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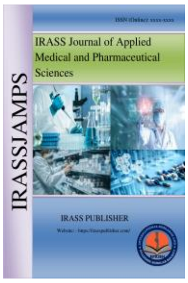

Incidence of Gastrointestinal Parasites among Patients Attending the Buea Regional Hospital Annex Cameroon

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Abstract: Intestinal parasitic infections remain a major public health problem in many parts of Cameroon, particularly in rural areas where Buea is one of the most fast growing cosmopolitan city where 90% of the population have no access to basic forms of sanitation. This study aimed to evaluate the incidence of gastrointestinal parasitic infections among the people living in Kumba, Southwest Region. The study was a cross sectional study carried from the 18 of January to the 18 of march, a total number of 100 fecal samples were randomly collected in different areas in kumba such as Fiango, Mbonge road, Kumba town and Kossala by giving stool samples collecting containers, tissues and questionaires with proper collecting procedure explained to them. And the stool samples collected were carried to a private laboratory for laboratory analysis and the stool were examined macroscopically to check for adult worms, consistency, color and abnormal features such as blood, mucus and fat globules and microscopically by the direct wet mount examination using normal saline and lugol's iodine. The stool sample was latter preserved with 10% formolsaline and was transported to Bamenda for further laboratory analytical procedure which is the formol-ether concentration technique and the modified ziehl Nelson staining technique. Base on the work done the results showed an overall incidence of intestinal parasites among the inhabitants of Kumba to be (11%). And based on the 11%, helminth infections (85.8%) were more common than protozoan infections (14.2%) with the most prevalent intestinal parasites being hookworms and Ascaris lumbricoides (3%) and the lowest was Gastrodicoides hominis and Diphyllobotrium latum (1%). And also based on sex the results showed a higher infective incidence in men (17.4%) and female being (9.1%) with Kosala having the highest incidence (18.8) and Kumba town being the lowest (0%). A greater focus on intervention is required by improving sanitation and personal hygiene to prevent the spread of intestinal parasitic infection.

Keywords: Incidence, gastrointestinal, parasites, Kumba.

Introduction

1.1 Background of the Study

In tropical and subtropical regions where environmental factors including warmth and humidity, poor hygiene, poverty, sociocultural practices, and demographic characteristics encourage the growth of parasitic diseases, they represent a significant health concern (Nougning et al., 2012). According to WHO estimates, this parasite illness affects approximately 2 billion people worldwide, with school-age children and women who are fertile being the most affected (WHO, 2012).

According to Agbolade et al. (2004), intestinal helminthiasis is the most prevalent parasite infection in the poor world, affecting 89.9 million school-age children in sub-Saharan Africa (Brooke et al., 2006). These intestinal parasites' way of spread depends on environmental conditions and their mode of transmission (Crompton et al., 1993; Okoronkwo et al., 1979; Inabo et al., 2000). Various helminth and protozoan parasite species are responsible for intestinal parasitic illnesses. They continue to be a significant public health concern worldwide and are classified as neglected tropical illnesses (Hotez et al., 2015). Soil-transmitted helminths are a common intestinal parasite in tropical and subtropical regions.

Necator americanus (Dunn et al., 2016), roundworms (Ascaris lumbricoides), whipworms (Trichuris trichiura), and two distinct hookworm species—Ancylostoma duodenale and Wongsaroj et al., 2014—are the four main nematode species of human soil-transmitted helminths, also referred to as geohelminths (Hotez et al., 2015). Depending on the nematode species, humans can contract the infection by unintentionally consuming eggs at the infectious stage or by skin penetration by infected larvae in soil. One of the most pressing health problems in the world is still the lack of access to clean water, proper sanitation, and proper hygiene. Improving water supply, sanitation, hygiene, and resource management might prevent nearly a tenth of the world's disease burden. Millions of people's lives will be improved if the impoverished had access to clean drinking water, proper sanitation, and personal, household, and communal hygiene (WHO, 2008).

1.2 Statement of Problem

According to a study by the secretary of state for public health in Cameroon, there are 16.1 million people living in the country, and over 10 million of them have helminthiasis [Essogo, 2004], which means that over 60% of the population is sick. In addition to their negative health impacts, intestinal helminth infections harm children's physical and mental development, hinder their ability to succeed in school, and skew economic growth (Drake et al., 2000; Guyatt et al., 2000). Access to basic sanitary services, such safe and clean water and appropriate waste disposal, has become a challenging issue for the city of Buea's officials over time.

Proper sanitation guarantees a healthy environment and sustain humans existence and development but in Buea 90% of the people living there have no access to basic forms of sanitation such as an adequate and reliable water supply. In which the reason for high incidence of parasites in some parts of the country are as a result of lack of clean and safe water, high population density, lack of proper disposal of waste, non compliance with health standards, lack of adequate washing of vegetables, and lack of well cooked meat and also specific climates of the regions, local custom and use of animal and human fertilizers in agriculture (Ezatpour et al., 2013) will all lead to high incidence of intestinal parasites(Damen et al., 2007)And in Buea most of the practices listed above are being done by some of the natives and inhabitants of Buea where by exposing them to these parasites which are important causal agent of gastrointestinal disorder such as diarrhea dysentery, vomiting, lack of appetite, haematuria and abdominal distension and sometimes mentally related disorders (Garcia,2004, Bethony et al 2006).

1.3 Research Questions

What is the incidence of gastrointestinal parasites among patients attending the Buea regional hospital

1.4 Research objectives

1.4.1 General objective

To Evaluate the incidence of gastrointestinal parasites among patients attending the Buea regional hospital.

1.4.2 Specific objective

To assess the incidence of gastrointestinal parasites among patients attending the Buea regional hospital.

1.5 Hypothesis

1.6 Impacts of the Study

This study will help in creating an awareness on the incidence of gastrointestinal parasites among patients attending the Buea regional hospital and identify possible control measures.

1.7 Limitations

This study did not include the associated risk factors which are routes to the incidence of intestinal parasites

1.8 Delimitations (Scope of the Study)

The work was limited only to patients attending the Kumba Regional Hospital Annex

Literature Review

2.1 Intestinal Parasite Infections

Due to fecal contamination of food and water, a hospitable climate, and environmental and sociocultural variables that facilitate parasite transmission, intestinal parasitic infections represent a global health burden in many developing nations. Both humans and other animals' gastrointestinal tracts are home to these parasites (Loukopolous et al., 2007). Unlike helminthes, protozoan parasites are more likely to cause gastrointestinal infections in urbanized nations (R. Haque, 2007). Amoebiasis is the third most common cause of parasite disease-related deaths, and it primarily affects people in developing nations. According to estimates from the World Health Organization (WHO), 40–100,000 people die each year from insidious amoebic infections, which affect about 50 million people globally (Petri et al., 2000). According to current estimates, hookworms can infect 740 million individuals, T. trichiura can infect 795 million, and Ascaris lumbricoides can infect over a billion (Nrdesilva et al., 2003).

Rarely do intestinal helminths result in mortality. Instead, the saddle of disease is associated with lower mortality rates due to the long-term and subtle impacts on the host's health and nutritional state (Stephen et al., 2000). In addition to their detrimental effects on health, intestinal helminth infections impair children's physical and mental development, hinder economic growth, and inhibit educational success (Drake et al., 2000, H.Guyatt et al., 2000). Ascaris lumbricoides, hookworms (Necator americanus), Trichuris trichiura, Strongyloides stercoralis, and Entamoeba histolytica are among the prevalent parasites found in the majority of the previous systematic examinations (P. Agi., 1997). According to Monstressor et al. (1998) and Mbanugo et al. (2002), these are dependent on poverty, poor personal cleanliness, pathetic environmental care, insufficient health services, and a lack of appropriate and essential knowledge of the parasites' life-cycle patterns and modes of transmission.

The World Health Organization (WHO) reports that about two-thirds of the world's population has some form of intestinal parasite infection, with Ascaris and Giardia infections having the highest prevalence (Vojdanni et al., 2002). The use of human and animal fertilizers in agriculture, local customs, and the particular temperature of the areas are the causes of the high prevalence of parasites in some parts of the country (Ezatpour et al., 2013). The high incidence of intestinal parasites is caused by a number of factors, including a lack of clean and safe water, a dense population, improper waste disposal, noncompliance with social and individual health standards, inadequate vegetable washing, and undercooked meat (Dennis et al., 2007, H. soleimanpoor et al., 2013). These circumstances create the conditions for intestinal parasite infections to spread continuously (Mata, 1982; Montresor et al., 1998; Crompton, 1999). As a poor nation in West Africa, Cameroon is not immune to the widespread intestinal parasite burden. Numerous investigations with relatively high incidence have been conducted in various cities around the country, such as Buea in the southwest and Babadjou in the west (Payne et al., 2015, Mbuh et al., 2010).According to Garcia (2004) and Bethony et al. (2006), these parasites are significant causes of gastrointestinal illnesses, including diarrhea, dysentery, vomiting, appetite loss, abdominal distension, and occasionally disorders related to the mind.

2.2. Infection by Intestinal Protozoans

On this point, protozoans are a very diverse collection of unicellular organisms that may be found in nearly every ecological niche that humans are aware of, including the borders of glacier flows and the bottom of hot springs (Melhorn, 1988, Katz et al., 1989). A significant portion of protozoa also exist as mutualistic, commensal, or parasitic organisms, despite the fact that the bulk of them exist as free-living organisms in soil, damp, marine, or freshwater settings (Mehlhorn, 1988, Katz et al., 1989). It is known that many invertebrates and all vertebrate species are afflicted by protozoan parasites. They can adapt to almost every part of their hosts' bodies. Their pathogenicity within the host is increased by their distinctively high infectivity (Katz et al., 1989; Neva et al., 1994).

2.2.1 Intestinal Amoebae

The genera Entamoeba, Iodomoeba, and Endolimax include the amoeba that live in the human digestive tract. Entamoeba dispar, Entamoeba gingivalis, Entamoeba coli, Entamoeba hartmani, Endolimax nana, and Iodamoeba butschlii are among the non-pathogenic members of these groups (Mahon et al., 20006). Entamoeba histolytica is the pathogenic member (Mahon et al., 2000).

2.2.1.1 Entamoeba Histolytica infection

2.2.1.2 Epidemiology of Entamoeba Histolytical

An estimated 50 million persons worldwide are infected with Entamoeba histolytica (Ryan et al., 2004). 10% of people worldwide are thought to be infected with E. histolytica, with a higher prevalence in developing nations with inadequate sanitation (Chaconcruz, 2009). In regions of Africa, Asia, and Central and South America, the prevalence of Entamoeba histolytica infection can reach 50%. Asymptomatic E. histolytica infections may be as high as 11% in Brazil and appear to vary by region. Nevertheless, it is anticipated that 500 million people with asymptomatic Entamoeba infections are colonized by E. dispar since the advent of genetic techniques (Fotedar et al., 2007). The global incidence of E. histolytica infection shows that 10% of infected people have clinically noticeable disease, while 90% of infected people are asymptomatic carriers (Li et al., 2003, Fotedar et al., 2007). When it comes to protozoa-associated mortality, amebiasis is second only to malaria (Li et al., 1996, Stanley, 2003, Fotedar et al., 2007).

2.2.1.3 Morphology and Life Cycle of Entamoeba Histolytica

Entamoeba histolytica belongs to the subphylum Sarcodina. It exhibits an amoeboid shape and has pseudopodia for locomotion and food acquisition. The life cycle of Entamoeba histolytica includes both trophozoite and cyst phases. The infectious type is a cyst. They have one to four nuclei and are spherical, measuring roughly 10 to 16 μm in diameter. They have four nuclei when fully grown. Within the juvenile cyst, there is a reserve of energy (glycogen) in a unique vacuole that diffuses to adult cysts, whose cell wall is made of chitin (Botelho et al., 2011). They can live for weeks or months in the environment, particularly in environments with ideal humidity and temperature levels.

Temperatures below 5°C and above 40°C can cause degeneration in them (Tanyuksel et al., 2003). The vegetative forms, known as trophozoites, are linked to disease. They typically measure 20 to 40 μm, while the more invasive varieties may grow to 60 μm. It generally has a single nucleus that is visible in fresh preparations but highly distinct when stained. The trophozoites in these preparations are pleomorphic and quickly generate thick, hyaline pseudopodes that appear to slide over the blade's surface (Silva et al., 2005). Through phagocytosis of detritus and pinocytosis of liquid particles, amoeba consume food. However, erythrophagocytosis and leukophagocytosis are also frequently confirmed in the invasive types of amoebiasis. The ligation of the Gal lectin/GalNAc initiates the phagocytosis process (Okada et al., 2005). Amoeba spores and cysteine proteinases are then released to the phagosomes to facilitate breakdown (Botelho et al., 2011).

Entamoeba histolytica has a normal fecal-oral life cycle, which includes trophozoites that multiply in the large intestine and infectious cysts that are discharged in feces. Cyst ingestion is how the infection is contracted, and tainted food and water are the main risk factors. Eight immature trophozoites are produced when the cyst excysts in the lower part of the small intestine after passing through the stomach. Trophozoites multiply by binary fission and settle in the large intestine, where they consume bacteria and cell debris. The majority stay commensals in the lumen, but some can infiltrate the large intestine's mucosa and cause symptoms including colitis, diarrhea, and dysentery, among others. These diarrheal stools will contain some trophozoites. Invasive/extra-intestinal amoebiasis, which can result in abscesses and other potentially fatal disorders, can also be caused by trophozoites invading the large intestine's blood arteries and spreading to other organs such the liver, brain, and lungs. The dehydration of the colon's contents brought on by water absorption in the colon walls causes encystations. Two rounds of nuclear replication are necessary for cysts to mature. They may be picked up by another host and are expelled in feces.

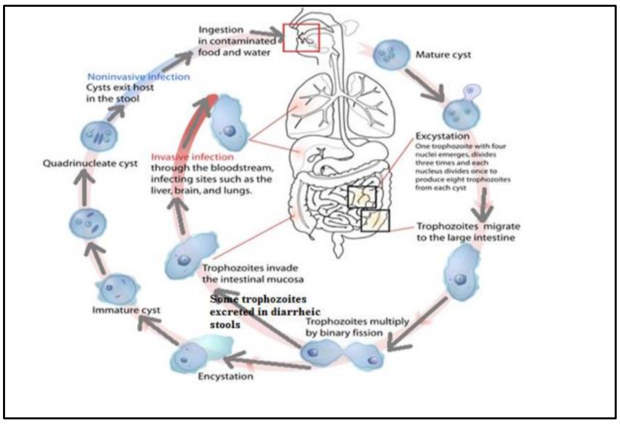


Figure 2.1 Schematic diagram of the life cycle of *E. histolytica*

2.2.1.4 Clinical Manifestation of Entamoeba Histolytical

Entamoeba histolytica is the protozoan that causes amoebiasis, often known as amoebic dysentery (Haque et al., 2003). The majority of infections don't cause any symptoms, but invasive intestinal disease might cause cramping, abdominal pain, bloody or watery diarrhea, and weight loss for a few weeks (Haque et al., 2003). There have been reports of widespread extraintestinal illnesses like purulent pericarditis, pneumonia, liver abscess, and even cerebral amoebiasis (Haque et al., 2003). Worldwide, it has been estimated that up to 50 million people are affected by E. histolytica, primarily in developing countries, and it is responsible for over 100,000 deaths a year (T. Bercu et al., 2007, C. Ximenez et al., 2010).

Ingestion of contaminated food or drink as a result of cysts excreted in the feces, or even fecal-oral transmission, is the usual method of transmission. According to Haque et al. (2003) and Acheeepsattayakorn et al. (2014), Entamoeba histolytica is an invasive intestinal protozoan. When mature nucleated cysts from feces are consumed in food or water, the infection usually starts. Motile trophozoites are released after excystation in the small intestine and then go to the large intestine. Trophozoites undergo binary fission to create new cysts, and while both phases are expelled in feces, only the cysts possess the capacity to spread illness because of the barrier that protects them. In the outside world, cysts can endure for a few days to a few weeks. Trophozoites, on the other hand, are quickly eliminated as they leave the body or, if consumed, by stomach secretions.

2.2.1.5 Laboratory Diagnoses of Entamoeba Histolytical

Direct fecal smear and staining is the most widely used technique, as explained by Cheesesbrough (2005). When fully grown, cystic forms have up to four nuclei and are spherical in shape. While the trophozoitic forms, which are typically pleomorphic and mono-nucleic, are prevalent in diarrheal or pasty fecal material, they are seen on consistent feces. Strains cannot be identified using this diagnostic procedure in conjunction with the formal ether concentration technique that the WHO (2006) recommends. Because E. histolytica/E. dispar cysts are intermittently eliminated and do not differentiate from other intestinal amoebae like E. coli, there is a potential that a diagnosis will be missed (Botelho et al., 2011). The microscopic diagnosis could potentially be compromised by cellular debris (Botelho et al., 2011). Ngonjo et al. (2012) found that the formol-ether approach was only 70% sensitive, meaning it was unable to detect all of the trophozoites in a study conducted to ascertain the Incidence and Intensity of Intestinal Parasites in School-age Children in Thika District, Kenya.

Since the Polymerase Chain Reaction (PCR) is thought to be the most accurate technique for identifying E. histolytica infections, it presents fresh ideas for normal laboratory use in the future. To make this approach more affordable and useful, it still needs to be optimized (Silva et al., 2005). Gutierrez et al. (2010) demonstrated that real-time PCR has been utilized for the identification and distinction of E. histolytica and E. dispar infections in an attempt to enhance the diagnosis of intestinal amoebiasis. Real-time PCR analysis of fecal samples from 130 people with positive microscopic inspection revealed that only 10 (7.7%) of the materials included E. histolytica DNA, whereas 117 (90.0%) of the samples contained E. dispar DNA.

2.3. Intestina Flagelates

Intestinal flagellates that infect humans include Trichomanas hominis, Enteromonas hominis, and Chilomastix mensnii. The only intestinal flagellat thought to be harmful is Giardia lambia (Washington et al., 2006).

2.3.1 Giardia Lamblia

2.3.1.1 Epidemiology of Giardia lamblia

The World Health Organization (WHO) estimates that 200 million cases of gardiasis occur worldwide (Showkat et al., 2010). The organization is widely distributed and contributes significantly to childhood epidermic diarrhea in underdeveloped nations. The range of incidence rates is 4–42%. It is the intestinal parasite that is isolated the most frequently worldwide. In impoverished nations, rates of 20–40% are documented, particularly for youngsters

(Chaconcruz, 2009). The incidence rate in the United States ranges from 3 to 13 percent. One of the many reasons why tourists get diarrhea is gardiasis. Groups that practice poor oral and fecal hygiene, such daycare center youngsters, are linked to person-to-person transmission (Chaconcruz, 2009). About 20% of children who are asymptomatic have Gardia lamblia, which is endemic in daycare facilities. Between 20 and 50 percent of daycare centers have G. lamblia attacks during outbreaks (Chaconcruz, 2009). Intestinal parasite incidence was found to be 21.3% and G. lamblia incidence to be 13.2% in a study carried out in Kaski district, western Nepal, using stool samples taken from students chosen from eleven (11) rural and eight (8) urban schools in 2019 (Chaandrashekhar et al., 2005). According to a research by Klaus et al. (2007) in northern Ghana, Gardia lambia were more common in asymptomatic people (9.7%) than in symptomatic people (3.7%).

2.3.1.2 Morphology and life cycle of Giardia lamblia

The two stages of the Gardia lamblia life cycle are trophozoites and cysts (Wolf, 1992). The cysts are oval in shape and range in length from 7 to 10 micrometers. There are four nuclei in the developed cyst. They spread disease and are resistant to environmental changes (Wolf, 1992). Cysts have been found in natural surface water and can survive for several months in cold, humid conditions (Farthing, 1996). According to Jones et al. (1988), they can withstand the typical chlorine use in the water filtration system. After cysts are consumed, infection happens. The life cycle starts at this point.

Through a process known as excystation, mature cysts in the small intestine release trophozoites after ingestion (Jones et al., 1988). Although cysts can withstand contact to stomach acid, it can actually cause encystation (Farthing, 1996). In humans, the trophoziote stage is in charge of causing clinical illness. The trophoziotes have four pairs of flagellae and two unique nuclei. From above, they seem like teardrops, while from below, they have the shape of a spoon. Their length ranges from 12 to 15 micrometers. Trophozoites use the central sucking disk to adhere to the intestinal mucosa as they colonize the small intestine. Following that, the trophoziotes proliferate through longitudinal binary fission (Hill, 1995). The gardia trophoziotes retreat into the cyst stage, often referred to as encystations, when they approach the colon, and the newly formed cyst is expelled in feces.Intestinal mucus and bile salts promote the growth and encystation of trophoziotes.

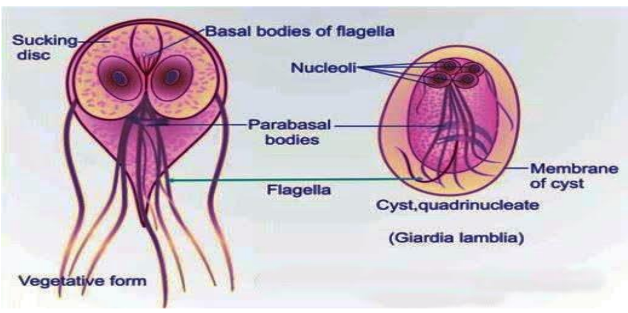


Figure2.2: Morphology of Gardia lambia (Wolf,1992).

2.3.1.3. Clinical manifestation of Giardia Lamblia

At first, gardia infections were thought to be non-pathogenic and frequently occurred in patients who showed no symptoms. Nonetheless, there is now strong evidence that GARDIA lamblia is pathogenic (Wolfe, 1992). Prolonged diarrhea is one of the main signs of acute giardiasis, which primarily affects tourists. Infections typically take 9–15 days to incubate. Typically, the acute stage starts with gastrointestinal distress and progresses to nausea and anorexia (Wolfe, 1992). Chills and a low-grade fever are possible. Following these symptoms are belching, abdominal pain, bad gas passage, and watery, foul-smelling, explosive diarrhea (Levinson, 2008). There have also been reports of malabsorption brought on by persistent Gardia infections. Abdominal pain, flatulence, bloating, vomiting, and weight loss are other typical signs of giardiasis (Flanagan, 2008). The quantity of the inoculum, the length of the infection, and the specific host and parasite factors all influence the symptoms, which differ from person to person (Wolfe, 1992). According to Homan et al. (2001), the diarrhea may be light and result in semi-solid stools, or it may be severe and incapacitating. Children often get asymptomatic infections and are often less sick than adults (Flanagan, 1992). Up to 50% of infections may be asymptomatic, according to some estimates.

2.4. The Coccidia

Small protozoans known as parasitic coccidians are members of the phylum apicomplexer, which is a subclass of sporozoa (Washington et al., 2006). Toxoplasma gondii, Isospora belli, and Cryptosporidium parvum are the three main intestinal coccidians that infect humans. They have both sexual and asexual stages in their life cycle and are obligatory tissue parasites (Washington et al., 2006).

2.4.1. Cryptosporidium Parvum

2.4.1.1 Epidemiology of Cryptosporidium Parvum

Microscopic parasites known as Cryptosporidium are the cause of the diarrheal illness known as cryptosporidiosis. In the 1980s, cryptosporidiosis became known as an opportunistic infection in individuals suffering from AIDS, following the 1976 report of the first human case (O'connor et al., 2011, Petetz et al., 2013). It is now commonly acknowledged that it is a parasite cause of acute diarrhea in healthy adults and a significant contributor to severe diarrhea in young children and those with weakened immune systems (Kosek et al., 2001).

2.4.1.2 Morphology and Life Cycle of Cryptosporidium Parvum

Cryptosporidium is a parasitic protozoan. There are now 26 known species of Cryptosporidium (Ryan et al., 2014). More than 90% of human infections are caused by Cryptosporidium hominis (C. hominis) and C. parvum, two of the species that infect humans. In contrast to C. parvum, which can spread from human to human or from animal to human, C. hominis is primarily transmitted from person to person. Numerous animals, especially cattle, have the potential to harbor Cryptosporidium zoonotic infections (Ryan et al., 2014). Worldwide, there are differences in the geographic distribution of Cryptosporidium species in humans. According to Vanathy et al. (2017), Cryptosporidium has a complicated life cycle that consists of both asexual and sexual stages in a single host. Without a host, the parasite cannot proliferate. It spreads by way of the infected host's voided feces. The parasite is expelled as sporulated oocysts, which are tiny, 4–6μm in diameter, thick-walled, and mature and infectious. There are four sporozoites in each oocyst. Excystation happens when the oocysts enter the gastrointestinal tract and release infectious sporozoites after being consumed by a host. The intestinal epithelial cells are invaded and attached to by sporozoites. After that, the parasites multiply asexually (schizogony) and sexually (gametogony) inside the brush border of the epithelial cells, which is where microgamonts and macrogamonts are created. Two distinct oocyst types—thick-walled and thin-walled oocysts—are produced from the zygote upon fertilization of the microgamont and macrogamont. While the thin-walled two oocysts excyst within the same host and initiate a new infection cycle (autoinfection), the thick-walled oocysts are expelled from the host into the environment.

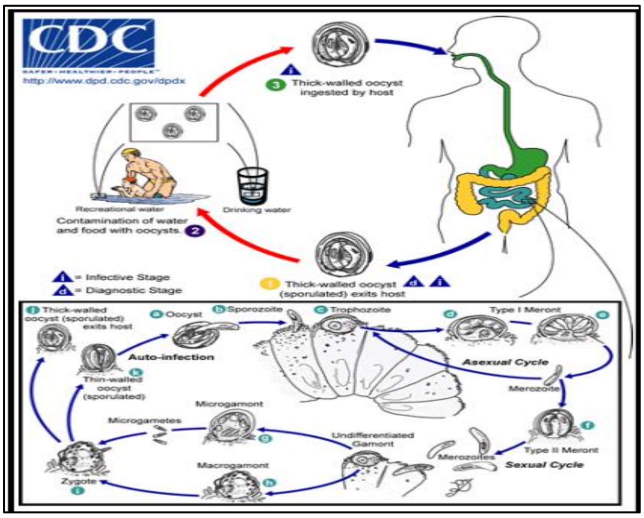


Figure2.3. Life cycle of Cryptosporidium species (source: United States Centers for Disease Control and Prevention)

2.4.1.3 Clinical Manifestation of Cryptosporidium Parvum

Although cryptosporidiosis is often a mild, self-limiting illness, it can become more serious in children and those with weakened immune systems. The usual incubation period is seven days, although it can range from two to ten days (Centers for Disease Control and Prevention, 2019). Immunocompetent individuals infected with Cryptosporidium may exhibit moderate, self-limiting symptoms lasting one to two weeks, or they may be asymptomatic (Centers for Disease Control and Prevention, 2015). Five to ten episodes of watery diarrhea with mucus flecks per day are among the symptoms, which include both bloody and non-bloody diarrhea. Abdominal pain, dehydration, nausea, vomiting, fever, and weight loss are other symptoms. Following an apparent remission of symptoms, patients may experience a recurrence (Center of disease control and prevention, 2019, Edwin et al., 2012). The symptoms can be more severe and persistent in immunocompromised people, such as AIDS patients, cancer patients, or transplant recipients on immunosuppressive medications, and they can result in serious or life-threatening infections (Centers for Disease Control and Prevention, 2019).

The site of infection and the CD4+ T-cell count determine how serious the disease is; an infection is typically more severe (Striepen, 2013) when the count is less than 200 cells/mm3. Extraintestinal cryptosporidiosis has been documented in AIDS patients, despite the fact that the intestinal tract is the most often infected region (Shrivastava et al., 2017). Although they may also be impacted, other organs like the pancreas, biliary tract, and lungs are most likely extensions of an initial intestinal infection. In populations with immunological competence, cryptosporidiosis-related mortality is rare, and epidemic data showed that the case fatality rate was less than 1 in 100,000 (WHO, 2009).

2.4.1.4 Laboratory Diagnosis of Dryptosporidium Parvum

The three main diagnostic techniques

- Microscopic analysis, including acid fast staining
- Techniques for detecting antigens, such as enzyme-linked immunosorbenassay
- Tests that use molecules, such the polymerase chain reaction (PCR).

2.4.1.5 The Common Treatment for Intestinal Protozoans

Metronidazole 750-800 mg three times a day

2.5. Intestinal Helminths Infection

According to deSilva et al. (2003), the four most prevalent soil-transmitted helminths are hookworms (Necator americanus and Ankylostomea duodenal), whipworms (Trichuris trichura), and roundworms (Ascaris lumbriciod). According to recent estimates, 795 million people are infected with T. trichura, 740 million with hookworm, and 1.221 billion with A. lumbriciodes (deSilva et al., 2003). Two million or more people are considered to be at risk, and it is believed that over one billion people worldwide are infected with these parasites (Montessoret et al., 1998). According to reports, children are particularly vulnerable to serious illnesses, as well as the accompanying mortality and morbidity (Chan et al., 1994). According to Connolly et al. (1993), helminth infections have been associated with a higher incidence of various nutritional anemias, protein-energy malnutrition, and slower physical growth and development in newborns and children.

2.5.1. Nematodes

Nematodes are bilaterally symmetric, cylindrical, unsegmented helminths. They range in size from a few millimeters to one meter, and their digestive tracts are completely formed. Human-infecting nematodes have distinct sexes, with the male often being smaller than the female. Infectious larvae that penetrate the skin or infectious eggs that are consumed are the two ways that the infection is spread. Like hookworms, rhabditiform larvae are non-infectious first-stage larvae that emerge from eggs in the soil or small intestine. The worm's infectious stage, the filariform larva, penetrates the skin to spread infection.

2.5.1.1 Ascaris Lumbriciodes (Round Worm)

2.5.1.2 Epidemiology and Incidence of Ascaris Lumbricoides

Ascaris Lumbriciodes is a parasitic roundworm that causes human ascariasis (Berger et al., 2006). The enormous round human worm, Ascaris lumbricodes, is a member of the phylum Nematodes. With rates of 45% in Latin America and 95% in some regions of Africa, it is possible that up to 25% of the world's population is infected (Berger et al., 2006). Ascaris is very common in hygienic areas and tropical places. The WHO estimates that 60,000 individuals suffer with Ascaris lumbriciodes each year, and that 250 million more are at risk of contracting the infection (Monstressor et al., 1998). Common reserviors for A include both domestic and wild animals. Lumbriodes. The parasite Ascaris lumbriciodes is a strong one. This characteristic results from eggs' resilience, which allows them to endure a variety of harsh conditions, including high heat and cold, chemicals, and chemical disinfectants (Neva et al., 1994).

2.5.1.3 Morphology and Life Cycle of Ascaris Lumbriciodes

Ascaris eggs can survive for years in the soil and are among the most resilient helminth eggs (Crompton, 1999, Gilgen et al., 2000). The large size of Ascaris lumbricoides is one of its characteristics. Males measure 15–31 cm in length and 2-4 mm in diameter (Roberts et al., 2009). According to Roberts et al. (2009), females are 20–49 cm length and 3-6 mm broad. Fertilized eggs have a thick outer shell, are 45–75 micrometers wide, and are oval to spherical in shape. The width of unfertilized ggs is between 88 and 98 micrometers (Rboberts et al., 2009).

The jejenum of the small intestine is home to Ascaris lumbriciodes (Guyat et al., 1995). A female can generate up to 65 million eggs in her lifetime, or up to 240,000 eggs every day. Unsegmented eggs are transferred into feces. The eggs develop in warm, wet, shaded soil, and after three weeks an infectious larva emerges (Guyat et al., 1995). Humans consume the eggs, which then hatch in the duodenum. The released larvae then pass through the intestinal mucosa, enter the portal and lymphatic systems, and are transported to the liver, heart, and lungs (Guyat et al., 1995). It takes a few days to complete this migration phase (Guyat et al., 1995). After exiting the capillaries and entering the aveoli, the larvae ascend the respiratory tree and are ingested. They continue to develop in the intestine and achieve sexual maturity 8–12 weeks after infection (Guyat et al., 1995). After a year or so of life, the adults are expelled in the feces (Guyat et al., 1995).

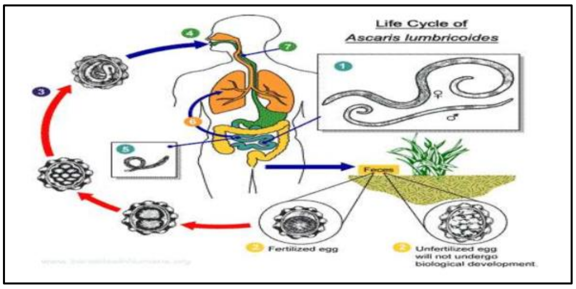


Figure 2.4. Life cycle of Ascaris lumbriciod (source: United States Centers for Disease Control and Prevention)

2.5.1.4 Pathogenicity and Clinical Manifestation of Ascaris Lumbriciodes

The first migration is started by migratory larvae, and its intensity is determined by the quantity of invasive organisms, the host's sensitivity, and its nutritional condition. Recurrent infected individuals develop sensitization, and migratory larvae may induce eosinophilic filtration and tissue responses in the liver and lungs (Guyat et al., 1995). Adult worms can obstruct the intestine, and when they migrate, they can cause serious illness by getting into other organs. There could be biliary stones and acute pancreatitis. Rare deaths are typically caused by biliary ascariasis or intestinal blockage (Guyat et al., 1995).

2.5.1.5 Laboratory Diagnosis of Ascaris Lumbriciodes

Ascaris lumbriciodes eggs in stool are typically detected under a microscope to make a diagnosis. The oval-shaped egg has uneven surfaces. The patient may occasionally notice mature worms in their stool (Jawetz et al., 1996). The preferred method for visualizing Ascaris worms in the biliary tree is abdominal ultrasonography (Sherman et al., 2005).

2.6 Cestodes (Tape Worm)

The multi-segmented, dorsoventrally flattened tape-like worms known as cestodes (Greek: kestoss-girdle or ribbon) range in size from a few millimeters to several meters. The human small intestine is home to the adult worms. Their reproductive system is highly developed, as they are hermaphrodites, and they have a flat, segmented body with three regions: the Strobila, which includes the immature, mature, gravid proglottids (segments), the Neck, which is the germinal section, and the Scolex, which consists of suckers, hooklets, and grooves. Every species is parasitic.

2.6.1 Taenia Solium

2.6.1.2 Epidemiology and Incidence of Teania Solium

In endemic regions of Asia, Africa, and Latin America, Taenia solium human cysticercosis (HCC) is a zoonotic parasite disease that causes serious health and economic issues (Terherson et al., 2011). The prevalence of free-roaming pigs, open defecation, poor hygiene, and poverty are all linked to the disease (Flisser et al., 2006). In endemic regions of Asia, Africa, and Latin America, Taenia solium human cysticercosis (HCC) is a zoonotic parasite disease that causes serious health and economic issues (Terherson et al., 2011). The prevalence of free-roaming pigs, open defecation, poor hygiene, and poverty are all linked to the disease (Flisser et al., 2006). Pigs are the intermediate hosts infected with the metacestode larval stage (cysticercus), usually in the muscle tissue, while humans are the sole definitive hosts carrying the intestinal adult tapeworm in T. solium's natural life cycle. When it came to reporting active infections, America showed similar serological results for exposure to T.solium eggs (34.55% and 31.22%, respectively). However, the African community reported nearly 12 times as many infections as the Latin American community (Mahajai et al., 1982, Medina et al., 1990). indicating that there were notable differences in each community's transmission circumstances and infection establishment. Because of this, extending findings from one group to a regional or even global scale can be risky.

2.6.1.3 Life Cycle of Taenia Solium

The life cycle is completed in two hosts.

Humans are the definitive host; pigs and occasionally humans are the intermediate hosts. Humans become infected when they consume pork that has been contaminated with cysticerci and is not cooked correctly. When the scolex comes into contact with bile inside the human alimentary canal, it exvaginates and attaches itself to the gut wall using its hooks and suckers. By gradually becoming a worm, the larvae transform into adults. In two to three months, the worm reaches sexual maturity and begins to produce eggs, which are then expelled together with the gravid segments in the feces.

When pigs consume eggs or gravid proglotites from human excrement, they become infected. The oncospheres develop from eggs in the pig's intestine. Through hooks, they adhere to the intestinal mucosa, pass through the intestinal wall, enter the portal arteries or mesenteric lymphatic, and ultimately enter the systemic circulation. The liver, right side of the heart, lungs, left side of the heart, brain, or other tissue with strong blood flow are typically the first places they reach after passing via the portal vein. After filtering out of the bloodstream, the naked onchospheres enter the muscle tissue, where they eventually settle and continue to develop.

Within nine to ten weeks, they lose their hooklets, grow, and transform into a fluid-filled cyst. They can survive in pig muscle for up to eight weeks, during which time they can still infect humans. The cycle is repeated when the new host consumes pig meat that has been contaminated. Humans can occasionally become infected by consuming food or water tainted with eggs. The onchospheres are expelled from the eggs in the colon upon eating. After invading the intestinal mucosa, these larvae are transported by the bloodstream to various tissues, where they mature into cysts. The majority of human cysts form in the skeletal muscles, eye, subcutaneous tissue, and central nervous system, leading to a condition known as cysticercosis.

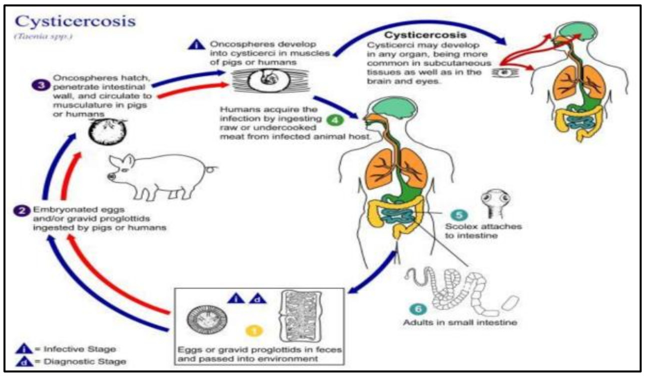


Figure 2.5. Life cycle of Taenia solium (source: United States Centers for Disease Control and Prevention)

2.6.1.4 Pathogenicity and Clinical Manifestation of Taenia Solium

Adult worms and cysts are both harmful. The worms are less harmful as adults. Their armed scolex can occasionally induce moderate intestinal mucosal irritation or inflammation. More harmful are the cysts. They are the cause of a dangerous illness. Human cysticercosis mostly affects the skin, skeletal muscles, eyes, and central nervous system. The cyst may continue to grow for a few years. The cyst overcomes the host's defenses to survive in the brain. Prostaglandins and other chemicals that prevent complement activation and cytokine generation are secreted by it.

As a result, the area surrounding the living cysticercus has very little host inflammation. A limited minimum cellular response, comprising a small number of macrophages and eosinophiles, envelops the living cyst. A thick infiltration of inflammatory cells, including leucocytes, multinucleated giant macrophages, inflammatory cells, and less commonly, foreign body giant cells, surrounds the dead cyst. There is a zone of fibrosis and persistent inflammatory infiltration outside of this region.

2.6.1.5 Laboratory Diagnoses of Taenia Solium

Proglottids in the feces, on the animal, or in the environment, as well as taeniid eggs in the feces using fecal flotation and sedimentation procedures, can be used to identify taeniasis in the definitive host.

Although PCR and other genetic methods can more accurately identify the particular organism, they are rarely utilized for animal taeniasis outside of research. Since the eggs are shed sporadically and cannot be effectively concentrated using the standard flotation techniques, repeated sample may be required to find them. Taeniid eggs have a striated embryophore coat and are thick and brown. Taeniid antigens in feces can be found using coproantigen assays, although they typically cannot tell distinct species apart.

Biopsies may be useful if the cyst is accessible, and imaging tests like ultrasonography are occasionally utilized, particularly in smaller animals. Although T. solium management programs occasionally include ELISA tests that identify antigens from actively growing larvae, these tests are insufficiently sensitive to be applied to individual pigs.

2.7. Trematodes (Flukes)

Trematodes are large, flat, unsegmented helminths that resemble flat fish or tree leaves. Trematodes get their name because they have big, conspicuous suckers with a hole in the middle (Greek: trema, which means hole, and eiodos, which means appearance). The flat, hermaphrodite worms known as intestinal flukes (trematodes) can be anything from a few millimeters to several centimeters in size. Another name for trematodes is platyhelminths. They are formed like flat leaves. They are frequently linked to aquatic animals such as fish, mollusks, and snails.

2.7.1. Fasciolopsis Buski

2.7.1.2. Epidemiology and Incidence of Fasciolopsis Buski

The intestinal illness known as fasciolosiasis is brought on by the zoonotic trematode Fasciolopsis buski. The illness is regarded as ignored due to the presence of F. buski. South and Central China (Goddard, 1919), Taiwan (Hsieh, 1960), Southeast Asia (Cross, 1960, Manning et al., 1970), Bangladesh (Gilman et al., 1982), Japan (Ohi, 1924), and Indonesia (Hadidjaja et al., 1982) are among the nations where it is endemic. An estimated 10 million persons globally are thought to be infected by the parasite (CDC, 2012). In the villages of Sungai Papuyu, Kalumpang Dalam, Sarang Burung, Telaga Mas, Putat Atas, Padang Bangkal, and Sapala Bararawa, the National Institute of Health Research and Development investigated the prevalence of fasciolopsiasis and discovered that 7.8% of 1555 inhabitants carried the parasite (Anorital et al., 2005). The illness was particularly prevalent among Kalumpang Dalam Village residents (Anorital et al., 2005, Hairani et al., 2005).

2.7.1.3. The life Cycle of Fasciolopsis Buski

Fasciolopsiasis is caused by F. buskiis. The parasite is the biggest trematode in the world. Animals act as reservoir hosts, whereas humans are its definitive host. The worm does not spread throughout the body; it lives and reproduces in the intestine. A freshwater snail serves as the first resevior host during the life cycle of F. buski, whereas aquatic plants serve as the second resevior host (CDC, 2012). In various geographical locations, fasciolosis affects different reservoir hosts. In Southeast India (Rajendran et al., 2019) and China's Kwangtung Province (Hsu, 1964), pigs are the most prevalent reservoir. Miracidia from F. buski eggs grow into sporocysts, rediae, and cercariae after infecting appropriate freshwater snails. The latter evade the snail and encyst in aquatic plants that are favorable for them, such lotus roots and water chest nut bulbs (Mahajan et al., 2010). Consuming raw or undercooked aquatic plants can cause fasciolosis in people. In the small doudenum, encysted cercariae transform into metacercariae and excysts, adhere to the mucosa, and mature into adults in roughly three months.

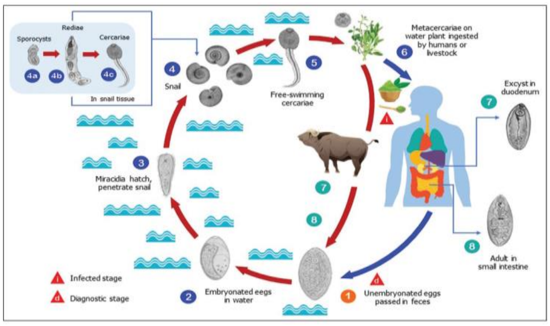


Figure 2.6 Life cycle of *Fasciolopsis buski* (source: United States Centers for Disease Control and Prevention)

2.7.1.4. Pathogenicity and Clinical Manifestation of Fasciolopsis Buski

Fasciolopsaisis is pathogenic because of its poisonous, mechanical, and traumatic effects. Local ulceration and inflammation are brought on by larvae that adhere to the mucosa of the duodenum and the jejunum. Clinical disease is also explained by intoxication and sensitization. The adult worms induce malabsorption, protein-losing enteropathy, partial intestinal blockage, and poor absorption of vitamin B12 in cases of severe infections. Abdominal pain and diarrhea are the first signs. Symptoms of allergies and toxins typically manifest as prolonged diarrhea, anemia, and edema ascites.

2.7.1.5. Laboratory Diagnoses of Fasciolopsis Buski

The diagnosis is supported by the history of living in endemic areas and is verified by the presence of worms or eggs in feces following the administration of an anti-helminthic medication.

2.7.1.6 Treatment For Intestinal Helminths

Drugs	Parasites	Dosage
mebendazole*	*Ascaris, Trichuris*, hookworm *Enterobius*	100mg twice daily for 3 days 100mg single dose, repeat at 2 weeks
albendazole†	*Ascaris, Enterobius, Trichuris*, hookworm cutaneous larva migrans *Strongyloides* *Trichinella*	400mg single dose 400mg once daily for 3 days (unlicensed use) 400mg twice daily for 3 days 400mg twice daily for 1 week
piperazine*	*Ascaris*, hookworm *Enterobius*	4g single dose, repeat monthly up to 3m if reinfection risk 4g single dose, repeated at 2 weeks
ivermectin†	*Strongyloides*, cutaneous larva migrans	200µg/kg once daily for 2 days
niclosamide†	tapeworm	2g single dose
praziquantel†	tapeworm *Hymenolepis nana* schistosomiasis	5-10mg/kg single dose 25mg/kg single dose 20mg/kg 2 doses, 6 hours apart
levamisole†	*Ascaris* hookworm	120-150mg single dose 120-150mg single dose, repeat at 1 week if heavy infestation

2.7.1.7 General Preventive and Control Measures of Intestinal Parasite

- ❖ Improvements in housing, sanitation and hygiene.
- ❖ Health education to prevent re-infection.
- ❖ Periodical deworming to eliminate infecting worms.
- ❖ Control of vectors.
- ❖ Avoid walking bare footed and improve sanitation to reduce soil contamination with infective eggs or larvae.
- ❖ Development of drugs and vaccines.

2.8 Emperical Literature

Matsinkou Mba Rosin Ruth, Yamsi Cedric, and Mbong Erica Malla conducted a study in 2020 to ascertain the prevalence of gastrointestinal parasites in school-age children in the Bamendjou west region of Cameroon. Of the 493 stool samples that were taken, 57 tested positive. The study's overall prevalence was 11.6%.

According to a 2019 study by Thomas Kuete, Hugues Ghlslain Mbwang, Catherine Ngule, and Albert Kobo, the overall incidence of intestinal parasites among the inmates of New-bell Central Prison in Cameroon was 39.3%, with protozoa accounting for 24.6% and helminths for 16.6%.

Asene Zongi and Abdou Karim Ouattard conducted a study in December 2018 titled Incidence of Parasitic Infection in Children Under 5 Years in the City of Ouagadougou, Burkina Faso. The incidence of Albert Theophane Yonli was 20.8%.

According to a 2012 study by Adou-Bryn and Kouadio Yapor, the total incidence of intestinal parasites among the people living in Biankouma, Ivory Coast, was 10.4%.

Ngangnang Ghislain Romeo and Vincent Khan Payne in 2017 carried out a research on the incidence of gastrointestinal parasites among school age children in Nkondjock, Littoral Region of Cameroon and had an overall incidence of 24%.

3.1 Material and Method

3.1.1 MATERIAL: Clean open-mouth containers, a centrifuge tube, slides, a cover slide, a microscope, sanitary tissue, a bold marker, a test tube rack, a strainer, and a notebook are the supplies needed for the investigation.

3.2. Methods

3.2.1 Ethical Consideration

- Redemption Higher Institute of Biomedical and Management Sciences Buea's administrative board will provide ethical authorization, and the Buea Regional Hospital will provide administrative authorization after that.
- Participants will sign an informed consent form after being instructed on the specifics (benefits and nature of the study) in order to provide their informed permission.
- Codes will be used instead of names to safeguard the participant's identify. Personal identities will not be used.

3.2.1 Description of Study Area

3.2.1 Located in the Fako division of the South West Region of Cameroon, at the base of Mount Cameroon, the Buea Regional Hospital is Located Exactly between the Army Camp and the Education Delegation on the High Road Leading to the Bokwango Area.

The general supervisor, who keeps an eye on the work of the technical staff, supports the director, who is in charge of the hospital. The medical unit, the surgical unit, the pediatric unit, the maternity unit, the HIV/AIDS unit, the laboratory unit, the x-ray unit, the hemodialysis center, the tuberculosis center, the diabetes center, the theater department, and the outpatient department (OPD) are some of the departments and units that comprise the hospital. Patients from all around the country are treated at the facility.

3.2.3 Study Design

This will be a cross sectional study

3.2.4 Sample Size

Using the Cochran's formula a sample size of 148 was calculated

n = Z2 x P(1-P)

e2

n = (1.96)2(0.11)(1- 0.11)

(0,05)2

n = 148 participants

where

- n is the required sample size
- Z is the confidence interval

- P is the pre-estimated value incidence (11%) obtained from a previous study carried out by Matsinkou Mba *et al*., 2022.

3.2.5 Study Sample

Human feces was the only sample collected.

3.2.6 Sampling Method and Data Collection Tool

They will be enlisted while they are in the hospital. They will be contacted, informed about the study, given the informed consent form, and recruited once it has been signed during sample collection. In addition to providing the questionnaire to the persons and explaining the appropriate collection process, the inform consent form will be read and explained to those who are unable to read and comprehend it. Additionally, the questionnaires will be reviewed, verified, and stored for later data entry at the conclusion of each day.

3.2.7 Examination of Parasites (Laboratory Analysis)

3.2.7.1 Collection of Samples

Intestinal parasite detection and identification depend on appropriate sample collection. Anyone who agrees to participate in the study will receive a small screw-capped plastic cup, tissue, and a little plastic scoop. It is recommended that they fill half of the plastic cup and throw away the tissue after usage. For the analytical process, the samples will be gathered at the lab. The appropriate sample number or code will be appropriately labeled on all containers holding stool samples.

3.2.7.2 Macroscopy of Sample

The stool samples will be inspected macroscopically with the naked eye to check for the presence of worms, color, abnormal features like mucus, blood or fat globules, and pathologic odor, which can be either offensive or non-offensive. Consistency can be classified as hard, formed, semi-formed, and watery.

3.2.7.3 Saline and Iodine Wet Mount

- About 2 mg of stool sample will be dropped into the saline, and the same will be done with the iodine. A drop of regular saline will be placed in the middle of the left half of the slide, and a drop of Lugol's iodine solution will be placed in the middle of the right half.
- After that, the drips and excrement will be combined to create a uniform suspension.
- Each drop will be covered with a cover slip, and the saline solution will be examined under a 10X objective to detect intestinal protozoan motile forms, cysts, and oocysts, as well as helminth ova or larvae. Additionally, the cyst stages of protozoa are identified by observing an iodine solution under 40X objectives. The cyst's nuclei will be stained by the iodine.

3.2.7.5 Sedimentation Edimentation Technique (Formol-Ether Concerntration Technique)

- About 2g or 2ml of stool is mixed in 10ml of normal saline solution.
- The stool samples will be filtered using a strainer into a centrifuge test tube.
- The test tube containing the mixture will be centrifuge for one minute at a speed of 2000rpm and pour off the supernatant fluid.
- And 10ml of formaldehyde solution is added to the sediment.
- The suspension will be well mixed and allow to stand for five minutes.
- 3ml of ether is then added to the tube and stoppered then will be shaken vigorously for 30 seconds.
- The stopper is then removed and centrifuge at low speed of 1500rpm.
- Four layers will be form the 1st layer ether, 2nd layer debris, 3rd layer formaldehyde solution and the 4th layer deposit containing stages of parasites (cyst, egg, and or larva).
- The supernatant will be poured off and the remaining fluid is well mixed with the deposit by gently tapping the tube.
- Then 2 drops of the sediments from the tubes will then be added to the slide and covered with cover slids.
- The preparations will be examined microscopically using the 10x objective for eggs and larva of helminths. The 40x objective is used to examine small cysts of protozoa.

3.2.7.6 Modified Ziehl-Neelson Stain (Acid Fast Staining)

A smear will be created on a slide, fixed with methanol for two to three minutes, and then flooded with five to seven drops of carbol fuchsin for ten minutes, followed by another rinse. After 30 seconds of 1% acid alcohol decolorization, it will be rinsed. After that, the smear will be counter-stained for a minute using methylene blue. After being rinsed, drained, and allowed to air dry, the smear will be examined at 10X, 40X, and 100X oil immersion.

Results

For the study, a total of 100 samples were gathered from a variety of home visits conducted in various parts of Kumba.

4.1. Sociodemographic Characteristics of Study Population.

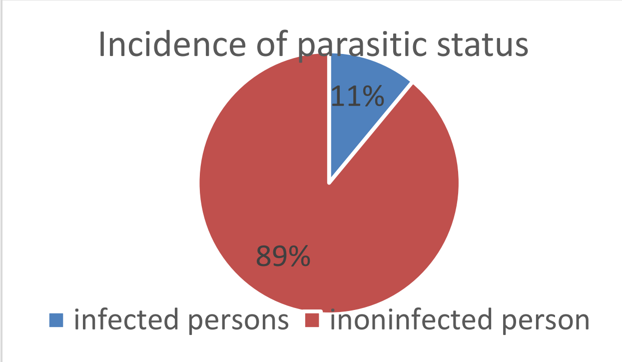
A sample of one hundredth (100) people was taken. There were 77 females with 7 infected, resulting in an incidence of 9.1%, and 23 men with 4 infected (17.4).

Table 1: Characteristics of Study Population According to Demographic Data.

Characteristics		N^0 of individuals	Number positive	Incidence
Home address	Fiango	29	2	6.9
	Mbonge road	35	6	17.2
	Kumba town	25	0	0
	Kossala	16	3	18.8
Sex	Female	77	7	9.1
	Male	23	4	17.4
Age	<25	30	3	10
	25-50	60	6	10
	50-75	10	2	20

The population's demographic information, including home address, sex, and age, is displayed in the above table along with the overall number of people, infected people, and their occurrence.

Figure 4.1: Pie Chart presentation of the General Distribution of Infected and Non-Infected Individuals.



The aforementioned pie chart, which displays the occurrence of parasite status, shows that 89 people were not infected (89%) and 11 people were infected (11%).

Table 2: Parasitism Infection Status.

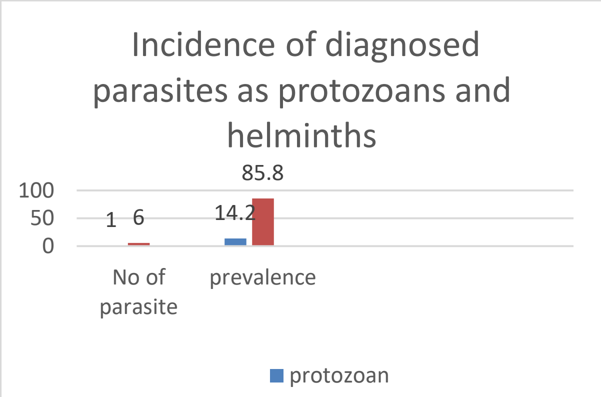
Infection status	Number of individuals	Incidence(%)
Monoparasitism	8	72.7
Polyparasitism	3	27.6
Total	11	100

According to the table, three individuals had several parasite infections, resulting in an incidence of 27.6, while eight individuals had a single parasite infection, with an incidence of 72.7.

Table 3: The Different Intestinal Parasites Diagnosed and Corresponding Incidence

Type of parasite	Number of individuals	Incidence (%)
Egg of hookworm	3	3
E histolytica	2	2
Diphyllobothrium latum	1	1
Fasciola hepatica	2	2
Gastrodiscoides hominis	1	1
Ascaris sp	3	3
Taenia saginata	2	2

Figure 4.2: Bar Chart Presentation on Incidence of the Diagnosed Gastrointestinal Parasite as Protozoa and Helminthes



The bar graph displays the number of parasites diagnosed and their incidence as helminths and protozoa, with helminths having a total number of 6 and an incidence of 85.8 and protozoa having a number of 1 and an incidence of 14.2.

5.1 Discussion

Approximately 50% of people on the planet live in environments that lead to nutritional stress and parasitic illnesses caused by helminthes or protozoan parasites. In the current study, 100 stool samples from low-socioeconomic communities in the Kumba region of southwest Cameroon were examined parasitologically, paying particular emphasis to intestinal protozoa and helminthes. As a result of modernization, the general incidence of intestinal parasite infection among Kumba's residents is 11 percent. According to this study, residents of Kumba, Cameroon, had a high incidence (85.8%) of intestinal parasite infections, accounting for 11% of all intestinal parasite infections.

Overall, 11% of people had intestinal parasites. This rate was lower than the overall intestinal parasite incidence of 24.5% found in a prior study by Ngangnang and Payne in Nkondjock, Cameroon.

Additionally, the study was comparable to one conducted in Ivory Coast by Adou-Bryn et al., which found an incidence of 10.4%. These disparate incidence levels demonstrate how intestinal parasite infection differs over time and even within a single region. More precisely, the geographical circumstances of the study area or the living standards of study participants may be the cause of the variation in occurrence. The prevalence of intestinal parasite infections among Kumba residents may be brought on by a lack of awareness regarding cleanliness and hygiene.

The prevalence of parasitic infections may be exacerbated by poor sanitation practices and drainage issues. Furthermore, proper hand washing, which often stops the spread of some parasites, is obviously insufficient in this case. There was a significant variation in the intestinal parasite incidence according to gender. Rather than gender, the illnesses are probably related to the people's daily activities. In order to significantly lower the prevalence of parasites, efforts should be increased to ensure that there is enough clean water and to raise public awareness of improved ecological and personal hygiene. Civilization and years of widespread drug administration programs may be major factors in the study's low prevalence when compared to the research mentioned above.

5.2 Conclusion

I may therefore draw the conclusion that, with an overall incidence of 11%, the prevalence of gastrointestinal parasites among Kumba's residents is comparatively low based on the work completed or my findings. This could result from modernization and deparatization.

5.3 Recommendation

The ministry of public health should develop programs to raise awareness of the risks associated with inadequate sanitation and hygiene practices.

Deworming activities ought to be held at marketplaces, churches, and schools.

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