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The Prevalence of Intestinal Parasitic Infections among People with Disabilities in Gem, Siaya County - Kenya

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Abstract— *Intestinal parasitic infection (IPI) is a worldwide public health concern that has received little attention as compared to other diseases like COVID-19, HIV/AIDS and malaria. Although, people with disabilities (PWDs) are more susceptible to intestinal parasites they have limited access to adequate healthcare services. At least 0.9 million Kenyans have disabilities and Siaya is among four counties with high disability prevalence of above 4.1%. Gem has 4.3% PWDs that is twice higher than the national level. Although, they encounter many challenges that negatively affect their health outcomes, little is known about the burden of IPIs among PWDs in Gem, Siaya County. The study aimed to determine the prevalence of IPIs among PWDs in Gem, Siaya County. A descriptive cross-sectional study was conducted. Multistage sampling was applied to select 190 participants. The study site was divided into 9 strata based on the existing administrative units. Simple random sampling was applied to select 2 Community Health Volunteers (CHVs) from each administrative unit (research assistants). Finally, each CHV proportionately and randomly selected eligible participants from the administrative units. Fresh stool samples from each participant were examined using direct saline and iodine mounts, and formol-ether concentration to detect intestinal parasites. Semi-structured questionnaires were applied to collect data on their sociodemographic characteristics. Chi-square and logistic regression tests were computed to determine the significant association between the variables of interest ($\alpha = 0.05$). The overall prevalence of IPIs was 46.03%. Ascaris lumbricoides (37.93%) and Entamoeba histolytica (29.89%) were more predominant. Persons with physical disability (62.07%) and mental disability (32.18%) had the highest prevalence. Management of the high burden of IPIs is even more complicated especially when associated with disability. These findings provide evidence-based information to the Ministry of Health, PWDs and other stakeholders for use in formulation of policies on the management of IPIs among PWDs.*

Keywords— *Prevalence; intestinal parasites; enteroparasitosis; disabilities; impairment; Gem; Siaya; Kenya.*

I. INTRODUCTION

Intestinal parasites are protozoan and helminthic parasites that have at least a stage of their life cycle within the intestines (Albonico, Montresor, Crompton, & Savioli, 2006; Paniker & Ghosh, 2017). WHO (2020) reported that about 60% of the world population suffer from intestinal parasitic infections (IPIs) and these are among the leading causes of morbidity and mortality worldwide. Abbaszadeh et al. (2021) examined that the situation is worse amongst the deprived communities as a result of their poor sanitation, personal hygiene and healthcare facilities. At least 819 million, 464 million and 438 million people around the world are infected with *Ascaris lumbricoides*, *Trichuris trichiura* and hookworms (*Ancylostoma duodenale* and *Necator americanus*) respectively (Pullan, Smith, Jasrasaria, and Brooker (2014). Naser (2020) reported that giardiasis and amoebiasis are among the most prevalent intestinal protozoa, with approximately 100,000 deaths reported annually due to *Entamoeba histolytica* infections. Infection by intestinal parasites occurs in both disabled and non-disabled people.

Disability is any physical or mental condition that inhibits an individual's mobility, activities or senses (WHO, 2007). According to the KPHC (2019), forms of disabilities include physical disability, visual impairment, hearing impairment, mental impairment, communication and self-care difficulties. Williams et al. (2015) suggests that nearly every individual is at a high risk of experiencing disability due to the increased accidents, chronic health-related conditions and ageing populations. Baffoe (2013) reveals that about 15% of the population live with disability, and due to their disabling condition, are discriminated against equitable access to health,

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education, employment and sociocultural opportunities. People with disabilities (PWDs) experience poorer levels of health; hence more susceptible to communicable diseases including intestinal parasitic infections as revealed by Shehata and Hassanein (2015), Rasti, Arbabi, and Hooshyar (2012) and Mitra, Posarac, and Vick (2013). Comparatively, according to Saeidinia et al. (2016) and Ayalew, Achamyeleh, Aniley, and Admas (2019), the disabled people experience a greater health burden from IPIs than non-disabled people.

In Sub-Saharan Africa, Kenya included, according to Kimosop, Langat, Ngeiywa, and Mulambalah (2021) and Ngonjo et al. (2012), the burden of IPIs continues to be a public health concern. Although several studies including Kipyegen, Shivairo, and Odhiambo (2012), Chege (2020) and Ibrahim, Karanja, and Kombe (2017) have been done to determine the magnitude of IPIs in Kenya; none of the studies address the prevalence among the PWDs, especially in Siaya county. The information on the burden of IPIs among PWDs is important in providing data-driven evidence to stakeholders necessary for designing appropriate health policies for the management of IPIs among the PWDs.

Although increasing evidence, as reported by WHO (2020), reveals that people with disabilities are highly susceptible to infections; unfortunately, they have been neglected in health programmes related to the management of intestinal parasitic infections. There is little known about the burden of IPIs among PWDs in Siaya County, Kenya. This is crucial because if left untreated, persons with disabilities who are the primary sufferers may eventually become reservoirs for the reintroduction of ova, larvae or cysts from the gastrointestinal parasites to the local environment, thereby maintaining transmission.

II. METHODOLOGY

A. Study Area

The area of study was Gem, Siaya County, one of the counties in the Lake Region of Kenya. The area is located at latitude $0^0$02’29.74” North and longitude $34^0$27’16.19” East. It is divided into nine administrative units; Central Gem, East Gem, North West Gem, North Gem, North East Gem, South West Gem, South Gem, West Gem and Yala Township; distributed within an area of 405.30 km^2. The area has about 40 health facilities that include, dispensaries, health centres, private health facilities, a faith-based health facility, and one sub-county referral hospital. Among the learning institutions in the area, are two special schools for PWDs, one School for the Blind and the School for the Deaf. The area has varying relief, soil types and land-use patterns, with an altitude range from 1140 to 1400m above sea level. The main drainage features are River Yala, streams and a few stagnant pools of water. The amount of rainfall in the Gem is bimodal, varying from 800 mm to 2000 mm. The area has a total population of 179,792 in 44,884 households; with 85,696 males, 94,092 females and 4 intersex persons, with an average household size of 4; the population density is 444 persons per km^2 (KNBS, 2019). Approximately 4.3 % of the people in Gem sub-county live with disability (KPHC, 2019). Most of the residents in Gem are either unemployed or engage in low income-earning activities such as small-scale farming. The majority of the households have earth floors, mud walls and corrugated iron sheet roofing. Common societal challenges include poverty, indiscriminate defecation, alcohol and substance abuse, risky sexual behaviour, widow inheritance, taboos and community rites. The study area has high morbidity and mortality resulting from communicable diseases. Diarrhoeal disease epidemics are common due to water pollution resulting from dumping of wastes and open defecation; the majority of the households use untreated water due to the high cost and unavailability of water treatment facilities. Malnutrition is among the factors contributing to the high morbidity and mortality rates in Gem (KDHS, 2014).

B. Study Design

A descriptive cross-sectional study was conducted to investigate the prevalence, person-related and health system-related factors that affect the management of IPIs among the PWDs in Gem, Siaya County. This involved the collection of quantitative data using semi-structured questionnaires and laboratory examination of the stool samples collected from the participants for intestinal parasites.

C. Inclusion and Exclusion Criteria

All persons with physical/mobility, vision, hearing or mental impairment; at least 5 years of age; and had been residents of Gem for the past one year before the study and willing to take part in the study by signing the written informed consent form were included. PWDs who had received anti-intestinal parasite drugs within two weeks before data collection, were excluded from the study. All children below 5 years of age were also excluded from this study; previous research showed that the risk of IPIs is lower among children below 5 years (Kassaw, Abebe, Tlaye, Zemariam, & Abate, 2019), probably due to persistent care and sanitation from their parents/caregivers that minimize the chances of exposure to pathogenic intestinal parasites. In addition, at this age they are undergoing transition in their ability to carry out activities making it difficult to diagnose their disability status.

D. Sample Size Determination

Cochran’s formula (Cochran, 1951) was applied to determine the desired sample size as follows;

$$n = \frac{z^2pq}{d^2}$$

Where: n =the desired sample size, z = the standard normal deviation at 1.96, corresponding to 95% confidence interval (CI), p = the prevalence of IPIs in the previous study is 12.9% (Okoyo et al., 2020), hence p = 0.129, q = 1.0 – p = 1.0 – 0.129, d = degree of accuracy desired at 0.05 corresponding to the 1.96. 10% adjustment was factored in to consider the possibility of non-response and this brought the total sample to 190 PWDs.

E. Sampling Procedure

The study applied multistage sampling during the selection of the desired sample. First, stratified sampling was applied to

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divide the study area into 9 strata based on the existing administrative units. Simple random sampling was then applied to select 2 Community Health Volunteers from each administrative unit. The Community Health Volunteers were trained as research assistants for this study. Finally, each of the trained Community Health Volunteers proportionately and randomly selected eligible study participants from each administrative unit. The sample size per strata was determined proportionately by dividing the population per strata by the total population in Gem (179,792), then multiplied by the desired sample size.

F. Data Collection

Pre-tested semi-structured questionnaires and laboratory examination of stool samples were used to collect primary data from the study participants. The questionnaire was prepared in English language, then translated in Dholuo (native language) and lastly retranslated in English to retain its accuracy. The Dholuo-translated semi-structured questionnaire tool was developed and then administered to the PWDs who had submitted written informed consent to collect data on their sociodemographic characteristics and the factors associated with IPIs. Stool samples were collected from all the study participants and examined using direct technique (saline and iodine mounts) to detect cysts and trophozoites of intestinal protozoan parasites, and using the formol-ether concentration technique to detect the eggs and larvae of the helminths (Citation). Each participant/caregiver was clearly instructed on how to collect an appropriate and sufficient amount of stool specimen prior to sample collection. Clean dry and leak-proof specimen containers, well-labelled with unique identity codes were given to each participant/caregiver to collect stool samples that were tested at Dophil Maternity and Nursing Home as per the routine standard laboratory protocols by two registered medical laboratory technologists performing the tests.

G. Data Processing and Analysis

The quantitative data collected was entered, cleaned, coded and then analysed using STATA version 14. Descriptive statistics were applied to summarize the sociodemographic characteristics of the study participants. Variables of interest were summarized into frequencies, mean, proportions and confidence intervals. Chi-square and logistic regression tests were computed to determine a significant association between the variables of interest ($\alpha = 0.05$).

H. Study Approval

Scientific and ethical approvals were obtained from the JOOUST Board of Postgraduate Studies and the JOOTRH Ethical Review Committee respectively before starting field activities. The permission to conduct this study was obtained from NACOSTI, NCPWD, the Ministry of Health, Dophil Maternity and Nursing Home and the local authority within Gem. Informed consent was obtained from each study participant and parents/guardian, and information collected from participants was kept confidential. The study participants who tested positive for different IPIs were treated at Dophil Maternity and Nursing Home for management using Metronidazole and Albendazole group for protozoan and helminthic infections respectively. Those with serious complications were closely monitored at the health facility for further management. The study liaised with the CHVs for deworming and/or further follow-up since there are MDA drugs from the Government of Kenya within the local health facilities.

I. Consenting

Each of the study participants and/or a legally authorized representative (parent or guardian or unbiased witness) were verbally taken through the details of this study including the study purpose, procedures, benefits, potential risks and alternatives to participation, and then allowed to ask questions at each stage. The study participant and/or a legally authorized representative (parent or guardian or unbiased witness) were then issued an IRB-approved written consent form. An appropriately translated consent form was then issued to those who could not read and write in English. The participants/legal representatives were then given enough time to evaluate potential risks and benefits, procedures and alternatives and thereafter make an informed decision regarding whether or not to participate in the study. The study participants were given enough time to go through the consent form upon which they were allowed to ask questions for further clarification on what they had not understood. Those who had agreed to take part in the study signed and dated the consent form; those with disabilities that limited their ability to sign, put a mark on the consent form. The consent form was also signed and dated by the investigator, and a copy was given to the study participant. They were then informed of their right to refuse or even withdraw from the study at any time and assigned unique numbers to maintain a high level of confidentiality.

III. RESULTS

The findings show that among the 189 study participants, IPI prevalence was high, as 87(46.03%) tested positive for intestinal parasitic infection (Table 1). 64(73.56%) of the infected participants had a single parasitic infection while polyparasitism was observed in 23(26.44%) of the infected participants (Figure 2). Cumulatively, the overall prevalence was highest in *Ascaris lumbricoides* 33(37.93%), followed by *Entamoeba histolytica* 26(29.89%), hookworms 21(24.14%), *Giardia lamblia* 20(22.99%), *Entamoeba coli* 8(9.20%) and *Trichuris trichiura* 2(2.30%), as shown in Table 2.

Majority of the study participants were aged between 11 to 20 years, 47(24.87%), followed by those above 60 years, 40(21.16%), while the least were aged below 10 years, 4(2.12%). The age of the study participants had a significant influence on the prevalence of intestinal parasitic infection among the study participants (p=0.008). The highest prevalence was observed among the participants aged between 11 – 20 years whereas those aged below 10 years had the least, as shown in Table 3.

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TABLE 1. Distribution and prevalence of IPI among study participants within the Gem

Variable (Location)	N (%)	Intestinal Parasitic Infection		p-value
		Negative n (%)	Positive n (%)	
Location				
Central Gem	28(14.81)	18(64.29)	10(35.71)	0.221
East Gem	20(10.58)	14(70.00)	6(30.00)	
North East Gem	13(6.88)	9(69.23)	4(30.77)	
North Gem	31(16.4)	14(45.16)	17(54.84)	
North West Gem	18(9.52)	10(55.56)	8(44.44)	
South Gem	27(14.29)	13(48.15)	14(51.85)	
South West Gem	12(6.35)	4(33.33)	8(66.67)	
West Gem	8(4.23)	2(25.00)	6(75.00)	
Yala Township	32(16.93)	18(56.25)	14(43.75)	
Total	**189(100)**	**102(53.97)**	**87(46.03)**	

TABLE 2. Distribution of the IPIs by species

Intestinal Parasite	Frequency (n)	Prevalence (%)
Ascaris lumbricoides	17	8.99
Hookworms	14	7.41
Trichuris trichiura	2	1.06
Entamoeba coli	3	1.59
Entamoeba coli + Ascaris lumbricoides	2	1.06
Entamoeba coli + Hookworm	3	1.59
Entamoeba histolytica	12	6.35
Entamoeba histolytica + Ascaris lumbricoides	11	5.82
Entamoeba histolytica + Hookworm	3	1.59
Giardia lamblia	16	8.47
Giardia lamblia + Ascaris lumbricoides	3	1.59
Giardia lamblia + Hookworms	1	0.53
Infected	87	46.03
No Infection	102	53.97
Total	**189**	**100.00**

TABLE 3. Prevalence of the intestinal parasitic infections among the study participants

Variables	N (%)	Intestinal Parasitic Infections		p-value
		Negative n (%)	Positive n (%)	
Age category (years)				
Below 10	4(2.12)	0(0.00)	4(100.00)	0.008
11 - 20	47(24.87)	20(42.55)	27(57.45)	
21 - 30	26(13.76)	12(46.15)	14(53.85)	
31 - 40	24(12.70)	12(50.00)	12(50.00)	
41 - 50	24(12.70)	13(54.17)	11(45.83)	
51 - 60	24(12.70)	20(83.33)	4(16.67)	
Above 60	40(21.16)	25(62.50)	15(37.50)	
Disability type				
Hearing impairment	16(8.47)	11(68.75)	5(31.25)	<0.001
Mental impairment	38(20.11)	10(26.32)	28(73.68)	
Physical impairment	119(62.96)	65(54.62)	54(45.38)	
Vision impairment	13(6.88)	13(100.00)	0(0.00)	
Other type	3(1.59)	3(100.00)	0(0.00)	
Sex				
Female	95(50.26)	53(55.79)	42(44.21)	0.614
Male	94(49.74)	49(52.13)	45(47.87)	
Education level				
None	47(24.87)	21(44.68)	26(55.32)	0.006
Primary complete certificate	32(16.93)	20(62.5)	12(37.5)	
Primary no certificate incomplete	79(41.8)	36(45.57)	43(54.43)	
Secondary complete certificate	21(11.11)	17(80.95)	4(19.05)	
Secondary incomplete no certificate	7(3.70)	7(100.00)	0(0.00)	
Tertiary complete certificate	1(0.53)	0(0.00)	1(100.00)	
Tertiary incomplete no certificate	2(1.06)	1(50.00)	1(50.00)	
Marital status				
Divorced separated	10(5.29)	6(60.00)	4(40.00)	0.003
Married	66(34.92)	47(71.21)	19(28.79)	
Single	79(41.8)	32(40.51)	47(59.49)	
Widowed	34(17.99)	17(50.00)	17(50.00)	
Religion				
Christian	186(98.41)	100(53.76)	86(46.24)	0.656
Islamic	3(1.59)	2(66.67)	1(33.33)	
Occupation				
Employed	1(0.53)	0(0.00)	1(100.00)	0.001
Farmer	38(20.11)	26(68.42)	12(31.58)	
Self-employed	12(6.35)	12(100.00)	0(0.00)	
Student	34(17.99)	15(44.12)	19(55.88)	
Unemployed	104(55.03)	49(47.12)	55(52.88)	
Monthly income				
Below KShs 5000	178(94.18)	92(51.69)	86(48.31)	0.036
Kshs5000 – 10000	7(3.70)	6(85.71)	1(14.29)	
Above KShs. 10000	4(2.12)	4(100.00)	0(0.00)	

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Majority of the participants had physical impairment 119(62.96%), followed by mental impairment 38(20.11%), hearing impairment 16(8.47%), vision impairment 13(6.88%) and the other disability types 3(1.59%). Disability type had a significant influence on the prevalence of the IPIs among the study participants ($p<0.001$); the highest rates of infection were observed among those with physical impairment (62.07%) followed by mental impairment (32.18%) and then hearing impairment (5.75%). The number of male and female participants was almost the same, 94(49.74%) and 95(50.26%) respectively. Hence, the sex of the participants had no significant influence on the prevalence of the IPIs among the study participants ($p=0.614$), as shown in Table 3.

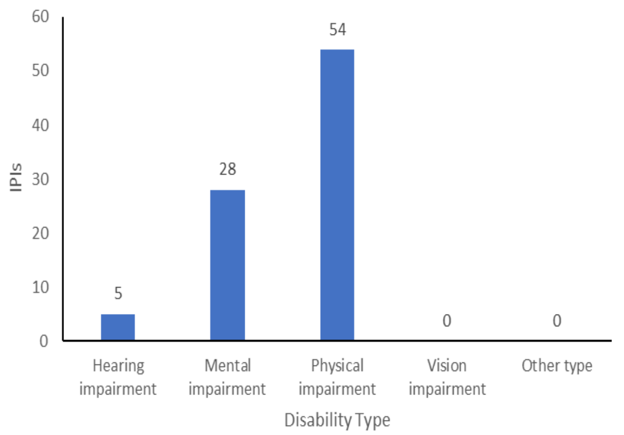

Fig. 1. Distribution of the IPIs by disability types

Most of the respondents had not completed primary school, 79(41.8%) while the least had completed tertiary education, 1(0.53%). Education level was found to have significant influence on the prevalence of the IPIs among the study participants ($p=0.006$). The participants who had not completed primary school education had the highest prevalence of intestinal parasitic infections (49.43%). The study population consisted of only two religions; with the majority of the respondents being Christians, 186(98.41%) while the rest were Muslims, 3(1.59%). However, religion had no significant influence ($p=0.656$) on the prevalence of the IPIs among the study participants.

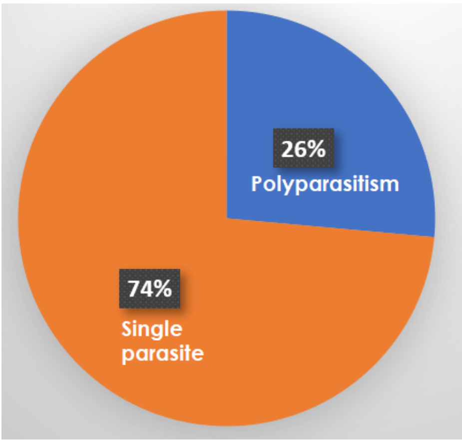

Fig. 2. Number of intestinal parasites among the study participants

Most of the respondents were unemployed, 104(55.03%) followed by farmers, 38(20.11%) while only a few were employed, 1(0.53%). The findings also show that occupation had a significant influence on the prevalence of the IPIs among the study participants ($p=0.001$). The prevalence of IPIs was highest among those participants who were unemployed (63.22%), followed by students (21.84%) and then farmers (13.79%). Most participants earned below KShs. 5000, 178(94.18%) while only 4(2.12%) earned above KShs. 10000. Further analysis revealed that monthly income had a significant influence on the prevalence of the IPIs ($p=0.036$) among the study participants. The participants whose monthly income was below KShs. 5000 had the highest prevalence (48.31%) of the IPIs than the rest.

The majority of the participants were single 79(41.8%), followed by married, 66(34.92%) while a few were either divorced or separated, 10(5.29%). Also, the marital status had a significant influence on the prevalence of the IPIs among the study participants ($p=0.003$). Those participants who were still single had the highest prevalence of the IPIs (54.02%).

IV. Discussion

The study findings indicate that the overall prevalence of IPIs among the PWDs in Gem, Siaya County was 46.03%. The prevalence is lower than that of the study done by Kamande, Muthami, and Ouma (2015) in Murang'a, Kenya (53.8%), Burkina Faso; 86.2% (Erismann et al., 2016) and Ethiopia; 56.7% (Fentahun, Asrat, Bitew, & Mulat, 2019). This lower prevalence could be due to the heightened hygiene practices observed during this era of the COVID-19 pandemic. Also, microscopy is less reliable as compared to the serological and molecular-based techniques because of its low sensitivity and specificity. However, this prevalence is higher as compared to the previous studies done in Egypt; 43.5% (Shehata & Hassanein, 2015), Nepal; 32.1% (Poudyal et al., 2017), Brazil; 17.5% (Faria et al., 2017), Yogyakarta; 1.5% (Gunasari & Murhandarwati, 2021) and Northern Iran; 29.5% (Saeidinia et al., 2016). This variation in the prevalence of the IPIs is due to differences in sample populations, hygiene practices, diagnostic methods applied, occupations of the study participants, age variations, geographical variations, water, sanitation and health conditions.

In this study, 73.56% of the infected participants had a single species of the intestinal parasites while polyparasitism was observed among the 26.44% of the infected participants. These results show that co-infections are still common and therefore agree with previous studies done in Murang'a (Kamande et al., 2015). This was higher than the prevalence reported in previous studies (Hailegebriel, 2017). The high rate of co-infections might be due to the disability status of the participants, especially physical and mental disability, that compromise their standards of sanitation and hygiene and thus increase the risk of infection by the enteroparasites.

The prevalence of helminthic infection was 29.63%; the most prevalent helminth was *A. lumbricoides* (37.93%), followed by hookworms (24.14%) and *Trichuris trichiura* (2.30%). However, the rate is higher than that observed in Kakamega; 14.4% (Kiiti, Omukunda, & Korir, 2020) and

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Yogyakarta; 0.14% (Gunasari & Murhandarwati, 2021). The high prevalence of helminthic infection could be caused by the barriers that limit the inclusion of PWDs in the MDA campaigns. With reference to parasite species, the findings of this study contradict studies done in Iran where *Enterobius vermicularis* and *Strongyloides stercoralis* were the most predominant helminthic infections (Abbaszadeh et al., 2021). These variations could be as a result of differences in the sensitivity of the diagnostic methods, health awareness and status of the study participants.

The overall intestinal protozoan infection prevalence was 28.57%; *Entamoeba histolytica* was the most common intestinal protozoan infection at 29.89%, followed by *Giardia lamblia* (22.99%) and *Entamoeba coli* (9.20%). This prevalence of *Entamoeba histolytica* is higher than that of the study by Kamande et al. (2015) in Murang'a, Kenya (42.3%). The distribution of parasite species is similar to the results of a study done in Burkina Faso (Erismann et al., 2016), but contrary to the one done in Nepal in which *G. lamblia* (17%) was the predominant intestinal protozoa followed by *E. histolytica* (9%) (Poudyal et al., 2017) and in Egypt (Shehata & Hassanein, 2015). This is attributable to the variation in sanitary conditions, quality of drinking water and sensitivity of the diagnostic methods. Previous studies have shown that drinking contaminated water, poor personal hygiene and consumption of raw food increase the risk of infection by *Entamoeba histolytica* (Singh, Banerjee, Kumar, & Shukla, 2019). Similarly, this study confirms that poor personal hygiene, untreated drinking water and poor handwashing with soap after toilet use and before eating were strongly associated with infection by protozoan parasites including *Entamoeba histolytica*.

The study findings indicate a significant association between age and IPIs; most infections occurred in the participants aged between 11 and 20 years 31.03% (p=0.008) than the other age groups. This is similar to previous reports from other studies (Kamande et al., 2015); this could be because the majority of the young people engage in activities that increase contact with the infective forms of the enteroparasites.

These findings showed a significant association between disability type and IPI (p<0.001). Some forms of physical disability such as physical disability, limit the individuals from the regular wearing of shoes, proper toilet use and personal hygiene thereby increasing their exposure to intestinal parasites. Similarly, in Ethiopia, the prevalence of IPIs was higher among mentally impaired school children (56.7%) than those who were not disabled (41.1%) (Fentahun et al., 2019). Mentally disabled individuals have low intellectual capacity to strictly adhere to sanitation and hygiene practices as compared to their counterparts. This study reported a higher prevalence of IPIs among the mentally impaired participants than that reported in studies done in Brazil; 8.3% (de Freitas et al., 2017), Tanzania; 12.45% (Nyundo, Munisi, & Gesase, 2017) and Northern Iran; 5.15% (Soleymani, Davoodi, & Azami, 2016). Physically and mentally disabled individuals have poor health outcomes due to their disability status which compromises their sanitation and personal hygiene, hand washing and health-seeking behaviour.

There was no significant difference in distribution of IPIs between males and females (p=0.614). This is probably because they both experience similar socioeconomic and environmental conditions. This is consistent with the previous research done in Kenya and Argentina (Kiiti et al., 2020; Periago, García, Astudillo, Cabrera, & Abril, 2018). However, the findings contradict other studies done in Ethiopia (Fentahun et al., 2019) in which males had a higher prevalence than females.

The study findings showed a significant inverse association between the education level and IPIs (p=0.006). Those without formal schooling had a higher prevalence of IPIs than those who lacked formal education. This is consistent with the results of a study conducted in Ethiopia (Fentahun et al., 2019). The lower the level of education, the higher the prevalence of IPIs because illiteracy about transmission dynamics, sanitation and personal hygiene increases the chances of exposure to the infective forms. In this study, religion and IPIs had no significant association (p=0.656).

The majority of the participants were unemployed (55.03%). Those who were unemployed had a higher prevalence of IPI, 63.22%. Probably because they had lower monthly earnings leading to socioeconomic deficiencies like walking barefoot and poor WASH facilities thus predisposing them to enteroparasites. However, this investigation contradicts the study done in Accra, Ghana, that found no significant association between employment status and infections by enteroparasites (Forson, Arthur, & Ayeh-Kumi, 2018). Just like the study done in Nigeria (Mohammed, Abdullah, Omar, Eugene, & Ismail, 2015), in this study farming as an occupation is associated with infection by intestinal parasites, especially hookworm infection, due to frequent exposure to contaminated soil and animal droppings.

There was a significant association found between marital status and IPIs (p=0.003). Married study participants had a lower prevalence of intestinal parasitosis (21.83%) than unmarried participants. Studies have revealed that married people have better health-seeking behaviour (Robles, 2014) hence have a lower the risk of infection including intestinal parasitosis.

Also, the study findings revealed a significant association between monthly income and IPI (p=0.036) among the people with disabilities. Higher monthly income was associated with a lower risk of IPI; this could be due to increased access to better health care, nutrition, personal hygiene and sanitation facilities. This is consistent with some studies (Marami, Hailu, & Tolera, 2018; Taye, Desta, Ejigu, & Dori, 2014) but contradict studies done in Northwest Ethiopia (Gelaw et al., 2013).

V. Conclusion

This study aimed to determine the prevalence of IPIs among people with disabilities in Gem, Siaya County. The results indicate that IPI is still a significant public health concern that is so complicated to manage especially when associated with

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disability. *Ascaris lumbricoides* and *Entamoeba histolytica* are the predominant intestinal parasites, and people with physical and mental disabilities are at a higher risk of IPIs than other forms of disability. The relatively high prevalence of intestinal parasitic infections indicate that preventive measures should be put in place for this high-risk population especially those with physical and mental disability. This can be achieved by increasing their/caregivers' level of awareness about sanitation and personal hygiene.

VI. Recommendations

Further research should be conducted using highly sensitive diagnostic methods than microscopy which gives lower prevalence estimate than that achieved when molecular methods are used. In addition, due to the cyclical nature of intestinal protozoa and helminths, at least 3 consecutive stool samples in 3 consecutive days should be tested from each of the participants instead of using a single stool sample to estimate the burden of the intestinal protozoa and helminths.

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Competing Interests Statement

I, Oyoya Michael Kala, declares that I have no significant competing financial, professional or personal interests that might have influenced the performance or presentation of the work described in this manuscript.

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