FACTORS ASSOCIATED WITH INTESTINAL PARASITE INFECTION AMONG SCHOOL GOING CHILDREN IN LODWAR MUNICIPALITY, TURKANA COUNTY, KENYA

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Factors Associated with Intestinal Parasite Infection among School Going Children in Lodwar Municipality, Turkana County, Kenya

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University

Signature…….. Date…….

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This thesis has been submitted for examination with our approval as the University supervisors.

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DEDICATION

I dedicate this thesis to the entire Lowoko family for their endless love, unlimited support, and encouragement offered to me all along this journey of my studies.

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ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immune Deficiency syndrome
CDC	Centre for Disease Control
E.H	Entaemoeba Histolytica
HIV	Human Immunodeficiency Virus
KEMRI	Kenya Medical Research Institute
MOH	Medical Officer Health
PHO	Public Health officer
SPSS	Scientific Package for Social Sciences
TCG	Turkana County Government
WHO	World Health organization

ABSTRACT

Infection by intestinal parasites is a serious health problem affecting an estimated 400 million school age children worldwide. The main objective of the study was to determine the prevalence and factors associated with intestinal parasites among children in 10 schools within Lodwar Municipality in Turkana County, Kenya. This was a cross-sectional study carried out amongst school going children randomly selected from 10 schools. The data collection included background data of participants and laboratory procedures on faecal specimens collected to determine the various intestinal parasites. The data collated was analyzed using STATA version 13. Chi square was used to determine associations between the various variables.This study recruited 310 participants, of which 46.1% were female and 53.9% were male. Cyst of *Entamoeba histolytica* was found to be the most common parasite in the samples tested with a prevalence of 75.2%, followed by trophozoites of *Giardia lamblia* with prevalence of 14.3%, ova of Taenia spp with a prevalence of 4.6% whereas trophozoites of *Entamoeba histolytica*, ova of *Ascaris lumbricoides*, cyst of *Giardia lamblia*, and ova of *Taenia saginata* had a prevalence of below 5%.This current study found no strong association between the source of water and the occurrence of intestinal parasites.Helmithes infections are still a public health concern in Turkana County, which, if unchecked, could affect child growth and development. There is need for both the National and County governments to mount series of campaigns and interventions to deworm all children of intestinal infections especially at the family level among the nomadic Turkana community whose environments and lifestyles are fertile grounds for helmithes.County government should set resources (both financial and personnel) towards continuous support of deworming children and make it a compulsory exercise to all households.

CHAPTER ONE

INTRODUCTION

1.1 Background

Intestinal parasitic infections, regarded as a serious public health problem, are amongst the most common infections affecting human beings in the world. Intestinal parasites are mainly found in regions exhibiting warm and moist climates coupled with poor sanitation and hygiene. Although individuals from all societies and regions play host to worms at some time in their lives, the highest rates occur among children in rural areas of the tropics and subtropics (Bethony *et al.,* 2006).

It is estimated about one third of the world, more than two billion people, are infected with intestinal parasites with an average prevalence of 50% in developed world and almost 95% in developing countries (WHO, 2009). In addition, approximately 300 million people are severely ill with these worms and of these, at least 50% are school-age children (WHO, 2009). According to WHO (2011), an estimated five million children were reported to be infected with intestinal parasitic worms in Kenya.

The WHO (2012) report indicates that in Africa, the number of children at risk of infection by intestinal parasites is 280 million in 42 countries. In 2009 the national prevalence of intestinal parasitic infections 2 among school going children was 56.8% (Stewart, 2011). The prevalence of intestinal helminthic infections in 2015 was found to be 32.4% (Brooker *et al*., 2015).

In 2001, the Fifty Fourth World Health Assembly resolved to attain by 2010 a minimum target of regular administration of chemotherapy to at least 75% and up to 100% of all school-age children at risk of morbidity from the disease. The school preventive chemotherapy has covered 25% of the school age children in the period between 2006 and 2009 (WHO, 2012).

A study by Abate *et al*. (2013) in Ethiopia found Ascaris lumbricoides to be the most predominant parasite (23.2%) followed by hookworms (6.6%), Hymenolepis nana (1.5%), Enterobius vermicularis (0.4%), and Strongyloides stercoralis (0.2%). The study found that absence of toilet and lack of hand washing after toilet contributed to these infections. In Kenya the prevalence of helminthic infections varies with regions (Andereck *et al*., 2014).

Intestinal parasitic infections caused by protozoa and helminthes are among the most widespread of human infections worldwide. These constitute the greatest single cause of illness and disease and are important threats to healthy living in both developed and developing countries (Strunz- Ec *et al*., 2014; WHO 2017).

Intestinal parasites have a worldwide distribution, some are known to cause malabsorption in human, abdominal pain, severe diarrhoea, vomiting, weight loss, dermatitis or proritis and chronic urticeria (Giacometi *et al*., 2004). The infections have been reported to have serious consequences such as causing iron deficiency anaemia, growth retardation and other physical and mental health problems (Ngui *et al*., 2011).

According to some studies, parasites found in the intestines can be categorized into two groups namely protozoa and helminths (Matthys *et al.,* 2011). Intestinal helminths and protozoan infections are amongst the most common infections world-wide (Ouattara *et al.,* 2010). Protozoa are unicellular eukaryotes that constitute the flagellates like the *Giardia lamblia*, the amoeboids like *Entamoeba histolytica*, the sporozoans like *Isospora belli* and the ciliates like *Balantidium coli (*Cheesbrough, 1998; Garcia & Bruckner, 1997). Most are around 10 – 50 um, but can grow up-to 0.5mm and can be easily seen under a microscope. Most protozoa exist in two stages of life which are in the form of trophozoites and cysts (Ortega & Sterling, 1996). As cysts, protozoa can survive harsh conditions such as exposure to extreme temperatures and harmful chemicals or long periods without access to nutrients, water or oxygen (Amin, 1984). Being in the cyst form enables parasitic species to survive outside the host and allows their transmission from one host to the other (Ortega & Sterling, 1996).

Among the many species of intestinal protozoa, *Entamoeba histolytica* and *Giardia lamblia* are potentially pathogenic and in many parts of the world either or both organisms constitute a public health problem (WHO, 2008). Intestinal protozoa are the aetiological agents of several wide spread parasitic diseases. The most common of which are caused by *Entamoeba histolytica* and *Giardia lamblia*. Amoebiasis caused by *Entamoeba histolytica* is a cosmopolitan infection transmitted by the feacal –oral route. It is most common in Africa and Asia (Kamnuvi *et al*., 1983).

Hookworms and the whipworm, *Trichuris trichura* are as widely distributed as Ascaris. The parasites are soil transmitted helminthes of global distribution and is less prevalent than Ascaris. Ascaris has highest prevalence in sub tropics and tropical areas of Africa, Asia and American countries. The hookworm *Necatar americanas* occur in America, equatorial Africa, and South East Asia. *Ancylostoma duodenale* commonly occur in Africa and in Northern and South West Asia (Kaye, 1988). A study has shown that *Entamoeba histolytica* and *Giardia lamblia* causes diarrhea and are prevalent in Kenya with another study identifying six species of intestinal helminthes *Ascaris lumbricoides*, *Trichuris trichiura,* hookworm, *Schistosoma mansonii, Enterobius vermacularis* and *Hymenolepis nana* (Yoshiki *et al*., 1993; Ngonjo *et al*., 2012).

Parasitic worms or helminths are a division of eukaryotic parasites that live inside the host. They feed on living hosts receiving nourishment and protection while disrupting their hosts' nutrients absorption causing weakness and disease. They are categorized into three groups which includes; the Cestodes such as *Taenia species*, the nematodes like *Ascaris lumbricoides* and the trematodes such as *Schistosoma species* (Beaver, 1952). Intestinal parasites infections occur in both rural and urban populations, necessitating regular deworming especially in school going children who are more vulnerable (Kamnuvi, 1983).

Protozoa and helminthes are intestinal parasites that parasitize the bowel producing varying degrees of injury to the intestinal lining. The most invasive protozoan, *Entamoeba histolytica* erodes and penetrates into the intestinal sub mucosa and produce

ulcerative lesions. One ciliated protozoan, *Balantidium coli* also induces ulcerative lesions, but these are usually not deeply erosive. Some species of amoeba and flagellates live as saprophytes in the bowel inducing no injury (Wolfe, 1992).

Helminth infection of the bowel is usually not serious unless the worm actually parasitizes the intestinal tissues or its larval forms migrate beyond the bowel. The hookworm (acquired through larval penetration of the skin) is a notable example of a helminth adult that parasitizes the body from an intestinal site, attaching itself to the mucosa with a cutting mouth through which it infests the host blood. This situation is debilitating and can lead eventually to severe anaemia if many worms are involved (Benenson, 1995). Many intestinal roundworms and tapeworms live saprophytically in the bowel. Some attach with hooklets and suckers but derive nutrient from bowel contents, not from living tissue. Some have no means of attachment but their activities or products may cause local injury. If they are numerous and large enough, they can create intestinal obstruction. The small intestinal round worms that are not equipped for holding on like the pin worm (*Enterobius*) or whip worm (*Trichuris*) often find their way or are pushed into the appendix. This seldom causes difficulty but may be an incidental finding in appendixes that have been surgically removed for some other reason (Cheesbrough, 1998).

Epidemiological research carried out in different countries has shown that the social and economical status of the individuals is an important cause in the prevalence of intestinal parasites. The effect of social economic situation on risk of infectious diseases in general, and intestinal parasites infection in particular, is complex in nature and attributed to several factors such as lack of environmental sanitation, low level of education, lack of access to safe water and improper personal hygiene and therefore occur wherever there is poverty (Vikram *et al.,* 2008).

When the water/soil is contaminated, the resilient infective forms (eggs, cysts, spores) of the pathogenic organisms can be transported to vegetables, fruit, hands, tools, handles doors, currency, etc. (Nyarongo *et al.,* 2008). The hot and humid climate, high

population density, poor conditions of hygiene and the presence of insects as vectors or merely as mechanic carriers of parasites, limited economic resources and some social cultural habits (food and others) promote the transmission of parasites (Adoeye *et al.*, 2007.).

Factors associated with transmission of these intestinal parasitic infections include poor hygiene practices and sanitation. Should these factors be addressed, this would be preventing intestinal parasitic infections. Nevertheless, there are risk factors which community members are able to control without much effort, like washing hands before eating, drinking boiled or treated water, wearing shoes and eating well cooked food. Recent studies support that both individual and community perceptions and attitudes of parasitic worm infections and their prevention and treatment are important factors ((Uchoa-E *et al*., 2000) Mwanga-Jr *et al.,* 2004, Aagaard-Hj *et al.,* 2009).

Parasitic infections in children are an important public health issue, particularly in developing countries. World-wide, 3.5 billion people are affected by intestinal parasites, and 450 million people, mostly children, present clinical symptoms (Arani *et al.*, 2008). It has been estimated that *Ascaris lumbricoides*, hookworm and *Trichuris trichiura* infect 1,450 million, 1,300 million and 1,050 million people worldwide, respectively. While *Entamoeba histolytica* and *Giardia lamblia* are also estimated to infect about 60 million and 200 million people worldwide, respectively (Murray PR, 2002).

1.2 Statement of the problem

Intestinal parasitic infections are a public health concern both in urban and rural areas in Kenya like in Lodwar Municipality, Turkana County where the poverty level is 95% and illiteracy index is high. Although studies have shown that many groups in society are affected by these infections, school going children especially in the rural areas are the prime victims of intestinal parasitism that affect their physical development, school attendance and ability to learn (Al-Mohammed *et al*., 2010). This has subjected children to myriad of problems caused by malabsorption in their intestines, abdominal pain,

severe diarrhoea, vomiting, weight loss, dermatitis or pruritis and chronic urticeria (Ngui, *et al*., 2011).

Despite deworming efforts organized and supported by the national government through the Ministry of Health, regions that are considered hard to reach like Lodwar have continued to witness few activities relating to the same. It is in Lodwar and the entire Turkana County that many children walk barefoot, play with soil and take food without washing their hands. Such situations coupled with poor hygiene among children exposes them to easy infection with soil related ova of helminthes and cyst of *Entamoeba histolytica and Giardia lamblia*. Further, poor excretal disposal coupled with a hot and humid tropical climate contributes to intestinal parasitic infection in the region.

Given the conditions in harsh climatic conditions and human activities in semi-arid region like Lodwar, parasitic infections will continue to torment, curtail and retard overall growth school going children further exposing them to more serious outcome. However these infections occur in all age groups but the problem is more in school going children (Ngonjo *et al*., 2012).

1.3 Justification of the study

Studies have shown the adverse effect associated with intestinal parasites especially amongst children. Studying intestinal parasites brings a better understanding of prevalence and the factors associated with the prevalence of helmithes amongst school going children to both levels of the National and County government. This, on the one hand, will enable the two levels of government to continue mounting feasible strategies of inclusion and evaluation existing control measures in schools, if unchecked as the literature has revealed, can affect the overall growth and development of children both in schools and within the community.

Studies on intestinal parasites among children aged between 6 and 18 years in hard-to-reach environments like Turkana region. This study will therefore add more knowledge

on the effects of parasitic infection on children especially in the tender age of between 6 and 18 years, with a view to informing County governments on the situation, especially on the prevalence and the common factors that are associated with parasitic infection, in order to either directly or invite the participation and contribution of other stakeholders to assist in developing and mounting interventions which can go along way in supporting the growth of children from the tender age at the family level. It is expected that the study will generate data on the status of parasitic infections in the county and will yield to programmes such as deworming and continuous sensitizations at the lowest level including the family so that parents can also be involved in activities towards alleviating the suffering and stress associated with intestinal parasites.

Studies have shown that as intestinal parasites population builds up over time, many of the health problems caused by these parasites become chronic. Studying the distribution of the parasites in Lodwar municipality is useful so that effective treatment and prevention of the parasites can be implemented. There is also need to empower the community with the necessary information on how to prevent the transmission of the parasite infection. Accurate information on the distribution of specific parasite among sexes and age groups is needed for the purposes of planning, implementation and subsequent evaluation of control measures. This will be useful since the approach to be used in the control measures would vary with age groups as well as sexes.

Studies delineating the pattern of parasitic infections among school going children are scarce (Al-Mohammed et al., 2010). Intestinal parasitic infections are of high prevalence among the poor and social economically deprived communities where there is overcrowding, no public health awareness, poor environmental sanitation, low level of education and lack of access to safe water. Information on prevalence and social cultural factors on transmission of Intestinal protozoa infections in school going children is scarce and little data is available in Turkana County. Parasitic infections contribute to economic instability and social marginalization, and the poor people of under developed nations experience a vicious cycle of under nutrition and repeated infections leading to excess morbidity with children being the worst affected.

With meaningful programmes from all levels of governments and other relevant stakeholders including parents, children are expected to have good health and be able to concentrate on their academic and social development hence improving performance in their schools.

1.4 Research Questions

1. What is the prevalence of intestinal parasitic infection in school going children between 6 and 18 years in Lodwar Municipality?

2. What are the socio-cultural factors associated with intestinal parasitic infection in school going children between 6 and 18 years in Lodwar Municipality?

3. What are individual behavioral factors associated with intestinal parasitic infection in school going children between 6 and 18 years in Lodwar Municipality?

1.5 Objectives

1.5.1 General Objective

To investigate factors associated with intestinal parasitic infection among school going children aged between 6-18 years in Lodwar Municipality, Turkana County.

1.5.2 Specific Objectives

I. To determine the prevalence of intestinal parasitic infection in school going children between 6 and 18 years in Lodwar Municipality.
II. To determine socio-cultural factors associated with intestinal parasitic infection in school going children between 6 and 18 years in Lodwar Municipality.
III. To determine individual behavioral factors associated with intestinal parasitic infection in school going children between 6 and 18 years in Lodwar Municipality.

CHAPTER TWO

LITERATURE REVIEW

2.1 Background

Among the many species of intestinal protozoa, *Entamoeba histolytica* and *Giardia lamblia* are potentially pathogenic and in many parts of the world, either or both organisms constitute a public health problem (WHO, 2008).

2.2 Transmission of intestinal parasites

When the water/soil is contaminated, the resilient infective forms (eggs, cysts, spores) of the pathogenic organisms can be transported to vegetables, fruit, hands, tools, handles doors, currency, etc. (Nyarongo *et al.,* 2008). The hot and humid climate, high population density, poor conditions of hygiene and the presence of insects as vectors or merely as mechanic carriers of parasites, limited economic resources and some social cultural habits (food and others) promote the transmission of parasites (Adeoye *et al.,* 2007).

Factors associated with transmission of these intestinal parasitic infections include poor hygiene practices and sanitation. Should these factors be addressed, this would be prevent intestinal parasitic infections.

Nevertheless, there are risk factors which community members are able to control without much effort, like washing hands before eating, drinking boiled or treated water, wearing shoes and eating well cooked food. Recent studies support that both individual and community perceptions and attitudes of parasitic worm infections and their prevention and treatment are important factors ((Uchoa-E *et al.,* 2000) Mwanga-Jr *et al.,* 2004, Aagaard-Hj *et al.,* 2009).

2.3 Diseases caused by intestinal parasites

Parasites are responsible for ill health conditions including diarrhoea, gastro intestinal upset, joint pain, nervous diseases, immune dysfunction and chronic fatigue. Long undetected infection can cause many systemic problems (Benenson, 1995). For the very old, very young or immunocompromised, a parasitic infection can be extremely problematic. Signs of infection include less conclusive symptoms such as running nose, night time restlessness and blisters in the lower lip inside the mouth. Infected individuals feel bloated, tired and hungry. They can have allergies, anaemia and headaches (Katzman, 1989).

Ascariasis is the most common intestinal worm infection. It is found in association with poor personal hygiene, poor sanitation, and in places where human faeces are used as fertilizer. Human taeniasis is caused by infection with the adult stages of tapeworms, *Taenia saginata* and *Taenia solium*. Taeniasis is known to cause pathomorphological changes in the jejuna mucosa or lowered gastric secretions being found in 70% of patients. *Schistosoma mansoni* causes intestinal schistosomiasis; clinical features are encountered in only small portion of patients with persistent or heavy infection. In cases of hook worm infection, it results to anaemia due to blood loss. It has been associated with iron deficiency anaemia. Amoebiasis is the most common infection and is caused by *Entamoeba histolytica*. Giardiasis is caused by *Giardia lamblia* which is the second most prevalent intestinal parasite in human and found in drinking water. *Giardia* resides in the small intestines and at times in the gall bladder (Morello *et al*., 1998).

These infections occur worldwide with the prevalence disproportionately increased in developing countries. This has been associated with poor socioeconomic conditions and sanitation levels which facilitates contamination of food or water by *E. histolytica* cysts. Infection with E. dispar occurs approximately 10 times more frequently than infection with E. histolytica (Peterson *et al.*, 2011).

However, the available literature shows a widespread intestinal protozoan infections in many parts of the country. A study by Nguhiu *et al.,* 2009 reported intestinal protozoan parasitic prevalence of 12.6% in Kitui. Kisavi *et al.,* 2014 later reported a higher prevalence of 38.6% in the same County. Nyarang'o *et al.,* 2008 reported a prevalence of 11.9% of *Entamoeba histolytica* among the food handlers attending Kisii hospital. Another prospective study among children age less than six years found a prevalence of 4% of *cryptosporidium* (Gatei *et al.,* 2006). Another study in Thika by 13 Ngonjo *et al.,* (2012) found an overall prevalence of protozoan infections was 46.3%, 38.9%, 34.8% and 28.7% for Peri- urban, rural, slum and urban schools respectively.

2.4. Prevention and control of intestinal parasites

There are important basic measures to prevent and control intestinal parasite which include hand washing after defecation and before eating, preventing water supplies from becoming contaminated with feacal matter and covering food and water to prevent contamination from flies, which act as cyst carriers. However, other efforts under health promotion programs vary from country to country and from situation to another.

World Health Organization has recommended three interventions measures to control morbidity due to parasitic intestinal infections. This includes regular drug treatment of high-risk groups for reduction of the worm burden over time, health education and sanitation supported by personal hygiene aimed at reducing soil contamination. In areas where transmission of intestinal parasites is intense, drug treatment offers the best approach. School based deworming is preferable for areas where rates of transmission and reinfection are high. Drugs such as albendazole, levamisole, mebendazole and pyrantel are recommended for public health treatment of intestinal parasite infections (WHO, 2006).

For deworming to be effective and sustainable, environmental health, access to safe water and improved hygienic behavior are essential. Health education aims to improve health and increase hygiene awareness and to change health-related behavior in the population (Ziegelbauer *et al.*, 2012).

2.5. Prevalence of Parasitic infections

School going children have been reported to be at highest risk for intestinal parasites due to the fact that as the child grows older the exposure to many of the risk factors for intestinal parasites infection increases. Another factor for increased prevalence in children is their weak immune system and higher nutritional requirements which to many is unaffordable and unmanageable (Bundy *et al.*, 2003).

Hookworms and the whipworm, *Trichuris trichura* are as widely distributed as Ascaris. The parasites are soil transmitted helminthes of global distribution and is less prevalent than Ascaris. Ascaris has highest prevalence in sub tropics and tropical areas of Africa, Asia and American countries. The hookworm *Necatar americanas* occur in America, equatorial Africa, and South East Asia. *Ancylostoma duodenale* commonly occur in Africa and in Northern and South West Asia (Kaye, 1999).

Studies in Kenya have shown the existence of intestinal helminthes. A study conducted in Thika, Kenya (Ngonjo *et al*., 2012) identified six species of intestinal helminthes *ascaris lumbricoides*, *trichuris trichiura*, hookworm, *Schistosoma mansonii*, *Enterobius vermacularis*, *Hymenolepis nana* with overall prevalence of 42% (158 out of 377). Protozoa species identified included *Entamoeba histolytica* (14.6%), *Entamoeba coli* (18.8%), *Giardia lamblia* (6.9%) and the lowest *Iodamoeba bustchili* 5.8%, with overall prevalence of protozoa infections being 46.3%, 38.9%, 34.8% and 28.7% for peri-urban, rural, slum and urban school respectively.

2.6 Social-cultural factors

Epidemiological research carried out in different countries has shown that the social and economical status of the individuals is an important cause in the prevalence of intestinal parasites. The effect of social economic situation on risk of infectious diseases in general, and intestinal parasites infection in particular, is complex in nature and attributed to several factors such as lack of environmental sanitation, low level of education, lack of access to safe water and improper personal hygiene and therefore occur wherever there is poverty (Vikram *et al.,* 2008).

According to the World Health Organization (WHO) reports, Giardia lamblia is one of the most common parasites which affects nearly two thirds of people worldwide WHO, 2010). Giardiasis has a worldwide distribution, but it is more common in areas with poor sanitary conditions and insufficient water treatment facilities (WHO 2010). The prevalence is high in Sub-Saharan Africa due to poor sanitary habits, lack of access to safe water, and improper hygiene, and hence, these infections are often referred to as diseases of poverty (Amoa-Id e*t al*., 2017).

In many Africa countries, the prevalence of infections varies from one region and community to another due to various factors. This is in most cases is associated with contaminated environment and the sociocultural habits of communities (Bekele-F *et al*., 2017; Speich-B *et al.,* 2016; O'Conell-Em *et al.,* 2016).

Consequently, helminths are intimately associated with poverty, poor sanitation, and lack of clean water. For instance; According to Andrea *et al.* (2012), social determinants for example poverty that mostly lead to low level of education of mothers has been associated with intestinal parasites in children. Parents with high levels of education provide good sanitary practices to their children as compared to children whose parents have low levels of education especially in socio economic challenged areas. Improper hygiene in children is closely associated with parents' level of education.

However, lack of sanitation, poor water supply and unclean practices contribute to the spread of all intestinal helminths' infections in the community. In recognition of the burden helminthes infections impose on human populations, particularly the poor, major intervention programmes have been launched to control them (Mwanga-J *et al.,* 2015) Although reductions in the prevalence and morbidity have been achieved through chemotherapy, it is generally accepted that improvements in domestic water supplies, environmental sanitation, health education, access to health services for diagnosis and treatment must be integrated in control and elimination programmes to assure their effectiveness (Wynd-S *et al*., 2007).

2.7 Behavioural factors

The factors that put people at higher risk of getting intestinal parasites may include living in or visiting an area known to have parasites, poor sanitation (from both food and water), poor hygiene, age (children are more likely to get infected than adults), HIV or AIDS.

Another risk factor for intestinal parasites especially in children below 6 years is behavioural habits. This is in relation to geography, hygiene and sanitation. These Children are very active in terms of playing, where most of the games played involve interaction with soil in one way or another. Intestinal parasite eggs hide in fingernails and since most children do not wash their hands, the eggs find their way into the intestines via the mouth (Henry, 1981).

Behavior, Household Clustering and Occupation Specific occupations, household clustering, and behaviors influence the prevalence and intensity of helminth infections (Bethony *et al.,* 2006). particularly for hookworm, in which the highest intensities occur among adults Engagement in agricultural pursuits, for example, remains a common denominator for hookworm infection. Behavioral and occupational factors, through their effect on water contact, interact with environmental factors to produce variation in the epidemiology of schistosomiasis (Brooker *et al.,* 2006).

Transmission of Intestinal Protozoan infections Feacal-oral contamination of water and food is generally the main mode of transmission of intestinal protozoan infections (Shrihari *et al.,* 2011). Feacally contaminated food or water is the most frequent route of transmission of *Giardia lamblia*, through drinking contaminated tap water or recreational exposures in lakes, rivers, or swimming pools (Wiser, 2015). Transmission of intestinal parasites is through faecal-oral contact or contamination of water or food, due to poor sanitation and hygiene practices. They are acquired by ingestion or penetration of skin by infective forms (Tariq, 2006). People become infected with *A. lumbricoides and T. trichiura* by ingesting infective parasite eggs. The eggs which may be attached to vegetables are ingested when the vegetables are not carefully cooked, washed or peeled. Eggs may also be ingested from contaminated water sources. Children may ingest eggs when they play in soil and then put their hands in their mouths without washing them.

Environmental factors known to cause intestinal parasites are related to water supply and availability of toilets and behavioral habits. According to Ziegelbauer *et al.* (2012), systematic review and Meta-Analysis study on effect of Sanitation on intestinal parasitic infection found that the availability and use of sanitation facilities were associated with a reduction in the prevalence of infection with intestinal parasites. Therefore, the provision of safe water and improved sanitation are essential for the control of helminth infection.

Health education is aimed at reducing transmission and re-infection by encouraging health behaviours. The main purpose is to reduce contamination of soil, promoting the use of latrine and hygienic behaviours (WHO 2002).

For health education activities to be effective they will also need the identification of the target audience and the formulation of clear messages, which consider local perceptions and attitudes to bring about behaviour change (Uchoa-E *et al.,* 2000) Furthermore, the role played by the target population is of great importance. If the members of the community are aware of the negative effects of intestinal helminthes on the health of

their children, they will be more likely to support and sustain uptake of MDA intervention measures.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Site

The study was conducted in primary schools that were sampled from Lodwar Municipality-Turkana County. Lodwar Municipality is found within Lodwar town which is the administrative capital of Turkana County. The population in the municipality is cosmopolitan though the majority of the people are from the Turkana community. Pastoralism is largely the main socio-economic activity in the county.

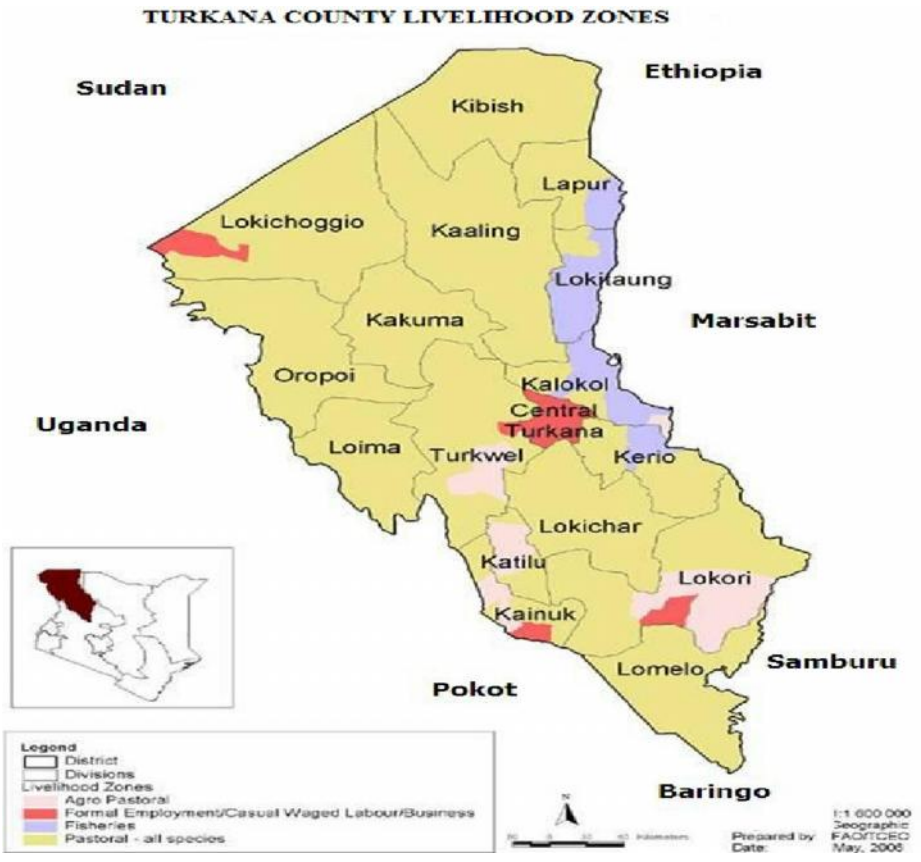

Figure 3.1: Map of Turkana County

3.2 Study Design

This was a cross-sectional descriptive study which utilized quantitative technique in data collection.

3.3 Study Population

This consisted of school going children aged between 6 and18 years.

3.4 Inclusion and exclusion criteria

3.4.1 Inclusion criteria

- School going children aged between 6-18 years.
- School going children whose mothers consented.

3.4.2 Exclusion criteria

- All the children who were very sick were excluded from the study.

3.5 Sample Size Determination

The minimum sample size for this study was calculated using the formula developed by Cochran (1963) and the prevalence of 28% (Okodua *et al*., 2004) was used.

$$n = \frac{Z_{1-\alpha}^2 P(P-1)}{d^2}$$

Where

n- The required sample size

$\mathbf{Z}_{1-\alpha}^{2}$-Critical value associated with significance level

P-is the estimated size of the proportion

d-Margin of error

Substituting the formula

$$\mathbf{n=}\ \frac{1.96^2 * 0.28(1-0.28)}{0.05^2}$$

n = 310

3.6 Sampling procedure

Two field workers were selected and trained on data collection techniques. Ten primary schools (2 urban and 8 rural based on ratio of how many schools in the rural areas) were randomly selected. Data were collected using a structured questionnaire (Appendix II). Systematic random sampling was used to pick participants. Sampling frame were registers in each school where participants were selected. Sampling interval (Kth number) was calculated using the formula Kth=N/n. Where, **K**th number is the sample interval which was calculated by dividing total study population size (1300) of children from 10 randomly selected schools.

Therefore;

1300/ 310 = 4

The 1st participant was randomly selected in the list and then every 4th child was picked until the required sample size of 310 pupils was obtained.

3.7 Data Collection

3.7.1 Data collection tool

The questionnaire was used to capture data from participants. The questionnaire was translated and administered to parents of the children in Kiswahili language. The researcher recruited two trained field workers to assist in administering the questionnaire.

3.8 Data Collection

3.8.1 Collection of stool samples

The samples were stool specimens from school going children and which were taken by the principal investigator to Lodwar county referral hospital laboratory for analysis within the period of the study.

Only the 310 sampled children aged between 6 and 18 years from the 10 randomly selected schools were invited to provide formed stool sample in a clean, wide mouthed, screw capped, transparent, dry and disinfectant free containers which were pre-labeled with their numbers identical to numbers assigned to students. Spatula and plastic bag were also given for proper stool scooping into the container to avoid contamination with soil helminthes that can give un-realistic results. Ice boxes were also used to maintain cold chain of stool during transportation. The stool samples were collected in clean containers (polypots) and transported in cool ice boxes to Lodwar County Referral

Hospital laboratory for examination. The stool samples were labled with a laboratory reference number which was recorded together with the age and sex of the student. The samples were then processed using both the direct and concentration methods.

3.8.1.1 Laboratory procedures

One of the methods used in this study was the direct method which involved direct macroscopic observation where the appearance of the specimen were reported and any parasitic worm or tapeworm segments identified. Then the specimens were observed microscopically for motile parasites such as trophozoites of *Entamoeba histolytica* and helminth eggs.

To do the above some procedures of the direct method were done. A drop of fresh physiological saline was placed on one side of a slide and a drop of iodine on the other end. Then a small amount of specimen was picked with an applicator stick and mixed with saline and a similar amount with iodine. This was followed by the entire saline preparation which was examined systematically for larvae, ciliates, helminth eggs and cysts. The iodine preparation assisted in the identification of cysts.

In addition, the concentration method was also used. This was where faeces were emulsified in formal saline, the suspension strained to remove large faecal particle added and the mixed suspension centrifuged. Eggs, cysts and larvae were then fixed. Sediment and the faecal debris were separated in a layer between the ether and formal saline. Faecal fat was dissolved.

The procedure of stool direct and concentration method followed Cheesbrough (1998).

The procedure of the stool concentration method involved the following;

The Stool was emulsified with 8 mls of 10% formal saline.

The content was then poured through 4 layers of cotton gauze in a funnel into a centrifuge tube.

4 mls of ether was added.

The tube was corked and shaken for 20 seconds.

It was then centrifuged at 1000 RPM for 2 minutes.

The tube was gradually uncorked to ease out pressure.

The plug formed was dislodged carefully using an applicator stick.

The tube was inverted gently and the supernatant poured off.

The deposits was then mixed by tapping the tube.

A drop of the deposit was placed on a microscope slide and cover-slipped after adding a drop of Lugol's iodine.

The entire preparation was examined using X10 and then X40 objective lens and the results recorded.

3.7.1.2 Data collection tool

The questionnaire was also used to capture data from participants. This captured issues such as socio- demographic characteristics, prevalence of intestinal parasites and common risk factors associated with intestinal parasites. The questionnaire was translated and administered to parents of the children in Kiswahili language. However, two trained field workers assisted parents in responding to issues raised in the questionnaire.

3.9 Data Analysis and Management

Laboratory results data was entered in parasitological forms, transferred to excel spreadsheet and exported to STATA version 13 for analysis. The results yielded included socio-demographic characteristics of participants, distribution of participants in schools by numbers, distribution of participants by schools and occurrence of intestinal parasites, Pets kept, water source and gender characteristics and the occurrence of intestinal parasites and behavioural practices towards prevention of intestinal parasites and their occurrence, distribution and Characteristics of Housing and Toilet, Prevalence rates of intestinal parasites by school and Prevalence of parasites by gender and age groups .Results were presented in form of tables, charts, percentage, mean and frequencies. Chi square was used to analyse categories for proportions and prevalence, intensities of parasitic infections between schools and was analysed using one way ANOVA statistical package. Data from questionnaire was also entered into SPSS database and analysed. The findings are presented in form of tables, figures, frequencies, mean and associations.

3.10 Ethical Considerations

This study was presented to the Scientific Steering Committee and Ethical Review Committee at the Kenya Medical Research Institute (KEMRI) for scientific and ethical approvals, respectively. Permission to access and undertake the study in the primary schools was obtained from the County Directors of education and Health as well as primary school heads. Permission to process the samples in the laboratory at Lodwar County Referral hospital was sought from its management board. The consent was obtained by the lead researcher from the parents of the selected children which entailed requesting them to sign on a consent form which had been translated into Turkana language (Appendix 1). The objectives and procedures of the study were explained to them before they agreed to sign the consent form. However, participants were assured confidentiality in that none of their names or names of their children would appear in any report.Invitation (through letter) were done to mothers of selected children to accompany their children to school to give their consent.

CHAPTER FOUR

RESULTS

A total of 310 participants were recruited for the study. The results are presented in line with the objectives of the study, first the demographics.

4.1 Socio - Demographic characteristics of participants

Results show that more than half of the participants (53.9%) were boys with 46.1% being girls. Age distribution showed that 15.5% of the respondents were aged between 6 and 9 years, 57.4% were aged between 10 to 13 years and 27.1% were aged between 14 and 18 years. The respondents' parent's level of education showed that 27.1% of them attended primary school, 41.0% of them attended secondary school, 5.5% of them attended a tertiary institution and 26.5% of them never attended school. Majority of the parents were married (81.3%) followed by 13.2% who were single and 5.5% were divorced. The housing distribution also showed that 38.7% of the respondents lived temporary houses, 54.5% lived in semi-permanent houses and 6.8% lived in permanent houses. In addition, 97.1% were Christians while 2.6% were Muslims. Regarding the occupations, 17.1% were farmers, 30.3% were businessmen or businesswomen, 12.6% were pastoralists and 37.1% were in the formal employment.

Table 4.1: Socio - Demographic characteristic of participants

Characteristic	Frequency n(%)
Sex of the child	
Male	167(53.9)
Female	143(46.1)
Age of child	
6 - 9	48(15.5)
10 – 13	178(57.4)
14 – 18	84(27.1)
parents socio demographics	
Parent's Level of education	
Primary	84(27.1)
Secondary	127(41.0)
Tertiary	7(5.5)
None	82(26.5)
Marital status	
Single	41(13.2)
Married	252(81.3)
Divorced	17(5.5)
Housing Status	
Temporary	120(38.7)
Semi-permanent	169(54.5)
Permanent	21(6.8)
Mother Religion	
Christians	301(97.1)
Muslim	8(2.6)
Non-Religious	1(0.3)
Mother occupation	
Farmer	53(17.1)
Business	94(30.3)
Pastoralists	39(12.6)
Formal employment	115(37.1)
Unemployed	9(2.9)

4.2 Distribution of participants by gender

Table 4.2 shows that almost three quarter of the pupils at Kakwanyang Primary were male (70%). This was closely followed by Bishop Mahon Primary with 63.4%. Canaan Primary School was the only Primary School to record a higher number of female pupils amongst all the mixed primary schools (60%).

Table 4.2: Distribution of study participants by school and gender

School	Gender	
	Male (%)	**Female (%)**
Canaan Primary School	12(40)	18(60)
AIC Napuu Primary School	20(60.6)	13(39.4)
St. Perpetua Nabulon Girls	0(0)	15(100)
Nakwamekwi Primary School	29(63)	17(37)
Bishop Mahon Primary School	26(63.4)	15(36.6)
St. Michael Kawalase Primary School	21(60)	14(40)
Lodwar Mixed Primary School	30(46.9)	34(53.1)
St. Mary Primary School	12(60)	8(40)
Monti Primary School	10(62.5)	6(37.5)
Kakwanyang Primary School	7(70)	3(30)
Total	167(53.9)	143(46.1)

4.3 Distribution of participants by school

Figure 4.1 shows that Lodwar mixed primary had the highest number of participation (20.6%). It was followed by Nakwamekwi Mahon primary school with 14.8% respondent. Kakwanyang Primary School had the least number of respondents (3.2%).

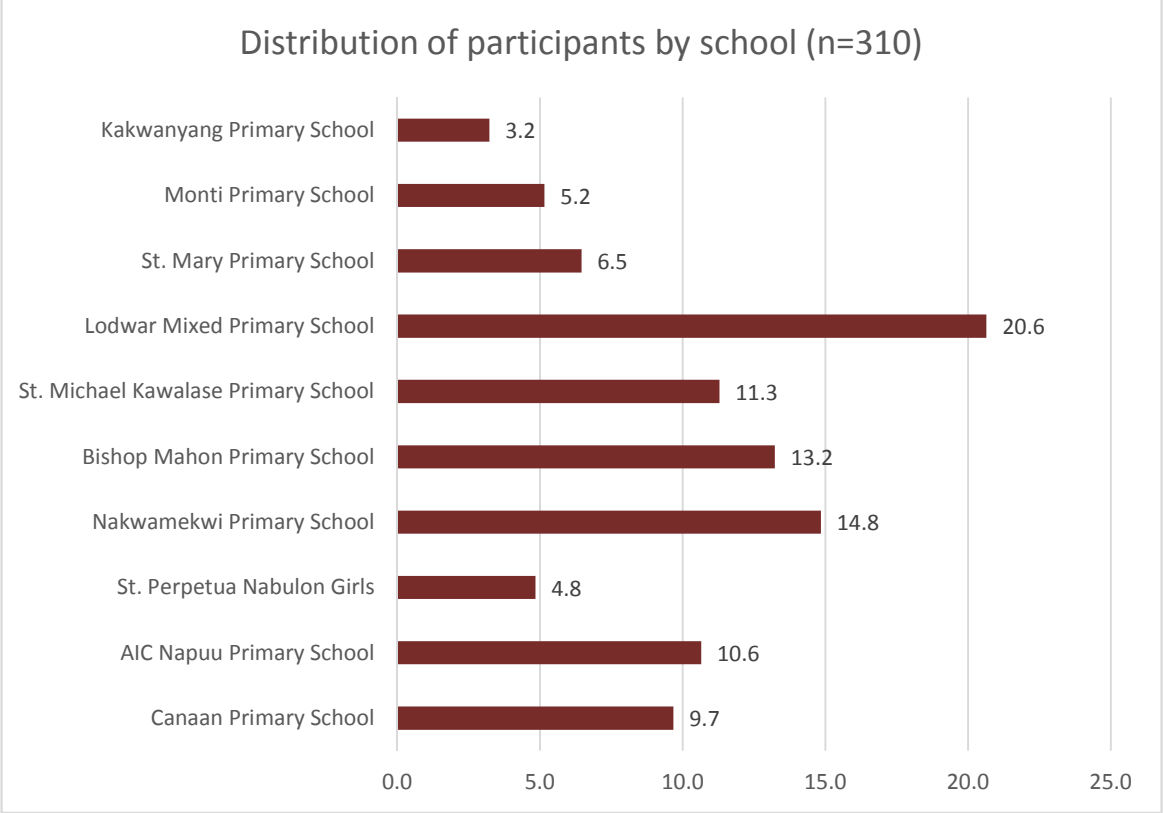

Figure 4.1: Distribution of participants by school

4.4 Prevalence of intestinal parasites

4.4.1 Prevalence of intestinal parasites by school

Table 4.3 shows that majority of the respondents (53.3%) in St. Perpetua Nabulon girls school tested positive for intestinal parasites. This was followed closely by AIC Napuu primary school with 45.5% of their respondents testing positive. Canaan primary school had the least (23.3%) testing positive.

Table 4.3: Prevalence of intestinal parasites by school

Schools	Positive n(%)	Negative n(%)
Canaan primary school	7(23.3)	23(76.7)
AIC Napuu primary school	15(45.5)	18(54.5)
St. Perpetua Nabulon girls	8(53.3)	7(46.7)
Nakwamekwi primary school	17(37)	29(63)
Bishop Mahon primary school	16(39)	25(61)
St. Michael Kawalase primary school	9(25.7)	26(74.3)
Lodwar mixed primary school	18(28.1)	46(71.9)
St. Mary's primary school	8(40)	12(60)
Monti primary school	6(37.5)	10(62.5)
Kakwanyang primary school	4(40)	6(60)

4.4.2 Prevalence by gender

Table 4.4 shows that the overall prevalence rate of intestinal parasites in the schools under study was 34.8%. Prevalence among male respondents were 38.9% with 30.1% among the female respondents testing positive for intestinal parasites. Chi square test were performed to check on possible association between gender and infection by intestinal worms. There was no association between gender and parasite infection (p=0.103).

Table 4.4: Prevalence by gender

Gender	Positive n(%)	Negative n(%)
Male	65(38.9)	102 (61.1)
Female	43 (30.1)	100 (69.9)
Total	108 (34.8)	202 (65.2)

4.5 Prevalent types of parasites

The chart below indicates that the most prevalent type of intestinal parasite was *cysts of entamoeba hystolitica* as identified amongst 75.2% of the pupils infected with intestinal worms. This was followed at a distant by *Troph of giardia lamblia* at 14.3%. least type of intestinal parasite identified were ova of *T saginata* at 0.6%

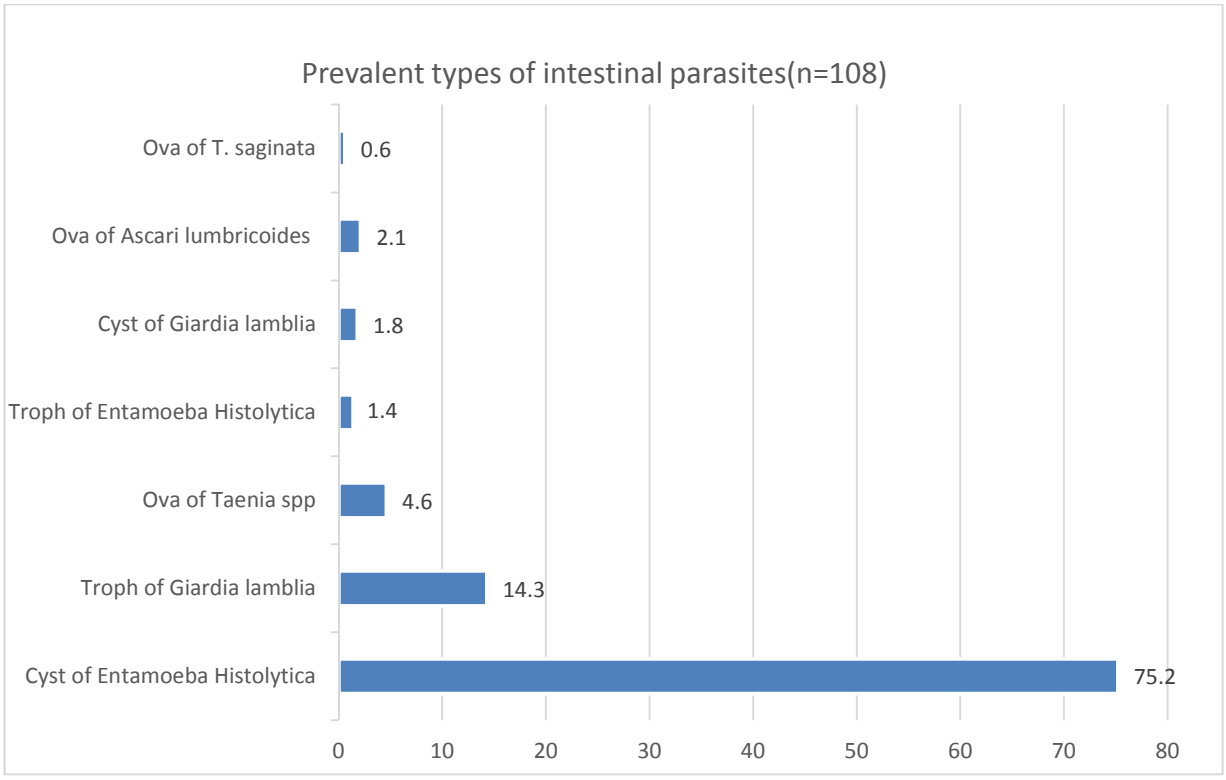

Figure 4.2: Prevalent types of intestinal parasites

4.6 Prevalence of parasites by gender and age groups

The table below (Table 4.5) shows that cyst of entamoeba histolytica was the most common parasite in the samples tested with a prevalence of 77.4%, followed by troph of giardia lamblia with prevalence of 9.1%, ova of taenia spp with a prevalence of 8.7%, troph of Entamoeba histolytica with a prevalence of 2.1%, ova of ascari lumbricoides with a prevalence of 2.1%, cyst of Giardia lamblia with a prevalence of 1.8% and ova of T. saginata 0.6%. Cyst of entamoeba histolytica and troph of giardia lamblia parasites were highly distributed across different age groups and gender. Ova of Taenia spp was mainly found in children between the ages of 14 and18 years(16.3%). Troph of entamoeba histolytica was only found in the female respondents (4.9%). Samples from school going children between the age group of 6 and 9 years were only found to contain Cyst of entamoeba histolytica and troph of giardia lamblia parasites.

Table 4.5: Prevalence of parasites by gender and age groups

Parasite	**Overall Prev (%)**	**Gender (%)**		**Age groups (Years)**		
		Male	Female	6-9 (%)	10–13(%)	14 – 18 (%)
Cyst of Entamoeba Histolytica	75.2	77.4	72	74.3	76.8	72.2
Troph of Giardia lamblia	14.3	9.1	14	25.7	15.4	3.1
Ova of Taenia spp	4.6	8.7	5.2	0	3.8	16.3
Troph of Entamoeba Histolytica	1.4	0	4.9	0	2.5	2.8
Cyst of Giardia lamblia	1.8	3.5	0	0	1.5	0
Ova of Ascari lumbricoides	2.1	1.3	2.3	0	0	2.8
Ova of T. saginata	0.6	0	1.6	0	0	2.8

4.7 Socio cultural factors associated with intestinal parasite infection

4.7.1 Characteristics of Housing and toilet

Table 4.6 shows that 32.1% respondents without latrines tested positive for intestinal parasites. The study further revealed that 30% respondents who lived in permanent houses tested positive for intestinal parasites. 37.4% of the respondents who had a pit latrine tested positive for intestinal parasites. All the respondents who reported to have a flush toilet tested negative for intestinal parasites. Since one of the cells in the table contains values less than 5, fishers exact test were used to test for association between the toilet and housing distribution characteristics and the occurrence of intestinal parasites. Fishers exact test couldn't reveal an association between ownership of toilet (P = 0.754), house type (P = 0.731), toilet type (P = 0.251) and the occurrence of intestinal parasites.

Table 4.6: Characteristics of Housing and Toilet

Characteristics	value	Positive n(%)	Negative n(%)	P Value
Toilet/Latrine ownership	Yes	99(35.1)	183(64.9)	P = 0.754
	No	9(32.1)	19(67.9)	
Housing Status	Permanent	6(30)	14(70)	P = 0.731
	Semi-Permanent	53(33.5)	105(66.5)	
	Temporary	49(37.1)	83(62.9)	
Type of toilet facility	Pit latrine	82(37.4)	137(62.6)	P = 0.251
	VIP latrine	14(28)	36(72)	
	Flush toilet	0(0)	5(100)	
	Others	1 (233.3)	24(66.7)	

4.7.2 Cultural factors

This involved livestock keeping and pet as a way of life of the study community. Housing status shows that many respondents live in temporary structures (31.7%) while 33.5% are in semi – permanent structures as shown in Table 4.6 above. The structures reflect the Turkana way of life. Housing structures are associated with dust and infestation of insects such as cockroaches. Both temporary and semi – permanent structures have spaces where such insects can live.Semi-permanent and temporary structures depict a picture of poverty, poor sanitation and lack of sufficient clean water.

Regarding sanitation, majority of the study participants (91%) had / owned latrine while a few (9%) didn't. However, there were various types of toilet with pit latrine being the most common as shown in table 4.6 above. Lack of sanitation, poor water supply and unclean practices contribute to the spread of all intestinal helminths' infections in the community.

Respondents were also asked of the pets they kept at home. Amongst those who reported having a cat in their household, slightly over a quarter (29.4%) of them tested positive for intestinal parasites with 24.0% of those who kept a dog in their households testing positive. About similar proportion (31.7%) of those who kept chicken in their households tested positive for intestinal parasites. Keeping pets and dogs poses great risks to human life as they are associated with zoonotic potentials

As regards water source, 26.8% respondents who used borehole water tested positive for intestinal parasites while 22.7% respondents who utilized stream water tested positive for intestinal parasites. Of those respondents who used tap water, 35.8% of them tested positive for intestinal parasites with 27.3% of the respondents who used rain water tested positive for intestinal parasites. Almost half of the respondents (47.1%) who used open wells, tested positive for intestinal parasites while 46.2% of the respondents who used river water testing positive. All of the respondents (100%) who reported to be utilizing water from a dam tested negative for intestinal parasites. Since one of the cells had

small values (less than 5), fishers exact test was performed to determine if there was an association between water source, type of pets kept and the occurrence of intestinal parasites. To this effect, no significant association between these variables and the occurrence of intestinal parasites was observed.

Water, is an essential resource for life. Water becomes contaminated by parasites depending on its sources, a fact that can cause a variety of illness, disability and death.

Table 4.7: Pets kept, water source and the occurrence of intestinal parasites

Variable name	values	Positive n (%)	Negative n (%)	P Value
Households with	Yes	37(29.4)	89(70.6)	**P =0.094**
Cats	No	71(38.6)	113(61.4)	
Households with	Yes	12(24)	38(76)	**P = 0.079**
Dogs	No	96(36.9)	164(63.1)	
Households with	Yes	40(31.7)	86(68.3)	**P = 0.344**
Chicken	No	68(37)	116(63)	
Households with	Yes	6(35.3)	11(64.7)	**P = 0.968**
Rabbit	No	102(34.8)	191(65.2)	
Household using	Yes	11(26.8)	30(73.2)	**P = 0.248**
Borehole water	No	97(36.1)	172(63.9)	
Household using	Yes	5(22.7)	17(77.3)	**P =0.216**
Stream Water	No	103(35.8)	185(64.2)	
Household using	Yes	87(35.8)	156(64.2)	**P =0.498**
Tap Water	No	21(31.3)	46(68.7)	
Household using	Yes	3(27.3)	8(72.7)	**P = 0.753**
Rain Water	No	105(35.1)	194(64.9)	
Household using	Yes	8(47.1)	9(52.9)	**P = 0.277**
Open Well	No	100(34.1)	193(65.9)	
Household using	Yes	12(46.2)	14(53.8)	**P = 0.206**
River	No	96(33.8)	188(66.2)	
Household using	Yes	0(0)	2(100)	**P = 0.545**
Dam	No	108(35.1)	200(64.9)	

4.8 Behavioral factors associated with intestinal parasitic infection

This was a multiple response question whereby an individual can give more than one response. Table 4.8 shows that 57.1% who did not wash their hands daily tested positive for intestinal parasites. 38.9% tested positive for intestinal parasites amongst those who reported not wearing their shoes. The waste disposal distribution showed that 35.9% respondents who disposed waste through open dumping testing positive for intestinal parasites. 35.7% respondents who disposed waste through closed dumping tested positive for intestinal parasites while 27.3% who disposed of waste through burning tested positive for intestinal.

On water treatment, 34.3% respondents who reported using treated water at the household level tested positive for intestinal parasites. Fishers exact test was performed to determine if there was an association between behavioral prevention practices and the occurrence of intestinal parasites. Study results reveal an association between daily hand washing practices ($P = 0.026$) and infection with intestinal parasites.

This study has further shown that majority (94%) of the children were wearing shoes, a component which some studies have associated with intestinal parasites.

Table 4.8: Behavioural practices towards prevention of intestinal parasites and their occurrence

Behavioural practices	values	Positive n(%)	Negative n(%)	P Value
Daily Hand washing	Yes	96(33.2)	193(66.8)	P = 0.026
	No	12(57.1)	9(42.9)	
Child Wearing shoe	Yes	101(34.6)	191(65.4)	P = 0.710
	No	7(38.9)	11(61.1)	
Waste disposal	Open dump	33(35.9)	59(64.1)	P = 0.829
	Closed dump	71(35.7)	128(64.3)	
	Burning	3(27.3)	8(72.7)	
	At a central dump(municipal)	1(12.5)	7(87.5)	
Water treatment at household	Yes	99(34.3)	190(65.7)	P = 0.424
	No	9(42.9)	12(57.1)	

4.9 Factors associated with intestinal parasitic infection

All the behavioural practices were subjected to regression analysis in order to identify factors that are associated with infection with intestinal parasites. The test was carried out at 95% confidence level (alpha=0.05). study results reveals that an association between daily hand washing and intestinal parasitic infection exists (p=0.001).Controlling for waste disposal, wearing shoes and water treatment at household, the odds of getting intestinal parasites decrease by a factor of 0.097381 amongst those who practice daily hand washing compared to those who do not practice daily handwashing. In other words, those who practice daily hand washing are 91% less likely to suffer from intestinal parasitic infection compared to those who do not wash

their hands daily. All the other factors didn't show an association with having intestinal parasitic infection.

Table 4.9: Factors associated with intestinal parasitic infection

Intestinal Parasitic infection	Odds Ratio	Std. Err.	z	P>z	[95% Conf. Interval]	
Daily hand washing						
Yes	0.097381	0.0546361	-4.15	0.001	0.0324267	0.2924458
Child wearing shoes						
Yes	0.9526103	0.3396638	-0.14	0.892	0.473598	1.916111
waste disposal						
Open dump	2.33456	1.436693	1.38	0.168	0.6988336	7.79895
Closed dump	2.153725	1.332936	1.24	0.215	0.6402994	7.244314
Burning	2.104667	1.358562	1.15	0.249	0.5939264	7.458199
At central dump (municipal)	0.7620412	0.273292	-0.76	0.449	0.3773207	1.539027
Others	0.8474666	0.2921472	-0.48	0.631	0.431209	1.665549
water treatment at household						
Yes	1.004789	0.1096941	0.04	0.965	0.8112378	1.244519
_cons	5.476429	2.770636	3.36	0.001	2.031689	14.76174

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1. Discussion

5.1.1 Prevalence of intestinal parasites infection

This study has showed that intestinal parasitic infections is a public health concern as the overall prevalence rate among children aged 6 -18 years old in the schools under study was 34.8% compared to 65.2 % who were free from intestinal parasitic infections. The prevalence shows that he overall growth and development of the 34.8% will be affected by the intestinal parasites an indication that their concentration and overall performance in schools will be jeopardized if concerted effort to address it are not put in place. Further, the result shows that children in that age group are the most vulnerable to parasitic infections. According to Jasti *et al*. (2007) children are a population group at great risk that is likely to experience the impact of parasitic infections on cognitive function. This may result in morbidity, malnutrition and iron deficiency among other consequences. This finding was consistent with findings in South West Nigeria at 28% (Salako *et al*, 2001), 27.2% in Eastern Ethiopia (Tadesse *et al.*, 2005) and 27.2% in Saudi Arabia (Al-Mohammed *et al*., 2010).

This study found that daily hand washing and distribution of schools were strongly associated with occurrence of intestinal parasites. 33.2% of the respondents who reported to be washing their hands daily tested positive for intestinal parasites compared to 57.1% who were positive amongst those who did not wash their hands daily. These findings tally with that of another study done in Ethiopia (Tadesse *et al.*, 2005) which found a strong relationship between children washing their hands and occurrence of intestinal parasites ($P < 0.05$). The study showed that children who reported washing their hands frequently had a significantly lower prevalence of parasitic infections compared to those who did not.

The prevalence of intestinal parasitic infections in schools shows that children in urban set – ups are less likely to be infected than those in rural set – ups. For instance, the prevalence in urban schools such as Lodwar mixed primary and St. Michaels Kawalase primary was 28.1% and 25.7% respectively while schools in rural areas such as Kakwanyang and St. Perpetua Nabulon girls had 40% and 53% respectively. This study observed that while many schools in urban set – up were having water connections to borehole water and piped water in addition to storage water tanks compared to schools in the rural set – ups that have very limited source(s) of water. The latter rely mostly on water collected from vendors from unknown sources. Children in schools with a lot of water are likely to effectively observe hygiene and sanitation unlike children who have problems accessing the limited water which exposes them to eating and or consuming food frm poorly cleaned hands and or utensils. A study done in Thika (Njonjo *et al*., 2012) also revealed a strong relationship between the distribution of schools and the occurrence of intestinal parasites. Similar observations have been made by Muchiri *et al*. (2001) in Busia and Ngonjo *et al.* (2012) in Thika. The two studies revealed that in endemic communities, schools in rural/slum set ups have high intestinal parasites prevalence rates compared to schools in urban/peri-urban setups. They attributed this difference to the socio-economic status of the schools surroundings and the difference in housing and sanitation.

This study further revealed that *Entamoeba histolytica* was the most common parasite in the samples with a prevalence of 75.2%. *Entamoeba histolytica* parasite is more prevalent in the region due to lack of water & hygiene and sanitation. Turkana region is one of the areas / counties that receive very limited rainfall but have two seasonal rivers (Turkwell & Kerio). The poor water situation compromise hand washing practices amongst its population with children being vulnerable to consequences associated with lack of water. The prevalence of *Entamoeba histolytica* in this study was higher than those revealed in other studies. A study done in Naivasha, Kitui, Machakos, Taveta and Nandi hills had a prevalence rate of 31.8% for *Entamoeba histolytica* (Iseki *et al*., 1983).

A study in Ondo state, Nigeria, observed a high prevalence rate of 67.6% of this parasite (Simon-Oke *et al*., 2014).

In addition, a study found out that Trophoites of *Giardia lamblia* had a prevalence rate of 14.3% and ova of *Ascaris lumbricoides* had a prevalence rate of 2.1%. The prevalence rate of Giardia lamblia in this study was higher than that recorded in Naivasha, Kitui, Machakos, Taveta, Nandi hills and Kiambu which recorded a prevalence rate of 8.3% (Ngonjo *et al*., 2012; Iseki et al., 1983). The low prevalence rate of *Ascaris lumbricoides* in this study was consistent with prevalence rates of 3.6% of the parasite in Machakos (Change *et al.*, 1995). However, this was low compared to other studies, which revealed high prevalence rates of 32.5% of *Ascaris lumbricoides* (Abdel-aziz *et al*., 2010). According to the World Health Organization (2010) *Giardia lamblia* is one of the most common parasites globally which affects nearly two thirds of people worldwide and but it is more common in areas with poor sanitary conditions and insufficient water treatment facilities (WHO, 2010). A study has showed that the prevalence is high in Sub-Saharan Africa due to poor sanitary habits, lack of access to safe water, and improper hygiene, and hence, these infections are often referred to as diseases of poverty (Amoa-Id *et al*., 2017).

This study found out that *Entamoeba histolytica* was more prevalent in males (77.4%) than in females (72%). This finding is consistent with results from a study done in Ethiopia (Firdu *et al*., 2014) but were not supported with the findings of Teshome *et al*., who found the parasite being more prevalent in females.

Male prevalence is associated with socio – economic and cultural practices and habits that require them to accompany and care for livestock including taking them to water drinking points that are in most cases, from flowing rivers, boreholes and water ponds. This practice exposes males to also utilizing or sharing the same water for drinking. However, *Giardia lamblia* was found to be more prevalent in females (14%) than in males (9.1%), this was not supported by findings from Central Sudan that revealed a higher prevalence rate in males (37.8%) than in females (28%) (Abdel-aziz *et al.*,

2010).Other studies done in Nigeria were consistent with the above findings as they found no significant association between gender and the occurrence of intestinal parasites (Iseki *et al.,* 1983; Houmsou *et al*., 2010). Taiwo and Agbolade (2000) maintained that both genders had an equal chance of contracting intestinal parasites. However, other studies were inconsistent with these results as they revealed a strong association between gender and the occurrence of intestinal parasites (Tadesse 2005; Tsehai *et al*., 1998). The difference in these results may be due to cultural factors for instance; school going girls in Ethiopia did not have a history of playing or swimming close to water sources which would increase their exposure to these parasites as boys.

In terms of age groups, cyst of *Entamoeba histolytica* and trophozoite of *Giardia lamblia* (25.7%) were more prevalent amongst children in 6 – 9 years age group. This is mainly attributed to the playful nature of this population with a lot of tendencies to even eat or mix soil with food and smear utensils with soil .Lack of sufficient drinking clean water that can be used to clean utensils and subsequently food compromises children health in this regard. These, coupled

With low level of education of parents, are issues that have witnessed high prevalence of such parasitic infections in the study site,

Results by Iseki *et al*. (1983) found out that *Entamoeba histolytica* had in the same age group was prevalent among 25.5% for children aged 6 and 9 years, 34.6% for children aged 10 and 13 years and 33.3% for children aged 14-18. That study further found that *Giardia lamblia* had lower prevalence rates; 10% for children aged (6-9 years and 8.2% for children aged 10-13 years) than the current study (25.7% for children aged 6-9 years and 15.4 % for children aged 10-13 years). The difference in the prevalence rates may be due to the different tests used in the studies and the geographical differences of the study areas.

5.1.2 Socio – cultural factors associated with parasitic infections

Lack of sanitation, poor water supply and unclean practices contribute to the spread of all intestinal helminths' infections in the community. In recognition of the burden helminthes infections impose on human populations, particularly the poor, major intervention programs have been launched to control them (Mwanga *et al*., 2015).

This study found that 32.1% respondents who were without latrines tested positive for intestinal parasites. This is an indication that children relief themselves anyhow and anywhere including within / near homesteads and the same compounds where they are expected to play in. This exposes them to dirt arising from the same and subsequently intestinal infestations. 35.1% of the respondents who had a pit latrine tested positive for intestinal parasites. All the respondents who reported to have a flush toilet tested negative for intestinal parasites. Fishers exact test couldn't reveal an association between ownership of toilet (P = 0.754), house type (P = 0.731), toilet type (P = 0.251) and the occurrence of intestinal parasites. This finding differ with that of another study which indicated a strong association between the burden of parasitic infections and poor sanitation (Ulukanligil & Adan, 2003).

Housing, especially the type, has been linked to paeasitic infections (Andrea *et al.*, 2012). It is in this regard that this study found 30% respondents who lived in permanent houses tested positive for intestinal parasites. However, majority of respondents (70%) who lived in permanent houses tested negative for the same. This type of housing depicts a population which is able (have resources) and subsequently can access treatment of parasitic infections whenever and wherever appropriate. Semi-permanent and temporary structures depict a picture of poverty, poor sanitation and lack of sufficient clean water. This finding concurs with that of another study that added that socio – cultural habits of communities in hard to reach areas are linked to occurrence of parasitic infections (Bekele *et al*., 2017).

Regarding, the respondents' level of education that 27.1% attended primary school while 26.5% of them never attended school hadn't attended any level of school though the finding show a majority with semi-literate levels the variable was not significantly associated with occurrence of intestinal parasites. However the findings differs with those from studies such as the one done in South Africa which revealed that the parents' level of education and employment status was significantly associated with occurrence of intestinal parasites among school going children (Nxasana *et al*., 2013).

Children's wearing shoes is another social issue which this study looked into. In this regard it found out that 5.8% didn't have shoes while the majority (94.2%) had shoes. However, this aspect was found not significantly associated with parasitic infections. Study in Nepal found a significant association between children wearing shoes and the occurrence of intestinal parasites with those who did not wear shoes having a high prevalence of intestinal parasites (46.5%) compared to those wore shoes at 16.2% (Sah, *et al*., 2013).). The difference in this study may be due to geographical differences, environmental factors, socio-economic conditions, cultural practices or society's awareness to intestinal parasites.

Another aspect that this study looked into was livestock keeping.This involves livestock keeping and pet as a way of life of the study community. Livestock keeping is the backbone of the Turkana community and the main means of livelihood (TCG, 2013 – 2017). Respondents were also asked of the pets they kept at home. Amongst those who reported having a cat in their household, slightly over a quarter (29.4%) of them tested positive for intestinal parasites with 24.0% of those who kept a dog in their households testing positive. About similar proportion (31.7%) of those who kept chicken in their households tested positive for intestinal parasites. According to Sergio *et al*. (2014) keeping pets and dogs poses great risks to human life as they are associated with zoonotic potentials. The same study shows that the prevalence of intestinal parasites in pet dogs and cats varies a great deal (12.5% - 34.4% for dogs and 10.1% - 22.8% for cats). In addition *Giardia duodenalis* was found to be the most common parasite with prevalence values varying from 1.3% to 24.78% (dogs) and from 0% to 20.3 (cats)

(Barutzki, & Schaper, 2011). Helminthic infections, hookworms, ascarids and whipworms were the most prevalent intestinal parasites in dogs as shown in other studies (Little et al., 2009; Katagiri & Oliveiva, 2008).

Housing status shows that many respondents live in temporary structures (31.7%) while 33.5% are in semi – permanent. The structures reflect the Turkana way of life who are largely pastoralists. The Turkana community is the second largest pastoralist community in Kenya after the Maasai. They, like the Samburu and Maasai, still maintain their undiluted way of life. The Turkana people live a nomadic life, always moving from one place to another depending on availability of pasture and water for their animals. Housing structures like the ones most common in Turkana especially the semi – permanat and temporary ones have been noted to house insects such as cockroaches, which a study Adenusi *et al.* (2018) has associated with transmission of intestinal parasites such as *Entamoeba histolytica* (44.1%), *E.coli* (37.8%) and *Giardia lamblia* (18.7%, among others. These parasites were found to be responsible for mainly hookworms. Another important aspect of such housing status is existence of dust, an environmental issue in it sense. Dust contaminate uncovered food and food utensils making a source of houseflies (Kagei, 1983).

Water, an essential resource for life, is a factor that studies have studied to ascertain its association with parasitic infections. Of essence is its source(s**).** This study found out that, 26.8% respondents who used borehole water tested positive for intestinal parasites while 22.7% respondents who utilized stream water tested positive for intestinal parasites. Of those respondents who used tap water, 35.8% of them tested positive for intestinal parasites with 27.3% of the respondents who used rain water tested positive for intestinal parasites. Almost half of the respondents (47.1%) who used open wells, tested positive for intestinal parasites while 46.2% of the respondents who used river water testing positive. All of the respondents (100%) who reported to be utilizing water from a dam tested negative for intestinal parasites. Since one of the cells had small values (less than 5), fishers exact test was performed to determine if there was an association between water source, type of pets kept and the occurrence of intestinal parasites. To

this effect, no significant association between these variables and the occurrence of intestinal parasites was observed. A study by CDC (2018) indicates that water becomes contaminated by parasites depending on its sources, a fact that can cause a variety of illness, disability and death. The main water related diseases caused by parasites include guinea worm. Schistosomiasis, amoebiasis and giardiasis (CDC, 2018).

This current study found no strong association between the source of water and the occurrence of intestinal parasites. These results are inconsistent with findings of a study in Ethiopia which found a strong association between sources of water (rivers and springs) and the occurrence of intestinal parasites ($P < 0.05$) (Firdu *et al*., 2014). The difference in results may be due to the sources of water in the study area in Ethiopia being infected with intestinal parasites.

5.1.3 Behavioral factors associated with parasitic infections

Issues relating to individual child habits and practices especially of the affected children within their immediate environment were considered as factors associated with intestinal parasitic infections. This study found that intestinal parasitic infections was prevalent amongst 34.8% of children in the study schools. Hand washing is a behavioral factor related to intestinal parasitic infections amongst such study population which, if not adhered to due to lack of water or poor hand washing practices, could expose them to parasitic infections. Hand washing habits before meals, open field defecation habit, consistency in wearing shoes, habit of eating raw and unwashed vegetables were found to be the most important predictor associated with high risk of parasitic infections ($P < 0.05$) (Sitotaw, Mekuriaw & Destaw, 2019).

This study found that 57.1% who did not wash their hands daily tested positive for intestinal parasites. This is an indication that access to water for daily cleaning hand washing was a problem to many children. Children aged less than 14 years play a lot within their immediate compound which is in most situations are dusty and at times in compounds with animal (livestock) wastes. According to Bethony *et al*. (2006) such child behavior influence the prevalence and intensity of helminthes infections especially the hookworm. Turkana region is largely a dry area that receive very limited rainfall. This study found that the main source of water to very few households include borehole, open wells and seasonal stream rives that are far apart accessed through terrains.

Children's wearing shoes is another social issue which this study looked into 38.9% tested positive for intestinal parasites amongst those who reported not wearing their shoes. In this regard it found out that 5.8% didn't have shoes while the majority (94.2%) had shoes. However, this aspect was found not significantly associated with parasitic infections. Study in Nepal found a significant association between children wearing shoes and the occurrence of intestinal parasites with those who did not wear shoes having a high prevalence of intestinal parasites (46.5%) compared to those wore shoes at 16.2% (Sah, *et al*., 2013). The difference in this study may be due to geographical differences, environmental factors, socio-economic conditions, cultural practices or society's awareness to intestinal parasites.

Waste disposal is also another key issue that this study assessed Respondents were asked about how they dispose any waste. It found that open dumping was used by 29.6% while 64.1% dumped their waste in a closed manner. Open dumping which include defecation are contaminants that can easily seep into the ground water as well as carried by rain water to water sources thus making water a source on intestinal parasites when consumed by human beings as study by Thomas *et al*., (2013 shows. This study further showed that 35.9% respondents who disposed waste through open dumping testing positive for intestinal parasites. 35.7% respondents who disposed waste through closed dumping tested positive for intestinal parasites while 27.3% who disposed of waste through burning tested positive for intestinal parasites.

On water treatment, this study found that majority of respondents (93.2%) noted that they were treating water in their households. Unlike 6.8% who were not. Water treatment is crucial to human health as it allows them not to consume contaminants and other undesirable components. According to Scott *et al*., (2012) water treatment using whichever method such as boiling, filtration and or chlorination could significantly reduce incidence of waterborne diseases and parasitic infections. Moreover, this study found that, 34.3% respondents who reported using treated water at the household level tested positive for intestinal parasites.

Controlling for waste disposal, wearing shoes and water treatment at household, the odds of getting intestinal parasites decrease by a factor of 0.097381 amongst those who practice daily hand washing compared to those who do not practice daily hand washing. In other words, those who practice daily hand washing are 91% less likely to suffer from intestinal parasitic infection compared to those who do not wash their hands daily. According to Jasti *et al*. (2007) infected children with intestinal parasitic infections are less active, often exhibiting sluggish behavior with both mental and physical activities appearing dull and slow.

5.2. Conclusions

- Given the high prevalence of intestinal parasitic infections as found out by this study among the school going children, this study conclude that helmithes infections is a public health concern in Turkana County.
- The current study has revealed that intestinal parasites are prevalent in differing magnitudes among school going children in Turkana County. *Entamoeba histolytica* and *Giardia lamblia* are intestinal parasites with a high prevalence in school going children in Turkana County.
- Children from poor environmental conditions and socio- cultural factors were more vulnerable to intestinal infections.
- Daily washing of the hands and location of schools are the main factors associated with occurrence of intestinal parasites.

5.3. Recommendations

- There is need for both the National and County governments to mount series of campaigns to rid all children of intestinal infections especially at the family level among the nomadic Turkana community whose environments and lifestyles are fertile grounds for helmithes.
- The Turkana County government should set resources (both financial and personnel) towards continuous support of deworming children and make it a

compulsory exercise to all households. The public health officers should give more attention to issues relating to intestinal parasites within the community.

- There is need for school going children with intestinal parasites to be treated periodically using multi drug combinations due to multiple parasitism susceptible to children
- County government should engage the public in the sensitization activities in an effort towards making them own, support and take up control measures at all levels at within the community. Health education on prevention and control of intestinal parasites should be taught in schools through local health workers and teachers who have undergone hygiene education training.
- Behavioral change campaigns, especially focused on hand washing should be scaled up in the county.
- There is an urgent need for both the national and Turkana County government to increase access to sanitation and water facilities, through construction of latrines and provision of hand pumps and water filters in primary schools, as one of the calculated ways of getting rid of intestinal parasites among children.

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APPENDICES

Appendix I: Informed Consent form (ICF) - English

Title: Epidemiology of intestinal parasites in school going children in Lodwar Municipality, Turkana County, Kenya

Principal Investigator: Benjamin. N. Lowoko

Co-investigator: Dr. Benjamin Ngugi, Dr. Albert Mala, Dr. Joseph Mutai

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Tel:254-67-52711/52181, 0710247332

www.jkuat.ac.ke, loben33@yahoo.com

INTRODUCTION

My name is Benjamin Lowoko and I am studying for a Masters Degree in Epidemiology at Jomo Kenyatta University of Agriculture and Technology (JKUAT). This information form seeks informed consent for you to participate in a research project that aims to understand the Epidemiology of intestinal parasites in school going children in Lodwar Municipality. Intestinal parasites cause various parasitic diseases with severe consequences' in human body. The most common intestinal worm infection is association with poor personal hygiene, poor sanitation, and in place of poor excretal disposal. Parasitic infection spreads through contaminated water, fruits, vegetables, poultry, fish or meat. People become infected with intestinal worms through contact with soil that has been contaminated with human faeces from an infected person. In the case of round worm or whip worm, people become infected when they ingest the worm eggs,

either by eating contaminated food like fruits and vegetables that have been washed with water which is contaminated. People become infected with hookworm when the larva burrows through the skin of bare feet.

The purpose of the study

In this study we intend to identify Epidemiology of intestinal parasites in school going children in Lodwar Municipality as well as identifying the factors that may be placing people at risk of contracting the intestinal parasites. This information will be used to estimate degree of infection of intestinal parasites, areas with high endemicity of intestinal parasites and the pattern of the intestinal parasites they are infected with, as these are important aspects in control programmes of the intestinal worms' infections.

Procedures involved - Consenting to parents or Guardians of the child

Your child has been selected for participation in this study because s/he is a school-going child within age ranging from is it 5-13 yrs and might be infected by intestinal parasite infections. Therefore taking part in this study will involve collecting faecal specimen from the child that will be used to test if they are infected with intestinal parasite infections. Stool specimen collection is a routine medical procedure, non-invasive and no experience of any pain. If you agree to participate in this research, we will ask you some questions and on your livestock related to the spread of the disease. The faecal specimen will be transported to Turkana County referral hospital laboratory in Lodwar for analysis and storage.

Participation

Please understand participation in this study is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty.

Confidentiality

A coded identification number will be assigned to each household and used only for the purpose of sample tracking. Privacy will be maintained in all published and written data resulting from the study.

Who to contact

If you have questions about participation in the study or you are dissatisfied at any time with any aspect of this study, you may contact the investigators on the contacts given above or The Secretary KEMRI ERC office. P.O Box 54840-00200, Nairobi Tel. 2722541 Ext. 3307.

……

Participant name

……

Signature/thumb print Date

……

Name of interviewer Signature Date

Appendix II: Informed Consent form - Kiswahili

TRANSLATION TO KISWAHILI

VIAMBATISHO

Kiambatisho cha II: Fomu ya Idhini baada ya kuisoma kwa umakinifu

Kichwa: Somo kuhusu tatizo la minyoo miongoni mwa watoto wa shule katika Manispaa ya Lodwar, Kaunti ya Turkana, Kenya.

Mtafiti mkuu: Benjamin N. Lowoko

Mtafiti mwenza: Dr. Benjamin Ngugi, Dr. Albert Mala, Dr. Joseph Mutai

S.L.P 62000-00200, Nairobi, Kenya

Simu:254-67-52711/52181, 0710247332

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Utangulizi

Jina langu ni Benjamin Lowoko na ninasomea shahada ya juu ya digrii katika elimu kuhusu mkrupuko wa magonjwa kwenye chuo kikuu cha kilimo na teknolojia cha Jomo Kenyatta (JKUAT). Fomu hii ya utafiti inatafuta idhini baada ya kuisoma kwa umakini ili kukuwezesha kushiriki katika mradi wa utafiti ambao lengo lake ni kufahamu athari za minyoo miongoni mwa watoto wa shule katika Manispaa ya Lodwar. Minyoo husababisha magonjwa mbali mbali yaliyo na athari mbaya kwa miili ya mwanadamu. Mara nyingi tatizo la minyoo hushirikishwa na afya duni ya kibinafsi, kuto-zingatiwa

kwa kanuni za afya, na hali ya kutupa kinyesi chako ki-holela. Maambukizi ya viini husambazwa kwa njia ya maji chafu. Matunda, mboga, ndege wa kufugwa, samaki na hata nyama. Watu huambukizwa minyoo kwa kushika udongo uliochafuliwa kwa kinyesi cha binadamu kutoka kwa mtu aliyeambukizwa. Kuhusiana na minyooo aina ya tegu watu huambukizwa wanapomeza mayai ya minyoo kupitia ulaji chakula kilicho na mayai hayo kama vile matunda na mboga zilizosafishwa kwa maji chafu. Kwa upande mwingine watu huambukizwa minyoo aina ya michango kwa njia ya viluwiluwi yaani lava za minyoo hao kupenya ngozi ya miguu ambayo haujakingwa kwa chochote.

Lengo la utafiti

Utafiti huu unalenga kubaini chanzo cha shida ya minyoo miongoni mwa watoto wa shule katika manispaa ya Lodwar na pia kutambua maswala ambayo huenda yanawaweka watu katika hatari ya kuambukizwa magonjwa ya minyoo. Habari hizi zitatumiwa kukadria kiwango cha maambukizi ya minyoo, kubaini maeneo ambako kuna hatari kubwa ya kusambaa kwa magonjwa ya minyoo na aina ya minyoo wanaopatikana kwa wingi katika maeneo hayo, kwani hizi ni habari muhimu kwa juhudi za kuangamiza minyoo.

Taratibu zinazohusika- kuwajulisha wazazi au walezi wa mtoto

Mtoto wako ameteuliwa kushiriki katika utafiti huu kwa sababu yeye ni mtoto wa shule kati ya umri wa miaka 5-13 na huenda ameambukizwa minyoo.

Hivyo basi kushiriki kwake katika utafiti huu kutahusisha kuchukuliwa kwa sampuli za kinyesi ambacho kitatumiwa kupima iwapo wameambukizwa minyoo. Ukusanyaji wa sampuli za kinyesi ni utaratibu wa kawaida wa kimatibabu, usiohitaji kuweka kifaa chochote tumboni na kamwe hausababishi uchungu wowote. Ukikubali kushiriki katika utafiti huu tutakuuliza maswali juu ya familia yako na pia mifugo kuhusiana na kusambaa kwa magonjwa ya minyoo. Sampuli za kinyesi zitapelekwa kwenye maabara ya hospitali ya rufaa ya kaunti ya Turkana mjini Lodwar kwa uchunguzi na kuhifadhiwa.

Kushiriki

Tafadhali elewa ya kwamba kushiriki kwako katika utafiti huu ni kwa hiari, na pia ni haki yako kubadili nia, ama kuacha kushiriki wakati wowote bila faini.

Siri

Kila nyumba itapewa nambari ya siri ambayo itatumiwa tu kwa ajili ya kufuatilia sampuli. Majina ya watu hayatatajwa hadharani kwenye takwimu zote zitakazoandikwa na kuchapishwa baada ya utafiti huu

Niwasiliane Na Nani

Ikiwa una swala juu ya kushiriki kwako katika utafiti huu ama utakosa kuridhika wakati wowote kuhusiana na jambo fulani juu ya utafiti huu, unaweza kuwasiliana na watafiti wetu kupitia nambari zilizotolewa hapo juu Au katibu afisi ya KEMRI ERC P.O BOX (**Sanduku la posta**) 54840-00200, Nairobi, Tel. (**Nambari ya simu**) 27223541 Ext.(**Mkondo wa**) 3307

……

Jina la anayeshiriki …….

Sahihi/alama ya kidole gumba Tarehe……..

Jina la mtafiti Sahihi Tarehe

Appendix III: Questionnaire – English

Name of respondent (optional) .....

Name of study child ……

Sub-county.....

Division.....

Location.....

Village.....

Section A: Socio demographic characteristics

1. What is the age of the child?

……..

2. What is the gender of the child? Tick

☐ Male ☐ Female

3. What is the parent's religion? Tick

☐ Christian ☐ Muslim ☐ Non-religious

4. What is the Education Level of parents? Tick

☐ No Education ☐ Primary Level ☐ Secondary Level ☐ Tertiary Level

5. What is the housing status? Tick

☐ Temporary ☐ Semi-Permanent ☐ Permanent

6. What is the parents' occupation? Tick (you may tick more than one)

☐ Farmer ☐ Business ☐ Pastoralists ☐ formal employee

☐ Other (specify).....

7.What is the parents' marital status? Tick

☐ Single ☐ Married ☐ Divorced

Section B: Child Diseases

8. What was the child suffering from? Tick (you may tick more than one)

☐ Diarrhoea ☐ Cough ☐ Pneumonia ☐ Malaria

☐ Healthy ☐ Other (specify).....

9. Does the child have history of intestinal parasites? Tick

☐ Yes ☐ No

Section C: Behavioral habits Tick (you may tick more than one)

10. Do you have any domestic animals/pets? ☐ Yes ☐ No

11. If Yes, which ones? Tick (you may tick more than one)

1. Cat
2. Dog
3. Chicken
4. Rabbit
5. Others, specify …….

12. Do you interact with domesticated animals ☐ Yes ☐ No

Section D: Environmental factors

13. What is your source of water? Tick (you may tick more than one)

☐ Borehole ☐ Stream ☐ Tap ☐ Rain water

☐ Open Well ☐ River ☐ Dam

14. Do you treat your drinking water? (Tick one) ☐ Yes ☐ No

If yes, how? (Tick)

☐ Boiling ☐ Filtering ☐ Chemical Additives ☐ Other

15. Do you have a toilet facility for use by your household members? Tick ☐ Yes ☐ No

16. What type of toilet facility do you have?

☐ Pit Latrine ☐ VIP latrine ☐ Flush Toilet ☐ Other (Specify)

(VIP - ventilated Improved Latrine)

17. How frequent do you wash your hands in a day? ☐

Specify no of times.....

18. Does the child wear shoes ☐ Yes ☐ No

19. How do you dispose your waste?

a) Open dump

b) Closed dump

c) Burning

d) At a central dump (Municipal)

e) Other Specify: .....

Appendix IV: Questionnaire – Kiswahili

TRANSLATION TO KISWAHILI

Kiambatisho cha IV: Masuala

Maelezo kuhusu jinsi ya kujaza

Jina ……

Kaunti-ndogo …….

Taarafa ……

Kata ……

Kijiji ……..

Sehemu ya A: Takwimu ya kima cha uzazi, vifo, maradhi n.k. katika jamii

1.Umri wa mtoto (weka alama)

Miaka 6-7 ☐ Miaka 8-9 ☐ Miaka10-11 ☐ Miaka 12-13 ☐

2. Jinsia ya mtoto (Weka alama)

☐ Mvulala ☐ Msichana

3. Dini ya mtoto (Weka alama)

☐ Mkristo ☐ Muislamu ☐ Hana dini

4. Kiwango cha elimu ya wazazi (Weka alama)

☐ Bila elimu ☐ Elimu ya msingi ☐ Elimu ya sekondari ☐ Elimu ya chuoni

5. Hali ya nyumba (weka alama)

☐ Ya muda ☐ sio ya kudumu sana ☐ ya kudumu

6. Ajira ya wazazi (weka alama) -unaweza kuweka zaidi ya alama moja

☐ Mkulima ☐ mfanyibiashara ☐ Mfugaji wa kuhama-hama ☐ Ajira ya kudumu

☐ Ajira nyingine (Eleza)……

7. Hali ya ndoa ya wazazi (weka alama)

☐ Mzazi mmoja ☐ Wazazi wawili ☐ Mtalaka

Sehemu ya B:… Magonjwa ya Watoto

8. Ugonjwa wa mtoto (weka alama)- unaweza kuweka zaidi ya alama moja

☐ Kuhara(Kuendesha) ☐ Kohozi ☐ Nimonia(Kichomi) ☐ Malaria

☐ Mwenye afya nzuri ☐ Nyingine (eleza)…….

9. Je mtoto ana historia ya shida ya minyoo ? (weka alama)

☐ Ndio ☐ La

Sehemu ya C: Mwenendo(Tabia) (weka alama)-unaweza kuweka zaidi ya alama moja

10: Una mifugo ama mnyama kipenzi nyumbani kwako ?

☐ Ndio ☐ La

1. Ikiwa jawabu ni Ndio ni Mnyama yupi ?weka alama (unaweza kuweka zaidi ya alama moja)

1. Paka

2. Mbwa

3. Kuku

4. sungura

5 Wengine (eleza)……..

12. Je unajishughulisha na wanyama kwa vyovyote ? ☐ Ndio ☐ La

Sehemu ya D: Maswala ya kimazingira

13. Kipi chanzo cha maji ?

☐ Kisima cha Borehole ☐ Kijito ☐ Mfereji ☐ Mvua

☐ Kisima cha wazi ☐ Mto ☐ Bwawa

14. wewe hutumia dawa ya kutibu maji ☐ Ndio ☐ La

Ikiwa Ndio kwa njia Ipi? (Weka alama)

☐ ya Kumchemsha ☐ ya Kuchunga ☐ ya kuweka kemikali ☐ Nyingine

15. Je familia yako ina choo? (Weka alama)

☐ Ndio ☐ La

16. Ni Choo ya aina ipi ?

☐ ya Shimo ☐ iliyoimartishwa kwa hewa safi (VIP) ☐ ya Maji ☐ Nyingine (eleza)

17. Wewe hunawa mikono mara ngapi kwa siku ?

Eleza ni mara ngani kwa siku…….

18. Mtoto wako huvaa viatu ? ☐ Ndio ☐ La

19. Taka zako hutupwa kwa njia ipi ?

a) Njia la wazi

b). Njia la kufungwa

c).Kwa kuchoma

d).Kwenye taka la manispaa

e).Kwa njiia nyingine (eleza)……