FACTORS ASSOCIATED WITH INTESTINAL PARASITIC INFECTIONS AMONG FOOD HANDLERS IN SELECTED EATERIES IN NAIROBI COUNTY, KENYA

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Factors Associated With Intestinal Parasitic Infections among Food Handlers in Selected Eateries in Nairobi 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.

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DEDICATION

This thesis is dedicated to my wonderful husband Ali Abdullahi Issack, my children Shamsa Ali, Salwa Ali, Nadhir Ali and Sabrin Ali whose endless love, care, support and encouragement made me get to this stage. Thank you for giving me a chance to prove and improve myself through all my walks of life. I love you all

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TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

APPENDICES

ACRONYMS AND ABREVIATIONS

CDs	Communicable Diseases
FH	Food handlers
HI	Hospitality industry
IPI	Intestinal Parasitic Infections
ITROMID	Institute of Tropical Medicine and Infectious diseases
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KEMRI	Kenya Medical Research Institute
MOH	Ministry of Health
NCC	Nairobi City County
SSA	Sub Saharan Africa
WHO	World Health Organization

DEFINITION OF TERMS

Eatery: A restaurant or other commercial establishment serving food

Food handler Employees who fall into the following categories as classified by the Department of Health in Food handlers. People employed directly in the production and preparation of foodstuffs, including those in the manufacturing, catering and retail industries. People undertaking maintenance or repairing equipment in food-handling areas, whether permanent staff or workers on contract, and visitors to food-handling areas.

High-risk groups: Although everyone is susceptible to foodborne illness, certain segments of the population are particularly at risk of contracting a foodborne illness. This includes young children, the elderly, pregnant women, the immune-compromised and travelers.

Professional food Handlers: These are individuals such as street food vendors, catering personnel and those working in the food processing industry. This is a critical group for food hygiene education in view of the large numbers of people they feed and the potential impact on food safety.

ABSTRACT

Intestinal parasitic infections are major public health problems of majorly among children contributed in part by the adults in developing countries. Food handlers play a critical role in the spread of disease globally. Food contamination may occur at any of the stages including; production, processing, distribution, and preparation. The risk of food contamination therefore depends largely on the health status of the food handlers, their personal hygiene, knowledge and practice of food hygiene. This cross-sectional study was nested within the KEMRI routine medical examination and certification of food handlers from various eateries and food industries in Nairobi Kenya between 2015 and 2016. Structured questionnaire was used to collect socio demographic data and associated risk factors. Stool samples were collected and examined for intestinal parasites using single Kato-Katz and single Sodium acetate-acetic acid-formalin (SAF) solution concentration methods. A total of 298 food handlers were enrolled in the study. The majority of study participants were males (58.4%), aged between 21 to 30 years (59.4%), had secondary level of education (41.6%), 46% were currently married, had between 1 to 3 children (74.6%) and used piped water for domestic purposes (68.1%). About 43 (14.4%) of food handlers were found to be positive for different intestinal parasites with the most abundant parasite of *Entameoba histolytica* 30 (69.8%) followed by *Iodamoeba butschlii* 7(16.3%), *Giardia lamblia* 4 (9.3%), *Endolimax nana* 1 (2.3%) and *Trichomonas hominis* 1 (2.3%). Consumption of borehole water (OR 2.2, 95% CI 1.2 to 4.1) and general personal hygienic characteristics such as hand washing before eating (OR 0.5, 95% CI 0.2 to 0.9), after using toilet (OR 0.1, 95% CI 0.02 to 0.5), cooking (OR 0.1, 95% CI 0.02 to 0.6) and wearing of protective gears (OR 1.7, 95% CI 1.1 to 6.4) were associated with intestinal parasitic infection. The present study revealed a high prevalence of intestinal parasite in asymptomatic (apparently healthy) food handlers working in various eateries and food industries in Nairobi Kenya and that water quality and personal hygiene contribute significantly to parasitic infection. Such infected food handlers can contaminate food, drinks and could serve as a source of infection to consumers via food chain.

CHAPTER ONE

INTRODUCTION

1.1 Background

Infections caused by intestinal parasites and protozoan are widespread causing significant problems in individuals and public health, particularly in developing countries, with a prevalence rate of 30-60% (Saab et al., 2004). In addition, Intestinal parasites are responsible for one of the major health problems with socio-economic effects in the world, especially in developed countries in tropical and sub-tropical areas (Wakid et al., 2009). Rural-to-urban migration rapidly increases the number of food eating places in towns and their environs. Some of these eating establishments' have poor sanitation and are overcrowded, facilitating disease transmission, especially through food handling (Paul et al., 2012).

Globally, due to intestinal parasitic infections, some 3.5 billion people are affected; 450 million are symptomatic and yearly more than 200,000 deaths are reported (Wakid et al., 2009). A study conducted in Riyadh, Saudi Arabia testing for parasitic infections amongst food handlers showed that 12.8% of the specimens tested positive for the parasites (Khalid et al., 2001). This shows how widespread the parasites are globally with no boundaries. A similar study conducted in the City of Makkah During Hajj Season investigating Intestinal Parasitic Infection among Food Handlers, Intestinal parasites were detected in 31.94% of the food handlers (Majed et al., 2009).

Reports indicates, food-handlers working in hotels, hostel mess and other catering services personal hygiene and sanitation conditions are the major potential sources of intestinal helminths and protozoa from many developed and developing countries all over the world (Takizawa et al., 2008; Nyarango et al., 2008; Zaglool et al., 2011; Aklilu et al., 2015). Intestinal parasites are transmitted either directly or indirectly through food, water or hands highlighting the importance of fecal-oral human-to-human transmission (Zaglool et al., 2011; Ramakrishnaiah et al., 2014; Addis, et al., 2015). Asymptomatic carriers in particular are a public health hazard, especially if they work as food handlers where they may become a source of intestinal parasitic infection to others (Khalid et al., 2001). The parasites are not easily detected when they get into the human body, hence can live in human body for long without being diagnosed. They are responsible for major health problems with socio-economic effects in the world and especially so in developing countries in tropical and sub-tropical areas (Babiker et al., 2011).

The helminths; *Taenia saginata, Hymenolepis nana, Ascaris lumbricoides, Strongyloides stercoralis, Trichuris trichiura, Enterobius vermicularis* and hookworms and the protozoans Giardia *lamblia* and *Entamoeba histolytica* are the major intestinal parasites leading to digestive disorders (Cheesbrough, 2009). According to WHO, 2013, every year, 45 000 deaths are directly attributable to hookworm infections, and another 43,00 to *Ascaris lumbricoides* (roundworm). *Entoameoba histolytica* which causes

amoebiasis, this is estimated to cause severe disease in 48 million people, killing 54 000 each year. Multiple infections with several different parasites (e.g., hookworms, roundworms and amoebae) are common, and their harmful effects are often aggravated by co-existent malnutrition or micronutrient deficiencies (WHO, 2016).

Various prevalence has been reported; In Ethiopia, 45.3% of food handlers were found to be positive for different intestinal parasites (Aklilu et al., 2015). In Sudan, 29.4% of food-handlers were harboring intestinal protozoa (Babiker et al., 2009). In Iran intestinal parasites were found in 15.5% food handlers (Sharif et al., 2015). None of the food-handlers were found positive for protozoan cysts and helminthic ova in Mangalore, India (Solanki et al., 2014). In Kenya, intestinal parasitic infections among food handlers ranging 5 to 23.7% have been reported (Onyango et al., 2009; Biwott et al., 2014). A study conducted in Abu Dhabi revealed that, among 42,022 people who were tested for intestinal parasites, 14,136 (33.64%) persons were positive for different pathogenic intestinal parasites. They were found to show ten species of helminths and protozoa with overall incidence of 23.91% and 14.96% respectively. *Ancylostoma duodenale* was prevalent among the helminth group, with an incidence of 13.80%. *E. histolytica* were highly prevalent among the protozoan group with an incidence of 8.88%. Seemingly, a study conducted in India indicated out of the 50 food handlers screened, 21 (41%) Were infected with intestinal parasites (Nada et al, 2011).

In Africa, particularly Sub-Saharan Africa a study carried out over a ten-year period between 1999 and 2009 reported a 30.2% - 55.6% prevalence of intestinal parasites among the vast majority of the people (Adamu et al., 2009). In Kenya, the presence of intestinal parasitic infections has been reported to cause close to 50,000 deaths annually (MoH, 2004) mainly due to the low standards of hygiene in the country, like any other developing country. The situation appears to be more aggravated in rapidly expanding areas especially in the urban centers such as Nairobi (Wabukala et al., 2000). For instance, a study done in Eldoret municipality indicated that there was a high prevalence of parasitic infections among food handlers (Biwott et al., 2014). The results indicated that there was presence of intestinal protozoans (*E. histolytica, E. coli, and G. lamblia),* which were the highest, followed by helminthes *(T. saginata, A. duodenal, A. lumbricoides, and H. nana).* A high prevalence was also recorded among food handlers working in butcheries, Supermarkets and slaughterhouses (Biwott et al., 2014).

Nairobi has one of the highest numbers of eateries (hotels, hostel mess and other catering services) in Kenya. Generally, food handlers comprising all those working in hotels, restaurants, butcheries, food production factories, slaughter house, institutional catering unit, supermarket and vegetable and fruit vendors. Majority of these food handlers across eateries in Nairobi have an agreement with Kenya Medical Research Institute for their medical examination and certification program. At the time of this study, well over 70,000 eateries had enrolled into this program. Unfortunately, data is skewed on the epidemiology of intestinal parasites among these eateries in the KEMRI

program. This study is among the now growing reports documenting prevalence and correlates of parasitic infections among food handlers in the capital city of Kenya.

1.2 Statement of the problem

Destipe the effort of WHO to eradicate intestinal parasitic infections, the infection continues to be most common tropical diseases in developing countries (WHO, 2008). In these countries, intestinal parasitic infections affect about one-third of the population yearly (Schlundt *et al*., 2004). Generally parasitic infections, are associated mainly with low socio-economic setting marked by poor hygiene, sanitation and environmental conditions (Paul et al., 2012; Gilbert et al., 2014). Intestinal parasitic infection has usually caused serious health conditions by making the body weak and undernourished, thereby increasing its vulnerability to viral, fungal and bacteria diseases as well as chemical and metal poisoning worldwide (WHO, 2008).

The spread of disease by food handlers is a common and persistent problem globally (Sharif et al., 2015). Food handlers with poor personal hygiene working in the food service settings can be infected by different enteropathogens (Takalkar et al., 2010), where they can cause fecal contamination of foods by their hands during food preparation, and which may be transmitted to the public (Sharif et al., 2015). Therefore, a proper screening procedure for food handlers is helpful in the prevention of probable morbidity and the protection of consumer health. Reports indicates, food-handlers working in hotels, hostel mess and other catering services personal hygiene and sanitation conditions are the major potential sources of intestinal helminths and protozoa

from many developed and developing countries all over the world (Aklilu et al., 2015). The risk of food contamination therefore depends largely on the health status of the food handlers, their personal hygiene, knowledge and practice of food hygiene. Unfortunately, data is lacking on the prevalence and foctors associated with intestinal parasites among these eateries in the KEMRI program.

1.3 Justification

The prevalence of intestinal parasites has been high in low and middle-income countries with demographic changes, increasing urbanization and increase in fast food eateries with poor hygiene among others. Most developing countries of Sub-Saharan Africa (SSA), including Kenya, are faced with a double burden of infectious diseases and the non-communicable disease pandemic. Studies have shown that the incidence of intestinal parasitic infections may approach 99% in developing countries (Bern et al., 2004).

Many foodborne illnesses caused by intestinal parasites are preventable by minimizing the risk factors. This strategy has been recognized as an essential preventive method to reduce the occurrence (Phiri et al., 2000). The identification of the prevalence and the major risk factors predisposing people to intestinal parasitic infection is valuable for effective primary preventive and control interventions. Findings from this study aimed at filling the gap in knowledge on the prevalence and correlates of intestinal parasitic infections among food handlers working in eateries within Nairobi county. The information was meant to guide training and health promotion programs for intestinal

parasitic infection prevention and control.

1.4 Research questions

1. What is the prevalence of intestinal parasitic infections among food handlers in selected eateries in Nairobi County?
2. What are the socio demographic and socio economic characteristics among food handlers in selected eateries in Nairobi County?
3. What is the level of knowledge and practices with regard to intestinal parasitic infections among food handlers in selected eateries in Nairobi County?
4. What are the factors associayed with intestinal parasitic infections among food handlers in selected eateries in Nairobi County?

1.5 Objectives

1.5.1 Broad Objective

To determine factors associated with intestinal parasitic infections among food handlers in selected eateries in Nairobi County

1.5.1. Specific Objectives

1. To determine the prevalence of intestinal parasitic infections among food handlers in selected eateries in Nairobi County
2. To determine the socio-demographic and socio-economic characteristics of food handlers in selected eateries in Nairobi County
3. To determine the level of knowledge and practices regarding intestinal parasitic infections among food handlers in selected eateries in Nairobi
4. To determine the factors associated with the intestinal parasitic infections among food handlers in selected eateries in Nairobi County

CHAPTER TWO

LITERATURE REVIEW

2.1 Disease burden

During the early 21st century, food borne diseases can be expected to increase, especially in the developing countries, because of environmental and demographic changes (Kaferstein et al., 1999). Growing urbanization and lifestyle changes lead people to dine away from home more often, contributing to the unregulated opening of eating establishments that often have inadequate hygiene conditions (Guidelines for the management and health surveillance of food handlers, 2011). Food contamination may occur at any point during production, processing, distribution, and preparation. The risk of food getting contaminated depends largely on the health status of the food handlers, their personal hygiene, knowledge and practice of food hygiene (Omemu et al., 2014).

2.2 Global burden

Intestinal parasites and protozoan infections are amongst the most common infections worldwide. It is estimated that some 3.5 billion people are affected, and that 450 million are ill as a result of these infections, the majority being children and 1.2 million deaths reported anually (WHO, 2008).

2.3 Intestinal Protozoal Infections

Intestinal protozoa of importance to man are *Entamoeba histolytica* and *Giardia duodenalis, Blastocystis hominis* and opportunistic protozoa such as *Cryptosporidium* sp. and *Isospora* sp. (Norhayati et al., 2003). Other protozoal intestinal infections have restricted distribution *(Balantidium coli)* or are widely distributed but not pathogenic *(Entamoeba coli, Dientamoeba jragilis, Trichomonas hominis)* (Norhayati et al., 2003). The *E. histolytica* affects about 10% of the world's population or 480 million people (WHO, 2002), however this infection can be as high as 25% in certain areas of underdeveloped tropical countries. About 36 million develop clinical amebiasis and about 40,000 die annually (Cheesbrough, 2009). The *G. duodenalis* is the most common intestinal protozoal infection and it is found throughout temperate and tropical regions (WHO, 2002; Cheesbrough, 2009). Their prevalence varies between 2%-5% in developed countries and 20%-30% in developing countries. In USA and UK, giardiasis is the most commonly reported intestinal parasitic infection of man (WHO, 2002; Cheesbrough, 2009). It is estimated that about 200 million infections occur each year in Africa, Asia and Latin America. Human cases of *Cryptosporidium* sp. have been reported in various parts of the world and the prevalence appears to be highest in the tropics (WHO, 2002; Cheesbrough, 2009). This infection has been reported in 13% of diarrhea in children in India and 7.3% in Thailand (Adamu et al., 2009).

2.4 Intestinal Helminthic Infections

Intestinal helminths of importance to man are *E. vermicularis* (pinworm), soil-transmitted helminths- *A. lumbricoides* (round worm), *T. trichiura* (whip worm), *N. americanus* and *A. duodenale* (hookworm) and *S. stercoralis* (threadworm) (WHO, 2002; Cheesbrough, 2009). The other intestinal nematodes *(Anisakis sp., Capillaria philippinensis)*, trematodes and cestodes are less widespread in man (WHO, 2002; Cheesbrough, 2009). Their distribution is limited to certain areas' in the world and the infections are usually confined to certain communities (WHO, 2002; Cheesbrough, 2009). It is estimated that 25% of the world population are infected by *A. lumbricoides* and this causes up to a million cases of disease annually; 500-600 million people worldwide are infected by *T. trichiuria* and about 500 million by hookworm (Norhayati et al., 2003; Solanki et al., 2014; Omemu et al., 2014). The distribution of S. *stercoralis* infection usually follows that of hookworm. It is estimated that 50-100 million of the world's population are infected by S. *stercoralis.* The worldwide infection by *Enterobius vermicularis* is about 200 million and it is the commonest helminthic infection in the United States (40 million) (Solanki et al., 2014). In contrast to soil transmitted helminthiasis, enterobiasis is prevalent in both developed and developing countries (WHO, 2002; Norhayati et al., 2003; Solanki et al., 2014). Intestinal helminthic infections are endemic and widely distributed throughout poor and socioeconomically deprived communities in the tropics and subtropics; where poverty, overcrowding, poor environmental sanitation and low level of education are more apparent problems.

2.4.1. Prevalence in Africa

Higher prevalence of intestinal parasites was reported in Abeokuta, Nigeria (97%) Ethiopia from Hawassa (63%), Mekele University Northern Ethiopia (49.4%), North west Ethiopia (29.1%), Khartoum (29.4%), Sudan (30.1%) (Addis, *et al.*, 2015).

2.4.2. Prevalence in Kenya

There are current studies indicating the general prevalence of intestinal parasitic infection in Kenya as a whole. However, few studies are available reporting prevalence in some specific Counties in Kenya. Examples; a study conducted by Nyarango et al., in 2008 in Kisii county revealed that the most prevalent intestinal parasites are protozoa: *Entamoeba histolytica, Giardia lamblia* and *Balantidium coli. Helminthes* includes: *Ascaris lumbricoides, Trichuristrichiura* and *hookworms.* Similarly, another study conducted in Eldoret by (Gilbert et al., 2014) indicated that there was presence of intestinal protozoans and helminthes among food handlers with protozoans being the majority, infecting 14.1% food handlers and consisting of *E. histolytica* (7.2%), *E. coli* (5.7%) and *G. lamblia* (1.2%). The overall prevalence of helminthes was 6.6% in the order of *T. saginata* (2.4%), *A. duodenale* (2.1%), *A. lumbricoides* (1.5%), and *H. nana* (0.6%).

2.5 Public Health Significance of Intestinal Parasitic Infections

The amount of harm caused by intestinal parasites to the health of communities depends on several factors such as species, prevalence and/or intensity of infection, the interaction between the parasites and concurrent infections, the nutritional and immunological status of the population and numerous socio-economic factors (Norhayati et al., 2003; Adamu et al., 2009). Their significance is extremely difficult to assess because most of these infections are asymptomatic with very low morbidity and mortality. Therefore, the public health significance is always measured by the prevalence, intensity of the infection and association of these infections with human nutrition, growth and development of children and work productivity in adults.

The impact of intestinal parasitic infections on nutrition, growth and development of children has been studied since the seventies. The findings however, have remained controversial. Evidence from community studies indicate that ascariasis is associated with growth impairment, impaired lactose digestion, decreased food consumption and lower plasma vitamin AGI (Norhayati et al., 2003; Adamu et al., 2009). The role of hookworm infection in causing iron deficiency anemia has been confirmed by several studies (Adamu et al., 2009). Chronic giardiasis can interfere with the growth of children by impaired nutrient digestion (fat and vitamin) and lactose intolerance. Recently, it has been shown that trichuriasis and ascariasis impair school performance and cognitive functions of children (Adamu et al., 2009).

2.6 Prevention and control

The most effective control program of intestinal parasitic infections is an integrated approach with community participation. The long-term objective is to reduce the prevalence, intensity of infection and severity of intestinal parasitic infections to levels at which they cease to be of public health significance (Norhayati et al., 2003). Theoretically, the infections can be controlled and prevented by improvement in environmental sanitation such as safe methods of faeces and waste disposal and provision of safe water supplies and health education on health promotion of personal and food hygiene (CDC, 2003). Such measures are usually slow to take effect, require considerable investment and need to be accompanied by social, economic and educational, development (CDC, 2003). Recently the availability of single-dose broad-spectrum anthelminthics has helped in reducing the worm burden in endemic communities. Studies have shown that periodic chemotherapy strategy has successfully lowered the intensity of *Ascaris* and hookworm infections (Adamu et al., 2009; Zouré et al., 2011).

In Kenya efforts made towards the control of soil transmitted helminths intestinal parasitic infections are minimal compared to other health activities. There is no national policy for the prevention and control of these infections. Instead their control is integrated in the National Environmental Sanitation Program. The objectives of this program are to educate and to increase public awareness on personal hygiene and environmental sanitation and to give antihelminthic treatment to children. The

effectiveness of this program in controlling soil transmitted helminths and other intestinal parasitic infections is still questionable.

2.7 Clinical Significance of Intestinal Parasitic Infections

Although the prevalence of intestinal parasitic infections is high, the morbidity and mortality caused by these infections is very low. They are usually considered an unimportant problem. Besides that, the statistics for hospital admissions due to intestinal parasitic infections are also scarce although the WHO estimates suggest that there may be some 3.5 million cases admitted annually with clinical disease associated with nematode infections (Norhayati et al., 2003; Solanki et al., 2014). Intestinal parasitic infections associated with clinical disease are well documented. Ascariasis can result in often-fatal intestinal obstruction; hookworm infection can cause iron deficiency anemia; trichuriasis is associated with chronic dysentery and rectal prolapse (Norhayati et al., 2003; Solanki et al., 2014). Amebiasis can result in dysentery and extraintestinal complications; giardiasis is associated with acute diarrhea, steatorrhea and lactose intolerance. *Cryptosporidium paroum* and *Blastocystis hominis* have been documented as the commonest opportunistic parasites causing severe enteritis and chronic diarrhea in immunocompromised people (Norhayati et al., 2003; Solanki et al., 2014). *Cryptosporidium paroum* has also been increasingly recognised as a cause of diarrheal illness in both immunocompetent and immunocompromised people (Norhayati et al., 2003). Ascariasis was the cause of intestinal obstruction in 5-35% of all paediatric cases in a comparison of studies conducted throughout the tropics. Rectal prolapse due to

trichuriasis occurred in nearly 4% of children studied in the West Indies (Omemu et al., 2014).

2.8 Determinants of intestinal parasitic infection

By increasing standards of health and controlling the carriers or intermediate hosts, most industrialized countries have successfully decreased the rates of infestation. In developing countries, however, geographic and socioeconomic factors as well as unpredictable factors such as natural disasters contribute to the problem. These countries are mainly located in warm or hot and relatively humid areas that, combined with poverty, malnutrition, high population density, unavailability of potable water and low health status, provide optimum conditions for the growth and transmission of intestinal parasites. Insufficient research into infectious and parasitic diseases, lack of attention in developing countries to the problem and lack of follow-up treatment are also barriers to decreasing the rates of parasitic infestation (Speich *et al.*, 2016). Despite all the medical and pharmaceutical advances and developments in sanitary engineering, intestinal parasitic infections remain among the most common infectious diseases worldwide, particularly in developing countries, where inadequate water treatment, poor sanitation and lack of adequate health services are common (Speich et al., 2016). Additionally, it is more difficult to implement enteric parasite-control actions in these regions due to the high cost of improvements in infrastructure, and the lack of educational projects offered to the population (Speich et al., 2016).

Water is essential to life, but is also a major vehicle for pathogen dissemination. The potential for waterborne parasite transmission is high since infective helminth eggs and protozoa (oo)cysts are distributed through water in the environment. Pathogens like *Giardia lambia* and *Cryptosporidium spp.* are recognized as important waterborne disease pathogens and are associated with severe gastrointestinal illness. *Amoebiasis, balantidiosis, cyclosporidiosis* and *microsporidiosis* outbreaks have been reported throughout the world (Baldursson and Karanis, 2011; Kumar et al., 2014). It is well documented that conventional water and sewage treatment process are not completely effective in destroying protozoa (oo)cysts and helminth eggs (Savioli et al., 2006; Hatam-Nahavandi et al., 2015). Improper disposal of human and animal waste has also been identified as a source of infection, contaminating water sources (Smith et al., 2007) and recreational waters such as swimming pools, water parks and lakes (Savioli et al., 2006). Occasionally, sewer overflows also contribute to contamination of surface water and agricultural lands, which leads to potential human infection. Food contamination is also important and can occur directly in the handling process (contaminated equipment, infected food handlers or wash water), or indirectly through contaminated irrigation water (Dawson, 2005).

The lack of sanitary conditions to which the population is exposed favours the acquisition of various pathogens, and patients are often multiply infected (polyparasitized). Recently, a systematic review and meta-analysis showed that sanitation facilities and water treatment are associated with lower risks of infection with

intestinal protozoa, and could also prevent diarrhoeal diseases (Speich et al., 2016). The same relationships were observed by (Strunz et al., 2014) for soil-transmitted helminths.

CHAPTER THREE

MATERIAL AND METHODS

3.1 Study area

Nairobi county is bordered by three other major counties namely: Kajiado, Machakos and Kiambu Counties. The county is divided into eight sub counties, namely; Dagoretti, Kibera, Central, Westland, Makadara, Pumwani, Kasarani and Embakasi. The population of county is among those in Kenya consistently on the rise from below 120,000 people in 1948 to about 3.2 million people in 2009. The current population density is estimated at 3,079 people per square kilometer with the average household size was 5.2 and the mean monthly income per household was 7200 Ksh (about 72 USD) (The World Factbook. Cia.gov.). Seventy-five percent of the population had access to piped potable water while the remaining 25% used wells, springs and other sources (The World Factbook. Cia.gov).

Nairobi has one of the highest numbers of eateries (hotels, hostel mess and other catering services) in Kenya. Most of food handlers from these eateries have an agreement with Kenya Medical Research Institute for their medical examination and certification program. At the time of this study, well over 70,000 eateries had enrolled into this program. Unfortunately, data is skewed on the epidemiology of intestinal parasites among these eateries in the KEMRI program. This study is among the now growing reports documenting prevalence and correlates of parasitic infections among food handlers in the capital city of Kenya.

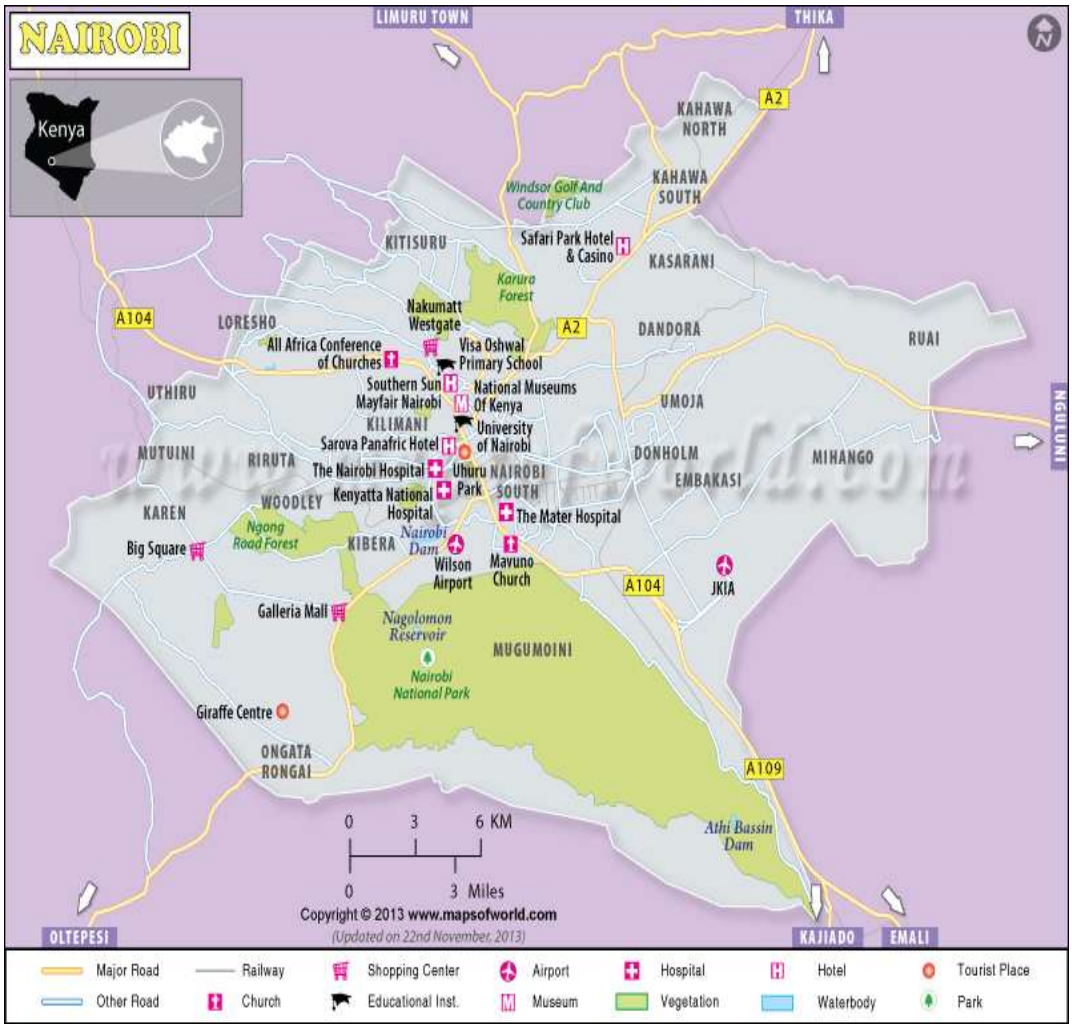

Figure 3.1: Location of some of the major hotels and eateries in Nairobi

(sources: Google map available (https://www.google.com/search?q=map+of+Nairobi+hotels&hl=en&site=webhp&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwjv4Yr3m73TAhWK2hoKHQBHCZUQsAQIRw&biw=1366&b)

3.2 Study design and Settings

This was a descriptive cross-sectional study conducted between December 2015 - January 2017 and used both quantitative and qualitative approaches to gather information to answer the objectives. This design is a research tool used to capture information based on data gathered for a specific point in time. The data gathered is from a pool of participants with varied characteristics and demographics known as variables. The research findings in this design help remove assumptions and replace them with actual data on the specific variables studied during the time period accounted for in the cross-sectional study. The justification for this design includes: that it is used to prove and/or disprove assumptions. The design in not costly to perform and does not require a lot of time. It captures a specific point in time. It contains multiple variables at the time of the data snapshot. The data can be used for various types of research. Many findings and outcomes can be analyzed to create new theories/studies or in-depth research

3.3 Study population

This study recruited all persons employed and working as food handlers in selected eateries in Nairobi County. The study was nested within an existing program in KEMRI that involved regular (6 monthly) examination and certification of food handlers in Nairobi Kenya. The program involved collection of specimens (blood, stool and urine) from food handlers working within hotels/food industries in Nairobi for mandatory medical examination and certification.

3.4 Sample Size determination

The formula by Lwanga, 1991 was used to calculate the minimum sample size required to achieve a 95% power as shown below.

$$n = \left(\frac{z}{m}\right)^2 p(1-p)$$

Where,

- z is the critical value based on the desired confidence level (e.g., z = 1.96 for 95% confidence level);
- m is the margin of error or precision of the estimate in this case m=0.05.
- p is the estimated value of the prevalence (24%) of intestinal parasitic infection among food handlers in Eldoret, Kenya (Biwott *et al.*, 2014).

Substituting in the formula yielded:

$$\mathrm{n} = \frac{1.96^2 \times 0.24(1-0.24)}{0.05^2}$$

n = 281 consenting food handlers

To account for non-response rate, 6% was added to the total sample size giving a total of 298 consenting food handlers.

3.5 Inclusion criteria

The study consent and enrolled those that were:

1. Adults aged 18 years and above
2. Working in a food eatery in Nairobi
3. Attending KEMRI food handler's examination and certification program
4. Willing to participate by providing a written consent to participate
5. Able to give stool sample and undergo a 30 minutes face to face interview

3.5.1. Exclusion criteria

Participants were excluded if:

1. Aged below 18 years
2. Working in a food eatery outside Nairobi
3. Nonattendance to KEMRI food handler's examination and certification program
4. Unwilling to participate by providing a written consent to participate
5. Unable to give stool sample and undergo a 30 minutes face to face interview

3.6 Sampling procedure

All eateries that had employed workers (whether on temporary or permanent basis) who handle food and covered by the medical examination and certification program in KEMRI constituted the sampling frame which consists of 65,536 eateries. About 10% of the eateries were randomly selected by computer generated random numbers. The individual workers/participants were then randomly selected using computer generated random numbers until the desired sample size was attained.

3.7 Data collection

3.7.1. Structured face to face interviews

Three well trained persons collected the data through structured questionnaires to obtain information regarding age, sex, residence, family size, and occupation.

Further, an in-depth interview was conducted to collect qualitative data. The study interviewed key informants from a pool of managers, supervisors and the team leaders after gaining consent. Summary notes were taken and tape recording done for data collection.

3.7.2. Stool samples

Stool specimens (about 5g) were collected from all study participants in a tight lead plastic container. A portion of the stool were preserved in 10% formalin in a proportion of 5g of stool in 3 ml of formalin or in PVA (polyvinyl- alcohol) where one volume of the stool specimen was added to three volumes of the preservative for future laboratory analysis. The stool specimens were transported in cool box immediately to the Center for Microbiology Research (CMR) – KEMRI for laboratory analysis.

3.7.3. Laboratory analysis

The specimens were examined microscopically for the presence of eggs, trophozoites and cysts. All stool specimens were examined by direct saline thin smear and formal-ether concentration methods and the findings were recorded using pre-prepared formats. Direct saline thin smear was chosen because of its cost, simplicity, and reliability.

3.7.3.1 Direct saline thin smear microscopy

Direct stool examination was done as follows; briefly, two wet preparations of fresh stool from the same food-handler were made as follows: a drop of fresh normal saline was placed on one end of a microscopic glass slide and a drop of Lugol's iodine on the other end. The proper amount of stool specimen (0.25 mg) was picked with an applicator stick and emulsified with the formal saline on one end of a glass slide; a same-size stool sample was treated in the same way with the Lugol's iodine on the opposite end of the same slide. The two preparations were then covered with glass cover slips (22 mm×22 mm) and examined under an ordinary light microscope for the presence of any parasites. The different intestinal parasites species identified were recorded with respect to type of eatery, gender, age, and educational level (Paul *et al.*, 2012).

3.7.3.2 Formal ether concentration technique

The concentration technique was carried-out using 3g of fresh stool sample emulsified in 7 mL of formal saline. The resulting suspension was filtered through three layers of wet cotton gauze in a funnel into a centrifuge tube and 3 mL of diethyl ether added. The centrifuge tube was corked, shaken vigorously and then centrifuged at 1000 *g* to 2500 *g* for 3-5 min. The plug was dislodged with an applicator stick and the supernatant poured off. Two wet preparations were made out of the deposit after slight shaking, and covered using a glass cover slip (22 mm×22 mm) and examined for the presence of parasites, type of parasites and intensity (Paul *et al.,* 2012).

3.8 Ethical consideration

The research protocol was presented for scientific and ethical approvals by the Kenyatta National Hospital and University of Nairobi (KNH & UoN) Ethical Review Committee prior to commencement of field activities (P540/08/2015). Written informed consent was obtained from each participant. Confidentiality was maintained by assigning all participants with a unique identification number. All data were stored in a restricted-access room at the research station.

3.9 Statistical analyses

Proportions were used to describe categorical variables. Chi-square or Fisher's exact test were used to test for significance where applicable. The overall prevalence of intestinal parasitic infection was determined for all participants. In bivariate analyses, odds ratios (OR) and 95% confidence intervals (CI) for the association between intestinal parasitic

infection and socio-demographic, and knowledge and practices characteristics were calculated using Poisson regression. In multivariate analyses, a manual backward elimination approach was utilized to reach the most parsimonious model, including factors that were independently associated with intestinal parasitic infection at the significance level of $p \leq 0.05$. All statistical analyses were performed using STATA version 13 (StataCorp LP, Texas, USA).

The qualitative data (KII) were subjected to a thematic content analysis. This approach entails the categorization of recurrent data collected under thematic areas (Green & Thorogood, 2010). The analysis was done manually using general purpose software tools using Microsoft Word (La Pelle, 2004).

CHAPTER FOUR

RESULTS

4.1 Demographic characteristics of the study participants

A total of 298 participants working in the hospitality industry visiting KEMRI for medical examination met the inclusion criteria and were recruited into this cross-sectional study.

4.1.1. Distribution of participants with regard to facility

The participants were drawn from 6 different regions. Hotel I contributed 41 (13.8%) participants while hotel II contributing 55(18.5%) participants. Others included 45 (15.1%) hotel III, 54(18.1%) hotel IV while hotel VI had the most contribution of 68 (22.8%) (Table 4.1). There was significant difference in the contribution of study participants with regard to the hotels they serve ($\chi 2 = 14$; df = 5; P = 0.001) (Table 4.1).

4.1.2. Distribution of participants with regard to gender

There were 174 (58.4%) males versus 124(41.6%) females, consequently there were significantly more males enrolled compared to women ($\chi 2 = 8.389$ df = 1; P = 0.001) (Table 4.1).

4.1.3. Distribution of participants with regard to age

The mean age of the participants was 29.14 (SD 7.07) years with median of 28 years (range 24 to 35 years). The majority, 177 (59.4%) participants were aged between 21 to 30 years while the least 20 (6.7%) were aged between 15 to 20. There was significantly difference in the distribution of study participants with regards to age ($\chi 2 = 278.03$; df = 3; P = 0.001) (Table 4.1).

4.1.4. Distribution of participants with regard to education level

The majority 124 (41.6%) of the participants had secondary level of education, with 116(38.9%) having tertiary level of education while the least 19(6.4%) reported not attended any formal education (Table 4.1). There was significantly difference in the distribution of study participants with regards to educational level ($\chi 2 = 114.268$; df = 3; P = 0.001).

4.1.5. Distribution of participants with regard to marital status

The majority 137 (46%) of the study participants were currently married with 19 (6.4%) divorced while 7(2.3%) currently seprated. There was significantly difference in the distribution of study participants with regards to marital status ($\chi 2 = 204.067$; df = 3; P = 0.001).

4.1.6. Distribution of participants with ragards to household population size

The mean number of the participant's household population was 1.78 (SD 1.262) persons with median of 5 (range 0 to 12 persons). The majority 223 (74.6%) of the participants were from household with 1 to 3 occupants while 43 (14.4%) had no children. There was significantly difference in the distribution of study participants with regards to household population ($\chi 2 = 114.268$; df = 3; P = 0.001).

Table 4.1: Demographic characteristics of the study participants

Variable	Unit	Number	Percentage	c2	df	P value
	Hotel I	41	13.8			
	Hotel II	55	18.5			
Hotel	Hotel III	45	15.1	14	5	0.001
	Hotel IV	54	18.1			
	Hotel V	35	11.7			
	Hotel VI	68	22.8			
	Male	174	58.4			
Gender	Female	124	41.6	8.389	1	0.001
	Mean (± SD)	29.14(7.07)				
	Median (IQR)	28(24-34)				
Age	Range	38(17-55)				
(Years)	15-20	20	6.7			
	21-30	177	59.4	219	3	0.001
	31-40	80	26.8			
	>41	21	7			
	Primary	39	13.1			
Education level	Secondary	124	41.6	114.268	3	0.001
	Tertiary	116	38.9			
	Non-Formal	19	6.4			
	Single	135	45.3			
	Married	137	46			
Marrital status	Divorced	19	6.4	204.067	3	0.001
	Separated	7	2.3			
	Mean (± SD)	1.78(1.262)				
Number of children	Median (IQR)	2(1-3)				
(Persons)	Range	5(0-5)				
	1-3	223	74.8			
	>4	32	10.7	114.268	2	0.001
	None	43	14.4			

IQR- Interquartile range; SD - Standard deviation; c2-chi square; df-degrees of freedom; P-Level of significance; $P \leq 0.05$ indicates the relationship is significant

4.2 Socio-economic characteristics of the study participants

4.2.1. Distribution of participants with ragards to monthly income

There were near equal peaks on the participant's montly income; about 84(28.2%) of the participants earned between Ksh 5001 to 10,000 for their monthly income compared to 71(23.8%) who earned between Ksh 10,001 to 15,000 per income. The least paid participant 30(10.1%) earned Ksh <5000 per month. There was significantly difference

in the distribution of study participants with regards to monthly income ($\chi 2 = 29.617$; df = 4; (P = 0.001) (Table 4.2).

4.2.2. Distribution of participants with ragards to housing type

The majority 230(77.2%) of the participants resided in rental houses while some 38(12.8%) owning their own houses they resided in. There was significantly difference in the distribution of study participants with regards to housing type ($\chi 2 = 258.148$; df = 2; P = 0.001) (Table 4.2).

4.2.3. Distribution of participants with ragards to household water source

The majority 203(68.1%) of the participant resided in houses with pipped water, while 66(22.1%) sourced water from boreholes. Only 29(9.7%) harvested rain water for their domestic use. There was significantly difference in the distribution of study participants with regards to household water source ($\chi 2 = 169.174$; df = 2; P = 0.001) (Table 4.2).

4.2.4. Distribution of participants with ragards to source of cooking energy

The majority 147(49.3%) of the participant used gas as a cooking source followed by 126(42.3%) who use kerosene while 13(4.4%) used firewood for cooking. There was significantly difference in the distribution of study participants in terms of their energy for cooking ($\chi 2 = 209.356$; df = 3; P = 0.001) (Table 4.2).

4.2.5. Distribution of participants with ragards to source of household lighting

The majority 202(67.8%) of the participant used electricity as their lighting energy source. Other 77(25.8%) used kerosene while 19(6.4%) used solar lighting source. There was significantly difference in the distribution of study participants with regards to household lighting energy source ($\chi 2 = 176.101$; df = 2; P = 0.001) (Table 4.2).

Table 4.2: Socio-economic characteristics of the study participants

Variable	Unit	Number	Percentage	c2	df	P value
Family Monthly Income (USD)	<5000	30	10.1	29.617	4	0.001
	5001-10000	84	28.2			
	10001-15000	71	23.8			
	15001-20000	65	21.8			
	>20001	48	16.1			
Housing	Self owned	38	12.8	258.148	2	0.001
	Rental	230	77.2			
	Other	30	10.1			
Household water source	Bore hole	66	22.1	169.174	2	0.001
	Rain	29	9.7			
	Pipped	203	68.1			
Source cooking energy	Firewood	12	4	209.356	3	0.001
	Kerosene	126	42.3			
	Gas	147	49.3			
	Others	13	4.4			
Source of energy for lighting	Kerosene	77	25.8	176.101	2	0.001
	Solar	19	6.4			
	Electricity	202	67.8			

c2-chi square; df-degrees of freedom; P-Level of significance; $P \leq 0.05$ indicates the relationship is significant

4.3 Knowledge of participants with regard to intestinal parasite

4.3.1. Knowledge of Intestinal Parasites

Majority 275(92.3%) of the participants were aware/knowledgeable about the intestinal parasite compared 23(7.7%) who were not aware of the intestinal parasites (Table 4.3). There was significantly difference in the distribution of study participants with regards to their knowledge of intestinal parasitic infections ($\chi 2 = 492.289$; df = 3; P = 0.001).

4.3.2. Infection with intestinal parasites

When asked if they had ever been infected with any intestinal parasites, majority 226(75.8%) admitted having been infected compared to 72(24.2%) who stated on the contrary (Table 4.3). There was significant difference in the distribution of study participants with regards to previous intestinal parasitic infections ($\chi 2 = 79.554$; df = 1; P = 0.001).

4.3.3. Importance of hand washing before eating

From table 4.3, the majority 225(75.5%) of study participants strongly agreed that washing hands before eating food was very important. This was followed by 58(19.5%) who agreed on the importance of hand washing while only 2(0.7%) were not aware on the importance of hand washing before eating. There was significant difference in the distribution of study participants with regards to their knowledge on importance of hand washing before eating ($\chi 2 = 62.067$; df = 1; P = 0.001).

4.3.4. Need for and frequency of medical examination

Surprisingly, about 209(70.1%) of the study participants were not aware on the purpose for the medical examination that were undergoing in the hospitality industries compared to 89(29.9%). There was significant difference in the distribution of study participants with regards to knowledge on need for medical examination ($\chi 2 = 48.322$; df = 1; P = 0.001) (Table 4.3).

About 166(55.7%) of the participants were aware on the frequency these medical examinations yearly compared to 132(44.3%) who were not aware. There was significant difference in the distribution of study participants with regards to knowledge on frequency of medical examination ($\chi 2 = 3.879$; df = 1; P = 0.049) (Table 4.3).

4.3.5. Awareness on the legal consequences for the lack of medical examination

About 172(57.7%) of the participants were aware of the legal consequences for not taking the regular medical examinations in the hospitality industries compared to 126(42.3%) who were not aware. There was significant difference in the distribution of study participants with regards to knowledge on the legal consequences for the lack of medical examination ($\chi 2 = 7.101$; df = 1; P = 0.001).

4.3.6. Specific work stations requiring medical examination

The majority 208 (69.8%) were not aware of spefic work station requiring medical certification compared to 90 (30.2%) who knew specific work stations requiring the regular medical examination. There was significant difference in the distribution of study participants with regards to knowledge on the specific work stations requiring medical examination ($\chi 2 = 46.725$; df = 1; P = 0.001).

When asked on the work section requiring medical examination; the majority 189(63.4%) stated that all workers in all section of hospitality industry require medical examination. Others included 33(11.1%) stated Kitchen only, 30(10.1%) stated those in drinks and beverage section only, while 21(7%) stated only waiters and service section require these medical examinations. There was significant difference in the distribution of study participants with regards to list of specific work stations requiring medical examination ($\chi 2 = 352.604$; df = 4; P = 0.001).

Table 4.3: Participants knowledge related with intestinal parasites

Variable	Unit	Number	Percentage	c2	df	P value
	KNOWLEDGE					
	Yes	23	7.7			
Know intestinal parasite	No	275	92.3	213.101	1	0.001
Ever been infected	Yes	226	75.8			
with intestinal parasites?	No	72	24.2	79.584	1	0.001
	Bacteria	84	28.2			
	Amoeba	114	38.3			
Types of intestinal parasites	Virus	13	4.4	188.564	5	0.001
	Eschirichia coli	8	2.7			
	Diarrhoea	20	6.7			
	Other	59	19.8			
	Strongly agree	225	75.5			
Washing hands before eating	Agree	58	19.5	62.067	2	0.001
very important	Disagree	15	5.1			
	Yes	89	29.9			
Know need for medical certificate	No	209	70.1	48.322	1	0.001
Know the Frequency	Yes	166	55.7			
of medical examinations	No	132	44.3	3.879	1	0.049
Aware of legal consequence	Yes	172	57.7			
for lack of medical examinations	No	126	42.3	7.101	1	0.008
Know specific work section	Yes	90	30.2			
Requiring Medical Certificate	No	208	69.8	46.725	1	0.001
	All sections	189	63.4			
Specify Work Station requiring	Waiter and serving sections	21	7			
Medical Certificate	Kitchen	33	11.1	352.604	4	0.001
	Drinks and beverages	30	10.1			
	Others	25	8.4			

c2-chi square; df-degrees of freedom; P-Level of significance; $P \leq 0.05$ indicates the relationship is significant

4.3.7. Symptoms associated with intestinal parasites

From the survey, when asked to list the signs and symptoms associated with intestinal parasite infection, majority 136 (45.6%) stated diarrhea followed by 79(26.5%) stating stomach ache. Others included 12(4%) presence of blood in stool, 8(2.7%) headache, 4(1.3%) fever, while 46(15.4%) did not know (Figure 4.1). There was a significant

difference in the frequency of study participants based on the knowledge of the types of intestinal parasite ($\chi 2 = 492.289$; df = 3; P = 0.001).

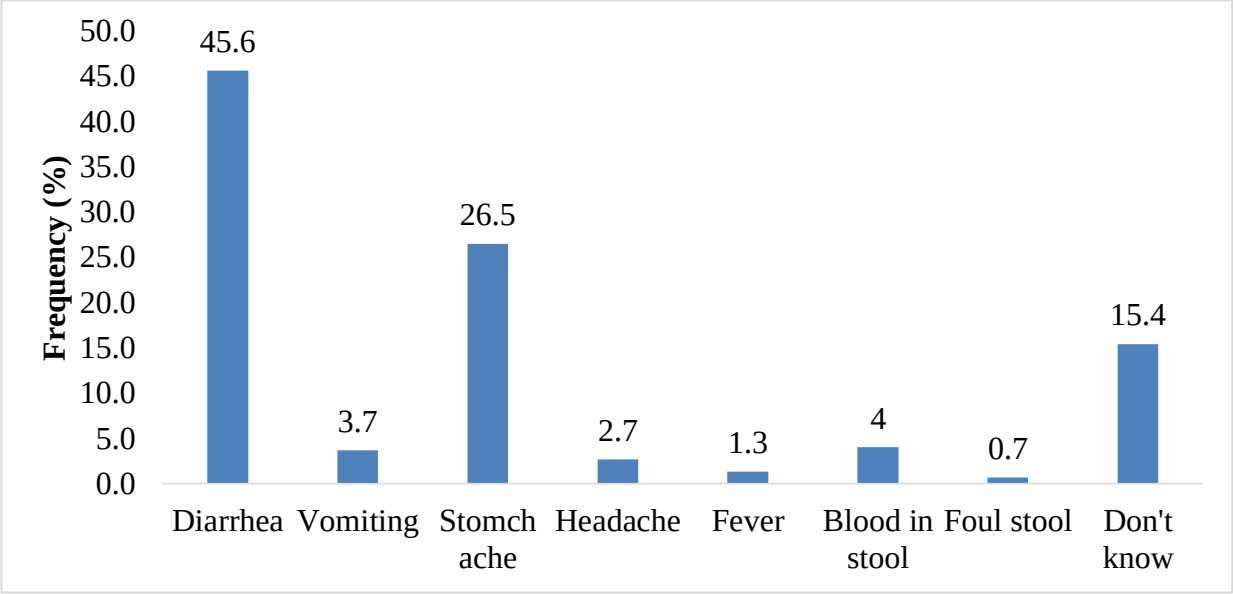

Figure 4.1: Signs and symptoms associated with intestinal parasites

4.3.8. Infecting intestinal parasites

Among those ever infected, the majority 114(38.3%) was due to amoeba, followed by 84(28.2%) due to bacterial, 20(6.7%) diarrhea, 13(4.4%) viral and 8(2.7%) stated *E. coli* (Figure 4.2). There was a significant difference in the frequency of study participants based on the infecting intestinal parasite ($\chi 2 = 266.226$; df = 4; P = 0.001).

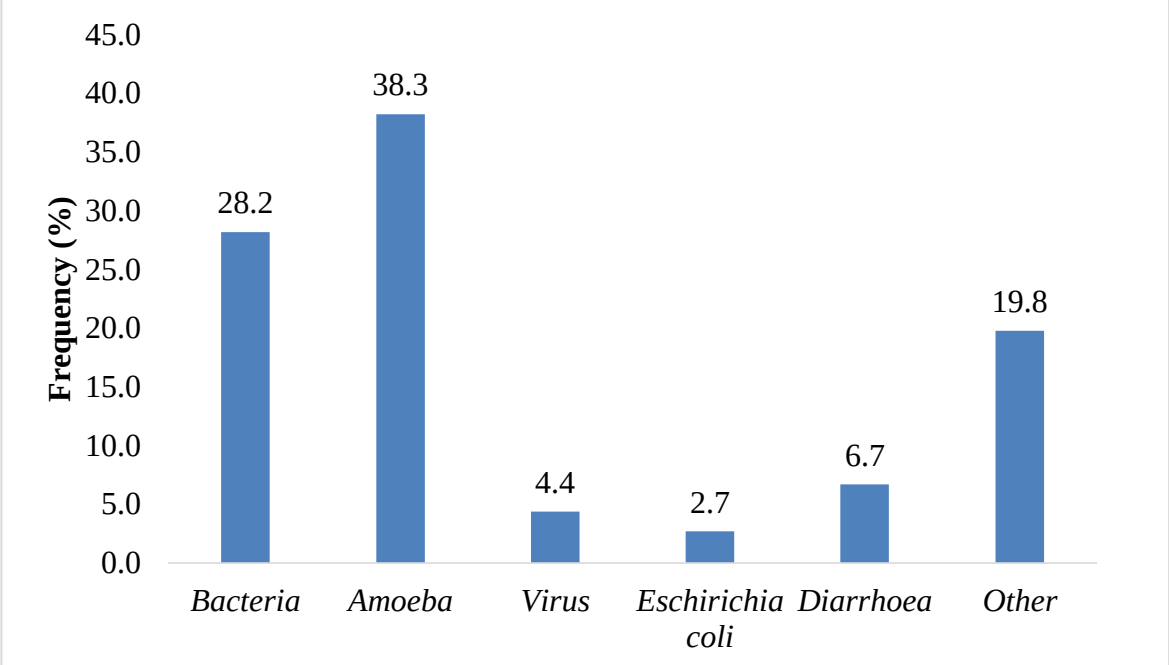

Figure 4.2: Dstribution of study participants by infecting intestinal parasites

4.4 Practices of participants regarding intestinal parasite

4.4.1. Hand washing practices

As summarized in table 4.4, the majority 217(72.8%) of study participants stated that they do wash their hands regularly compared to 81(27.2%) who did not. There was a significant difference in the frequency of study participants based on the hand washing habit ($\chi 2 = 62.067$; df = 1; P = 0.001).

4.4.2. Frequency of hand washing

Out of the 298 study participants, 173(58.1%) stated that they always washed their hands regularly followed by 72(24.2%) who washed their hands on sometimes basis, while 53(17.8%) rarely washed their hands. There was a significant difference in the frequency of study participants based on the hand washing frequency ($\chi 2 = 83.765$; df = 2; P = 0.001) (table 4.4).

4.4.3. Sanitation and cleanliness

Majority 173(58.1%) of study participants worked in eateries that had specific people employed to clean the work place toilets compared to 125(41.9%) who did not have such kind of employees. There was a significant difference in the frequency of study participants based on the presence of specific people employed to clean work place toilets ($\chi 2 = 7.732$; df = 1; P = 0.005) (table 4.4).

4.4.4. Personal hygeine

Majority 259(86.9%) of study participants stated regularly cutting their nails compared to 39(13.1%) who did not. There was a significant difference in the frequency of study participants based on how regular they cut their nails ($\chi 2 = 162.914$; df = 1; P = 0.001). The majority 203(68.1%) of the participants acknowledged wearing protective cloths during cooking compared to 95(31.9%) who did not. There was a significant difference

in the frequency of study participants based on the practice of wearing protective cloths at work place ($\chi 2 = 39.141$; df = 1; P = 0.001) (table 4.4).

Table 4.4: Participants practices related with intestinal parasites

Variable	Unit	Number	Percentage	c2	df	P value
	PRACTICES					
Do you wash hands	Yes	217	72.8	62.067	1	0.001
	No	81	27.2			
Frequency of hand washing	Sometimes	72	24.2	83.765	2	0.001
	Rarely	53	17.8			
	Always	173	58.1			
Specific people wash the toilets	Yes	173	58.1	7.732	1	0.005
	No	125	41.9			
Regular nail cutting	Yes	259	86.9	162.914	1	0.05
	No	39	13.1			
Do you wear protective clothing	Yes	203	68.1	39.141	1	0.001
	No	95	31.9			

c2-chi square; df-degrees of freedom; P-Level of significance; $P \leq 0.05$ indicates the relationship is significant

4.4.5. Purpose of hand washing

When asked reasons for washing hands, the majority 132(44.3%) of study participants washed hands for eating purpose. This was followed by 67(22.5%) who stated atleast two purpose of hand washing, 44(14.8%) washed hand after using the toilet while 37(12.4%) washed hands for cooking purposes (Figure 4.3). There was a significant difference in the frequency of study participants based on the purpose of hand washing ($\chi 2 = 130.55$; df = 4; P = 0.001).

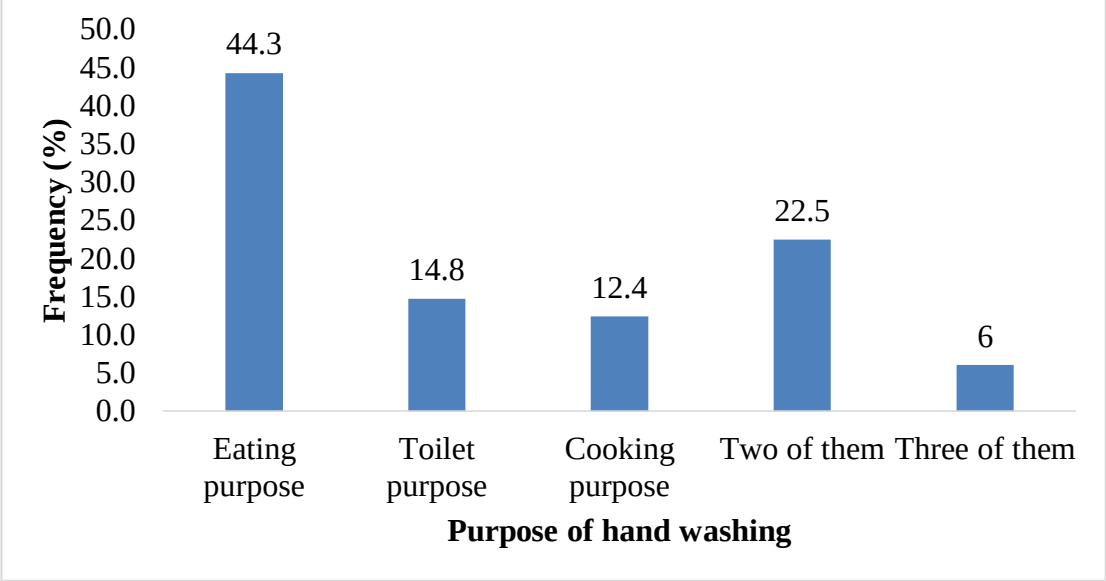

Figure 4.3: Purpose of hand washing practice

4.5 Laboratory analysis

4.5.1. Stool appearance

From the laboratory analysis, out of the 298 participants stool samples, a total of 282 (94.6%) were formed, 14 (4.7%) were semi-formed stool while 2 (0.7%) had loose stool (Figure 4.4). There was a significant difference in the frequency of study participants based on the appearance of their stool samples ($\chi 2 = 504.591$; df = 2; P = 0.001).

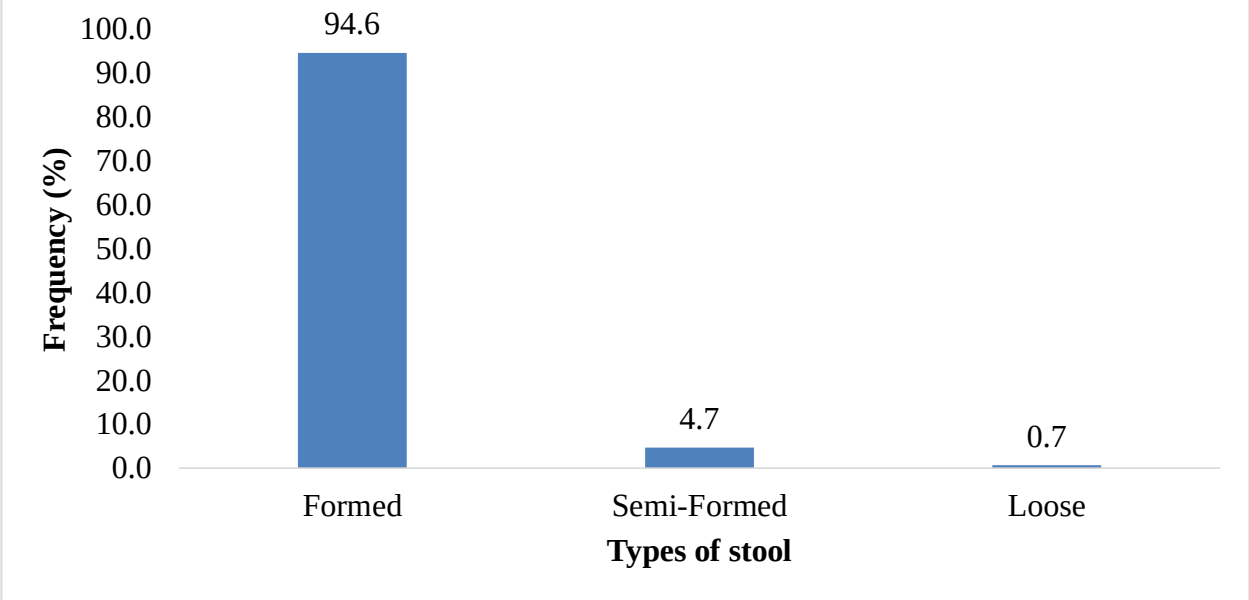

Figure 4.4: The frequency of participants stool type

4.5.2. Laboratory diagnosis of intestinal parasites

Out of the 298 enrolled participants 43 (14.4%) had one type of intestinal parasite infection while 255 (85.6%) had no cysts detected. Of these 43 intestinal parasites detected, the majority 30 (69.8%) was *Entamoeba histolytica*. Others included 7(16.3%) *Iodamoeba butschlii*, 4(9.3%) *Giardia lamblia*, 1(2.3%) *Endolimax nana* and 1(2.3%) *Trichomonas hominis* (figure 4.5). There was a significant difference in the prevalence of intestinal parasitic infection among study participants ($\chi 2 = 188.564$; df = 5; P = 0.001).

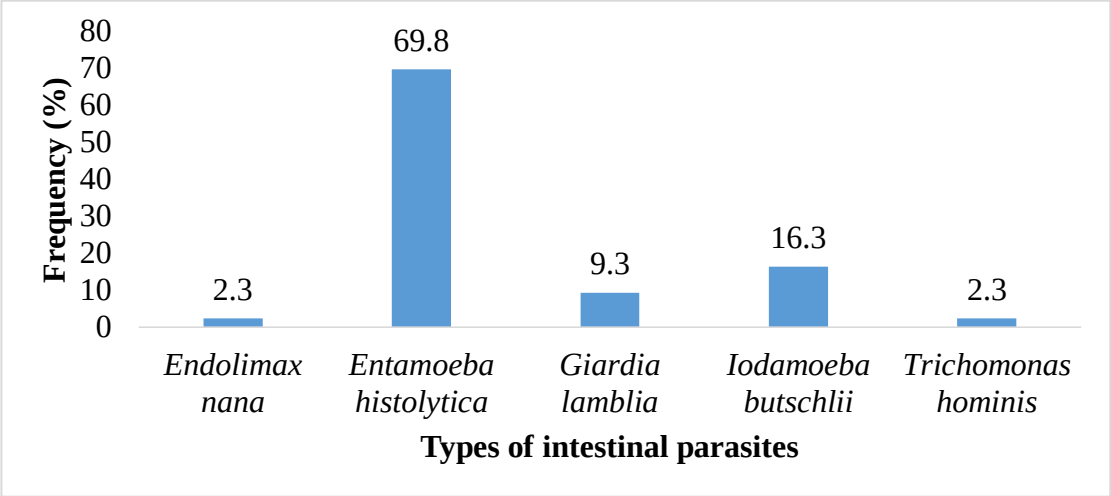

Figure 4.5: Distribution of intestinal parasitic infection among study participants

4.6 Facility related characteristics

As summarized in table 4.5, the majority of the surveyed eateries had toilets with majority, 57.7%, having one latrine. The condition of latrines in 57.6% of the eateries surveyed were clean only 4.6% found to be dirty. Furthermore, findings indicated that 72.6% of eateries were clean with only 10.1% having garbage heaps. The findings also indicated that all the eateries had a drainage system with 75% of them being in good state. All the eateries in Nairobi were also found to have presence of water, presence of hand washing basins and presence of hand washing soaps.

Table 4.5: Participants practices related with intestinal parasites

Variable	Unit	Number	Percentage	c2	df	P value
Number of latrines	One	172	57.7	89.2	2	0.001
	Two	110	37.2			
	Three or more	16	5.3			
Conditions of toilets	Clean	172	57.6	83.77	2	0.001
	Fairly clean	112	37.8			
	Dirty	14	4.6			
General cleanliness of the facility area	Clean	216	72.6	67.89	2	0.001
	Fairly clean	64	21.3			
	Dirty	18	6.1			
Presence of garbage heaps	Yes	30	10.1	112.23	1	0.02
	No	268	89.9			
Condition of drainage system	Bad state	74	25	45.81	1	0.001
	Good state	224	75			

c2-chi square; df-degrees of freedom; P-Level of significance; $P \leq 0.05$ indicates the relationship is significant

4.7 Factors associated with intestinal parasite infections

This section highlights various demographic, socio-economic factors as well as participant's knowledge and practices associated with intestinal parasitic infection

4.7.1. Demographic factors

Table 4.6 shows summarizes demographic factors associated with infection with intestinal parasites. Both in bivariate and multivariate analysis, none of participant's demographic variables such as work place, age, education level, marital status and household population size were found associated with intestinal parasitic infection.

Table 4.6: Demographic factors associated with intestinal parasite infections

Variable	Sample size	Infection with intestinal parasite		P value	Bivariate	P value	Multivariate
		Frequency	Percentage		uOR (95% CI)		aOR (95% CI)
Hotel							
Hotel I	41	9	21.9	0.847	1.1(0.6-1.7)	0.973	0.9(0.5-1.8)
Hotel II	55	7	12.8	0.95	1.1(0.3-2.9)	0.653	1.1(0.7-1.8)
Hotel III	45	5	11.1	0.206	1.8(0.7-4.5)	0.754	1.2(0.4-3.1)
Hotel IV	54	11	20.4	0.316	1.5(0.6-3.8)	0.594	1.2(0.5-2.6)
Hotel V	35	8	22.9	0.247	2.3(0.6-9.4)	0.915	0.9(0.1-4.6)
Hotel VI	68	12	17.6	Reference	Reference	Reference	Reference
Gender							
Male	174	25	14.4	0.847	1.1(0.6-1.7)	0.973	0.9(0.5-1.8)
Female	124	18	14.5	Reference	Reference	Reference	Reference
Age grouping							
15- 20	20	3	15	0.482	1.5(0.4-5.5)	0.828	1.1(0.6-1.9)
21-30	177	28	15.8	0.826	0.9(0.3-2.5)	0.928	1.1(0.6-1.8)
31-40	80	11	13.8	0.844	1.1(0.4-3.3)	0.893	0.9(0.6-1.7)
≥41	21	1	4.8	Reference	Reference	Reference	Reference
Education level							
Primary	39	7	17.9	0.627	0.7(0.2-2.5)	0.876	1.1(0.7-1.4)
Secondary	124	11	8.9	0.95	1.1(0.3-2.9)	0.653	1.1(0.7-1.8)
Tertiary	116	22	19	0.715	0.8(0.3-2.3)	0.415	0.7(0.3-1.6)
Non-Formal	19	3	15.8	Reference	Reference	Reference	Reference
Marrital status							
Single	135	21	15.6	0.989	ND	0.99	ND
Married	137	20	14.6	0.989	ND	0.99	ND
Divorced	19	2	10.5	0.989	ND	0.99	ND
Separated	7	0	0	Reference	Reference	Reference	Reference
Household size							
1-3	223	31	13.9	0.206	1.8(0.7-4.5)	0.754	1.2(0.4-3.1)
>4	32	7	21.9	0.64	1.3(0.4-4.6)	0.218	2.2(0.6-8)
None	43	5	11.6	Reference	Reference	Reference	Reference

uOR - Unadjusted and aOR - Adjusted Odds Ratio; CI - confidence interval; ND-Not done; P - Level of significance; P ≤ 0.05 indicates the relationship is significant

4.7.2. Socio-economic factors

Table 4.7 shows socio-economic factors associated with infection with intestinal parasites. In bivariate analysis, participants whose household consumed borehole water were more likely to be infected with intestinal parasite compared to those who had pipped water (OR 2.2, 95% CI 1.2 to 4.1). Further, in multivariate analyses, participants

who stilled used water from borehole for domestic use (OR 2.2, 95% CI 1.2 to 4.1) remained independently associated with intestinal parasitic infection.

Table 4.7: Socio-economic factors associated with intestinal parasite infections

Variable	Sample size	Infection with intestinal parasite		P value	Bivariate	P value	Multivariate
		Frequency	Percentage		uOR (95% CI)		aOR (95% CI)
Monthly Income (USD)							
<5000	30	3	10	0.57	1.3(0.5-4.1)	0.289	0.4(0.3-1.8)
5001-10000	84	11	13.1	0.773	1.1(0.4-2.8)	0.433	0.6(0.3-1.8)
10001-15000	71	5	7	0.418	1.4(0.6-3.5)	0.078	0.4(0.1-1.1)
15001-20000	65	15	23.1	0.316	1.5(0.6-3.8)	0.594	1.2(0.5-2.6)
>20001	48	9	18.8	Reference	Reference	Reference	Reference
Housing							
Self owned	38	4	10.5	0.486	0.7(0.3-1.6)	0.695	0.7(0.8-3.1)
Rental	230	35	15.2	0.486	0.7(0.3-1.6)	0.983	0.9(0.3-2.8)
Other	30	4	13.3	Reference	Reference	Reference	Reference
Household water source							
Bore hole	66	18	27.3	**0.01**	**2.2(1.2-4.1)**	**0.011**	**2.2(1.2-4.1)**
Rain	29	0	0	0.989	ND	0.987	ND
Pipped	203	25	12.3	Reference	Reference	Reference	Reference
Source cooking energy							
Firewood	12	0	0	0.936	ND	0.991	ND
Kerosene	126	21	16.7	0.772	1.2(0.3-5.2)	0.658	1.3(0.3-6.2)
Gas	147	20	13.6	0.734	1.3(0.3-5.3)	0.807	1.2(0.3-5.2)
Others	13	2	15.4	Reference	Reference	Reference	Reference
Source of energy for lighting							
Kerosene	77	8	10.4	0.783	0.9(0.5-1.6)	0.271	0.6(0.3-1.4)
Solar	19	4	21.1	0.705	0.8(0.2-2.5)	0.216	1.9(0.6-5.7)
Electricity	202	31	15.3	Reference	Reference	Reference	Reference

uOR - Unadjusted and aOR - Adjusted Odds Ratio; CI - confidence interval; ND-Not done; P - Level of significance; $P \leq 0.05$ indicates the relationship is significant

4.7.3. Knowledge related factors

Table 4.8 shows participant's knowledge related to intestinal infection. Both in bivariate and multivariate analysis none of the factors assessed; (Knowledge of intestinal parasite, transmission of intestinal parasite; sings and symptoms associated with intestinal parasite; past infection) were found associated with intestinal parasite infections

Table 4.8: Participants knowledge associated with intestinal parasite infections

Variable	Sample size	Infection with intestinal parasite		P value	Bivariate uOR (95% CI)	P value	Multivariate aOR (95% CI)
		Frequency	Percentage				
Know intestinal parasite							
Yes	275	39	14.2	0.247	2.3(0.6-9.4)	0.915	0.9(0.1-4.6)
No	23	4	17.4	Reference	Reference	Reference	Reference
Transmission of intestinal parasite							
Ingestion	167	20	12	0.357	0.7(0.3-1.5)	0.278	0.6(0.2-1.5)
Skin penetration	21	3	14.3	0.795	0.8(0.3-3.1)	0.668	0.7(0.2-3.1)
Inhalation	28	6	21.4	0.642	1.2(0.4-3.4)	0.893	0.9(0.3-2.8)
Person-to-person contact	17	3	14.3	0.949	1.1(0.3-3.7)	0.959	0.9(0.2-4.1)
Don't know	65	11	16.9	Reference	Reference	Reference	Reference
Problems associated with intestinal parasites							
Diarrhea	136	20	14.7	0.318	1.8(0.6-6.2)	0.277	2.1(0.5-7.9)
Vomiting	11	3	27.3	0.592	1.2(0.6-2.3)	0.647	1.1(0.6-2.4)
Stomch ache	79	14	17.7	0.874	0.8(0.1-6.3)	0.825	0.7(0.09-6.3)
Headache	8	1	12.5	0.995	ND	0.995	ND
Fever	4	0	0	0.991	ND	0.993	ND
Blood in stool	14	0	0	0.545	0.7(0.3-1.9)	0.884	0.9(0.2-3.5)
Don't know	46	5	10.9	Reference	Reference	Reference	Reference
Ever been infected with intestinal parasites?							
Yes	226	36	15.9	0.491	0.8(0.5-1.5)	0.481	1.8(0.3-9.6)
No	72	7	9.7	Reference	Reference	Reference	Reference
Types of intestinal parasites							
Bacteria	84	15	17.9	0.613	0.8(0.4-1.8)	0.801	0.8(0.1-5.1)
Amoeba	114	14	12.3	0.784	0.9(0.4-1.8)	0.49	0.5(0.07-3.4)
Virus	13	1	7.7	0.473	1.5(0.4-1.8)	0.353	0.2-0.02-4.1)
Eschirichia coli	8	2	25	0.64	0.6(0.07-4.7)	0.949	0.9(0.08-9.9)
Diarrhoea	20	5	25	0.698	1.2(0.4-3.4)	0.704	1.3(0.1-9.7)
Other	59	6	10.2	Reference	Reference	Reference	Reference
Washing hands before eating very important							
Strongly agree	225	38	16.9	0.994	ND	0.992	ND
Agree	58	5	8.6	0.994	ND	0.992	ND
Disagree	15	0	0	Reference	Reference	Reference	Reference
Know need for medical certificate							
Yes	89	10	11.2	0.481	1.5(0.5-5.2)	0.412	0.7(0.3-1.5)
No	209	33	15.8	Reference	Reference	Reference	Reference
Know the Frequency of medical examinations							
Yes	166	26	15.7	0.346	0.7(0.3-1.4)	0.806	0.9(0.4-1.9)
No	132	17	12.9	Reference	Reference	Reference	Reference
Aware of legal consequence for lack of medical examinations							
Yes	172	30	17.4	0.114	1.6(0.9-3.2)	0.548	1.5(0.3-7.4)
No	126	13	10.3	Reference	Reference	Reference	Reference
Know specific work section Requiring Medical Certificate							
Yes	90	11	12.2	0.51	0.8(0.4-1.6)	1	ND
No	208	32	15.4	Reference	Reference	Reference	Reference
Specify Work Station requiring Medical Certificate							
All sections	189	32	16.9	0.985	ND	0.992	ND
Waiter and serving sections	21	3	14.3	0.985	ND	0.994	ND
Kitchen	33	6	18.2	0.994	ND	0.994	ND
Drinks and beverages	30	2	6.7	0.986	ND	0.994	ND
Others	25	0	0	Reference	Reference	Reference	Reference

uOR - Unadjusted and aOR - Adjusted Odds Ratio; CI - confidence interval; ND-Not done; P - Level of significance; $P \leq 0.05$ indicates the relationship is significant

4.7.4. Practice related factors

Table 4.8 shows practices related to intestinal infection. In bivariate analysis, participants who stated washing hands for the purposes of eating (OR 0.3, 95% CI 0.6 to 0.7), after using toilet (OR 0.1, 95% CI 0.1 to 0.3), cooking (OR 0.09, 95% CI 0.02 to 0.4) or two of these reasons (OR 0.03, 95% CI 0.03 to 0.3) were less likely to get intestinal infection compared to those who stated three different reasons for hand washing. On the other hand, the participants who stated wearing protective head gears (OR 3.5, 95% CI 1.3 to 9.1) were more likely to get intestinal parasitic infection compared to those who did not wear any head protective gear.

In multivariate analyses, participants who stated washing hands for the purposes of eating (OR 0.5, 95% CI 0.2 to 0.9), after using toilet (OR 0.1, 95% CI 0.02 to 0.5), cooking (OR 0.1, 95% CI 0.02 to 0.6) or two of these reasons (OR 0.1, 95% CI 0.03 to 0.4) and stated wearing protective head gears (OR 1.7, 95% CI 1.1 to 6.4) remained associated with intestinal parasitic infection.

Table 4.5: Participants practices associated with intestinal parasite infections

Variable	Sample size	Infection with intestinal parasite		P value	Bivariate uOR (95% CI)	P value	Multivariate aOR (95% CI)
		Frequency	Percentage				
Do you wash hands							
Yes	217	34	15.7	0.359	1.4(0.6-2.9)	0.707	0.8(0.2-2.4)
No	81	9	11.1	Reference	Reference	Reference	Reference
Frequency of hand washing							
Sometimes	72	10	13.9	0.678	0.8(0.4-1.7)	0.989	1.1(0.2-2.5)
Rarely	53	5	9.4	0.266	0.6(0.2-1.5)	0.415	0.5(0.2-2.2)
Always	173	28	16.2	Reference	Reference	Reference	Reference
Why wash hands							
Eating purpose	132	25	18.9	**0.004**	**0.3(0.6-0.7)**	**0.011**	**0.5(0.2-0.9)**
Toilet purpose	44	2	4.5	**0.001**	**0.1(0.01-0.3)**	**0.005**	**0.1(0.02-0.5)**
Cooking purpose	37	2	5.4	**0.003**	**0.09(0.02-0.4)**	**0.006**	**0.1(0.02-0.6)**
Two of them	67	4	6	**0.001**	**0.1(0.03-0.3)**	**0.001**	**0.1(0.03-0.4)**
Three of them	18	10	55.6	Reference	Reference	Reference	Reference
Specific people wash the toilets							
Yes	173	30	17.3	0.124	1.6(0.8-3.2)	0.614	1.2(0.5-2.5)
No	125	13	10.4	Reference	Reference	Reference	Reference
Regular nail cutting							
Yes	259	42	16.2	0.068	6.3(0.9-45)	0.264	3.4(0.3-28.8)
No	39	1	2.6	Reference	Reference	Reference	Reference
Do you wear protective clothing							
Yes	203	38	18.7	**0.008**	**3.5(1.3-9.1)**	**0.048**	**1.7(1.1-6.4)**
No	95	5	5.3	Reference	Reference	Reference	Reference

uOR - Unadjusted and aOR - Adjusted Odds Ratio; CI - confidence interval; ND-Not done; P - Level of significance; P ≤ 0.05 indicates the relationship is significant

4.7.5. Facility related factors

Table 4.9 shows facility related factors associated with intestinal infection. In bivariate analysis, participants whose facility had two different latrines were more likely to be infected with intestinal parasite compared to those that had three or more latrines (OR 2.2, 95% CI 1.2 to 4.1). Further, participants whose facility's general cleanliness was considered fairly clean were more likely to be infected with intestinal parasite compared to those whose facility general cleanliness was considered dirty (OR 1.9, 95% CI 1.1 to 3.4). In multivariate analysis, participants'' whose facility had two different latrines (OR

5.5, 95% CI 1.9 to 15.5) and those that the general cleanliness was considered fairly clean (OR 9.6, 95% CI 2.5 to 36.9) remained independently more likely to be infected with the intestinal parasites.

Table 4.9: Facility related factors associated with intestinal parasite infections

Variable	Sample size	Infection with intestinal parasite		P value	Bivariate uOR (95% CI)	P value	Multivariate aOR (95% CI)
		Frequency	Percentage				
Number of latrines							
One	172	12	6.9	0.068	6.3(0.9-45)	0.093	0.5 (0.2 - 1.2)
Two	110	30	27.3	**0.01**	**2.2(1.2-4.1)**	**0.001**	**5.5 (1.9 - 15.5)**
Three or more	16	1	6.3	Reference	Reference	Reference	Reference
Conditions of toilets							
Clean	172	13	7.6	0.678	0.8(0.4-1.7)	0.329	0.7 (0.3 - 1.5)
Fairly clean	112	29	25.8	**0.01**	**1.9(1.1-3.4)**	**0.001**	**9.6 (2.5 - 36.9)**
Dirty	14	1	7.1	Reference	Reference	Reference	Reference
General cleanliness of the facility area							
Clean	216	31	14.4	0.783	0.9(0.5-1.6)	0.842	1.1 (0.5 - 2.6)
Fairly clean	64	9	14.1	0.705	0.8(0.2-2.5)	0.22	2.3 (0.6 - 8.3)
Dirty	18	3	16.7	Reference	Reference	Reference	Reference
Presence of garbage heaps							
Yes	30	4	13.3	0.51	0.8(0.4-1.6)	0.858	0.9 (2.6 - 3.1)
No	268	39	14.6	Reference	Reference	Reference	Reference
Condition of drainage system							
Good state	224	33	14.7	0.247	2.3(0.6-9.4)	0.8	1.1 (0.48; 2.56)
Bad state	74	7	9.5	Reference	Reference	Reference	Reference

uOR - Unadjusted and aOR - Adjusted Odds Ratio; CI - confidence interval; P - Level of significance; $P \leq 0.05$ indicates the relationship is significant

4.8 Emerging themes and responses from Key informant interviews

Table 4.10 highlightes the emerging themse from the content analysis of KII. Generally, the results obtained from the responses given by the Key informant interviews. The results were consistent with the results reported by quantitative analysis of the data obtained from the questionnaires. The key theme was highlighted from the interview and the main responses were presented in direct speech as they were responding

Table 4.10: Emerging themes and responses from Key informant interviews

Code Name	Emerging themes	Examples of responses
What is your source of water?	Piped water from Borehole	*``First the source of water we use is not stagnant. We use piped water from the borehole''*
What are the modes of your liquid and solid waste disposal systems?	Septic tank	*``Here, for now, we have our own sewer line-septic tank. Our septic is almost hundred meters from where we are working. When full, we call exhausters to empty it. The exhauster is always far from the premises so there is no contact''*
What factors promote good health in your place of work?	Practicing cleanliness Frequent medical checkups	*``We encourage cleanliness among the workers, the house and the utensils we use. All the employees also undergo medical checkups from time to time and we have the medical certificates''*
What are the barriers and challenges to good health at your place of work?	Delays by clinical officers to conduct routinely inspections	*``Mostly one of the challenges might be lack of cooperation among the workers to uphold good health. Another challenge is the clinical officers who delay so much before they conduct the routinely inspection. They even inspect twice a year. That is a big challenge to us''*
What is your source of supply of groceries?	Fresh groceries from the farm	*``Mostly our groceries are brought from the farm in the rural area. We don't buy from the market''*
What are the barriers and challenges that hinder you from attaining your best?	Distance of the medical inspectors is a hindrance	*`` The medical officers are far from us. They should be brought close to us so as to enhance more routinely inspection''. Furthermore, water line should be separated among users. We should not use the same line''*

4.9 Key Informant response on the factors contributing to intestinal parasitic infection

Varied responses were gathered on the problems in this industry that contribute to intestinal parasitic infection. These included staff-based factors (awareness, experiences,

expectations, income, employment, family); health facility-based factors (interactions with care providers, availability of care, quality of care, distance, affordability, logistics availability, follow up and service administration); and policy and standards (service standards, implementation manuals and policy documents) were mentioned.

One KII participant (CEO) said *"mostly to prevent infection we enforce cleanliness both from workers and the facilities*".

Second KII participant (Head of environment) said *"Occasionally when we have pest infestation…we normally spray especially at odd hours when no clients are available".*

Third KII participant (CEO) said "*Yes, we also ensure our employees comply with the regulation of the hospitality industry…. all my employed have been medically certified from KEMRI…except the gate watchman and I can provide the documentations".*

Fourth KII participant (Head of environment**) said "***The biggest problem in this industry to health include, cleanliness, good working environment including having hand sanitizers at strategic positions.*

Third KII participant (CEO) said *"sometimes the health evaluation is not done on a regular basis. Sometimes we as the leaders must take leadership and check the expiry dates of medical certificate. Upon expiry we must send the staff for re-evaluation…. not all in this industry get medical examinations done regularly".*

Third KII participant (Kitchen head) said *"to ensure we avoid contamination; most industries try to produce their own food items in hygienic conditions…. we rarely buy food items grown using the sewage irrigation wastes".*

Third KII participant (Kitchen head) said *"the other major challenge in getting food items is the lack of sufficient produce…. the market in our locality is very small and its far, so sometimes we might compromise on the quality of food by cooking stale for items".*

Fourth KII participant (Head of environment) said "*the other challenge is the lack of regular inspection of these premises by the health workers…. these workers are still at the central government and not devolved so they take long to come…we always benefit from their inspection".*

Fifth KII participant (senior worker hospitality industry) said "*most of contamination occurs from the staff themselves…. maybe they have low level of education and consequently poor socio-economic and hygienic conditions of families which are brought to work stations".*

Fourth KII participant (Head of environment) said "*other items that reduces contamination includes; having the correct uniform and protective cloths such as dust coats, gumboots, head gears etc depending on the work station".*

Sixth KII participant (Health worker) said "*in my years of service we have shown that intestinal parasitic infections are more common in rural than urban areas. People living in rural areas may lack sanitary water supplies and live close to sources of parasites in social and environmental conditions that predispose to intestinal parasitic infections. Further, the common intestinal parasitic infections generally occur more frequent in children because of their interaction with other children and their poor*

hygiene. Families with children are known to have adult infected with these parasites as well"

Fourth KII participant (Health worker) said *"intestinal infection and transmission are also contributed by other underlying health conditions…. such as those who have compromised immunity such as HIV are more likely to have these persistent infections. Medical checkup should include such kind of evaluation as well for control and management".*

CHAPTER FIVE

DISCUSSION CONCLUSSIONS AND RECOMMENDATIONS

5.1 Discussion

Food handlers may be carrying a wide range of enteropathogens and have been implicated in the transmission of many infections to the public in the community and to patients in hospitals. Reports globally have emphasized the significance of food handlers with poor personal hygiene as a risk in the transmission of parasitic and bacterial diseases (Takalkar *et al*., 2010). There are currently over 70,000 eateries and hotels in Nairobi including close to 400 five star rated. These eateries and hotels are not only visited by the locals but also attract high numbers of international tourists including dignitaries. With this understanding in early 90s, Kenya Medical Research Institute (KEMRI) initiated the food handler program to hotels, restaurants and food processors in selected cities in Kenya. The service involves certification of all people who directly handle foodstuff (preparation, serving or packing) in hotels and food-based industries that they are free from any food borne diseases thus minimizing risks associated with food contamination. In 2015 the Nairobi government and the KEMRI signed an agreement to test food handlers in all eateries and hotels within Nairobi county.

5.1.1. Prevalence of intestinal parasitic infections

This study is therefore among the first to report on the prevalence and correlates of intestinal parasitic infection among food handlers within the KEMRI clientele. The overall prevalence of protozoan infections was 14.4%. Mixed intestinal parasite infections were detected in 1.9% of the study participants. Higher prevalence rates have been reported from food handlers in Nigeria (97%) (Idowu *et al*., 2006), in Iran (74%) (Fallah *et al*., 2004), in 52.2% in Anatolia Turkey (Simsek *et al*., 2009), in Ethiopia (45.3%) (Aklilu *et al*., 2015), Sudan (29.4%) (Babiker *et al*., 2009), and Gaza Strip, Palestine (24.3%) (Al-Hindi *et al*., 2012). However lower prevalence was in Turkey (8.8%) (Selman *et al*., 2008), Khuzestan, Southwest of Iran (7.78%) (Saki *et al*., 2012), North India (1.3 to 7%) (Khurana *et al*., 2008), and Thailand 10.3% (Kusolsuk *et al*., 2011). This difference can be explained largely due to epidemiological, environmental distribution difference, poor personal hygiene practices, environmental sanitation and ignorance of health-promotion practices.

In our study, the majority of parasitic infection (51.2%) was *Entamoeba histolytica* followed by 9.3% *Iodamoeba butschlii,* 2.3% *Giardia lamblia*, 2.3% *Endolimax nana* and 2.3% *Trichomonas hominis*. Similar parasitic dominancy of *E. histolytica* and *G. lamblia* was reported in Ethiopia (Aklilu *et al*., 2015), and in Turkey (Selman *et al*., 2008). Other studies have identified *G. lamblia* as the leading parasite followed by other parasites such as in Ethiopia (Abera *et al*., 2010), and in Iran (Saki *et al*., 2012). Kamau

et al. (2012) in Kenya reported *Giardia* parasite as one of 6 common types of parasites among members of restaurant staff.

From our study and various others, it is indicated that the prevalence of intestinal parasitic infections has recently changed compared to the past and the prevalence of infection has declined, totally (Balarak *et al.*, 2016a). The reduction in the incidence of infections over the years can be attributed to the development of networks for the distribution of drinking water, more comprehensive monitoring of health systems, and ongoing communication with employees and stricter rules than in the past to provide health advice and provide hygiene standards, continuous testing of parasitic infections (6 months) and the availability of drugs for the treatment of infections, higher levels of life expectancy in terms of health and increasing level of individual health information and the use of less human fertilizer by farmers (Balarak *et al* ., 2016a and b).

5.1.2. Factors associated with intestinal parasitic infection

5.1.2.1 Demographic and socio-economic variables

5.1.2.1.1. Gender

This study did not find any relationship between intestinal parasitic infection and participant's residency, age, education level, marital status, income and household population size. However, most of the food handlers in this study were males, young in age (below 30 years), with or lower secondary level education, and low monthly income below 15,000ksh. These characteristics of our food handlers is similar to a larger extent

in other settings. A study in Ethiopia Mama and Alemu, (2016) showed that most of the food handlers were females, young adults and had low educational levels; which is in line with studies from different parts of the world (Abera *et al.*, 2010; Aklilu *et al.*, 2015; Anjum *et al.*, 2017). There was however no difference between male (14.4%) and female (14.5%) in terms of intestinal parasitic infection. This is contrary to the study of Mama and Alemu, (2016) that reported higher proportion of infected female food handlers (22.6 %) with intestinal parasites than the proportion of infected male food handlers (12 %). This can be due to the fact that women are much more involved in kitchen work than men. Most of the males participate in the delivery of the already prepared food, while women are those who go bare footed during the preparation of the food, as well as those who do the washing of vegetables and fruits mainly in the kitchen.

5.1.2.1.2. Age

Concerning the relation of age group and parasitic infection, cumulatively although not significant, the study revealed relatively a higher infection rate in the age group younger than 30 years. No significant difference was found in the distribution of parasitic infection among all age groups which shows that there is equal exposure to the infection and suggests an effect of environmental conditions on infection. This outcome is similar to various reports in India, Ethiopia and other regions of the world (Gelaw *et al.*, 2013; Mama and Alemu, 2016; Anjum *et al.*, 2017).

5.1.2.1.3. Income and socio-economic status

Although monthly income was not a contributor to intestinal parasitic infection in our study, consumption of water from borehole was associated with parasitic infection. It is particularly not surprising for this association, boreholes in most parts of Kenya are never handled according to the WHO standards including proper treatment and protection from external contamination. Studies have shown that environmental route of transmission is important for many protozoan and helminth parasites, with water, soil and food being particularly significant. Both the potential for producing large numbers of transmissive stages and their environmental robustness, being able to survive in moist microclimates for prolonged periods of time, pose a persistent threat to public and veterinary health (Karanis *et al*., 2007). Drinking water has been shown as a major source of microbial pathogens in developing regions (Baldursson and Karanis, 2011). Generally, source of water has been linked to the socio-economic status of the population with many reports showing higher prevalence of intestinal parasitic infection more commonly in rural areas and in lower socio-economic strata (Anjum *et al.*, 2017). These reports have attributed this to probably an inability to afford and maintain food and water cleanliness.

5.1.2.2 Hygienic practices characteristics

Our study showed a significant overall relationship between food handler's sanitation and hygiene and intestinal parasitic infection. Food handlers hand washing reasons; for the purposes of eating (OR 0.3, 95% CI 0.6 to 0.7), after using toilet (OR 0.1, 95% CI 0.1 to 0.3), cooking (OR 0.09, 95% CI 0.02 to 0.4) or two of these reasons (OR 0.03, 95% CI 0.03 to 0.3) were less likely to get intestinal infections. On the other hand, food handlers who wore general protective head gears (OR 3.5, 95% CI 1.3 to 9.1) were more likely to get intestinal parasitic infections. Other studies have also reported several environmental and behavioral variables significantly contributing to intestinal parasite infection (Sharif *et al*., 2015). Like in our study, reduced hand washing with soap prior to eating, after using the toilet, or in both situations, and contact with soil, significantly increased the risk of intestinal parasitic infection (Zaglool *et al*., 2011; Sharif *et al*., 2015). Other studies have also shown hand washing practice to be a determinant for intestinal parasitic infection among food handlers (Abera *et al.*, 2010; Nigusse and Kumie, 2012). Improper hand washing before handling food is one obvious route for dissemination of infections. Parasite eggs in the soil can be transmitted to vegetables, then on to hands and hence directly into the mouth (Koyabashi, 1999), or ingested by eating raw vegetables (Ulukanligil *et al*., 2001). Examination of finger nail contents of food handlers for ova or parasites is one way of indicating the possible contamination of food (Suriptiastuti and Manan, 2011; Omalu *et al.*, 2013).

5.1.2.3 Knowledge related factors

This study did not report any association in participant's knowledge related factors (Knowledge of intestinal parasite, transmission of intestinal parasite; Problems associated with intestinal parasite; past infection) to intestinal infection. Based on the participant's responses, it can be concluded that generally intestinal parasitic knowledge/literacy level was higher in this population. A study in South-East Asia showed that food handlers had relatively less knowledge about these infections; thus, there are more infections in those regions (Zain and Naing, 2002), while the infection level is less in developed countries like Italy (Angelillo *et al.*, 2000). As reported by Balarak *et al.*, (2016a) literacy level reduces the number of positive samples; in other words, there is a significant relationship between level of education and degree of parasitic infection. It could be interpreted that if the literacy rate increased, then awareness about parasitic infections will also increase. Therefore, the lower need for health advice and better compliance with sanitary regulations will be achieved, as noted in other studies (Kheyrandish *et al.*, 2004).

5.1.2.4 Facility factors related to intestinal infection

Information related to facility factors contributing to intestinal infection were gathered through employee in-depth interviews and a checklist. Some of the highlights of eateries and hotel facility-based factors included general cleanliness affirmed by one participant "*mostly to prevent infection we enforce cleanliness both from workers and the facilities". "The biggest problem in this industry to health include, cleanliness, good*

working environment including having hand sanitizers at strategic positions" reported another participant. Uncleanliness is associated with presence of pests implicated in transition of infections. *"Occasionally when we have pest infestation…we normally spray especially at odd hours when no clients are available"* reported a participant. Both individual and facility environmental characteristics have been shown to significantly contribute to intestinal parasite infection (Zaglool *et al*., 2011; Sharif *et al*., 2015). The source of food raw material is key. "*the other major challenge in getting food items is the lack of sufficient produce…. the market in our locality is very small and its far, so sometimes we might compromise on the quality of food by cooking stale for items"* one participant asserts. Many companies now produce their own food and water purification systems within the facility to minimize contaminations. *"to ensure we avoid contamination; most industries try to produce their own food items in hygienic conditions…. we rarely buy food items grown using the sewage irrigation wastes"* said another. The carefully developed networks for the distribution of drinking water and food items is key in reducing the incidence of infections over the years in many food industries and hotels (Balarak *et al.*, 2016a and b).

Other facility related factors such as availability of institutional health care, distance, policy and standards (service standards, implementation manuals and policy documents) have been shown to eventually influence the general employee's health. Confirmed by one employee *"Yes, we also ensure our employees comply with the regulation of the hospitality industry…. all my employees have been medically certified by*

KEMRI…except the gate watchman and I can provide the documentations". Yet another commended about the policy *"sometimes the health evaluation is not done on a regular basis. Sometimes we as the leaders must take leadership and check the expiry dates of medical certificate. Upon expiry we must send the staff for re-evaluation…. not all in this industry get medical examinations done regularly".* The role of company's policy and standards on the overall wellbeing of worker's health has been well documented (Angelillo *et al.*, 2000; Kheyrandish *et al.*, 2004; Balarak *et al.*, 2016a) showing a positive correlation.

5.1.2.5 Strength and Limitation

One of the major strengths of this study is the ability to contribute to wealth of knowledge by showing that food handlers working in various eateries and hotels in Nairobi are potential carriers of intestinal parasitic infection. Although the decline in the prevalence compared to other previous studies both in Kenya and other regions is worth noting. The study also showed the potential association between duration of food handling, hygienic condition with intestinal parasitic infection.

However, some of the limitation to our assessment of intestinal parasitic infection outcomes needs to be pointed out: Firstly, cross-sectional nature of our study only allowed us to describe associations between potential factors and intestinal parasitic infection, not a causal conclusion. Such outcomes can be confirmed in a longitudinal study. Secondly, we only enrolled a small fraction less than 5% of all the food handlers enrolled in the KEMRI medical examination program, as such we may not have

captured the true distribution of intestinal parasitic infection outcomes in this study. Thirdly, although we reported high carriage of intestinal parasitic infection among the food handler's, we cannot conclusively predict the source of exposure to these intestinal parasitic infections. Fourthly, although we might expect some seasonal variation in transmission of intestinal helminths (Babiker *et al*., 2009), the present study did not evaluate temporal and seasonal variability of intestinal parasitic infection. Difference in climatic conditions may explain the different findings.

5.2 Conclusions

The following are conclusions drawn from this study:

Socio-demographic characteristics: A majority of food handlers attending the KEMRI medical certification program were male, young in age, with lower than secondary level of education, with low family monthly income, currently married, had between 1 to 3 children and used pipped water for domestic purposes.

Parasitic infection; prevalence and types: The prevalence of intestinal parasitic infection was moderate among food handlers showing a general decline compared to other previous studies in Kenya and elsewhere. Most of the food handlers just as in other regions were infected with *Entameoba histolytica* while *Endolimax nana* and *Trichomonas hominis* were the least common.

Factors associated with intestinal parasitic infections: The following factors played a key role in the infection with intestinal parasitic infection among food handlers in

Nairobi: low income characterizes by utilization of bore hole water and general poor personal hygiene.

5.3 Recommendations

Based on the findings of the study, the following recommendations are made: -

1. Because of the cross-sectional nature of our study which only allowed us to describe associations between potential factors and intestinal parasitic infection, it is recommended that larger studies covering the whole of Kenya utilizing combination of other research designs including prospective and institutional observational studies in order to identify the actual prevalence of intestinal parasitic infection as well as the associated factors including the role of hotel facilities
2. Mitigating steps such as enforcement of systems that promote improvement of personal and facility level hygiene, more training, and wider enforcement of medical certification policy are vital

REFERENCES

Abera, B., Biadegelgen, F., & Bezabih, B. (2010). Prevalence of salmonella typhi and intestinal parasites among food handlers in Bahir Dar town. Northwest Ethiopia. *Ethiop J Health Dev. , 24*(1), 47–50.

Al-Ballaa, S.R., Al-Sekeit, M., Al-Balla, S.R., Al-Rasheed, R.S., Al-Hedaithy, M.A. and Al-Mazrou, A.M. (2003). Prevalence of pathogenic intestinal parasites among preschool children in Al-Medina district, Saudi Arabia Dhu Al Qa'da. *Journal of Tropical Disease Management,* 13: 259–63.

Adamu, H., Endeshaw, T., Teka, T., Kifle, A., & Petros, B. (2009). Prevalence of intestinal parasites in paediatric diarrhoeal and non-diarrhoeal patients in Sub-Saharan Africa, with special emphasis on opportunistic parasitic infections. . *Ethiopian Journal of Health and Development, 20*(1), 39-46.

Addis, A. (2015). Prevalence of intestinal parasites, salmonella and shigella among apparently health food handlers of Addis Ababa University student's cafeteria, Addis Ababa, Ethiopia. *Journal of Biomedical Central, 8*(17).

Al-Hindi, A., Abdelraouf, A., Elmanama, Ashour, N., Hassan, I., & Salamah, A. (2012). Occurrence of intestinal parasites and hygiene characters among food handlers in Gaza strip, Palestine. *Ann Alquds Med., 1433*(8), 2-3.

Al-Shammari, S., Khoja, T., Al-Khwasky, F., & Gad, A. (2001). Intestinal Parasitic diseases in Riyadh, Saudi Arabia: Prevalence, Socio demographic and environmental associates. *Tropical Medicine and International Health, 6*(3), 184–9.

Aklilu A, Kahase D, Dessalegn M, Tarekegn N, Gebremichael S, Zenebe S, Desta K, Mulugeta G, Mamuye Y and Mama M. 2015. Prevalence of intestinal parasites,

salmonella and shigella among apparently health food handlers of Addis Ababa University student's cafeteria, Addis Ababa, Ethiopia. *BMC Research Notes*. 8:17

Angelillo, I. F., Viggiani, N. M., Rizzo, L., & Bianco, A. (2000). Food handlers and foodborne diseases: knowledge, attitudes, and reported behavior in Italy. *Journal of Food Protection, 63*, 381–385.

Anjum, W., Kalasker, P. S., & Bhaskar, K. (2014). Prevalence of intestinal parasites and its associated socio-demographic factors among the food handlers of Bagalkot city, Karnataka, India. *Int J Community Med Public Health, 4*(1), 1-4.

Aschalew, G., Belay, A., Bethel, N., Betrearon, S., Atnad, Y., Meseret, A., et al. (2013). Prevalence of intestinal parasitic infections and risk factors among school children at the University of Gondar Community School, Northwest Ethiopia. *BMC Public Health, 13*, 304.

Babiker, M. A., Ali, M. S., & Ahmed, E. S. (2009). Frequency of intestinal parasites among food-handlers in Khartoum, Sudan. *Eastern Mediterranean Health Journal, 15*, 1099-1104.

Babiker, M. A., Ali, M. S., & Ahmed, E. S. (2011). Frequency of intestinal parasites among food-handlers: a review. *Journal of Parasitic Infections, 133*, 1098-1112.

Balarak, D., Ebrahimi, D., Modrek, D. J., Bazrafshan, E., Mahvi, A. H., & Mahdavi, Y. (2016). Investigation of parasitic contaminations of vegetables sold in markets in the city of Tabriz in 2014. *8*(10), 178–184.

Balarak, D., Modrek, M. J., Bazrafshan, E., Ansari, H., & Mostafapour, F. K. (2016). Prevalence of Intestinal Parasitic Infection among Food Handlers in Northwest Iran. *Journal of Parasitology Research*.

Baldursson, S., & Karanis, P. (2011). Waterborne transmission of protozoan parasites: Review of worldwide outbreaks—An update 2004–2010. *Water Res. , 45*(20), 6603–14.

Bern, C., & Glass, R. I. (2004). *Impact of Diarrhoeal Disease Worldwide. Infections of the Gastrointestinal Tract.* New York: Marcel Derker.

Biwott, G., Wanjala, P., & Ngeiywa, M. (2014). Prevalence of Gastrointestinal Parasitic Infections among Food Handlers in Eldoret Municipality, Kenya. *Journal of Biology, Agriculture and Healthcare, 4*, 27.

Centers for Disease Control and Prevention (CDC). (2003). Guidelines for environmental infection control in health-care facilities: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). *52(RR-10)*, 1-48.

Cheesbrough, M. (2009). *Medical Laboratory Manual for Tropical Countries.* Oxford: Butterworth.

Dawson, D. (2005). Foodborne protozoan parasites. *Int J Food Microbiol., 103*(2), 207–27.

Fallah, M., Sadeghian, S., Taherkhani, H., Habibi, F., & Barghi, Z. H. (2004). Study of parasitic and bacterial infections in the food-handling personnel, Ramadan, Iran. *J Res Health Sci. , 4*, 3-10.

Gelaw, A., Anagaw, B., Nigusse, B., Silesh, B., Yirga, A., & Alem, M. (2013). Prevalence of intestinal parasitic infections and risk factors among school children at the University of Gondar Community School, Northwest Ethiopia: a cross-sectional study. *BMC Public Health, 13*, 304-14.

Guidelines for the management and health surveillance of food handlers. (2003). Retrieved from https://www.westerncape.gov.za/text/2003/foodhandlers.pdf

Gilbert, K., Biwott, P., Wanjala, M., Moses, M., & Ngeiywa. (2014). Prevalence of Gastrointestinal Parasitic Infections among Food Handlers in Eldoret Municipality, Kenya. *Journal of Biology, Agriculture and Healthcare, 4*(27).

Green, J., & Thorogood, N. (2010). *Qualitative Methods for Health Research* (2nd ed.). London: Sage Publication.

Hatam-Nahavandi, K., Mahvi, A. H., Mohebali, M., Keshavarz, H., Mobedi, I., & Rezaeian, M. (2015). Detection of parasitic particles in domestic and urban wastewaters and assessment of removal efficiency of treatment plants in Tehran, Iran. *J Environ Heal Sci Eng., 13*(1), 4.

Idowu, O. A., & Rowland, S. A. (2006). Oral fecal parasites and personal hygiene of food handlers in Abeokuta, Nigeria. *Afr Health Sci., 6*, 160-4.

Kaferstein, F., & Abdussalam, M. (1999). Food safety in the 21st century. *Bull World Health Organ, 77*, 347-51.

Kamau, P., Aloo-Obudho, P., & Kabiru, E. (2012). Prevalence of intestinal parasitic infections in certified food-handlers working in food establishments in the City of Nairobi, Kenya. *Journal of Biomedical Research, 26*(2), 84-9.

Karanis, P., Kourenti, C., & Smith, H. (2007). Waterborne transmission of protozoan parasites. *A worldwide review of outbreaks and lessons learnt, 5*(1), 1-38.

Khalid, A., Kalantan, E. A., Al-Faris, A. A., & Al-Taweel. (2001). Pattern of intestinal parasitic infection among food handlers in riyadh, Saudi Arabia. *Journal of Family Community Medicine, 8*(3), 67-72.

Kheyrandish, F., Badparva, E., & Tarahi, M. (2004). Prevalence of intestinal parasites in Khorramabad bakeries' workers in 2001. *Yafteh, 5*(17), 45-50.

Khurana, S., Taneja, N., Thapar, R., Sharma, M., & Malla, N. (2008). Intestinal bacterial and parasitic infections among food handlers in a tertiary care hospital of North India. *Trop Gastroenterol., 29*(4), 207-9.

Koyabashi, A. (1999). Ascaris. In *Japan International Cooperation Agency. Textbook for seminar on parasite control administration for senior officers-a step towards primary health care.* (pp. 233-42). Tokyo: JICA.

Kumar, T., Onichandran, S., Lim, Y. A., Sawangjaroen, N., Ithoi, I., & Andiappan, H. (2014). Comparative study on waterborne parasites between Malaysia and Thailand: A new insight. . *Am J Trop Med Hyg. , 90*(4), 682-9.

Kusolsuk, T., Maipanich, W., Nuamtanong, S., Pubampen, S., & Sa-nguankiat, S. (2011). Parasitic and enteric bacterial infections among food handlers in tourist-area restaurants and educational-institution cafeterias, Sai-Yok district, Kanchanaburi province, Thailand. *J Trop Med Parasitol. , 34*, 49-53.

La Pelle, N. (2004). Simplifying qualitative data analysis using general purpose software tools. *Field Methods, 16*, 85-108.

Lwanga, S. K., & Lemeshow, S. (1991). *Sample size determination in health studies a practical manual.* . Retrieved from World Health Organization (WHO): apps.who.int/iris/bitstream/10665/40062/1/9241544058_(p1-p22).pdf

Majed, H., Wakid, E. I., Azhar, T. A., & Zafar, 1. (2009). Intestinal Parasitic Infection among Food Handlers in the Holy City of Makkah During Hajj Season . *JKAU: Med. Sci., 16*(1), 39-52.

Mohammedaman, M., & Getaneh A. (2016). Prevalence and factors associated with intestinal parasitic infections among food handlers of Southern Ethiopia: cross sectional study. *BMC Public Health , 16*, 105.

Nigusse, D., & Kumie, A. (2012). Food hygiene practices and prevalence of intestinal parasites among food handlers working in Mekelle university student's cafeteria, Mekelle. *Global Advanced Research Journal of Social Science, 1*(4), 065–071.

Norhayati, M., Fatmah, M. S., Yusof, S., & Edariah, A. B. (2003). Intestinal Parasitic Infections in Man: A Review. *Med J Malaysia, 58*, 296-306.

Nyarango, R. M., Aloo, P. A., Kabiru, E. W., & Nyanchongi, B. O. (2008). The risk of pathogenic intestinal parasite infections in Kisii Municipality, Kenya. *BMC Public Health, 8*, 237 -239.

Omalu, I. C., Paul, S., Adeniran, L. A., Hassan, S. C., & Pam, V. A. (2013). Assessment of the Level of Gastrointestinal Parasites Infection among Food Vendors in Minna, North Central Nigeria. *Annual Review & Research in Biology, 3*(4), 705–713.

Omemu, A. M., & Oloyede, F. O. (2014). Assessment of the hygienic practices and the incidence of enteric bacteria in food handlers in small businesses in an urban area in Abeokuta. *Int. Res. J. Microbiol. , 5*(3), 41-9.

Onyango, A. B., Kenya, E. U., Mbithi, J., & Ng'ayo, M. O. (2009). Pathogenic Escherichia coli and Food Handlers in Luxury Hotels in Nairobi, Kenya. *Journal of Travel Medicine and Infectious Disease, 7*, 359-366.

Paul, K., Penina, A.-O., Ephantus, K., Kepha, O., Bernard, L., Obadiah, M., et al. (2012). Prevalence of intestinal parasitic infections in certified food-handlers

working in food establishments in the City of Nairobi, Kenya. *Journal of Biomedical Research, 26*(2), 84–89.

Phiri, K., Whitty, C. J., Graham, S. M., & Ssembatya-Lule, G. (2000). Urban/rural differences in prevalence and risk factors for intestinal helminth infection in southern Malawi. . *Annals of Tropical Medicine and Parasitology, 94*(4), 381-387.

Ramakrishnaiah, Y., Ketha, R. R., & Bhuvana, R. (2014). Screening of intestinal parasitic infections among food handlers. *Indian Journal of Medical Case Reports, 3*(1), 76-77.

Saab, B. R., Musharrafieh, U., Nassar, N. T., Khogali, M., & Araj, G. F. (2004). Intestinal parasites among presumably healthy individuals in Lebanon. *Saudi Med J. , 25*, 34-37.

Saki, J., Khademvatan, S., Masoumi, K., & Chafghani, M. (2012). Prevalence of intestinal parasitic infections among food handlers in Khuzestan, Southwest of Iran: a 10-year retrospective study. *Afr J Microbiol Res. , 6*(10), 2475–80.

Savioli, L., Smith, H., & Thompson, A. (2006). Giardia and Cryptosporidium join the "Neglected Diseases Initiative". *Trends Parasitol., 22*(5), 203–8.

Selman, C. A., & Green, L. R. (2008). Environmental health Specialists' self-reported Foodborne illness outbreak investigation practices. *J Env Health., 0*(6), 16-21.

Schlundt, J., Toyofuku, H., Jansen, J. and Herbst, S.A. (2004). Emerging food-borne zoonoses. *Review of Science and Techology*, 23: 513-5.

Sharif, M., Daryani, A., Kia, E., Rezaei, F., Nasiri, M., & Nasrolahei, M. (2015). Prevalence of Intestinal Parasites Among Food Handlers of Sari, Northern Iran. *Revista do Instituto de Medicina Tropical de São Paulo, 57*(2), 139-144.

Simsek, Z., Koruk, I., Copur, A. C., & Gürses, G. (2009). Prevalence of Staphylococcus aureus and intestinal parasites among food handlers in Sanliurfa, Southeastern Anatolia. *J Publ Health Manag Pract., 15*, 518–23.

Smith, H. V., Cacciò, S. M., Cook, N., Nichols, R. A., & Tait, A. (2007). Cryptosporidium and Giardia as foodborne zoonoses. *Vet Parasitol., 149*(1-2), 29-40.

Solanki, R., Kaiya, R. N., Jaysawal, A., Dhanashree, B., Meghna, C., & Vidyalakshmi, K. (2014). Study of prevalence of intestinal parasites in food handlers in Mangalore. *Int J Cur Res Rev., 6*(22), 14-16.

Speich, B., Croll, D., Fürst, T., Utzinger, J., & Keiser, J. (2016). Effect of sanitation and water treatment on intestinal protozoa infection: a systematic review and meta-analysis. *Lancet Infect Dis. , 16*(1), 87–99.

Strunz, E. C., Addiss, D. G., Stocks, M. E., Ogden, S., Utzinger, J., & Freeman, M. C. (2014). Helminth Infection: A Systematic Review and meta-analysis. *PLoS Med., 11*(3).

Suriptiastuti, J., & Manan, W. S. (2011). Intestinal parasites from fingernails of sidewalk food vendors. *Univ Med , 30*(2), 120-125.

Takalkar, A. A., Madhekar, N. S., Kumavat, A. P., & Bhayya, S. M. (2010). Prevalence of intestinal parasitic infections amongst food handlers in hotel and restaurants in Solapur city, India. *Indian J Public Health., 54*, 47-8.

Takizawa, M. G., Falavigna, D. L., & Gomes, M. L. (2008). Enteroparasitosis and their ethnographic relationship to food handlers in a tourist and economic center in Paraná, southern Brazil. *Rev Inst Med trop S Paulo., 51*, 31-35.

The World Factbook. (n.d.). Retrieved from CIA.gov: https://www.cia.gov/library/publications/the-world-factbook/geos/ke.html

Ulukanligil, M., Seyrek, A., Aslan, G., Ozbilge, H., & Atay, S. (2001). Environmental pollution with soil-transmitted helminths in Sanliurfa, Turkey. *Mem Inst Oswaldo Cruz., 96*, 903-9.

Wabukala, P., Makokha, D. L., Promidis, P. O., & Jeuline, D. E. (2001). Prevalence of intestinal parasitic infections in Kenya: Study of the slums in Nairobi. *Journal of Tropical Epidemiology, 12*, 189-197.

Wakid MH (2009). Fecal Occult Blood Test and Gastrointestinal Parasitic Infection. Journal of Parasitology Research. 2010, Article ID 434801, 4 pages, 2010. https://doi.org/10.1155/2010/434801.

WHO. (2016). *Human Intestinal Parasites.* WHO Report.

WHO. (2008). *Intestinal protozoan and helminthic infections. Report of WHO Scientific Group, Switzerland, .* Geneva: WHO.

Zaglool, D. A., Khodari, Y. A., Othman, R. A., & Farooq, M. U. (2011). Prevalence of intestinal parasites and bacteria among food handlers in a tertiary care hospital. *Niger Medical Journal, 52*(4), 266-270.

Zain, M. M., & Naing, N. N. (2002). Sociodemographic characteristics of food handlers and their knowledge, attitude and practice towards food sanitation: a preliminary report. *Southeast Asian J Trop Med Public Health, 33*, 410-417.

Zarezadeh, M., & Malakotian, M. (2014). Prevalence of bacteria (Salmonella, Shigella) and intestinal parasites among food handlers in Kerman, Iran, in 1390. *Pajoohandeh Journal., 19*(1), 55-59.

Zouré, H. G., Wanji, S., Noma, M., & Amazigo, U. V. (2011). The Geographic Distribution of Loa loa in Africa: Results of Large-Scale Implementation of the Rapid Assessment Procedure for Loiasis (RAPLOA). *PLoS Negl Trop Dis., 5*(6), e1210.

APPENDICES

Appendix I: Consent Form for Questionnaire in English

STUDY TITLE: Factors associated with Intestinal parasitic infections among food handlers in selected eateries in Nairobi City County

Institutions and Investigators:

Researcher	**Institution**	**Contact**
Saadia A Ibrahim	Kenya Medical Research Institute (Principal investigator)	+254-720-975423
Prof. Simon Karanja	Jomo Kenyatta University	+254-726-424669
Dr. Yeri Kombe	Kenya Medical Research Institute	+254-734-257864

PART A

Introduction

You are invited to participate in this study. You have been selected as a possible participant in this study. We ask that we read and explain this form to you as you ask any questions you may have before agreeing to be in this study. The risk of intestinal parasites among food handlers is relatively high and this increases the risk of passing it on to their customers. Therefore, this study intends to find out the factors associated with Intestinal parasitic infections among food handlers in selected eateries in Nairobi City.

Purpose of the study

To determine the associated factors of intestinal parasitic infections, among food handlers in selected eateries in Nairobi County

Risks of Study Participation

This study has no known risks. Although your details will be written on paper, no other person will be allowed to read this information except the ones directly involved in this study. There are almost no chances of you getting an injury in the course of our study. Discomfort is not anticipated either and as you will complete the questionnaire, there shall be absolute privacy.

Benefits

By participating in this study and answering to our questions, you will help to increase our understanding of the reasons and situations that make intestinal parasitic infections prevalent among food handlers, and how to avoid them. Taking part in this study will not involve any payment.

Study Procedures

If you agree to take part in this study: We shall ask you detailed questions for about 30-45 minutes regarding yourself and presence and associated factors of intestinal parasitic infections, whose answers we shall note on paper. The information that you will provide during the study will be kept confidential. Only the interviewer and the researcher will have access to the questionnaires. The information will be destroyed after the study.

Confidentiality

The records of this study will be kept private. The questionnaire will not have your names but codes. The privacy will be enhanced by the use of lockable cabinet. Any publication or presentations arising from this study will not include any information that will make it possible to identify you as a subject. However, this information will only be available to the people who are involved in the study.

Voluntary nature of the study

Participation in this study is voluntary. You have the right to refuse to participate or to answer to any question that you feel uncomfortable with. If you change your mind, you have the right to withdraw at any time. If anything is not clear or if you need further information, we shall provide it to you. Your decision whether or not to participate in this study will not affect your current or future relations with this institution or the other

institutions involved. If you decide to participate, you are free to withdraw at any time without affecting those relationships

PART B: CONSENT FORM

Please read the information sheet (PART A) or have the information read and explained to you carefully before completing and signing this consent form. If there are any questions you have about the study, please feel free to ask them to the investigator prior to signing your consent form.

Declaration of the participant

I_____ hereby give consent to participate in the proposed study. I have read the information sheet concerning this study, I understand the aim of the study and what will be required of me if I take part in the study. The risks and benefits if any have been explained to me. Any questions I have concerning the study have been adequately answered. I understand that at any time that I may wish to withdraw from this study I can do so without giving any reason and without affecting my work.

I realize that I will be interviewed once. I consent voluntarily to participate in this study.

Participant's name_____

Signature or left thumb print _____Date_____

Name of person taking consent_____

Signature_____Date_____

Name of Investigator_____

Signature of Investigator_____ Date_____

Contacts and Questions

The researcher conducting this study is Saadia Adan Ibrahim. You may ask any questions you have now, or if you have questions later, you are encouraged to contact her through telephone number: +254-720-975423, E-mail saadia.ibrahim@yahoo.com or the following;

Prof. Simon Karanja	Jomo Kenyatta University	+254-726-424669
Dr. Yeri Kombe	Kenya Medical Research Institute	+254-734-257864

For any questions pertaining to rights as a research participant, the contact person is: The chairperson, Kenyatta National Hospital/University of Nairobi Research and Ethics Committee, Prof. A.N Guantai at Telephone numbers: 2726300 ext. 44355/44102.

The study staff will pay you back for your charges to these numbers if the call is for study related communication.

Appendix II: Consent Form for Questionnaire in Swahili

Mada Ya Utafiti: utafiti ambao utakadiria viwango vya magonjwa ya viini vinavyo ambukiza tumbo na hali zinazo changia maambukizi haya katika watu wafanyao kazi katika sehemu zinazo tayarisha chakula kwa matumizi ya umma katika County ya Nairobi.

Watafiti na taasisi: Mtafiti: Saadia Adan Ibrahim, +254-720-975423; Prof Simon karanja, +254-726-424669; Dr Yeri Kombe, +254-734-257864

Umealikwa kushiriki katika utafiti huu. Umechaguliwa kama mshiriki katika utafiti huu. Tunakuomba usome fomu hii na uulize maswali yoyote kabla ya kukubali kushiriki katika utafiti huu. Utafiti huu ni kuhusu mambo yanayosababisha magonjwa ya viini vya matumbo katika watu wafanyao kazi katika sehemu zinazo tayarisha chakula kwa matumizi ya umma katika County ya Nairobi.

Sababu ya utafiti: Utafiti huu ni kuhusu mambo yanayosababisha magonjwa katika watu wafanyao kazi katika sehemu zinazo tayarisha chakula kwa matumizi ya umma katika County ya Nairobi.

Madhara ya Kushiriki Kwa Utafiti: Utafiti huu hauna madhara yoyote. Ingawa tutaandika mambo kukuhusu, hakuna mtu mwingine yeyote atakayeisoma habarí hii isipokuwa wale wanaohusika na utafiti huu moja kwa moja. Hakuna uwezekano wowote wa kutapata majeraha wakati wa utafiti huu.

Faida: Kwa kushiriki katika utafiti huu na kujibu maswali, utasaidia kuongezea kueleweka kwa sababu zinazochangia magonjwa yasiyo ya kuambukiza. Kushiriki katika utafiti huu hautakugarimu malipo yoyote kwa taratibu zote utakazo fanyiwa.

Taratibu za utafiti: Iwapo utakubali kushiriki katika utafiti huu: Tutakuuliza maswali mengi kwa mda wa dakika 30-45, juu yako mwenyewe na mambo ya tabia zako za kiafya. Habari utakayoitoa kwetu itakuwa siri. Ni mhojaji na mtafiti pekee ndio

watakaoiona. Habari yote itafutwa baada ya utafiti huu.

Siri: Rekodi za utafiti zitahifadhiwakwa siri. Siri yenyewe itafungiwa kabatini. Toleo lolote ama makala yanayotokana na utafiti huu hayatafanya utambulike na yeyote. Hata hivyo rekodi zako za utafiti zitaonwa na wahusika wa utafiti peke yao.

Hali ya kujitolea kwa utafiti huu: Utafiti huu ni wa kujitolea kwa hiari. Una ruhusa ya kutoshiriki ama kukataa kujibu swali lolote lile. Ukibadilisha nia yako ya kushiriki, una ruhusa ya kujiondoa wakati wowote. Iwapo kuna jambo lisiloeleweka, ama kuhitaji habari zaidi tutakujuza. Uamuzi wako wa kushiriki au kutoshiriki katika utafiti huu hautaathiri uhusiano wako na kazi yako pamoja na taasisi nyingine ambazo zimehusika sasa hivi au baadaye. Ukiamua kutoshiriki, una uhuru wa kujiondoa wakati wowote bila kuathiri uhusiano huo.

Consent form in Kiswahili

Utapewa nakala ya fomu hii ili uihifadhi kama rekodi yako. Tafadhali soma ujumbe kwenye karatasi au usomewe kwa makini kabla ya kujaza na kutia sahihi kwenye fomu hii. Iwapo una maswali yoyote kuhusu utafiti huu, tafadhali mwuulize mchunguzi kabla ya kutia sahihi kwenye fomu ya kutoa idhini.

Uamuzi wa anayejitolea

Mimi _____natoa idhini kwa Saadia Adan Ibrahim anishirikishe kwenye utafiti huu juu ya mambo yanayochangia magonjwa ya viini vya tumbo katika watu wafanyao kazi katika sehemu zinazo tayarisha chakula kwa matumizi ya umma katika County ya Nairobi.

Nimesoma ujumbe wote kuhusu utafiti huu, linaelewa lengo lake na wajibu wangu iwapo nitashirikishwa. Nimeelezwa hatari na faida zo zote zile iwapo zipo na maswali yangu yote yamejibiwa.

Nimeelewa kuwa naweza kujiondoa kwenye utafiti huu wakati wowote bila kutoa sababu zangu na pasi na kuhatarisha kazi yangu. Naelewa kwamba nitahojiwa mara moja. Nakubali kwa hiari yangu kushiriki katika utafiti huu.

Jina la mhojiwa _____Tarehe _____

Sahihi/alama ya kidole gumba (kushoto) _____

Jina la anayepewa ruhusa_____

Sahihi_____Tarehe _____

Jina la mtafiti _____

Sahihi ya mtafiti_____Tarehe _____

Anwani na Maswali

Mtafiti ni Saadia Adan Ibrahim. Unaweza kuuliza maswali sasa au baadaye. Nambai yake ya simu ni: 0720-975423 au barua pepe saadia.ibrahim@yahoo.com au

Iwapo una maswali yoyote kuhusiana na utafiti huu na ungependa kuongea na mtu mwengine isipokuwa mtafiti au watafiti, unaweza kuwasiliana na:

Mwenyikiti, Kenyatta National Hospital/University of Nairobi Research and Ethics Committee, Prof. A.N Guantai Nambari ya simu 2726300 ext. 44355/44102.

Appendix III: Questionnaire in English

SECTION ONE – SOCIO DEMOGRAPHIC AND SOCIO ECONOMIC

(1) Serial No_____

(2) Age_____

(3) Sex Male □ female □

(4) Marital Status

(a) Single □

(b) Married □

(c) Divorced/ Separated □

(d) Widowed □

(5) How many children do you have?

(a) None□

(b) One □

(c) Two □

(d) Three □

(e) Four or more □

(6) Formal Educational level

(a) None□

(b) Primary □

(c) Secondary □

(d) Tertiary □

(7) What is the highest professional qualification you attained?

(a) None

(b) Certificate

(c) Diploma

(d) Undergraduate degree

(e) Postgraduate degree

(8) What is your main day-to-day duty in this facility?

(a) Waiter

(b) Bar tender

(c) Chef

(d) Cook

(e) Cleaner of utensils

(f) Cleaner of kitchen and/food serving places

(g) Other, specify_____

(9) What is the range of your income per month?

(a) 0-5000/-

(b) 5001- 10,000/-

(c) 10,001- 15,000/-

(d) 15,001- 20,000/-

(e) More than 20,000/-

(10) What type of housing do you live in?

(a) Self owned house

(b) Rented house

(c) Other, specify_____

(11) What is number of rooms of your house?

(a) One

(b) Two

(c) Three

(d) Other, specify_____

(12) How many people live in one room?

(a) One

(b) Two

(c) Three

(d) Other, specify_____

(13) What are the walls of your house made of?

(a) Mud

(b) Timber

(c) Bricks and blocks

(d) Other, specify_____

(14) What is the roof of your house made of?

(a) Thatch

(b) Iron sheet

(c) Tiles

(d) Other, specify_____

(15) What is the floor of your house made of?

(a) Mud

(b) Cemented

(c) Ceramic tiles

(d) Other, specify_____

(16) What is the main source of water in your house?

(a) Bore hole

(b) Rain

(c) Piped

(d) Other, specify_____

(17) What is the main source of energy for cooking in your house?

(a) Firewood

(b) Kerosene

(c) LPG Gas

(d) Other, specify_____

(18) What is the main source of energy for lighting in your house?

(a) Kerosene

(b) Solar

(c) Electricity

(d) Other, specify……

SECTION TWO – (KNOWLEDGE)

(19) Do you know what an intestinal parasite is? Yes □ No □

(20) If yes, name the intestinal parasites that you know:

(a) Bacteria

(b) Amoeba

(d) Virus

(e) *Escherichia Coli*

(f) Diarrhoea

(g) Other, specify_____

(21) How are these intestinal parasites transmitted?

(a) By ingestion

(b) By skin penetration

(c) By inhalation

(d) By person-to-person contact

(e) Don't know

(22) What are the problems associated with intestinal parasites?

(a) Diarrhea

(b) Vomiting

(c) Stomach ache

(d) Headache

(e) Fever

(f) Blood in stools

(g) Foul stools

(h) Don't know

(23) Washing hands before eating food is very important

(a) Strongly agree

(b) Agree

(c) Don't know

(d) Disagree

(e) Strongly disagree

(24) Have you ever been infected with intestinal parasites? Yes □ No □

(25) If yes, which parasites infected you?
(a) _____
(b) _____

(d) _____

(e) _____

(26) If the answer is yes to question 23 above, state the treatment you received for the infection

(a) Antibiotics □

(b) Anti-helminthics □

(c) Antimalarials □

(d) Other, specify_____

(27) What type of documents is issued to you by the examining institution for the outcome of the medical examination?

(a) Medical certificates □

(b) Only the results □

(c) Don't know □
(d) Other (State) _____

(28) Do you know the purpose for the medical examination that is conducted on you? Yes □ No

(29) If the answer is 'Yes' to question 28 above, state the purpose.

(a) It is a government requirement □

(b) To improve our health □

(c) To improve the health of our clients □

(d) To prevent diseases □

(e) Other, specify_____

(30) Do you know how many times in 12 months that these examinations require to be conducted? Yes □ No □

(31) If the answer is 'Yes' to question 29 above, state the number of times in 12 months that the medical examination requires to be done.

(a) Once □

(b) Twice □

(c) Three times □

(d) Other, specify_____

(32) What are the legal consequences of you not taking these medical examinations at all?

(a) Will be arrested by City Council *Askaris* □

(b) Will be arrested by Public Health Officers □

(c) Public Health Authorities will close down the work place □

(d) Will be charged in a court of law □

(e) Don't know □

(f) None at all □

(g) Other, specify_____

(33) Do you know the specific work sections in your institution whose workers must be subjected to this medical examination? Yes □ No □

(34) If the answer is 'Yes' to question 32 above, state the sections.

(a) All sections □

(b) Waiter and serving sections only □

(c) Kitchen □

(d) Drinks and Beverage Section □

(e) Other, specify_____

SECTION THREE – (PRACTICES)

(35) Do you wash hands? Yes □ No □

(36) If yes, how often do you wash hands?

(a) Sometimes

(b) Rarely

(c) Alway

(37) When do you wash your hands? _____

(38) Do you know what protective clothing's are? Yes □ No □

(39) If yes, which ones do you know?

(40) Do you wear protective clothing? Yes □ No □

(41) If yes, which ones do you wear and when

(42) If no, why not

(43) Do you eat raw foods? Yes □ No □

(44) If yes, what do you do before you eat them? _____

(45) Do you prepare raw foods for the customers? Yes □ No □

(46) If yes, how do you prepare raw foods for the customers?

(47) Are there specific people employed to wash the toilets? Yes □ No □

(48) If no, who washes the toilets?

(49) Do you cut your nails short**?** Yes □ No □

(50) Do you cover your head when handling and preparing food yes □ No □

Appendix IV: Questionnaire in Swahili

MAHOJIANO KWA LUGHA YA KISWAHILI

SEHEMU YA KWANZA – (YANAYOHUSU MTU BINAFSI)

(1) Namba tambulishi ya pahali_____

(2) Umri_____

(3) Jinsia Mume □ Mke □

(4) Hali ya maozi

(a) Sijaolewa/owa □

(b) Nimeolewa/owa □

(c) Tulitalakiana/Tengana □

(d) Mjane □

(5) Umeweza kupata watata wangapi?

(a) Sina mtoto□

(b) Mtoto mmoja □

(c) Watata wawili □

(d) Watoto watatu □

(e) Watoto wane au zaidi □

(6) Kiwango cha juu zaidi cha elimu ulicho fikia ni gani?

(a) Sikuenda shule□

(b) Elimu ya msingi □

(c) Elimu ya upili □

(d) Chuo kikuu/ Elimu ya utatu □

(7) Kiwango cha juu zaidi ulichosomea kazi yako ni gani?
(a) Sikusomea kokote

(b) Satifiketi

(c) Diploma

(d) Digrii ya kwanza

(e) Digrii ya pili

(8) Kazi yako ya kawaida kila siku katika kituo hiki ni gani?

(a) Mhudumu wa wateja wanapokuja kula

(b) Msimamizi wa sehemu ya vinywaji

(e) Kiongozi wa wapishi

(f) Mpishi

(g) Mwoshaji vyombo vya jikoni

(h) Mwoshaji wa jiko/sehemu za kuwahudumia wateja

(i) Nyengine, taja_____

(9) Kiwango cha mapato ya kila mwezi
(a) 0-5000/-

(b) 5001- 10,000/-

(c) 10,001- 15,000/-

(d) 15,001- 20,000/-

(e) 20,000/- na zaidi

(10) Je, unaishi kwa nyumba ya hali gani?

(a) Yangu mwenyewe

(b) Kukodesha

(c) Nyingine, taaja_____

(11) Nyumba unayoishi ina vyumba ngapi vya kulala?

(a) Moja

(b) Mbili

(c) Tatu

(d) Nyingine, taja_____

(12) Je, waweza kutueleza ni watu wangapi wanaoshi katika chumba moja?

(a) Mmoja

(b) Wawili

(c) Watatu

(d) Nyingine, taja_____

(13) Je, ukuta ya nyumba yako imejengwa na nini?

(a) Matope

(b) Mbao

(c) Mawe

(d) Nyingine, taja_____

(14) Paa ya nyumba yako imejengwa na nini?

(a) Makuti

(b) Mabati

(c) Tiles

(d) Nyingine, taja_____

(15) Sakafu ya nyumba yako imejengwa na nini?

(a) Matope

(b) Simiti

(c) Tiles

(d) Nyingine, taja_____

(16) Je, chanzo cha maji unayoyatumia nyumbani kwako yanatoka wapi?

(a) Kisima

(b) Mvua

(c) Mifereji

(d) Nyingine, taja_____

(17) Je, chanzo cha moto unayotumia kwa kupikia ni upi?

(a) Kuni

(b) Mafuta ya taa

(c) Gasi

(d) Nyingine, taja_____

(18) Je, unaweza kueleza chanzo cha moto unayotumia kwa nyumba yako kwa mwangaza nyakati za usiku?

(a) Mafuta ya taa

(b) Jua ama sola

(c) Stima

(d) Nyingine, taja_____

SEHEMU YA PILI – (WANAYOYAFAHAMU)

(19) Unafahamu mdudu au viini wa matumbo ni yupi? Ndio □ La □

(20) Kama unafahamu, taja wadudu unaowafahamu:

(a)Viini vya bakteria

(b)Viini vya Ameba

(c)Viini vya Virus

(d) Escherichia Coli

(e) Kuhara

(f) Nyingine, taja_____

(21) Unafahamu jinsi wadudu hawa huenezwa?

(a) Kwa njia ya kumeza

(b) Kwa kupenya ngozi

(c) Kupitia sehemu za kupumua

(d) Kwa kuambatana mtu na mtu

(e) Sijui

(22) Je, utamtambua vipi mtu aliyeambukizwa na mdudu wa matumbo?

(a) Kuhara

(b) Kutapika

(c) Kuumwa na tumbo

(d) Kuumwa na kichwa

(e) Joto jingi mwilini

(f) Choo kilicho na damu

(23) Je, kwa maoni yako, ni muhimu kunawa mikono kabla ya kula chakula?

(a) Nakubaliana kabisa

(b) Nakubali

(c) Sijui

(d) Sikubaliani

(e) Sikubaliani kamwe

(24) Je umewahi, wakati wowote ule, kupata maambukizi ya vidudu vya tumbo? Ndio □ La □

(25) Kama ulipata maambukizi haya, ilikuwa ni aina gani ya vidudu?

(a) _____

(b) _____

(d) _____

(e) _____

(26) Kama umepata kuambukizwa na kutibiwa, taja tiba uliyopokea

(a) Dawa za viini vya bacteria □

(b) Dawa za minyoo □

(c) Dawa za malaria □

(d) Nyingine, taja_____

(27) Ulipewa stakabathi gani za kuonyesha matokeo ya vipimo hivyo kutoka kwa hao waliokupima?

(a) Barua za vithibitisho □

(b) Majibu pekee □

(c) Sijui □

(d) Nyingine, taja _____

(28) Unafahamu sababu za wewe kufanyiwa vipimo hivi vya afya? Ndio □ La

(29) Kama unafahamu sababu hiyo/zo zitaje.

(a) Nisheria ya serikali □

(b) Kuboresha afya yetu □

(c) Kuboresha afya ya wateja wetu□

(d) Kuzuia maambukizi□

(e) Nyingine, taja_____

(30) Unajua kama vipimo hivyo vinahitajika kufanywa mara ngapi kwa kila miezi 12?

Ndio □ La □

(31) Kama unafahamu vipimo hivyo vyahitajika kufanywa mara ngapi kwa kila miezi 12, eleza ni mara ngapi.

(a) Mara moja □

(b) Mara mbili □

(c) Mara tatu □

(d) Nyingine, eleza_____

(32) Je, bila kufanyiwa vipimo hivi, eleza jambo lolote la kisheria ambalo waweza kukumbana nalo?

(a) Kushikwa na askari wa Council □

(b) Kushikwa na afisa wa afya ya umma □

(c) kituo cha kufanyia kazi kufungwa na afisa wa afya ya umma □

(d) Kushtakiwa kortini □

(e) Sijui □

(f) Hakuna lolote laweza kufanyika □

(g) Nyingine, taaja, _____

(33) Je unafahamu ni sehemu gani kati ya zile mnazofanyia kazi, kila anayefanya kazi hapo anahitaji kufanyiwa vipimo hivyo? Ndio □ La □

(34) Kama unafanya sehemu hizo, zitaje.

(a) Sehemu zote □

(b) Sehemu za huduma za chakula pekee □

(c) Jikoni□

(d) Sehemu ya vileo na vinywaji vingine □

(e) Sehemu nyingine, taaja _____

SEHEMU YA TATU – (YANAYOTEKELEZWA)

(35) Je, unaelewa umuhimu wa kunawa mikono? Ndio □ La □

(36) Waweza kutueleza ni wakati gani wewe hunawa mikono?

(a) wakati chache

(b) wakati chache sana

(c) Kila wakati

(37) wawezaza kutueleza ni wakati gani wewe hunawa mikono? _____

(38) Kama unafahamu nguo za kujikinga unapokuwa kazini ni zipi? Ndio □ La □

(39) Kama unaweza kuzitaja nguo hizo za kujikinga unapofanya kazi?

(40) Je, unayavaa nguo hizo za kujikinga unapokuwa kazini? Ndio□ La □

(41) Kama unaweza kutuelezea ni nguo zipi unazovaa, na ni kwa wakati upi

(42) Kama unaweza kutueleza ni kwa sababu gani huvai nguo za kujikinga ukiwa kazini?

(43) Waweza kutueleza kama unaweza kula mboga iliyo mbichi? Ndio □ La □

(44) Kama unaweza kutueleza ni yapi unayatekeleza kabla ya kula mboga hizo mbichi?

(45) Je, unawatayarishia wateja wako mboga mbichi? Ndio □ La □

(46) Kama unaweza kutueleza jinsi unavyowatayarishia wateja wako mboga mbichi?

(47) Je, unaweza kutueleza kama kuna wafanyikazi maalum walioajiriwa kwa kazi ya kusafisha vyoo pekee? Ndio □ La □

(48) Kama hakuna wafanyikazi maalum wa kuosha choo, basi ni nani anayeosha choo?

(49) Je, unahakikisha kuwa kwa kila mara kucha zako zimekatwa ziwe fupi? Ndio □ La □

(50) Unahakikisha kuwa unafunika nywele za kichwa kabla ya kutayarisha chakula? Ndio□ La□

Appendix V: Facility Related Checklist in English

Facility details

Type of facility_____

Code_____

General cleanliness

(1) Type of facility_____

(2) Presence of toilets Yes □ No □

(3) Number of Latrines / Lavatories (i) one (ii) two (iii) three or more

(4) Condition of Toilets W / C (i) clean (ii) fairly clean (iii) dirty

(5) General Cleanliness of facility area (i) clean (ii) fairly clean (iii) dirty

(a) Presence of garbage heaps Yes □ No □

(b) Presence of filth flies Yes □ No □

(6) Presence of drainage System Yes □ No □

(7) Condition of the drainage system Bad state □ Good state □

(8) Is there waste segregation? Yes □ No □

(9) Is there water? Yes □ No □

(b) If yes, what kind?

(i) Running water

(ii) Bucket

(10) Are there hand-washing basins? Yes □ No □

(11) Are there hand washing soaps on the basins? Yes □ No □

(b) If yes, what kind?

(i) Liquid soap

(ii) Bar soap

(12) Are there hygiene certificates displayed on the wall? Yes □ No □

If yes, is it up to date? Yes □ No □

Infection prevention

(13) Are there equipments used for disinfection of dishes before use?

(i) Triple sink system? Yes □ No □

(ii) Disinfectant preferably jik? Yes □ No □

(iii) Hot water? Yes □ No □

(14) Are dishes dried before next customer use? Yes □ No □

(a) If yes, what mode of drying of dishes used?

(i) Air-drying

(ii) Use of kitchen towels (a) disposable □ (b) reusable □

Appendix VI: Consent Form for In-Depth Interview in English

Institutions and Investigators:

Researcher	**Institution**	**Contact**
Saadia A Ibrahim	Kenya Medical Research Institute	+254- 720975423
Prof. Simon Karanja	Jomo Kenyatta University	+254-726424669
Dr. Yeri Kombe	Kenya Medical Research Institute	+254-734257864

PART A

Background

I am Saadia Adan Ibrahim, from the Institute of Tropical Medicine and Infectious Diseases-JKUAT. We are carrying out a study on Factors associated with Intestinal parasitic infections among food handlers in selected eateries in Nairobi County. This is due to the fact that the risk of intestinal parasites among food handlers is relatively high and this increases the risk of passing it on to their customers. Therefore, you have been requested to participate in this interview aimed at finding out the factors associated with Intestinal parasitic infections among food handlers in selected eateries in Nairobi County.

Purpose

The purpose of this interview is to find out the reasons and circumstances that contribute to the prevalence and associated factors of intestinal parasitic infections among food handlers in selected eateries in Nairobi County.

Procedure

By agreeing to participate in this study, you will be required to answer questions, which will help to increase our understanding of the reasons why there's presence and associated factors of intestinal parasitic infections among food handlers and thus

reduce the sickness in the hospitality industry in Nairobi County. As you answer the questions we will be writing down the points and also record the statements.

All the views that you give are very important, there is no right or wrong answers. Please feel free to speak your opinion. The interview will last for about 30-45 minutes.

Potential Harm, Injuries, Discomforts or Inconvenience, Risks

The proposed research will involve an interview Discussion and specimen collection of non-invasive methods; therefore, no physical harm or injury is expected.

Potential Benefits

This study has no direct benefit; however, by participating you will help increase the understanding of why food handlers get intestinal parasitic infections and how to minimize the risk. This understanding will assist reduce sickness and deaths linked to parasitic infections amongst food handlers and the customers as well in Nairobi County.

Confidentiality

The information given here will be used for research purposes and will be kept confidential.

Anonymity is assured, meaning that your real name and the transcribed responses will be kept safe and will not be revealed in any part of the thesis. In the course of the study, your consent form, your filled questionnaire and the transcribed answers will be kept separately. The information that you provide will be integrated with those of other participants for the purpose of analysis. At the end of the study it will be impossible to determine who said what.

Right to refuse/Withdraw

Your participation in this study is voluntary; you may refuse to answer any particular questions or to participate altogether. You can choose to participate or not or stop at any timing.

Tape recording

The study will involve use of a recorder that you can see here to record the interview. All the views are very important to us so that is why we would like to record. The recorded information will only be used to fill in the blanks that the note taker will have left. It will not be shared with anyone who is not involved in this study. After wards, all the recorded information shall be erased.

Consent form in-depth interview

In order to show that you have given us the permission to interview and record the interview, we need your written consent.

I have had the research explained to me. I have understood all that has been read and had my questions answered satisfactorily. I understand that I can change my mind at any stage and it will not affect the benefits due to me. I understand the information and agree to participate in the interview under the conditions stated.

Name of respondent_____

signature/thumb print_____Date _____

Interviewer/assistant_____

signature_____ Date_____

Contact

If you have any questions or clarifications about this study, in the course of the study or even after the study itself, feel free to contact me using the following addresses Saadia Adan Ibrahim, P.O. BOX 1743 00100, Nairobi. Tel: +254-720-975423. Email address: saadia.ibrahim@yahoo.com

Details of other investigators:

For any questions pertaining to rights as a research participant, the contact person is: The chairperson, Kenyatta National Hospital/University of Nairobi Research and Ethics Committee Prof. A.N Guantai at Telephone numbers: 2726300 ext. 44355/44102.

Appendix VII: Consent Form for In-Depth Interview in Swahili

Mada Ya Utafiti: utafiti ambao utakadiria viwango vya magonjwa ya viini vinavyo ambukiza tumbo na hali zinazo changia maambukizi haya katika watu wafanyao kazi katika sehemu zinazo tayarisha chakula kwa matumizi ya umma katika County ya Nairobi.

Watafiti na taasisi: Watafiti na taasisi: Mtafiti: Saadia Adan Ibrahim, +254-720-975423; Prof Simon karanja, +254-726-424669; Dr Yeri Kombe, +254-734-257864

Utafiti huu unafanywa na Saadia Adan Ibrahim wa Taasisi ya Dawa za Kitropiki na magonjwa ya kuambukizana, Chuo kikuu cha Jomo Kenyatta. Umealikwa kushiriki katika utafiti huu. Tunakuomba usome fomu hii na uulize maswali yoyote kabla ya kukubali kushiriki katika utafiti huu.

Sababu ya utafiti: Utafiti huu ni kuhusu mambo yanayosababisha magonjwa a viini vya matumbo katika watu wafanyao kazi katika sehemu zinazo tayarisha chakula kwa matumizi ya umma katika County ya Nairobi.

Taratibu: Iwapo utakubali kushiriki katika utafiti huu, haya yatakuwa ni mahojiano kwa mda wa dakika 30-45. Tutakuuliza maswali na unaombwa kujibu maswali ipaswavyo, hakuna jibu sio sahihi kwa hinyo twakusihi utupe maoni yako. Mahojiano yanapoendelea mtafiti mwingine atakuwa anaandika na kurekodi pia. Rekodi itatumika kujazia pengo itayoachwa na mnakili. Una uhuru wa kushiriki au kutoshiriki katika mahojiano haya au kuacha wakati wowote.

Madhara ya Kushiriki Kwa Utafiti: Utafiti huu hauna madhara yoyote. Ingawa tutaandika mambo kukuhusu, hakuna mtu mwingine yeyote atakayeisoma habarí hii isipokuwa wale wanaohusika na utafiti huu moja kwa moja. Hakuna uwezekano wowote wa kupata majeraha wakati wa utafiti huu.

Faida: Kwa kushiriki katika utafiti huu na kujibu maswali, utasaidia kuongezea

kueleweka kwa sababu zinazochangia magonjwa yasiyo ya kuambukiza. Kushiriki katika utafiti huu hautakugarimu malipo yoyote kwa taratibu zote utakazo fanyiwa.

Siri: Rekodi za utafiti zitahifadhiwakwa siri. Siri yenyewe itafungiwa kabatini. Toleo lolote ama makala yanayotokana na utafiti huu hayatafanya utambulike na yeyote. Hata hivyo rekodi zako za utafiti zitaonwa na wahusika wa utafiti peke yao.

Hali ya kujitolea kwa utafiti huu: Utafiti huu ni wa kujitolea kwa hiari. Una ruhusa ya kutoshiriki ama kukataa kujibu swali lolote lile. Ukibadilisha nia yako ya kushiriki, una ruhusa ya kujiondoa wakati wowote. Iwapo kuna jambo lisiloeleweka, ama kuhitaji habari zaidi tutakujuza. Uamuzi wako wa kushiriki au kutoshiriki katika utafiti huu hautaathiri uhusiano wako na kazi zako pamoja na taasisi nyingine ambazo zimehusika sasa hivi au baadaye. Ukiamua kutoshiriki, una uhuru wa kujiondoa wakati wowote bila kuathiri uhusiano huo.

Kurekodi: Utafiti huu utahusisha kurekodi mahojiano. Rekodi itatumika kujazia pengo itayoachwa na mnakili. Rekodi hizi zitaharibiwa baada ya utafiti kuisha na zitasikizwa na wahusika wa utafiti pekee.

Consent Form In-Depth Interview in Kiswahili

Utapewa Nakala Ya Fomu Hii Ili Kuhifadhi Kama Rekodi Yako

Tafadhali soma ujumbe kwenye karatasi (SEHEMU YA A) au usomewe kwa makini kabla ya kujaza na kutia sahihi kwenye fomu hii. Iwapo una maswali yoyote kuhusu utafiti huu, tafadhali mwuulize mchunguzi kabla ya kutia sahihi kwenye fomu ya kutoa idhini.

Uamuzi wa anayejitolea

Mimi_____ natoa idhini kwa Saadia Adan Ibrahim anishirikishe kwenye utafiti huu juu ya mambo yanayochangia magonjwa ya viini vya matumbo katika watu wafanyao kazi katika sehemu zinazo tayarisha chakula kwa matumizi ya umma katika County ya Nairobi.

Nimesoma ujumbe wote kuhusu utafiti huu, linaelewa lengo lake na wajibu wangu

iwapo nitashirikishwa. Nimeelezwa hatari na faida zo zote zile iwapo zipo na maswali yangu yote yamejibiwa.

Nimeelewa kuwa naweza kujiondoa kwenye utafiti huu wakati wowote bila kutoa sababu zangu na pasi na kuhatarisha kazi yangu. Naelewa kwamba nitahojiwa mara moja. Nakubali kwa hiari yangu kushiriki katika utafiti huu.

Jina la mhojiwa _____

Tarehe _____

Sahihi/alama ya kidole gumba (kushoto) _____

Jina la anayepewa ruhusa_____

Sahihi_____

Tarehe _____

Jina la mtafiti _____

Sahihi ya mtafiti_____Tarehe_____

___

Anwani na Maswali

Mtafiti ni Saadia Adan Ibrahim. Unaweza kuuliza maswali sasa au baadaye. Nambai yake ya simu ni: 0720-975423 au barua pepe saadia.ibrahim@yahoo.com au

Iwapo una maswali yoyote kuhusiana na utafiti huu na ungependa kuongea na mtu mwengine isipokuwa mtafiti au watafiti, unaweza kuwasiliana na:

Mwenyekiti, Kenyatta National Hospital/University of Nairobi Research and Ethics Committee, Prof. A.N Guantai nambari ya simu 2726300 ext. 44355/44102.

Appendix VIII: In-Depth Interview Guide in English

Study site: _____

Date: _____

Time of interview: _____

Role of respondent: _____

Experience: _____

Interviewers name: _____

Interview questions

1. What is your source of water?

2. What are the modes of your liquid and solid waste disposal systems?

3. What factors promote good health in your place of work?

4. What are the barriers and challenges to good health at your place of work?

5. What is your source of supply of groceries?

6. What are the barriers and challenges that hinder you from attaining your best?

Appendix IX: In-Depth Interview Guide in Swahili

Mahali pa utafiti: _____

Tarehe: _____

Wakati wa mahojiano: _____

Kazi anayefanya mhojiwa: _____

Ujuzi ulionao katika kazi yako: _____

Jina la anayehoji: _____

Maswali

1. Je, chanzo cha maji ya mnayoyatumia yanatoka wapi?

2. Ni njia gani mnayotumia ya kusitiri maji machafu na taka?

3. Ni mambo gani yanayohimiza afya bora kazini?

4. Ni mambo gani yanayozuia afya bora kazini?

5. Je, kwa njia gani mnayoyapata mboga na matunda?

6. Ni mambo gani yanayozuia kwenu kutimiza kazi vile inavyotakikana?

Appendix X: Certificate of Translation

Protocol tittle: factors associated with intestinal parasitic infections among food handlers in the selected eateries in Nairobi County.

Investigator: Saadia Adan Ibrahim

To whom it may concern

I **Silister Moraa Nyambane** do hereby testify that I translated the English version of the, interviews and informed consent forms from the version dated 28/7/2015 to Swahili language for the above-named study. I certify that this is an accurate and true translation to the best of my ability.

Signed_____

Dated_____

17081-00100, Nairobi Kenya, Email: moraa26@yahoo.com

Tel: +254-725-234083