PREVALENCE AND INFLUENCERS OF INTESTINAL PROTOZOA INFECTION AMONG SCHOOL CHILDREN AT KIGEME REFUGEE CAMP: NYAMAGABE DISTRICT - RWANDA)

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SUMMARY

Entamoeba histolytica and *Giardia lamblia* are two of the most significant and widespread diarrhea-related parasitic protozoa in the world (N'Goran, 2010). School going children are highly prone and affected by these protozoa causing gastro-enteric disorders (Farzana, *et al*., 2015). Personal hygiene, use of toilet, consumption of clean and boiled water are very important eradication measure. Cross section study with purpose of determining the prevalence of the disease involving 126 children between 6 – 13 years was done in KIGEMA Refugee Camp. Data was collected using questioners and examination of stool samples.

Results revealed prevalence is 50(39.7%) among the population with 39(30.9%) having *E.histolityca*, 6(4.7%), *G.lamblia* and 5(3.9%) having both. The prevalence was strongly

associated with none-wash of hands before eating (X^2=9.297, df=6, p=0.002), after toileting (X^2=12.007, df=6, p=0.001), consumption of un boiled water (X^2=16.177, df=6, p=0.001) and gender (p=0.003). Adequate health education regarding hygiene as well as boiling water before use are key issue in the fight against the disease in this camp.

INTRODUCTION

Background of the study

Intestinal protozoa infections are reasonably common worldwide. They are distributed from one region to another depending on the degree of individual and community hygiene, sanitation and climatic factors (Mahdi & Jassim, 2007). Although intestinal parasites seem to move up much less significantly than do HIV/AIDS and tuberculosis, they are public health difficulties in tropical regions (Dianou, P. *et al*., 2004). In 2002, WHO estimated that the number of people infected with intestinal protozoa are 3.5 billion and the number of people made sick by them at 450 million global.

Intestinal protozoa are highly prevalent between refugee and immigrant population around the world because of overcrowding, poor sanitation, and lack of clean water supply **(Alicia, *et al*., 2013).** *Entamoeba histolytica* and *Giardia lamblia* are some of intestinal protozoa, which are pathogenic and have been associated with human gastrointestinal disorders worldwide among schoolchildren **(Atu, B. *et al*., 2014**). In Benue State in Nigeria, problems of poor sanitation and hygiene affect sources of drinking water, food preparation, public eating habit, care of fruits and vegetables and hands washing are common to cause intestinal protozoa infections **(Atu, B. *et al*., 2014).**

In northern California refugees, 126 refugees (10.2%) had intestinal protozoa in their stool. *Giardia lamblia* was the most common protozoan identified **(Chang, *et al*., 2013).** School going children are highly affected by these protozoa **(Farzana, *et al*., 2015).** In

the study conducted by Ashok *et al*., involving a total 208 stool specimen with a mean age group of 8.8 ± 2.11, 63.9% were infected with one or more intestinal parasites, 71.4% of the population were infected with single parasite, (28.6%) with two or more parasites, whereas (30.8%) and (19.54%) had *E. histolytica* and *G. intestinalis* respectively. According to this study age, social and economic status of the group were regarded as very important factors associated with intestinal protozoa infections **(Ashok, R. *et al*., 2013).**

In Africa, *Giardia duodenalis* and *Entamoeba histolytica* are the most common intestinal protozoa and the most frequent parasitic agent of gastroenteritis with a regional occurrence of infection differing enormously and with 30% in children in the African and Eastern Mediterranean region **(Thompson & Smith, 2011).** The study carried out in Kenya, among 1,254 refugees showed that, 1,143 had protozoa, with the most common pathogenic protozoan being *Giardia lamblia* (17%) **(Paul, L. *et al*., 2003).**

In Rwanda, a study by **Ignatius *et al***. found that *G. duodenalis* was the most widespread parasite as identified and detected by microscopy in 19.8% (114/583) followed by *E. histolytica* with 1.1% prevalence **(Ignatius R., 2012).** This is as opposite to study conducted in KIE that reported prevalence of *E. histolytica* being higher (54.5%) than *G. duodenalis (*3.6%) **(Niyizurugero, E. *et al*., 2013).**

Intestinal protozoa infections, are transmitted through fecal-oral route, humans are affected by ingestion of cystic forms, due to poor sanitation, and management of water supply **(Al-Saeed & Issa, 2006)**. Giardiasis is a frequent cause of diarrhea that can give a negative impact on growth and development of children **(Yadollahie, M. *et al*., 2002).** Amoebiasis does have a graded effect on global public health. It is estimated to cause

around 40,000 to 100,000 deaths yearly, making it one of the foremost causes of mortality from intestinal protozoa diseases **(Lebbad, 2010).**

Microscopic identification of cystic or vegetative forms of these protozoa were reported by **Ignatius, R. *et al.*, (2012).** Serology tests and molecular identification are used as confirmatory test and differentiate pathogenic and non-pathogenic species with same morphology such as *E. histolytica* and *E. dispar* **(Lebbad, 2010).** Metronidazole and Tinidazole are used to treat Giardiasis and Amoebiasis. Good hygiene is the most preferable way to prevent infection **(Jason H, 2003).**

To trounce the burden of the intestinal protozoa diseases, control measures such as the provision of preventive chemotherapy designed for the at risk populations of preschool-aged and school-aged children have been started in many targeted countries, including East African countries like Rwanda, Uganda, Kenya (**WHO 2012).** Rwandan Ministry of Health in collaboration with its health sector development partners launched a Mass Drug Administration (MDA) program of anti-helminthic and anti-protozoal drugs in 2008 to schoolchildren **(Niyizurugero E. *et al.*, 2013).**

This study noticed overcrowding, few toilet facilities, poor sewage and garbage disposal, and unpredictable water supply in this camp that may contribute to the reasonable prevalence of intestinal protozoa. Coupled with establishment of the de-warming program of the Governments, the study aimed at determining the prevalence of intestinal protozoa infections among schoolchildren aged between 6-13 years in KIGEME Refugee Camp, NYAMAGABE district and what the contributing risk factors that could associate that prevalence.

LITERATURE REVIEW

Introduction

Intestinal protozoa infections enjoy worldwide distribution. They are estimated to affect an estimated 3.5 billion people, most who are children residing in developing countries **(WHO 2000).** The major IPI's of global public health concern are the protozoal species *Entamoeba histolytica* and *Giardia lamblia,* and the incidence and prevalence of these parasitic pathogens varies both between and within countries **(Sackey, 2001).** According to many literatures, the majority of infections are associated with poverty conditions such as reduced access to safe drinking water, adequate sanitation and hygiene, housing, and inadequate access to health care, and those conditions are more found in tropical and developing countries (**Sackey, 2001).**

Amare Mengistu *et al*. in 2007 had done a study in Ethiopia to assess the magnitude and pattern of intestinal parasitism. Of the total, 754 (83%) had one or more intestinal parasitic infections. The prevalence of Giardia and *Entamoeba histolytica* were significantly higher in school children than other age groups. Higher proportions of teenagers were infected by *A. lumbricoides* and *S. mansoni*. Taeniasis was also dominant in teenagers. They concluded that the proportion of intestinal protozoal infections was higher.

A case-control study was conducted to determine the prevalence of *G. lamblia,* Cryptosporidium spp. and *E. histolytica/dispar* in diarrheal children at Yirgalem Hospital in Ethiopia, where a total of 230 children participated in the study of which 115 (50%) were cases and 115 (50%) were controls. The prevalence of *G. lamblia*, Cryptosporidium spp, and *E. histolytica/dispar* was 15.65%, 9.56%, and 4.35% in children with diarrhea, respectively, and 1.74%, 5.21%, and 1.74% in those without it, respectively. *E. histolytica/dispar* revealed higher infection in males 5.4%, than in females 2.43%. *G.*

lamblia infection was higher in females than in males. This study showed the association among intestinal protozoal infection with sex (**Teshome F. *et al*., 2014).**

Some literature showed that schoolchildren are more affected compared to other people. For example, a study conducted in Thika District, Kenya to demonstrate overall prevalence of protozoan infections. Protozoa observed in this population were *Entamoeba histolytica* (14.6%) *Entamoeba coli* (18.8%), *Giardia lamblia* (6.9%) and the lowest *Iodamoeba bustchili* 5.8%, which was closely related to the poor sanitary conditions found in rural and slum areas (**Ngonjo T.W. *et al*., 2012).**

A study done in Agbovillle, Cote d'Ivoire to see the prevalence and spatial distribution of *Entamoeba histolytica* and *Giardia lamblia* among 1,300 schoolchildren. Prevalence of *E. histolytica/dispar* and *G. lamblia* were, respectively, 18.8% and 13.9%. Significant negative association was observed between use of clean water and high prevalence of *E. histolytica/dispar* infection. High prevalence of *G. lamblia* infection was positively associated with use of ponds as the source of drinking water. A significant negative association was observed between infection with *E. histolytica/dispar* and household use of clean water. *G. lamblia* was significantly associated with household use of pond water. Parasites prevalence decreases when clean water is used and increases when surface water is used (**Ouattara M. *et al*., 2010).**

The prevalence of intestinal protozoa infections in Refugee camp were assessed. For example, a study done on prevalence of intestinal parasites in three localities in Gaza Governorates-Palestine including Jabalia Camp. Multiple factors such as socio-economic (economic resources, employment, poverty), demographic and environmental conditions influence health status. School children between 6 and 11 years old were examined. The prevalence of intestinal parasites among 309 school children was higher in the rural area

(53.3%) and the Refugee Camp (48.0%) than in urban areas (33.0%) **(Agha R. *et al*., 2002).**

A study carried out in Guma Local Government Area of Benue State, Nigeria in 2006 among children in Guma refugee camp demonstrated that of the 292 specimen in the age groups of 0 to 19 years. Males and females' infection rate were 42.4% and 37.8% respectively but there was no significant difference. Children in the age group of 5- 9 years were found to be more infected (44.5%) while those of the age group of 15 -19 years (0.0%) showed no infection (**Nyamngee A. *et al*., 2006).**

In Rwanda, Niyizurugero *et al*. in 2010 in Kigali Institute of Education conducted a study where fresh stool samples were collected from 109 students chosen randomly. The prevalence of IPIs was strongly associated with drinking any kind of water and eating outside of the KIE cafeteria and significantly related to living outside of the KIE campus.

Risk factors of intestinal protozoa infections

Hands washing habit and source of food are risk factors which are strongly associated with IPIs, In Benue State, Nigeria, there was a study done on prevalence of pathogenic infections in humans and their associated risk factors. The results showed that source of drinking water was positively associated with protozoa infections, age were statistically significant. It was seen that literacy level, household toilet facility and care of fruits significantly increased infection rates **(Atu *et al*., 2014).**

In Wukro town, Eastern Tigray, Ethiopia, a study done to determine prevalence of intestinal parasitic infections and their associated risk factors in schoolchildren. A total of 384 fresh stool samples of school-children were examined and the overall prevalence of intestinal parasitic infection was 60.7%. The prevalence of intestinal parasitic infections

was significantly associated with some of risk factors, such as family size, source of water and its hands washing, and availability of latrines. Even though there were high parasitic infections, they were not statistically associated with some socio-demographic factors, such as parent's educational level, personal hygiene, life skills, awareness to parasitic infections, residence and wearing shoe or not (**Kidane E. *et al*., 2014).**

Osman M. *et al*. in 2016 conducted a study among schoolchildren in Tripoli, Lebanon in a general pediatric population including both symptomatic and asymptomatic subjects on means of exposure include ingestion of contaminated fruits and vegetables, consumption of infected water and personal contact (**Osman M. *et al*., 2016).** Statistical analysis using a logistic regression model showed that contact with family members presenting gastrointestinal disorders was the primary risk factor for transmission of these protozoa. In addition, they found that personal contact plays an important role as a risk factor associated with protozoan infection and contaminated food (raw vegetables and fruits) was found to be a risk factor for giardiasis (**Osman M. *et al*., 2016).**

PATHOGENESIS AND CLINICAL MANIFESTATIONS

Amoebiasis (Entamebosis)

Entemoeba histolytica is a protozoan parasite that causes amebic colitis and liver abscess **(Mahdi & Jassim, 2007**). *E. histolytica* cysts, are resistant to acidification, chlorination and desiccation, and capable of surviving in a moist environment for several weeks, spread via the ingestion of fecally contaminated food or water (**Abbas N. *et al*., 2011).** The cyst wall dissolved in the upper gastrointestinal tract and the organism excysts within the lumen of the small intestine. Trophozoites of *E. histolytica* are motile forms, which adhere to and invade intestinal epithelial cells that line the gastrointestinal tract. Once penetration of the intestinal mucosa is affected, dissemination cause extra-intestinal

infections to other organs, such as brain, lung and usually the liver, can occur **(Dawit A., 2006)**. Extra intestinal amoebiasis begins with hepatic involvement; many patients with acute intestinal infection also have hepatomegaly. Amebic abscess in the liver represents metastasis from intestinal infection (**Medical-labs.net, 2014).**

The abscess appears slowly with liver enlargement. Patient will have right upper pain. Abscess may cause dome of diaphragm which presses on the right lung base and that abscess nears the diaphragm, inflammation may cause pleural effusion **(Obadiah H., 2012).**

Pleural, pulmonary, and pericardial infection occurs because of direct extension from liver. Infection metastatic from the liver can involve other viscera or can give rise to a brain abscess. However, those complications are uncommon **(medical-labs.net, 2014).** Diarrhea, flatulence, and cramping are complaints of symptomatic patients. More severe disease is characterized by the passing of numerous bloody stools in a day. Systemic signs of infection (fever, leukocytosis, severity) are present in patients with extra intestinal amoebiasis (**Assafa D. *et al*., 2004).**

Gardiasis (Lambliosis)

Giardia lamblia is the most common Protozoan intestinal parasite isolated worldwide as causative agents of diarrhea (Giardiasis) with 12 to 20 days of incubation **(Lynne G, 2007).** Giardia trophozoites attach to the cell surface of villi by means of a disk on their posterior or ventral surface. Lectin, a protein on the trophozoite lining, recognizes specific receptors on the intestinal cell and may be partly responsible for the tight attachment between the parasite and the villi. Following attachment of trophozoites, there will be major structural and functional abnormalities in the small intestine (Jason H, 2003). Some of these abnormalities include mucosal damage because of mechanical

obstruction or blockage of the intestine by a large number of parasites, the release of cytopathic substances such as thiol proteinases and lectins from Giardia trophozoites, the stimulation of a host immune response with release of cytokines and mucosal inflammation and de-conjugation of bile salts **(Dawit A, 2006).**

Trophozoites do not usually go through the epithelium, invade surrounding tissues, or enter the bloodstream. Thus, infection is generally contained within the intestinal lumen (Jason A., 2003). Clinical symptoms of Giardiasis usually are diarrhea, steatorrhea, epigastric pain, wasting, and loss of appetite. In chronic and complicated cases, hypoalbuminemia, cholecystitis and malabsorption of folate and Vitamin B12 may be observed (**Sackey M., 2011).**

Prevention

Several drugs are available for the treatment of amoebiasis and the choice of drugs depends on the clinical stage it means noninvasive or invasive stage of the infection. Noninvasive or asymptomatic infections are treated with luminal amebicides such as paromomycin, diloxanide furoate, or iodoquinol (Sackey M., 2011). Metronidazole or tinidazole is recommended for symptomatic invasive disease (**Fotedar S., 2007).**

In the cases of amebic colitis or perforation of the intestinal wall, a broad-spectrum antibiotic can be used to treat intestinal bacteria in the peritoneum **(Kayser F. *et al*., 2005).** Necrotic colitis requires vital hospitalization to restore fluid and electrolyte balance. For asymptomatic carriers and diseased patients of Giardiasis, the drug of choice is quinacrine hydrochloride or metronidazole (**Assafa D. *et al*., 2004).**

Fecally, contamination of food and water with human must be prevented for these are usually difficult by the high incidence of asymptomatic cyst passers (Benito &Roche,

1999). Boiling water destroys *E. histolytica* and *G. lamblia* cysts, should be encouraged, particularly in endemic developing countries. Uncooked foods, including salads and vegetables should be well washed and treated with vinegar before eating them (Sackey M., 2011). Potable filters used for water filtrations present various degrees of protection. In addition, proper water and sewage systems should be ensured, hygiene habits of hands washing should also be improved (**Ashok R. *et al*., 2013).**

More community awareness programs to encourage a superior understating on the adverse impacts of Amoebiasis and Giardiasis and other health troubles among children are necessary. Such awareness will bring about positive modifications and adaptation in both social and cultural practices that can facilitate in reducing the infection rate through appropriate use of water supply and practice of modern sanitation (**Obadiah H., 2012).**

METHODOLOGY

Study area

This study was carried out at KIGEME Primary School B located in KIGEME Refugee Camp. This camp is located in NYAMAGABE District of Southern Province, about 150 Km from Kigali and 120 Km from DR Congo and Rwanda's border (midimar.gov.rw). It was established in 2012, it holds 14,000 refugees on 34 hectares and 40% of them are children (rw.unpnd.org, 2012).

Study design

Cross sectional study was used to determine the prevalence of intestinal protozoa infection and it will be done for a period of three months that is from February to April 2016.

Study population

The study population consisted of schoolchildren aged 6 to 13 years from KIGEME Refugee Camp. Schoolchildren aged 6 to 13 years are more infected because of intimate contact with contaminated materials resulting in fecal oral transmission of the infective stages of the parasites.

Sample size

The study was carried out on 126 schoolchildren. Sample size was calculated and obtained by using a formula as follow: $N = \frac{z^2 XP(1-P)}{d^2}$ With:

N: Sample size, **Z**: level of significance or confidence interval at 95%, which is equal to 1.96, **P**: mean prevalence intestinal protozoa, which is equal to 9%. (PEPFAR 2013)

d: margin of error which is equal to 5%., $N = \frac{(1.96)^2 XO.09(1-0.09)}{(0.05)^2} = 125.85 = 126$

Sample strategy

Simple random sampling was done from all voluntary schoolchildren aged between 6 to 13 years.

Data collection

After getting an ethical clearance from UR-CMHS, Institution Review Board (IRB) and permission of MIDIMAR to conduct the study in KIGEME Refugee Camp, we explained the aim of the study, scientific procedures that were used to parents/guardians of children.

Two days before the parasitological survey, questionnaires were distributed in Community Health Workers in Camp. Parents or guardians of selected children filled

questionnaire. It had taken into account some aspects such as water supply sources, washing hands with soap, waste management, and feces disposal.

Specimen collection

126 stool samples were collected for laboratory examination. Children were supplied with appropriate plastic containers that were labeled, and fresh stools were collected. After stool collection, the samples were placed in racks and sent to the laboratory of KIGEME Hospital where they were analyzed. Hospital laboratory helped us with microscopes for identification of protozoa forms in direct wet mount smear and our research samples were placed in safe place separately from hospital patients' samples. First, physical examination of stool samples was carried out to assess for the following features: watery or bloody diarrhea and mucous in stool. Then, 10% stool suspension in physiological saline, were mounted on microscopic slide and examined by light microscopy. Direct microscopic identification of all protozoa forms, were carried out and definitive diagnosis were made based on morphology and size.

Data analysis

In this study, the percentage, chi square, p-value and results were analyzed using SPSS 16.0.

Ethical considerations

For carrying out the study, written permission was granted by IRB through UR/ College of Medicine and Health Sciences, MIDMAR and KIGEME Hospital. Willingness to participate in the study depended on explanation of the purpose of the study whereby the benefits of the study was explained to the potential respondents before data collection. The oral consent also was used for the parents/guardians who cannot read nor write. All

this was done by assuring confidentially of participants. Obtained results were sent to medical coordinator in order to give drugs to infected children.

RESULTS

Introduction

The research presented and described the findings among 126 schooling children in the study area. The results were analyzed under the following variables: Sex, Age, washing hands with soap before eating and after toilet activities, Use of clean water, drinking boiled water and use of toilets.

Table: 4. 1. Prevalence rate of *Entamoeba histolytica* and *Giardia lamblia* according to Sex

			E.histolytica and G.lamblia				
			E.histolytica	G.lamblia	both	None	Total
Sex	Female	Count	24	3	2	51	80
		% of Total	19.0%	2.4%	1.6%	40.5%	63.5%
	Male	Count	15	3	3	25	46
		% of Total	11.9%	2.4%	2.4%	19.8%	36.5%
Total		Count	39	6	5	76	126
		% of Total	31.0%	4.8%	4.0%	60.3%	100.0%

Results in 4.1 show that out of 46 male school children, 15(11.9%) have E. histolytica, 3(2.4%) with G. lamblia, 3(2.4%) with co-infection and 25(19.8%) without infection. From 80 female school children, 24(19.0%) had E. histolytica, 3(2.4%) had G. lamblia, 2(1.6%) had co-infection whereas 51(40.5%) had no infection. It shows significant difference in gender (p=0.003).

Table: 4. 2. Distribution of *Entamoeba histolytica* and *Giardia lamblia* according to age groups

			E.histolytica and G.lamblia				
			E.histolytica	G.lamblia	both	None	Total
Age	12-13	Count	8	0	1	16	25
		% of Total	6.3%	.0%	.8%	12.7%	19.8%
	9-11	Count	9	2	1	23	35
		% of Total	7.1%	1.6%	.8%	18.3%	27.8%
	6-8	Count	22	4	3	37	66
		% of Total	17.5%	3.2%	2.4%	29.4%	52.4%
Total		Count	39	6	5	76	126
		% of Total	31.0%	4.8%	4.0%	60.3%	100.0%

Results in table 4.2 illustrate the correlation between those intestinal protozoa infection with age groups: among 39 with *E. histolytica*, majority 22(17.5%) are in 6-8 years, out of 6 with *G. lamblia*, majority 3(2.4%) have 6-8 years whereas out of 5 with co-infection 3(2.4%) are 6-8 years. No significant difference in age groups ($p>0.05$)

Table: 4. 3. Association between Intestinal parasites and children's hygienic habits

	E. histolytica	*G. lamblia*	Both	None	Total
Washing hands with soap before eating					
Always	2 (1.5%)	1(0.8%)	0(0%)	1(0.8%)	4(3.2%)
Sometimes	18(13.8%)	3(2.3%)	2(1.5%)	18(13.8%)	41(32.5%)
Never	19(14.6%)	2(1.5%)	3(2. 3%)	57(43.8%)	81(64.3%)
Washing hands with soap after toilet activities					
Always	10(7.7%)	0(0%)	2(1.5%)	4(3.1%)	16(12.7%)
Sometimes	18(13.8%)	6(4.6%)	2(1.5%)	32(24.6%)	58(46.0%)
Never	11(8.5%)	0(0%)	1(0.8%)	40(52.6%)	52(41.3%)
Drink of boiled water					
Always	6(4.6%)	3(2.3%)	2(1.5%)	1(0.8%)	12(9.5%)
Sometimes	25(19.2%)	2(1.5%)	2(1.5%)	35(26.9%)	64(50.8%)
Never	8(6.2%)	1(0.8%)	1(0.8%)	40(30.8%)	50(39.7%)
Washing vegetables and fruits before eating					
Always	2(1.5%)	3(2.3%)	1(0.8%)	1(0.8%)	7(5.6%)
Sometimes	20(15.4%)	2(1.5%)	2(1.5%)	25(19.2%)	49(38.9%)
Never	17(13.1%)	1(0.8%)	2(1.5%)	50(38.5%)	70(55.6%)

Result in Table 4.3 describes the hygienic habits of children "wash their hands before eating, after toilet activities' washing vegetables and fruits before eating and drinking boiled water". As shown, the majority n=81 (64.3%) never wash their hands before eating: (X^2=9.297, df=6, p=0.002) as majority n=52 (41.3%) did not as well wash their hands after toilet activities with (X^2 = 12.007, df = 6, p = 0.001). Regarding cleaning of vegetables and fruits, majority n=70 (55.6%) eat vegetables without washing though no significance to prevalence (p>0.05) as opposite to majority n=64 (50.8%) sometimes drink boiled water (X^2 = 16.177, df = 6, p=0.001).

Table: 4.4. Association between Intestinal Parasites and hygiene children' families

	E. histolytica	*G. lamblia*	Both	None	Total
Use of clean water					
Always	1(0.8%)	1(0.8%)	0(0%)	9(6.9%)	11(8.7%)
Sometimes	12(9.2%)	1(0.8%)	3(2.3%)	40(30.8%)	56(44.4%)
Never	26(20.0%)	4(3.1%)	2(1.5%)	27(20.8%)	59(46.8%)
Usage of toilet					
Public	39(30.0%)	6(4.6%)	5(3.8%)	73(56.2%)	123(97.7%)
Private	0(0%)	0(0%)	0(0%)	3(2.3%)	3(2.3%)
Educational status of parents or guardians					
None	20(15.4%)	3(2.3%)	3(2.3%)	32(24.6%)	58(46.0%)
Primary	13(10.0%)	3(2.3%)	1(0.8%)	32(24.6%)	49(38.9%)
Secondary	6(4.6%)	0(0%)	1(0.8%)	12(9.2%)	19(15.1%)
University	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
Participation of parents in organized meeting about hygiene and sanitation					
Yes	18(13.8%)	3(2.3%)	2(1.5%)	49(37.7%)	72(57.1%)
No	21(16.2%)	3(2.3%)	3(2.3%)	27(20.8%)	54(42.9%)

Result regarding association between the prevalence of intestinal parasites and familial hygiene (Table 4.4) shows that: Majority n=122 (97.7%) use public toilet, n=59 (46.8%) never use / access clean in their daily activities whereas the majority n=58 (46.0%) of parents/guardians did not attend school. It further shows that: majority n=72 (57.1%) of parents attend meetings about hygiene and sanitation. However, the level of significance is only seen on the use of clean water: (X^2 =10.391, df=6, p=0.001).

DISCUSSION

Introduction

The study was carried out among schooling children being the most vulnerable and affected age group with the highest exposure rate to intestinal parasites and was generally accessible (Ouattara M. *et al*., 2014). The population in the camp was chosen due to the high risk factors associated with parasitic. The study revealed an overall prevalence of intestinal parasites (39.6%) noted to be higher than one reported by Teshome F. *et al*., 201 (36.52%).

The study shows that washing hands habits is very crucial risk factor to the distribution of intestinal protozoa infection among schoolchildren in KIGEME Refugee Camp. Washing hands before eating is high significant association to the prevalence of intestinal protozoa infection (X^2=9.297, df=6, p=0.002). Among 126 schoolchildren only 3.1% wash hands before eating, 32.5% sometimes and 64.2% they never wash hands before eating, among them 30.0% have *E.histolytica*, 4.6% have *G.lamblia* and 3.8% are co-infected while 58.5% have no infection. Similar findings were found in a study done by Ayman S., there was a, significant association between parasite infections and washing hands (P-value > 0.05) (Ayman S.H., 2011). Washing hands after toilet activities is also significant to the prevalence seen (X^2=12.007, df=6, p=0.001), where 52(41.3%) never wash hands after toilet activities, 58(46.0%) sometimes and only 16(12.6%) always wash their hands after toilet activities. Results are in accordance with results that are done by Kidane E. *et al*., 2014 were washing hands after toilet activities were positively significant to the prevelance of intestinal protozoa (p=0.003).

The results showed that there is significant association between prevalence of two parasites and gender. High prevalence of infection found in male (25.2%) more than

females (23,1%) where p=0.003. This is probably due to the higher activity of male children and more contact with environment outdoors, compared to females. Those results are correspondent to the study done by Amjed Q. in Kadhmiyah Hospital University of Baghdad –Iraq in 2012, stated that the male ratio that infected with *Entamoeba histolytica* was 9.83%, while the female ratio was 9.74%; and the male infected with *Giardia lamblia* was 2.18 %, while the female ratio was 1.51% (Amjed Q., 2012).

To drink not boiling water is high significant association to the prevalence of intestinal protozoa infection (X^2=16.177, df=6, p=0.001) and increase the odds of the observed population acquiring intestinal protozoa infection in KIGEME Refugee Camp. Our results showed that, 12(9.6%) drink boiled water, 64(50.7%) they sometimes drink boiled water whereas 50(39.7%) never drink it. Not boiling water may be caused by lacking of trees. Those findings are in accordance with results obtained in the study done by Atu *et al* in 2014 where stated that handling of drinking water was positively associated with protozoa infections ($p<0.05$).

There is no significant association seen for participation of parents/guardians in meeting for hygiene and sanitation, educational status of parents, washing fruits and vegetables, statistics showed no significance ($p>0.05$).

CONCLUSION

Intestinal parasitic infections are among the most common infections in the world responsible for mortality and morbidity (WHO 2012). Inadequate water supply and sanitation, polluted water or unavailability of water is largely responsible for many deaths in developing countries every year. Overall prevalence is 50(39.7%) out of 126 schoolchildren, where 39(30.9%) for *E.histolityca*, 6(4.7%) for *G.lamblia* and 5(3.9%) for

coinfection of both. An increasing prevalence in this study was associated with factors such as not washing hands before eating and after toilet activities, scarcity of boiled and clean water for consumption, poor personal hygiene. There are many people living into small area; those factors are seen in KIGEME Refugee Camp as well as in other camps. Schoolchildren in this camp are under risk to acquire intestinal protozoa infection. Apart of intestinal protozoa infection, there is a massive number of helminthic infections such as Ascariasis, Trichuriasis found in this study population. Finally, hygiene and sanitation of schoolchildren in this camp should be improved.

RECOMMANDATIONS

The study has been provided a baseline data in identifying the prevalence and associated risk factors of intestinal protozoa infection among schoolchildren in KIGEME Refugee Camp. To improve the diagnosis and prevention of intestinal protozoa infection, the following recommendations were made:

TO MIDIMAR AND KIGEME REFUGEE CAMP

The Ministry of Disasters and Management of Refugee Affairs in collaboration with KIGEME Refugee Camp has to batten hygiene and sanitation of refugee especially schoolchildren. They must give prophylactic drugs to schoolchildren in order to decrease the rate of intestinal protozoa infections. KIGEME Camp authorities should mobilize people to use of clean water.

TO RESEARCHERS

Further researchers are needed to determine all possible associated risk factors of intestinal protozoa infection in the KIGEME Refugee Camp. Later laboratory diagnostic methods should be used to differentiate species of intestinal protozoa found in the area.

More researches should be carried out to identify the prevalence and different helminths found in the area. A more elaborate study including all age groups is recommended.

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