

**ASSESSMENT OF FACTORS INFLUENCING JIGGER INFESTATION IN  
HOUSEHOLDS WITH PRIMARY SCHOOL GOING PUPILS IN KARUNGU,  
MIGORI COUNTY, KENYA**

**BY**

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**SCHOOL OF PUBLIC HEALTH AND COMMUNITY DEVELOPMENT**

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## DECLARATION

I declare that this thesis is my original work written in partial fulfilment for the award of a Master of Public Health (Epidemiology and Population Health) degree of Maseno University and has not been presented for a degree in any other university. The work herein has been carried out by me and all sources of information have been specifically acknowledged by means of references. No part of this thesis may be reproduced without prior written permission of the author and or Maseno University.

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**PG/MPH/00012/2011**

### **Declaration by the Supervisors**

This thesis has been submitted for examination with our approval as university supervisors;

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Finally, to God through his grace and wisdom he has enabled the accomplishment of this work.

## **DEDICATION**

I dedicate this thesis to my loving parents, bothers Emmanuel and Joseph, sister Evaline, daughter Liz and friends for their love, perseverance and support during this study. There is no equivalent thing to pay back for your kindness that you gave to me during my study.

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## ABSTRACT

Jigger infestation is one of the parasitic Neglected Tropical Diseases that is caused by *Tunga penetrans* also known as Tungiasis. This causes debility in resource-limited countries such as Kenya. This infestation is endemic in over 88 countries worldwide Kenya being one of them. Approximately 2.68 million people are infested with jigger in Kenya, of which 56% are school going pupils. In Karungu Division, Migori County, jigger infestation is endemic among school going pupils where its prevalence and associated factors have not been intensely studied. The main objective of the study was to assess factors associated with jigger infestation in households with primary school-going pupils in Karungu Division. The study was guided by the following specific objectives; to assess the prevalence, the cultural beliefs associated with jigger infestation; to determine the health-seeking behaviour associated with jigger infestation; and hygiene and sanitation practices associated with jigger infestation. A cross sectional study design was conducted; stratified random sampling was used to select a sample size of 383 householdheads with primary school-going children as determined by Israel et al (2009). A semi-structured questionnaire was used to collect quantitative data. Jigger infestation prevalence rate was 33.2% and the most affected age of pupils was 6-12 years. Nearly a half 48.8% of those infested by jigger had a cultural belief that jigger infestation is caused by dirt while 31.5% perceived jigger to be harmful. Over 50% of the respondents acknowledged that 1-2 children in the households were infested. 62.4% reported removing jigger using thorns and 11.7% reported the use of separation of individuals who were jigger infested. Risk factors associated with occurrence of Tungiasis at multivariate analysis included living in mud walled house (AOR=3.4; 95%CI, 1.0 – 11.4; P<0.05); wearing open shoes (AOR= 1.8; 95%, 1.0 – 3.2; P<0.05); walking bare footed (AOR=8.1; 95%CI, 3.9 – 16.7; P<0.001); grazing animals within the compound (AOR=0.6; 95%CI, 0.4-0.9<0.05); and living in lower wealth quintile index (AOR=1.8; 95%CI, 1.1 – 2.8; p= 0.19). Overall, younger children were at a greater risk and both economic and cultural factors are important risk factors. An integrated approach addressing these factors needs to be designed and implemented by all stakeholders.

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## ABBREVIATIONS

<b>AIDS</b>	:	Acquired Immunodeficiency Syndrome.
<b>DHIS</b>	:	District Health Information System.
<b>EPSD</b>	:	Epidermal Parasitic Skin Diseases
<b>IQR</b>	:	Interquartile Range
<b>KDHS</b>	:	Kenya Demographic Health Survey.
<b>MDG</b>	:	Millennium Development Goals
<b>MOH</b>	:	Medical Officer of Health.
<b>MoH</b>	:	Ministry of Health.
<b>MUERC</b>	:	Maseno University Ethical Review Committee.
<b>MPHS</b>	:	Ministry of Public Health and Sanitation.
<b>NGOs</b>	:	Non-Governmental Organizations.
<b>NTDs</b>	:	Neglected Tropical Diseases.
<b>SCPHO</b>	:	Sub-County Public Health Officer.
<b>SDGs</b>	:	Sustainable Development Goals.
<b>UNICEF</b>	:	United Nations International Child's Emergency Fund.
<b>WB</b>	:	World Bank.
<b>WHO</b>	:	World Health Organization
<b>NTD</b>	:	Neglected Tropical Disease

## OPERATIONAL DEFINITION OF TERMS

The terms used in the study are as follows:

- Child** Person who has not yet attained the legal age for consent to treatment or procedures involved in research as determined by the Kenyan law.
- Household heads** This are individual (father, mother, older siblings, grandparents or care givers) in one family setting who provides actual support and maintenance to one or more individuals who are related to him or her through Adoption, blood. This can be single, marriage, widow(er), divorced or separated.
- Jigger** A flea, also known as sand flea, Funza, Ndutu, Dudu, Chigoe or Tunga penetrans, an ecto-parasite which causes Tungiasis. They burrow into human flesh and lay pea-sized egg sacs.
- Jigger Infestation** An attack of the jigger parasite (a disease) in large numbers limiting the child's ability to carry out activities that require use of the hands and feet. In some cases it is referred to as Tungiasis.
- Pupil:** Primary school going child who attend their class in a given public primary school in the study area.
- Tunga penetrans:** An ecto parasite which embeds in human or any other animal species live entirely in their cells.
- Health-seeking behaviour** has been defined as a “sequence of remedial actions that individuals undertake to rectify perceived ill-health. It has become a tool for understanding how people engage with the health care

systems in their respective socio-cultural, economic and demographic circumstances.

**Health Practices and Methods** the regular practices that you may associate with your health, even if it is something a doctor never discussed with you or regular practices a person might associate with health.

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## CHAPTER ONE

### INTRODUCTION

This chapter summarizes the background information of the study, statement of the problem, justification of the study and the objectives. It further presents the research questions, the significance and limitations of the study.

#### **1.1 Background Information**

Jigger infestation also referred to as Tungiasis, is an ecto-parasitic infestation caused by the female flea *Tunga penetrans* which affects both human and animals (Cestar, 2007).

Tungiasis is among the Neglected Tropical Disease category (NTD), which has remained an important public health problem for poor people. The many popular names for the flea include *Funza, Ndotu, Dudu, jigger, chique, Chigoe, chica, nigua, bicho de pe', puce-chique, tu* indicates that Tungiasis has long been a common disease in many parts of the tropics (Muehlen *et.al.*, 2003; Akwe, 2008). The common English name for *Tunga penetrans* is sand flea. *Tunga penetrans* and *Tunga trimamillata* are the only species known to cause *Tungiasis* in both humans and animals. While *T. penetrans* occurs in all endemic areas which include Africa, *T. trimamillata* has only been reported in a few countries in South America (Pampiglione *et.al.*, 2009; Linard *et.al.*, 2010; Mutebi *et.al.*, 2015).

Although studies on jigger infestation have been done in central part of Kenya, no study has been done to determine its prevalence and factors associated with jigger infestation in Karungu Division, Migori County Kenya among households with primary school going children. Therefore, the current magnitude of the problem in Kenya remains unclear.

Several studies have been done on parasitic infections caused by worms which lead to malnutrition, anaemia and retarded growth in children which may increase susceptibility to other infections (Echoka, 2007; Otula, 2005; Muchiri & Fredrick, 2001; Mburia, 1999). Poor

health may interfere with the pupil's involvement in school activities and hence poor academic performance (Akwe, 2008)

Other studies have mainly focused on health conditions such as parasitic infections like malaria, HIV; tuberculosis, cancer and malnutrition (Mburia, 1999; Makena and Mwoma, 2014). These studies did not establish the effects of Tungiasis in school going children. Jigger infestation has negative impact on human health (Collins, 2009). However, the relationship between factors influencing jigger infestation in relation to school going children has not been given much attention. Worldwide, 88 countries are jigger infested, most of these infested countries are in Africa continent which includes Nigeria, Angola, Cameroon, Tanzania, Uganda and Kenya among others (Heukelbach, 2005; Ugbomoiko, 2007; Rutttoh *et al*, 2012).

In Brazil the prevalence of *Tungiasis* was at 51% (Heukelbach *et al.*, 2003; Damazio, 2006). Approximately, 45.2% of Nigerian communities in Lagos State were observed to be infected, with most of the cases occurring in children aged 5-14 years ( Ugbomoiko, 2007). The study however, did not give the effects of the infestation on children's school attendance and performance. In Cameroon jigger prevalence was highest among school-going children, decreased in adults and increased again among the elderly people (Collins, 2009). The reason given for high prevalence in children was that the culture and the traditions of the people placed children at a higher risk.

In a village in rural Haiti, nearly 75% of the population was observed to have Tungiasis lesions while 6% of the patients visiting a travel-associated dermatitis clinic in Paris had Tungiasis (Pilger, *et.al.*, 2008). In Zimbabwe and Congo Brazzaville, Tungiasis was cited as also a menace to individual households members including school going pupils (Joseph *et*

*al.*, 2006). The prevalence of Tungiasis in Tanzania has been documented to be at 39% (Mazigo *et.al.*, 2012) while in Uganda the prevalence was at 47% in children between 3-8 years of age (Mutebi *et.al.*, 2015). In Uganda, human Tungiasis occurs in all regions but the prevalence appears to be particularly high in the Busoga sub-region, South Eastern, and Karamoja in North Eastern Uganda. These regions are rated to be among the poor regions in Uganda (Ministry of Health Uganda, 2010). In many countries with the greatest presence of *T. penetrans*, lack of health education, poor housing, traditional beliefs and living in close proximity to animals are some of the factors associated with Tungiasis (Muehlen *et.al.*, 2003; Ugbomoiko, 2007) .

In Kenya, the affected population is approximated to be 3 million, out this population 1.6million are children of school going age and another 10 million are at risk of jigger infestation (MPHS, 2008 unpublished data; Ministry of Health, 2013; Makena, B. and Mwoma, 2014). However, of the 1.6 million school going children infested with jiggers nationwide little is known of the affected population in Migori County. It is against this backdrop that this study sought to determine the prevalence of jigger infestation in primary school going pupils of Karungu Division.

The severity of the *Tunga penetrans* is compounded by social stigma, community apathy and ignorance of proper control measures due to this community shuns those infected rather than helping them remove the flea, clean their homes and report cases to public health authorities to take action or take them to hospital for treatment for better health (Ruttoh, K., *et. al.*, 2012). In Karungu Division, unpublished data from SCPHO approximated 233 school going pupils each term were mostly affected in previous years on their limbs making it difficult to walk or gripe using their hands and this might have contributed to pupils to drop from school



or affect their class performance hence leading to delays in achieving quality education and good health (MPHND, 2012; (UNICEF, 2005).

Tungiasis is endemic in developing countries in the tropics, particularly where poverty and poor standards of basic hygiene and sanitation exist, like in the resource poor communities of South America, the Caribbean and sub-Saharan Africa, where it is an important but neglected health problem. Tungiasis has been reported in Africa countries including;- Nigeria, Cameroon, Zimbabwe, Congo, Uganda, Tanzania and Kenya among others (Heukelbach & De Oliveira, 2001; Kibaki, 2011). Jigger infestation has been observed in various regions in Kenya with the burden of infestation witnessed in number of regions which includes Central, Nyanza, Western, Coast and Rift valley regions. The communities affected are in the following sub-counties; Baringo, Bomet, Subukia, Bungoma, Busia, Elgeyo Marakwet, Homa Bay, Kakamega, Kericho, Kiambu, Kilifi, Kirinyaga, Kisii, Kwale, Marsabit, Migori, Murang'a, Nandi, Nyamira, Nyeri, Samburu, Siaya, Taita-Taveta, -Uasin Gishu, and Vihiga (Kibaki, 2011; Ministry of Health, 2013). The young adults jigger is agile, jumpy and crawl on the ground until they locate a suitable host, usually man.

Although armadillos, monkeys, jaguars, elephants, pigs, dogs, cats, cattle, sheep and the domestic rodents such as rat are important reservoirs in transmission of jigger infestation (Mutebi *et al.*, 2015). Tungiasis is still categorized as a zoonotic disease that affects a broad range of domestic, per domestic animals and wild animals (Eisele *et al.*, 2003). Where humans live in close contact with these animals and human behaviour favour exposure, the risk for infection is high (Feldmeie *et al.*, 2003). The relevance of each animal species in the epidemiology of human Tungiasis varies from one endemic area to another. While in urban Brazil dogs, rodents and cats are the species that are most frequently infested by *T. penetrans*. In West Africa, pigs appear to be the important animal reservoirs (Heukelbach *et al.*, 2003;

Pilger *et al.*, 2008; Pampiglione *et al.*, 2009). Jigger transmission from one person to another is not possible but it occurs through the unimproved sanitary environment. The flea survives best in sandy and dusty environments. Poverty and powerlessness or inability to do anything about it is the greatest cause of ill health among communities (Kimani and Nyagero, 2012).

The flea commonly attacks the periungual region of the toes but any other part of the body is no exception (Feldmeie *et al.*, 2003). The female jigger flea penetrates into the skin of its host and releases proteolytic enzymes during penetration and growth, leading to an inflammatory response of the skin presenting with erythema, oedemas, pain and itching. The immune response of the host might contribute to the intense inflammation observed soon after penetration. The flea uses hindquarter for breathing, defecating, and expulsing eggs (Ehrenberg, 2005). The mature eggs are extruded onto the ground, where the larvae feed, pupate and metamorphose into the adult flea (Heukelbach, 2005).

Some part of the flea remains in contact with the air, leaving a sore (240–500  $\mu\text{m}$ ) in the skin. The sore is an entry point for pathogenic microorganisms. The organism undergoes a peculiar hypertrophy in 10 days, expels several hundred eggs for a period of less than 3 weeks, and eventually dies. The shrivelled carcass is then sloughed from the epidermis by host repair mechanisms (White, 2002).

Numerous case reports detail the clinical aspects of Tungiasis. However, they almost all exclusively describe travellers who have returned from the tropics with a mild disease (Heukelbach *et al.*, 2003). After reviewing 14 cases of Tungiasis imported to the United States, it was reported that the patients showed only one or two lesions except for itching and local pain, no clinical pathology was observed (Heukelbach, 2005). In contrast, older observations show that indigenous populations and recent immigrants, as well as deployed

military personnel, frequently suffered from severe disease, characterized by deep ulcerations, tissue necrosis leading to denudation of bones, and auto amputation of digits, resulting in physical disability (Franck *et.al.*, 2003; Feldmeier, 2013). Other studies have shown that the development of eggs from adult fleas can take place indoors and outdoors. In rural and urban communities in Brazil, Tungiasis has been acquired peridomiciliary and intradomiciliary (Linard *et.al.*, 2010).

In non-vaccinated individuals Tungiasis has been associated to be one of the predisposing factor to lethal tetanus secondary infection and also may contribute to transmission of blood borne pathogens such as Hepatitis B Virus (HBV) and HIV (Feldmeier *et al.*, 2007; Ugbomoiko, 2007). This occurs when non-sterilized instruments are used to remove the embedded sand flea are shared within the household members. Death from Tungiasis related complications have also been reported in Brazil, Tanzania, Uganda and Kenya in the affected areas (Feldmeier *et al.*, 2013; Mazigo *et al.*, 2012; Jawoko, 2011; Ahadi Kenya, 2010). In a study done in Sao Paulo State, Brazil, Tungiasis was identified as the place of entry in 10% of tetanus cases. The risk of infection is high and tetanus is a common secondary infection that has reported associations with death (Feed the Children, 2007).

Household status and hygiene determines the health conditions of the occupants, home structures and hygiene is important in order to control the flea and provide pleasant atmosphere to household members (Wamalwa, 2006). In Kenya, Ahadi Trust (Non-governmental organization) has been championing the campaign to eradicating jiggers by end of 2012 which has not yet been achieved (Ahadi Kenya, 2012).

The traditional beliefs of sharing sleeping quarters with chickens and other domestic animals can be perfect carriers of the fleas that spread jigger infestation (Ahadi Kenya, 2010). When human beings live in close contact with infected animals, the risk and the intensity of jigger

infestation is high. Other communities believe that the infestation is as a result of cult, curse or wealth (Lilian, 2009; Kimani and Nyagero, 2012). Investigation to ascertain the cultural beliefs that are associated with jigger infestation in school going pupils in Karungu Division is not yet known (MPHS, 2012 unpublished data).

Health educators and health professionals worldwide have been calling for total commitment to good health as a way of life. An individual cannot be active and productive in his/her day to day activities if they are unhealthy (Kelly and Lewis, 2014). According to the Kenya Health Policy (2012-2030), every Kenyan citizen has a right to the highest attainable standard of health including reasonable standards of sanitation and the right to a clean healthy environment but many segments of the population in Karungu division have minimal access to high-quality healthcare and social services.

The underlying causes of ill-health, in the sub-Saharan Africa have been said to be mainly extreme poverty, inadequate caring practices, low levels of education of parents and poor access to health services (UNICEF, 2005). Health determinants which include social, economic and physical environment that create favourable conditions for transmission which impact on the epidemiological pattern of these diseases and health seeking behaviour (Heukelbach and De Oliveira, 2001; Kehr *et al.*, 2007) which will also increase susceptibility to environmental factors leading to more breeding sites for the vectors and increase the risk of jigger transmission (Kimani and Nyagero, 2012). If health workers are to treat the affected community then there is need to understand the affected community's practices, role of ignorance, poverty and attitude towards Tungiasis (Ehrenberg, 2005). Hence there was need to understand health seeking behaviour of primary school children in households in Karungu Division in relation to jigger infestation.

Tungiasis is considered to be a disease of the very poor and improvement in housing hygiene and sanitation practices may provide effective approach, not only to control Tungiasis, but also other Epidermal Parasitic Skin Diseases (EPSD) associated with poverty (Njeumi, 2002; Heukelbach, 2005; Mutebi, *et al.*, 2015). In Africa, epidemiological data on this ectoparasitosis are scarce (Heukelbach, 2005). Thus, there was need to conduct an empirical study to find out whether such relationship existed. This study sought to assess factors associated with jigger infestation in households with primary school going pupils in Karungu Division, Migori County, Kenya.

## **1.2 Problem Statement**

Jigger infestation is a public health problem whose adverse effects include auto-amputation of the limbs which creates open sores for secondary infection, anaemia, tetanus and mortality especially in poor communities in endemic areas. In Kenya it is approximately estimated that 3 million people are infested. International community and Kenya Government has emphasized on importance of children health and its determinant on physical growth and development, academic performance and participation in life activities among school going children while other factors contributing to children's poor health are known to include malnutrition, childhood diseases and parasitic infections.

The Kenya Health Policy (2012-2030) and the New Constitution of Kenya aims at improvement of health standards, alleviating poverty and addressing inequalities in health and education among other issues. In Kenya, Tungiasis is common among people living in twenty four counties, substantial number of between 1.2 and 1.6 million children of school going age suffer from jigger infestation. In Migori County, the infestation has been associated with considerable morbidity and loss of quality of life. In Karungu division, Migori county unpublished data for the year 2014 from SCPHO-DHIS system approximated an average of

233 school going children termly being affected on their limbs making it difficult for them to walk or gripe using their hands, this might have made them to drop from school or affected their performance hence scientific documented evidence is needed. Despite evidence that more children are infested or are at risk of infestation and considering that systematic data on disease occurrence is indeed still dearth, there was limited empirical data and knowledge on factors associated with Jigger infestation in school going children in Karungu Division. The purpose of this study was to ascertain the occurrence of jigger infestation in school going children and establish the factors associated with jigger infestation in households with school going children living in Karungu Division, Migori County.

### **1.3 Justification**

Tungiasis has long been known but is still Neglected Tropical Disease by those who are affected, the medical profession and the scientific community. Sustainable control measures against this infestation can only be developed if prevalence and other associated factors are well understood. This may lead to delay in achieving Sustainable Development Goals (SDG) on health, education and good sanitation practices in Kenya. In order to achieve these goals the children must be put at the centre of the agenda. Hence the study has provided data on jigger infestation in school going children in Karungu Division, Migori county Kenya that may assist in formulating policies to eliminate jigger infestation and achieving SDG by 2030. Moreover, several countries including Kenya agreed that every child should be provided with a nurturing, caring and safe environment in order to survive, be physically healthy, mentally alert, emotionally secure and socially competent to be able to learn.

## **1.4 Objectives**

### **1.4.1. Broad Objective**

To assess factors influencing jigger infestation in households with primary school going pupils in Karungu Division, Migori County, Kenya.

### **1.4.2. Specific Objectives**

1. To assess the prevalence of jigger infestation in primary school going pupils in Karungu, Migori County, Kenya.
2. To assess the cultural beliefs associated with jigger infestation in primary school going pupils in Karungu, Migori County, Kenya.
3. To determine the health seeking behaviour associated with jigger infestation in primary school going pupils in Karungu, Migori County, Kenya.
4. To determine hygiene and sanitation practices that are associated with jigger infestation in primary school going pupils in Karungu, Migori County, Kenya.

## **1.5. Research Questions**

1. What is the level of occurrence of jigger infestation in households with primary school going pupils in Karungu, Migori County, Kenya?
2. Which cultural practices influence jigger infestations in households with primary school going pupils in Karungu, Migori County, Kenya?
3. Which health seeking behaviours influence jigger infestations in households with primary school going pupils in Karungu, Migori County, Kenya?
4. Which hygiene and sanitation practices are association with jigger infestation in households with primary school going pupils in Karungu, Migori County, Kenya?

## **1.6. Significance of the Study**

The findings from this study has provided statistical data which will inform both Ministry of Health on health seeking behaviours and Education on the extent to which health and education has been affected by jigger infestation, so that they can devise ways of assisting the infested children. These findings are also useful to policy makers as it has yielded information on cultural practices and sanitation and hygiene that will assist in addressing challenges facing jigger infected children and the community in study area. The health programs will also benefit by determining suitable rations of resources allocated to affect group hence attainment of desired health. This will improve the management of jigger infestation in Karungu Division. The public health officers will use the findings of this study to come up with intervention measures that will improve the health of school going children in the study area and the entire community. The study will benefit future scholars who would wish to do related studies, as it will serve as a source of documented literature.

## **1.7 Limitations**

The study was only done in Karungu Division. Some respondents also withheld information about the parasite since it seemed shameful for them to tell the truth. There are different types of parasitic infestation which affects children but this study concentrated only on the jigger parasite and its effects on school going children. The study considered children because they are more vulnerable to the jigger parasite. The findings of this study may only be generalized to children who are infested with jiggers in areas with similar characteristics as Karungu Division. The study also assumed that interview was conducted without any bias, all the information given by the respondents was a true reflection of the actual situation, the sample size taken was a true representative of the entire population in the study area hence the researcher used the selected samples to make conclusions for the entire Sub-County population of interest.



## **1.8 Assumptions**

This study was done with assumption that all selected households had primary school going pupils who were vulnerable to jigger. It also assumed cultural beliefs, health seeking behaviours; hygiene and sanitation practices had an effect on the occurrence of jigger infestation.

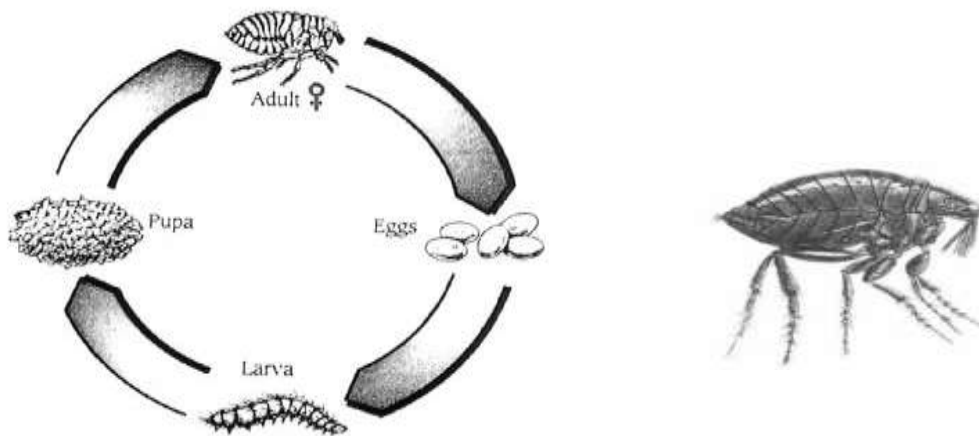
## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1. Introduction

This chapter discusses the literature related to the jigger parasite and its effects on school going children. The chapter is divided into sections under the following subtopics; Life cycle of jigger, occurrence of jigger infestation in the study area, cultural beliefs, health seeking behaviour, hygiene and sanitation practices associated with jigger infestation in the study area. Other sub topics in this chapter include conceptual framework and operational frame work.

#### 2.2. Life cycle of *Tungiasis*



**Figure 1: Life Cycle of *Tunga penetrans* and an adult Jigger Flea**

Source: (Eisele *et. al.*, 2003)

Human beings are hosts to many parasites which live inside the body or on the skin. The ones that live inside the body include hookworms, threadworms and roundworms among others while those that live on the skin include ticks, lice and jigger. Studies done on intestinal infections caused by these worms and other parasites indicate that they suck blood, leaving

the host very weak (Echoka, 2007). They also cause malnutrition and retarded growth among children of school going age (Otula, 2005).

The jigger flea is similar to other fleas except that it is smaller about 1 millimetre long (Akwe, 2008). The jigger requires a warm blooded host to reproduce. The jigger reservoir hosts include humans, domestic animals and other wild animals. The jigger parasite is not known to transmit diseases from one human to another, but it is a nuisance once it enters the skin. It causes irritation and severe sores that becomes entry point of secondary infection, (Akwe, 200; Feldmeier *et al.*, 2013). The female flea penetrates the skin and makes her home beneath the skin surface. She remains under the skin to feed and produce eggs. Several studies have shown that the development of eggs from adult fleas can take place both indoors and outdoors (Linard *et al.*, 2010). The embedded flea causes a painful inflamed swollen lesion on the infected skin. It also causes a lot of itching and irritation. If there are many fleas embedded the health consequences of the individual is serious ranging from anaemia, difficulty in walking, reducing the infected person's ability to work normally due to loss of digits or limbs to death (Akwe, 2008). For those with access to medical care, surgical removal of the jigger fleas and cleaning of the wound bring the jigger irritation to a halt (Heukelbach *et al.*, 2004).

Children are exposed to serious health risks from environmental hazards which are as a result of poor environmental conditions. These conditions are a product of adverse social and economic situations, particularly poverty and malnutrition. Poor environmental conditions are likely to harbor parasites like jiggers which may hinder children from participating effectively in school activities (UNICEF, 2005).

The main factor associated with jigger parasite infestation is poverty (Heukelbach *et al.*, 2004). Jigger is found among communities with limited resources in several countries within America, Asia and Africa (Akwe, 2008) reported that the jigger parasite is found in warm, dry soil, sand benches and stock farms in America. She adds that people who visit the said regions without shoes face the danger of getting infected with this jigger parasite. The jigger parasite is said to thrive in dusty areas and mud floors where water is inadequate (Collins, 2009).

Jigger infestation can cause condition in which an individual's general body is affected. The most at risk population are children, the elderly, physically and mentally challenged persons in the affected areas which is approximately more than ten million Kenyans (Kibaki, 2011; Ministry of Health, 2013). Epidemiological studies have reported prevalence of up to 60% in South America and Africa while in endemic areas in Kenya the prevalence ranges from 15-40% of the population (Hotez *et al.*, 2008; Ministry of Health, 2013; Mutebi *et al.*, 2015).

### **2.3 Global Status of Tungiasis Infestation**

Tungiasis has been reported to be potentially endemic in more than 88 countries worldwide with varying incidence and prevalence in low-resource communities. Estimates on the occurrence of Tungiasis rely primarily on community-based studies hence the exact prevalence rates worldwide is not well documented (Gideon, 2011; Feldmeier *et al.*, 2013). Originally, the *Tunga penetrans* was restricted to Latin America, South America and the Caribbean between the 18<sup>th</sup> and 19<sup>th</sup> centuries however, the parasite is said to have stowed-away through ships carrying sand from Brazil to Angola in West Africa (Heukelbach, 2005).

From Angola, the parasite spread to other parts of sub-Saharan Africa (Ugbomoiko, 2007). At the turn of the 20<sup>th</sup> century, the *Tunga penetrans* reached the Indian sub-continent and

thirty years later, the first case of the parasite was reported in New Orleans in the United States (Heukelbach, 2005; Sachsen, 2007; Ugbomoiko, 2007). Several older studies from southern Nigeria reported a high prevalence and morbidity in both rural and urban part of the country of more than 65% (Heukelbach *et.al.*, 2004). Historic reports from Zimbabwe and Congo Brazzaville indicated that Tungiasis was a major cause of tetanus infection in unvaccinated individuals (Njeumi, 2002). In widespread areas of South America, the Caribbean and Africa, human Tungiasis has been reported as an imperative health problem where need for operative safe and simple treatment is apparent (Heukelbach & De Oliveira, 2001).

Hundreds of millions of people in more than 70 nations in the developing countries are risk of infection (Muehlen *et al.*, 2003). In other endemic areas, prevalence ranges from 15-40% (Pampiglione *et al.*, 2009). The ministry of health approximates affected population to be over 3 million people in Kenya who need assistance in the fight against this plague. One of the key challenges is lack of political goodwill from the political leaders who feel it is embarrassing to come out openly and fight against the scourge (Ahadi Kenya, 2011; Ruttoh *et al.*, 2012). Non-Governmental Organization such as Ahadi Kenya has reported over one million children to be infested by jigger menace; however no comprehensive survey has been carried out hence making it difficult to know the actual number of population infested. Tungiasis has so far claimed over 265 lives over the last two years (Ahadi Kenya, 2011).

#### **2.4. Prevalence of Jigger Infestation**

The current epidemiological situation of jigger infestation in Africa continent is not well known or documented and is mainly based on the anecdotal observations. Recent studies in Nigeria, Cameroon and Brazil reported similar high prevalence of Tungiasis of 45%, 49% and 51% respectively. The general prevalence, especially in poor communities, has been

known to approach 50% (Njeumi, 2002; Heukelbach *et al.*, 2004; Ugbomoiko 2007; Winter, *et al.*, 2009). In an epidemiological study carried out in rural community traditional fishing village in Ceara state, north-eastern Brazil, it was found out that topographic area of the feet gives high prevalence of infestation at 51.3% (Heukelbach, 2005).

The presence of periungual lesions on the toes was identified as the most useful rapid assessment to estimate the prevalence of Tungiasis (Heukelbach, 2005). The study concluded by indicating that prevalence of Tungiasis can reliably be estimated in communities with distinct cultural and geographical characteristics through application of a simple and rapid epidemiological method. This approach can help detect high-risk communities and assist in monitoring control measures aimed at reducing Tungiasis (Muehlen *et al.*, 2003).

In a community-based cross-sectional study done in two villages in Kasulu District of Tanzania, it was found out that age was a factor in jigger infestation. Those who were above 45 years were more infested when compared to the younger children (71%). The prevalence was higher in males than in females, 45% versus 40% respectively. The study concluded that Tungiasis is a public health threat in the study villages and the disease needed to be recognized by health authorities (Mazogo *et al.*, 2012).

Tungiasis has re-emerged to epidemic levels in many countries across sub-Saharan Africa. A community-based cross-sectional study that was performed in 2 villages in Western Tanzania shows prevalence of *Tungiasis* at 71.1%, Uganda the prevalence is estimated at 40.6% while in Kenya the prevalence is not clearly documented (Kehr *et al.*, 2007; Ahadi Kenya, 2011; Olukya, 2011). Kimani and Nyagero, (2012) did a study in central Kenya - Murang'a County and found out that the prevalence of Tungiasis was at 23.6% and 18.8% of the study

participants reported that there was an infested household member and confirmed that jigger infestation as a real threat especially in rural areas.

Health workers have ignored jigger infestation problem and concentrated on other areas they feel are of immediate concern such as maternal and child health not knowing that Tungiasis also contributes to poor health outcomes in children (Njau *et al.*, 2012). Studies on health have mainly focused on health conditions such as parasitic infections like malaria, helminths and other conditions including HIV, Tuberculosis, cancer and malnutrition but jigger infestation has been ignored while it is a health issue (Makena and Mwoma, 2014). An estimated 1.4 million Kenyans translating to 4% of the total population suffer from jigger infestation, with the highest prevalence rates found in Central, Nyanza, Western, Coast and Rift valley regions. Among the counties in Nyanza region, Migori County was included in the list of counties with the highest prevalence rates (Ministry of Public Health and Environmental, 2014)

## **2.5 Cultural Beliefs Associated with Jigger Infestation**

Despite the war against Tungiasis, traditional beliefs may still be a major set-back. It is important to identify the existing knowledge and the available community structures for positive behaviour change in prevention and control of infestation (Ruttoh *et al.*, 2012). The World Health Organization has listed Tungiasis as a neglected disease of marginalized populations and has encouraged more significant research on this disease (Hotez *et al.*, 2008). It is important for the health workers to uphold the spirit of public and private partnership for sustainable hygiene practices and empowerment for sustainable health and community development. A multi-sectorial approach, active community involvement and participation are necessary if the infestation is to be addressed leading to eradication of

Tungiasis, hence improved health and economic outcomes of the country (Feldmeie *et al.*, 2003; Pilger *et al.*, 2008; Ruttoh *et al.*, 2012)

In some communities, it is a belief that Tungiasis is as assign of wealth, witchcraft, curse, cult or mental illness while in some it is believed that if a family member dies due to jigger infestation then the entire generation will suffer from the same infestation (Lilian, 2009; Carvalho *et al.*, 2003; Feldmeier *et al.*, 2003).The traditional belief of housing domestic animals in human premises increases the chances of jigger infestation especially when humans are in close contact with infected animals, the probability of infestation and the intensity of infestation are high. These animals act as reservoirs and they continue spreading the sand flea and contribute to ongoing transmission of infestation in the community as long as the animals are still in close contact with human beings (Feldmeie *et. al.*, 2003; Pilger *et. al.*, 2008).

Communities in Tanzania believed that jigger problem started in the 20th century when members of Kibondo District started interacting with foreign Indians (Mazigo *et al.*, 2012). Others believed it was caused by witchcraft and therefore people should be careful with the way they deal with each other lest they become victims of jiggers. The Maasai's in Kioge Village Tanzania believe that jiggers are a bad omen. Victims of jigger infestation in rural Uganda thought they are bewitched and that is why they are suffered from jiggers. So many of those affected end up seeking treatment from traditional healers instead of seeking conventional health care givers (Wanzala and Silai, 2016).

In some parts of central Kenya residents reported that jiggers only attack one's feet, they are caused by witchcraft, jiggers are only found in that study region, they only attack children and elderly people and those with jiggers are mentally retarded. These are only but a few of



the myths and beliefs that have been associated to the jigger infestation which has lead to loss of lives (Kimani and Nyagero, 2012). There have been reported cases of isolation and death as result of severe jigger infestation plague in most parts that are affected (Njau *et al.*, 2012). The study therefore seeks to indentify traditional and cultural beliefs that may be associated with this infestation in Karangu, Migori County, Kenya.

## **2.6. Health Seeking Behaviours Associated with Jigger Infestation**

Health of human is an important factor if productive results are to be realized from any activity. Health educators and health professionals worldwide agitate for total commitment to good health as a way of life. Health is the physical, mental and social wellness of a person. According to Kelly and Lewis, (2014) an individual cannot be active and productive in his/her day to day activities if they are unhealthy. The underlying causes of malnutrition and in turn ill-health, in the sub-Saharan Africa have been said to be mainly extreme poverty, inadequate caring practices, low levels of education of parents and poor access to health services (UNICEF, 2005).

According to the Kenya Health Policy (KHP), every Kenyan citizen has a right to the highest attainable standard of health and that includes reasonable standards of sanitation and the right to a clean heath environment even though many segments of the population have minimal access to high-quality healthcare and social services (KHP, 2012). Jigger infestation leads to poor health and jiggers can invade any part of the body. The embedded flea can be removed through using a sharp object or seeking for medical attention in hospital. When these sharp objects are shared, then this can lead to the spread of other blood borne diseases such as HIV/AIDS, hepatitis and syphilis (Ruttoh *et al.*, 2012).

Low self-esteem is as result of stigmatization and dependency brought about by debilitating effects of Tungiasis which lives one with shame and withdrawal from social group. Infested

children experience trauma as a result of excruciating pain during the removal of the jiggers. Stigma may also lead to self-medication where an individual shun away from health facilities to avoid public shame (Ruttoh *et al.*, 2012; Ahadi Kenya, 2011)

A study by Heukelbach, done in poor community set-up in north-east Brazil revealed that communities suffering from Tungiasis did not identify it as an important health threat, even with severe disease present among many children (Heukelbach *et al.*, 2005). In actual fact, mothers rarely took their children with lesions to health care centres because they feel it is a shame since this would indicate that they do not sufficiently care for their children. This leads to the fleas being removed practically by the caregivers and lesion scars left to heal by themselves, not considering the most likely secondary infection that is likely to occur due to *Tunga penetrans* (Heukelbach and De Oliveira, 2001). In a study done in Murang'a, a female respondent was quoted as saying; "I would rather hide in my hut than seek treatment because then, my family will become the laughing stock of the village" (Kimani and Nyagero, 2012). This was also noted in Baringo Central District Kenya, where a research report showed that 88% of the respondents preferred home-based treatment to hospital care, as a result of fear that many people will be aware about their condition (Ruttoh, *et al.*, 2012).

Treatment requires the mechanical removal of the flea with a sterile pin, followed by an antiseptic dressing. The use of kerosene and diesel application has been practiced in some communities. This kills the flea but results into ulceration of the skin until the dead flea is expelled (Erik, 1999). WHO deliberation on parasitic zoonotic infections identified Tungiasis as a public health problem in some parts of Africa, Kenya being one of them that needed collective approach due to its major impact on health and economic well-being of individuals (World Health Organization, 2012). In Karungu Division, there are limited records that are

associated with health seeking behaviour of school going children associated with jigger infestation. Hence the study seeks to fill in this gap.

Jigger infestation is communal issue hence efforts to fight against it have not been forthcoming due to low publicity and ignorance on the part of key players. Jigger infestation is linked to a number of factors which contribute to its thriving (Kimani and Nyagero, 2012). The level of education plays a key role in helping individuals acquire skills, knowledge and form attitudes towards life. In a cross-sectional study assessing knowledge, attitude and practices on jigger infestation among household members in Murang'a rural, about 17% were able to identify the cause of infestation to be the jigger, while about 95% were able to identify signs and symptoms of Tungiasis. The participants believed that about 60% of those infested were lazy people, 26% poor while 62% were not aware of the communal jigger prevention activities (Kimani and Nyagero, 2012; Makena and Mwoma, 2014).

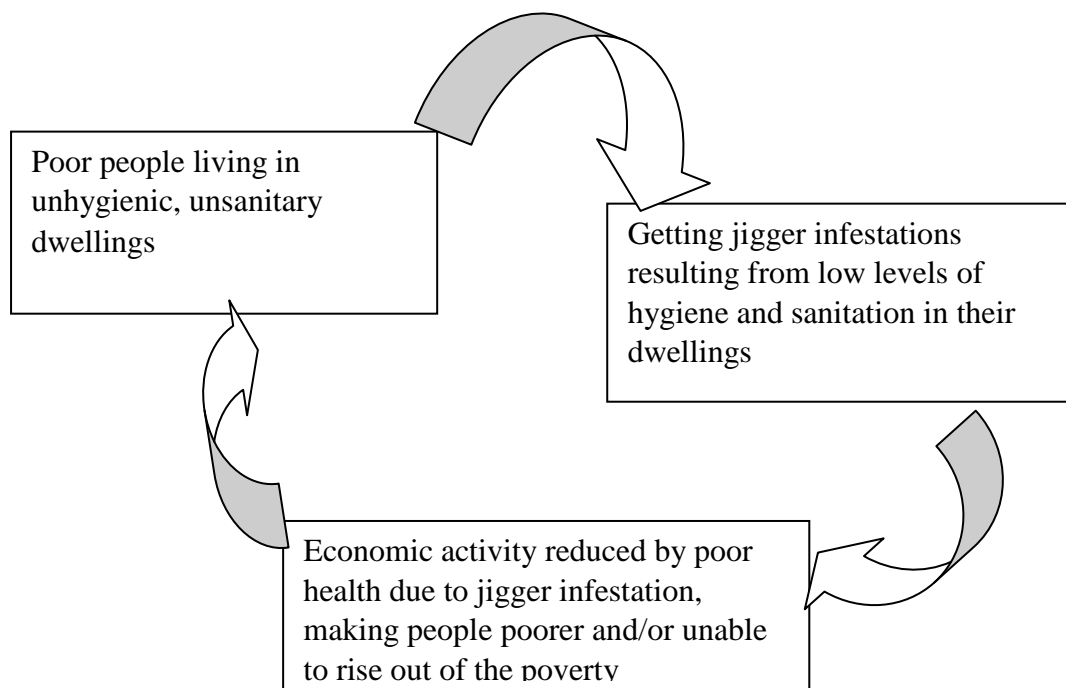
Despite efforts by few NGOs who are out to end the menace by creating awareness, educating the masses by ensuring everyone has the basic education is not enough if the levels of poverty will still be high (Ahadi Kenya, 2010). Lack of appropriate basic needs such as proper housing structures, foot ware, clean clothing, sharing houses with domestic animals as a result of poverty, not only speeds up the scourge but contributes to the vicious cycle of poverty (Ruttoh *et al.*, 2012; Kimani and Nyagero, 2012).

Low domestic income level is an indicator of poverty. From most studies done poor resource set-ups aggravate the plague. Most of those affected do not have a strong economic background meaning they are not able to meet their basic needs (Kimani and Nyagero, 2012).

In a study done in Brazil, the severity of Tungiasis was directly associated with economic status of the households where individuals live (Feldmeier *et al.*, 2002; Heukelbach, 2005).

Morbidity of Tungiasis depends on the time period of the disease meaning that the longer the infestation progresses, the higher the intensity of clinical signs and symptoms. This affects health seeking behaviour especially when it comes to limited access to health care that requires financing which will lead to delay in diagnosis and treatment especially where there is shortage of drugs for treatment. Other infections which are likely to set in are HIV/AIDS and tetanus (Heukelbach, 2005; Cestar, 2007). Karungu Division is among the areas with high poverty level, hence majority of people in the study area are living in absolute poverty (Migori County Strategic Plan, 2010; World Bank, 2013). This may be associated with jigger infestation in the study area. People afflicted with jiggers are less economically active, which raises poverty levels.

Jigger infestation prevalence data is important for understanding the magnitude of the problem, planning and evaluating the effects of interventions in policy and practices (Ministry of Health, 2013). Today Tungiasis is common and re-emerging but neglected health problem in many impoverished communities in South America, Caribbean and sub-Saharan Africa (Heukelbach and De Oliveira, 2001; Muehlen *et al.*, 2003).



**Figure 2: The Vicious Cycle of Poverty**

**Source: Adopted from Ahadi Kenya Report (2008)**

### **2.7. Hygiene and Sanitation Practices Associated with Jiggers Infestation**

Tungiasis may be as a result of poor hygiene conditions where individuals don't practice good grooming and observe personal hygiene practices. This is common in poor resource set-ups where animals and human beings are equally affected (Rutto *et al.*, 2012). Tungiasis is one of the Epidermal Parasitic Skin Diseases (EPSD) which occurs worldwide. Regardless of the considerable burden caused by EPSD, this group of parasitic diseases has been widely neglected by the scientific community and health-care providers (Feldmeier *et al.*, 2007 ;Heukelbach *et al.*, 2004). Household hygiene status determine the health conditions of the occupants hence home and school hygiene were important in order to control pests, parasites and provide pleasant atmosphere for its members to live (Kimani and Nyagero, 2012).

Jigger transmission from one person to another is not usually possible but it occurs through the insanitary environment (Heukelbach *et al.*, 2004). The flea survives best in sandy and dusty environments, after infestation, the jigger flea causes debility meaning an individual is

incapacitated or unable to do anything hence it is the greatest cause of ill health among communities (Kimani and Nyagero, 2012; Ruttoh *et al.*, 2012).

Climatic conditions influence the spread of *Tunga penetrans*, prolonged dry spells are a good medium under which Tungiasis thrives. A longitudinal study that was carried out in a slum in Fortaleza in north eastern Brazil revealed that infestation has a considerable seasonal variation, with the prevalence of Tungiasis being highest at the peak of the dry season and lowest after the first rain of the rainy season (Heukelbach, 2005; Ruttoh *et al.*, 2012).

Hygiene and sanitation practice at home and in school involve the presence and adequate use of water. According to KDHS, 24% of Kenyan households get their water from a non-improved source, mainly surface water from lakes, streams, and rivers 46% of which are the rural households (Kelly and Lewis, 2014). In western Kenya, available water sources include Lake Victoria, rivers, streams, excavated ponds, springs, and boreholes (Crump *et al.*, 2004).

Statistics reveal that 40% of the world's population lacks improved sanitation; in Kenya only 24.3% can access improved sanitation while in Karungu 78% of the total population live in unimproved sanitation (Kelly and Lewis, 2014; KNBS, 2009; UNICEF, 2012)

The most common sources of water for the residents of Karungu Division are river Kuja, Lake Victoria, bore holes (which shallow), ponds, and rain water. The main sources of water for households during both dry and wet seasons were mainly unprotected water sources for 65% of the population during dry season and 56% during wet season (Bruce *et al.*, 2005).

A study done in Baringo revealed that most of the respondents' compounds were not adequately cleaned hence prompting the heavy jigger infestation in the area. In Baringo central 56% had not observed adequate hygiene while 79% of respondents who participated in similar study in Kisii Central Districts had not observed adequate hygiene in their

compounds. This had contributed to the high infestation rates in these areas. This is because dirty environment provides good breeding grounds for the jigger. The same study revealed a low rate of floor smearing in Baringo Central, further contributing to the escalated infestation (Alfred, 2009; Lilian, 2009). Frequent smearing could check the spread of Tungiasis, as it reduces the dust, hence depriving the pest of adequate breeding grounds (Jawoko, 2011).

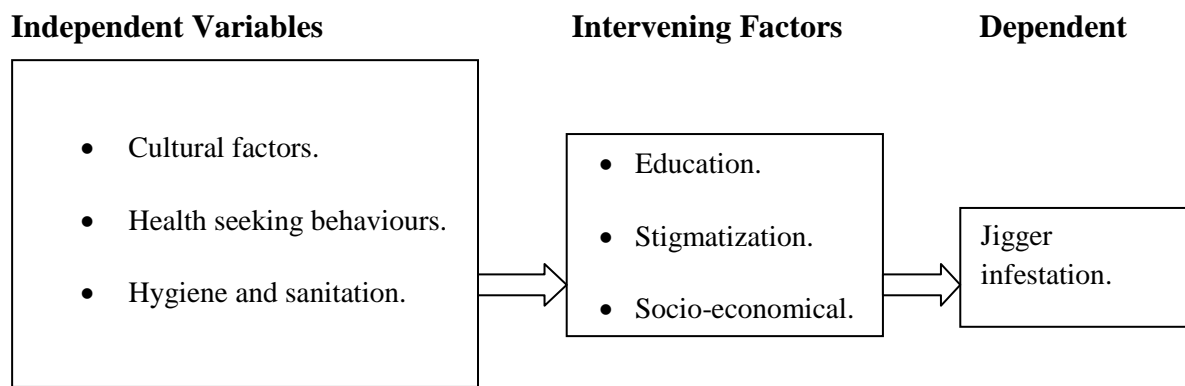
The presence of domestic animals in homes may act as reservoirs for jigger. Cattle, pigs, dogs and cats are equally affected apart from human beings. For household common pests, the brown rat of species *Rattus norvegicus* is well known to harbour the fleas that transmit jiggers (Kibaki, 2011). Hence standard sanitation and hygiene practices are the major strategies needed to prevent and control the plague. Various studies have proved that poor hygiene practices and constant association with domestic animals is one route of cross transmission of *Tungiasis* hence makes it a zoonotic disease (Kimani and Nyagero, 2012; Ruttoh *et al.*, 2012).

Tungiasis also affects the children's mental cognitive capacity compared to the uninfected children due to inability to participate in normal learning activities on the same level with uninfected pupils (Feed the Children, 2007). The infestation is coupled with intimidation and mockery from their peers and repeated absenteeism in school resulting to continuous absenteeism and eventually school drop-out (Kimani and Nyagero, 2012). Houses which often have earth floor that is not maintained are point of infestation (Alfred, 2009; Ruttoh *et al.*, 2012).

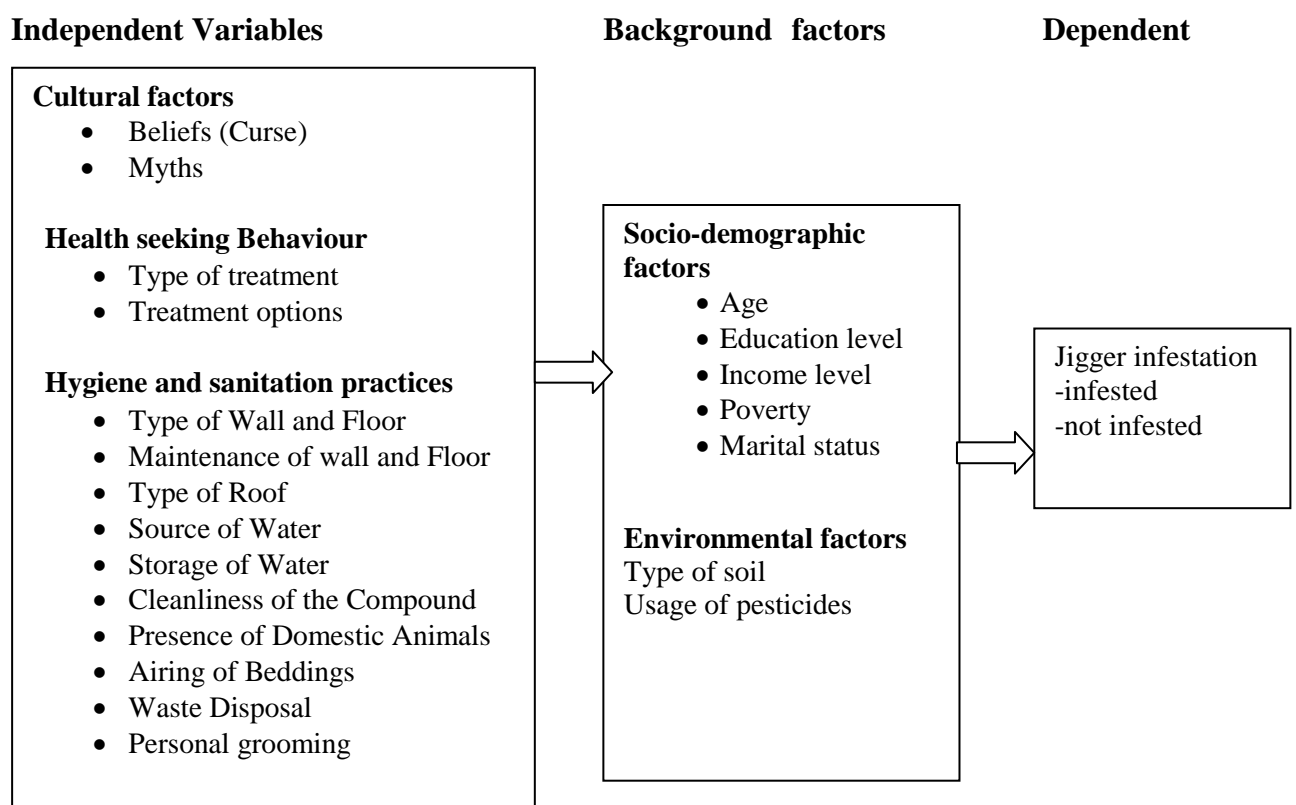
School children learn in classes made of mud and earthen floors. The cracks on the walls are very favourable habitat for jiggers to hide. The biggest causes of jigger infestation are poverty and lack of proper hygiene. People living in unclean homes, who do not take bath daily, and also who share living areas with animals especially poultry are at a higher risk of

being affected with jiggers (Ahadi Kenya, 2016). This study assessed hygiene and sanitation practices that are associated with jigger infestation in Karungu Division so as to add to the existing knowledge.

### 2.8. Conceptual Framework



### 2.9. Operational Framework



**Figure 1: Operation Framework**



## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1. Study Area**

The study was conducted in Karungu Division, Nyatike sub-county, Migori County. The study area was chosen because it was identified by Ministry of health as one of the areas that are jigger infested (Ministry of Health, 2013). Karungu division has jigger infestation burden in Migori County (DHIS, 2013). Migori County is located in the western Kenya region and it constitutes of seven sub-counties namely Migori, Uriri, Nyatike, Awendo, Rongo, Kuria East and Kuria West. Migori county borders Homa-Bay, Kisii, Narok counties and Tanzania to the southern part. The study area was Karungu Division in Nyatike sub-county whose headquarters is Nyatike town. The division has two seasons of rain that is in April to May and August to September.

It experiences temperature ranges of 21 to 35 degree Celsius. The most common economic activities in this area are farming, especially small scale farming of cereals and fishing in beaches along Lake Victoria. It lies between latitudes  $00^{\circ} 52'00''$  South and  $34^{\circ} 4'30''$  East (Appendix 9). Migori County has a population of 917,170 representing 2.38% of the national total population. The male comprise of 48% and female 52% of the total population. It has a population density of 353 people per  $\text{Km}^2$ . The population growth rate is 3.05%. The age distribution is 0-14 years (49%), 15-34 years (34%), 35-64 years (14%) and 3% over 65 years of age while Nyatike has a total population of 36,170 (KNPC, 2009; Kelly and Lewis, 2014)

Nyatike Sub-county has four government Health facilities and two private hospitals namely; Karungu Sub-county Hospital, Nyamanga Dispensary, Riat Health Centre and Otati Health Centre, St. Camillus Mission Hospital and Sori-Lakeside Nursing home makes up the private facilities available. The leading top five health problems include; Clinical malnutrition,

Urinary Tract Infections, Malaria, Respiratory Tract Infections, HIV/AIDS and Diarrheal related Diseases (Ministry of Public Health & Sanitation, 2012), although jigger infestation is highly reported by the community health volunteers there no serious medical attention taken. Households live on average at 8 to 16 kilometers to the nearest health facility in Karungu sub-county. Nyatike is still one of the poor sub-counties in Kenya and the second poverty report (June 2010) in Migori County identifies Nyatike sub-county as poor in terms of food poverty, hardcore poverty, and absolute poverty. It was approximated that 58% of the division population lives in absolute poverty whereas a large percentage experience food poverty (Migori County Strategic Plan, 2010).

### **3.2. Study Design**

This study adopted descriptive cross-sectional design. Both quantitative and qualitative methods were used. The advantages of cross-sectional study design include; it allows statistical inferences to broader populations and permits to generalize the findings to real-life situations. It also allows use of random probability samples, and this study design requires no follow up and allows collection of both qualitative and quantitative data.

### **3.3 Study Population**

#### **3.3.1. Households Ppopulation**

This study targeted households with primary school going pupils, these households were the primary study population. Currently, there are 2,699 households and total population of 12,249 within the four sub-locations (DHIS, 2013). The division is further divided into four major local administrative locations which includes; Central, West, South-East and East Karungu Location. Jigger infestation is highly manifested in primary school pupils within Otati, Raga, Okayo and Alendo sub-locations which are situated in northern dry part hence most pupils are affected (DPHO, 2013).

### 3.3.2. Inclusion Criteria

The following conditions had to be met in order to be included into this study:

- i. Participants must have been residents of Karungu Division for the last three months.
- ii. Participants must have been household heads/guardians/care givers with primary school going pupils within the randomly selected sub-locations.
- iii. The household heads who had given consent.

### 3.3.3. Exclusion Criteria

- i. All household heads that did not provide informed consent were excluded from the study.
- ii. The 10% population that were involved in pilot test were all excluded from participating in this study.

## 3.4. Sampling and Sample size Determination

### 3.4.1. Sampling Size Determination

Sample size was calculated using the formula for sample size calculation for prevalence studies. Sample size was determined using (Israel, 2009) sample size calculation formula i.e.  $n = N / [1 + N (e)^2]$

Where by:

n = the sample population;

N = the population;

e = level of precision at 95% confidence interval = 0.05

Israel's Formula

$$n = \frac{N}{1 + (N) e^2} \qquad n = \frac{2,699}{1 + (2,699) 0.05^2}$$

$$= 348.37$$

$$= 348.37 + 10\% [348.37]$$

$$= 348.37 + 34.8$$

$$= 383 \text{ Households}$$

(10% of the calculated sample size was added to buffer for refusals, non-responses, and incomplete responses thus bringing the final sample size to 383).

**Table 1: Probability Proportionate Sample size for Households**

<b>Sub-location</b>	<b>No. of villages</b>	<b>Population of households</b>	<b>Probability Proportion to size</b>	<b>Sample size</b>
Otati	10	547	$547/2699 \times 383$	<b>78</b>
Raga	18	1014	$1014/2699 \times 383$	<b>144</b>
Okayo	18	637	$637/2699 \times 383$	<b>90</b>
Alendo	20	501	$501/2699 \times 383$	<b>71</b>
<b>Total</b>		<b>2699</b>		<b>383</b>

### **3.4.2 Sampling Technique**

The study area was purposively selected as it bore great burden of jigger infestation in Migori County (DPHO Nyatike). Proportional Stratified Random Sampling (PRS) method was used to determine the proportion of households sample in each sub-location. PRS was used to select households with children in public primary schools in each village; this was done by obtaining a list of all households in each village from household register from the chiefs with the help of CHWs and households with primary school going pupils were grouped together. These households were then randomly selected to form a representative sample of the study. PRS method is superior to simple random sample since the population is divided into smaller homogeneous groups before sampling, giving less variation within the sample selected. The sampling unit was households with school going children.

### **3.5. Data Collection Tools**

#### **3.5.1 Questionnaire**

The principal investigator assisted by research assistants that were trained on basic research conducted the research. The research assistants team were members who had diploma in Community Health and basic skills in research survey. Data was collected from the respondents using semi-structured questionnaire (Appendix5) which was administered in

English/dholuo to the household head after obtaining written informed consent that was signed from them (Appendix1). Data was collected from household heads who responded on behalf of children.

### **3.6. Research Variable**

#### **3.6.1. Dependent Variable**

Jiggers infestation occurrence-number of children infested by jigger three months prior to the study-in households with primary school going pupils in Karungu division.

#### **3.6.2. Independent Variable**

- i. Socio- demographic characteristic; - age, sex, level of education and marital status.  
Socio-economic; - Source of income, type of house, Source of fuel, type of assets.
- ii. Cultural beliefs, myth, cult, curse.
- iii. Health seeking behaviour; - Type of treatment and treatment options, preventive measures.
- iv. Hygiene and sanitation;- Water source, bathing habits, Waste disposal, domestic animal kept, House structure: House floor, house roof, animals ownership and how where they live

### **3.7. Recruitment and Training of Research Assistants**

Research assistants were selected from Community Health Workers and Community Health Extension Workers who identified the selected households. Research assistants were trained to assist in data collection, interviewing techniques and on the importance of complete and legible data. Their roles in the research process as individuals and as a team, the importance of quality data collection, familiarity with the research topic, study objectives and expected outputs including the tools used and methods of data collection was also emphasized.

### **3.8. Validity and Reliability of the Tools**

Validity determines whether the research truly measures that which it is intended to measure so that any inferences made from the research findings will be accurate and meaningful to users while reliability is the measure of the degree to which a research instrument yields consistent results or data after repeated trials (Kiman,i B., Nyagero, 2012; Mugenda and Mugenda, 2003).

Validity of the survey tools were ensured by sharing the tools with supervisor and other expert researchers to ensure that the questionnaire answers what they were intended to answer. Thorough training of research assistants was conducted on the tools which were translated into local language this was further subjected to validity.

Reliability is the consistency of information generated from the data collection. A pilot study was conducted in a sub-sample of 10% of the households. A test-rest method was used in which a repeated pilot was conducted at an interval 2 weeks in the same population and correlation analysis done. The pilot study results were analysed and Cronbach's alpha determined by use of SPSS statistics.

### **3.9 Data Management**

All questionnaires were cross-checked for accuracy, consistency and completeness of data. Data were coded and entered into a Statistical Package for Social Sciences (SPSS). Data validation and cleaning process was done by running logical checks and error listing using SPSS syntax. All questionnaires were stored in lockable cabinets throughout the study and accessed by authorized persons so as to ensure confidentiality and avoid data loss.

### **3.10 Data Analysis**

The data analyses were conducted using Statistical Package for Social Science (SPSS, version 20) as follows:

- i. Description of the target population characteristics using statistical package for social sciences software. Descriptive statistics was used to obtain frequencies, means and proportions of Tungiasis. The outcome gave an estimate of the prevalence of Tungiasis. The findings were presented in tables, pie charts and bar graphs.
- ii. Both bivariate and multivariate logistic regression analysis was performed to establish effect of multiple variables on jiggers' infestation. All variables (Table 3, 4, 5 and 6) with P-value < 0.05 in the bivariate analysis were considered for the multivariate analysis. Adjusted Odds Ratios with 95% Confidence intervals (95%CI) were reported to measure the magnitude of the effect. P-values <0.05 were considered statistically significant results.
- iii. Socioeconomic status of the households was assessed using Multiple Correspondence Analyses (MCA). A composite household social economic status(SES) score was created from Multiple Correspondence Analysis of household assets and house characteristics such as domestic animal kept, type of assets, source of fuel, type of house, source of water and average income per month (Amek, 2015) was done. Household were then classified in quintiles (five groups; 1=very poor, 2= second poor, 3=third poor, 4=fourth least poor, 5= least poor). The five quintiles were then dichotomized as poor (lowest poor wealth quintiles) or less-poor (highest 2 wealth quintiles).

### **3.11. Ethical Considerations**

The proposal for the study was presented to Maseno University School of Graduate Studies. The ethical approval for the study was sought from Maseno University Ethics Review Committee (MUERC) on behalf of National Council for Science and Technology (Appendix 10, 11). Permission to collect data was sort from both county and division authority (Appendix 12). All the respondents were considered and treated anonymously. All the information collected was treated with the highest degree of confidentiality possible.



## CHAPTER FOUR

### RESULTS

#### 4.1 Introduction

A preliminary description of the data was done to determine the socio-demographic characteristics of jigger infestation by household heads as shown in Table 1. The data was disaggregated to show the two different household heads categories (Male household heads and Female household heads).

**Table 1: Socio-demographic characteristics of jigger infestation among households' heads**

Variable	Male HHH (n=160) n (%)	Female HHH (n=223) n (%)	Overall (n=383) n (%)
<b>Age in Years:</b>			
16 – 19	6 (50.0)	6 (50.0)	12 (3.1)
20 – 24	8 (53.3)	7 (46.7)	15 (3.9)
25 – 29	13 (28.3)	33 (71.7)	46 (12.0)
30 – 34	22 (56.4)	17 (43.6)	39 (10.2)
35 – 39	26 (36.6)	45 (63.4)	71 (18.5)
40 – 44	17 (34.7)	32 (65.3)	49 (12.8)
>45	68 (45.0)	83 (55.0)	151 (39.5)
<b>Level of education:</b>			
Primary	121 (41.0)	174 (59.0)	295 (77.0)
Secondary	24 (72.7)	9 (27.3)	33 (8.6)
Tertiary	15 (27.3)	40 (72.7)	55 (14.4)
<b>Marital Status:</b>			
Married	139 (50.7)	135 (49.3)	274 (71.5)
Separated	6 (46.2)	7 (53.9)	13 (3.4)
Divorced	2 (25.0)	6 (75.0)	8 (2.1)
Window	13 (14.8)	75 (85.2)	88 (23.0)
<b>Religion:</b>			
Christian	159 (42.5)	215 (57.5)	374 (97.6)
Muslim	1 (11.1)	8 (88.9)	9 (2.4)
<b>Source of income:</b>			
Salaried	15 (50.0)	15 (50.0)	30 (7.8)
Casual labourer	39 (69.6)	17 (30.4)	56 (14.6)
Farmer	97 (37.3)	163 (62.7)	260 (67.9)
Hand-outs	5 (15.2)	28 (84.9)	33 (8.6)
Fishing	4 (100.0)	0(0)	4 (1.0)

HHH; Household head

Among the 383 household heads interviewed, 41.8% were male headed households and 58.2% were female headed households. Majority 151 (39.5%) were 45 years and above, 49 (12.8%) were between the ages 40 – 44 years old, 71 (18.5%) were between the ages 35 – 39 years old and 46 (12.0%) were between the ages 30 – 34 years old. In terms of level of education, most of the respondents 295 (77.0%) had primary level of education, while 33 (8.6%) and 55 (14.4%) had secondary and tertiary level of education respectively. More than a third of the households head interviewed 224 (71.5%) were married, while 88 (23.0%) were widowed and 21 (5.5%) were either divorced or separated.

**Table 2: Relationship between socio-economic characteristics and jiggers infestation of households**

<b>Variable</b>	<b>Overall n (%)</b>	<b>Jigger infestation n (%)</b>	<b>Odd ratio (95% CI)</b>	<b>P-value</b>
<b>Domestic Animal kept:</b>				
None	24 (6.3)	8 (4.9)	Ref.	Ref.
Goats	102 (26.6)	49 (30.3)	1.85 (0.7 – 4.7)	0.197
Cattle	159 (41.5)	61 (37.7)	1.24 (0.5 – 3.1)	0.636
Sheep	10 (2.6)	7 (4.3)	4.67 (0.9 – 23.0)	0.059
Chicken	84 (21.9)	34 (21.0)	1.36 (0.5 – 3.5)	0.528
Cats	4 (1.0)	3 (1.9)	6.00 (0.5 – 67.3)	0.146
<b>Type of House:</b>				
Bricks	19 (5.0)	2 (1.2)	Ref.	Ref.
Semi-permanent	48 (12.5)	24 (14.8)	8.50 (1.8 – 40.9)	0.008*
Mud	316 (82.5)	136 (84.0)	6.42 (1.5 – 28.3)	0.014*
<b>Source of Water:</b>				
Improved	40 (10.4)	12 (7.4)	Ref.	Ref.
Unimproved	343 (89.6)	150 (92.6)	1.81 (0.9 – 3.7)	0.100
<b>Wealth quintiles index</b>				
Less Poor	150 (39.6)	50 (31.1)	Ref.	Ref.
Poor	233 (60.4)	111 (68.9)	1.87 (1.2 – 2.9)	0.004*

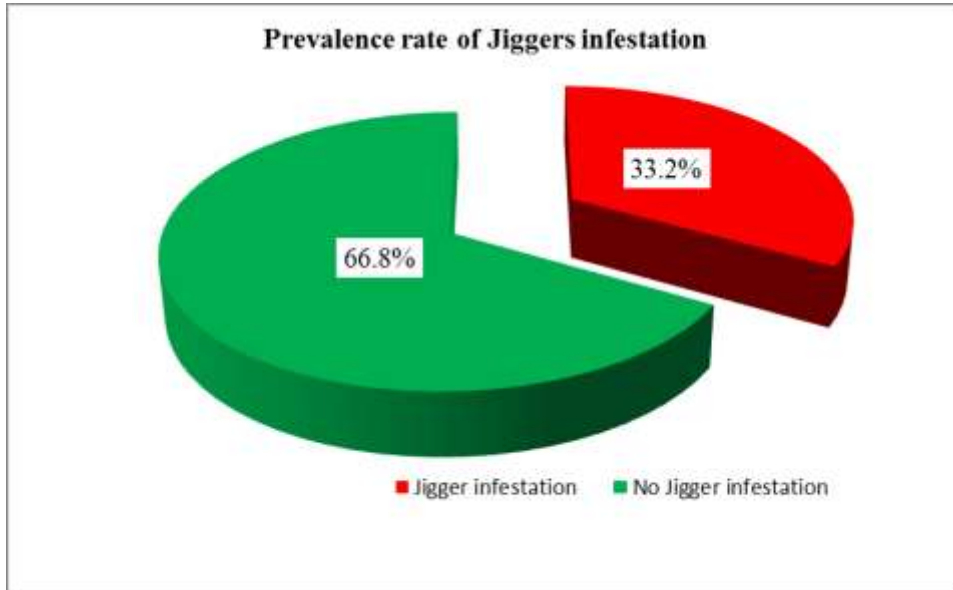
\*Significant at  $P < 0.05$ ,

Farming was the most 260 (67.9%) source of income among the participants in the area, while 30 (7.8%) and 56 (14.6%) were salaried and casual labourers respectively. Majority of

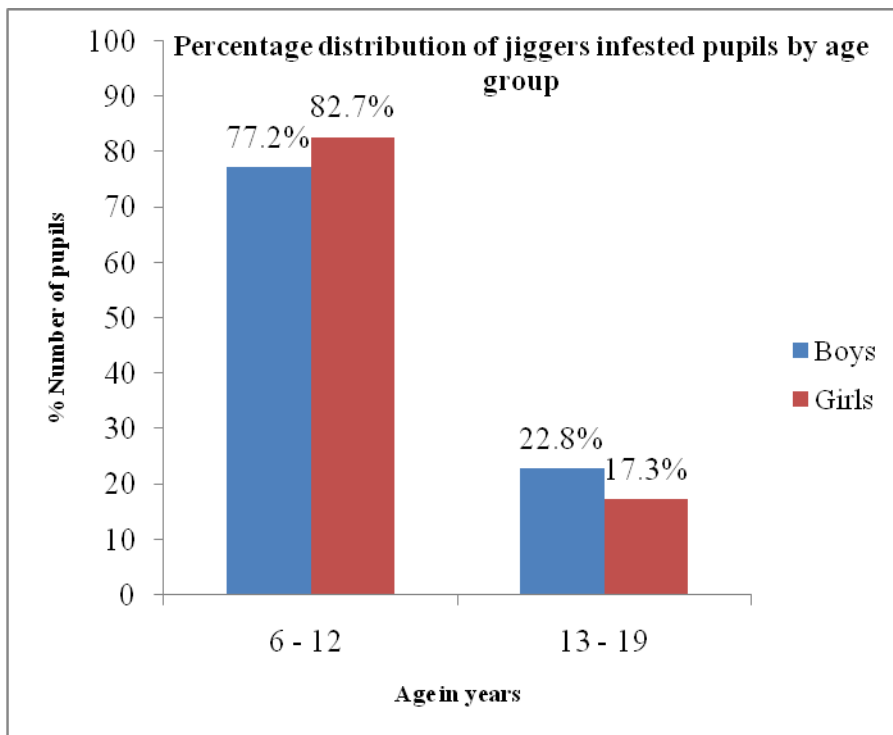
the participants 374 (97.6%) were Christian while 9 (2.4%) were Muslims (Table 1). Among the domestic animals kept, cattle 159 (41.5%) was the most kept animals by the respondents. Majority of the participants, 316 (82.5%) were using an unimproved water, nearly three quarter of the respondents 233 (71.0%) were classified as poor using the wealth quintiles index and most of the participants 316 (82.5%) were living in mud houses. In order to identify the relationship between socio-economic characteristics and jiggers infestation, the households living in mud house (OR= 6.42; 95% CI, 1.5 – 28.3) were more likely to be infested with jiggers as compared to households living in bricks type of house and those who were classified in the poor wealth quintile index (OR= 1.87; 95% CI, 1.2 – 2.9) were more likely to be infested by jiggers as compared to those classified as less poor (Table 2).

#### **4.2. Prevalence of jigger infestation**

The prevalence rate was calculated as the proportion of the number of school going pupils infected in the household divided by the total number of household members. There was 33.2% prevalence rate of jigger infestation among school going pupils in the households of Karungu division within the last three months as shown in Figure 4. Among the 383 households with school going pupils interviewed, the most affected age groups were school going pupils of age 6 - 12 years at 82.7% for girls and 77.2% for boys. As the ages increase, there was a decrease in pupils infested with jigger, 22.8% for boys and 17.3% for girls (Figure 5).



**Figure 2: Prevalence rate of jigger infestation among pupils at household's level**

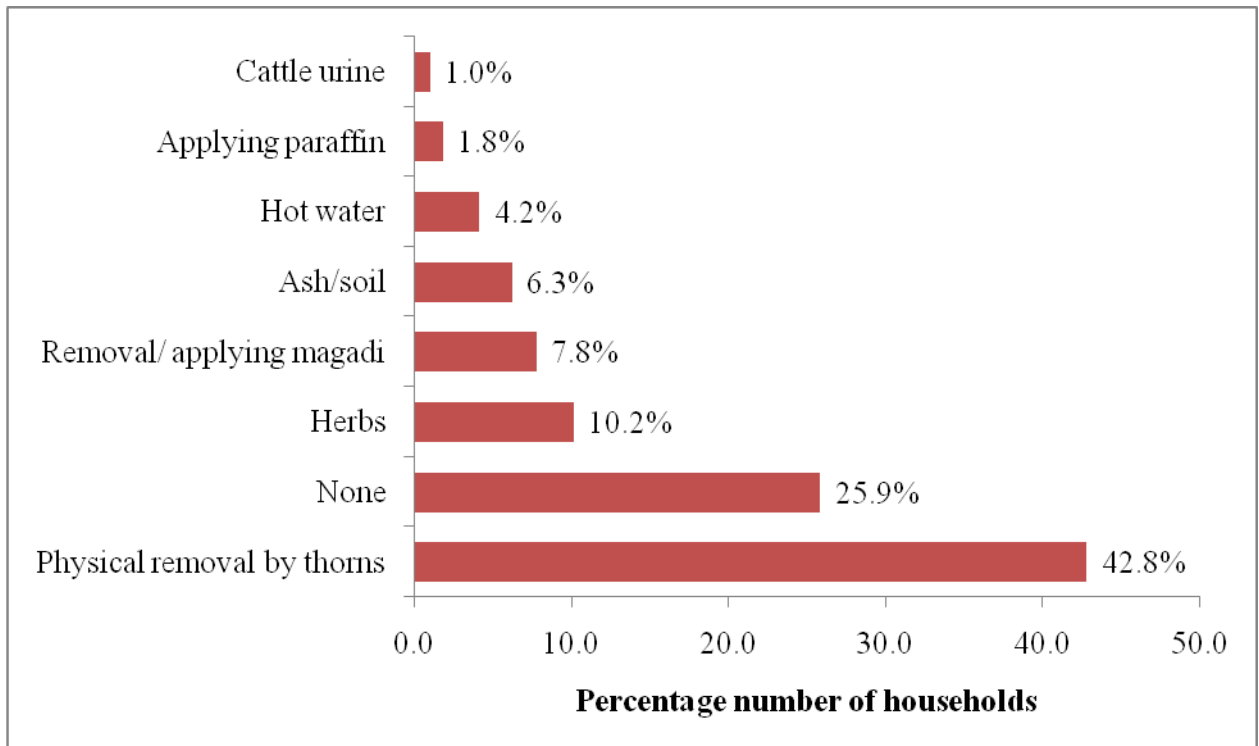


**Figure 3: The percentage number of pupils infested by jiggers at household level**

### **4.3. The cultural practices and jigger infestation in households**

Majority of the households who were infested by jiggers culturally believed that jiggers are caused by dirt 79 (48.8%), while 53 (32.7%) believed it is caused by parasite, 18 (11.1%) by worms and 8 (4.9%) believed it is caused by witchcraft and cult. Most of the infested households 139 (85.8%) culturally believed that jiggers infest seasonally.

When interviewed on how they culturally handled the infested persons, majority 101 (62.4%) reported removing jiggers, 19 (11.7%) mentioned separation, 22 (13.6%) reported doing nothing and 4 (2.5%) reported use of paraffin as a culturally accepted methods of jiggers handling. While on their cultural perception of jiggers infestation, 51 (31.5%) perceived that it is harmful, 24 (14.8%) it's kills, 13 (8.0%) perceived that it is a curse while 11 (6.8%) perceived that it demoralises. On the cultural methods for treating jiggers infested patients, nearly half 42.8% used physical removal by thorns, 10.2% applied herbs, 4.2% used hot water while 1.8% and 1.0% used paraffin and cattle urine as cultural methods for treating jiggers infested patients Figure 6.



**Figure 4: Cultural methods for treating jiggers infested patients**

In the univariate logistic analysis, it was culturally believed that worms and dirt cause jiggers infestation (OR= 5.2; 95% CI, 1.9 – 13.8) and (OR= 0.4; 95% CI, 0.3 – 0.7) respectively. Those infested with jiggers when separated (OR= 0.5; 95% CI, 0.2 – 0.8) were less likely to be infested by jigger as shown in Tables 3.

**Table 3: Effects of cultural practices on jigger infestation among households with primary school going pupils**

Variable	Jigger infested n (%)	Overall n (%)	OR (95%CI)	P-value
<b>Cultural believe:</b>				
No	59 (36.4)	145 (37.9)	Ref.	Ref.
Yes	102 (63.0)	234 (61.1)	1.1(0.7 – 1.7)	0.579
None	1 (0.6)	4 (1.0)	0.5 (0.1 – 4.7)	0.536
<b>Causes of jigger infestation:</b>				
Parasite	53 (32.7)	144 (37.6)	Ref.	Ref.
Witchcraft	7 (4.3)	21 (5.5)	0.9 (0.3 – 2.3)	0.757
Cult	1 (0.6)	5 (1.3)	0.4 (0.1 – 3.9)	0.455
Mental illness	1 (0.6)	3 (0.8)	0.9 ( 0.1 – 9.7)	0.902
Worms	18 (11.1)	24 (6.3)	5.2 ( 1.9 – 13.8)	0.001*
Dirt	79 (48.8)	181 (47.2)	1.3 (0.8 – 2.1)	0.213
Don't know	3 (1.9)	5 (1.3)	2.6 ( 0.4 – 15.9)	0.309
<b>Infestation seasonal:</b>				
No	23 (14.2)	91 (23.8)	Ref.	Ref.
Yes	139 (85.8)	292 (76.2)	2.7 (1.6 – 4.5)	0.001*
<b>Jigger handling:</b>				
Washing/removing jigger	101 (62.4)	212 (55.4)	Ref.	Ref.
Applying insecticide	8 (4.9)	19 (4.9)	0.8 (0.3 -2.1)	0.644
Spraying their houses	3 (1.8)	5 (1.3)	1.6 (0.3 – 10.1)	0.588
Use of paraffin	4 (2.5)	16 (4.2)	0.4 (0.1 – 1.2)	0.091
Do nothing	22 (13.6)	50 (13.1)	1.0 (0.5 – 2.1)	0.643
Cattle urine	1 (0.6)	6 (1.6)	0.2 (0.0 – 1.9)	0.170
Taken to hospital	4 (2.4)	10 (2.6)	0.7 (0.2 – 0.8)	0.637
Separated	19 (11.7)	65 (16.9)	0.5 ( 0.2 – 0.8)	0.010*
<b>Perception of jigger infestation:</b>				
Harmful	51 (31.5)	100 (26.1)	Ref.	Ref.
Kills	24 (14.8)	46 (12.0)	1.0 (0.5 – 2.1)	0.895
Dirt	42 (25.9)	136 (35.5)	0.4 (0.3 – 0.7)	0.002*
Demoralises	11 (6.8)	23 (6.0)	0.9 ( 0.4 – 2.2)	0.784
Insecticide/spraying	5 (3.1)	12 (3.1)	0.7 (0.2 – 2.3)	0.543
Curse	13 (8.0)	38 (9.9)	0.5 (0.2 – 1.1)	0.080
Can be treated	6 (3.7)	12 (3.1)	0.9 (0.3 – 3.2)	0.948
Witchcraft	10 (6.2)	16 (4.2)	1.6 ( 0.5 – 4.7)	0.395

\*Significant at P<0.05,

#### **4.4. Health Seeking Behaviour that Influences Jigger Infestations in Households**

Health seeking behaviours that influences jigger infestation among households infested with jiggers are shown in Table 4. Majority of the respondents 124 (76.5%) had discussed jiggers infestation with members of the household. Over half of the households members infested 112 (69.1%) were between 1 – 2 members in a household. Several methods of dealing with jigger infestation were reported i.e. removing, applying insecticide, paraffin, cattle urine, being hospitalized and separation. Most of the infested participants 101 (62.4%) reported removing as a method of dealing with jigger infestation, 19 (11.7%) mention separation as a method of dealing with jigger infestation. Nearly a quarter of the respondents 22 (13.6%) reported doing nothing while 4 (2.4%) highlighted being hospitalized as a method of dealing with jigger infestation.



**Table 4: Health seeking behaviour that influences jigger infestations in households**

Characteristics	Frequency (n=162)	Percentages (%)
<b>Number of households members infested:</b>		
1– 2 members	112	69.1
2– 4 members	44	27.2
5 – 6 members	4	2.5
7 – 8 members	2	1.2
<b>Ever discussed jiggers with households:</b>		
Yes	124	76.5
No	38	23.5
<b>How do jiggers infested people handled:</b>		
Removing	101	62.4
Applying insecticide	8	4.9
Spraying the houses	3	1.8
Use of paraffin	4	2.5
Do nothing	22	13.6
Cattle urine	1	0.6
Taken to hospital	4	2.4
Separated	19	11.7

#### **4.5. Hygiene and Sanitation Practices that Associate with Jigger Infestation**

When households infested with jiggers were interviewed on their hygiene and sanitation practices, nearly a half of the respondent 77 (47.5%) were disposing their garbage anywhere. Majority 151 (93.2%) were living in mud walled houses and 153 (94.4%) were staying in earthen floor houses. Over a half of the respondent 104 (64.2%) had their compound covered with grass/soil and 48 (29.6%) were walking bare footed.

The univariate analysis revealed that the respondents bathing twice a week (OR=2.82; 95%CI, 1.5 – 5.4) were more likely to be infested with jiggers. The households disposing their garbage in the garden (OR=2.3; 95%CI, 1.2 – 4.3) and disposing anywhere (OR=3.4; 95%CI, 2.0 – 5.6) were more likely to be infested with jiggers. The respondents who were living in mud walled house (OR=6.0; 95%CI, 3.0 – 12.2), soiled compound (OR=4.5; 95%CI, 2.1 – 9.4) and having earthen floor type of house (OR=6.5; 95%CI, 3.1 – 13.5) were more likely to be infested with jiggers. Similarly, households walking bare footed (OR=8.2; 95%CI, 4.2 – 16.5) were more likely to be infested with jiggers.

**Table 5: Hygiene and sanitation practices that associate with jigger infestation in households with primary school going children**

Variable	Overall n (%)	Infested n (%)	Odds Ratio (95% CI)	P-value
<b>Bathing:</b>				
Daily	304 (79.4)	119 (73.5)	Ref.	Ref.
Twice	45 (11.7)	29 (17.9)	2.82 (1.5 – 5.4)	0.002*
Thrice	32 (8.4)	13 (8.0)	1.06 (0.5 – 2.2)	0.870
Occasionally	2 (0.5)	1 (0.06)	1.55 (0.1 – 25.1)	0.756
<b>Garbage disposal:</b>				
Burning/Burly	140 (36.6)	39 (24.1)	Ref.	Ref.
Gutter/Ditch	47 (12.3)	18 (11.1)	1.6 (0.8 – 3.2)	0.180
Garden	59 (15.5)	28 (17.3)	2.3 (1.2 – 4.3)	0.008*
Disposed anywhere	136 (35.6)	77 (47.5)	3.4 (2.0 – 5.6)	<0.001*
<b>Wall construction:</b>				
Stone/Bricks	70 (18.3)	10 (6.2)	Ref.	Ref.
Iron Sheet	11 (2.9)	1 (0.6)	0.6 (0.1 – 5.2)	0.643
Mud	302 (78.8)	151 (93.2)	6.0 (3.0 – 12.2)	<0.001*
<b>Grazing animal in compound</b>				
No	191 (49.9)	94 (58.0)	Ref.	Ref.
Yes	192 (50.1)	68 (42.0)	0.6 (0.4 – 0.9)	0.051
<b>Compound cover:</b>				
Grass	96 (25.1)	26 (16.1)	Ref.	Ref.
Soil	48 (12.5)	30 (18.5)	4.5 (2.1 – 9.4)	<0.001*
Both grass/soil	235 (61.4)	104 (64.2)	2.1 (1.2 – 3.5)	0.004*
Sand	4 (1.0)	2 (1.2)	2.7 (0.4 – 20.1)	0.334
<b>Feet Protection:</b>				
Wearing closed shoes	252 (65.8)	82 (50.6)	Ref.	Ref.
Wearing open shoes	71 (18.5)	32 (19.8)	1.7 (1.0 – 2.9)	0.052
Walking bare footed	60 (15.7)	48 (29.6)	8.2 (4.2 – 16.5)	<0.001*
<b>Type of Floor:</b>				
Concrete slab	70 (18.3)	9 (5.6)	Ref.	Ref.
Earthen	313 (81.7)	153 (94.4)	6.5 (3.1 – 13.5)	<0.001*

\*Significant at P<0.05

#### 4.6 Multivariate analysis

Multivariate logistic regression analysis was performed in order to identify factors associated with jigger infestation. All variables with P value < 0.05 during the univariate analysis were considered in the multivariate analysis. Upon fitting all these factors using binary logistic regression and by specifying forward conditional progressive stepwise method with inclusion at P < 0.05, four factors were established to be associated with jigger infestation as shown in Table 6.

**Table 6: Factors associated with jigger infestation with jigger infestation at multivariable analysis**

Factors	Jigger infestation %	Unadjusted OR 95%CI	Adjusted OR 95%CI	P value
<b>Wall construction:</b>				
Stone/Bricks	6.2	Ref.	Ref.	Ref.
Iron Sheet	0.6	0.6 (0.1 – 5.2)	0.3 (0.1 – 3.2)	0.348
Mud	93.2	6.0 ( 3.0 – 12.2)	3.4 (1.0 – 11.1)	0.042*
<b>Feet Protection:</b>				
Wearing closed shoes	50.6	Ref.	Ref.	Ref.
Wearing open shoes	19.8	1.7 (1.0 – 2.9)	1.8 (1.0 – 3.2)	0.041*
Walking bare footed	29.6	8.2 ( 4.2 – 16.5)	8.1 (3.9 – 16.7)	<0.001*
<b>Type of floor:</b>				
Concrete slab	5.6	Ref.	Ref.	Ref.
Earthen	94.4	6.5 (3.1 – 13.5)	1.4 (0.4 – 4.9)	<0.001*
<b>Grazing animal in compound</b>				
No	58.0	Ref.	Ref.	Ref.
Yes	42.0	0.6 (0.4 – 0.9)	0.6 (0.4 – 1.0)	0.05*
<b>Compound cover:</b>				
Grass	16.1	Ref.	Ref.	Ref.
Soil	18.5	4.5 (2.1 – 9.4)	1.7 (0.7 – 4.0)	0.243
Both grass/soil	64.2	2.1 (1.2 – 3.5)	1.4 (0.7 – 2.5)	0.331
Sand	1.2	2.7 (0.4 – 20.1)	0.8 (0.1 – 8.7)	0.853
<b>Wealth quintiles index</b>				
Less Poor	31.1	Ref.	Ref.	Ref.
Poor	68.9	1.9 (1.2 – 2.9)	1.8 (1.1 – 2.8)	0.019*

\*Significant at P<0.05, AOR; Adjusted Odd Ratio, CI; Confidence Interval

Households living in mud walled house (AOR=3.4; 95%CI, 1.0 – 11.4; P<0.05) were 3.4 times more likely to be infested with jiggers compared to households in stone/bricks wall house. Wearing open shoes and walking bare footed (AOR= 1.8; 95%, 1.0 – 3.2; P<0.05) and (AOR=8.1; 95%CI, 3.9 – 16.7; P<0.001) were 1.8 times and 8.1 times more likely to be infested with jiggers respectively as compared to wearing closed shoes. Respondents grazing animals within the compound (AOR=0.6; 95%CI, 0.4-0.9<0.05) were 0.6 times more likely to be infested with jigger than those who did not graze within the compound. Respondents classified as poor in the wealth quintile index (AOR=1.8; 95%CI, 1.1 – 2.8; p=0.019) were 1.8 times more likely to be infested with jiggers as compared to respondents who were

classified in the less poor wealth quintile index. Participants living in earthen floor (AOR=1.4; 95%CI, 0.4 – 4.9; P<0.001) were 1.4 times more likely to be jiggers infested as compared to the households living in concrete houses.

## CHAPTER FIVE

### DISCUSSION

#### **5.1.Socio-Demographic Characteristics of Jigger Infestation of Household Heads**

The results of this cross-sectional study show that Tungiasis is a public health problem of major concern in Karungu Division Migori County. This concurs with studies done in Nigeria, Cameroon, Uganda, Tanzania and Kenya (Ugbomoiko, 2007; Jawoko, 2011; Mazigo *et al.*, 2012; Njau *et al.*, 2012). The level of education was generally low and majority of the respondents were married Christians having attained education up to primary school level. Most respondents lived in traditional mud houses with earthen floors and walls and more than three quarters of the population fetched water from unimproved source. Small scale farming and cattle keeping emerged to be the main economic activity practiced by majority of the household heads in this study. Previous findings of Tungiasis being a disease of the poor were further confirmed in this study where higher odds of infestation were observed in respondents classified as poor in the wealth quintile index (AOR=1.8; 95%CI, 1.1 – 2.8;  $p=0.019$ ) were more likely to be infested with jiggers as compared to respondents who were classified in the less poor wealth quintile index. Participants living in earthen floor (AOR=1.4; 95%CI, 0.4 – 4.9;  $P<0.001$ ) were more likely to be jigger infested as compared to the households living in concrete houses. This may be attributed to affordability of some basic commodities including soap, water, footwear and better shelter regarded as protective factors (Ugbomoiko, 2007). This finding also concurs with a studies done in Nigeria, Tanzania, Baringo, Muranga and Kericho were economical status of an individual influenced jigger infestation (Heukelbach, 2006; Mazigo *et al.*, 2012; Ruttoh *et al.*, 2012; Kamau *et al.*, 2014; Cheuri, 2016) while in central Kenya poverty levels was slightly low when compared to the study area (Njau *et al.*, 2012). The difference in socio-economic status may be due to the

fact that in central Kenya farming is practiced in large scale for cash crops selling due to favourable soil and rain pattern while in Karungu small scale farming is practiced for domestic consumption due to the type of soil with low usage of fertilizers. The evidence on quality and use of water is appoint of concerned by World Health Organization which reported that point-of-use water treatment is the most cost-effective approach to reach the Millennium Development Goal of halving the number of persons with no access to safe water (WHO, 2000). This study also concurred with a study done in Baringo District Kenya in which 88% of the respondents were living in earthen and dusty floors and cracked walls on their houses that gave appropriate environment for jiggers breeding site (Alfred, 2009). However, it is in contrast with a study done in Uganda where most households 89% had earthen floors that were occasionally smeared with cow dung and the most reared animal was pig (66.8%) which was also a reservoir for Tungiasis (Mutebi *et al.*, 2015).

## **5.2. Prevalence of Jigger Infestation**

The study established a 33.2% prevalence rate of jigger infestation among school going pupils in the households of Karungu Division within the last three months prior to survey. The most affected age groups of school going pupils were 6-12 years. Distribution of infestation by gender was not statistically significant. Data available from Trinidad, Tobago, and Brazil showed the prevalence of between 6% and 55% of the population being infested (Muehlen *et al.*, 2003; Carvalho *et al.*, 2003).

The prevalence in this study is within the prevalence rate range between 21% and 43% documented in other similar studies done in Nigeria among school going children (5-12 years) and in Kipkelion Kericho Kenya where prevalence of Tungiasis was at 30.1% while contrary to a study that was conducted in Murang'a South, where the prevalence rate was at 57% among school going children aged 5-12 years (Ugbomoiko, 2007; Cheuri, 2016; Njau *et*

*al.*, 2012). Distribution of infestation by gender was not statistically significant in this study. However, it is in contrast to previous studies done in a rural setting in Nigeria, the proportion of male infested was slightly higher than female (Ugbomoiko, 2007). This could be attributed to higher exposure as males spend more time outside (mostly barefooted) and difference in disease related behavior. In a study done in North West Cameroon, the prevalence was slightly high at 53% of the respondents were infested with *Tunga penetrans* and the prevalence was higher in children of school going age, diminishing in adults and then increasing again in the elderly population (Collins, 2009) and in Nigeria approximately 45.2% of a Nigerian community in Lagos State were observed to be infected, with most of the cases occurring in children aged 5-14 years (Heukelbach, 2006). This is in contrast with a study done in Kasulu district in western Tanzania where the prevalence was higher at 71.1% in elderly people (Mazigo *et al.*, 2012) while in Uganda the prevalence was at 40.6% (Jawoko, 2011).

In Alego Usonga Kenya, the prevalence was at 37.1% , Homa-Bay County 36.1%, Kisii County at 43.4% (Siaya County, 2010; Homa Bay County, 2011; DHIS KC, 2009) while in Vihiga County the prevalence is at 37.6% (Vihiga County, 2010).

### **5.3. The Cultural Practices and Jigger Infestation in Households**

Majority of the households who were infested by jiggers had a cultural belief that jigger infestation is caused by dirt 48.8%, parasite 32.7% or worms 11.1% while others had a belief that it is caused by witchcraft. Most of the infested households 85.8% had a cultural belief that jigger infestation was seasonal and those infested were handled by separating them from the rest. The results in this study are comparable to a study done in Fortaleza in north-eastern Brazil in which the native habitants were more infested than the migrants due to their traditional beliefs and practices (Heukelbach, 2005). This study also concurred with a study



done in central Kenya were almost half of the respondents 48.7% had a belief that myths and culture are associated with jigger infestation but was in contrast on how jigger is handled by removal using needles/pins at 38.7% (Kimani and Nyagero, 2012), while in Karungu Division jigger was removed using thorns at 62.4% and 10.2% of infested population used herbs. In the study area, there was slightly higher usage of thorns when compared to needles this may be due to ease in availability of thorns that grow as natural vegetation in the study area as well as the evident of semi-arid status in Karungu. Separation of infested family members may lead to stigmatization by the community members while in other reports Tungiasis had so far claimed the lives of over 265 people in the last two years and this number could be higher, as most cases go unreported due to the traditional belief that it is a taboo for these cases to be reported (Ahadi Kenya, 2010).

The results in this study disagreed with another study done in Nyaura and Nyanchwa Kisii County Kenya where the community's cultural belief of presence of jigger infestation in household members was a sign of wealth or future wealth and was not to be removed from infested people nor killed (Lilian, 2009). These differences could be due to dissimilarities in cultural beliefs and practices that were diverse in both communities.

#### **5.4. Health Seeking Behaviour that Influences Jigger Infestations in Households**

The health seeking behaviour in this study indicated that majority of the respondents 76.5% had discussed jiggers infestation with household members. Over half of the household members infested 69.1% had between 1–2 School going child/children infested in their household. Several methods of dealing with jigger infestation were reported which included removing using thorns, applying insecticide, paraffin, cattle urine, separation of the infested people and others reported doing nothing about jigger infestation. More than a half 62.4% still reported removing the jigger as a method of treatment while 2.4% responded that seeking

treatment from hospital as a method of dealing with jigger infestation although none of the respondents' sought treatment in hospital. This concurs with a study done in Kipkelion Kericho where most respondents did not seek any medication from hospitals (Cheuri *et al.*, 2016) and a study done in Baringo Central which showed that 88% of the respondents preferred home-based treatment to hospital care, as a result of fearing that many people may be aware about their condition hence stigmatizing them (Ruttoh *et al.*, 2012). This is also in contrast with a study done in Murang'a where 91% of the participants acknowledged using needles/pins as a control measure of jigger infestation (Kimani and Nyagero, 2012).

Other studies done in western Nigeria clearly indicate lack of medical attention and most infested people opted for self healing (Ugbomoiko, 2007). Other reports from Non-Governmental Organization equally show high number of infested population that does not seek medical attention (Ahadi Kenya, 2009). According to Heukelbach *et al.*, (2004) poverty and powerlessness or inability to do anything about it is the greatest cause of ill health in jigger infested communities.

#### **5.5. Hygiene and Sanitation Practices that are Associate with Jigger Infestation in Household with Primary School Going Children**

The study found out that hygiene and sanitation practices were directly associated with jigger infestation. A half of the respondent 47.5% were disposing their garbage anywhere within the homestead while majority 93.2% of the respondents were living in mud walled houses and 94.4% were staying in earthen floor houses which were not maintained. Over a half of the respondent 64.2% had their compound covered with grass/soil and 29.6% were walking bare footed and grazing the animals in the compound. This study demonstrated that Tungiasis is preventable through practicing proper personal hygiene, environmental hygiene and use of footwear. This finding concurs with a study conducted by Kimani and Nyagero, (2012), in

Murang'a Kenya, where 70.1% acknowledged poor hygiene and sanitation contributed to jigger infestation while 16.6% identified jigger flea as the cause of jigger infestation. Similarly, this study also concurs with a study done by Heukelbach, (2005) in north-eastern Brazil which demonstrated that waste collection was performed merely at the boundaries of the slums and garbage of all sorts was scattered throughout the area and there was no public sewage system and hygienic conditions were precarious which contributed to high levels of prevalence of Tungiasis. This also concurred with Ahadi Kenya report which noted that jigger infestation was caused by subsequently lack of proper hygiene and sanitation (Ahadi Kenya, 2010). Based on these findings there is potential influence of hygiene in relation to jigger infestation.

In a study done in Nigeria it was indicated that proper waste disposal reduce the incidence of Tungiasis (Heukelbach *et al.*, 2004). It was also established that there was significant reduction in risk of jigger infestation in households with school going pupils who protected their feet frequently using closed footwear when compared with households with children who walked bare footed or used open shoes. Similar results was reported in a study done in Swiss land where 63% of the respondents who use of foot ware were protected from most Neglected Tropical Diseases (NTDs) of which Tungiasis is one of NTDs (WHO, 2010; Utzinger *et al.*, 2012), while in Nigeria no regular use of closed footwear was at 51.1% contributed to jigger infestation ( Ugbomoiko, 2007). In contrast, a study done in Central Kenya by (Kimani, B., & Nyagero, 2012) about two thirds (62.0%) were not aware of communal jigger prevention, use of footwear and other control activities. This difference may be due to other factors such as alcoholism, physical challenges and illiteracy levels that were higher in the latter compared to the study area. The knowledge about Tungiasis in the study

area is low hence it does not translate to jigger preventive measures and control in the study area.

The importance of housing conditions for transmission of Tungiasis has been described in previous studies. In Brazil, living in a house built on dune, living in a house made of palm leaves and having a floor of sand or clay were important risk factors for jigger infestation in multivariate analysis (Muehlen *et al.*, 2003). Similar to studies conducted in Nigeria and Murang'a the house type was not an independent factor associated with occurrence of Tungiasis but was confounded by the type of floor of house and presence of cracks on walls and floors (Nicholas *et al.*, 2012; Kamau *et al.*, 2014; Ugbomoiko, 2007).

In this study univariate analysis revealed that the respondents bathing twice a week (17%) were more likely to be infested with jiggers compared to responded who bath daily (73%) this difference was statistically significant (OR=2.82; 95%CI;1.5-5.4;  $p<0.002$ ). The households disposing their garbage in the garden and disposing anywhere were more likely to be infested with jiggers when compared to those disposing in refuse pit (OR=3.4; 95%CI;2.0-5.6;  $p<0.001$ ). Respondents grazing animals within the compound (AOR=0.6; 95%CI, 0.4-0.9 $<0.05$ ) were 0.6 times more likely to be infested with jigger than those who did not graze within the compound. The respondents who were living in mud walled house, soiled compound and having earthen floor type were more likely to be infested with jiggers when compared to cemented houses(OR=6.0 95%CI; 3.0-12.2;  $p<0.001$  and (OR=6.5; 95%CI; 3.1-13.5;  $p<0.001$ ).

Earthen floor was found in majority of the houses in Karungu Division provides an ideal breeding environment for the jigger flea. Similarly, household members walking bare footed were more likely to be infested with jigger when compared with those who used closed

footwear (OR=8.2; 95%CI; 4.2-16.5;  $p<0.001$ ). Use of closed shoes whenever one walks on contaminated soil has been previously reported to prevent Tungiasis in Brazil (Heukelbach and De Oliveira, 2001). Consistent use of closed shoes has also been reported to reduce infestation rate by half in Nigeria (Ugbomoiko, 2007).

Similarly, lack of regular use of footwear emerged to be a very significant factor associated with occurrence of Tungiasis in Karungu Division. This concurred with a study done in Baringo central, Kisii Central and Kipkelion Kericho County Kenya where 56% and 79% of the respondents agreed that they had not observed adequate hygiene in their compounds respectively which contributed to high infestation rates in these areas (Ruttoh *et al.*, 2012; Lilian, 2009; Cheuri *et al.*, 2016).

In this study the safe disposal of waste referred to the disposal of both organic and inorganic waste inside refuse pit or waste receptacles or disposal by burning and the unsafe disposal meant the way of disposing by crude method or indiscriminate disposal. This study is in agreement with a study done by Cairncross (2010) on practices such as haphazard garbage disposal (organic or inorganic) are unhygienic behaviour and common in South and South-East Asia, Latin America and Africa. These result into environmental degradation which directly affects the health and quality of life of millions of people, especially those who comes from resource poor communities and vulnerable people in those regions.

Animal reservoir plays an important role for transmission of infestation in endemic communities (Heukelbach *et al.*, 2004). In particular jaguars, cattle, pigs, dogs, cats and rats have been described to be commonly infested (Carvalho *et al.*, 2003). In this study more than a half of the respondents have their compound ground covered with both grass and soil, majority reared cattle and they dispose the wastes anywhere within the compound hence dirty environment provides good breeding grounds for the jiggers. While studies carried out in

Baringo and that in Kisii Central District Kenya revealed a low rate of floor smearing which further contributed to the escalated infestation. Frequent smearing of earthen floor could reduce the spread of *Tungiasis*, hence depriving the pest of adequate breeding grounds (Alfred, 2009; Lilian, 2009; Ruttoh *et al.*, 2012). This study also concurred with a study done in Murang'a Kenya where *Tungiasis* was identified to be associated with respondents living in houses with an earthen floors (Njau *et al.*, 2012).

In this study more than a half collected water from unprotected source that were seasonal hence not getting enough water for domestic use this concurred with studies done in Nigeria that assessed how the presences and sources of water had an indirect relationship with *Tungiasis* (Ugbomoiko, 2007). Presence and usage of water influences hygiene standards particularly daily bathing, sprinkling of water on earthen floors, smearing and cleaning of earthen floors. The poverty among the people impedes ownership of cemented houses, shoes, vital sanitary effects and other basic needs thus compelling them to walk bare footed, reside in poorly structured houses and also share the houses with the domestic animals which are reservoirs of the pest (Ahadi Kenya, 2016).

This difference could be attributed to the fact that in Karungu the cattle were left to graze freely within the compound while studies done in Uganda shows that pigs were kept away from human houses but in shades with earthen floor with minimal environmental sanitation (Jawoko, 2011). This may be due the fact that pigs have highly vascularised coronary band and bulb at the sole of the hoof with soft skin cushion hence making them more susceptible to sand flea. The presence of many species of animal in household's compound may contribute to poor environmental sanitation and overall poor animal management particularly regarding ectoparasite control.

## **CHAPTER SIX**

### **SUMMARY, CONCLUSION AND RECOMMENDATION**

#### **6.1. Summary of the Main Findings**

In summary, the study had sought to address four objectives; to determine the occurrence of Jigger infestation, to assess cultural beliefs associated with jigger, to determine health seeking behaviour associated with jigger and hygiene and sanitation practices that are associated with jigger infestation in households with primary school going children in Karungu Division, Migori County.

##### **6.1.1. Prevalence of Jigger Infestation**

The study established an overall prevalence of jigger infestation of 33.2%. The most affected age group of children was 6-12 years.

##### **6.1.2. Cultural Beliefs Associated with Jigger Infestation**

Most respondents 48.8% had a cultural belief that jigger was caused by dirt or worms and 63% agreed that there were cultures and myths that are associated with jigger while 85.8% agreed that jigger infestation was seasonal and infested people were separated from the rest.

##### **6.1.3 Health seeking Behaviour**

Majority of the respondents 69.1% had 1-2 children who were jigger infested in the household while 62.4% reported removal of jigger as a method of treatment jigger others applied paraffin and cattle urine. None of the respondents sought medical attention from hospital.

##### **6.1.4. Hygiene and Sanitation Practices**

The following factors were statistically significant frequency of taking bath, garbage disposal within the compound, wearing open shoes, walking bare footed, type of house and grazing domestic animals in the compound were most likely to be infested by jigger.

## **6.2. Conclusion**

### **6.2.1. Prevalence of Jigger Infestation**

The prevalence of jigger infestation was relatively high 33.2%, this was similar to a study done in Kipkelion Kericho 30.1% and slightly lower than that found in Muranga at 57%.

### **6.2.2. Cultural Beliefs Associated with Jigger Infestation**

Most respondents 48.8% had a cultural belief that jigger was caused by dirt or worms and jigger was removed using thorns while in Central Kenya 48.7% had a belief that there were myths and culture associated with jigger infestation while 16.6% identified jigger flea as the cause of jigger infestation but was in contrast on how jigger was handled by removal using needles/pins at 38.7%.

### **6.2.3. Health Seeking Behaviour**

More than a half of the respondents 76.5% had discussed jigger infestation with members of the household. In most households 69.1% had between 1 – 2 children infested with jigger who were treated by applied insecticide, paraffin and cattle urine while none sought medical attention from hospital while in Baringo 88% of the respondents preferred home-based treatment to hospital care.

### **6.2.4. Hygiene and Sanitation Practices**

Types of house, frequency of taking bath, garbage disposal, use closed footwear, grazing domestic animals in the compound were factors influencing jigger. This was similar to Murang'a Kenya, where 70.1% acknowledged poor hygiene and sanitation contributed to Tungiasis. While in Nigeria lack regular use of closed footwear was at 51.1% contributed to jigger infestation. In Central Kenya 62.0% were not aware of communal jigger prevention, use of footwear and other control activities.

## **6.3. Recommendations**

For effective and sustainable control of Tungiasis, it is recommended that the Ministry of



Health should encourage the following:

### **6.3.1 Recommendations on Occurrence of Jigger Infestation**

- i. Due to the prevalence of Tungiasis among school going pupils in Karungu Division, more efforts should be geared towards prevention and control of jigger fleas and treatment to discontinue the transmission cycle. These include environmental and personal hygiene, chemical control of jigger fleas and the use of repellents.
- ii. More community-based studies and studies on animal reservoirs on zoonotic jigger infestation are required to determine the extent of this problem in other counties that are jigger infested to enable health policy makers to design prevention programs that suits each region.
- iii. Empower household members with health education information. A continuous multi-sectorial approach, active community involvement and participation are also necessary to identify and address underlying causes to jigger infestation. This will go a long way in reducing the Tungiasis prevalence rate in the study area.

### **6.3.2. Recommendations on Cultural Beliefs**

Continuous community sensitization, counselling and education at household level, barazas and at schools on jigger infestation, the causative agent and how it can be prevented. Regular awareness campaigns should be one by partnering with other non-government organizations on preventive measures to be taken to limit jigger infestation.

### **6.3.3. Recommendations Health Seeking Behaviour**

- i. Health education that focuses on behavior change among those infested (seeking health care in the formal health care system).
- ii. Administration of Tetanus Toxoid (TT) vaccine to those infested by jigger and those at risk should be scaled up both at facility and household level to reduce secondary tetanus infection. Therefore, treatment camps should be organized regularly as an important outreach mechanism in endemic areas.

- iii. Follow-up of jigger infested people identified at household level for adequate treatment. Promotion materials should be provided with an aim of educating the public and particularly those persons at risk on the lifecycle of the jigger flea to enable them take preventive measures and control hence breaking the life cycle this should be complemented with information on hygiene and it should ideally target the entire community.

#### **6.3.4. Recommendations Hygiene and Sanitation Practices**

- i. Dusting or spraying domestic animals and houses with insecticides is necessary in reducing the infestation of jiggers from animals to human. Improvement of housing conditions (cement floors or smear continuously with cow dung, smearing cracked walls), implementation of a sustainable positive hygiene and improvement on sanitation, personal hygiene, availability of treated piped water, health education and waste disposal management.
- ii. Animals sleeping quarters should be separated from human residence because animals act as reservoirs for sand flea that causes jigger infestation. Security should be reinforced in the study area hence limiting theft of domestic animal and avoiding keeping domestic animals within the house or grazing them in the compound.

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## APPENDICES

### APPENDIX 1: Informed Consent for Household Heads.

MASENO UNIVERSITY  
PRIVATE BAG  
MASENO

**RISK FACTORS ASSOCIATED WITH JIGGER INFESTATION AMONG HOUSEHOLDS WITH PRIMARY SCHOOL GOING PUPILS IN KARUNGU, MIGORI COUNTY**

Serial No. -----

Morning/Afternoon. My name is.....I am part of the team assessing risk factors influencing jigger infestation among households with primary school going pupils in Karungu Division. Our team will interview 383 households in this area. We have been granted permission by your local leaders to conduct this study. Your house has been randomly selected to participate. We would very much appreciate your participation in this survey.

#### **Purpose of the study**

The main objective of the study is to assess the risk factors influencing jigger infestation in households with primary school going pupils in Karungu Division, Migori County. The study will form the baseline information on the factors influencing jigger infestation in order to recommend for sustainable intervention strategies that will address knowledge, attitude and practice of the community members. The study will be useful to target population, Government and other stakeholders to know the important risk factors that are associated with jigger infestation hence reducing jigger occurrence.

#### **Study procedures**

If you agree to take part in this study, you will be interviewed on various issues such as demographic characteristics, occurrence of jigger, cultural practices, health seeking behaviour, social-economical factors, hygiene and sanitation practices. The questionnaire will take a maximum of 30 minutes. It will be conducted at household level.

**Benefits**

You may not have a direct benefit as an individual however your participation would benefit society by helping in providing vital information that would enhance preventive rather than treatment measures for jigger infestation, management and in policy making. The information you give will help come up with ways of helping in the design of policies and programs to curb this menace.

**Confidentiality**

Your identity and other personal information remain confidential and will not appear when we present this study or publish the results. You will receive a copy of the consent form.

**Right to refuse or withdraw**

It is important that you understand the following general principles that will apply to all participants in the study:

1. Participation is entirely voluntary.
2. You may withdraw from this study at any time without penalty or loss of benefits.

I acknowledge that this consent form has been fully explained to me in a language that I understand and had the opportunity to ask questions which have been answered to my satisfaction. I agree voluntarily to participate in this study and understand that I have the right to withdraw at any time without penalty.

Participant's signature \_\_\_\_\_ Date: \_\_\_\_\_

Study No.: \_\_\_\_\_

Investigator's Name: \_\_\_\_\_ Date \_\_\_\_\_

**Contact:** If you have questions in future, please contact,

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## APPENDIX 2: Informed Consent Translated into Local Language for Household

Heads.

**MBALA RIANY MAR MASENO  
NAMBA MAR POSTA  
AGULU MA KENDE  
MASENO**

***Yore mag achiji maluwore gi medruok mar minembe ekind ute kod nyindo mag primary skul ei Karungu, Migori County***

Namba .....

Oyware/Osaure. Nyinga en..... An achiel kuom jo nonro mar *Yore mag achiji maluwore gi medruok mar minembe ekind ute kod nyindo mag primary skul ei Karungu, Migori County*. Oganda wa, biro non utel 383 ei aluora ni. Osemiwa thuolo mar timo nonro gi jotendu mag gweng' . Ute u oluom ni mondo obed achiel kuom nonro ni. Wabiro mor kod yie maru mar bedo achiel kodwa ei nonro ni.

### **Achune mar Nonro**

Tiend nonro ni hie, en kedo gi achije mag landruok mar minembe *ute kod nyindo mag primary skul ei Karungu, Migori County*. Nonro ni biro chiwo kuku mar weche ma medo landruok mar minembe, eka yore malong'o ibiro many ne ji, kokal kuom; miyo gi ng'eyo, paro kod tim ma inyalo ked godo landruog ni. Nonro ni biro bedo malong'o ne ute moseyier gi, ne sirikal kod jotelo mokiewo kod nonro ni, mondo gi ng'e achije maluwore gi medruokmar minembe, mondo omi dok chien mar minembe obdie.

### **Yore Mag Nonro**

Ka ise yie bedo achiel mar nonro, ibiro penji ng'eyo mari ei yore kaka chal mar jok mudak godo, chakruok mar minembe, kit anyuola ma untie, kit thieth, ng'iyoy mar jo gweng', yore mag ler mar kod ritruok, nonro ni biro kawo thuolo mar dakika piero adek kende.

### **Ohala mar Nonro**

Ok inyal bedo gi ohal moriere kaka jachiwore to mak mana bedo ni e ichiel mar nonro ni biro konyo oganda mar gweng eyo miyo gi adiera mabiro konyo geng'o molo thiedho landruok mar kute mag minembe kod rito gi loso chike ma inyalo luo. Duoko ma ibiro chiwo biro kelo yore ma konyo loso chike kod thuolo ma inyalo ti godo kuom tieko masira ni.

### **Apanda mari**

Ng'eruok mari kod giki ma kende biro dong' ka opandi makata ok bi yel e kinde mar ndiko duoko mar nonro. I biro yudo barua mar chiwruok ni.

**Ratiro mar Tamruok kata Weyo**

En giam ber ni koro iseng'eyo yore ma ibiro lu kod jochiwore duto.

Chiwruok en mana kuom yie mar ng'ato

Inyalo wuok ei nonro ni e kinde moro amora maonge siem moro amora kata lal mar ohala

An kod adier ni barup chiwruok ni oselero na e dhok ma awinjo; bende na bedo kod thuolo mar penjo moro amora mane oduoka e kar dwaro mar chunya. I ayie kuom chiwruok ni modo abed achiel kod nonro kendo ang'eyo ni an gi ratiro mar wuok e kinde moro amora maonge siem maibiro miya.

Seyimar Jachiwore \_\_\_\_\_ Tarik \_\_\_\_\_

Namba \_\_\_\_\_

NyingJatim-----

Nonro: \_\_\_\_\_ Tarik \_\_\_\_\_

Yor Yudo wa

Ka in kod penjo e kinde ma biro

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**APPENDIX 3: Informed assent for School Going Children.**

**MASENO UNIVERSITY  
PRIVATE BAG  
MASENO**

**RISK FACTORS ASSOCIATED WITH JIGGER INFESTATION AMONG HOUSEHOLDS  
WITH PRIMARY SCHOOL GOING PUPILS IN KARUNGU, MIGORI COUNTY**

Serial No.-----

I, \_\_\_\_\_, have been told that one of my parents/guardians has given his/her permission for me to participate in this study about risk factors associated with jigger infestation among households with primary school going pupils in Karungu, Migori County.

The children will be asked simple questions which will include; what jigger are? What causes jigger? Has she/he being in affected with jigger in the last three months? Which parts of the body are commonly affected? Any kind of treatment he /she got? Has she / he ever missed attending school due to jigger infection? When infected do you freely mingle with your fellow children? Are there any other children in the neighbourhood that are affected? How often do you shower and change your clothing? Which type of footwear do you use when going to school? Are you taught about jigger infestation in school by your teachers?

I understand that my participation is voluntary. I have been told that I can stop participating in this project at any time. If I choose to stop or decide that I don't want to participate in this project at all, nothing bad will happen to me. My grade/treatment/care (include as appropriate) will not be affected in any way.

**Accept----- Date-----**

**Decline----- Date-----**

**Contact:** If you have questions in future, please contact,

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**APPENDIX 4: Child/Minor Assent Form Translated into Local Language (Informed Assent)**

**MBALA RIANY MAR MASENO  
NAMBA MAR POSTA AGULU MA KENDE  
MASENO**

**Yore Mag Chich maluwore gi medruok mar minembe ekind ute kod nyindo mag primary skul ei Karungu, Migori County**

Namba .....

An ....., osenyisa ni achiel kuom jonyuol na kata watna ose chiwo na thuolo ni mondo abed achiel kuom nonro mar Yore Mag achiji maluwore gi medruok mar minembe ekind ute kod nyindo mag primary skul ei Karungu, Migori County.

Ang'eyo ni bedo na ei nonro en kuom chiwruok. Osenyisa ni anyalo weyo bedo ei achiel mar nonro saa saya. To kata ka ayiro mar weyo bedo e nonro ni, oonge gi moro amora marach mabiro timore na. My rang'iny mara kata chiwrok na kata ratiro no ok bi kethore e yo moro amora.

**Yie..... Tarik.....**

**Dagi..... Tarik.....**

Yor Yudo wa

Ka in kod penjo e kinde ma biro

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**APPENDIX 5: Household Questionnaire**

**MASENO UNIVERSITY  
PRIVATE BAG  
MASENO**

**RISK FACTORS ASSOCIATED WITH JIGGER INFESTATION AMONG  
HOUSEHOLDS WITH PRIMARY SCHOOL GOING PUPILS IN KARUNGU  
DIVISION, MIGORI COUNTY**

Serial No. -----

Name of the nearest school/household Number.....  
Location.....  
Sub-location/ Village .....  
Date.....

*Please tick (✓) the option that best suits your opinion on the corresponding statements.*

**SECTION A. SOCIO-DEMOGRAPHIC FACTORS**

1. Gender

Male [ ] Female [ ]

2. What is your age? .....

3. What is the highest level of education you have attained/Respondent?

Primary [ ] Secondary [ ]  
Tertiary [ ] Others specify.....

4. Marital status

Married [ ] Separated [ ]  
Divorced [ ] Widowed [ ]  
Other specify.....

5. Religion

Christian [ ] Muslim [ ]  
Other specify.....

6. Number of household members.....

7. What is your Source of income

Salaried [ ] Casual laborer [ ] Fishing [ ]  
Peasant Farmer [ ] Hand outs [ ] Large-scale farmer [ ]

Others Specify .....



8. Which type of domestic animals do you keep and how many are they?

Goats [ ] [ ] Cattle [ ] [ ]  
 Sheep [ ] [ ] Chicken [ ] [ ]  
 Cats [ ] [ ] Rabbits [ ] [ ]  
 Dogs [ ] [ ] Pigs [ ] Non [ ]  
 Others specify.....

9. **Socio-economic status of households** (Tick were applicable).

<b>Type of asset</b>	Television	Radio	Furniture	
<b>Source of fuel</b>	Firewood	Charcoal	Gas	
<b>Type of house</b>	Mud	Semi-permanent	Brick	
<b>Source of water</b>	Improved	Unimproved		
<b>Source and average income per month</b>				

**SECTION B. KNOWLEDGE AND HEALTH-SEEKING BEHAVIOUR**

1. Do you know what jiggers are?

Yes [ ] No [ ] Not sure [ ]

2. What is the major cause of this disease? .....

.....

3. Have you ever discuss with your household members about Jigger infestation?

Yes [ ] No [ ]

4. How do you consider jigger infestation in relation to other disease?.....

.....

5. Has any household member been infested by jigger in the last three months?

Yes [ ] No [ ]

If Yes, how many?

Age	Gender	Level of education	Treatment given	How many days missed to work/school	Occupation/school

5. When infested do you mingle with others?

.....  
.....

6. Which action do you take when infested? .....

7. Are there other diseases/infections that are related to jigger infestation?

Tetanus [ ] Skin Infections [ ]

Disability [ ] Others (specify) .....

8. Has anyone died due to jigger infestation in his village?

.....  
.....

**SECTION C. CULTURAL PERCEPTION ABOUT JIGGERS INFESTATION**

10. What causes jiggers infestation?

Parasite [ ] Witchcraft [ ]

Cult [ ] Mental illness [ ]

Worms [ ] Dirt [ ]

Don't know [ ]

Others (Specify).....

11. In this society are there any cultural believe that are related to jigger infestation?

Yes [ ] No [ ]

If yes, state.

.....  
.....

12. How do jigger infested people handled?

.....  
.....

13. Are there any cultural methods are used to treat jigger infested people?

.....  
.....

14. Is the infestation seasonal?

Yes [ ] No [ ]

15. If Yes, when is the infestation high/low? .....

16. What is your perception about jiggers' infestation?

.....  
.....

**SECTION D. HOUSEHOLD HYGIENE AND SANITATION**

17. What is the main source of water for use?

- |                  |     |                       |     |
|------------------|-----|-----------------------|-----|
| Borehole         | [ ] | Protected dug well    | [ ] |
| Protected spring | [ ] | Rain water collection | [ ] |
| River /Lake      | [ ] | Unprotected dug well  | [ ] |
| Unprotected      | [ ] | Spring                | [ ] |
| Piped water      | [ ] |                       |     |

18. How many times do the members take bath in a week?

- |                     |     |       |     |
|---------------------|-----|-------|-----|
| Daily               | [ ] | Twice | [ ] |
| Thrice              | [ ] | Non   | [ ] |
| Others Specify..... |     |       |     |

19. Where do you dispose your garbage?

- |                        |     |                   |     |
|------------------------|-----|-------------------|-----|
| Burning/Burly          | [ ] | Gutter/Ditch      | [ ] |
| Garden                 | [ ] | Disposed Anywhere | [ ] |
| Others (Specify) ..... |     |                   |     |

20. What is you compound ground covered with?

- |                     |     |                        |     |
|---------------------|-----|------------------------|-----|
| Grass               | [ ] | Soil                   | [ ] |
| Both Grass and Soil | [ ] | Others (specify) ..... |     |

21. Do domestic animals graze within the compound?

- |     |     |    |     |
|-----|-----|----|-----|
| Yes | [ ] | No | [ ] |
|-----|-----|----|-----|

22. If Yes, which type of animals?

- |                     |     |         |     |      |     |
|---------------------|-----|---------|-----|------|-----|
| Goats               | [ ] | Cattle  | [ ] | Dogs | [ ] |
| Sheep               | [ ] | Chicken | [ ] |      |     |
| Cats                | [ ] | Rabbits | [ ] |      |     |
| Non                 | [ ] |         |     |      |     |
| Others specify..... |     |         |     |      |     |

23. Which material is used for construction of houses walls?

- |                        |     |        |     |
|------------------------|-----|--------|-----|
| Stone/bricks           | [ ] | Timber | [ ] |
| Iron Sheet             | [ ] | Mud    | [ ] |
| Others (Specify) ..... |     |        |     |

24. Which type flooring do the houses have?

- |               |     |             |     |
|---------------|-----|-------------|-----|
| Concrete Slab | [ ] | Timber Slab | [ ] |
| Wooden Poles  | [ ] | Earthen     | [ ] |

25. How often do you clean/ smear the house floor/wall within one week?

.....  
 .....

26. How often do you clean and air the beddings used by household members?

.....  
.....

27. How do you protect your Feet? (Give multiple response were applicable)

Wearing Closed Shoes [ ]      Wearing Open Shoes [ ]  
Walk Bare footed [ ]      Others (Specify) .....

28. Do you use insecticides when farming at the household level?

Yes [ ]      No [ ]

29. What is your common resting place in the homestead?

Under The Tree [ ]      In the Class Room [ ]  
Veranda [ ]      Road Paths [ ]  
Others (Specify) .....

30. How can jigger infestation be managed/ prevented? .....

.....

31. Do you have any comments or suggestions regarding the interviews?

.....  
.....  
.....

**Thank you for your cooperation**

**Name of Facilitator.....Date.....**

**APPENDIX 6: Household Questionnaire Translated to Dholuo.**

**MBALA RIANY MAR MASENO  
NAMBA MAR POSTA AGULU MA KENDE  
MASENO**

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**FACTORS ASSOCIATED WITH JIGGER INFESTATION AMONG HOUSEHOLDS  
WITH PRIMARY SCHOOL GOING PUPILS IN KARUNGU DIVISION, MIGORI  
COUNTY**

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**GIGO MAHINYO KELO TUOCHE MAG KUDNI MAR MINEMBE EUTE MAN  
KOD NYITHINDO MAPOD SOMO E SKUNDE MAG PRAIMAR MAYUDORE  
EGWENG' KARUNGU, EI COUNTY MA MIGORI**

---

---

Amosi ahinya ni oyaore/iriyo nade? Nyinga en ..... An achiel kuom jotim nonro manono **Gigo Mahinyo Kelo Tuoche Mag Kudni Mar Minembe Eute Man Kod Nyithindo Mapod Somo E Skunde Mag Paimar Mayudore Egweng' Karungu, Ei County Ma Migori.** Wabiro timo nonro ka wapenjo penjo e ute ma wayiero e Gweng'ni, kendo wayudo thuolo mar timo mano kuom jotendu mag gweng'ka. Odi en achiel kuom ute manyocha wayiero eyor kwanyo ute aluoma-aluoma. Wakwayi kod muolo ahinya nimondo iyie iduokie penjo ma wabiro penji etimo nonroni.

**Thoro mar Timo Nonro (Gimomiyo Watimo Nonroni)**

Thoro maduon'g momiyo watimo nonroni en nimondo wayang anena malong'o **Gigo Mahinyo Kelo Tuoche Mag Kudni Mar Minembe Eute Man Kod Nyithindo Mapod Somo E Skunde Mag Paimar Mayudore Egweng' Karungu, Ei County Ma Migori.** Duoko mabiro wuok bang' timo nonroni, wageno mondo wati godo eyor chano okenge mowinjore, kendo mabiro konyowa kuom ndalo mabiro eyor loko pachwa egigi ma wang'eyo, kaka watimo gik moko e gweng'wa kaa.

Tomaduon'g molooyo, duoko mar nonroni biro konyo ahinya sirikal marwa, jochiu kony kaachiel kod jogo machano chenro mag dongruok eyor ng'eyo ber malong'o e **Gigo Mahinyo Kelo Tuoche Mag Kudni Mar Minembe Eute Man Kod Nyithindo Mapod Somo E Skunde Mag Paimar Mayudore Egweng' Karungu, Ei County Ma Migori.**

### **Kaka Wadhitayo Nonro**

Kaponi iyie mondo ibed achiel kuom ute ma watimoe nonroni, wabiro penji penjo motenore kod hiki, sombi, tiji mitimo makeloni yuto, in jading mane, un ji adi eodu kaa tokod penjo makamago, ka watenogi kod kit dak mudak godo tokod muoch mar touché mikelo kod kudni mar minembe. Wabiro kao dakika maok oingo 30 ka wapenji penjogi kendo wabiro wuotho eot kaot.

### **Ber Mibiro Yudo Bang' Nonroni**

Kata obedoni onge ber ma aching' kata achiel kachiel mibiro yudo kuom bedo achiel kuom joma oyie nimondo watim nonro eode, daher mar nyisi mor ma wan godo ni iyie mondo ikony e sumo riekni mibiro tii godo eyor geng'o touché mikelo kod kudni mar minembe maok warito mana thiedho tuohegi eseche magisemuoch kendo mako jii e gweng' kaa.

Tokaka Thoro maduon'g momiyo watimo nonroni en nimondo wayang anena malong'o **Gigo Mahinyo Kelo Tuoche Mag Kudni Mar Minembe Eute Man Kod Nyithindo Mapod Somo E Skunde Mag Praimar Mayudore Egweng' Karungu, Ei County Ma Migori**, rieko ma ibiro miyowa nokony ahinya e chano chenro mong'ith kendo keto okenge mabeyo mag geng'o touché mikelo kod kudni mar minembe.

### **Maling'-ling'**

Nyingi tokod weche duto mibiro wachonwa ekinde ma watimo nonroni, biro bedo maling'-ling' maonge ng'ama nong'e kata ok wana lieke kata ndike kata luongo nyingi kamoro amora. Wabiro miyi kopi mar oboke manyisoni nene iyienwa mondo wapenji penjo e seche mane watimo nonroni.

### **Ratiro Mari Mar Tamori Kata Weyo Duoko Penjo**

Daher nimondo iyang adimba kendo iwinj wehegi, mabiro bedo kaka gigo matenore kod nonroni;

1. Ibiro duoko penjo eyor hero mari maonge achune moro amora
2. In kod thuolo mar tamori duoko penjo miwe wach mar nonroni e saa asaya, kendo onge rach moro amora kata wito ber moro amora mibiro wito.

Ayieni en adier ni oboke makwaya thuolo mondo openja penjo mag nonroni, olerna eyoo mahuyanga kendo kod dhok mawinjo maliu, manyaka penjo duto mapenjo oduoka eyo maowinjore kendo motucha. Omiyo, ayie eyor hero mara maok ochuna nimondo openja penjo mag nonroni, tobende wayiere ni anyalo weyo maok aduoko penjo mopenja maonge wach marach mabiro timorena.

Namba mar otasni:

\_\_\_\_\_

Nying ja non wach: \_\_\_\_\_ Taric \_\_\_\_\_

### **Weche Motelo**

Penjo ma wabiro penji, gin nonro mag weche somo omiyo ok wanatii kod duokogi eyo moro amora kata nade. Weche duto ma wabiro yudo esama wapenjo penjo, gin weche ma wabiro kano kaka weche maling'-ling' kendo ok wanaliekgi ne ng'ato ang'ata, kata okwana tii kodgi marach eyo maok nomiyo watimo nonroni.

Wakwayi nimondo iduok penjogi eyor adiera kendo kaka ing'eyo maber ahinya.

Serial No. (Otas Penjoni Namba

adi).....

Household Number (Odni En Ot Namba

adi).....

Location/Nying Lokeson

.....

Sub-location/ Village/ Nying Sub-Lokeson kod

Gweng' .....

Date/Tarik.....

.....

**Please tick (✓) the option that best suits your opinion on the corresponding statements.  
(Gotik Kama Owinjore kaluore Kod Duoko Mar Kit Penjo Mopenji?)**

**SECTION A. SOCIO-DEMOGRAPHIC FACTORS (Weche Mag Chal Jachuok Penjo)**

32. Gender (Kit Chwech Mari/ Gotik Achiel)

Male (Dichuo) [ ] Female (Miyo/Dhako) [ ]

33. What is your age? (Hiki En Adi?) .....

34. What is the highest level of education you have attained/Respondent? (Esombi, isomo migik

kanye?) Primary (Primari) [ ] Sekondari (Sekondari) [ ] Tertiary/College (Kolej) [ ]

University (Mbalariany) [ ] Onge (Okasomo) [ ]

35. Marital status (Chal Mari Mar Keny)

Married (Okendi/Ikendo) [ ] Separated (Udak Mopogore Kod Jaodi) [ ]

Divorced (Ne Uweru Kod Jaod1) [ ] Widowed (In Chi/Chuur Liel) [ ]

Single (Pok Okendi/Pok Ikendo) [ ] Other specify (Machielo Mopogore, Nyisa

ane?.....

36. Religion (In Jadin Mane?)

Christian (Jakristo) [ ] Muslim (Muislam) [ ]

Other specify (Jadin Machielo, Fulna Nyinge) .....

37. Number of household members (Eodu Kaa, un Ji Ade Modakie?) .....

38. What is your Source of income (En Tich Mane Mitimo Makeloni Yuto?)

Salaried (Ondika Achamo Msara [ ] Business/Self Employed (Atimo Ohala Andikora

Kenda [ ] Casual Laborer (Atimo Tije Mag Amali) [ ] Fishing (An Jalupo E

Nam) [ ]

Peasant Famer (An Japur Mothechore) [ ] Handouts (An Okatii, Igonya [ ]

Large-scale famer (An Japur Mondiek)[ ]

Others Specify (Koso Itiyo Tich Mane Machielo?).....

39. Which type of domestic animals do you keep and how many are they? (Gin Kit Chiaye Kod

Lee Mage Mipidho Eodi Kaa, Tokwangi Romo Adi)

Goats (Diek) [ ] Cattle (Dhok) [ ]

Sheep (Rombe) [ ] Chicken (Gwen) [ ]

Cats (Paka) [ ] Rabbits (Apuoyo) [ ]



Dogs (Guogi) [ ] Pigs (Anguro) [ ] Non (Onge Lee mapidho) [ ]

Others specify (Kantie Moko, Gin Mage).....

40. Socio-Economic Status Of Households (Tick Where Applicable) (Chal Mar Kaka Joodni Odak Tokod Gik Mantie–Gotik Kama Owinjore)

Type of Asset (Gik Main Godo)	Television (TV)	Radio (Nyakalondo)	Furniture (Komb)
Source of Fuel (Itedo Gang'o)	Firewood (Yien)	Charcoal (Makaa)	Gas (Gas)
Type of House (Odi Chal Nade)	Mud (Od Loo)	Semi-permanent (Od Semi)	Brick (Od Kidi)
Source of water (Pii Iyudo Nade)	Improved (Molosi)	Unimproved (Maok Olosi)	
Source and average income per month (Yuto Mar Dwe Ka Dwe Romo Nade-Ichamo Pesa Adi)			

**SECTION B. KNOWLEDGE AND HEALTH-SEEKING BEHAVIOUR (NG'EYO MAIN GODO EWECHÉ MAG RITO NGIMA).**

6. Do you know what jiggers are? (Bende Inge'yoe Kudni Mar Minembe Nien Ang'o?)

Yes (Kamano Ang'eyo) [ ] No (Ooyo Akia) [ ] Not sure (Aonge Kod Adieri Kangeyo Kata Akia [ ]

7. What is the major cause of this disease? (Ang'o Ming'eyo Mathoro Kelo Tuoche Mag Minembe?)

.....  
.....

8. Have you ever discuss with your household members about Jigger infestation? (Bende Iseloso Kod Joma Idak Godo Eodi Kaa Kuom Tuoche Mikelo Kod Minembe?)

Yes (Asetimo Kamano) [ ] No (Ooyo Podi) [ ]

9. Is jigger infestation in relation to other disease? (Gipachi Iwuon, Bende Minemmbe Kelo Tuoche Moko Kuom

Dhano?.....

10. Has any household member been infested by jigger in the last three months? (Kuom Dweche Adek Mokalo, Bende Nitie Achiel Kuom Joma Odak Eodi Kaa Ma Minembe Osemako?)

Yes (Nitie)[ ] No (Onge)[ ]

If Yes, how many? (Kaponi Nitie, Gin Jii

iAddi?).....

Age (Jahiga adi)	Gender (En nyako/wuoyi)	Education Level (Osomo mogik kanye?)	Treatment given (Thieth Mumiye)	How many days missed to work/school (Noleo Netich Kata School Ndalo Adi)	Occupation /School (Tiji Mitiyo)

11. When infested do you mingle with others? (Ekinde Ma Minembe Omaki, Bende Iriwori  
Kod Joweteni Mamoko?)

.....

12. Which action do you take when infested? (En Okenge Mage Mikaoga Ekinde Ma Minembe  
Omaki?)

.....  
.....

13. Are there other diseases/infections that are related to jigger infestation? (Gipachi Iwuon,  
Bende Nitie Tuoche Mamoko Motenore Kod Kudni mar Minembe?)

Tetanus (Athany)            [   ]    Skin Infections (Gwonyo)  
[   ]

Disability (Ng'ol)            [   ]    Others (specify) (Mamoko Mopogore, fulna Anena?)  
[   ]

14. Has anyone died due to jigger infestation in this village? (Bende Nitie Ng'ama Minembe  
Osenego

Egweng  
Kaa?).....  
...

**SECTION C. CULTURAL PERCEPTION ABOUT JIGGERS INFESTATION (Weche Mag Kweche Motenore Kod Tuoche Makudni Mar Minembe Kelo?)**

1. What causes jiggers infestation? (Ang’o Mamiyo Minembe Makoji?)

- Parasite (Kute) [ ] Witchcraft (Juok) [ ]  
 Cult (Lamo Jachien) [ ] Mental illness (Tuo Neko) [ ]  
 Worms (Njofni) [ ] Dirt (Chilo) [ ] Do not know (Akia) [ ]  
 Others (Specify) (Mamoko Mopogore, Fulna Anena?) .....

2. In this society, are there any cultural beliefs that are related to jigger infestation? (Egweng’u Kaa, Bende Nitie Kweche Muyiego Motenore Kod Tuoche Ma Minembe Kelo?)

- Yes (Kamano) [ ] No (Ooyo) [ ]

If yes, state (Kaponi Nitie, Fulna Nigin Kweche Mage Muyiego?).....

.....  
 .....

3. How do jigger infested people handled in the family? (Eodu Kaa, Ere Kaka Ukao kata Urito Jogo Ma Minembe

Omako?).....  
 ...

4. Are there any traditional methods used to treat jigger-infested people? (Bende Nitie Kit Thieth Mag Yiend Nyaluo Mithiegodo Jogo Ma Minembe

Omako?).....

.....  
 .....

5. Is the infestation seasonal? (Bende Minembe Nikod Kindegi Magithoro Makoe Jii Ahinya)

- Yes (Kamano) [ ] No (Ooyo) [ ]

6. If yes, when is the infestation high/low? (Kaen Kamano, Minembe Thoro Makoji Kinde Mage?)

.....  
 .....

7. What is your perception about jigger infestation? (Gipachi, Ang’o Miparoni Miyo Minembe Makoji?).....

**SECTION D. HOUSEHOLD HYGIENE AND SANITATION(Ler mar ot del gialuora ne)**

1. What is the main source of water for use? (Ugolo Pii Kanye Mutiyogodo Eot Kaa?)

Borehole (Kisima) [ ] Protected dug well (Kisima Mokuny Moum) [ ]

Protected spring (Yao Moum) [ ] Rain water collection (Pii Koth Mochoki)

[ ]

River /Lake (Pii Aora/Nam) [ ] Unprotected dug well (Kisima Maok Oum)

[ ]

Unprotected Spring (Pii Yao Mokoum) [ ] Piped water (Pii Fireji)

[ ]

2. How many times do the children take bath in a week? (Ejuma, Nyithindi Luokore Di-Dii?)

Daily (Pile-Pile) [ ] Twice (Diriyo) [ ]

Thrice (Didek) [ ] None (Onge) [ ] Others Specify (Mopogore, En mane).....

3. Where do you dispose your garbage? (Uwito Yugi Kanye)

Burning/Burry (Wawang’o/Waiko) [ ] Gutter/Ditch (Waolo Ebur Mokuny)

[ ]

Garden (Wapuko Epuodho) [ ] Disposed Anywhere (Wapuko Kamoro

Amora [ ]

Others (Specify) (Mogore, En Mane).....

4. What is your compound ground covered with? (Laro Mar Odu Kaa Ang’o Moumo?)

Grass (Lum) [ ] Soil (Loo) [ ]

Both Grass and Soil (Lum Kod Loo) [ ] Others (specify) (Mopogore, Mage?).....

5. Do domestic animals graze within the compound? (Bende Jamni Kwayoga Elaro Kaa?)

Yes (Kamano) [ ] No (Ooyo) [ ]

6. If Yes, which type of animals? (Kantie Jamni Makwayo Kaa, Gin Jamni Mage?)

Goats (Diek) [ ] Cattle (Dhok) [ ] Dogs (Guogi) [ ]

Sheep (Rombe) [ ] Chicken (Gwen) [ ]

Cats (Paka) [ ] Rabbits (Apuoche) [ ]  
Non (Onge) [ ] Others specify (Mopogore, Mane?).....

7. Which material is used for construction of houses walls? (Kor Odni Omuon Kod Ang'o?)

Stone/bricks (Kidi/Matafari) [ ] Timber (Yien) [ ]

Iron Sheet (Opanga) [ ] Mud (Lowo) [ ]

Others (Specify) (Mopogore, Mane) .....

8. Which type flooring do the houses have? (Dierdni Olos Nade)

Concrete Slab (Ogoo Simiti) [ ] Timber Slab (Opang Yiende) [ ]

Wooden Poles (Oketie Pols) [ ] Earthen (Omuon Kod Lowo) [ ]

9. How often do you clean/ smear the house floor/wall within one week? (Uyweyo kata Uluoko Dier Oduni kod Kor Oduni Didii E

Juma?).....

10. How often do you clean and air the beddings used by household members? (Umoyo kata

Uluoko Ongede kod Piende Mag Nindo Mutiyogodo Eodu Kaa Maromo

Nade?).....

11. How do you protect your Feet? (Give multiple response where applicable) (Ere Kaka Ugeng'o Tiendeu? Inyalo Chiwo Duoko Ariyo Kaponi Mano Nyalore)

Wearing Closed Shoes (Warwako Wuoche Moumore) [ ]

Wearing Open Shoes (Warwako Wuoche Mafuyanga) [ ]

Walk Bear footed (Wabang'o Gitiendwa Nono) [ ]

Others (Specify) (Mopogore, Mage) .....

12. Do you use insecticides when farming at the household level? (Bende Utiyo Kod Yath Epuodho?)

Yes (Kamano) [ ] No (Ooyo) [ ]

13. What is your common resting place in the homestead? (Ere Kama Ithoro Yweyoe Gaa Dalakaa?)

Under The Tree (Etipo Mabuo Yien) [ ] In the Class Room (Ei Klas) [ ]

Verandah (Laro Oko) [ ] Road Paths (Ebath Yoo) [ ]

Others (Specify) (Kama Opogore, Makanye?).....

14. How can jigger infestation be managed/ prevented? (Miya Pachi Kaka Wanyalo Geng'o Minembe?)

.....  
.....

**15. Do you have any comments or suggestions regarding the interviews? (Bende Inkod Penjo Moro Kata Mana Wach Moro Amora Minyalo Wecho Ewii Penjo Mapenji?).....**

.....  
.....

Thank you for your cooperation (Erokamano kuom yiana apenji penjo).

Nyny ja nonro mar weche gi..... Tarik.....

**APPENDIX 7: Household and Village Data**

	<b>OTATI SUB-LOCATION TOTAL NO. OF POPULATION 2503 TOTAL NO. OF VILLAGES 10</b>	<b>NO. OF HOUSEHOLDS PER VILL.</b>
1.	Kanyondieny A	87
2.	Kanyondieny B	73
3.	Kamoloadhiambo	55
4.	Kanyojuok A	57
5.	Kanyojuok B	66
6.	Kanyochanda A	80
7.	Kanyochanda B	63
8.	Kanyandianga A	77
9.	Kanyandianga B	88
10.	Kanyameo	82
<b>TOTAL NO. OF HOUSEHOLDS</b>		<b>547</b>
	<b>RAGA SUB- LOCATION TOTAL NO. OF POPULATION 4699 TOTAL NO. OF VILLAGES 18</b>	<b>NO. OF HOUSEHOLDS PER VILLAGE.</b>
1.	Kanyodieny A Raga	42
2.	Kanyodieny B Raga	38
3.	Upper Kanyodieny A Raga	39
4.	Lower Kanyodieny	40
5.	Raga Manywanda	64
6.	Kamaina A	61
7.	Kamaina B	68
8.	Kamaina C	65
9.	Kowesi A	58
10.	Kowesi B	64
11.	Kowesi C	48
12.	Bongu A	80
13.	Bongu Centre	85
14.	Kanyohanda	49
15.	Sidika	52
16.	Nyorem	47
17.	Hoho	53
18.	Raguda	61
<b>TOTAL NO. OF HOUSEHOLDS</b>		<b>1014</b>
	<b>OKAYO SUB-LOCATION TOTAL NO. OF POPULATION 3071 TOTAL NO. OF VILLAGES 18</b>	<b>NO. OF HOUSEHOLDS PER VILLAGE.</b>
1.	Magongoria	45
2.	Okeru	25
3.	Nyakech A	27
4.	Nyakech B	27

5.	Okayo A	50
6.	Okayo B	32
7.	Alara	35
8.	Tangwe	28
9.	Ungoe	28
10.	Omange	31
11.	Ongonya	32
12.	Pedo	33
13.	Ojawa	31
14.	Osula	46
15.	Kibuon	36
16.	Kisumu A	53
17.	Kisumu B	36
18.	Manyanda	42
<b>TOTAL NO. OF HOUSEHOLDS</b>		<b>637</b>
	<b>ALENDO SUB- LOCATION</b>	<b>NO. OF HOUSEHOLDS PER</b>
	<b>TOTAL NO. OF POPULATION 2285</b>	<b>VIL.</b>
	<b>TOTAL NO. OF VILLAGES 20</b>	
1.	Kogore	26
2.	Rabare	30
3.	Alendo A	41
4.	Alendo B	35
5.	Alendo C	34
6.	Mire	21
7.	Nyogunde	24
8.	Nyamolo	18
9.	Kamiudhi	24
10.	Nyohago A	21
11.	Nyohago B	18
12.	Nyahago C	17
13.	Opea A	24
14.	Opea B	24
15.	Opea C	26
16.	Opea D	22
17.	Nyogalo A	31
18.	Nyogalo B	27
19.	Nyorondo A	26
20.	Nyorondo B	19
<b>TOTAL NO. OF HOUSEHOLDS</b>		<b>501</b>

Source: *Census Data, 200*



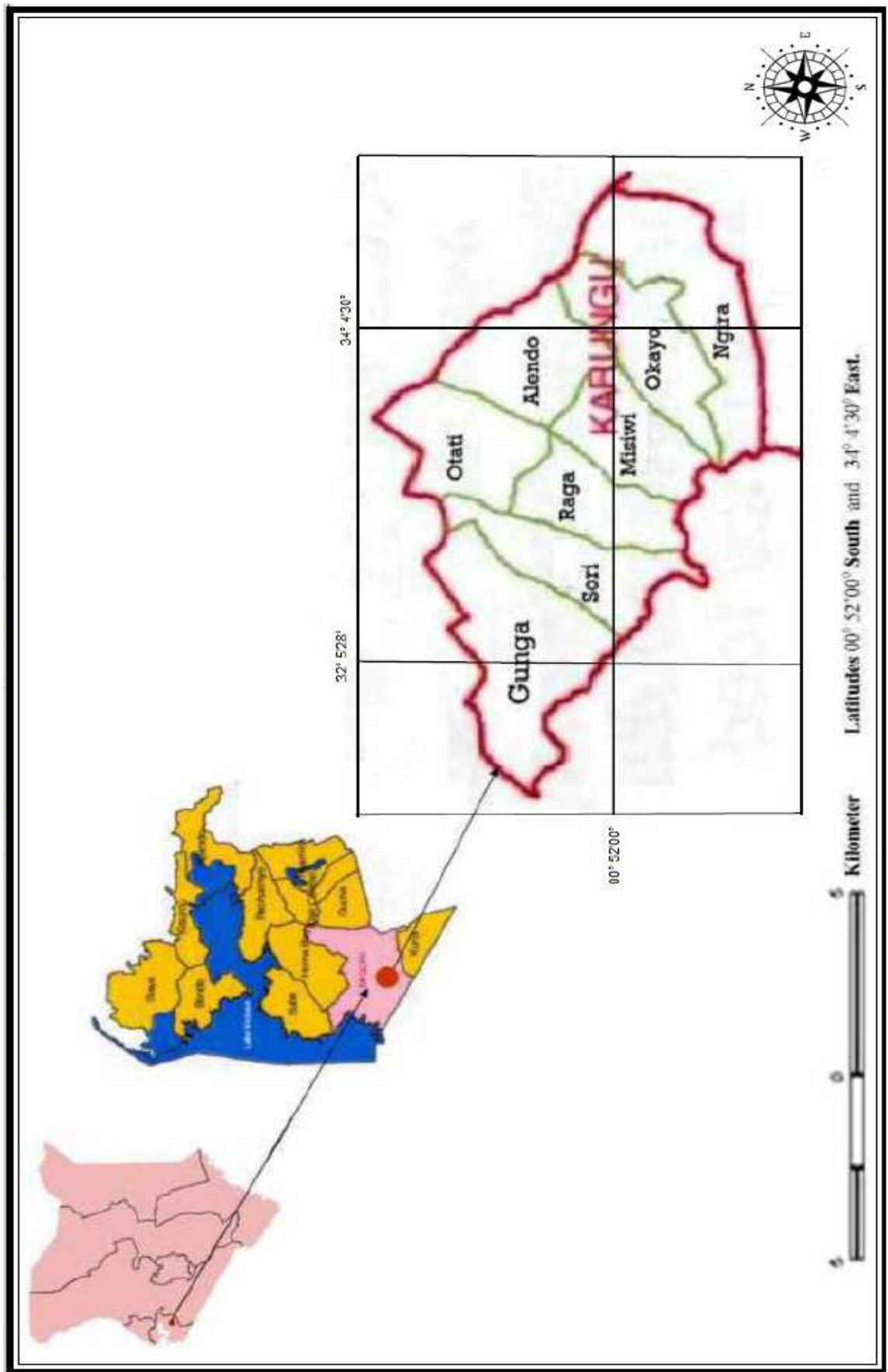
## APPENDIX 8: Population of Pupils in each School

The table below shows the respective schools and the total population of pupils in each school.


<b>Table 2: Alendo Zone</b>			
<b>Location</b>	<b>Sub-location</b>	<b>Primary school in each sub-location</b>	
		<b>School</b>	<b>Pupils</b>
East Karungu	Alendo	Alendo	<b>564</b>
		God bim	<b>264</b>
		Kogore	<b>223</b>
		Rabare	<b>315</b>
	Raga	Opeya	<b>260</b>
		Aringo	<b>447</b>
		Bondo Kosiemo	<b>640</b>
		Tianya godjope	<b>123</b>
South East-Karungu	Okayo	Kayara	<b>310</b>
		Angoye	<b>225</b>
		Lwanda	<b>223</b>
		Obware	<b>338</b>
		Adugo	<b>350</b>
		Ungoye	<b>225</b>
		Okayo	<b>297</b>
		Nyasoko	<b>346</b>
		Ojawa	<b>123</b>
Central Karungu	Otati	Otati	<b>556</b>
		Not	<b>292</b>
Total Pupils to be surveyed			<b>6152</b>

**Source:** D.E.O. office Nyatike District

Appendix 9: Map of Study Area.



## Appendix 10: Approval Letter 1



**MASENO UNIVERSITY ETHICS REVIEW COMMITTEE**

Tel: +254 057 351 622 Ext: 3050  
Fax: +254 057 351 221

Private Bag – 40105, Maseno, Kenya  
Email: [muerc-secretariat@maseno.ac.ke](mailto:muerc-secretariat@maseno.ac.ke)

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**FROM:** Secretary - MUERC

**DATE:** 11<sup>th</sup> May, 2015

**TO:** Ruth Moraa Mageto  
PG/MPH/00012/2011  
Department of Public Health  
School of Public Health and Community Development,  
Maseno University, P. O. Box, Private Bag, Maseno, Kenya

**REF:** MSU/DRPI/MUERC/00142/15

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**RE: Risk Factors Associated with Jigger Infestation in Households with Primary School Going Pupils in Karungu Division, Migori County, Western Kenya.  
Proposal Reference No.: MSU/DRPI/MUERC/00142/15**

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This is to inform you that the Maseno University Ethics Review Committee (MUERC) determined that the ethics issues raised at the initial review were adequately addressed in the revised proposal. Consequently, the study is granted approval for implementation effective this 11<sup>th</sup> day of May, 2015 for a period of one (1) year.

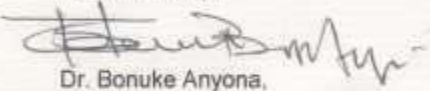
Please note that authorization to conduct this study will automatically expire on 10<sup>th</sup> May, 2016. If you plan to continue with the study beyond this date, please submit an application for continuation approval to MUERC Secretariat by 8<sup>th</sup> April, 2016.


Approval for continuation of the study will be subject to successful submission of an annual progress report that is to reach MUERC Secretariat by 8<sup>th</sup> April, 2016.

Please note that any unanticipated problems resulting from the conduct of this study must be reported to MUERC. You are required to submit any proposed changes to this study to MUERC for review and approval prior to initiation. Please advise MUERC when the study is completed or discontinued.

Thank you.


Yours faithfully,

  
Dr. Bonuke Anyona,  
Secretary,  
Maseno University Ethics Review Committee.

  
11 MAY 2015  
MASENO UNIVERSITY

Cc: Chairman,  
Maseno University Ethics Review Committee.

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MASENO UNIVERSITY IS ISO 9001:2008 CERTIFIED 

## Appendix 11: Approval Letter 2

### MIGORI COUNTY



### DEPARTMENT OF HEALTH SERVICES

Telegrams: "MOH", Migori  
Telephone: Suna (059) 20058  
Email: migoricountyHMT@gmail.com  
When replying please quote

COUNTY DIRECTOR OF HEALTH  
MIGORI COUNTY  
P.O. BOX 1045-40400  
SUNA - MIGORI

Ref No: MCG/MOH/CDH/VOL 1/1

10<sup>th</sup> June, 2016

TO

**MAGETO RUTH MORAA**

**PG/MPH/00012/2011**

**DEPARTMENT OF PUBLIC HEALTH**

**SCHOOL OF PUBLIC HEALTH AND COMMUNITY DEVELOPMENT**

**MASENO UNIVERSITY**

**P.O. BOX PRIVATE BAG**

**MASENO, KENYA**

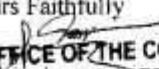
Dear Madam/Sir,

**REF: AUTHORIZATION LETTER TO CONDUCT A STUDY AT KARUNGU DIVISION,  
NYATIKE SUB COUNTY, MIGORI COUNTY.**

This is to inform you that following the approval by Maseno University Ethics and Review Committee (MUERC) for you to conduct a study in Karungu Division, Nyatike Sub County, formally Nyatike District; you are hereby granted permission by this office to carry out your study within the period of June 2015 to 10<sup>th</sup> May 2016. Please note that the study period automatically expires on 10<sup>th</sup> May 2016. Should you wish to continue with the study after this date, due process has to be followed as you have been advised by the Maseno University Ethics and Review Committee.

I would like to take this opportunity to wish you well in your study and am looking forward to receiving the results of the study.

Yours Faithfully

  
**OFFICE OF THE COUNTY DIRECTOR  
OF HEALTH SERVICES - MIGORI**  
Tom Odhiambo  
For: County Director of Health  
**MIGORI**

**Appendix 12: Approval Letter 3**

**MIGORI COUNTY GOVERNMENT**



**MINISTRY OF HEALTH**

KARUNGU DIVISION  
PUBLIC HEALTH OFFICE  
P.O BOX 99 – 40402  
MACALDER  
03/06/2015

MAGETO RUTH M.  
ADM. NO. PG/MPH/00012/2011  
MASENO UNIVERSITY  
PRIVATE BAG  
MASENO

**RE: PERMISSION TO COLLECT DATA**

This office has granted permission to the student to collect data for her research for the period of May 2015 to May 2016 as stated by the Maseno University Ethical and Review Committee

The office will fully support and assist the student for any needs that may arise

Thank you

Nashon Makokha

A handwritten signature in blue ink, appearing to be 'Nashon Makokha'.



0727421208.

*nashonmakokha2@gmail.com*

C.C.

1. COUNTY PUBLIC HEALTH OFFICER - MIGORI
2. SUB COUNTY PUBLIC HEALTH OFFICER - NYATIKE