) | $\chi^2$=1.877; df 1; p=0.099 |
| | Trichuris trichiura | 18(25.4%) | 16(20.8%) | $\chi^2$=0.556; df 1; p=0.405 |
| | Pinworm | 13(18.3%) | 9(11.7%) | p=0.654 |
| Gross infection levels | | 66(31.3%) | 78(37.0%) | $\chi^2$=1.204; df 1; p=0.263 |
| Protozoan infection | E coli | 34(55.7%) | 31(50.8%) | $\chi^2$=3.908; df 1; p=0.061 |
| | E. histolytica | 14(23%) | 21(34.4%) | $\chi^2$=2.803; df 1; p=0.187 |
| | Giardia lamblia | 13(21.3%) | 9(14.8%) | p=0.206 |
| Gross infection levels | | 61(28.9%) | 60(28.4%) | $\chi^2$=0.855; df 1; p=0.500 |

## The effects of interventions on intestinal helminthic infections

Ascaris lumbricoides (24.9%), Trichuris trichiura (15.1%), and Taenia spp. (13.5%) in the intervention group and pinworm (6.6%) in control group had higher change in infections. Additionally, the overall change in helminthic infections was 12.4% and 0.1% in intervention and control group respectively as well 21.3% and 0.0% in overall change in protozoan infections in intervention and control group respectively.

**Table 6: The effects of interventions on intestinal helminthic infections**

| | | Change in infections | | Test significance of change |
|---|---|---|---|---|
| | | **Intervention** | **Control** | |
| Helminthic infections | Hookworms | 2.5% | 0.4% | p=0.088 |
| | A. lumbricoides | 24.9% | -5.8% | p=0.030 |
| | Taenia spp | 13.5% | -5.4% | p=0.025 |
| | Trichuris trichiura | 15.1% | 4.6% | p=0.052 |
| | Pinworm | 6.0% | 6.6% | p=0.101 |
| | **Sub group Average change** | 12.4% | 0.1% | p=0.035 |
| Protozoan infection | E coli | 33.8% | 4.9% | p=0.021 |
| | E. histolytica | 24.3% | -11.4% | p=0.789 |
| | Giardia lamblia | 5.8% | 6.5% | p=0.236 |
| | **Sub group Average change** | 21.3% | 0.0% | p=0.012 |
| **Overall Intestinal Parasitic Infections Average change** | | 15.7% | 0.1% | p=0.029 |

## DISCUSSION

In both intervention and control groups, awareness of intestinal worms, provision of health promotions and knowledge on healthy lifestyle promotion for intestinal parasitic infections had no significant association with intestinal parasitic infections. Further, respondents' awareness on hand washing should be done using soap and water were significantly associated with intestinal helminthic infections and intestinal protozoan infections in intervention group. Further, it was observed at post intervention that the driving factors to reduction of intestinal parasitic infections in children stool could thus be linked strongly gender (p=0.033), and boiling drinking water (p=0.028). These policies and programs on healthy lifestyle promotion provided details on what are intestinal parasites, ways in which they are transmitted as well as prevention measures. This explains why, in the control group the increase in the awareness on intestinal parasitic infections was much lower than in the intervention group. The posters and flyers became cues to action, as indicated in the health belief model, which activated their readiness to take up the health behavior of hand washing. This is because they provided constant reminders to the pupils on how to wash hands properly with soap and water, a hygiene practice which reduced the rate of reinfection with intestinal parasites among the pupils in intervention schools. This is consistent with a study by Erismann *et al.*(10) done among children of three rural schools in Colombia and results indicated that gastrointestinal parasite infections in the tested population were mainly caused by suboptimal water quality and poor lifestyle. Moreover, molecular typing of *G. intestinalis* suggested contamination of water by animal- and human-derived cysts. In developing Kenya, the total DALYs due to unsafe water is more than 20 %(9). Point-of-use water quality interventions involving effective household water treatment and safe storage can benefit billions of people by ensuring there is no recontamination and statistics have shown that this can reduce diarrheal episodes by 39 %(11). Furthermore, improved household water management enhances water quality through simple, acceptable, low-cost interventions at the household and community level which has proved to reduce risks of diarrheal disease and death(12). The promotion of hygienic behaviour especially hand washing has been identified as a public health intervention likely to have considerable impact in the reduction of diarrhoeal diseases in young children in developing Countries(5). While washing hands at critical times is accepted as an effective intervention against diarrhoeal disease, evidence is also now growing for its effectiveness against respiratory infections(13). Based on the results of the Meru study, up-scaling of hand washing with soap practice is highly recommended, especially using the germ theory to promote healthy behaviour.

## CONCLUSION

It can be concluded from this study that hand hygiene practices were significant. There was no statistically significant difference between the prevalence of intestinal helminthic in intervention and that of control group at the baseline study. In the intervention group, the prevalence of intestinal helminthic infections reduced after intervention. At baseline, prevalence of intestinal protozoan infections was higher than that of intestinal helminthic infections in both intervention and control groups. In the intervention group, the prevalence of intestinal parasitic infections reduced after intervention. The driving factors to reduction of intestinal parasitic infections in children stool could thus be linked strongly gender, healthy eating habits, observing required nutrition, eating properly cooked food, and boiling drinking water. The public health interventions were effective in reducing the prevalence of intestinal parasitic infections in intervention group.

## *Declaration by Authors*

**Ethical Approval:** The study was approved by the Great Lakes University of Kisumu-Ethical Review Committee and a permission by National Commission for Science, Technology and Innovation, Kenya. Written consent was obtained from the participants
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