PREVALENCE OF INTESTINAL PARASITES AMONG HIV PATIENTS ATTENDING ANTIRETROVIRAL THERAPY CLINIC AT VARIOUS MEDICAL CENTERS IN BENIN CITY

BY

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DEPARTMENT OF MEDICAL LABORATORY SCIENCE

SCHOOL OF BASIC MEDICAL SCIENCES

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BEING A PROJECT SUBMITTED TO THE DEPARTMENT OF MEDICAL LABORATORY SCIENCE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR'S DEGREE IN MEDICAL LABORATORY SCIENCE (BMLS) UNIVERSITY OF BENIN, BENIN CITY, EDO STATE..

SUPERVISED BY

DR (MRS) IFUEKO.M. MOSES-OTUTU

NOVEMBER, 2025

CERTIFICATION

This is to certify that this research work titled "**PREVALENCE OF INTESTINAL PARASITES AMONG HIV PATIENTS ATTENDING ANTIRETROVIRAL THERAPY CLINIC AT VARIOUS MEDICAL CENTERS IN BENIN CITY**" was carried out by **EDDUAM GRACE DOERE** with Matriculation Number **BMS2001156**, in the Department of Medical Laboratory Science, School of Basic Medical Sciences, University of Benin, in partial fulfillment of the requirements for the award of Bachelor of Medical Laboratory Science (BMLS) degree

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PROF. OMORUYI PIUS OMOSIGHO **DATE**

(EXTERNAL EXAMINER

DEDICATION

I dedicate this project to Almighty God for granting me the Grace, Mercy, and Strength to successfully complete this work.

ACKNOWLEDGEMENT

I give thanks to Almighty God, my Creator, who has granted me grace and strength to complete this work. My profound gratitude goes to my supervisor, Dr. (Mrs.) Ifueko.M. Moses-Otutu, for her genuine concern, guidance, and support throughout the course of this study. My sincere appreciation also goes to Dr. (Mrs.) Zainab Omoruyi, Head of the Department of Medical Laboratory Science, whose counsel and encouragement greatly contributed to the success of this study.

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ABSTRACT

Intestinal parasitic infections (IPIs) remain a significant comorbidity among individuals living with HIV/AIDS, particularly in resource-limited settings. This study assessed the prevalence and distribution of intestinal parasites among HIV/AIDS patients attending ART clinics at a secondary health facility in Benin City. A total of 150 patients were recruited and stool samples were examined microscopically. Sociodemographic, clinical, and hygiene-related data were also collected using structured questionnaires, and associations were analyzed using chi-square tests.. The overall prevalence of intestinal parasites was 28.7%. The most frequently detected species were *Entamoeba coli*, followed by *Entamoeba histolytica, Ascaris lumbricoides,* and *Trichuris trichiura*. Prevalence was higher among females than males in both hospitals, with a statistically significant association (p = 0.042). Rural residence was also significantly associated with infection (p = 0.001). Other factors, including age, marital status, education, occupation, and hygiene practices, showed variations but no significant statistical associations. Widows and patients with tertiary education recorded disproportionately higher prevalence, while inconsistent hand washing, irregular deworming, and animal contact were linked with increased infection risk, though not statistically significant. IPIs remain common among HIV/AIDS patients in Benin City despite ART availability. Gender, rural residence, and socioeconomic vulnerabilities contribute to the persistence of infection. Routine stool screening, targeted deworming, gender- sensitive interventions, and improved sanitation in rural areas are recommended to reduce the burden of parasitic co-infections and improve HIV treatment outcomes.

CHAPTER ONE

INTRODUCTION

1.1 Background of Study

Human immunodeficiency virus (HIV) infection remains a major global health challenge, with sub-Saharan Africa bearing the greatest burden of the epidemic (Ikpeama *et al.,* 2016). HIV/AIDS weakens the immune system, predisposing patients to a wide range of opportunistic infections including intestinal parasitic diseases (Jegede et al, 2014). Intestinal parasites such as Cryptosporidium spp., Entamoeba histolytica, Giardia lamblia, and Isospora belli are frequently reported among HIV/AIDS patients in developing countries, where sanitation and hygiene practices are often inadequate (Abaver *et al.,* 2011).

Nigeria, being one of the countries with the highest prevalence of HIV/AIDS, faces a compounded burden of intestinal parasitic infections among affected populations (Akinbo *et al.,* 2010). Several studies from Nigerian cities including Abuja, Kano, Sokoto, and Benin City have reported a high prevalence of intestinal parasites among HIV/AIDS patients, underscoring the clinical significance of such co-infections (Abaver *et al.,* 2011; Jegede *et al.,* 2014; Ikpeama *et al.,* 2016; Akinbo *et al.,* 2010). Benin City, located in Edo State, has been documented to experience significant rates of intestinal parasite infections among HIV-positive patients, highlighting the need for continuous surveillance in this region (Akinbo *et al.,* 2010).

The advent of antiretroviral therapy (ART) has reduced the incidence of many opportunistic infections among HIV/AIDS patients by improving immune function (Jegede *et al.,* 2014). However, intestinal parasites continue to persist among ART-treated patients in Nigeria, suggesting that ART alone may not fully prevent parasite-associated morbidity (Ikpeama *et* *al.,* 2016).). Co-infection with intestinal parasites can exacerbate diarrhea, malnutrition, and poor absorption of antiretroviral drugs, thereby worsening treatment outcomes (Abaver *et al.,* 2011).

1.2 Statement of the Problem

In Nigeria and other parts of sub-Saharan Africa, HIV/AIDS continues to pose a serious public health challenge due to its high prevalence and severe impact on immune function (UNAIDS, 2022; NACA, 2020). The immunosuppressive nature of HIV makes affected individuals particularly susceptible to opportunistic infections, with intestinal parasitic infections (IPIs) among the most frequently encountered (Wumba *et al.,* 2012; Adamu *et al.,* 2013). These parasites not only increase morbidity but have also been linked to poor nutritional status, accelerated disease progression to AIDS, and elevated mortality in HIV-positive individuals (Terefe *et al.,* 2014). Evidence from previous studies suggests that intestinal parasitic infections are highly prevalent among HIV-infected patients in Benin City, Nigeria. For instance, Eyo *et al.* (2012) reported that more than 15% of HIV-positive individuals attending health facilities in the city were co-infected with parasites such as Cryptosporidium spp. And Isospora belli, both of which are known to cause severe, persistent diarrhea in immunocompromised hosts. Despite these concerning findings, there is a lack of recent and comprehensive data on the distribution and prevalence of various intestinal parasite species in HIV/AIDS patients in this urban setting. This lack of updated epidemiological data hinders effective diagnosis, treatment, and prevention efforts. Furthermore, infection rates may differ across healthcare centres in Benin City due to variations in environmental sanitation, water quality, personal hygiene practices, and whether or not routine parasitological screening is implemented as part of HIV care protocols (Uneke *et al.,* 2007). These inconsistencies contribute to a fragmented understanding of the burden of

IPIs in HIV care, making it difficult for clinicians and policymakers to formulate unified intervention strategies.

1.3 Justification of Study

There is a lack of information regarding the prevalence of intestinal parasites among HIV/AIDS patients in Benin City, a significant urban center with a dense population and a variety of socioeconomic circumstances that facilitate the spread of parasites (Eyo et al., 2012). The majority of the data currently available is extrapolated to rural villages or larger Nigerian populations (Uneke *et al.,* 2007), and thus, little is known about Benin City's localized epidemiology, which may include particular risk factors such as variations in water availability, sanitation facilities, and health-seeking behavior (Onyeneho and Igwe, 2017). Therefore, it is justified to conduct this study since it will: Provide vital baseline information on the prevalence and range of intestinal parasites among HIV/AIDS patients that is unique to the city of Benin. Improve clinical management by influencing empirical treatment methods and encouraging regular parasitological screening in HIV care programs. Encourage focused public health measures including mass deworming programs along with HIV treatment, better sanitation, and hygiene education. Add to national and international knowledge by facilitating comparisons with related studies and guiding meta-analyses.

1.4 Aim of Study

The study aimed to determine the prevalence of intestinal parasitic infections among HIV/AIDS patients attending various medical centers within Benin Metropolis, Benin City.

1.5 Specific Objectives

The specific objectives of the study were:

1. to determine the prevalence of intestinal parasitic infections among HIV/AIDS patients attending various medical centers within Benin Metropolis.
2. to identify the specific species of intestinal parasites most commonly infecting HIV/AIDS patients in these centers.
3. to evaluate the influence of sociodemographic factors (such as age, gender, education level, and occupation) on the prevalence of intestinal parasitic infections among HIV/AIDS patients.
4. to examine hygiene practices and water sources as possible risk factors contributing to intestinal parasitic infections in this patient population.

1.6 Research Hypotheses

1.6.1 Null Hypotheses (H_0):

There is no significant prevalence of intestinal parasitic infections among HIV/AIDS patients attending various medical centers in Benin Metropolis.

1.6.2 Alternative Hypotheses (H_1):

There is a significant prevalence of intestinal parasitic infections among HIV/AIDS patients attending various medical centers in Benin Metropolis.

CHAPTER TWO

LITERATURE REVIEW

2.1 Historical Review of HIV/AIDS and Global Burden

HIV/AIDS remains one of the most significant public health challenges globally, with decades of epidemiological impact and social burden (Tian *et al.,* 2023). The Human Immunodeficiency Virus (HIV), which leads to Acquired Immunodeficiency Syndrome (AIDS), was first identified in the early 1980s, quickly becoming a global pandemic affecting millions of people across continents (Pandey and Galvani, 2019). By the end of 2021, over 36 million people were estimated to be living with HIV, while more than 39 million deaths have occurred since the emergence of the virus (Pandey and Galvani, 2019). The global burden of HIV/AIDS has been tracked through initiatives like the Global Burden of Disease Study (GBD), which provides temporal and regional insights into infection prevalence, mortality, and disability-adjusted life years (DALYs) (Tian *et al.,* 2023). Between 1990 and 2021, significant progress has been made in lowering AIDS-related deaths, primarily due to the introduction of antiretroviral therapy (ART) and improved testing coverage (Carter *et al.,* 2024).

2.1.1 Historical Background of HIV/AIDS

The origins of the human immunodeficiency virus (HIV) are traced to cross-species transmission events of simian immunodeficiency viruses from primates to humans in Central and West Africa during the early 20th century (Sharp and Hahn, 2011). Molecular studies suggest that HIV-1 likely emerged from chimpanzees, while HIV-2 originated from sooty mangabey monkeys (Etienne *et al.,* 2011). Although sporadic cases resembling acquired immunodeficiency syndrome (AIDS) were reported in Africa before the 1980s, the first recognized cases of AIDS were officially documented in the United States in 1981, mainly among young men presenting with rare opportunistic infections such as Pneumocystis jirovecii pneumonia (Kagaayi and Serwadda, 2016). The epidemic rapidly spread to other regions including Europe, the Caribbean, and later Asia, highlighting its global nature (Gilbert *et al.,* 2007).

By the late 20th century, HIV/AIDS had become a pandemic with devastating health, social, and economic consequences worldwide, particularly in sub-Saharan Africa, where prevalence and mortality reached their highest levels (Kagaayi and Serwadda, 2016). Advances in antiretroviral therapy (ART) since the mid-1990s significantly improved survival and quality of life for people living with HIV, transforming the disease from a fatal infection into a manageable chronic condition (Sharp and Hahn, 2011).

2.2 Intestinal Parasitic Infections (IPIs)

2.2.1 *Entamoeba histolytica*

Entamoeba histolytica is a protozoan parasite that infects humans and is the causative agent of amoebiasis, one of the leading parasitic diseases worldwide (Chalmers, 2014). It is transmitted primarily through the fecal-oral route via contaminated food and water, making it prevalent in areas with poor sanitation and hygiene (Ben Ayed and Sabbahi, 2017). The parasite's life cycle consists of two main forms: the infective cyst stage, which is environmentally resistant, and the trophozoite stage, which colonizes the intestinal lumen and can invade host tissues (El-Dib, 2017). Distinguishing *E. Histolytica* from morphologically similar but non-pathogenic species such as E. dispar and E. moshkovskii is essential for accurate diagnosis and treatment (Chalmers, 2014).

2.2.2 *Giardia lamblia*

Giardia lamblia is a flagellated protozoan parasite that infects the small intestine of humans and animals, causing giardiasis, one of the most common parasitic diarrheal diseases worldwide (Adam, 2021). The parasite is transmitted primarily through ingestion of infective cysts via contaminated water, food, or direct person-to-person contact, making it highly prevalent in areas with inadequate sanitation (Vivancos and González-Álvarez, 2018). The life cycle of G. lamblia includes two stages: the trophozoite, which colonizes the small intestine and causes pathology, and the cyst, which is environmentally resistant and responsible for transmission (Gardner and Hill, 2001). The trophozoites attach to the intestinal mucosa, leading to malabsorption, inflammation, and diarrhea, although some infections remain asymptomatic (Adam, 2021). Globally, giardiasis affects both developed and developing countries, with an especially high burden among children in resource-limited settings (Vivancos and González-Álvarez, 2018). Clinical manifestations range from acute watery diarrhea and abdominal cramps to chronic infections with weight loss and malnutrition (Hawrelak, 2003).

2.2.3 *Cryptosporidium spp.*

Cryptosporidium species are intracellular protozoan parasites that cause cryptosporidiosis, an important diarrheal disease in both humans and animals (Helmy and Hafez, 2022). Transmission occurs primarily through ingestion of infective oocysts via contaminated water, food, or direct contact with infected hosts (Putignani and Menichella, 2010). The parasite has a monoxenous life cycle, completing both asexual and sexual stages within a single host, usually within the epithelial cells of the small intestine (Gerace, Presti, and Biondo, 2019). Infective oocysts are excreted in feces and are immediately capable of transmission, contributing to rapid environmental spread and outbreaks (Cacciò and Putignani, 2013).

Clinically, cryptosporidiosis manifests as watery diarrhea, abdominal pain, nausea, and weight loss, with severity ranging from mild to life-threatening depending on the host's immune status (Putignani and Menichella, 2010). Immunocompromised individuals, particularly those with HIV/AIDS, are highly susceptible to severe, chronic, and sometimes fatal disease (Helmy and Hafez, 2022).

2.3 Taxonomy and Nomenclature of Intestinal Parasites

Entamoeba histolytica

Taxonomy:

Domain: Eukaryota

Kingdom: Protista

Phylum: Amoebozoa

Class: Archamoebae

Order: Amoebida

Family: Entamoebidae

Genus: Entamoeba

Species: *E. Histolytica*

Entamoeba histolytica is the causative agent of amoebiasis, a major protozoan parasitic infection of humans, characterized by intestinal and extra-intestinal manifestations such as dysentery and liver abscesses (Cox, 2015).

Giardia lamblia

Taxonomy:

Domain: Eukaryota

Kingdom: Protista

Phylum: Metamonada

Class: Diplomonadea

Order: Diplomonadida

Family: Hexamitidae

Genus: Giardia

Species: G. lamblia (syn. G. intestinalis, G. duodenalis)

Giardia lamblia is a flagellated protozoan responsible for giardiasis, a diarrheal illness transmitted through contaminated food and water. Its classification has undergone several revisions, and it is also known as G. intestinalis or G. duodenalis depending on context (Cox, 2015).

Cryptosporidium spp.

Taxonomy:

Domain: Eukaryota

Kingdom: Protista

Phylum: Apicomplexa

Class: Conoidasida

Order: Eucoccidiorida

Family: Cryptosporidiidae

Genus: Cryptosporidium

Species (Human relevance): C. hominis and C. Parvum

Cryptosporidium species are important protozoan pathogens of humans, with C. hominis and C. parvum being most frequently implicated in cryptosporidiosis. This disease is associated with watery diarrhea and can be severe in immunocompromised individuals (Cox, 2015).

2.4 Mode of Transmission of Intestinal Parasites

Entamoeba histolytic**a**

The primary mode of transmission of *Entamoeba histolytica* is the fecal–oral route, in which humans ingest infective cysts through contaminated food, water, or hands (Singh *et al.,* 2021). Foodborne exposure is especially important, as poor hand hygiene among food handlers and the use of human faeces as fertilizer can introduce cysts into the food chain (Lin *et al.,* 2022). Direct person-to-person transmission is also possible in settings of poor sanitation, particularly where cysts can be spread through close contact (El-Dib, 2017). Additionally, sexual transmission through oral–anal contact has been documented among men who have sex with men, highlighting behavioral risk factors (Zermeño *et al.,* 2013). After ingestion, cysts excyst in the intestine, releasing trophozoites that colonize the large bowel. While many infections remain asymptomatic, some progress to invasive intestinal or extraintestinal disease (El-Dib, 2017).

Giardia lamblia

The transmission of *Giardia lamblia* (also known as G. duodenalis or G. intestinalis) occurs mainly through the fecal–oral route, where humans ingest infective cysts from contaminated water, food, or hands (Baruch and Isaac-Renton, 1996). Waterborne transmission is especially significant, as Giardia cysts are resistant to conventional chlorination and survive for long periods in the environment, leading to outbreaks in both developed and developing countries (Thompson, 2004). Foodborne transmission also occurs when food is washed with contaminated water or handled by infected individuals without proper hygiene (Espelage *et al.,* 2010). Direct person-to-person transmission is common in childcare centers and among household contacts, reflecting the low infective dose of the parasite (Hasan *et al.,* 2020). Zoonotic transmission is another important pathway since Giardia infects a wide range of domestic and wild animals, and certain assemblages (genotypes A and B) are capable of infecting both humans and animals (Thompson, 2004).

Cryptosporidium spp.

The transmission of Cryptosporidium spp. occurs primarily through the fecal–oral route, involving ingestion of infective oocysts excreted in the feces of infected humans or animals (Fayer *et al.,* 2000). The oocysts are environmentally resistant, immediately infectious upon excretion, and capable of surviving for long periods in water, soil, and food (Gerace *et al.,* 2019). Waterborne transmission is the most significant pathway, with numerous outbreaks linked to contaminated drinking water and recreational water, as oocysts resist standard chlorination methods (Cacciò and Putignani, 2013). Foodborne transmission occurs when produce or food is contaminated by infected water or improper handling (Gerace *et al.,* 2019). Person-to-person transmission is common in childcare centers, households, and healthcare facilities due to the low infective dose of oocysts (Fayer *et al.,* 2000). Zoonotic transmission is also significant, as C. parvum infects both humans and a wide range of animals, particularly calves and livestock (McLauchlin, Amar, and Pedraza-Diaz, 2000). In immunocompromised individuals, especially those with HIV/AIDS, cryptosporidiosis can be chronic, severe, and life-threatening, underlining the importance of understanding transmission routes for control and prevention (Cacciò and Putignani, 2013).

2.5 Pathogenesis of Intestinal Parasites

Pathogenic mechanisms of intestinal protozoa and helminths are multifaceted, involving immune evasion, tissue invasion, cytotoxic effects, and metabolic competition with the host. Protozoan parasites such as *Entamoeba histolytica, Giardia lamblia,* and *Cryptosporidium parvum* are known to employ sophisticated strategies to evade the host immune system by modulating antigen presentation and disrupting signaling pathways within intestinal epithelial cells (Sardinha-Silva and Alves-Ferreira, 2022). This evasion impairs mucosal immunity and allows the parasites to establish persistent infections in immunocompromised hosts. Helminths such as *Schistosoma mansoni* and *Ascaris lumbricoides* secrete immunomodulatory molecules that suppress T-helper cell responses, skew cytokine profiles toward a Th2 phenotype, and inhibit antigen-presenting cells like dendritic cells, contributing to long-term survival within the host (Chulanetra and Chaicumpa, 2021). The modulation of host immune signaling is often accompanied by structural tissue damage. For instance, cytotoxic T-lymphocyte activity, although essential for eliminating intracellular parasites, can also lead to collateral damage of intestinal tissues, increasing susceptibility to secondary infections (Shukla *et al.,* 2024). These parasites also compete for host nutrients, particularly iron and vitamin B12, leading to malnutrition and anemia in infected individuals. The combination of mechanical damage caused by attachment structures, production of cytolytic enzymes, and metabolic by-products contributes to villous atrophy, inflammation, and loss of absorptive surface area in the gastrointestinal tract (Kapczuk *et al.,* 2020). In protozoal infections such as giardiasis, epithelial apoptosis and disruption of tight junction proteins exacerbate intestinal permeability and inflammatory infiltration.

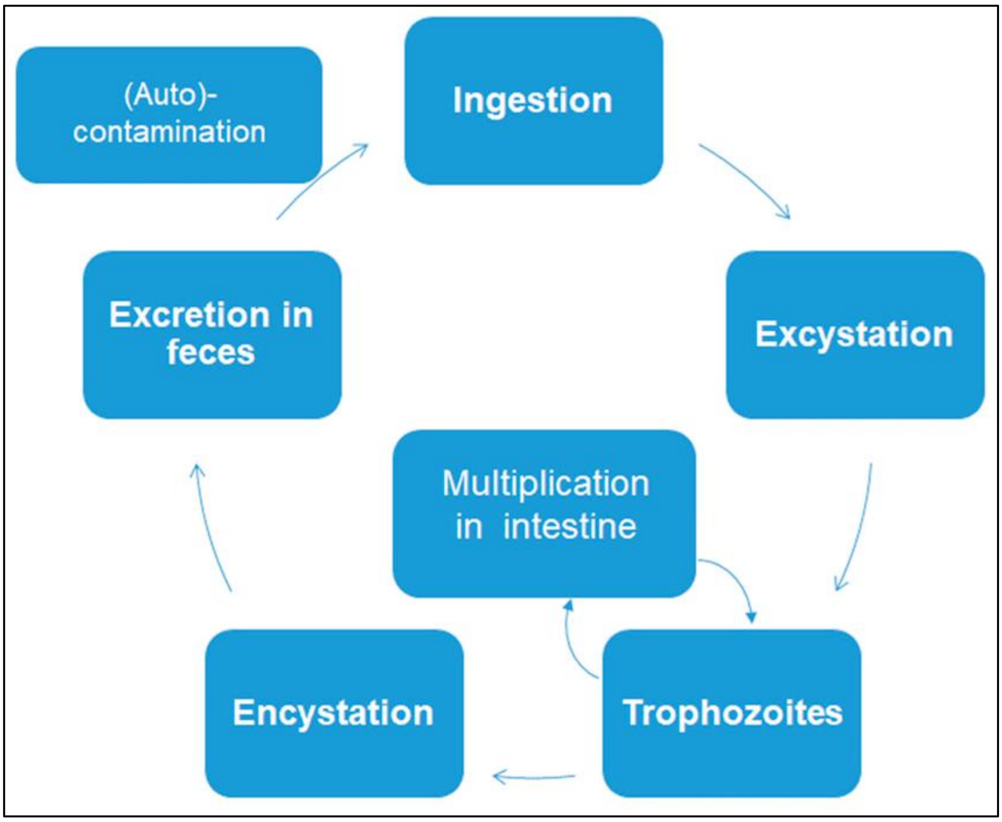

Figure 2.1 Comparative Pathobiology of the Intestinal Protozoan Parasite (Gilbert *et al.,* 2007)

2.6 Life Cycle of Intestinal Parasites

Entamoeba histolytica

Entamoeba histolytica alternates between two developmental stages: the infective cyst and the invasive trophozoite (Ali *et al.,* 2012).

Infective cyst stage – Humans acquire infection by ingesting mature quadrinucleate cysts through contaminated food, water, or hands (Luna-Nacar, Navarrete-Perea, and Moguel, 2016). Cysts are resistant to gastric acidity and environmental stress, enabling survival outside the host.

Encystation – In the small intestine, cysts undergo encystation, releasing trophozoites. Each cyst produces eight trophozoites after nuclear and cytoplasmic division .

Trophozoite stage – Trophozoites colonize the lumen and mucosa of the large intestine. They are responsible for tissue invasion, cytotoxicity, and clinical symptoms such as dysentery and liver abscesses.

Encystation – In the colon, trophozoites undergo encystation, transforming into immature cysts that mature into quadrinucleate forms before being excreted in feces.

Transmission – Cysts released in feces are immediately infective, perpetuating the fecal– oral cycle of transmission (Guillén, 2021).

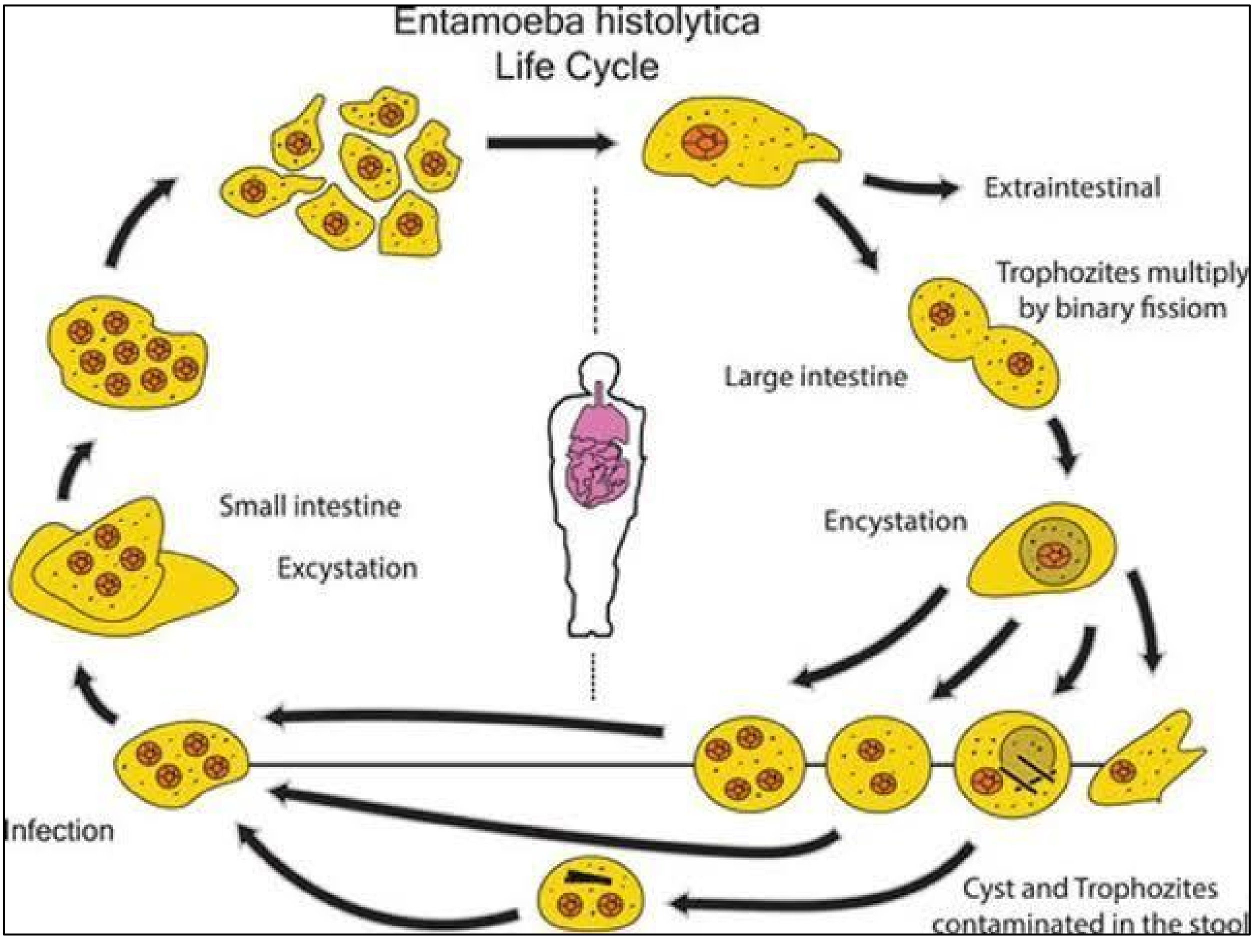

Figure 2.2 Life cycle of *Entamoeba histolytica* (Ali *et al.,* 2012).

Giardia lamblia

Giardia lamblia alternates between two main stages: the trophozoite and the cyst (Benchimol *et al.,* 2022).

Infective cyst stage – Humans acquire infection by ingesting mature cysts through contaminated water, food, or hands. Cysts are environmentally resistant and represent the key stage in transmission.

Encystation – Once ingested, cysts pass through the stomach and encyst in the upper small intestine, releasing two trophozoites per cyst. The encystation process is triggered by gastric acid and bile salts.

Trophozoite stage – Trophozoites attach to the intestinal mucosa via a ventral adhesive disc and replicate by binary fission. This stage is responsible for malabsorption and diarrheal disease in symptomatic cases.

Encystation – As trophozoites move toward the colon, they undergo encystation, forming environmentally resistant cysts. This transformation is triggered by bile deprivation and alkaline pH.

Excretion of cysts – Cysts are passed in feces and are immediately infective, perpetuating the fecal–oral transmission cycle (Benchimol *et al.,* 2022).

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Population

The study population comprised HIV-positive patients attending secondary health facilities in Benin City. A total of 150 HIV-positive individuals were recruited for the study. Informed consent was obtained from all participants following appropriate notification about the objectives of the research, potential risks, expected benefits, and assurances of confidentiality. Data collection was facilitated using a structured questionnaire.

3.2 Study Area

The area for this study was at secondary health facilities in Benin City, Edo State. Benin City is a city found in Edo State, It is located in the South - South region of Nigeria. It shares boundaries with Ondo State (west), Delta State (south), and Kogi State (north) (Edo State Government, 2024).

3.3 Study Design

This is a cross-sectional study. The instrument for the collection of data was a questionnaire. The questionnaire has two main sections, i.e., the demographic variables such as age, sex, and educational background, together with the anthropometric and basic health indices requested in the study area

3.3.1 Inclusion Criteria

Included in this study were;

Patients with HIV/AIDS within the age of 18 years and above, attending ART secondary health facilities in Benin City, Edo State.

Patients with HIV/AIDS who have been on ART therapy for at least 6 months or more.

Patients with HIV/AIDS who provide informed consent and meet specific health and enrollment criteria..

3.3.2 Participants were excluded from the study based on the following criteria:

Patients without HIV/AIDS

Patient with HIV/AIDS who did not provide informed consent.

Patients with HIV/AIDS who are less than 18 years of age

Patient with HIV/AIDS who has an acute infection or is sick at the time of sample collection

3.4 Sample Size

The sample size for the study was based on three factors, which are:

1. The estimated prevalence of the variable of interest from the literature review

2. Confidence level of 90%

3. The acceptable margin of error

The sample size was calculated according to the following formula;

$$n = Z^2 \times \frac{P(1-p)}{d^2}$$

Where,

n= minimum sample size

P= prevalence rate(0.214 or 21.35%) (Oyakhire *et al.,* 2023)

d= margin of error(5% or 0.05)

Z= confidence level(1.96)

Minimum sample size,

$$n = 1.962^2 \times \frac{0.214(1 - 0.214)}{0.05^2}$$

n= 132

To improve the reliability of the findings and to account for possible non-response, the sample size was adjusted upward to 150 participants, which was considered adequate

for the study.

3.5 Ethical approval

Ethical approval was obtained from the Edo State Ministry of Health, Benin City, Edo State, Nigeria with Ref No: HA/737/25/D/07230743 (Appendix I.)

3.5.1 Informed Consent

Informed consent was obtained from all participants prior to enrolment in the study, ensuring voluntary participation and protection of participants' rights and privacy. (Appendix II.)

3.5.2 Structured Questionnaire

Participants filled out a well-constructed questionnaire that addressed the socio-demographics and history of participant investigations. (Appendix III.)

3.5.3 Sample Collection

Fresh stool samples were collected from participating patients for parasitological examination. Each participant was provided with a clean, dry, wide-mouthed, screw-capped plastic container, clearly labeled with a unique identification code. Participants were instructed on proper stool collection procedures to avoid contamination with urine, soil, or water. Samples were collected in the morning and transported within 2–3 hours of collection to the Parasitology Laboratory, Department of Medical Laboratory Science, University of Benin Teaching Hospital in a cold box maintained at approximately 4°C to preserve parasite viability. Only a single fresh stool sample was collected per participant.

3.6 Laboratory Analysis

3.6.1 Saline Wet Mount

The direct saline wet mount technique was employed for the rapid detection of motile trophozoites, helminth larvae, and cysts in freshly collected stool samples. Clean glass slides and coverslips were prepared, and normal saline solution (0.85% NaCl) was dispensed in dropper bottles. Fresh stool specimens were examined within 2–3 hours of collection to preserve the motility of protozoan trophozoites. Using a sterile applicator stick, approximately 2 mg of stool (equivalent to the size of a matchstick head) was placed at the center of a clean glass slide. A drop of physiological saline was added, and the stool was thoroughly emulsified to form a thin suspension. A coverslip was then gently placed over the preparation, ensuring that air bubbles were avoided to prevent interference with microscopic visualization. The slide was immediately examined under a light microscope, first with the ×10 objective lens to scan the preparation, followed by the ×40 objective for more detailed observation. The saline mount facilitated the visualization of motile protozoan trophozoites, helminth eggs, larvae, and protozoan cysts. Identification was based on morphological characteristics such as size, shape, motility, internal structures, and the presence of nuclei, with motility serving as a key diagnostic feature for distinguishing viable trophozoites. Each preparation was examined by an experienced microscopist, and to minimize observer error, 10% of the slides were randomly re-examined by a second independent observer, with results compared for consistency.

3.6.2 Iodine Wet Mount

The iodine wet mount technique was employed to enhance the visualization of internal structures of protozoan cysts and helminth eggs in stool samples, serving as a complement to the saline wet mount by providing clearer morphological detail, particularly of nuclear structures. Clean glass slides and coverslips were prepared, and Lugol's iodine solution diluted at a ratio of 1:5 with distilled water was made available in dropper bottles to prevent overstaining. Fresh stool specimens were processed within 2–3 hours of collection. Using a sterile applicator stick, approximately 2 mg of stool (equivalent to the tip of a matchstick head) was placed at the center of a clean glass slide, after which a drop of diluted Lugol's iodine was added, and the sample was thoroughly emulsified to form a suspension. A coverslip was carefully placed over the preparation to ensure even distribution and minimize air bubble formation. The slides were examined under a light microscope, first at the ×10 objective lens for general scanning and then at the ×40 objective for detailed visualization. Unlike the saline mount, the iodine mount facilitated the clearer identification of protozoan cysts, as iodine staining made nuclear structures, glycogen vacuoles, and cytoplasmic inclusions more visible. Helminth eggs were also better visualized, with the staining highlighting features such as cyst wall thickness, the number of nuclei, vacuoles, and eggshell morphology. Each preparation was examined by a trained scientist, and to ensure accuracy, 10% of the slides were randomly re-examined by a second reader, with discrepancies resolved through joint review.

3.6.3 Formol-Ether Concentration Technique

The formol-ether concentration technique was employed to enhance the detection of intestinal parasites in stool samples by concentrating cysts, eggs, and larvae, making it particularly valuable for identifying parasites present in low numbers that might not have been observed on direct wet mount preparations. Approximately 1 g of stool sample was first emulsified in 7 mL of 10% formal saline using a glass rod to obtain a smooth suspension. The suspension was then filtered through fine wire mesh or double-layered gauze into a clean 15 mL centrifuge tube to remove coarse debris and undigested fibers. To the filtrate, an additional 3 mL of 10% formol saline was added to preserve the parasites and stabilize the suspension, after which 3 mL of diethyl ether was introduced into the tube. The mixture was securely stoppered and shaken vigorously for about 30 seconds to ensure complete mixing, followed by centrifugation at 3,000 rpm for 1 minute. This process produced four distinct layers: a top ether layer, a second layer of fecal debris, a third layer of formol saline, and a bottom sediment containing concentrated parasites. The top three layers were carefully decanted, leaving the sediment at the base of the tube. A drop of the sediment was then transferred to a clean glass slide, covered with a coverslip, and examined microscopically using the ×10 and ×40 objectives. Identification of parasites was based on morphological characteristics, including the shape and nuclear detail of protozoan cysts, as well as the size, shell thickness, and structural features of helminth eggs and larvae..

3.7 Statistical Analysis

Data obtained from the study were entered, cleaned, and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.0. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize sociodemographic variables and prevalence rates of intestinal parasite infection.

CHAPTER FOUR

RESULTS

The study investigated the prevalence and distribution of intestinal parasitic infections among HIV/AIDS patients attending secondary health facilities in Benin City, Edo State. Benin City.

Table 4.1 Socio-Demographic Characteristics of Study Participants

The socio-demographic characteristics of the participants are presented in Table 4.1. Out of 150 respondents, females were more represented (58.7%) compared to males (41.3%). The participants' ages ranged from 18 to 65 years, with a mean age of 39.91 ± 10.81 years. The largest proportion of respondents (24%) fell within the age group of 36–41 years, followed by those aged 48–53 years (16.7%). Regarding marital status, most participants were married (54.4%), while 33.6% were single, and smaller proportions were divorced (3.4%) and widowed (8.7%). In terms of education, secondary education accounted for the majority (43.9%), followed by primary education (33.8%), while 6.8% had no formal education and 15.5% attained tertiary education. With respect to occupation, trading/business was the most common (33.3%), followed by skilled artisans (16.7%) and professional/clerical workers (15.3%). Most participants resided in urban areas (98.7%), with only 1.3% residing in rural areas.

Table 4.2 Intestinal Parasites Isolated Among HIV Patients attending Various Medical Centre in Benin City.

Out of 150 stool samples examined, 43 (28.7%) were positive for one or more intestinal parasites. The most prevalent parasite identified was *E. Coli* (14.0%), followed by *E. Histolytica* (6.7%), *Ascaris lumbricoides* (5.3%), and *Trichuris trichiura* (2.7%). These findings suggest that *E. Coli* is the most common parasitic organism among the studied population. While, *Trichuris trichiura* was the least prevalent

Table 4.1 Socio-Demographic Characteristics of Study Participants

Variable	Category	Frequency (n=150)	Percentage (%)
Sex	Male	62	41.3
	Female	88	58.7
Age Group (years)	18–23	9	6
	24–29	22	14.7
	30–35	21	14
	36–41	36	24
	42–47	19	12.7
	48–53	25	16.7
	54–59	12	8
	60–65	6	4
Mean Age ± SD	39.91 ± 10.81		
Marital Status	Married	81	54.4
	Single	50	33.6
	Divorced	5	3.4
	Widow	13	8.7
Education Level	No formal education	10	6.8
	Primary	50	33.8
	Secondary	65	43.9
	Tertiary	23	15.5

Occupation	Trading/Business	50	33.3
	Skilled Artisan	25	16.7
	Transport	14	9.3
	Services	24	16
	Professional/Clerical	23	15.3
	Agriculture/Fishing	4	2.7
	Other (Specify)	10	6.7
Residence	Urban	148	98.7
	Rural	2	1.3

Table 4.2 Intestinal Parasites Isolated Among HIV Patients attending Various Medical Centres in Benin City.

Parasite Species	Number of Positive Cases (N=150)	Percentage (%)
E. Coli	21	14
E. Histolytica	10	6.7
Ascaris lumbricoides	8	5.3
Trichuris trichiura	4	2.7
Total	43	28.7

Table 4.3 Prevalence of Intestinal Parasites among HIV Patients Attending ARV Clinic at Various Medical Centre in Benin City

The prevalence of intestinal parasites among participants is shown in Table 4.3. Out of 150 individuals examined, 43 (28.7%) tested positive for intestinal parasites, while 107 (71.3%) were negative.

Table 4.4 Gender Distribution of Intestinal Parasites Among HIV Patients Attending ARV Clinic at Various Medical Centre in Benin City

Table 4.4 shows the relationship between intestinal parasite prevalence and gender. Among the infected participants, 18 (41.9%) were male and 25 (58.1%) were female. The odds ratio of 0.97 (95% CI: 0.47–1.99) with $p = 0.934$ indicates no significant association between gender and intestinal parasitic infection.

Table 4.5 Age Distribution of Intestinal Parasite Infection among HIV Patients

The association between intestinal parasite infection and age groups is presented in Table 4.5. The highest prevalence occurred among those aged 48–53 years (18.6%), followed by those aged 24–29 years, 36–41 years, and 42–47 years (all 16.3%). Lower prevalence was observed among the youngest age group (18–23 years, 9.3%) and the oldest (60–65 years, 2.3%). None of the age categories showed a statistically significant association with infection ($p = 0.751$).

Table 4.3 Prevalence of Intestinal Parasites among Study Participants

Variable	Frequency (n=150)	Percentage (%)
Intestinal Parasites Positive	43	28.7
Intestinal Parasites Absent	107	71.3
Total	150	100

Table 4.4 Gender Distribution of Intestinal Parasites Among HIV Patients

Sex	Number Examined	Intestinal Parasites Positive n=43 (%)	Odds Ratio	(95% CI)	p-value
Male	62	18 (41.9)	0.97	0.47–1.99	0.934
Female	88	25 (58.1)			
Total	150	43(100)			

Table 4.5 Age Distribution of Intestinal Parasite Infection among HIV Patients

Age Group (years)	Number Examined	Frequency (n)	Percentage (%)	Odds Ratio	(95% CI)	p-value
18–23	9	4	9.3	0.58	0.13-2.50	0.751
24–29	22	7	16.3			
30–35	21	5	11.6			
36–41	36	7	16.3			
42–47	19	7	16.3			
48–53	25	8	18.6			
54–59	12	4	9.3			
60–65	6	1	2.3			
Total	150	43	100			

Table 4.6 Distribution of Intestinal Parasite Infection Among HIV Patients Based on Marital Status

As shown in Table 4.6, marital status and intestinal parasite infection were compared. Married participants accounted for 53.5% of infections, singles 32.6%, widows 11.6%, and divorced individuals 2.3%. There was no significant association between marital status and infection ($p = 0.849$).

Table 4.7 Distribution of Intestinal Parasites Among HIV Patients Based on Educational Status.

The relationship between education level and intestinal parasite infection is summarized in Table 4.7. Participants with secondary education had the highest prevalence (55.8%), followed by primary education (25.6%), tertiary education (14%), and no formal education (4.7%). The odds ratios showed no significant association ($p = 0.301$).

Table 4.6 Distribution of Intestinal Parasite Infection Among HIV Patients Based on Marital Status

Marital Status	Number Examined	Frequency (n)	Percentage (%)	Odds Ratio	(95% CI)	p-value
Married	81	23	53.5	0-98	0.45 -2.15	0.849
Single	50	14	32.6			
Divorced	5	1	2.3			
Widow	13	5	11.6			
Total	150	43	100			

Table 4.7 Distribution Of Intestinal Parasites Among HIV Patients Based on Educational Status.

Education Level	Number examined	Positive (n)	Percentage (%)	Odds Ratio	(95% CI)	p-va
No formal education	10	2	4.7	1.13	0.21-6.03	0.3
Primary	50	11	25.6			
Secondary	**65**	24	55.8			
Tertiary	25	6	14			
Total	**150**	**43**	**100**			

Table 4.8 Distribution of Intestinal Parasites Among HIV Patients Based on Occupation.

In Table 4.8, occupation was examined against intestinal parasite prevalence. The highest proportion was observed among traders/business participants (39.5%), followed by skilled artisans and professional/clerical workers (16.3% each). Lower proportions were recorded among those in services (11.6%), agriculture/fishing (4.7%), and transport workers (4.7%). No significant association was observed (p = 0.708).

Table 4.9 Prevalence of Intestinal Parasites by Residence (Urban/Rural) and Association

Table 4.9 presents parasite prevalence by residence. Out of the infected participants, 95.3% resided in urban areas, while 4.7% resided in rural areas. The odds ratio (13.05; 95% CI: 1.15– 147.89) with p = 0.025 indicates a statistically significant association between residence and intestinal parasitic infection.

Table 4.8 Distribution of Intestinal Parasites Among HIV Patients Based on Occupation.

Occupation	Number examined	Frequency (n)	Percentage (%)	Odds Ratio	(95% CI)	p-value
Trading/Business	50	17	39.5	0.76	0.28-2.09	0.708
Skilled Artisan	25	7	16.3			
Transport	14	2	4.7			
Services	24	5	11.6			
Professional/Clerical	23	7	16.3			
Agriculture/Fishing	4	2	4.7			
Other (Specify)	10	3	7			
Total	**150**	**43**	**100**			

Table 4.9 Prevalence of Intestinal Parasites by Residence (Urban/Rural) and Association

Residence	Number Examined	Frequency (n)	Percentage (%)	Odds Ratio	(95% CI)	p-value
Urban	148	41	95.3	13.05	1.15-47.89	0.025
Rural	2	2	4.7			
Total	150	43				

Table 4.10 Prevalence of Intestinal Parasites by Duration of Diagnosis and Medication

Duration of HIV diagnosis and medication are compared with parasitic infection in Table 4.10. Prevalence was highest among participants diagnosed within one year (20.9%), followed by less than 5 years (23.3%) and more than 5 years (18.6%). Duration of diagnosis showed a significant association (p = 0.013), with those diagnosed for less than a year being more likely to be infected (OR = 2.92). Medication status showed no significant difference, with 90.7% of positives on medication and 4.7% not on medication (p = 0.774).

Table 4.11 Prevalence of Intestinal Parasitic Infections in relation to Clinical Symptoms

The association between intestinal parasites and symptoms is presented in Table 4.11. Abdominal pain was the most common symptom (14%), followed by multiple mixed symptoms (14%), persistent diarrhea (9.3%), and loss of appetite (9.3%). Other symptoms included nausea and vomiting (4.7%), abdominal pain with weight loss (2.3%), and abdominal pain with appetite loss (2.3%). Statistically significant associations were observed for abdominal pain with weight loss (OR = 4.00), persistent diarrhea (OR = 4.50), and especially abdominal pain with loss of appetite and weight loss (OR = 7.15; p = 0.026).

Table 4.12 Risk Factors Associated with Intestinal Parasitic Infection Among HIV Patient Attending Various Medical Centres in Benin City

Table 4.12 presents the association between selected variables and intestinal parasite infection. No significant associations were observed with sex, age group, marital status, source of drinking water, hand washing after using the toilet, or washing of fruits and vegetables.. However, hand washing before eating showed a significant association (p = 0.031), where those who sometimes washed their hands had a higher likelihood of infection (OR = 2.23) compared to those who always washed before eating.

Table 4.10 Prevalence of Intestinal Parasites by Duration of Diagnosis and Medication

Variable	Category	Number Examined	Frequency (n)	Percentage (%)	Odds Ratio	(95% CI)	p-value
Duration of Diagnosis	< 1 year	48	19	44.2	2.92	1.01-8.40	0.013
	< 5 years	56	10	23.3			
	> 5 years	46	14	32.6			
Total		150	43	100			
Medication	No	**40**	4	9.2	**1.18**	0.22–6.43	0.774
	Yes	**110**	39	90.7			
Total		**150**	43	100			

Table 4.11 Prevalence of Intestinal Parasitic Infections in relation to Clinical Symptoms

Symptoms	Number examined	Positive (n)	Percentage (%)	Odds Ratio	95% CI)	p-value
Abdominal pain	20	06	13.9	2.50	0.21–29.1	0.026
Abdominal pain, loss of appetite	20	06	13.9			
Abdominal pain, loss of appetite & weight loss	10	04	9.3			
Abdominal pain , weight loss	20	06	13.9			
Loss of appetite	10	04	9.3			
Nausea and vomiting	20	04	9.3			
Weight loss	20	03	6.9			
Persistent diarrhea	20	04	9.3			
Multiple symptoms (mixed combinations)	10	06	13.9			
Total	**150**	**43**	**100**			

Table 4.12 Risk Factors Associated with Intestinal Parasitic Infection Among HIV Patient Attending Various Medical Centres in Benin City

Variable	Category	Positive n=43 (%)	Negative n=107	Odds Ratio	(95% CI)	p-value
Sex	Male	18 (41.9)	44	0.97	0.47-1.99	0.934
	Female	25 (58.1)	63			
Age Group (years)	18–23	4 (9.3)	5	0.58	**0.13-2.60**	0.751
	24–29	7 (16.3)	15			
	30–35	5 (11.6)	16			
	36–41	7 (16.3)	29			
	42–47	7 (16.3)	12			
	48–53	8 (18.6)	17			
	54–59	4 (9.3)	8			
	60–65	1 (2.3)	5			
Marital Status	Married	23 (53.5)	58	0.98	0.45-2.15	0.849
	Single	14 (32.6)	36			
	Divorced	1 (2.3)	4			
	Widow	5 (11.6)	8			
Source of Drinking Water	Sachet	32 (74.4)	88	0.92	0.09-9.75	0.494
	Borehole	1 (2.3)	3			
	Tap	1 (2.3)	0			
	Borehole + Sachet	4 (9.3)	10			
	Tap + Sachet	4 (9.3)	6			
Handwashing before eating	Sometimes	19 (44.2)	28	2.23	1.06-4.70	0.031
	Always	24 (55.8)	79			
Hand washing after toilet	Sometimes	13 (30.2)	28			0.614
	Always	30 (69.8)	79			
Washing fruits and vegetables	Yes	18 (41.9)	54			0.578
	Sometimes	14 (32.6)	27			
	Always	11 (25.6)	26			

CHAPTER FIVE

DISCUSSION AND CONCLUSION

5.1 DISCUSSION

This study investigated the prevalence and distribution of intestinal parasitic infections among HIV/AIDS patients attending secondary health facilities in Benin City, Edo State. The overall prevalence of intestinal parasites was 28.7%. While this indicates that nearly one-third of HIV/AIDS patients harbored intestinal parasites, the prevalence was lower compared to similar studies in sub-Saharan Africa and parts of Nigeria. The prevalence of 28.7% observed in this study is lower than the 42% reported in Calabar, Nigeria (Okodua *et al.,* 2003) and the 46.5% in Kenya (Kipyegen *et al.,* 2012), as well as the 59.3% documented in Ethiopia (Alemu *et al.,* 2011). The relatively lower prevalence in Benin City may be attributed to environmental and infrastructural differences. Conversely, in this study, 98.7% of participants resided in urban areas, where improved sanitation, widespread use of sachet water, and better access to healthcare reduced exposure risk. This difference emphasizes the influence of geographical and infrastructural contexts on parasitic epidemiology.

Among infected participants, 58.1% were female and 41.9% male. However, the association between gender and infection was not statistically significant (OR = 0.97, 95% CI: 0.47–1.99, $p = 0.934$). This suggests that both males and females had a comparable risk of acquiring intestinal parasites in Benin City. Similar non-significant associations have been reported in studies from Ethiopia and Tanzania (Alemu *et al.,* 2011; Mosha *et al.,* 2014). The lack of a gender difference may be explained by the fact that both sexes share similar environmental exposures and behaviors in urban settings.

The highest prevalence was observed in the 48–53 years age group (18.6%), followed by 24–29, 36–41, and 42–47 years (all 16.3%). The lowest was in the 60–65 years group (2.3%).

Nevertheless, no significant association was found between age and infection (p = 0.751). This finding is consistent with reports from Jos, Nigeria, where no clear age trend was observed (Uneke *et al.,* 2006). The distribution suggests that while infection occurs across all ages, immunological status rather than age may be a stronger determinant of risk in HIV/AIDS patients. Married individuals accounted for 53.5% of infections, singles 32.6%, widows 11.6%, and divorced participants 2.3%. The relationship was not statistically significant (p = 0.849). Similarly, education level was not a significant predictor (p = 0.301), though participants with secondary education had the highest infection rate (55.8%). This contrasts with findings in rural Ethiopia where low education strongly predicted parasitism (Teklemariam *et al.,* 2013). In Benin City, the absence of an education effect may be due to urban residency, where access to treated water and sanitation cuts across educational strata.

Occupation did not significantly predict infection (p = 0.708), although traders/business participants accounted for 39.5% of infections. This may be due to higher daily interactions with contaminated environments such as markets. Interestingly, residence showed a statistically significant association (p = 0.025). While 95.3% of infections were in urban dwellers, the odds ratio indicated that rural residents had markedly higher odds of infection (OR = 13.05, 95% CI: 1.15–147.89). This reflects the well-established rural–urban disparity in parasite prevalence, with rural communities experiencing greater exposure due to poor sanitation, open defecation, and limited access to safe water(Brooker *et al.,* 2006). The apparent paradox of high urban prevalence in this study is explained by the overwhelming number of participants residing in urban areas (148/150). Duration of HIV diagnosis showed a significant association with parasitic infection (p = 0.013). Participants diagnosed for one year had the highest prevalence (20.9%) and were nearly three times more likely to be infected compared to those diagnosed less than five years earlier (OR = 2.93). This may be due to infection compared to those diagnosed less than five years earlier (OR = 2.92). This may reflect delayed initiation of antiretroviral therapy (ART) or weakened immunity in newly diagnosed individuals before immune recovery. Medication status, however, showed no significant association (p = 0.774), as 90.7% of infected participants were on ART. Similar findings have been reported in Tanzania, where ART did not eliminate parasitism but reduced symptom severity (Mosha *et al.,* 2014).

Statistically significant associations were found between infection and certain gastrointestinal symptoms (p = 0.026). Patients presenting with persistent diarrhea had an odds ratio of 4.50, those with abdominal pain and weight loss had an OR of 4.00, and those with abdominal pain plus appetite and weight loss had the highest odds (OR = 7.15). These findings align with the known clinical burden of intestinal parasites, which exacerbate gastrointestinal morbidity in HIV patients through chronic diarrhea, malabsorption, and wasting (Hunter and Nichols, 2002). Handwashing before eating showed a significant relationship (p = 0.031). Participants who washed their hands only "sometimes" were more than twice as likely to be infected (OR = 2.23) compared to those who always practiced handwashing. This finding highlights personal hygiene as a key determinant of infection risk, echoing earlier research from Kenya and Ethiopia where inconsistent handwashing was a major predictor of intestinal parasitism (Kipyegen *et al.,* 2012; Alemu *et al.,* 2011). Other variables such as handwashing after toilet use and washing fruits/vegetables were not significant, suggesting that food and water quality in Benin City may be less important drivers of infection compared to personal hygiene.

5.2 CONCLUSION

This study revealed a prevalence of 28.7% intestinal parasitic infection among HIV/AIDS patients in Benin City. The lower prevalence may be linked to the predominantly urban setting, better access to safe water, and improved sanitation practices. However, significant associations were observed with the duration of HIV diagnosis, handwashing before eating, and gastrointestinal symptoms such as persistent diarrhea and abdominal pain with weight loss. These findings underscore that, despite urbanization, intestinal parasites remain a public health concern among immunocompromised populations.

5.3 RECOMMENDATIONS

Based on the findings, the following recommendations are made: Routine Screening and Early Treatment: All newly diagnosed HIV patients should undergo stool examinations for intestinal parasites at baseline and periodically thereafter. Early detection and treatment can reduce morbidity and improve quality of life. Health Education and Hygiene Promotion: Intensive education on proper hand hygiene, safe food handling, and consistent washing of fruits and vegetables should be integrated into HIV clinic programs. Patients should be counseled on the risks of inconsistent handwashing before eating.

i. Improved Water Quality Monitoring: Regular testing of sachet and tap water for microbial contamination should be enforced by public health authorities. Patients should be encouraged to use treated or boiled water for drinking and food preparation.
ii. Urban Sanitation Measures: Urban communities should strengthen waste management, improve sewage disposal systems, and control overcrowding to reduce environmental contamination.
iii. Integration with HIV Care Services: Parasitic infection control strategies should be incorporated into routine HIV care, including prophylactic deworming and counseling at ART clinics.
iv. Further Research: Larger, multi-center studies should be conducted to identify specific parasite species and evaluate the impact of antiretroviral therapy on

infection rates. Longitudinal studies are needed to assess seasonal variations and treatment outcomes.

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EDO STATE MINISTRY OF HEALTH
HEALTH RESEARCH ETHICS COMMITTEE

PROTOCOL NUMBER	**HA/737/25/D/06240743 (PLEASE QUOTE IN ALL ENQUIRIES)**
APPROVAL NUMBER	**HA/737/25/D/07230743**
TITLE OF RESEARCH PROPOSAL	**PREVALENCE OF INTESTINAL PARASITES AMONG HIV AND AIDS PATIENTS ATTENDING ANTIRETROVIRAL THERAPY CLINIC IN VARIOUS MEDICAL CENTERS IN BENIN CITY, EDO STATE**
PRINCIPAL INVESTIGATOR (S)	**DOERE GRACE EDDUAM**
DATE CONSIDERED	**23RD JULY, 2025.**
DECISION OF THE COMMITTEE	**APPROVED**

THIS APPROVAL DATES 23/07/2025 TO 23/07/2026. IF THERE IS A DELAY IN STARTING THE RESEARCH, PLEASE INFORM THE HREC EDO SMoH SO THAT THE DATES OF APPROVAL CAN BE ADJUSTED ACCORDINGLY

REMARK: Please kindly note that the HREC Edo SMoH seal authenticates this approval

DR (MRS.) OMONYEMEN B. BELLO
(MBBS, MPH, FPHCM) *(CHAIRMAN)* **SIGNATURE & DATE**............ 01/08/2025

SUPERVISOR(S) ....

....

ATTESTATION BY INVESTIGATOR(S)

No participant accrual or activity related to this research may be conducted outside of the approval dates. All informed consent forms used in this study must carry the Edo SMoH HREC-assigned number and duration of your research. No changes are permitted in the research without prior approval of the Edo SMoH HREC except in circumstances outlined in the Code. The Edo SMoH HREC reserves the right to conduct compliance visits to your research site without previous notification.

EDO STATE MINISTRY OF HEALTH RESEARCH & ETHICS COMMITTEE SECRETARIAT DATE 23/07/2025 SIGN

Signature & Date...............................

APPENDIX II

INFORMED CONSENT FORM

Principal Investigator: Doere, Grace
Edduam Institution: University Of Benin

Department: Medical Laboratory Science

Phone/Email:
graceedduam65@gmail.com

Title of Study: Prevalence of Intestinal Parasites Among HIV/AIDS Patients Attending Antiretroviral Therapy (ART) Clinics at Various Medical Centres in Benin City, Edo State

Introduction

You are being invited to participate in a research study. Before you decide, it is important you understand why the research is being conducted and what it involves. Please take time to read the following information carefully.

Purpose of the Study

The purpose of this study is to determine the prevalence of intestinal parasitic infections among HIV/AIDS patients attending ART clinics in selected medical centres in Benin City. This research aims to improve understanding of co-infections and contribute to better management and care strategies.

Procedures Involved

If you agree to participate, you will:

1. Provide a stool sample for laboratory analysis.
2. Respond to a brief questionnaire concerning your health, hygiene, and other relevant risk factors.
3. Your participation will involve only one visit, lasting approximately 20–30 minutes.

Risks and Discomforts

The risks involved are minimal. The collection of stool samples poses no harm. Some personal questions may make you feel uncomfortable, but you are free to skip any you do not wish to answer.

Benefits

While you may not benefit directly, your participation will contribute to public health knowledge and may help improve treatment for other patients with similar conditions. You will also be informed of any parasitic infection detected and advised on appropriate care.

Confidentiality

All information obtained in this study will be kept strictly confidential. Your identity will not be revealed in any publication or report resulting from this study. Each participant will be assigned a code number instead of using names.

Voluntary Participation

Participation is completely voluntary. You are free to withdraw at any time without any effect on your treatment or care at this facility.

Consent Statement

I have read (or had read to me) the information above. I understand the purpose of the study, the procedures involved, and my rights as a participant. All my questions have been answered to my satisfaction. I willingly agree to take part in the study.

Participant’s Name: ____

Signature/Thumbprint:_______________________

Date: _____________________

Witness Name (if participant is illiterate): ___________________

Witness Signature: __________________

Researcher's Name: ________________

Researcher's Signature: _________________

Date: ______________________

APPENDIX III

QUESTIONNAIRE

SECTION A: Socio-Demographic Information

Age: years

Sex: ☐ Male ☐

Female

Marital Status: ☐ Single ☐ Married ☐ Divorced ☐ Widowed

Educational Level:

☐No formal education ☐ Primary ☐ Secondary ☐

Tertiary Occupation:

Religion: ☐ Christianity ☐ Islam ☐ Traditional ☐ Others:

Residential Area:

Type of Toilet Facility Used: ☐ Water closet ☐ Pit latrine ☐ Bush/open defecation

Source of Drinking Water: ☐ Tap ☐ Borehole ☐ Well ☐ River/Stream ☐ Sachet/Bottled water

SECTION B: MEDICAL HISTORY

How long have you been diagnosed with HIV/AIDS? ☐ Less than 1 year ☐ 1–5 years ☐ More than 5 years

Are you currently on ART (Antiretroviral Therapy)?

☐ Yes ☐ No

Have you experienced any of the following recently?

☐Persistent diarrhea

☐Abdominal pain

☐Nausea/Vomiting

☐Loss of appetite

☐Weight loss

☐None of the above

Have you ever been diagnosed with intestinal parasites before? ☐ Yes ☐ No

Have you received treatment for intestinal parasites in the past 12 months? ☐ Yes ☐ No

SECTION C: HYGIENE AND SANITATION PRACTICES

Do you wash your hands before eating? ☐ Always ☐ Sometimes ☐ Rarely ☐ Never

Do you wash your hands after using the toilet? ☐ Always ☐ Sometimes ☐ Rarely ☐ Never Do you eat raw or unwashed fruits/vegetables?

☐ Frequently ☐ Occasionally ☐ Never

Do you walk barefooted regularly? ☐ Yes ☐ No

Do you regularly deworm yourself?

☐ Yes – every 6 months ☐ Yes – once a year ☐ No

Do you have contact with animals or livestock? ☐ Yes ☐ No

SECTION D: LABORATORY SAMPLE AGREEMENT

Are you willing to provide a stool sample for laboratory examination? ☐ Yes ☐

No Thank you for your participation.

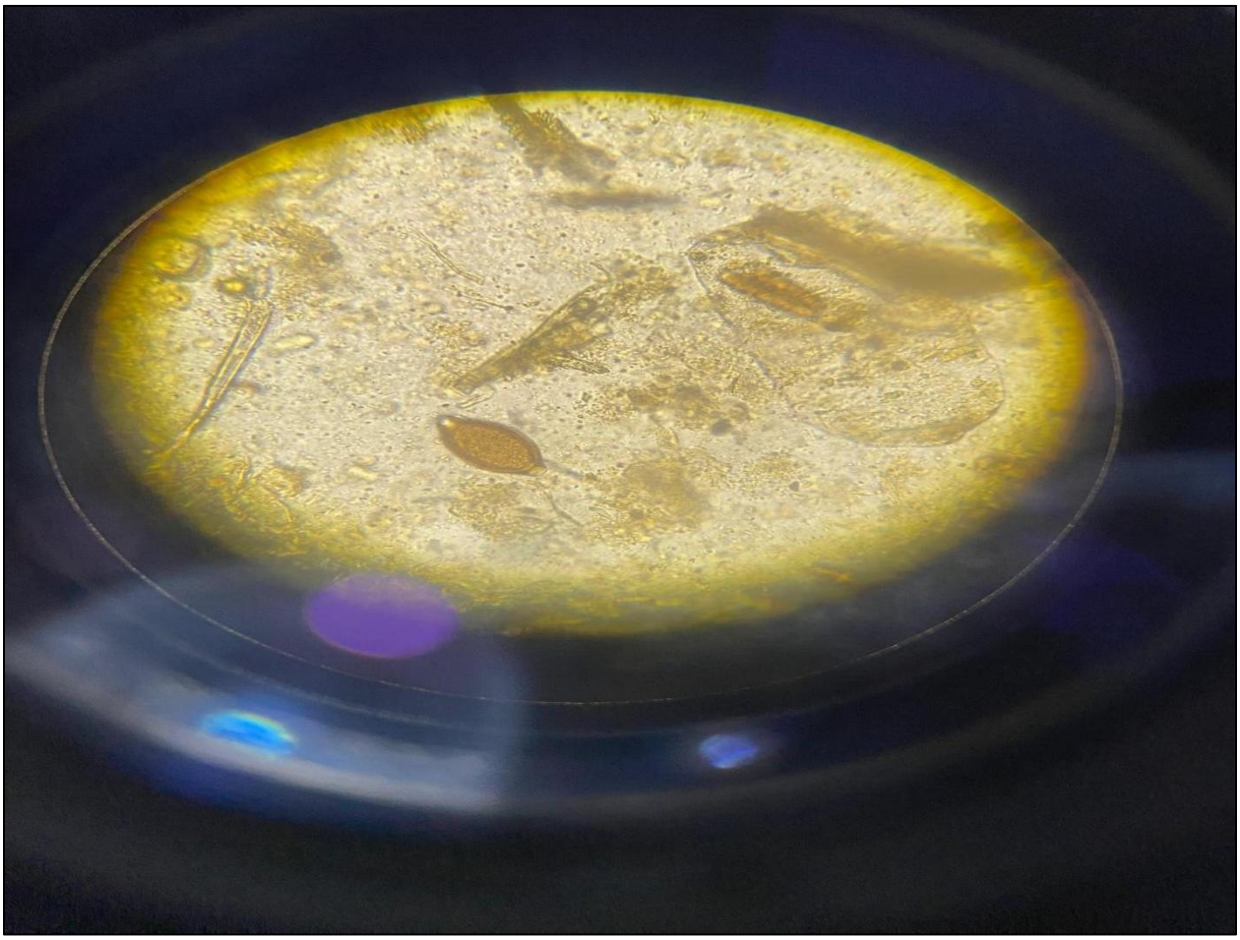
APPENDIX IV


Scoring of Malaria Parasite (White, 2003):
1 – 10 parasite per 100 field 1+
11 – 100 parasite per 100 field 2+
1 – 10 parasite per field 3+
≥10 parasite per field 4+
OLYMPUS
CX23

APPENDIX V

PARASITOLOGICAL RESULT

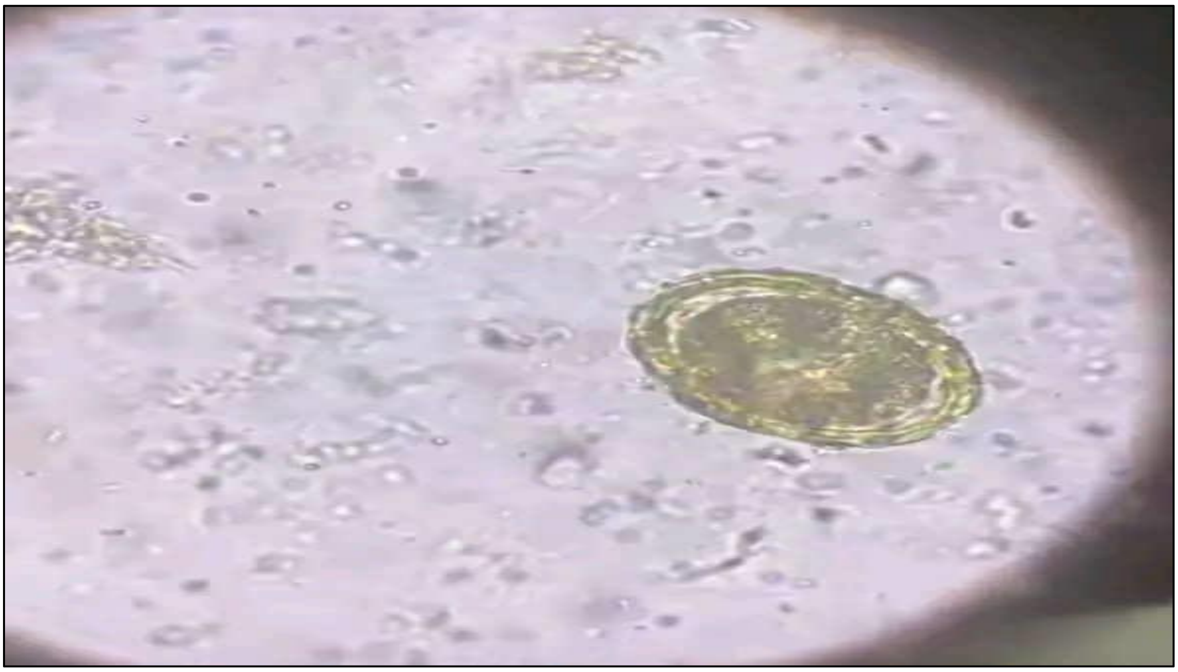
Ova of *Trichuris Trichiura*



APPENDIX VI

PARASITOLOGICAL RESULT

Ova of *Ascaris*



APPENDIX VII

PARASITOLOGICAL RESULT

Ova of *Ascaris* using Iodine

Ova of *E.coli*

69

APPENDIX VIII

PATHOLOGICAL RESULT

Ova of *E.coli*