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**CONSISTENCY OF STOOLS AS AN INDICATOR OF
TYPE OF INTESTINAL PARASITES HARBOURED BY
PATIENTS WITH ABDOMINAL PAIN AT KENYATTA
NATIONAL HOSPITAL, NAIROBI, KENYA**

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A THESIS SUBMITTED IN PARTIAL FULFILMENT FOR THE
REQUIREMENTS OF THE AWARD OF MASTER OF SCIENCE DEGREE IN
APPLIED PARASITOLOGY OF KENYATTA UNIVERSITY

OCTOBER 2007

Githigaro, Peter
*Consistency of stools
as an indicator of*

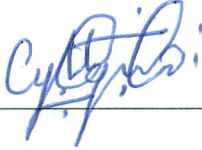


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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university or any other award.

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ACKNOWLEDGMENTS

I wish to extend my sincere thanks to all those who contributed to the completion of this thesis. Special appreciation goes to my university supervisors Prof. E.W. Kabiru and Prof. H.O. Pamba. I wish to thank them for the advice, encouragement, guidance, help and support given to me at all stages of this study. I am grateful to the board of management KNH, for allowing me to carry out this project in KNH. My thanks also go to KNH employees working in Parasitology laboratory, for the assistance they gave me while I was collecting the data. My gratitude also goes to the Chairman, Department of Medical Microbiology, University of Nairobi, for allowing me to use the computers in his Department. Finally I thank Kenyatta University for training me.

DEDICATION

This work is dedicated to my wife Magdaline Nduku and our children Mercy Wanjiru, Erastus Mwangi and Elizabeth Ndinda for their patience and support given throughout while doing this project.

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ABBREVIATIONS AND ACRONYMS

Abd.	Abdominal
AIDS	Acquired Immune Deficiency Syndrome
CNS	Central Nervous System
G.I	Gastrointestinal
GOK	Government of Kenya
KNH	Kenyatta National Hospital
MOH	Ministry of Health
Rcf	Relative centrifugal force
ROK	Republic of Kenya
SD	Standard Deviation
SPSS	Statistical Package of Social Sciences
WHO	World Health Organization
ZN	Ziehl-Neelsen

DEFINITIONS OF OPERATIONAL TERMS

Appearance	The colour of stool.
Consistency	Hardness or softness of stools (see appendix 3).
Diarrheic stool	Stool, which were loose or watery.
Formed stool	Stool that was hard and could not take the shape of the container.
Loose stool	Stool, which could pour off like thick porridge when the container is tilted.
Normal stool	Formed stool without blood stains or mucus.
Soft stool	Stool that took the shape of the container and could not pour when the stool container is tilted.
Stool	Human fecal materials.
Watery stool	Stool, which could pour off like water when stool container was tilted.

ABSTRACT

Abdominal pain is a common problem reported to clinicians for various ailments. Hospital records in Kenya show that high percentage of patients suffers from abdominal pain. Among the causes of abdominal pain are intestinal parasites. Intestinal parasites include protozoa and helminthes living in the intestine of animals and human. They are among the most common infections in developing countries. About 3.5 billion people worldwide are infected with intestinal parasites without considering those with abdominal pain. There are many people living with intestinal parasites without knowing. The impact of these parasites on public health has been under estimated, although they cause considerable morbidity and mortality. The main objective of this study was to determine whether consistency of stool could be used as an indicator of type of intestinal parasites causing abdominal pain in a patient. Patients being investigated for intestinal parasitic infections in the clinical laboratory were interviewed and a sample size of 400 patients suffering from abdominal pain selected. Stools of patients were macroscopically examined to determine their consistency; both direct saline and formal-ether concentration methods were used to identify parasitic agents. Stool specimens with eggs of *Taenia* species were stained and eggs differentiated to species using modified Ziehl-Neelsen stain technique. Harada-Mori culture technique was done on positive stools with hookworm looking like eggs in order to differentiate the worm species. Data was analyzed, and association among stool consistency, age groups, sex and intestinal parasites were tested using chi-square. Of the 400 patients 164(42.0%) had acute abdominal pain, 181(45.3%) had chronic abdominal pain and 55(13.8%) had recurrent abdominal pain. The consistency of stools from those patients were 218(54.5%) formed, 95(23.8%) soft, 78(19.5%) loose and 9(2.3%) watery. Stools from 79(19.75%) patients had inclusions; those with pus cells were 44(11.0%), mucus 33(8.25%), blood 23(5.75%) and yeast cells 15(3.75%). The results show 27.5% of patients complaining of abdominal pain had intestinal parasitic infections. The most prevalent helminth was hookworm (2.5%) while the most prevalent protozoan was *Blastocystis hominis* (10.75%). The study show stools from patients complaining of acute abdominal pain had higher amount of water than stools from patients with either chronic or recurrent abdominal pain ($\chi^2=47.3$, $df=6$, $P=0.000$). Patient's complains of different duration of abdominal pain was not related to presence of intestinal parasitic agents in stools ($\chi^2=72.95$, $df=64$, $P=0.207$). There was no association between intestinal parasitic infections and consistency of stools ($\chi^2=0.000$, $df=3$, $P=1.000$). Patients of 36-40 years age group had the highest number 50% of parasitic infection cases than any other age group ($\chi^2=38.52$, $df=10$, $P<0.001$). The findings from this study provide a general awareness among KNH practicing physicians the need of laboratory diagnosis of stools in confirming clinical findings when treating patients with abdominal pain.

CHAPTER 1: INTRODUCTION

1.1 Background information.

Abdominal pain is a differential diagnosis of various ailments such as malaria, typhoid, stomach ulcers, liver diseases, renal problems, pancreas diseases or intestinal parasitic infections. Causes of abdominal pain are bacteria infections, food poisoning, viral infections, fungal infections, malfunctioning of internal organs within the abdominal region and intestinal parasites. It is common problem reported to clinicians in various health providing services centers. GOK, MOH hospital records show intestinal parasites are among the leading causative agents of abdominal pain in patients. About 3.5 billion people in world are infected with intestinal parasites (WHO, 1998). In many areas, the highest parasite burden is in children under the age of 15 years (Peter, 2002). In Kenya, patients' incidence morbidity due to intestinal worms is 5% of diseases treated in the outpatient clinics (GOK MOH, 1999). The impact of intestinal parasitic infections on patients with abdominal pain has been under estimated, although their effects cause considerable morbidity, hospitalization, disability, mortality, decreased production and poor performances for school going children (Peter, 2002).

Intestinal parasites are protozoa and helminthes living in the intestine of animals and human. Abdominal pain results from clinical pathogeneses of intestinal parasitism. These are trauma, lytic necrosis, stimulation of host-tissue reactions, toxic and allergic reactions, or open pathways for entry of other pathogens into the tissues that cause abdominal pain (Howard *et al.*, 2002; Corry *et al.*, 2004). Eggs of *Schistosoma* species cause trauma with hemorrhage as they escape from mesenteric or vesical

venules into the intestinal lumen. Attachment of hookworms to the intestinal wall invariably results in traumatic destruction of the villi. Large worms such as *Ascaris* may produce acute intestinal obstruction (Corry *et al.*, 2004).

Patients with abdominal pain pass different consistency of stools. Consistency of stool depends on the amount of water it contains. Depending on the amount of water, stool may be semi-quantified and grouped as formed, soft, loose, or watery. Out of patients passing diarrheic (loose and watery) stools, 40% had been instigated to have intestinal parasitic infections (Yakubu and Bell, 1988). Clinical guidelines for diagnosis and treatment of common hospital conditions in Kenya indicate that intestinal protozoa (amoeba and *Giardia*) are among the commonest cause of abdominal pain and diarrhea (GOK MOH, 2002). Intestinal parasitic infections could be diagnosed by clinical finding, such as consistency of stools of patients.

1.2 Statement of the problem.

The high incidence and prevalence of intestinal parasites from previous studies in Africa has not changed although a number of control measures have been taken (WHO, 2002). Most surveys in Kenya have shown high prevalence of intestinal parasites in patients seeking treatment in hospital (Andungo *et al.*, 1991). The high rate of prevalence of infection with intestinal parasites in Kenya is similar to other African countries (Chunge, 1991). *Ascaris* and hookworm diseases have received much less attention than they deserve from public health officials and international agencies. The problems caused by intestinal parasites have been neglected partly because they rarely kill, or partly due to their insidious nature, that means signs and

symptoms are taken seriously after permanent impairment has occurred. Intestinal parasitic diseases are associated with poverty and any diseases linked to poverty, the numbers of people affected and corresponding resources required for control have been lacking. Moreover, as the greatest disease burden occurs in Sub-Saharan Africa, these diseases have been over taken by other health priorities (WHO, 2001). There is diminishing of laboratory services in diagnosis of intestinal parasitic diseases due to lack of resources such as equipment at primary and some of secondary health centers, this leaves the clinician without alternatives but to use only clinical diagnosis to treat intestinal parasitic infections. Clinicians partly use prevalence and intensity of parasites among patients in deciding the course of treatment.

1.3 Justification.

Patients seeking treatment at KNH suffer from intestinal parasitic infections and other major ailments such as cancer, AIDS, or diabetes. Intestinal parasites are thought not to pose any major problem. Most of those infections present with similar signs and symptoms or are asymptomatic, yet the treatment may be different. Signs and symptoms of intestinal parasitic diseases such as abdominal pain are mistakenly used to diagnose other major ailments. This makes it difficult to diagnose intestinal parasitic diseases clinically as, the clinician concentrate more with the major ailments like stomach ulcers, malaria, or typhoid. These parasites complicate the condition of the patient suffering from major ailment. Intestinal parasitic infections alter the consistency of stools passed by patients from formed to diarrheic stools.

Intestinal parasitic agent coursing abdominal pain in a patient could be eliminated at primary health centers if intestinal parasitic agent is identified. Due to the diminishing diagnosis services at primary health and some of secondary health centers, patients with abdominal pain are referred to other hospitals, which are secondary, tertiary and referral hospitals such as Kenyatta National Hospital. There is need to find a simple and a cheaper method based on consistency of the stools to identify intestinal parasitic agent. If this found there could be no patients with intestinal parasitic infections to be referred to secondary, tertiary and referral hospitals. The resources used to treat patients with intestinal parasitic infections in these institutions could be used to treat other patients with major ailments. This also reduce the duration of suffering in a patient with intestinal parasitic infections as proper diagnose and appropriate chemotherapy is administered at an early stage of disease progressive.

1.4 Research questions.

- a) Can consistency of stool be used as an indicator of type of intestinal parasites infecting a patient?
- b) What are the most common intestinal parasites in patients with abdominal pain at Kenyatta National Hospital?

1.5 Null hypotheses.

- a) Abdominal pain is not related to parasitic infection.
- b) The type of parasite is not associated with stool consistency of patient with abdominal pain.

1.6 Objectives.

1.6.1 General objective.

The main objective was to determine whether consistency of stool could be used as indicator of parasitic agent causing abdominal pain in a patient.

1.6.2 Specific objectives.

- a) To identify the types of parasites found in patients with abdominal pain in KNH.
- b) To identify the types of parasites in different consistency of stool specimens.

CHAPTER 2: LITERATURE REVIEW

2.1 Distribution of intestinal parasites.

The distribution of intestinal parasites is worldwide (Palmer *et al.*, 2002). They are cosmopolitan with higher prevalence in warm and moist than dry and cool climates. There is exception in *Enterobius vermicularis*, which is more common in cooler temperate areas (Michael, 1990). *Entamoeba histolytica*, hookworm and *Strongyloides stercoralis* are prevalent in the tropics. Trematode distribution depends on the distribution of the intermediate host, which is found near water. Distribution of *Balantidium coli* and *Taenia solium* depend on the distribution of pigs, which serve as reservoir and intermediate hosts respectively (Ombui *et al.*, 2001).

Global: More than 3.5 billion people all over the world are carrying a burden of intestinal parasite (Sandler *et al.*, 2000). Peter (2002) and Chan (1997) reported the global burden of diseases with helminthic infections ranked first among children aged 5–14 years. WHO (2001) estimated that helminthiasis is responsible for more than 40% of the diseases burden in the tropics. *Ascaris lumbricoides* is the most common worldwide with a prevalence rate of 11.9% followed by hookworm at 7.3% (Asasthi and Pande, 1997). Out of the two human hookworm species *Ancylostoma duodenale* is more common (67%) than *Necator americanus* at 33% (Rai *et al.*, 1997). Prevalence of *Giardia lamblia* is 17.5% and *Entamoeba histolytica* is 5.8% (Ighoboja and Ikeh, 1997). Intestinal parasites are identified in Uganda, Sudan, Ethiopia and Tanzania; those countries border Kenya (Ericson and Stephenson, 1996; Albonico *et al.*, 1997; Magambo *et al.*, 1998; Fisseha *et al.*, 1998).

Kenya: The high rate of infection with intestinal parasites in Kenya is comparable to some other African countries. Polyparasitism exist in most part of Kenya (Chunge *et al.*, 1985). Hospital records show that all Districts in Kenya have patients with intestinal parasitic infections (ROK MOH, 1998). The prevalence of intestinal parasites in Nyeri District is over 70%, Nyandarua is over 24%, Kakamega 79.6%, Bungoma 20.4%, Marsabit 94.6%, Isiolo 4.2%, Meru 1.2%, Kisumu 53.3%, Siaya 44.9%, West Pokot 13.6%, Samburu 11%, Narok 66% (Ombui *et al.*, 2001). In Kiambu District, the prevalence of *Entamoeba coli* is 96.4%, *Endolimax nana* 55.5%, *Iodomoeba butschlii* 32.9%, *Chilomastix mesnili* 29.3%, *Giardia lamblia* 40.8%, *Entamoeba histolytica* 28.5%, *Ascaris lumbricoides* 26.8% and *Hymenolepis nana* 10.2% (Chunge *et al.*, 1991) while in Siriba teacher college community *Giardia lamblia* is 5.3%, *Entamoeba histolytica* 14.7%, *Ascaris lumbricoides* 0.7%, hookworm 2.7%, *Trichuris trichura* 1.7%, *Schistosoma mansoni* 0.3% and *Taenia* species 0.3% (Andungo *et al.*, 1991). Between 1972 and 1976 the prevalence of parasites in stools of patients examined at Kenyatta National Hospital was 57.7% (Duncan, 1978). Between June 1993 and September 1994 the prevalence of different types of parasites identified in stools of patients with dyspepsia attending gastroenterology clinic at KNH was 5.6% (Ogutu *et al.*, 1998). Patients with abdominal complains are normally dewormed by medical doctors and paramedical staff in private clinics and primary health centers even without proof of parasitic infections (Ogutu *et al.*, 1998).

2.2 Epidemiology of intestinal parasites.

2.2.1 Environmental factors.

Soil: Human and reservoir hosts pollute soil with fecal materials containing parasitic agents. Soil maintains the live of the parasites outside the host body before they infect another host. Soil also supports the growth of plants, which in return shade the soil and provide it with humus. Shaded and sandy soil with humus is important for maintenance of eggs, cysts, oocysts and larvae in viable states and also the development of larvae. Shaded environments has no direct sunlight and heat which increase water loss from the bodies of parasites thus moisture takes longer to dry. Moisture also maintains eggs, cysts, oocysts and larvae in viable states. Humus provides nutrients for the nematode larvae. Sandy soil is porous for air circulation, which is needed by the developing larvae in the environment (Ericson and Stephenson, 1996).

Water: Water is important in the growth of plants and animals. In cases of schistosomiasis, water bodies are breeding habitats for intermediate hosts. Water is needed to dilute human feaces with viable eggs of schistosoma species for the eggs to hatch to miracidium. Infected snails with miracidia shed cercariae in the water. Man gets infection on contact with cercariae, which penetrate the skin to the blood circulation and then carried to the mesenteric artery and capillaries, where they mature to adults (Stone, 1990). Cysts and eggs of parasites such as *Giardia lablia* or *Ascaris lumbricoides* may contaminate water and when water is consumed man gets direct infections of those parasites as cited by Christopher (1982) and Andungo *et al.* (1991). Contamination of food products by parasites may occur at several points

along the path from growing and harvesting food at the farm. Possible contamination sources include the use of parasite contaminated irrigation, contaminated surfaces during harvesting or processing, and contamination of food products during final preparation and packing (Palmer *et al.*, 2002).

Air: Intestinal parasites need oxygen, which is one of the components of air, although at low tension for energy production. Dust and parasitic agents contaminate air. Eggs of *Enterobius vermicularis* and *Ascaris lumbricoides* are easily blown by wind. Airborne eggs of *Enterobius vermicularis* and *Ascaris lumbricoides* are dislodged from bed linens and clothes into the air, when bed linens and clothes are moved or hanged out side to dry. Breathing contaminated air with those eggs into the posterior pharynx, provide infections in the gastrointestinal system when the eggs are swallowed (Christopher, 1982).

2.2.2 Climatic conditions.

Temperature: Optimum temperature is important for promoting growth and development of eggs, larvae, trophozoites, cysts and oocyst and their maintenance in viable states. Favorable temperatures are responsible for high incidence of parasites in the tropics and sub-tropics (WHO, 2001). When temperatures of the environment reaches 35°C radiation and convection cease to function and vaporization bear the entire burden of heat loss. This lead to increased water loss, dryness, which kills the parasites. Freezing temperatures in the environment render oocysts noninfectious and nonviable (Fayer and Nerad, 1996). High and low temperatures are harmful for the

development of eggs and cysts, these temperatures kill larvae and trophozoites (Rukmono, 1980; Asaathi and Pande 1997).

Rainfall: Rainfall provides moisture, which is needed for embryonation of eggs before infecting their host (Michael, 1990). Development of hookworm and *Strongyloides stercoralis* larvae to infective stages need moisture. Rain provides water, which is needed by both animals and plants for growth. Too much water is harmful for the development of nematode larvae as water displaces air in the soil leaving larvae suffocating to death (Rukmono, 1980). In case of schistosomiasis rainfall increases fresh water masses, a favourable condition for breeding of intermediate hosts (snails), which shed cercariae that infect man (WHO, 1997).

2.2.3 Human factors.

Human waste disposal: Man contaminates the environment with faecal material containing parasitic agents. The way human dispose waste material is important in the spread of intestinal parasites. Sewage spilling out on the ground and uses of human waste material as manure contaminates the environments with intestinal parasites, where they develop to infective stages, and later infects unsuspecting individuals (WHO, 1997).

Feeding habits: Man prefers to consume some food when fresh, raw or undercooked. Consumption of raw fruits and vegetables bypass important preparatory measures intended to reduce or prevent infections by killing pathogens, especially the long surviving encysted forms of foodborne parasites (Palmer *et al.*, 2002). Tapeworm

infection occurs particularly where raw or undercooked pork, beef and fish are consumed (Flisser, 1990; Ombui *et al.*, 2001).

Migration: Infected individuals and intermediate host moving to previously uninfected areas having susceptible hosts infect the new environment with eggs, larvae or cysts of parasites, starting parasitic life cycles with stages infecting the people living there. In agricultural areas, infected farmers migrating from one area to another spread *schistosomiasis*, if the new area has the intermediate host (Ericson and Stephenson, 1996). Another factor to consider is transportation of food products from one place to another. Transport of foreign food products has become available to an unprecedented degree at the end of the 20th century has enhanced the chances of parasites infecting consumers at distance and may start parasitic life cycles with stages infecting the people living there. (Palmer *et al.*, 2002).

2.2.4 Economic status and social factors.

Economic status: Persons with high economic status have less risk of being infected with intestinal parasites than those with low economic status (Ericson and Stephenson, 1996). They attend good schools where they are taught public health education and personal hygiene that are needed in controlling intestinal parasites. They wear shoes that protect their feet from some of infections, and they seek treatment when infected. All these factors mask the spread of intestinal parasites among them (Ericson and Stephenson, 1996). These factors are lacking in persons with low economic status favoring the spread of intestinal parasites among them. Poverty lead to lack of many facilities needed in controlling intestinal parasites such

as houses with clean tap water, and drainage systems, lack of protective attire to wear, and funds to buy drugs when infected.

Social factors: Religion, cultural and traditional beliefs identify a group or a community in the society and is passed from one generation to another. Some of them may favour the transmission of intestinal parasites in a certain community. Behavior such as refusal to share a pit latrine between adults and children only lead to promiscuous defecation on the ground for one social group (WHO, 1992). This contaminates the environment with cyst, larvae and eggs of parasites (WHO, 2001). Washing clothes, bathing or wading in streams are cultural behaviors, which expose man to infections such as schistosomiasis. Cultivating land bare foot risk man to hookworm infections (Rukmono, 1980). Large social groups such as children homes, prisons and mental hospitals where there is overcrowding are vulnerable to infectious diseases owing to close proximity and frequent contact among individuals (Sonia *et al.*, 2003).

2.3 Mode of transmission of intestinal parasites.

Ingestion: The most common portal of entry of intestinal parasites is through the mouth (Ombui *et al.*, 2001). Intestinal protozoa species enter the host in the encysted stage, with exceptions of *Trichomonas hominis* and *Dientamoeba fragilis*, which are transmitted in the trophic condition. The common roundworm *Ascaris lumbricoides*, *Trichuris trichiura*, and *Enterobius vermicularis*, and human dwarf tapeworm *Hymenolepis nana*, all in full embryonated egg stages infect the host through the mouth. Man gets infections of *Taenia solium* and *Taenia saginata* from consuming

flesh containing mature larval stages of these worms. Tapeworm infection occurs particularly where pork, beef (Flisser, 1990; Peter and Barbara, 1994; Ombui *et al.*, 2001) and fish are consumed raw or undercooked.

Skin penetration: Species of human hookworm and *Strongyloides stercoralis* actively enter the host from the soil by active penetration, as do the blood flukes *Schistosoma* species (WHO, 2001). Man gets schistosomiasis, strongyloidiasis or hookworm infections through skin contact with cercariae, or third stage larvae of *Strongyloides stercoralis* and hookworm respectively (Stone, 1990).

Inhalation: Eggs of *Enterobius vermicularis* and *Ascaris lumbricoides* are air borne as cited by Corry *et al.* (2004). They are blown in the air, when bed linens are dislodged in an infected environment. They could be transmitted through inhalation into the posterior pharynx of the host (Christopher, 1982). From the pharynx the eggs are swallowed into the stomach and then pass to the intestine where they hatch to larvae, which have to go some developmental stages to become adult.

Autoinfection: The most common means of transmission of *Enterobius vermicularis* is direct anus to mouth by finger contamination in the same individual. This is autoinfection, transfer of viable eggs to the mouth are responsible for continued heavy infection in an individual or group of persons who have similar habits (Corry *et al.*, 2004). Heavy infections of *Strongyloides stercoralis* occur when rhabditoid larvae in the intestine moult to second rhabditoid larvae and then to infective filariform larvae, which penetrate the mucosa of the intestine. Autoinfection also occur when filariform

larvae of *Strongyloides stercoralis* penetrate perianal regions infecting or re-infecting the host without the parasite leaving the host body. Autoinfection of *Strongyloides stercoralis* commonly occurs in patients who are immune suppressed (Stone, 1990).

2.4 Signs and symptoms of intestinal parasites.

Loss of appetite: Patients infected with intestinal parasites have low appetite, in some cases they may feel hungry but on tasting the food they lose the appetite by feeling like vomiting hence they stop eating. Abdominal discomfort in a patient such as feeling as if the stomach is full of gases and constipation makes the patient unable to eat (Michael, 1990).

Anemia: This is a condition where there is reduced oxygen carrying capacity of the blood. Some of intestinal parasites cause anemia, by producing lesions in the intestine that bleed or they feed on blood or blood making products. Many species of amoeba give rise to infections of the intestinal lumen. Most amoeba are commensal, feeding on bacteria and producing neither lesions nor functional abnormalities. *Balantidium coli* and some strains of *Entamoeba histolytica* invade the tissue and produce intestinal lesions, which bleed (Antony and Nicholas 1991; Howard *et al.*, 2002) removing red blood cells in the circulation. Iron deficiency anemia is associated with hookworm (Bakta *et al.*, 1993; Peter and Barbara, 1994; Hardah *et al.*, 1999) while megaloblastic anemia is due to lack of vitamin B, a blood making product, which is taken by *Diphyllobothrium latum* as cited by Revenga (1993).

Ulceration: Parasites produce enzymes that help them to penetrate host tissue causing painful ulcerations or lesions. Some of lesions are intestinal and others are extra-intestinal. Extra-intestinal lesions appear in the liver, lungs, eyes, or in the brain. *Balantidium coli* and some strains of *Entamoeba histolytica* invade the tissue and produce intestinal lesions. Extra-intestinal lesions such as liver, pleuro-pulmonary and brain abscesses are caused by some strains of *Entamoeba histolytica* (Anthony and Nicholas, 1991; GOK MOH, 2002). Eggs of *Schistosoma* species also cause lesions on the same organs (Antony and Nicholas, 1991; Howard *et al.*, 2002). *Strongyloides stercoralis* and hookworm infections cause “ground itch”(cutaneous lesions) at the site where the filariform larvae enter the skin, leaving intense itching and burning sensation. *Ascaris lumbricoides* produces *Ascaris pneumonitis* when the larvae are migrating to the lungs. *Schistosoma* species cause dermatitis associated with the site of cercariae penetration. *Enterobius vermicularis* female causes pruritus around perianal regions, which provokes scratching of the irritated areas. This parasitic infection has effects on host behavior, a feeling of shame and inferiority, often occasioned by ridicule as a result of noticeable scratching by the patient to relieve pruritus (Corry *et al.*, 2004).

Consistency of stools: Food taked or intestinal parasitic infections may influence the amount of water in the stool passed by a patient (Michael, 1990; Olubuyide *et al.*, 1995). Intestinal parasites block free flow of feces in the intestine, interfere with food digestion and assimilation or they irritate the intestinal cells to produce fluids. Fluids produced from intestinal cells make the stool diarrheic or loose while blockage of free flow of feces in the intestine make stool formed. Patients with constipation pass

stools with 2 different consistency portions of diarrheic and formed as described by Michael (1990). Depending on the type of infection, diarrheic stool may be watery or loose and may be passed with blood or mucus. Passing of diarrheic stools with blood are associated with patients infected with amoeba, *Balantidium coli*, Hookworm, and Schistosoma species (Howard *et al.*, 2002; WHO, 2001; Ighogboja and Ikeh, 1997; Michael, 1990). Diarrhea due to amoeba is more common than diarrhea due to *Balantidium coli* in patients. Diarrhea caused by amoeba affects all age groups of patients (Antony and Nicholas, 1991; Howard *et al.*, 2002). Protozoa *Giardia lamblia* cause steatorrhea due to interference with fat digestion and assimilation (Howard *et al.*, 2002). *Cryptosporidium* causes self-limiting acute gastroenteritis in immune competent individuals and chronic intractable diarrhea in immune compromised individuals (Fisseha *et al.*, 1998; Singh *et al.*, 1988; Bijey and Yyotish 2002).

Abdominal pain: Abdominal pain is a differential diagnosis of various ailments such as malaria, typhoid, stomach ulcers, liver diseases, renal problems, pancreas diseases or intestinal parasitic infections. Causes of abdominal pain are bacteria infections, food poisoning, viral infections, fungal infections, malfunctioning of internal organs within the abdominal region and intestinal parasites. Abdominal pain may also originate from somewhere else, like the patient's chest, pelvic region or the pain may be due to a generalized infection affecting many parts of the body (Guerrant, 1995; Hardah *et al.*, 1999; Howard *et al.*, 2002). From GOK, MOH hospital records show intestinal parasites are among the leading causative agents of abdominal pain in patients. The effects of abdominal pain are associated with psychosocial functions (Malcolm, 1982). It interferes with normal school attendance and performance, peer

relationships, participation in organization and sports, and personal and family activities. Although pain is a feature to all abdominal problems, sufficient differences exist in its site, character and duration, when identifying its specific cause (Sandler *et al.*, 2000).

Abdominal pain may be classified as upper abdominal pain, lower abdominal pain, or pain felt at midgut. Upper abdominal pain, the source of the pain lies in the stomach, duodenum, gallbladder, liver, or pancreas. *Giardia lamblia* infect the duodenum and cause upper abdominal pain (Howard *et al.*, 2002). Midgut abdominal pain is referred as pain around the umbilical area. Most intestinal parasites infect the ileum part of the intestine, which is rich with digested food, where they rob the host some of the food (Hardah *et al.*, 1999). Lower abdominal pain is the pain overlying parietal peritoneum. Some of the parasites such as *Enterobius vermicularis* infect the large intestine, which is part of the lower abdomen (Malcolm, 1982).

The nature of the abdominal pain is determined by the characteristics and the duration of the pain leading to classification into three types acute abdominal, chronic abdominal and recurrent abdominal pain. Acute abdominal pain is the sudden onset of severe abdominal pain, which presents a genuine emergency in general practice of medicine and is a common cause of out-of-hours call. In a true acute abdominal pain, the patient is obviously ill. Although abdominal pain is common and often trivial, acute and severe pain nearly always is a symptom of intra-abdominal disease. Amoebic dysentery, which presents itself with acute abdominal pain, is often caused by *Entamoeba histolytica* (GOK MOH, 2002). Chronic abdominal pain is a common

complain of patients seeing a physician, and it is a leading reason for referral to a gastroenterologist. Chronic abdominal pain is a dull pain or discomfort in the stomach, which lasts over one month. Recurrent abdominal pain is diagnosed when there are three episodes of pain occurring over a period of at least one month in patients, and which are of sufficient severity that the discomfort interferes with individual normal activities. Intestinal helminthes are known to cause chronic and recurrent abdominal pain if the patients are not dewormed (Anthony and Nicholas, 1991).

2.5 Effects of intestinal parasites on host.

If intestinal parasitic diseases are not treated, the effects on the hosts are morbidity, hospitalization, disability, decreased production and poor performances for school going children (Peter, 2002). Death could result from intestinal obstruction and caused by heavy infections of *Ascaris lumbricoides* and prolapsed rectum produced by *Trichuris trichiura* (Christopher, 1982). Disability and morbidity may result from parasitic diseases condition, such as hepatosplenomegaly due to pathogenesis of the eggs of *Schistosoma* species in the liver and spleen. Mental disorder could occur when parasitic agents infect CNS and brain. It starts as progressive weakness of the lower limb, back pain, spastic paraplegia of the lower limbs with a sensory level at thoracic spine and localized spinal tenderness at thoracic spine when the parasite, parasite's larva or eggs such as of *Schistosoma mansoni* get into CNS (Davis, 1996). Other effects of intestinal parasites are social and economic associated problems in a community; people infected have decreased performance, failure to attend their working places as they seek medical treatment. Children fail to concentrate in class

work and failure to attend classes as they seek treatment in hospital (ROK MOH, 1998).

2.6 Diagnosis of intestinal parasites.

2.6.1 Clinical diagnosis.

Medical practitioners use signs and symptoms of diseases in diagnosing the disease-causing agent. They obtain information concerning the effect of parasitic infections in a patient on the basis of the symptom caused by the parasite, the patient history and physical examination. Majority of the symptoms attributable to parasitic diseases are not specific for diagnostic. On the basis of scientific knowledge and clinical experience, the medical practitioners consider several possible agents characteristics that produce the pattern of disease observed in the patient (Christopher, 1982; Chan, 1997).

2.6.2 Laboratory diagnosis.

Identification features of protozoa agents in stools: Amoeba are identified when a small portion of stool, about the size of a rice grain, is placed in a drop of physiological salt solution on a microscope slide, mixed and examined using a microscope, trophozoites are identified by the characteristics of the nuclei and chromatoids refractive nature of endoplasm and ectoplasm, nature of their motility, inclusions in the cytoplasm and the size of the protozoa. When a portion of stool is mixed with 1% potassium iodide the cysts are differentiated by the size and shape of the protozoa, size and position of the nuclear, the number of nuclei, nuclear karyosome

and characteristics of the chromatoids, inclusions in the cytoplasm as described by Cheesbrough (1998).

Ciliates are identified by the presence of cilia, size and shape of the protozoa, the presence of cytostome and cytopyge, number of nuclei, size and shape of the nuclei when stool is mixed with 1% potassium iodide and examined. The movement of the cilia is easily seen when stool is mixed with physiological salt solution on a microscope slide and examined. This identifies live trophozoites as described by Cheesbrough, (1998).

According to GOK MOH (2002) motile flagellates are identified by size, position and the number of the nuclei, shape of the protozoa, presence of undulating membrane, and number of flagella, presence of spiral groove when stool is mixed with physiological salt solution and examined using a microscope. The nature of motility identifies motile flagellates as described by Guerrant, (1995). Cysts of flagellates are differentiated by the size and shape of the protozoa, size and position of the nuclear, the number of nuclei when stool is stained with 1% potassium iodide and examined using a microscope.

Coccidia in stools are identified by the presence of oocysts. Oocysts are identified by their shape, size, number of sporocysts, and the number of sporozoites in each sporocyst when stool is mixed with physiological salt solution and examined under the microscope as described by Fesseha *et al* (1998).

Identification features of helminthes in stools: Adult parasites or parts of the adult parasites are seen in stool of patients. If segments of tapeworms are seen and identified in patients' stools, the patient is suffering from tapeworm infection. Adult *Ascaris lumbricoides* are seen in human feecal materials, especially when a patient had been dewormed for Ascariasis as cited by Micheal, (1990).

Eggs of helminthes are identified when stool is mixed with physiological salt solution or stained with 1% potassium iodide and examined using a microscope. The eggs of helminthes are relatively large, and are often detected on direct smears. They are identified by their size, shape, presence of opercula or spine, colour, inclusions, and the thickness of the outer layers as described by Cheesbrough, (1998).

Larvae of helminthes are identified when fresh stool is mixed with physiological salt solution and examined using a microscope, larvae of *Strongyloides stercoralis* and hookworms are motile, but mixing the stool with 1% potassium iodide kills them. Presence of dead larvae of *Strongyloides stercoralis*, and in some cases of hookworms in the old stool specimens processed by concentration methods is diagnostic of parasitic diseases (Rukmono, 1980).

2.7 Stool examination methods.

Before any parasitic diagnostic method is made, the entire stool specimen is examined grossly to determine its consistency, volume, colour, mucus, blood, tissue elements and undigested food materials. At times these stool content provide evidence of parasitic infections. Some patients pass feecal materials with adult worms of *Ascaris*,

Enterobius or proglottids of *Taenia*, *Dipylidium* without the presence of their eggs in the fecal part of the specimen as cited by Micheal (1990) and Ombui *et al.* (2001). Consistency (nature) and colour of stools also depend on the type of diet and amount of food taken by a person (Olubuyide *et al.*, 1995). Presence of stool inclusions such as blood, mucus, and fat are diagnostic of a diseased intestine (GOK MOH, 2002).

2.7.1 Microscopy.

Direct saline method: This is the most effective method for examining live trophozoites and involves the microscopic study of a portion fresh stool in 0.9% sodium chloride as described by Cheesbrough (1998). It also provides information on the content of the stool such as presence of leucocytes, red blood cells and yeast cells (Guerrant, 1995).

Concentration methods: Different concentration methods are used to detect eggs and larvae of parasites in stool specimen. According to WHO (2003) formal-ether concentration (Ritchie) method is good when identifying eggs of parasites with high density. Zinc sulphate flotation method is used in identifying cysts, eggs of parasites with light density as cited by Cheesbrough (1998).

Staining Methods: Fecal materials are temporary or permanent stained. Staining of stool smears reveal the presence of intestinal parasites such as *Dientamoeba fragilis*, which degenerate very fast as stated by Howard *et al.*, (2002) or are destroyed by concentration methods and missed on examination. Temporary staining of fecal materials by adding iodine or eosin to a prepared fecal material highlights the

internal structure of cysts and distinguishes cysts from vegetable matter. Permanently trichrome or iron hematoxylin stained fecal smear are useful in demonstrating morphological features of protozoa. They are used in teaching and confirming protozoa infections (Howard *et al.*, (2002). Ziehl-Neelsen staining method has been used in identifying and differentiating eggs of *Taenia* species as described by Cheesbrough (1998).

Culture Methods: Culture of parasites is done on limited areas, the reason as cited by Palmer *et al.*, (2002) are due to underdeveloped state of techniques, inability to culture most parasites and inability to design seeding experiments that are equivalent to working natural samples. *In vitro* culture of protozoa parasites involves highly complex procedures, which are subject to many variables. These parasites have very complex life cycles and depending on the life cycle stages, many require different culture parameters. *In vitro* cultivation is important in diagnosis of infections, antigen and antibody production and assessment of immune modulating capabilities. In addition drug screening, improvements in chemotherapy, identification of clinical isolates, determination of strains differences, vaccine production, development of attenuated strains, and continued supply of viable organisms for studying host-parasite interactions would benefit from *in vitro* cultures (Janice *et al.*, 1989; Heinz, 1998; Govinda and Lynne, 2002). Harada-Mori culture methods have been used in distinguishing helminthes such as *Necator americanus*, *Ancylostoma duodenale* and *Strongyloides stercoralis*, which have eggs with similar features as described by Bakta *et al.* (1993).

2.8 Control of intestinal parasites.

Chemotherapy: Chemotherapy is using chemical substances to treat and control certain parasitic diseases. In the patient it may constitute symptomatic relief or repression of the activities of causative agent but not necessarily its elimination. This is beneficial to patients and the entire community by curbing infection and re-infection, removing the source of infection and reducing the level of infection below those associated with morbidity (WHO, 2002).

Sanitation: The way human waste is collected and recycled or disposed in a community to avoid environment contaminations with parasitic agents is significant in the control of intestinal parasites. Sewage spilling out on the ground and uses of human waste as manure contaminates the environments with intestinal parasites (WHO, 1997). Often it also provides sites and opportunity for certain flies to lay their eggs to breed or to feed on the exposed material and carry infections. In addition, it sometimes creates intolerable nuisances of both odor and sight in the environment (WHO, 1992).

Personal hygiene: Parasites, which are transmitted through ingestion, are controlled by personal hygiene, that is; washing hands before eating and after visiting toilets, proper cooking or refrigerating of food to kill the parasites contaminating food, keeping food covered to prevent flies and cockroaches from contaminating them with parasites. Persons handling food should be regularly tested and treated of intestinal parasites to prevent transmission and also remove the source of infections in a community (WHO, 2002; WHO, 2001; Ombui *et al.*, 2001).

Environment manipulation: Environment manipulation is used to control soil-transmitted helminthes by making the conditions unfavorable for the parasite to survive outside the host body. These are done by removing moisture, preventing air movement and allow dryness in the soil. Those conditions kill eggs, larvae and cysts or delay the embryonation of eggs of some of the parasites (Rukmono, 1980).

Protective attire: Man gets hookworm infections, Strongyloidiasis and schistosomiasis through larvae penetrating exposed skin. Attire or wearing of protective clothes, gloves and boots for those people working in the field known to have hookworm, *Strongyloides stercoralis* and *Schistosoma* infections prevent them from being infected in those environments (Rukmono, 1980).

Health education: People at the community level should be educated about the dangers of intestinal parasites, how to seek medical advice when infected and how to control them. Knowledge of parasitic life cycle is important as it gives the parasitic stages, which are easily targeted. Personal hygiene is taught and how to manipulate the environment to keep away parasitic agents. This empowers the community with public health education in order to take care for themselves in controlling parasitic infections (WHO, 2002).

CHAPTER 3: MATERIALS AND METHODS

3.1 Study area.

The work was done at Kenyatta National Hospital (KNH), which is in Nairobi province, Kenya. It is the largest hospital in Kenya, situated 3 kilometres from Nairobi city centre in the North West, (appendix 1). It has a bed capacity of 1,800 patients and 2,200 are treated as outpatients daily. About 4,500 patients daily, seek treatment for various ailments in the hospital. It is a referral, teaching and research hospital with specialized out patient clinics, casualty department and inpatient wards. Kenyatta National Hospital was conveniently selected as a study area.

3.2 Study population.

Participants were inpatients and outpatients seeking treatment at Kenyatta National Hospital. Only patients who took stools specimen to Parasitology laboratory for intestinal parasites investigations, had history of abdominal pain and gave consent were included in the study. Patients who never gave consent, children under 2 years and patients from other hospitals who took stools specimen to Parasitology laboratory for intestinal parasites investigations were excluded in this study.

3.3 Study design.

A descriptive, cross-sectional study was carried to determine and compare the types and frequency of parasitic agents in different types of stools from patients with abdominal pain.

3.4 Sampling technique.

Patients were interviewed and those with a history of abdominal pain were assisted to fill questionnaire concerning the nature of their pain (appendix 2). Systematic simple random sampling was used to selected sample units where every stool specimen received from third patient with abdominal pain in the laboratory was considered. The number of patients from wards, outpatients clinics, casualty and paedietric filter clinic was calculated using probability of proportion to size at 88: 91: 103: 118 ratio respectively.

3.5 Sample size.

A sample size was selected using the formula ($n=Z^2pqD/d^2$) as used by Fisher *et al.* (1998), where n is sample size, Z is 1.96, p is a proportion of the targeted population estimated as 0.5 at confidence level of 95%, where q is 1-p, D is a design effect of 1 and d is 0.05 was used. Substituting these figures $n = \frac{1.96 \times 1.96 \times 0.5 \times 0.5 \times 1}{0.05 \times 0.05} = 384$, but due to attrition a sample size of 400 was taken.

3.6 Laboratory methods.

3.6.1 Direct observation.

Stool consistency: Stools specimens received in the laboratory were examined for consistency immediately. The consistency of stool was semi-quantitatively measured using an applicator stick and tilting the stool container to observe the movement of the stool (appendix 3). Depending on the amount of water the stools were recorded as formed, soft, loose, or watery (see definition of operational terms) as described by Olubuyide *et al.*, (1995).

Stool inclusions: Inclusions in the stools; such as presence of blood, mucus, fatty material, adult worms or segments of tapeworms were observed and recorded.

3.6.2 Microscopic examination.

Direct saline method: On receiving stool specimen, direct saline method was done immediately on watery and loose stools according to WHO (2003) and Cheesbrough (1998). A small portion (the size of rice grain) of stool specimen was picked with the tip of an applicator stick, emulsified in a drop of 0.9% saline solution on a microscope slide, then covered with a cover slip and examined under the microscope for motile trophozoites, and microscopic inclusions such as pus cells, red blood cells and yeast cells.

Formol-ether concentration method: According to Hardah *et al*, (1999) two pea-size portions of stool were emulsified using a pestle and a mortar in 7ml of 10% formal saline, strained through a sieve into a centrifuge test tube to remove large fecal materials. Three ml of ether added to the suspension, shaken vigorously, centrifuged at a speed of 2000 rcf for 2 minutes and the entire supernatant poured off. A drop of the sediment was placed on a microscope slide, and a drop of 10% iodine solution added, a cover slip was placed on and examined for parasitic agents using the 2 levels of magnifications in a microscope with power 10 and 40 objectives.

Harada-Mori culture technique : A thin film of faeces was spread at the middle third of a strip cut from filter paper. The strip of the filter paper had a width and length slightly less than that of centrifuge test tube, which was placed in the centrifuge test

tube containing 3ml of distilled water and covered with cotton wool. Then incubated at room temperature in the dark corner for 10 days. Larvae were harvested and identified using a microscope with power 40 as described by Rukmono (1980).

Modified Ziehl-Neelsen stain technique: Smears were made from stool specimens with *Taenia* species eggs, fixed with 1% hydrochloric-methanol. Then stained with 1% aqueous carbol fuchsin for 30 minutes, and counterstained with 1 % aqueous methylene blue. Washed with water, air-dried and examined using a microscope. Eggs, which stained pinkish, were identified as eggs of *Taenia saginata* as described by Cheesbrough (1998).

Identification of segments: Segments of tapeworms were pressed in between two slides, examined using a microscope with power 10 and 40 objectives and the number of uterine branches in segment counted. Segments with more than 13 uterine branches on each side were identified as segments of *Taenia saginata* and those with less than 13, as segments *Taenia solium* as described by Cheesbrough, (1998).

3.7 Ethical consideration.

Clearance to carry out the project was given from Kenyatta University, Ministry of Education, Science and Technology and Kenyatta National Hospital. Confidentiality of the patients' reports was maintained all through.

3.8 Data analysis.

Data was produced using SPSS programme. Ages of patients, nature of abdominal pain, frequencies of male and female, infections, inpatient and out patient was put into percentages and the relationships compared. Association among consistency of stools, nature of abdominal pain, age groups, sex and intestinal parasites was tested using chi-square.

3.9.1. *Yak, Central Department, which treat adults' emergency* (table 4.1)

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3.9.1.2. *Yak, Central Department, which treat adults' emergency* (table 4.1)

3.9.1.3. *Yak, Central Department, which treat adults' emergency* (table 4.1)

3.9.1.4. *Yak, Central Department, which treat adults' emergency* (table 4.1)

3.9.1.5. *Yak, Central Department, which treat adults' emergency* (table 4.1)

3.9.1.6. *Yak, Central Department, which treat adults' emergency* (table 4.1)

3.9.1.7. *Yak, Central Department, which treat adults' emergency* (table 4.1)

3.9.1.8. *Yak, Central Department, which treat adults' emergency* (table 4.1)

CHAPTER 4: RESULTS

4.1 Characteristics of the study population.

4.1.1 Distribution of patients in various sections of the hospital.

A total of 400 patients with abdominal pain were recruited in this study. Children below 12 years seen and diagnosed for intestinal parasites in the paediatric filter clinic were 118(29.5%). Casualty department, which treat adults' emergency cases, had 103(25.8%) patients. Out patient clinics had 91(22.8%) patients. There were 88(22.0%) patients admitted in the wards (table 4.1).

4.1.2 Age of patients.

Age of patients ranged from 2-86 years with a mean age of 22.0, median age of 20 and S.D of 17.7 years (table 4.9). The most occurring ages were 3 and 6 years, which occurred 13 times each.

4.1.3 Distributions of patients by sex.

Out of 400 patients with abdominal pain examined for intestinal parasites in their stools, female patients were 202(50.5%) and male were 198(49.5%). There were 48 female and 55 male patients from casualty department, 58 female and 60 male patients from paediatric filter clinic, 46 female and 45 male patients from out patient clinics, 50 female and 38 male were inpatients admitted in the wards (table 4.1). There was no gender disparity in this study.

4.1.4 Duration of abdominal pain.

Out of 400 patients interviewed 164(41.0%) had acute abdominal pain that were less than 7 days, 181(45.3%) patients had chronic abdominal pain that were more than 7 days, and 55(13.8%) had 3 or more episodes of abdominal pain in the last 2 months (table 4.1).

4.1.5 Other symptoms that occurred in patients with abdominal pain.

Of the 400 patients, 122(30.5%) had abdominal pain complain only, 178(44.5%) complained of abdominal pain and other gastrointestinal symptoms, 32(8.0%) had abdominal pain, other gastrointestinal and none gastrointestinal symptoms (section 4.7) while 68(17.0%) had abdominal pain and other none gastrointestinal symptoms (table 4.18).

Table 4.1. Distributions of patients with different duration of abdominal pain attending various departments in the hospital.

Abdominal Pain	Departments in KNH								Total
	Casualty		Paediatric filter clinic		Out Patient Clinics		Wards		
	Female	Male	Female	Male	Female	Male	Female	Male	
Acute	18	27	19	30	7	6	30	27	164
Chronic	26	24	22	18	34	29	17	11	181
Recurrent	4	4	17	12	5	10	3	0	55
Total	48	55	58	60	46	45	50	38	400

4.2 General characteristics of the stool samples.

4.2.1 Consistency of stool samples.

Out of 400 stool samples from patients with abdominal pain brought in the laboratory 218(54.5%) were formed, 95(23.8%) were soft, 78(19.5%) were loose and 9(2.3%) were watery (figure 4.1).

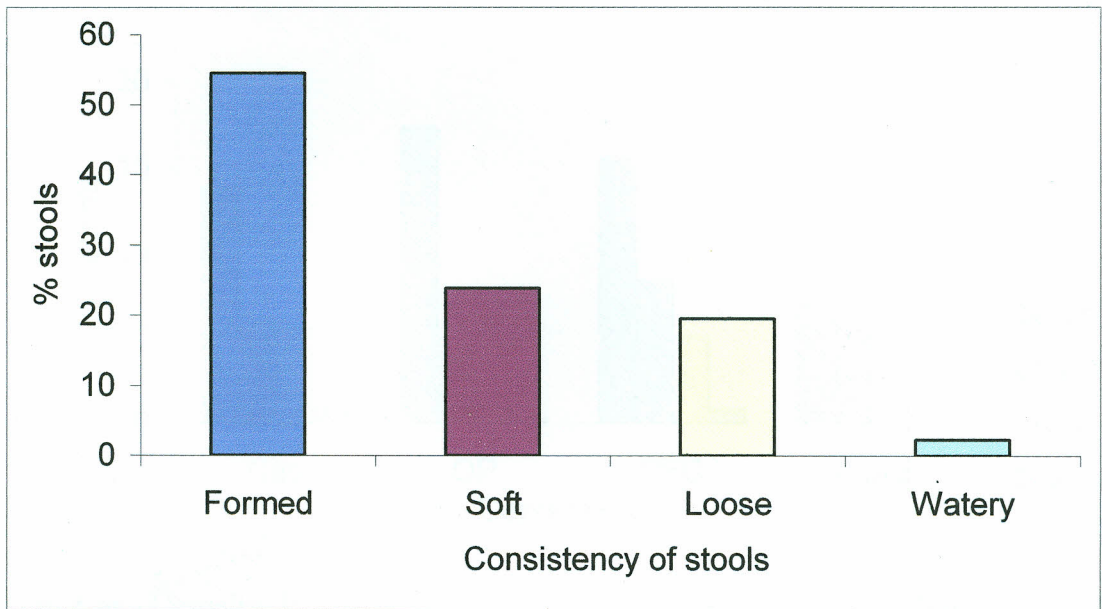
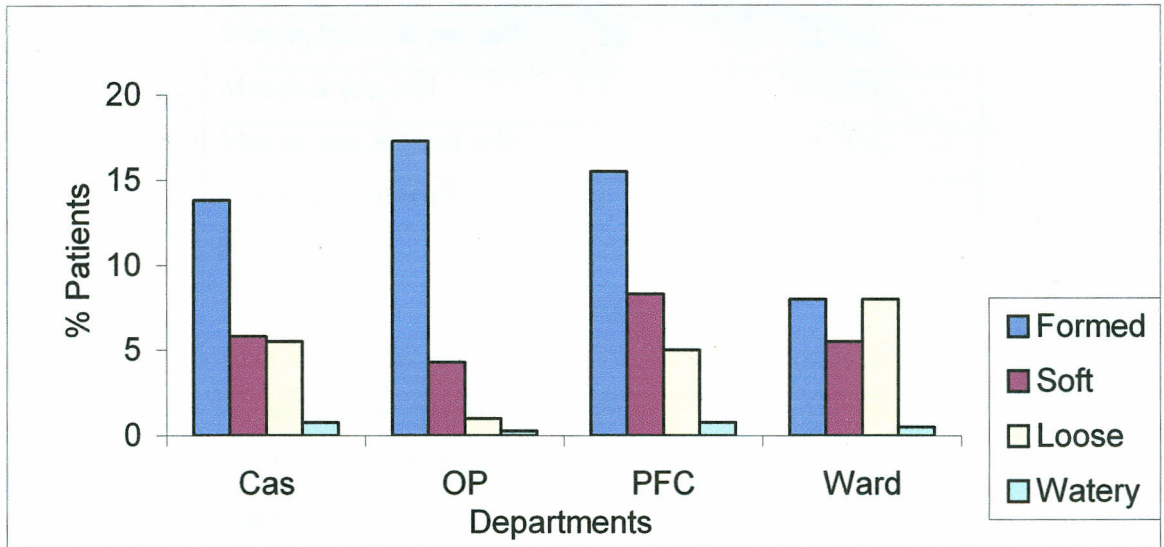


Figure 4.1. Consistency of stools received in the laboratory from patients with abdominal pain.

4.2.2 Consistency of stools passed by patients attending different departments.

Out of 400 patients with abdominal pain seeking treatment in KNH, among the patients seen in casualty department 55(13.8%) had formed stools, 23(5.8%) had soft stools, 22(5.5%) had loose stools and 3(0.75%) had watery stools. Those from paediatric filter clinic 62(15.5%) had formed stools, 33(8.3) had soft stools, 20(5%) had loose stools and 3(0.75%) had watery stools. Patients from outpatients' clinics 69(17.3%) had formed stools, 17(4.3%) had soft stools, 4(1%) had loose stools while those from ward 32(8%) had formed stools, 22(5.5%) had soft stools, 32(8%) had

loose stools and 2(0.5%) had loose stools (figure 4.2). When consistencies of stools were considered and the various departments the patients were attending, it was noted more patients in the wards were passing diarrheic stools than patients attending other departments ($\chi^2=39.86$, $df=9$, $P=0.000$).



Key: Cas - Casualty, P.F.C - Paediatric filter clinic, O.P - Out Patient Clinics

Figure 4.2 Comparison of consistency of stools from patients with abdominal pain attending different clinical departments at KNH.

4.2.3 Inclusions in the stools.

There were five types of inclusions found in the stools of patients with abdominal pain. Out of 400 patients interviewed, 79(19.75%) passed stools with at least one inclusion. There were 44(11.0%) stools of patients with pus cells, 33(8.25%) stools with mucus, 23(5.75%) stools with blood, 15(3.75%) stools had yeast cells, and one patient had segments of *Taenia saginata* in his stool sample (table 4.2).

Table 4.2. Prevalence of inclusions identified in stools of patients with abdominal pain.

Stools inclusions	Frequency	% Frequency
Blood	8	(2%)
Blood & pus cells	3	(0.75%)
Blood & yeast cells	1	(0.25%)
Mucus	12	(3%)
Mucus & blood	1	(0.25%)
Mucus, blood & pus cell	10	(2.5%)
Mucus & pus cell	7	(1.75%)
Mucus, pus & yeast cells	1	(0.25%)
Mucus & yeast cells	1	(0.25%)
Pus cells	22	(5.5%)
Yeast cells	12	(3%)
Segments of <i>Taenia</i> species	1	(0.25%)
Stools with inclusions	79	(19.75%)
Stools without inclusions	321	(80.25%)
Total	400	(100%)

4.2.4 Inclusions in stools passed by patients attending different departments.

Among the 4 clinical departments where patients with abdominal pain consult clinicians, out of 88 patients admitted in the wards 30(34.0%) had inclusions in their stools, of 118 patients in paediatric filter clinic 21(16.9%) had at least one inclusion in their stools. Out of 91 patients in outpatient clinics 8(8.8%) had at least one inclusion while of 103 patients in casualty 21(20.4%) had inclusions in their stools (table 4.3). More patients admitted in the hospital were passing stools with inclusions than those seeking treatment in any other clinical departments ($\chi^2=58.98$, $df=33$, $P=0.004$). Admitted patients with abdominal pain were passing stools with inclusions.

Table 4.3 Comparison of inclusions in stools passed by patients attending various clinical departments at KNH.

Inclusions in stools	Clinical departments			
	Casualty	Out patient clinics	Paediatric filter clinic	Wards
Blood	5	0	1	2
Blood & pus cells	1	0	1	1
Blood & yeast cells	1	0	0	0
Mucus	1	3	3	5
Mucus & blood	0	0	0	1
Mucus, blood & pus cell	5	2	2	1
Mucus & pus cell	4	0	1	2
Mucus, pus & yeast cells	0	0	0	1
Mucus & yeast cells	0	0	1	0
Pus cells	3	0	6	13
Yeast cells	1	2	5	4
Segments of <i>Taenia</i> species	0	1	0	0
Stools without inclusions	82	83	98	58
Total	103	91	118	88
% Stools with inclusions	20.4%	8.8%	16.9%	34.0%

4.2.5 Prevalence of parasites.

Overall prevalence of intestinal parasites in stools of patients with abdominal pain at KNH was 39.25%, where protozoa were 32.2% (table 4.4) and helminthes was 7% (table 4.5).

Prevalence of protozoa: A total of 129 protozoa parasites were identified in the stools of patients with abdominal pain (table 4.4). The most occurring protozoan was *Blastocystis hominis* (10.75%) and the least was *Trichomonas hominis* (0.5%).

Table 4.4. Prevalence of protozoa.

Protozoa	Frequencies	% Prevalence
<i>Endolimax nana</i>	23	5.75%
Cryptosporidium	3	0.75%
<i>Entamoeba histolytica</i> strains	6	1.5%
<i>Entamoeba coli</i>	34	8.5%
<i>Blastocystis hominis</i>	43	10.75%
<i>Giardia lamblia</i>	9	2.25%
<i>Chilomastix mesnili</i>	5	1.25%
<i>Idamoeba butschlii</i>	4	0.1%
<i>Trichomonas hominis</i>	2	0.5%
Total	129	32.25%

Prevalence of helminthes: A total of 28 cases of helminthic agents were identified. The most prevalence helminth was hookworm 2.5% and the least was *Taenia saginata* 0.25% (table 4.5).

Table 4.5. Prevalence of helminthes.

Helminth	Frequencies	% Prevalence
<i>Strongyloides Stercoralis</i>	4	0.1%
Hookworm	10	2.5%
<i>Ascaris lumbricoides</i>	4	0.1%
<i>Schistosoma mansoni</i>	9	2.25%
<i>Taenia saginata</i>	1	0.25%
Total	28	7%

4.2.6 Parasitic agents identified in patients attending various departments.

Out of 91 patients seeking treatment in outpatient clinics 34(37.4%) patients passed stools with parasitic agents, of 103 patients in casualty 30(29.1%) passed stools with parasitic agents. In the paediatric filter clinic 27(22.9%) patients out of 118 had parasitic agents in their stools. Out of 88 patients in the wards 31(25.6%) had parasitic agents in their stools (table 4.6). Parasitic infections had an equal distributed among patients with abdominal pain seeking treatment in various departments ($\chi^2=14.26$, $df=9$, $P=0.113$).

Table 4.6 Frequency of parasitic infections in stool passed by patients attending various departments at KNH.

Departments	Parasitic agents				Total
	Both protozoa & helminthes	Helminths	Protozoa	Negative cases	
Casualty	3 (2.9%)	3 (2.9%)	24(22.2%)	73 (70.9%)	103 (100%)
Out patients clinics	4 (4.4%)	4 (4.4%)	26(28.6%)	57 (62.6%)	91 (100%)
Paediatric filter clinic	1 (0.84%)	2 (1.6%)	24(20.3%)	91 (77.1%)	118 (100%)
Wards	2 (2.27%)	6 (6.81%)	11(12.5%)	69 (74.4%)	88 (100%)
Total	10	15	85	290	400

4.3 Relationship between consistency of stools and other variables.

4.3.1 Consistency of stools passed by patients and duration of abdominal pain.

Out of the 218 patients passing formed stools, 59(27.1%) had acute abdominal pain, 123(56.4%) had chronic abdominal pain, while 36(16.5%) patients had recurrent abdominal pain, while 95 patients passing soft stools 47(49.5%) had acute abdominal pain, 33(34.7%) had chronic abdominal pain, and 15(15.8%) had recurrent abdominal pain. There were 78 patients passing loose stools 53(67.9%) had acute abdominal pain, 21(26.9%) had chronic abdominal pain and 4(5.1%) had recurrent abdominal pain (table 4.7). Patient passing diarrheic stools were associated with acute abdominal pain while patients passing formed stools were associated with recurrent or chronic abdominal pain ($\chi^2=47.3$, $df=6$, $P=0.000$). Duration of abdominal pain influence the consistency of the stool passed by patients.

Table 4.7. Comparison of consistency of stools passed by patients with different duration of abdominal pain.

Duration of Abdominal pain	Consistency of stools				Total
	Formed	Soft	Loose	Watery	
Acute	59 (27.1%)	47(49.5%)	53(67.9%)	5(55.6%)	164
Chronic	123(56.4%)	33(34.7%)	21(26.9%)	4(44.4%)	181
Recurrent	36(16.5%)	15(15.8%)	4 (5.1%)	0(00.0%)	55
Total	218 (100%)	95 (100%)	78 (100%)	9 (100%)	400

4.3.2 Parasitic agents identified in different consistency of stools passed.

Various intestinal parasitic agents were identified in different consistency of stools. Out of those passing formed stools 32.6%, soft 21%, loose 20.5% and watery stools 33.3% had intestinal parasitic infections (table 4.8). There was no relationship between the amount of water (consistency) in the stool and intestinal parasites in patients with abdominal pain ($\chi^2=0.000$, $df=3$, $P=1.0$). Consistency of stool does not indicate intestinal parasitic infection. There were 110(27.5%) patients passing stools with parasitic agents. Out of 400, there were 33(8.25%) patients with mixed infections, and their stools had 2 or more parasitic agents. Out of 33 patients with multiple infections, 21 of them had *Entamoeba coli* occurring. Patients harbouring *Cryptosporidium* had no other parasitic agents in their stools. There were 4 patients with trophozoites of protozoa in their stools; one patient had both cysts and trophozoites of *Gardia lamblia* (table 4.8).

Table 4.8. Parasites found in different consistency of stools.

Parasites	Stools consistency				Total
	Formed	Soft	Loose	Watery	
<i>A.lumbricoides</i>		3			3
<i>B.Hominis</i>	19	3	3		25
<i>B.hominis</i> &Hookworm	2				2
<i>B.hominis</i> & <i>S.mansoni</i>	1				1
<i>B.hominis</i> & <i>S.stercoralis</i>	1				1
<i>B.hominis</i> & <i>C.mesnili</i>	1				1
<i>B.hominis</i> & <i>E.coli</i>	3		1		4
<i>B.hominis</i> , <i>E.coli</i> , <i>A.lumbricoides</i> &Hookworm			1		1
<i>B.hominis</i> , <i>E.coli</i> &Hookworm	1				1
<i>B.hominis</i> , <i>E.coli</i> & <i>S.mansoni</i>	1				1
<i>B.hominis</i> , <i>E.coli</i> & <i>G.lambli</i> a*				1	1
<i>B.hominis</i> & <i>E.nana</i>	2	3			5
<i>C.mesnili</i>	3				3
<i>C.mesnili</i> , <i>E.histolytica</i> strains & <i>E.nana</i>	1				1
<i>Cryptosporidium</i>	1		1	1	3
<i>E.coli</i>	11	1	1		13
<i>E.coli</i> &Hookworm	1				1
<i>E.coli</i> & <i>E.nana</i>	8				8
<i>E.coli</i> , <i>E.histolytica</i> strains & <i>E.nana</i>		1			1
<i>E.coli</i> , <i>E.nana</i> &Hookworm	1				1
<i>E.coli</i> , <i>E.nana</i> & <i>G.lambli</i> a	1				1
<i>E.coli</i> & <i>I.buschili</i>	1				1
<i>E.histolytica</i> strains	1		2		3
<i>E.histolytica</i> strains, <i>E.nana</i> & <i>S.mansoni</i>		1			1
<i>E.nana</i>	3	1	1		5
<i>G.lambli</i> a**	2	2	2		6
Hookworm	2	1	1		4
<i>I.butschili</i>	2		1		3
<i>S.mansoni</i>	1	2	1		4
<i>S. stercoralis</i>		2	1		3
Segments of <i>Taenia</i>	1				1
<i>T.hominis</i>				1	1
Total	71	20	16	3	110
Percent positive cases	32.6	21	20.5	33.3	27.5

* Cysts and trophozoites of *Giardia* occurred together.

** One case of trophozoites and the other of cysts.

4.3.3 Consistency of stools passed by different sexes.

Out of 202 stool samples from females 114 were formed, 46 soft, 36 loose, and 6 watery while out of 198 stool samples from males 104 were formed, 49 soft, 42 loose and 3 watery (figure 4.3). There was no gender disparity in consistency of stools ($\chi^2=1.975$, $df=3$, $P=0.578$).

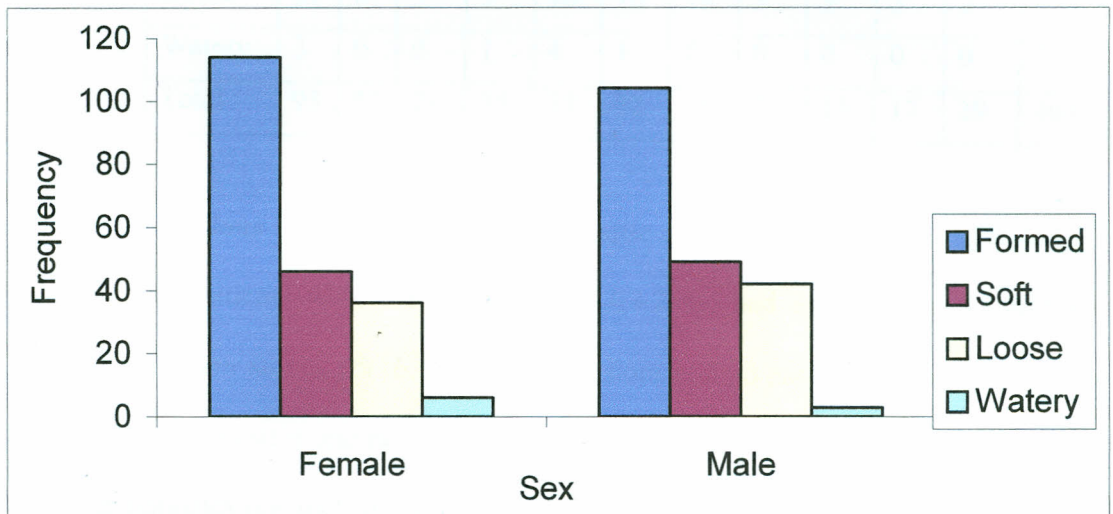


Figure 4.3. Comparison of consistency of stools passed by male and female patients with abdominal pain.

4.3.4 Consistency of stools in different ages groups.

In all age groups more patients passed formed stools than any other consistency of stools (table 4.9). When age was considered patients below 5 years and 16-30 years with abdominal pain passed stools with more amount of water than patients of 6-15 years and those who were over 30 year with abdominal pain ($\chi^2=57.527$, $df=30$, $P=0.002$). Consistency of stools depended on the age of the patient with abdominal pain.

Table 4.9. Association between age of the patients and consistency of stools passed by the patients with abdominal pain.

Stools	Age of patients											Total
	2-	6-	11-	16-	21-	26-	31-	36-	41-	46-	51-	
Formed	5	10	15	20	25	30	35	40	45	50	86	218
Soft	39	37	18	23	16	25	11	10	7	10	22	95
Loose	31	12	3	6	7	6	4	13	5	4	4	78
Watery	20	8	3	5	10	10	10	3	3	3	3	9
Total	3	0	0	1	4	1	0	0	0	0	0	9
Total	93	57	24	35	37	42	25	26	15	17	29	400

4.4 Inclusions found together with parasitic agents in stools.

Out of 400 patients with abdominal pain, 13(3.25%) had inclusions and intestinal parasites in their stools, 65(16.25%) had inclusions and no parasites, while 96(24.0%) patients had parasites and no inclusions in their stools, and 226(56.5%) patients had neither parasites nor inclusions in their stools (table 4.10). There was no relationship between inclusions and intestinal parasitic infection in patients with abdominal pain ($\chi^2=0.000$, $df=1$, $P=0.157$). Inclusions in the stool do not indicate intestinal parasitic infections.

4.10. Inclusions identified together with parasitic agents in stools.

Stools	With parasites	Without parasites	Total
With inclusions	13 (3.25%)	65 (16.25%)	78 (19.5%)
Without inclusions	96 (24.0%)	226 (56.5%)	322 (80.5%)
Total	109 (27.25%)	291 (72.75%)	400 (100%)

4.4.1 Relationship between inclusions passed with stools and duration of pain.

There were 164 patients with acute abdominal pain, 47(28.7%) had at least one inclusion in the stool. Out of 181 patients with chronic abdominal pain, 25(13.8%) had inclusions in their stools, while of the 55 patients with recurring abdominal pain, 8(14.5%) had inclusions in their stools. There were 24(6.0%) patients with 2 or more than 2 inclusions in their stools (table 4.11). There was relationship between inclusions in stools and duration of abdominal pain in a patient ($\chi^2=40.3$, $df=22$, $P=0.010$). Inclusions in stools indicate severity of pain.

Table 4.11. Inclusions found in stools of patients with abdominal pain.

Stools inclusions	Duration of pain			Total
	Acute	Chronic	Recurrent	
Blood	4	3	1	8
Blood & pus cells	3	0	0	3
Blood & yeast cells	1	0	0	1
Mucus	5	6	1	12
Mucus & blood	0	1	0	1
Mucus, blood & pus cells	6	3	1	10
Mucus & pus cells	7	0	0	7
Mucus, pus & yeast cells	1	0	0	1
Mucus & yeast cells	0	0	1	1
Pus cells	16	5	1	22
Yeast cells	4	5	3	12
Stools without inclusions	117	156	47	322
Total	164	181	55	400

4.4.2 Inclusions in stools passed by male and female patients.

There were 78(19.5%) patients with inclusions in their stools, 38(9.5%) were from male and 40(10.0%) from female patients (table 4.12).

Table 4.12. Occurrence of inclusions in stools passed by different sex of patients with abdominal pain.

Stools inclusions	Sex		Total
	Female	Male	
Blood	2	6	8
Blood & pus cells	0	3	3
Blood & yeast cells	0	1	1
Mucus	6	6	12
Mucus & blood	1	0	1
Mucus, blood & pus cells	6	4	10
Mucus & pus cells	2	5	7
Mucus, pus & yeast cells	1	0	1
Mucus & yeast cells	1	0	1
Pus cells	16	6	22
Yeast cells	5	7	12
Stools without inclusions	164	160	322
Total	202	198	400

4.4.3 Inclusions in stools and age of patients.

Out of 25 patients aged 31-35 years 9(36%) passed stools with inclusions and they were the majority compared with stools of other patients within other age groups (figure 4.4). There was no significant different between inclusions in stools and age of patients ($\chi^2=0.00$, $df=10$, $P=1.000$). All age groups had inclusions in their stools.

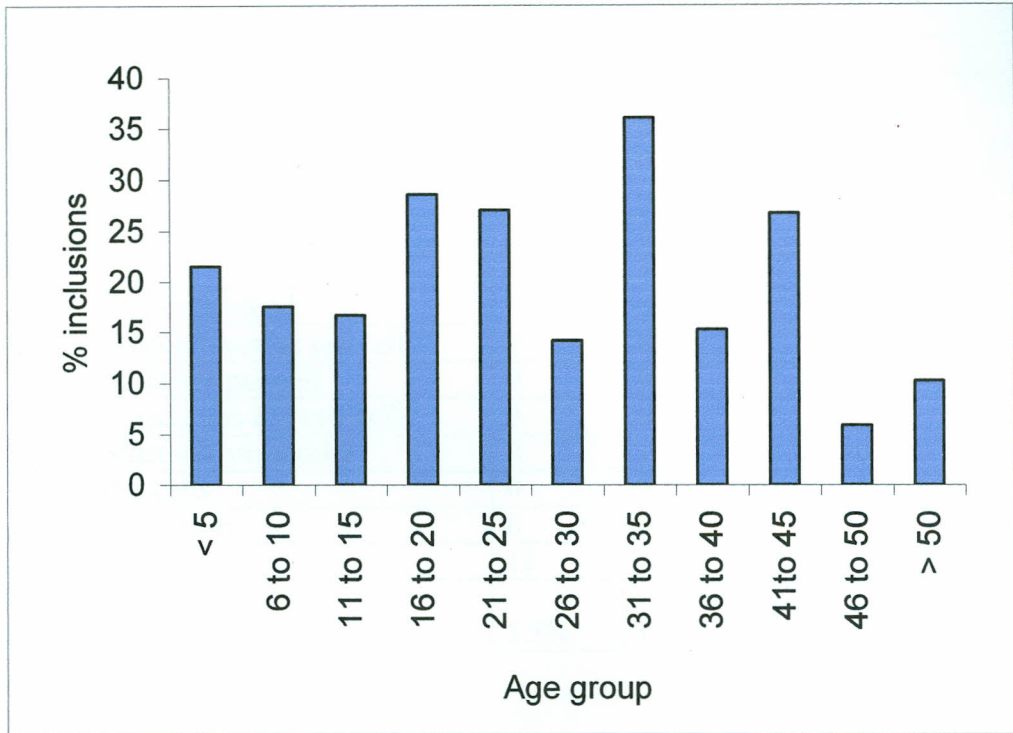


Figure 4.4. Percent frequency of inclusions in stools passed by patients with different ages.

4.4.4 Inclusions passed with stools of different consistency.

Different consistency of stools passed by patients with abdominal pain had different inclusions. Out of 78 patients passing stools with inclusions, 12(15.3%) had formed stools, 11(14.1%) had soft stools, 52(66.7%) had loose stools and 3(3.8%) had watery stools (table 4.13). Loose stools were associated with inclusions ($\chi^2=217.6$, $df=33$, $P=0.000$). Diarrheic stools of patients with abdominal pain had inclusions.

Table 4.13. Inclusions found in different consistency of stools.

Inclusions	Stools Consistency				Total
	218 Formed	95 Soft	78 Loose	9 Watery	
Blood	4	0	4	0	8
Blood & pus cells	0	0	3	0	3
Blood & yeast cells	1	0	0	0	1
Mucus	1	5	6	0	12
Mucus & blood	0	0	1	0	1
Mucus, blood & pus cell	0	0	9	1	10
Mucus & pus cell	0	0	7	0	7
Mucus, pus & yeast cells	0	0	1	0	1
Mucus & yeast cells	0	1	0	0	1
Pus cells	0	0	20	2	22
Yeast cells	6	5	1	0	12
Total	12	11	52	3	78
% Stools with inclusions	5.5%	11.6%	66.7%	33.3%	19.5%

4.5 Parasites and gender.

Out of 110 patients with abdominal pain and intestinal parasites, 58 were female and 52 male. Mixed infections of both protozoa and helminthes occurred in 5 male and 5 female. Female patients infected with protozoa were 45, while male patients were 40. There was no significant different between sexes and protozoa infections ($\chi^2=0.23$, $df=1$, $P=0.628$). Female patients infected with helminthes were 8 and male were 7 (table 4.14). There was no significant different between sex and helminthes infections ($\chi^2=1.7$, $df=1$, $P=0.189$). Intestinal parasitic infections had an equal distribution between sexes.

Table 4.14. Frequencies of parasites in different sexes.

Parasites	Sex		Total
	Male	Female	
Protozoa	40	45	85
Helminthes	7	8	15
Both Protozoa & helminthes	5	5	10
Total	52	58	110

4.5.1 Age and parasites.

The prevalence of intestinal parasites across all age groups with abdominal pain was 27.5%. The age groups with least parasitic infections were patients below 5 years, 46 to 50 years and patients above 50 years had 19.3%, 17.6%, and 17.2% infection respectively. The age groups of patients with the most infections were patients 36 to 40 years, followed by 11 to 15 years, 16 to 20 years, and 41 to 45 years with 50%, 37.5%, 37.1%, and 33.3% infection respectively. Age group 6 to 10 years, 21 to 25 years, 26 to 30 years and 31 to 35 years had 31.6%, 21.6%, 31%, and 20% infection respectively (table 4.15). There was significant different between age and parasitic infections ($\chi^2=38.52$, $df=10$, $P<0.001$). There was variation the way intestinal parasites infected patients of different ages.

Table 4.15. Frequencies of parasites in stools passed by patients with different age.

Patients with parasites	Age of patients											Total
	<5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	>51	
Protozoa	15	16	7	7	3	11	3	10	5	3	5	85
Helminthes	2	2	1	3	2	1	2	2	0	0	0	15
Both protozoa & Helminthes	0	0	1	3	3	1	0	1	0	0	0	10
Patients without parasites	75	39	15	22	29	29	20	13	10	14	24	290
Total	93	57	24	35	37	42	25	26	15	17	29	400
% Patients infected	19.3	31.6	37.5	37.1	21.6	31.0	20.0	50.0	33.3	17.6	17.2	27.5

4.6 Intestinal parasites identified in stools passed by patients with different duration of abdominal pain.

Out of 164 patients with acute abdominal pain, 30(18.3%) had parasitic infections, of 181 patients with chronic abdominal pain 63(34.8%) had parasites in their stools, while out of 55 patients with recurrent abdominal pain 17(30.9%) had intestinal parasites in their stools (table 4.16). There was no association between duration of abdominal pain and intestinal parasites ($\chi^2=72.95$, $df=64$, $P=0.207$). Duration of abdominal pain is not an indicator parasitic infection. Patients with abdominal had mixed infections; there was one case with 4 different intestinal parasites, *Blastocystis hominis*, *Entamoeba coli*, *Ascaris lumbricoides* and hookworm occurring together. There were no mixed infections with *Cryptosporidium* (table 4.16).

Table 4.16. Intestinal parasites identified in stools passed by patients with different duration of abdominal pain.

Parasites	Abdominal pain			Total
	Acute	Chronic	Recurrent	
<i>A.lumbricoides</i>	1	2	0	3
<i>B.Hominis</i>	4	15	6	25
<i>B.hominis</i> &Hookworm	0	2	0	2
<i>B.hominis</i> & <i>S.mansoni</i>	0	0	1	1
<i>B.hominis</i> & <i>S.stercoralis</i>	0	1	0	1
<i>B.hominis</i> & <i>C.mesnili</i>	1	0	0	1
<i>B.hominis</i> & <i>E.coli</i>	1	3	0	4
<i>B.hominis, E.coli, A.lumbricoides</i> &Hookworm	1	0	0	1
<i>B.hominis, E.coli</i> &Hookworm	0	0	1	1
<i>B.hominis, E.coli</i> & <i>S.mansoni</i>	0	1	0	1
<i>B.hominis, E.coli</i> & <i>G.lamblia</i> *	0	1	0	1
<i>B.hominis</i> & <i>E.nana</i>	0	5	0	5
<i>C.mesnili</i>	0	2	1	3
<i>C.mesnili, E.histolytica</i> strains & <i>E.nana</i>	0	1	0	1
<i>Cryptosporidium</i>	3	0	0	3
<i>E.coli</i>	3	7	3	13
<i>E.coli</i> &Hookworm	0	1	0	1
<i>E.coli</i> & <i>E.nana</i>	3	2	3	8
<i>E.coli, E.histolytica</i> strains & <i>E.nana</i>	1	0	0	1
<i>E.coli, E.nana</i> &Hookworm	0	1	0	1
<i>E.coli, E.nana</i> & <i>G.lamblia</i>	0	1	0	1
<i>E.coli</i> & <i>I.buschili</i>	0	1	0	1
<i>E.histolytica</i> strains	1	1	1	3
<i>E.histolytica, E.nana</i> & <i>S.mansoni</i>	0	1	0	1
<i>E.nana</i>	1	4	0	5
<i>G.lamblia</i> **	3	3	0	6
Hookworm	1	2	1	4
<i>I.butshili</i>	2	1	0	3
<i>S.mansoni</i>	1	3	0	4
<i>S.stercoralis</i>	2	1	0	3
Segments of <i>Taenia</i>	0	1	0	1
<i>T.hominis</i>	1	0	0	1
Total number of positive cases	30	63	17	110
Total number of negative cases	134	118	38	290
Percent positive cases	18.3%	34.8%	30.9%	27.5%

* Cysts and trophozoites of *Giardia lamblia* occurred together.

** One case of trophozoites and the other of cysts.

4.6.1 Duration of abdominal pain in male and female patients.

There were 74(18.5%) female and 90(22.5%) male with acute abdominal pain, 99(24.75%) female and 82(20.5%) male with chronic abdominal pain, 29(7.25%) female and 26(6.5%) male patients with recurrent abdominal pain (figure 4.5). There was no significant difference between sex of the patient and duration of abdominal pain ($\chi^2=3.282$, $df=2$, $P=0.194$).

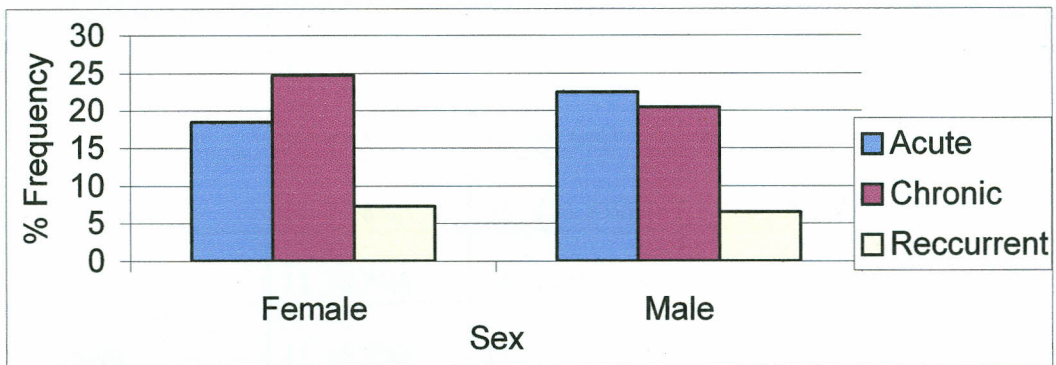


Figure 4.5. Comparison of duration of abdominal pain in male and female patients.

4.6.2 Abdominal pain in different age groups of patients.

Recurrent abdominal pain was more common than acute or chronic abdominal pain in patients below 20 years, while it occurred least in patients above 20 years. More patients below 10 years than patients above 10 years experienced acute abdominal pain (table 4.17). There was relationship between age of the patient and abdominal pain ($\chi^2=41.808$, $df=20$, $P=0.003$). As age increases from 2 to 15 years the number of patients with abdominal pain seeking treatment decline at the hospital, then the number of patients' increases as age of patients' increases from 16 to 30 years and as

age increases from 31 to 50 years a decline in number of patients with abdominal pain occur at the hospital.

Table 4.17. Comparison of category of abdominal pain in patients with different age.

Age of patients	Abdominal pain			Total
	Acute	Chronic	Recurrent	
<5	45 (27.4%)	30 (16.6%)	18 (32.7%)	93
6-10	21 (12.8%)	21 (11.6%)	15 (27.2%)	57
11-15	6 (3.7%)	12 (6.6%)	6 (10.9%)	24
16-20	15 (9.1%)	13 (7.1%)	7 (12.7%)	35
21-25	17 (10.3%)	18 (9.9%)	2 (3.6%)	37
26-30	16 (9.8%)	25 (13.8%)	1 (1.8%)	42
31-35	11 (6.7%)	11 (6.0%)	3 (5.2%)	25
36-40	11 (6.7%)	14 (7.7%)	1 (1.8%)	26
41-45	8 (4.9%)	7 (3.9%)	0 (0.0%)	15
46-50	6 (3.7%)	11 (6.0%)	0 (0.0%)	17
>51	8 (4.9%)	19 (10.4%)	2 (3.6%)	29
Total	164(100%)	181 (100%)	55 (100%)	400

4.7 Other gastrointestinal and other non gastrointestinal complains.

Some of the patients gave other gastrointestinal symptoms such as vomiting, nausea, diarrhea, heartburn, constipation, or feeling of full gases in their stomachs. Other patients gave other non-gastrointestinal symptoms such as skin scratching, muscle pain, back pain, fever, headache or general weakness.

4.7.1 Intestinal parasitic infections in patients with or without other symptoms.

Of the 400 patients, 122 had abdominal pain complain only, 178 complained of abdominal pain and other gastrointestinal symptoms, 32 had abdominal pain, other gastrointestinal and none gastrointestinal symptoms while 68 had abdominal pain and other none gastrointestinal symptoms (table 4.18). The frequency of parasites in 122 patients was 48(39.3%), in the 178 patients were 34(19.1%), in the 32 patients were 7(21.8%) and in the 68 patients were 21(30.8%). Abdominal pain alone is a better indicator of intestinal parasitic infections than when it exists with other symptoms ($\chi^2=20.844$, $df=9$, $P=0.013$).

Table 4.18. Comparison of parasitic infections in patients with abdominal pain and those with or without other symptoms.

Patients symptoms	Infections				Total
	Both protozoa & helminthes	Helminthes	Protozoa	Negative cases	
Abd. pain only	5	5	38	74	122
Abd. pain & other G.I complains	3	4	27	144	178
Abd. pain & other none G.I complains	0	3	4	25	32
Abd. pain, both G.I & none G.I complains	2	3	16	47	68
Total	10	15	85	290	400

Key: Abd-Abdominal, G.I-Gastrointestinal.

4.7.2 Occurrence of other symptoms in patients with different duration of abdominal pain.

Patients with abdominal pain and other gastrointestinal symptoms were 178 and 73.7% of them complained that the pain was acute (table 4.19). Duration of abdominal pain was influenced by other symptoms the patients were complaining ($\chi^2=112.7$, $df=6$, $P=0.000$). Acute abdominal pain occurred with other gastrointestinal complains.

Table 4.19. Occurring of other symptoms together with different duration of abdominal pain.

Patients symptoms	Abdominal pain			Total
	Acute	Chronic	Recurrent	
Abd. pain only	12 (7.3%)	82 (45.3%)	28 (50.9%)	122
Abd. pain & other G.I complains	121 (73.7%)	47 (26.0%)	10 (18.1%)	178
Abd. pain & other none G.I complains	15 (9.1%)	13 (7.1%)	4 (7.2%)	32
Abd. pain, both G.I & none G.I complains	19 (9.8%)	39 (21.5%)	13 (23.6%)	68
Total	164 (100%)	181 (100%)	55 (100%)	400

Key: Abd-Abdominal, G.I-Gastrointestinal.

4.7.3 Patients with different duration of abdominal pain attending different clinical departments at KNH.

Out of 164 patients with acute abdominal pain, 45(27.4%) attended casualty department, 13(7.9%) attended out patient clinics, 49(29.9%) attended paediatric filter clinic, and 34.8% were admitted in the wards, while of 181 patients with chronic abdominal pain 50(22.6%) were seen at casualty, 63(34.8%) were seen at outpatients clinics, 40(29.9%) were seen at paediatric filter clinic and 57(15.4%) were admitted in

the wards. Out of 55 patients with recurrent abdominal pain 8(14.5%) were attending casualty, 15(27.2%) attended outpatients clinics, 29(55.7%) attended paediatric filter clinic, while 3(5.4%) patients were admitted in the wards (table 4.20). Chronic and recurrent cases of abdominal pain were treated as outpatient ailments while acute cases of abdominal pain were treated as inpatient (ward) ailments ($\chi^2=66.9$, $df=6$, $P=0.000$).

Table 4.20. Frequency of patients with different duration of abdominal pain attending different clinical departments at KNH.

Clinical departments	Abdominal pain			Total
	Acute	Chronic	Recurrent	
Casualty	45 (27.4%)	50 (22.6%)	8 (14.5%)	103
Out patient clinics	13 (7.9%)	63 (34.8%)	15 (27.2%)	91
Paediatric filter clinic	49 (29.9%)	40 (22.0%)	29 (55.7%)	118
Wards	57 (34.8%)	28 (15.4%)	3 (5.4%)	88
Total	164 (100%)	181 (100%)	55 (100%)	400

4.8 Culture of hookworms' eggs.

Out of 10 cases of hookworm eggs identified, 7 were from male and 3 from female patients. Only 2 cases were from female patients admitted from wards. Those cases were from patients of the following age groups; 5 cases from patients of 16 to 20 years, 2 cases from patients of 21 to 25 years, 2 cases from patients of 26 to 30 years and one case from a child below 5 years. Out of 10 cases cultured 30% were of *Ancylostoma duodenale* and 50% were of *Necator americanus*.

CHAPTER 5: DISCUSSION

5.1 Study Population.

Age of patients: Clinically diagnosed patients for intestinal parasites were patients whom the clinicians wanted to confirm or to rule out that they had or had no intestinal parasites. Intestinal parasites infect all ages of patients from 2 to 86 years. This shows that intestinal parasites cause major problems or interfere with the treatment of other diseases in the patients. The study shows that children were 23.3% (under 5 years) and were the majority compared with other age groups (table 4.15). This group of patients has one major problem of communicating with the clinicians. In most cases the parents give the signs and symptoms of the child, which the clinicians cannot totally rely on and are left with no other choice except to request for the child's stool for parasites investigations. If the patient cannot give complain to the clinicians, the clinicians seek assistance from the medical laboratory technologist or parasitologist.

Health centers such as KEM (Addis Ababa)

Sex of the patients: There is no significant difference between male and female patients with abdominal pain tested for intestinal parasites, although more male than female are tested in the casualty department and more female patients than male were tested from the wards. There is no clear reason why more male patients were tested for intestinal parasites than female at casualty department. It seems male patients with abdominal pain were associated with intestinal parasites when they seek emergency health services such as those provided at casualty department (table 4.1). Abdominal pain in female patients seems to be an admission case to the wards for more observation. This justify that abdominal pain is differential diagnosis of a number of diseases.

Attendance at clinical departments: Out of the 4 clinical departments at KNH, wards had the least number of patients with abdominal pain tested for intestinal parasites compared with number of patients tested in any other departments (table 4.1). From this observation it compare well that intestinal parasites are thought not to cause any major problems (WHO, 2002). Outpatient are considered to have no serious problems, they are walking patients, who could be treated at primary health centers. Even if there is screening of patients with abdominal pain from intestinal parasitic infections in casualty, outpatient clinics, and paediatric filter clinic departments by the clinicians before being admitted to the wards quite a number of patients in the wards had intestinal parasites. It seems they had by passed parasitic investigation services offered in the out patients clinics, paediatric filter clinic and casualty, which was a breakdown of referral process from outpatient clinics to inpatient wards that is similar to referral process from primary health centers to secondary, tertiary and referral health centers such as KNH (Atkinson *et al.*, 2002).

5.2 Consistency of Stools.

Examinations of fresh stool specimen provide the clinician with an objective determination of the patient's subjective complains. A gross description of stool as watery, loose, soft or formed provides a step towards appropriate management of the patient. Sometimes macroscopic examination reveals intestinal parasitic infections. Most of the patients had normal stool (formed and soft) than diarrheic stools. Patients with abdominal pain passing diarrheic stools (loose and watery) were expected to be more than those passing normal stools, as diarrhea is also a symptom of intestinal parasitic infections, but it was not the case (figure 4.1). Patients with abdominal pain,

suspected to have intestinal parasitic infections, rarely pass diarrheic stools. Both male and female have equal chances of having the same consistency of stools. Sex has no influence to consistency of stools passed by patients with abdominal pain (figure 4.3). Patients attending different departments pass different consistency of stools (figure 4.2). Food taken by patients in the ward, drugs being taken by patients or confining patients in the hospital wards does make their stool consistency differ from that of outpatients attending casualty, outpatient clinics or paediatric filter clinic (Olubuyide *et al.*, 1995).

Diarrheic stools: Passing of diarrheic stools by patients with abdominal pain had no influence of intestinal parasitism. Although diarrhea is one of the symptoms of intestinal parasitic diseases (Yakubu and Bello, 1988), but in this study passing of diarrheic stools by patients with abdominal pain could not be used to indicate parasitic infections (table 4.18). Clinicians may use consistency of stools as a differential diagnosis for abdominal pain, but not for confirming intestinal parasitic infections. About 20.0% patients with abdominal pain had diarrheic stools. Age has effect on the consistency of stool a patient defecates. Patients of 21 to 36 years and under 5 years children had high number of patients passing diarrheic stools (table 4.9). It seems there is a correlation between the 2 groups of patients. Patients of 21 to 36 years are parents and spend much time with children below 5 years. Due to that closeness between the 2 groups any infection affecting the parent may be easily transmitted to the child or vice versa. The under 5 years, their systems are not well developed to absorb water from faecal materials thus their stools being diarrheic. When there is poor absorption of water, or system are failing, or digestion system is poor, or lot of

water and food intake, a person defecates diarrheic stool. Diarrhea could be caused by other pathogens such as bacteria, virus or fungus through contamination, children less than 5 years like playing outdoors, where they pick the infections (Yukubu and Bello, 1988). Prevalence of patients with abdominal pain passing diarrheic stools at KNH was 21.8% (table 4.9). Diarrhea cases could have been more than this but the study population considered only those patients with abdominal pain suspected to have intestinal parasites.

Normal stools: About 55% of patients with abdominal pain had formed stools in this study (figure 4.1). There was no significant different between parasitic infection and consistency of stools passed by patients with abdominal pain (table 4.8). The high number of formed stools from patients could be due to the feeding habit of different ages of patients such as fewer intakes of water and food that can influence the consistency of patients stool (Olubuyide *et al.*, 1995). Among the 4 clinical departments more patients from wards had diarrheic stools than those from other departments (figure 4.2). Out patients are walking patients are more active than inpatients and is known during activities a lot of water is absorbed by the body or lost through perspiration, which can influence the stool of a patient to be hard (formed).

5.3 Inclusions in the stools.

Blood: Out of 400 patients with abdominal pain, 23(5.75%) passed stools with blood (table 4.4). Stools are described as having blood when blood is either visually seen or red blood cells are seen microscopically. Descriptions of stool of a patient as having blood gives clues about its cause and guide the management of a patient. Only 5.75%

of the patients with abdominal pain could be considered as having dysentery (stool with blood). There are parasites associated with blood, which they may be causing abdominal pain in a patient. In this study there were parasites identified in those bloody stools. Parasites such as *Schistosoma mansoni*, *Entamoeba histolytica* and hookworm cause stools of patients to be bloody or blood stained. Age of patients with abdominal pain had no influence to the patients passing stools with blood. Blood in the stool indicates duration or severity of abdominal pain in a patient (table 4.11). Blood in patient's stools who had no intestinal parasites indicate other major problems such as ulcers in the alimentary canals. Fresh blood may indicate an ulcer in the lower parts of the intestines.

Mucus: Out of 400 patients with abdominal pain 33(8.25%) had mucus in their stools (figure 4.4). Mucus in the stools is visually examined. Stool contains small amount of mucus, which make it look shiny, but excess of it is suggestive of a disease condition in a patient. Appearances of mucus in the stools indicate changes in the composition and secretion of glycoprotein (mucus), which may be induced by genetic, physiological and pathological factors, leading to incomplete glycoprotein synthesis or formation of new glycoprotein as cited by Filipe and Ramachandra (1995). Patients with *Giardia lamblia* infections are known to pass stools with mucus (Howard *et al.*, 2002). Mucus in this study was associated with loose and soft stools passed by patients with abdominal pain (table 4.13). This could be the mucous cells from mucoid membrane of gastro-intestinal system secrete mucus and when a person is passing loose diarrheic stool, those mucus are eroded in large numbers. The remaining mucus in the intestine is seen as diarrhea stops, and stools start to be soft. Watery

diarrhea pass so fast that had no enough time to erode the mucus cells from the lining of the intestinal cells. More inpatients had mucus in their stools than outpatients, although there was no relationship between mucus and parasitic infections (table 4.3; table 4.10). This shows that mucus in stools is not a good sign or symptom of intestinal parasitic diseases. Appearances of mucus in the stools may gives clues about its cause and guide the management of a patient a clinician should take. Mucus was like blood in the stool that may indicate severity of abdominal pain in a patient (table 4.11).

Fat: Steatorrhoea is passing stools with fat. In this study there was no patient passing stool with fat. This does not mean patients with abdominal pain don't pass stools with fat. Fat may or may not be associated with abdominal pain but frequent appearance of it in stools leads to loss of calcium. Steatorrhoea is not a disease; it is a symptom, which may be described as fluid, mild or latent in stools. Establishing the presence of steatorrhoea is not to make a diagnosis but to demonstrate a condition, which require further investigations. *Giardia lamblia* infections are known to cause steatorrhoea (Howard *et al.*, 2002).

Pus cells: There were 44(11.0%) patients with abdominal pain passing stools with pus cells (table 4.13). Pus cells are seen microscopically when examining stools for intestinal parasites. They are neutrophiles and their presence in the stools indicates an inflammatory, usually infectious process. The presence of pus cells is suggestive of intestinal inflammation, but it is not diagnostic of intestinal parasitic infections (table 4.10). It can be seen with ulcerative colitis as well as with infections (Sandler, 2000).

Pus cells in stools passed by patients with abdominal pain are suggestive of problems that need to be diagnosed and treated. Pus cells in stools may indicate the severity of the pain (table 4.11).

Yeast cells: Out of the 400 patients with abdominal pain 15(3.75%) had yeast cells in their stools (table 4.13). Yeast cells are microorganism, but in this study they were considered as inclusions since they are not parasites. They are fungus know to infect the alimentary canal of animals and human. Appearance of yeast cells in stools is normal in a health person, but they can be a problem in patients with lowered body immunity. They appeared frequently in stools, which were diarrheic than formed stools (table 4.13). Yeast cells in stools of patients with abdominal pain is not diagnostic but indicates duration of the pain. Duration of abdominal pain was seen as indicators of severity of abdominal pain in a patient (table 4.11). Patients with abdominal pain attending outpatient clinics, 2.2% had yeast cells in their stools (table 4.3). Outpatient clinics are follow up clinics where patients treated in other departments are referred at KNH. This show there was improvement in patients' management considering yeast cell in stools as indicators of severity of disease conditions in patients (table 4.20).

5.4 Intestinal parasitic infections.

Prevalence of parasites: The prevalence of intestinal parasites in stools of patients with abdominal pain seeking treatment at KNH was 39.25% (table 4.4; table 4.5). The prevalence of intestinal parasites in the patients with gastroenteritis was 5.6% at KNH in 1998 (Oguta *et al.*, 1998). This is a higher prevalence than what Oguta *et al.*, (1998)

had found in stools of patients with gastroenteritis. Clinicians expect patients to have been treated for intestinal parasites in primary health centers, before seeking referral services in hospitals such as KNH, but this is not so. Low prevalence rate of intestinal parasites from the study done by Oguta (1998) could have risen from sampling of patients in one specialist clinic, gastroenterology. The prevalence of 5.6% was based on small population who could not represent the whole patient population in KNH.

Patients with abdominal pain have high prevalence of intestinal parasites than patients with gastroenteritis. Gastroenteritis is inflammation of the walls of the stomach and intestines, which present with abdominal pain. A prevalence of 39.25% intestinal parasites indicates that patients bypass primary health care centers to seek health services in referral hospitals. Although the prevalence of 39.25% was low compared with a prevalence of intestinal parasites of 57.7% in 1974 at KNH (Duncan 1978). There was difference in prevalence of every species of parasites from 1974 to 2006 in that study conducted by Duncan (1978) at KNH and this study. The decline rate of intestinal parasites in patients being treated in KNH from 1974 to 2006 was about 20%. The reason could be the study taken in 1978 considered all patients who were tested for intestinal parasites regardless of their symptoms and in this study only patients with abdominal pain were taken. Also the decongesting of patients process being taken at KNH by Kenya government to make it more effective as a referral and teaching institution could be a reason of the decline.

According to Muga, Director of medical services, MOH (2003) about 100,000 patients are suffering from minor ailment such as intestinal parasitic diseases attend

KNH monthly due to the collapse of city council clinics. The GOK had improved health services in city council clinics in the recent years attracting the patients to seek treatment. This could be the cause of the decline in the prevalence of intestinal parasites in patients with abdominal pain seeking treatment at KNH. An effective referral system is a key element of health services based on primary health care. If referral steps are bypassed treatment cost increases and referral hospital become overloaded while low-level facilities (city council clinics) are under used (Atkinson *et al.*, 2002). In this study, the population was based on faecal material from patients with abdominal pain who were clinically diagnosed for intestinal parasitic infections. This population is subjective to patients seeking treatment but however, this aspect should not overshadow the usefulness of the data presented in this study. The prevalence rates of different parasites may indicate what problem might be expected in the community. This could help in finding a control measure of intestinal parasites.

Level of personal hygiene is poor, or there

Helminthic infections: The most occurring helminthic infection was hookworm with a prevalence of 2.5% (table 4.5). Of the 10 cases of hookworm eggs cultured 50% larvae harvested were of *Necator americanus* and 30% were of *Ancylostoma duodenale* (section 4.8). Rai *et al* (1997) findings were 67% of hookworm eggs cultured were *Ancylostoma duodenale* and 33% were *Necator americanus*. The reason of this different could be, this study was hospital based and *Necator americanus* does not cause major problems like *Ancylostoma duodenale*. Patient with dull and chronic abdominal pain caused by *Necator americanus* may have high chances to live with complain as, *Necator americanus* infections present with mild symptoms while compared with *Ancylostoma duodenale* infection as cited by Rai *et al* (1997). This

tread might have happened that most of the patients were treated for *Ancylostoma* infections, which has signs and symptoms manifesting well at an earlier stage. Also disparity of the prevalence of the 2 species of hookworm may be due to geographical distribution of hookworm in Nepal where Rai *et al* (1997) did the work, may not be the same as in Kenya where this study was done. 20% of hookworm eggs never hatched (section 4.8). This could be the room temperature was unfavourable for hookworm eggs hatching or the patient may have taken drugs which could not allow the eggs to hatch. Those eggs that never hatched to larvae were from stools, which were loose. It is hard to make thick smear from a watery or loose stool on the filter paper when doing Harrod-Morri culture technique and here a mistake could have occurred.

Protozoa infections: The high prevalence of protozoa infection 32.25% show that the level of personal hygiene is poor, or there is lack of clean water and safe food since those parasites infect the patients through contamination. This is in line with WHO (1997) observation that developing countries are far from achieving those conditions. There were three patients passing stools with trophozoites (table 4.8). This does not mean trophozoites are few in stools of patients with abdominal pain; this could have been contributed by the fact that stools specimens are delayed for long hours before taken to the laboratory. In some cases, patient brought an over 18 hours old stool for parasitic infections and in this case the trophozoites had already died and degenerated. Even inpatients stools from wards rarely reached the laboratory on time.

Polyparasitism: There were multiple infections of protozoa and helminthes (table 4.8). This shows there was geo-parasitism, and this could be important when choosing a drug for mass treatment in the society as a means of control. The drug should eliminates 2 or more than 2 parasites.

5.5 Parasites in different consistency of stools.

Formed 32.6% and watery 33.3% stools had more intestinal parasites than loose 20.5% and soft 21.0% stools passed by patients with abdominal pain (table 4.8). Consistency of stools passed by patients with abdominal pain could not be used as sign to indicate intestinal parasites as the cause abdominal pain. Intestinal parasitic infections do not influence the consistency of stools passed by patients with abdominal pain. Yakubo and Bello (1988) concluded that 40% of diarrhea patients had parasites. In this study patients with abdominal pain had same prevalence of intestinal parasites as those with diarrhea. Other causative agents of diarrhea and abdominal pain in patients may be bacteria, viral, chemical poisoning or fungus.

Parasites and age of patients: The most infected age group was 36 to 40 years, had 50% infection (table 4.9). This could not be explained since that age group had few (26) patients whom were not enough to base on any conclusion. The average infection of patients among 6 to 15 years was 35.4% (table 4.9). Those are children who play and defecate around the doors infecting the environment with eggs and cysts of parasites and later infect other children who pick up those parasitic agents unknowingly with their fingers and introduce them to their mouths (WHO, 2001).

Abdominal pain: Intestinal parasites occurred in all patients with abdominal pain regardless to the duration of the pain. Description of abdominal pain as acute, chronic or recurrent has nothing to do with intestinal parasitic infections and there is no need of that history from a patient as step in the diagnosis for intestinal parasites. There was a decline in number of patients with abdominal seeking treatment at KNH as their age increases from 2-15 years. For children below 5 years their immunity is not well developed to withstand the pathogens, hence majority of them seek treatment, also the symptoms are acute and severe. Children of 6-15 years like playing with soil where they contaminate themselves with pathogens (table 4.17). The younger the children in this age group the higher the chances of getting infections. Patients with acute abdominal pain had stools that were soft, loose, or watery. Out of 181 patients with chronic abdominal pain in this study 123 (67.8%) had formed stools (table 4.7). Duration of abdominal pain seems to detect the consistency of stool being passed by a patient but not intestinal parasitic infections.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS.

6.1 Conclusions.

- (a) Intestinal parasites were not associated with the consistency of the stools. Consistency of the stools is not an indicator of intestinal parasites in patients with abdominal pain and should not be used as diagnostic step in management of intestinal parasitic diseases. Classifying stools as formed, soft, loose, or watery do not guide in diagnosis of intestinal parasitic diseases in patients with abdominal pain.
- (b) Duration of abdominal pain was associated with consistency of stools. Consistency of stools confirms the severity of abdominal pain in patients. Consistency of stools could be used to detect the nature of abdominal pain where there is no communication between the patients and the clinician.
- (c) Description of abdominal pain as acute, chronic, or recurrent is not associated with intestinal parasites. Clinical history that describes the duration of abdominal pain should not be taken as step in the diagnosis of intestinal parasitic infections.
- (d) The prevalence of intestinal parasitic infections among patients with abdominal pain was 27.5%. Patients should not be treated for abdominal pain before being diagnosed for intestinal parasitic infections.

- (e) Appearance of adult worms such as *Ascaris lumbricoides* or parts of mature worms such as segments of tapeworms in stools of patients with abdominal pain is a direct diagnosis of intestinal parasitic infection. Stools should be visually observed for these parasites, where it is not possible to continue with microscopic identification of parasitic agents, before treating any parasitic infections.

6.2 Recommendations.

- (a) Diarrheic stools with or without blood and/or mucus do not indicate intestinal parasitic infections. The populace should know that a patient with abdominal pain passing such stools do not warrant them to take anti-intestinal parasitic drugs, but to seek emergency medical advice.
- (b) Clinicians who are consulted by patients with abdominal pain should make sure the patients take their stools to the laboratory for parasitic investigations. The laboratory report should be used as a confirmatory diagnosis for intestinal parasitic diseases and as a differential diagnosis when treating cases of abdominal pain.
- (c) When reporting stool specimen for the causative agents of abdominal pain, medical laboratory personnel in the laboratory should report consistency of the stool, macroscopic and microscopic inclusions. Stool report should have confirmatory and differential diagnosis parts.

- (d) The findings from this study forms a baseline data for further research on diagnostic methods that may be used in identifying intestinal parasites from patients' fecal materials.

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Location of the study area

The map shows the location of the study area within the region of Eastern Kenya showing the position of the study area.

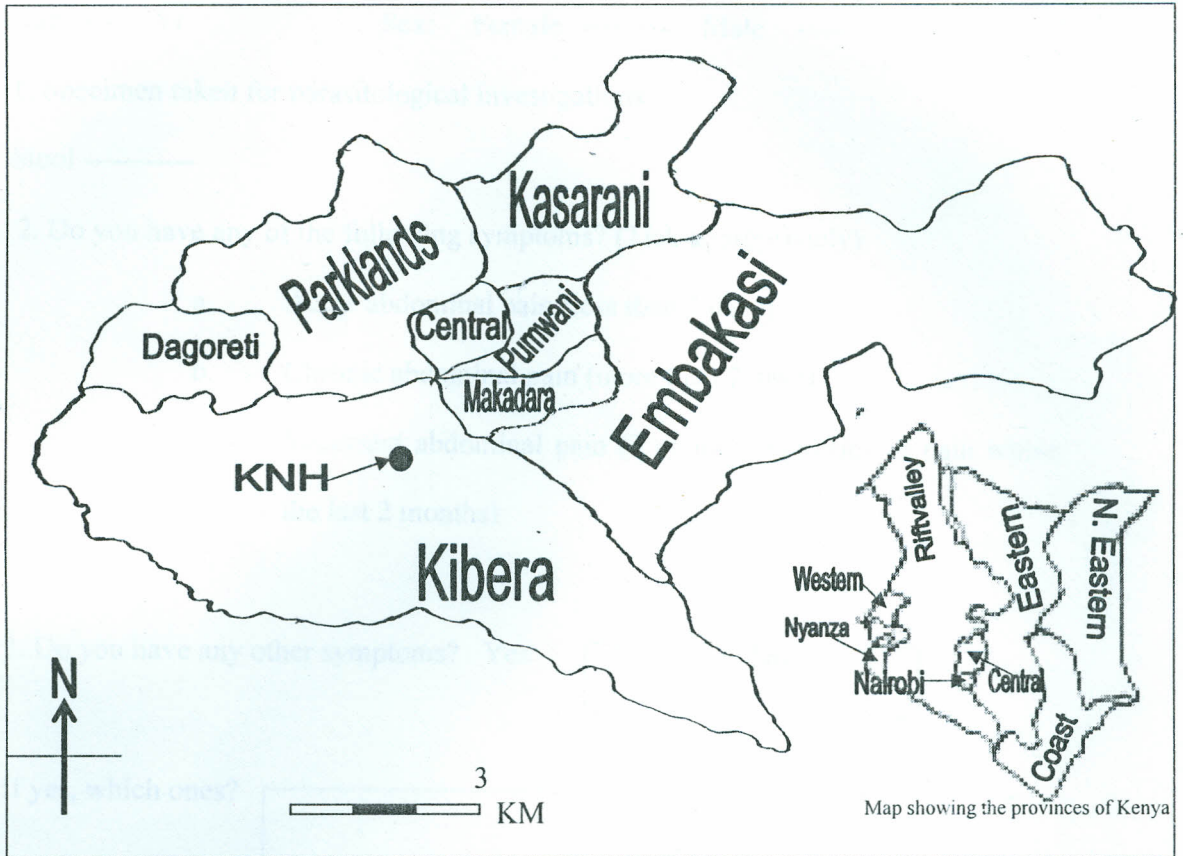


Source: NAIROBI and ENVIRONS, District of Nairobi, Kenya, 1978.

APPENDIX 1

Location of the study area

Map showing the location of the study area (KNH) and divisions of Nairobi Province (Inset map of Kenya showing the position of Nairobi).



Source: NAIROBI and ENVIRONS edition 3. Published by Survey of Kenya, 1978.

APPENDIX 2

Questionnaire

Study No -----

Date -----

Age -----Yr

Sex: Female ----- Male -----

1. Specimen taken for parasitological investigations.

Stool -----

2. Do you have any of the following symptoms? (Tick appropriately)

- a. Acute abdominal pain (less than 7 days)
- b. Chronic abdominal pain (more than 7 days)
- c. Recurrent abdominal pain (3 or more episodes of pain within the last 2 months)

3. Do you have any other symptoms? Yes

No

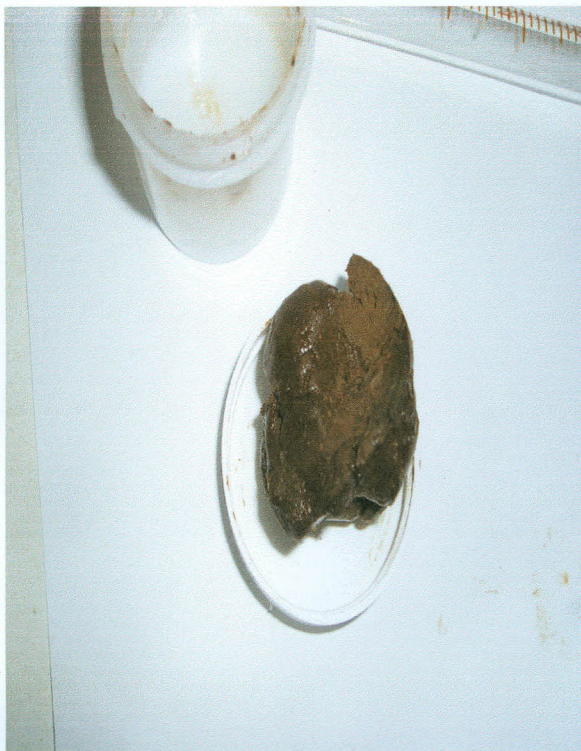
If yes, which ones?

4. Which department are you being treated? (Tick appropriately)

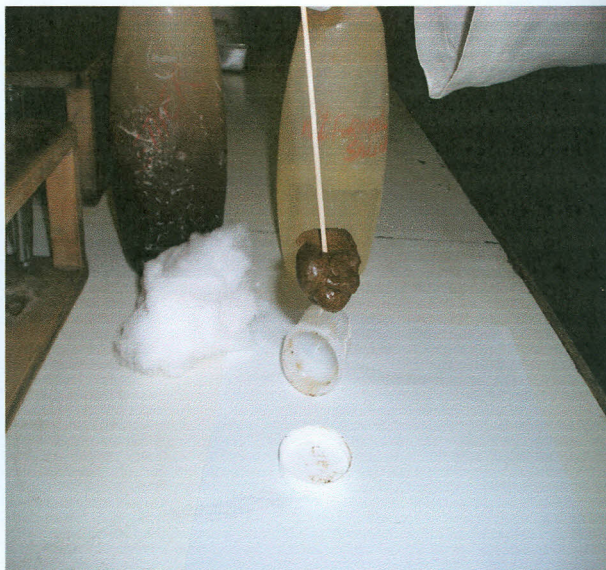
- a. Casualty
- b. Paediatric Filter Clinic
- c. Outpatient Clinic
- d. Ward (inpatient)

APPENDIX 3

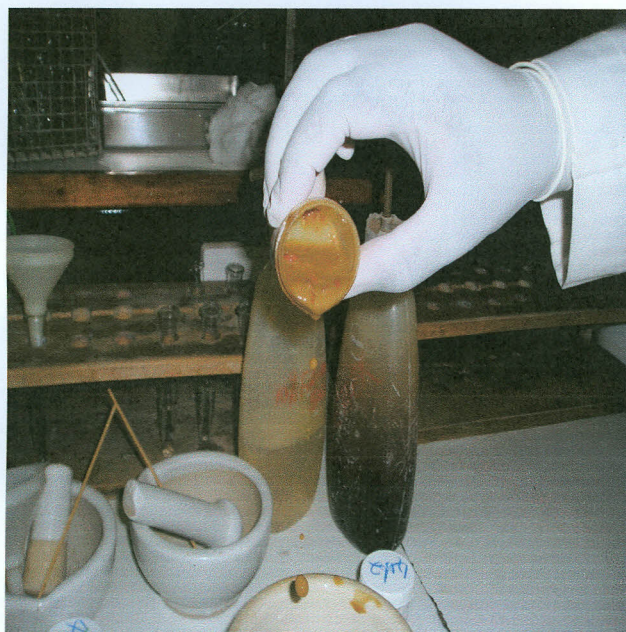
Photographs of various consistencies of stools



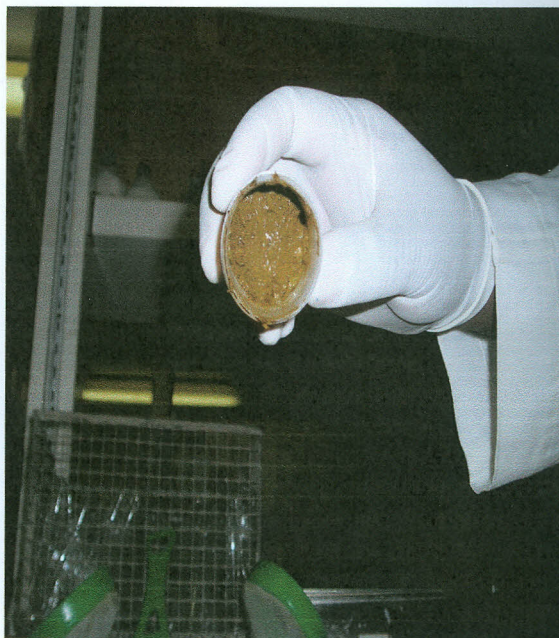
Formed stool



Formed stool adheres to the applicator stick that pricked it and was raised with it from the stool container



Diarrheic stool pour off as the stool container was tilted



Soft stool in a tilted container