ASSESSMENT OF KNOWLEDGE, ATTITUDES, PRACTICES AND THE PREVALENCE OF INTESTINAL PARASITES IN SARAH BAARTMAN DISTRICT, EASTERN CAPE

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Assessment of knowledge, attitudes, practices and the prevalence of intestinal parasites in Sarah Baartman District, Eastern Cape

BY

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DEDICATION

This research is dedicated to my mother, Nomboniselo Princess Jaxa, my sister, Wandisa Felicia Jaxa, my son, Kukhanya Mrwebi and my niece, Livuyise Jaxa for supporting me throughout my research and I also dedicate this to my late dad Milton Ngenisile Mrwebi. God has been my pillar.

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LIST OF ABBREVIATIONS AND ACRONYMS

CWP: Community Work Programme

DHIS: District Health Information System

DOH: Department of Health

ECDOH: Eastern Cape Department of Health

EH: Environmental Health

EPWP: Expanded Public Works Programme

KAP: Knowledge, attitudes and practices

KZN: KwaZulu-Natal

NHLS: National Health Laboratory Services

NICD: National Institude for Communicable Diseases

PPE: Personal Protective Equipment

REC-H: Research Ethics Committee: Human

SA: South Africa

SBDM: Sarah Baartman District Municipality

SPSS: Statistical Package for the Social Sciences

Soil Transmitted Helminths

WHO: World Health Organisation

ABSTRACT

Background:

Intestinal parasites also known as parasitic worms are one of the common water, soil and feacal transmitted infections of public importance in the world. This study evaluated the Knowledge, Attitudes and Practices (KAP) of public workers comprising EPWP and CWP general workers on intestinal parasites in a selected municipality in the study area . Additionally, using secondary data, the researcher established the prevalence of intestinal parasites in Sarah Baartman District Municipality (SBDM) from 2012 to 2020.

Method:

The study made use of a quantitative, cross-sectional research design resembling a study by S.D. Hambury .A structured questionnaire, closed-ended, telephonically-administered questionnaire was used to collect data from 160 Expanded Public Works Programme (EPWP) and Community Work Programme (CWP) general workers. Data on the prevalence was obtained from the SBDM National Health Laboratory Service (NHLS). Data was analysed using both inferential and descriptive statistics using SPSS software version 16.1, inferential statistics tests used were Chi^2 square tests and p-value tests. Descriptive statistic tests used included frequency distributions, percentage, cumulative percent, and valid percent.

Results:

The participants' overall awareness, attitudes and practices of the study were poor, 64.4% of the study participants had the correct knowledge about intestinal parasite infections. The age of study participants and who the participants thought was at risk of being infected by intestinal parasites had a non significant relationship ($p>0.05$). Gender and the responses to who is at risk of getting infected with intestinal parasites had a statistically significant ($p<0.05$) relationship. Intestinal parasite prevalence from 2012 to 2020 in SBDM was 46.37% which means it was close to half of the sampled population. Males had the highest prevalence as compared to females, with a prevalence of 53.1%

in males and 46.9% in females. The highest disease infection was found between ages one and six years.

Conclusion:

The researcher concluded that the overall awareness, attitudes and practices on intestinal parasites in SBDM were poor. The intestinal parasites present in SBDM were *Cytoisospora belli* (35.4%) and *Giardia lamblia* (35.4%), *Ascaris lumbricoides* (17.7%), *Trichuris trichiura* (3%), and *Taenia species* (2%). The study also revealed that the prevalence of intestinal parasites was low from 2012 to 2020. Recommendations were made with an emphasis on education to increase disease prevention and control awareness.

Key words:

Intestinal parasites, , Knowledge Attitudes and Practices (KAP), prevalence, , soil transmitted helminths, health

DISSERTATION OUTLINE

This dissertation contains five chapters. In chapter one, details on the introduction and the background of the research are provided, and chapter two elaborates on previous literature on intestinal parasites. Chapter three provides details on the study's first objective, which evaluates the KAP of public workers comprising EPWP and CWP general workers. Chapter four reports on the details of the second objective, which evaluated the secondary data result from the NHLS. Chapter five summarises findings from the objective chapters, limitations, recommendations and conclusion. Below is a breakdown of the chapters as summarised.

Chapter One: Study overview: This chapter provides details on the background, the necessity, the rationale and the objectives of the study. The introduction to the research designs, sampling method, study population and ethical standards used for the study were included in the chapter.

Chapter Two: Literature review: Previous research findings and the gap from other studies were reviewed and discussed in relation to the study.

Chapter Three: This chapter discussed the first objective (phase one), which assessed the KAP concerning intestinal parasites in the SBDM. The findings were presented and discussed relative to findings from previous studies.

Chapter Four: This chapter elaborated on the second objective (phase two), which assessed the prevalence of intestinal parasites in the SBDM from 2012 to 2020. The findings were presented and discussed in comparison with previous studies.

Chapter Five: Synthesizing the findings and recommendations of the study. This consists of the conclusions drawn from the study's objectives following findings from analysed data. Furthermore, details on the limitations encountered and recommendations for further research are provided in the chapter.

CHAPTER ONE

STUDY OVERVIEW

1.1. INTRODUCTION

Chapter one provided the study overview; that is the introduction and background of the research study. This chapter provided the aim, objectives, rationale, research questions, problem statement and ethical considerations were discussed.

1.2. BACKGROUND

Intestinal parasites also known as intestinal worms are nematodes which are categorised as helminths (*Trichuris trichiura, Ascaris lumbroides, Necator americanus, Ancylostoma duodenale*) and protozoa (Giardia lamblia, Entamoeba histolytica *Cystoisospora belli, Fasciola hepatica, Chilomastix mesnili, Hymenolepis nana, Taenia saginata, Iodamoeba butschlii, Strongyloides stercoralis and Entamoeba histolytica)*. These can lead to amoebiasis, giardiasis, hookworm infections, strongyloidiasis, trichuriasis, ascariasis, tapeworm infection, trichinosis, and echinococcus infection (Bhat et al., 2013). Intestinal parasitic infections are amongst neglected tropical diseases (NTDs) as they fall under the varying group of tropical infections, which are common in low socio-economic populations in developing regions in Africa, Asia, and America (WHO, 2017).

Intestinal parasites are mostly found in warm and moist habitats and areas with poor sanitation and hygiene (Chico et al., 2019). Access to Water Sanitation and Hygiene (WASH), includes the provision of safe water, safely constructed sanitation infrastructure which can help ensure the safe disposal of human waste, and promoting safe hygiene (personal and household practices such as hand-washing, bathing, and management of stored water in the home). These are all aimed at preserving cleanliness and enhancing the health of the populace (Kosinski et al., 2012). As of 2017 intestinal parasites were reported to infect above 1.5 billion (24%) of the world's population (Kleppa et al., 2017). According to Ajoge et al., (2019) in sub-Saharan Africa and certain regions of Asia a population of over 1 billion have intestinal parasite infection. A study conducted in 2022 in the Eastern Cape South Africa revealed that an intestinal parasite prevalence of 30% was found among patients who visited health establishment in Eastern Cape, South Africa (Ifeoma, Apalata, Aviwe, Oladimeji, & Abaver, 2022). According to Bhat et al., (2013) *Ascaris lumbricoides* are the mostly found intestinal parasites in South Africa, followed by *G .lamblia, T. trichiura* and *E. histolytica* on children between 4 and 11 years, and the less common intestinal parasites were found to be *H. nana*, *I. butschlii*, *Taenia spp, Fasciola spp.* and *C. mesnili .* A study on intestinal parasites conducted in Port Elizabeth,

Eastern Cape revealed that *A. lumbricoides* and *T. trichiura* are amongst common intestinal parasites in Eastern Cape, South Africa (Müller et al., 2016). A previous study stated that from year 2009 to 2019 the prevalence of intestinal parasite infections worldwide slightly declined in many low and middle socio-economic countries. This was done through the reduction of poverty, unlimited access to improved sanitation and unlimited access of preventative chemotherapy to high-risk categories such as children in school going age and people working in increased-risk occupations such as miners (Chico et al., 2019). The following sections will outline intestinal parasite transmission i.e., Intestinal parasite transmission and factors relating to intestinal parasites infection.

1.3. INTESTINAL PARASITE TRANSMISSION

According to Bhat et al., (2013) intestinal parasites include *Trichuris trichiura, Ascaris lumbroides, Necator americanus, Ancylostoma duodenale*, Giardia lamblia, Entamoeba histolytica *Cystoisospora belli, Fasciola hepatica, Chilomastix mesnili, Hymenolepis nana, Taenia saginata, Iodamoeba butschlii, Strongyloides stercoralis and Entamoeba histolytica.* This study assessed the above-mentioned intestinal parasites on phase 2 of the study, which assessed the prevalence of intestinal parasites from 2012 to 2020 in Sarah Baartman District. Humans get infected with intestinal parasites through ingestion of eggs (*Ascaris* and *Trichuris*) when contaminated hands come in contact with the mouth. People also get infected with helminths through consumption of contaminated fruits and vegetables that were grown in contaminated soil. Consumption of improperly cooked vegetables improperly washed fruit or peeled fruits and vegetables could lead to infection (CDC, 2020). Furthermore, infections with hookworm occur via the penetration of larvae via penetration on the skin which can take place when walking barefooted on soil contaminated with the parasites (Njomo et al., 2016). The highest rates (68%) of these infections is said to occur among children between of ages six to nine years in rural areas (Oswald et al., 2019).

Adult intestinal parasites are found in the intestinal tract, female worms which are fertile and in their matured state release around 200,000 eggs that are released to the environment through the feaces. Unfertilised eggs become non-infectious when they are released to the environment, however, fertilised eggs develop and become infectious where there is appropriate warmth, shade, and moisture. This process can take up to 18 days, when the infectious eggs are ingested by humans, the larvae hatch, occupying the enteric mucosa and travel through the venous system to the systemic circulation and ends up on the pulmonary alveoli. In the pulmonary alveoli the eggs mature further and reside for a few weeks, these then penetrate the alveolar walls to move up the bronchial tree to be swallowed through the throat. Upon getting to the intestines, the larvae mature and become

adults. This is where they mate, the intestinal parasite cycle then continues. It takes two to three months from the ingestion of eggs to the expulsion of the egg from the oviduct to the external environment by the adult female worm (Malavade, 2015). Once in the host, intestinal parasites mate in the intestines, adult female worms lay eggs that are released through feaces. Intestinal parasites reside in the host intestines; their eggs move through the feaces of an infected person and animal. When the host defecates the parasite eggs are still alive and get deposited in the environment. Roundworm and whipworm immature eggs become infective when they mature in soil, while hookworm eggs are not infectious as they get released into the soil, but instead hookworms release eggs which mature into filariform larvae. Intestinal parasites in larvae form, and enter the body through ingestion, absorption/ penetration through the skin, eyes, etc. Humans get infected with intestinal parasites through ingestion of eggs (*Ascaris* and *Trichuris*) when contaminated hands, contaminated food and contaminated water come in contact with the mouth. Humans also get infected with intestinal parasites when contaminated faeces is absorbed through the skin. Infections with hookworm and *G. lamblia* occur through penetration of larvae through the skin which occurs by walking barefooted on infected soil. After infection, intestinal parasites release more eggs inside the infected host's intestines, and transmission continues again (Njomo et al., 2016). High intensity infections can cause abdominal pain, nausea, vomiting, diarrhea, fatigue, confusion, weight loss, loss of appetite and malnutrition. A lifecycle diagram of intestinal parasites is shown in Figure 1.1.

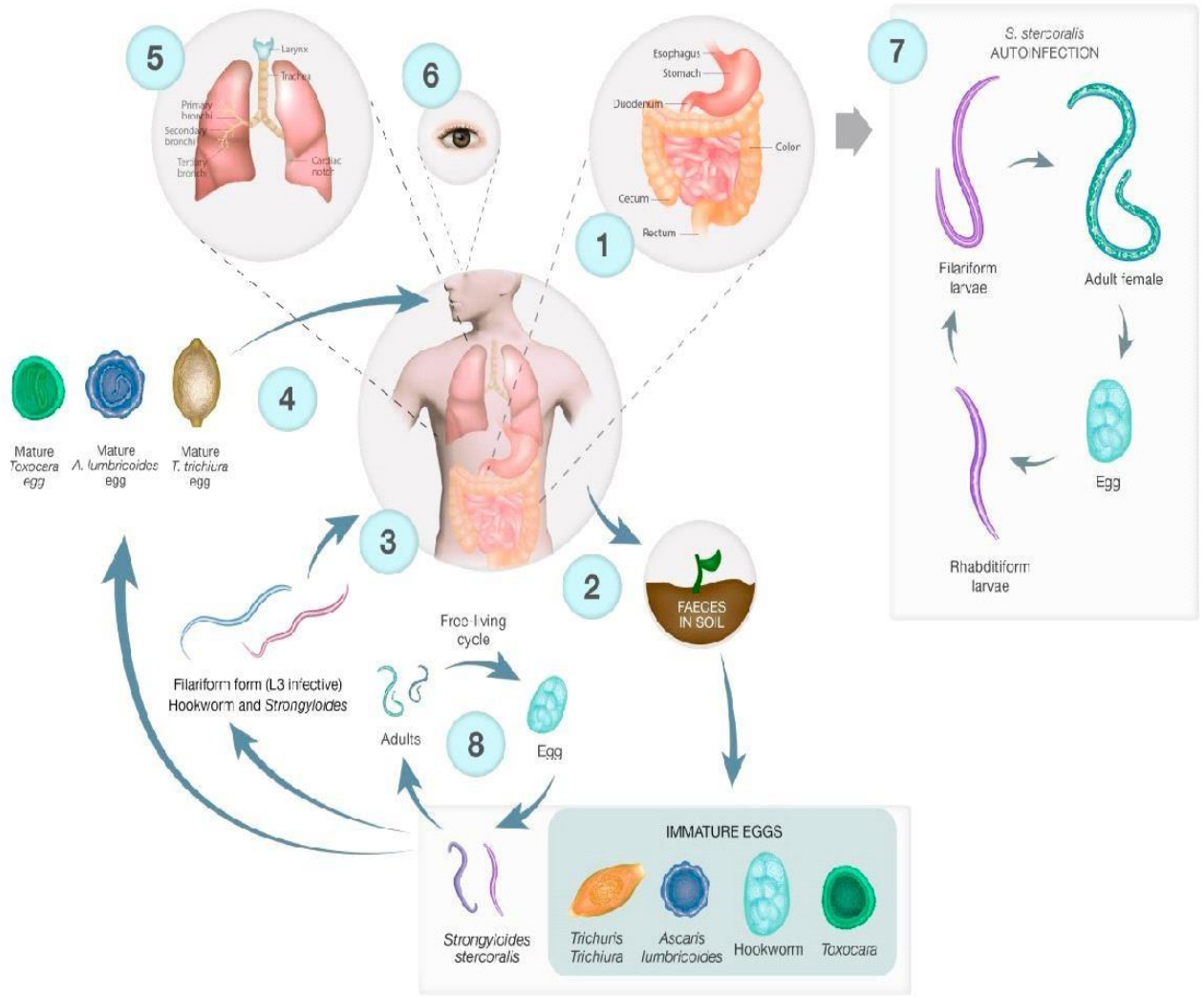


Figure 1.1: Lifecycle of intestinal parasite species (Njomo et al., 2016, p. 7)

1.4. FACTORS ASSOCIATED WITH INTESTINAL PARASITE INFECTION

Environmental factors associated with a higher risk of intestinal parasite infection included inadequate access to safe drinking water and safe sanitation services. A study carried out in Ukpal and Ugwu in Nigeria reported that high rate of helminth infections were found among people without toilet facilities (Kotingo et al., 2014). Lack of knowledge could also affected people's status and chances of getting infected with intestinal parasites, this led to negligence where there was possible intestinal parasite contamination. Limited, late or no diagnosis of infections and associated treatment could enhance transmission from infected individuals to uninfected individuals. Residing in poorly developed residential areas could lead to more intestinal parasite infections, due to practices such as open defecation (Olivia Farrant, Tegwen Marlais et al., 2020). Due to lack of employment, community members may not have had sufficient finances to buy items that would ensure adequate hygiene practices e.g hand-wash soap. Limited and unhygienic recreational facilities could increase

the risk of children acquiring intestinal parasite infections, as no hygienic playground would be available for children to play, and children may resort to playing within spaces with contaminated soil. Jobs/ tasks that involve high exposure to intestinal parasite vectors could increase chances of getting intestinal parasite infection, e.g., jobs that included working on soil with bare hands and harvesting fruits and vegetables with bare hands etc (Bhat et al., 2013).

WASH is necessary, but it is undervalued for purposes of intestinal parasites prevention, which has a potential to improve the well-being of people, when adequately applied. WASH has been listed on interventions which are effective in reducing transmission of larvae which could potentially lead to intestinal parasite infection (WHO, 2017).

1.5. PROBLEM STATEMENT AND RATIONALE

Globally, above 1 million people have been infected with roundworms and over 700 million people were infected with whipworms (Ajoge et al., 2019). In most of the sub-Saharan African countries intestinal parasites have been said to be co-endemic, meaning they are endemic together with any other diseases. According to a study conducted in sub-Saharan Africa on intestinal parasites in 2020, *Intestinal schistosomiasis* and *Giardiasis* are the most common intestinal parasite infections, these infect millions of children in areas where intestinal parasites are endemic. A study conducted in 2021 on the intestinal parasites prevalence from 2000 to 2018 revealed that in 2000 before the NTD control programme got implemented, intestinal parasites were widely spread across sub-Saharan Africa countries, with a prevalence of 76,5 million among children between ages 5 and 14 years (Sartorius B, Cano J, et. al., 2021). A research study conducted in the Nelson Mandela Bay area on school children had reported on a prevalence of a 45% in children where 259 out of 576 children were infected with intestinal helminths. The study identified intestinal helminths as one of the core infections of concern within warm and moist areas in Eastern Cape (Gall et al., 2017, p. 10).

A study conducted in the uMkhanyakude district, KwaZulu Natal, South Africa on the KAP of caregivers on soil transmitted helminths and Schistosomiasis which form part of the group of intestinal parasites revealed that a total of 79.6% of caregivers had good knowledge of intestinal parasites, the study concluded that efforts need to be channel on health education with the aim to eliminate and control intestinal parasite infections (Sacolo-Gwebu, Kabuyaya, & Chimbari, 2019). A study conducted in sub-Saharan Africa on the prevalence of soil transmitted helminths (STH) revealed that if the purpose is to eliminate STH by 2030 then there needs to be a continued implementation of treatment and prevention of STH in order to ensure that there is no group left behind. A study conducted in South Africa pertaining to intestinal parasites, highlighted a need to

invest in more resources which will help study intestinal parasites as few published studies were available especially in areas where there is poor sanitation and hygiene (Ajoge et al., 2019) This further emphasizes the need for more control interventions to fight the intestinal parasite infections.

Treatment alone is not enough to break the cycle of transmission of intestinal parasites, as curative means cannot get rid of the causal factors of intestinal parasite on their own; improvements on WASH infrastructure and proximity of health care facilities are crucial to achieve a sustained control of intestinal parasites, following the saying “prevention is better than cure”. During treatment cycles, in most instances small sections of the populations remain are not reached by chemotherapy programmes. These groups are the ones which in turn are categorised as those which have a high burden of infection, and they therefore serve as reservoirs for re-infection which raises the need for health education (Becker et al., 2020).

SBDM area is located 30.1km from the Nelson Mandela Bay Municipality in the Eastern Cape province. During a visit to the study area in 2021 it was noted that there were factors which were associated with the presence of intestinal parasites in the SBDM area, among which is inadequate sanitation and poor hygiene. For example, it was observed by the researcher that the bucket system toilets were used in one of the study area, which impacts on poor and is associated with the concept of intestinal parasites. See Fig 1.2.

EPWP is a nation-wide programme offered by the National Department of Public Works from 2003. CWP is currently managed by department of cooperative governance. The EPWP and CWP programmes were developed with the purpose of providing temporary work for financially disadvantaged and unemployed people in economically disadvantaged communities to counter poverty and to assist the individuals financially. The EPWP does this by employing individuals after training, on one-year contracts EPWP general workers posts, which are mostly renewed on yearly basis. The EPWP and CWP have the same objective of providing employment security through work opportunities, through enforcing social inclusion. In Fig 1.7. the study participants are enclosing potholes in roads making use of concrete, levelling gravel roads and removing rocks and other objects which become obstructions on the road. EPWP and CWP general workers perform these functions making use of tools such as spades, wheelbarrows, and rakes.

The possible means of intestinal parasite contamination from this function for EPWP and CWP general workers is through the concrete and soil, which the workers work with when enclosing potholes, removing obstructions from the road and when levelling the gravel roads using their hands

(MunicipalityKouga, 2013). Although there have been studies carried out pertaining to intestinal parasites in the region of the study area. Some of these studies were not published and the prevalence of intestinal parasites and the KAP status of CWP and EPWP general workers remains unclear in the study area.

According to Ramesh et al (2015) people at a high risk of being infected with intestinal parasite include adults in certain high-risk occupations such as tea-pickers, miners, etc. The functions of EPWP and CWP general workers fall under the category of people at risk for being infected with intestinal parasites, this is due to the nature of their tasks which they perform which include direct contact with soil in roads, working with fruits and vegetables harvested in gardens and direct contact with illegally dumped waste which could potentially contain nematodes that are known to cause intestinal parasites.

The study area consists of low to middle economic status residents, with a few people occupying steady employment positions. Most residents in the study area make use of government clinics for health care for which on each area there is a maximum of one clinic. Residential areas range from houses built from bricks to shacks, toilets used range from in-house flushing toilets to the bucket system toilets, Socio- economic factors are amongst factors that affect the ability of residents to make daily life choices. Inadequate sanitation and poor hygiene have also been associated with the occurrence of intestinal parasites (MunicipalityKouga, 2013).

A study conducted on intestinal parasites in Port Elizabeth, South Africa, which is located 30.1km from the study area revealed a high prevalence of two of the intestinal parasites, i.e. *Ascaris lumbricoides* and *Trichuris trichiura* (Müller et al., 2019). However, there is scarcity of information on the knowledge of the community members in the study area on intestinal parasites (Gall et al., 2017). Therefore, the study assessed the KAP of study participants on intestinal parasites and evaluated the retrospective prevalence in SBDM from 2012 to 2020 to possibly have more insight on the trend. There is need to assess the prevalence of intestinal parasites (over 8 years), the results of the retrospective prevalence of intestinal parasites could be evaluated relative to the KAP status of public workers comprised of EPWP and CWP general workers on intestinal parasites in SBDM, Eastern Cape.

Fig 1.2.: A picture of the toilets used in one of the residential areas in the study area next to one of the dumping sites where CWP general workers work (Source: the picture was taken by the researcher during a site visit conducted in November 2021)

Figure 1.3: CWP general workers enclosing road potholes on road (Source: The picture was taken by the CWP Manager during one of the monthly site visits in April 2022)

1.6. RESEARCH AIM

The study assessed the prevalence of intestinal parasites over eight years in the SBDM and determined the KAP of public workers comprising EPWP and CWP general workers at Kouga local municipality in the SBDM.

1.7. RESEARCH QUESTION

- What is the prevalence of intestinal parasites in SBDM from 2012-2020?
- What is the KAP of public workers comprised of EPWP and CWP general workers in SBDM regarding intestinal parasites?

1.8. RESEARCH OBJECTIVES

- To determine the prevalence of intestinal parasites in SBDM retrospectively from 2012-2020.
- To assess the KAP of public workers comprised of EPWP and CWP general workers in SBDM regarding intestinal parasites.

1.9. GENERAL METHODOLOGY

1.9.1. Methodology

A presentation of the research methodology is provided in this section consisting of the study area, study population, sample size and ethical considerations

1.9.2. Study Design

The study consisted of two phases; the first phase is a cross sectional study design which entailed the use of a structured questionnaire to determine the KAP of public workers comprised of EPWP and CWP general workers in the SBDM on Intestinal parasites. The questionnaire consisted of 33 closed ended questions categorised as demographics, knowledge, attitudes and hygiene practices. The questionnaire was administered to the public workers comprised of the EPWP and CWP general workers using the telephonic interview method. A sample size of 158 public workers of ages 18 years through 60 years (retirement age) was selected randomly. The second phase comprising of a retrospective analysis of intestinal parasite data, for the period 2012 to 2020. The data was obtained from the SBDM NHLS through the Eastern Cape Department of Health. Where data of people between the ages of 18 years to 60 years was used.

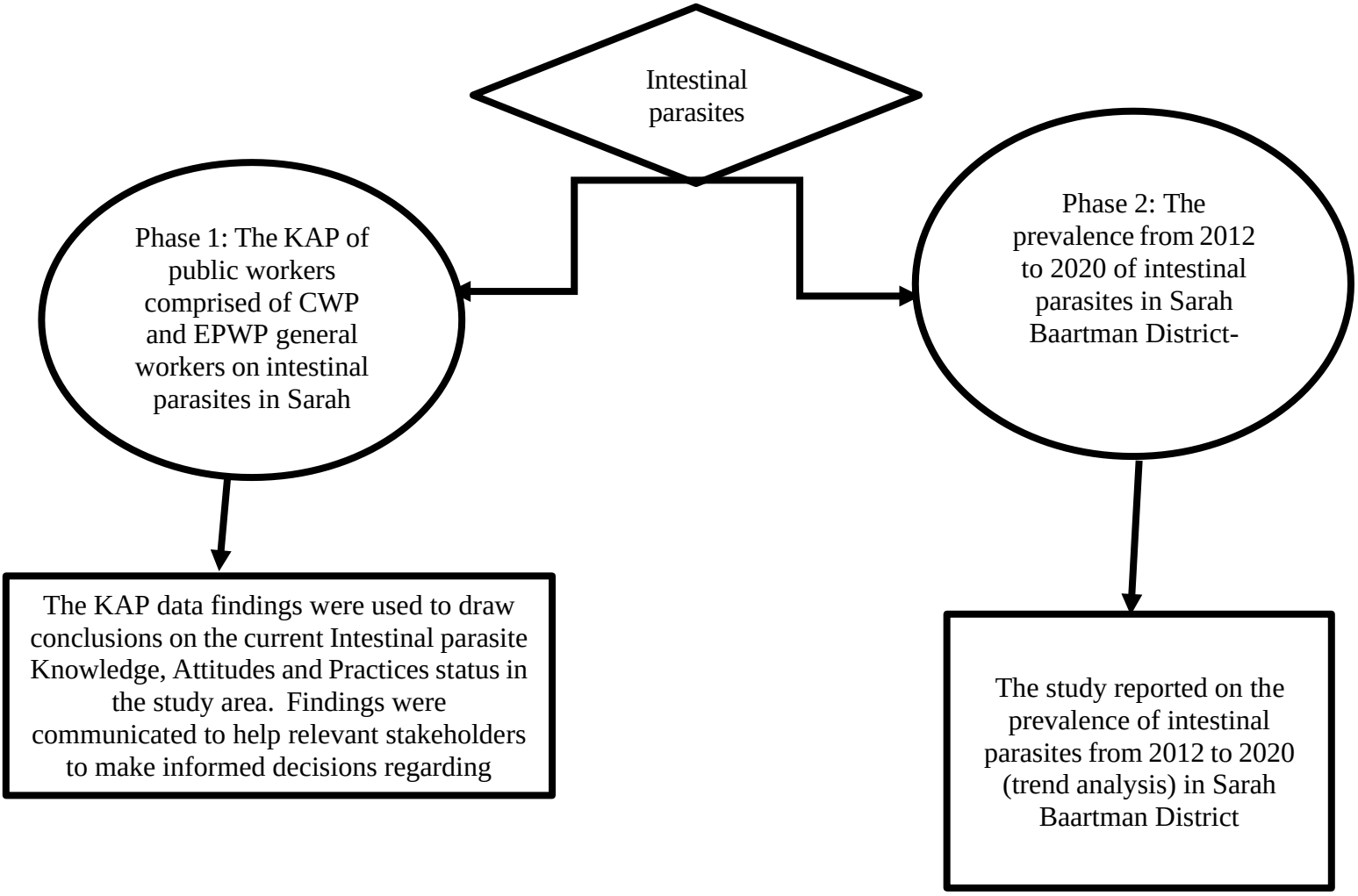


Fig 1.4. A Schematic flow diagram of the study

1.9.3. Study area

The SBDM is located in the western side of the Eastern Cape Province. A district municipality mostly provides support to local municipalities that are small within its area, this includes poor or rural communities.

The SBDM, with geographical coordinates: $33^{0}57'S\ 25^{0}36'E$ consists of seven local municipalities, namely, Koukamma, Dr Beyers Naude, Kouga, Blue crane route, Sundays River Valley, Ndlambe and Makana (Sarah Baartman District Municipality, 2016). SBDM area is located 30.1km from the Nelson Mandela Bay Municipality in the Eastern Cape province.

1.10. ETHICS APPLICABLE TO THE STUDY

The study was conducted in line with the Nelson Mandela University ethical standards. Ethical clearance for the project was sought from Nelson Mandela University ethics committee, before the beginning of the study (REC-H number H-20-HEA-ENV-006) as approved for the project, which was

forwarded to the gatekeeper; the EPWP and CWP general workers' Manager who informed the EPWP and CWP general workers about the study (See Annexure D).

The principles considered in alignment with the Belmont report include: Respect for persons; informed consent, voluntary participation and confidentiality, beneficence and justice.

Respect for persons was exercised in the form of informed consent forms which were handed to the study participants before the start of the telephonic interviews, study participants gave consent to the interviewer by signing the forms. Study participants were informed of their right of choice to either participate or not participate in the study, participants were alerted that their identity would be kept autonomous throughout the course of the interview, they were also informed of their right to withdraw from the study at any point of uncomfortability.

Beneficence was ensured through protecting subjects from harm that could arise from the study, this was done through maximizing the benefits which could arise from the study while minimizing the harm which can emanate from the study. Justice was ensured by treating all research subjects equally.

The informed consent forms handed to the participants indicated that participants would be contacted telephonically, and provision would be made in the form for the proposed participants to indicate their contact numbers if they would like to participate in the proposed study. Consent was asked from the EPWP general workers regarding recording the telephonic interview.

Credentials of participant were kept anonymous during the process of collecting data. All records were kept as confidential as possible using a password secured laptop, accessible only to the researcher and the Supervisors.

Data for the eight-year period (2012-2020) intestinal parasites prevalence was obtained from the Eastern Cape Department of Health (ECDOH) and the SBDM NHLS to assess the prevalence of intestinal parasites in the SBDM area.

CHAPTER TWO

LITERATURE REVIEW

2.1. INTRODUCTION

This chapter presents a review of literature from previous studies in alignment with the study objectives.

2.2. BACKGROUND

Intestinal parasites also known as intestinal worms are helminths caused by the ingestion, absorption and penetration of helminth eggs or larvae into the human host (Njomo et al., 2016). Intestinal helminths and protozoa are transmittable from one person to another. Intestinal parasites are transmitted between animals and humans as well. Intestinal parasites can spread through contaminated water, food, soil, waste, and blood (Japa et al., 2021).

Humans get infected with intestinal parasite infections when fruit and vegetables that were grown in contaminated soil and possibly contaminated fruit and vegetables are improperly cooked, improperly washed or peeled are consumed. Intestinal parasite transmission also occurs through contact with feacal content. The intestinal parasite routes of transmission include absorption through the skin and ingestion (Ajoge et al., 2019).

Intestinal parasites infections are detrimental, and everyone is at risk of getting infected with them. However, the people who are at higher risk of getting infected range from children, child care workers who work with children who may be infected, the elderly, pregnant women, caregivers of people who have the infection, people whose immune system is compromised, that is; people who are already sick with other diseases (Chico et al., 2019).

2.3. HEALTH PROBLEMS RELATING TO INTESTINAL PARASITES

Intestinal parasites pose a serious public health burden affecting more than 3 billion people in the world yearly (Hajare et al., 2021). These parasites are also dominant in sub-tropical countries and this has been associated with the lack of safe sanitary services, for example a lack of safe toilets, improper hand-washing facilities and unavailability of safe drinking water supplies (Eyayu et al., 2021). In South Africa, these parasites have been investigated predominantly in children and have been found to be prevalent on the sampled populations. Previous studies on intestinal parasites conducted in the Dominican Republic on pre-school children reported that stunted development or

poor growth, diarrhoea, abdominal pain, malnutrition impaired work capacity and malaise are symptoms linked to intestinal parasite infection amongst pre-school children (Japa et al., 2021).

2.3.1 Health problems relating to helminths

Helminths are large multicellular organisms that multipy outside the cells of the body of a host and typically do not multiply in their host and therefore they do not present an immediate risk during the initial infection (Njomo et al., 2016). Helminths include *Trichuris trichiura, Ascaris lumbroides, Necator americanus, Ancylostoma duodenale*. Helminths use humans and animals as primary hosts, most of the intestinal parasites do not require an intermediate host, because they have a direct life cycle and the parasitic infection takes place through feacal contamination of food, water and soil, there is however an exception of schistosomas species which require a snail as an intermediate host (Leroux et al., 2018). People who come into contact with food, soil or water contaminated with intestinal parasites stand a risk of ingesting or getting the parasites absorbed into their skin, leading to more eggs being hatched inside their intestines leading to more infections and transmissions (Htun et al., 2018).

Helminths can cause infections such as; Ascariasis, hookworm infections, abdominal angiostrongyliasis, intestinal capillariasis, strongylodiasis and cysticercosis (WHO, 2017). According to a study in Guinea Bissau adults, those who work in farm and in occupations that have contact with soil are at an increased risk of hookworm infection (Olivia Farrant, Tegwen Marlais et al., 2020). In addition, anaemia also contributes to health problems associated with intestinal parasites, affecting mostly female adults and children between 12 and 14 years of age (Olivia Farrant, Tegwen Marlais et al., 2020). *Ancylostoma duodenale* is known to be vertically transmitted between mother and child through ingesting the parasite in milk at its third stage. Early diagnosis can help the mother to take treatment so they don't infect the baby. *A. duodenale* can be acquired by walking barefoot on contaminated soil.

In addition to the infections associated with intestinal parasites are; dysentery, schistosomiasis and intestinal parasitosis. Intestinal parasitosis is an infection caused by both helminths and intestinal protozoa. These infections are characterised by fatigue, anaemia and liver damage (Raso et al., 2010).

A quantitative cross-sectional study conducted on intestinal parasites in Port Elizabeth, South Africa revealed that two members of the group of soil transmitted intestinal parasites, i.e., *A. lumbricoides*

and *T. trichiura* recorded a higher disease burden on children below 15 years when compared to those above 15 years (Müller et al., 2019).

2.3.2 Health problems relating to protozoans

Protozoa are small, single-celled organisms that multiply inside the cell and pose a high risk to the immune system of the host. Protozoa include *Giardia lamblia, Entamoeba* histolytica *Cystoisospora belli, Fasciola hepatica, Chilomastix mesnili, Hymenolepis nana, Taenia saginata, Iodamoeba butschlii, Strongyloides stercoralis and Entamoeba histolytica* (Bhat et al., 2013). Intestinal protozoa are known to cause giardiasis, amoebiasis, cyclosporiasis, and cryptosporidiosis. Intestinal parasites can lead to gastrointestinal distress as they reside in the intestines and there causes more damage, this can be seen by symptoms such as; diarrhoea, constipation, gas, bloating and nausea. Intestinal parasites can also cause weight loss which can be seen through nausea and poor nutritional absorption, these constitute important health and social challenges (Eyayu, et al., 2021).

A study on the prevalence of intestinal parasites conducted in India in 2020 revealed that *E. histolytica* can cause an increase in the risk for IntraUterine Growth Restriction (IUGR) on pregnant women of short stature, and *G. lamblia* can cause IUGR on women who are pregnant and underweight. In these women *G. lamblia* can be caused by poor nutritional and health state encountered during pregnancy, this can show in the following symptoms diarrhoea, dehydration and lactose intolerance (Roopal et al., 2020). The study further revealed that pregnant women with *Blastocystis hominis* are at a high risk to be asymptomatic of all other intestinal parasite infection symptoms, but the common factor amongst them can be anemia. The study also revealed that *B.hominis* infection does contribute to anemia development in expecting women, as 96% of the participants who were diagnosed with *B. hominis* were diagnosed with anemia (Roopal et al., 2020).

2.4. INTESTINAL PARASITES CONTROL STRATEGIES AND ASSOCIATED CHALLENGES

The WHO specified five groups or stakeholders that are accountable for the control of intestinal parasites, these groups include: organisations that support and endorse control strategies, e.g. WHO and UNICEF; organisations that are in the implementation of the strategies, e.g. the National Health authorities; authorities that are responsible for training health workers, i.e. lecturers of the health-related faculties in higher institutions of learning, health care teaching personnel; scientific experts and those who have powers to influence opinions of communities, e.g. journalists, health educators and community leaders (Alharazi et al., 2020).

According to WHO, in different regions and countries, the occurrence of intestinal parasites is associated with different factors, from social, to economic and health factors, depending on the level of development of a country. The general prevention and control strategies of intestinal parasites include; strengthening the drug administration procedure in preventing intestinal parasites to control the infection, followed by enhancing the process of intestinal parasite diagnosis for an early detection and intervention. Secondly, depending on a region's challenges and its level of development, an improvement in the health systems could prevent and control the occurrence of intestinal parasites. These strategies include building health facilities that are in close proximity to communities, bringing hygiene and intestinal parasite prevention education to communities, the provision of safe and proper sanitation facilities. WHO recommended combined approaches to the control, prevention and the elimination of intestinal parasites, these include: chemotherapy with the aim of prevention, periodic administration of medicines including albendazole or mebendazole for helminths, improvement of the overall WASH, change of behaviour and the management of the environment. These medications could safely be administered when helminths are endemic at the same time (WHO, 2022).

The Mass Drug Administration (MDA) for deworming (albendazole, mebendazole and ivermectin) forms part of strategies for preventing and controlling helminths, this is in order to break the transmission cycle of the parasites. According to a study conducted on the contribution of MDA to global health, South Africa is among the countries which were said to be not involved in the MDA programme towards prevention and control of intestinal parasites. Argentina, Arabia, South Africa, China, Indonesia, India, Mexico, Australia and Saudi Arabia are among countries with a high burden of Neglected Tropical Diseases (NTDs) of which some of the intestinal parasite infections such as; *Giardiasis* have been classified as non- NTDs. The above countries were included in the goal of being involved in the MDA by the year 2020, as they fall on the underprivileged countries living in the group of 20 countries (G20). A cross-sectional study conducted in Guinea Bissau on the prevalence of soil transmitted helminths highlighted the need for community-wide deworming programmes that will involve community members, many studies revealed that deworming programmes are mostly effected in schools and leave the adult community unattended. The deworming programme included age groups from 7 to 14 years (Olivia Farrant et al., 2020).

Deworming alone opens opportunities for reinfection, because deworming is done routinely atleast once a year. If an individual therefore misses the deworming date, reinfection may occur. Transmission of intestinal parasites is mostly associated with sanitation and hygiene practices, and

therefore the need for health education as a means to enhance knowledge of community members on helminths knowledge is needed (Njomo et al., 2016).

2.5. KNOWLEDGE, ATTITUDES AND PRACTICES IN RELATION TO THE DISEASE

A number of studies assessed the KAP of participants using questionnaires among different age group to determine the knowledge, attitudes, beliefs, and factors relating to intestinal parasites. These are elaborated on the sections below.

2.5.1. Knowledge in relation to intestinal parasites

Knowledge of intestinal parasites comprises of the participants' general knowledge on intestinal parasites, the source of intestinal parasite knowledge, the knowledge of the different types of intestinal parasites, transmission routes of intestinal parasites, routes of entry for intestinal parasites and intestinal parasites' preventative measures. Knowledge on risk factors and susceptibility to getting infected with intestinal parasites, knowledge on whether intestinal parasites are communicable are amongst the knowledge questions of intestinal parasites. In addition to these there are; questions on whether intestinal parasites are zoonotic and the signs and symptoms of intestinal parasites.

A study conducted in Ethiopia, in 2018 on participants ranging from ages 5 to 70 years found that 94.4% of the participants involved in the study had knowledge on intestinal parasites infection prevention while the remainder of 5.6% had poor knowledge. The same study conducted in Ethiopia also revealed that majority of the participants knew how intestinal parasites could be controlled (Gebreyohanns et al., 2018).

A study conducted on the KAP of parasitic worms in 2010 in Western Cote d'Ivore in 2010 revealed that less than half (47%) of the participants who were from ages 18 to 60 years had poor knowledge about intestinal parasites. The same study revealed that a majority (65%) of study participants responded that consumption of meat, sweets, and over-ripe fruits are possible sources of intestinal parasite transmission (Raso et al., 2010, p. 12).

A study in Nakhon Si Thammarat, Thailand conducted in 2022 on participants on both males and females revealed that 70.47% of the participants had poor intestinal parasite knowledge about routes of transmission, most of which were females between the ages above 60 years. The same study reported that 94% of the study participants had heard about intestinal parasites, however, but only 45% of them knew about the prevention of intestinal parasites (Narkkul et al., 2022).

A study conducted on the KAP of STH and Schictosomiasis in KwaZulu-Natal (KZN) found that the overall KAP of participants involved in the study was poor, the level of knowledge of the study participants on the transmission, prevention and control of STH was below half of the sampled population even though though the participants had heard about the infection (Sacolo-Gwebu, Kabuyaya, & Chimbari, 2019). A study conducted on the KAP of WASH in Limpopo, South Africa found that 78.40% study participants involved in the study had no knowledge on the different types of water-based diseases. The study further revealed that participants in urban areas were more knowledgeable on preventative measures of water-based diseases, such as handwashing after using the toilet than people in rural areas, this difference in knowledge was associated with the difference in participants' socioeconomic statuses, e.g. people residing in urban areas have access to important information on diseases and infections through television news and newspapers (Sibiya & Gumbo, 2013).

It is evident that lack of knowledge on intestinal parasites is a challenge in the world, regionally and nationally. Previous literature in South Africa revealed that most study participants residing in rural areas had heard of intestinal parasites but did not know hygienic measures to prevent being infected by intestinal parasites. A few studies have assessed the knowledge of people between 18 and 60 years, and there are few studies which assessed population knowledge of intestinal parasites in Eastern Cape. This therefore opens a gap for more studies to be conducted, assessing the knowledge of participants of ages between 18 and 60 years on intestinal parasites, in order to come up with remedial measures, depending on the findings.

2.5.2. Attitudes in relation to intestinal parasites

A study conducted in Cote d'Ïvoire on the KAP of intestinal parasites found that a 60% study participants of ages from 18 to 60 years involved in the study responded that ingestion of dirty water was the main route of transmission of intestinal parasitosis. A total of 65% study participants who reported to have the Dysentery infection, experienced severe bloody diarrhoea and mucus in the faeces. A total of 70% study participants responded that blood in stools was a serious health problem which can indicate infection with intestinal parasites (Raso et al., 2010).

A study in Ethiopia, on intestinal parasites revealed that 94% of the study participants revealed that they believe intestinal parasitosis is an important infection (Becker et al., 2020). In the same study, 99.7% of the study participants stated that taking medication against intestinal parasitosis is important in managing the disease. All the study participants responded that it is important to visit a health facility if a person gets abdominal discomfort. A percentage total of 68.1% of the study

participant believed that playing in soil can cause intestinal parasitosis. A total of 94.7% study participants believed that eating raw vegetables can cause intestinal parasitosis.

Another study conducted among Village Health Volunteers in 2022 which investigated factors associated with good KAP relating to soil transmitted helminth infection which form part of the intestinal parasites group, revealed the following; that 69.57% of the study participants felt intestinal parasites were an important condition that people need to know about, and 30.43% of the study participants felt it was not important for people to know about intestinal parasites. The participants in the study were chosen for the study as a result of their responsibility to conduct health education on community members (Narkkul et al., 2022).

A study conducted on the KAP of WASH in Limpopo, South Africa revealed that a majority of the study participants expressed that they felt that the responsibility of ensuring awareness of issues relating to the practices of safe sanitation and hygiene was the government's. Others responded that parents and schools were responsible for ensuring that children in school-going age were aware of the benefits of practicing safe sanitation and hygiene (Sibiya & Gumbo, 2013).

Previous literature in South Africa revealed that most people could not judge the level of importance intestinal parasites possess, and most people were not aware which stakeholder has the responsibility to keep communities informed about intestinal parasites, while in countries such as Cote d'Ivoire, China and Mexico people felt that intestinal parasites were an important infection people need to know about, this therefore implies a gap for more studies to be done locally on the subject (Bhat et al., 2013).

2.5.3. Practices in relation to intestinal parasites

A study conducted on the KAP of parasites in Cote d'Ivoire revealed that the study participants performed practices which promoted intestinal parasite prevention, such as the washing of hands after using the toilet. However, most households in the study area drank water from rivers and ponds and used it for hand-washing (Raso et al., 2010). Intestinal parasite practices include actions that study participants adopt to prevent or curb intestinal parasites, these include washing fruit and vegetables before eating, a low-cost hand washing point used when there is no running water available, the safe disposal of wastewater, nail-cutting intervals, the type of hand-protection used, hand-washing tool and hand-washing intervals, history of intestinal parasites infection and deworming status. Functioning pit latrines were available for only 29% of the study participants, the remainder of participants practiced open defecation, in areas close to the river, with the children

being allowed to defecate anywhere close to the residences, for safety purposes, which is not a safe sanitation practice (Raso et al., 2010).

Another study randomly selected in Taiz, Yemen assessed the intestinal parasite' knowledge, attitudes and practices among the participants. The study identified the following; the participants had a significant rate of inappropriate attitudes which included; wearing shoes "sometimes" when going outside (43.4%), trimming or cutting nails "sometimes" (31.4%) and not always washing fruits or vegetables before eating (19.2%) (Alharazi et al., 2020). A study on Health Volunteers which was assessing the practices of study participants revealed that 66.49% of the study participants had poor practices towards preventing and controlling the group of Intestinal parasites soil transmitted helminths (Narkkul et al., 2022).

A study on the KAP of WASH in Limpopo province, South Africa revealed that 60% participants only washed their hands before eating and after toilet use, the participants didn't wash their hands during other times. According to the study, this due to the unavailability of water in some rural areas (Sibiya & Gumbo, 2013).

Previous literature has revealed that socio-economic factors had a huge impact on people's practices to prevent intestinal parasites, in this literature, which were categorized as regional studies, most study participants practiced a few of the preventative measures as means to prevent infection. Amongst these were hygiene practices which were associated with type of residences participants resided in, type of toilet facilities which participants used, this therefore created a gap for more studies to be done locally, as similar trends of low socio-economic statuses, such as open defecation were found in the study area. The gap created an opportunity to come up with methods that can assist where there may be need.

2.6. CHAPTER SUMMARY

This chapter provided a review of previous studies on intestinal parasites with respect to the study objectives. Previous studies have proven that intestinal parasites have adverse effects on both adults and children, this therefore needs focus, as practices and attitudes are linked together and a lack of knowledge about the disease can also affect the behaviour of communities, more studies need to be done to assess the KAP of adults on intestinal parasites locally, to add to the body of knowledge and come up with remedial suggestions where there is need. The next chapter focuses on findings from the data collected in relation to the first objective: knowledge, attitudes and practices of the study participants.

CHAPTER THREE

KNOWLEDGE, ATTITUDES AND PRACTICES (KAP) RELATING TO INTESTINAL PARASITES AMONG PUBLIC WORKERS COMPRISED OF EPWP AND CWP GENERAL WORKERS IN SARAH BAARTMAN DISTRICT MUNICIPALITY

ABSTRACT

Background: In Eastern Cape (EC), South Africa, there are a few studies assessing the KAP, control and preventative measures of the adult population on intestinal parasites. This study investigated the KAP of participants on intestinal parasites from Kouga local municipality which is located in SBDM.

Methods: The study used a quantitative cross-sectional research approach. A structured questionnaire consisting of 31 close-ended questions was used to collect data from the participants. The data was analysed using descriptive and inferential statistics through the SPSS software version 16.1.

Results: The study was comprised of a total of 160 study participants, consisting of 136 (85%) females and 24 (15%) males. A total of 17.5% study participants were between the ages of 18 and 28 years, 34.4% study participants were between 29-39 years, 30% study participants were between 40 and 50 years and 29 (18.1%) study participants were between ages of 51 and 59 years. A total of 64.4% study participants had adequate knowledge on intestinal parasite infection, while 35.6% of the study participants had inadequate knowledge on intestinal parasites. A total of 86.9% study participants knew about the sources of intestinal parasite infection, the remaining total of 14.1% study participants did not know about the sources of intestinal parasites and gave responses such as “intestinal parasites were transmitted through excess candy consumption”. The relationship between the age of participants and how participants responded to the questions were assessed using Chi square test. There was no significant relationship (p=>0.05) between age and the response to the question of knowledge about intestinal parasites types. The study observed that 75.9% of Age-group 4 (51-59years) knew about intestinal parasites, while 50 % of Age-group 1 (18-28 years) study participants knew about intestinal parasites, while 39% of Age-group 2 (29-39years) knew about intestinal parasites and 30% of Age-group 3 (40-50years) knew about intestinal parasites.. A statistically insignificant (p>0.05) relationship was observed between Gender and knowledge of preventative measures The male (62.5%) participants involved in the study showed more knowledge on the preventive measures for intestinal parasites as compared to females (37.5%). Most (83,3%)

of the study participants who resided in informal settlements knew about the different types of intestinal parasites. A total of 55.5% study participants had positive attitudes towards intestinal parasites, participants responded that intestinal parasites are an important infection that the public needs to be informed of, they further responded that health workers were responsible for educating them and the community. A total of 32.5% study participants wore construction gloves when conducting work, while 20.6% study participants wore nothing on the hands when conducting work.

Conclusion: The study found that the KAP of the study participants involved in the study were poor. According to the results, demographic characteristics such as residential areas played a role in the knowledge of participants. Few of the study participants mentioned that they had benefited from the deworming Mass Drug Administration at their toddler stage. The lack of knowledge, attitudes and practices emphasizes on the need to implement health education intervention. This will help enhance the knowledge of the study participants and the community members at large.

Keywords: Knowledge, attitudes, practices, Intestinal parasites, Sarah Baartman District, Expanded Public Works Programme general workers, Community Work Programme general workers.

3.1. INTRODUCTION

This chapter elaborates on the research methods and design for the KAP study (Phase 1), and provides a detailed report on the methods and the findings from the study.

3.2. BACKGROUND

Intestinal parasites are caused mainly by round worms (*A. lumbricoides*), whipworms (*T. trichiura*) and hookworms (*A. duodenale* and *N. americanus*) (Grimes et al., 2015). Global statistics on intestinal parasite infections as of 2019 revealed a prevalence of between 800 and 1000 million people, who have had roundworm infections, and more than 700 million people who have been infected with whipworms. A total of 576-740 million people were infected with hookworms in 2014 globally. A previous study reported that over one billion people in sub-Saharan Africa and Asia have intestinal parasite infections (Ajoge et al., 2019). The NTD control programme was implemented mid the year 2000, following this the prevalent cases changed to 35 million cases in 2018 in children of ages between 5 an 14 years. In 2018, the following countries had the NTD programme implemented and these countries had a prevalence of intestinal parasites which was more than 20% of their population, these were i.e. Nigeria, Democratic Republic of the Congo, Ethiopia and Cameroon (Sartorius B, Cano J, et. al., 2021). The WHO estimated that annually more than 3 million people require treatment for intestinal parasites in South Africa, which highlights intestinal parasites as a problem in the country (WHO, 2021). This further emphasizes the need for more control interventions to fight the intestinal parasite infections (Kleppa et al., 2017). A study conducted in South Africa pertaining to intestinal parasites, highlighted a need to invest more energy resources into studying intestinal parasites, as few published studies were available, especially in areas where sanitation and hygiene are poor (Sibiya & Gumbo, 2013).

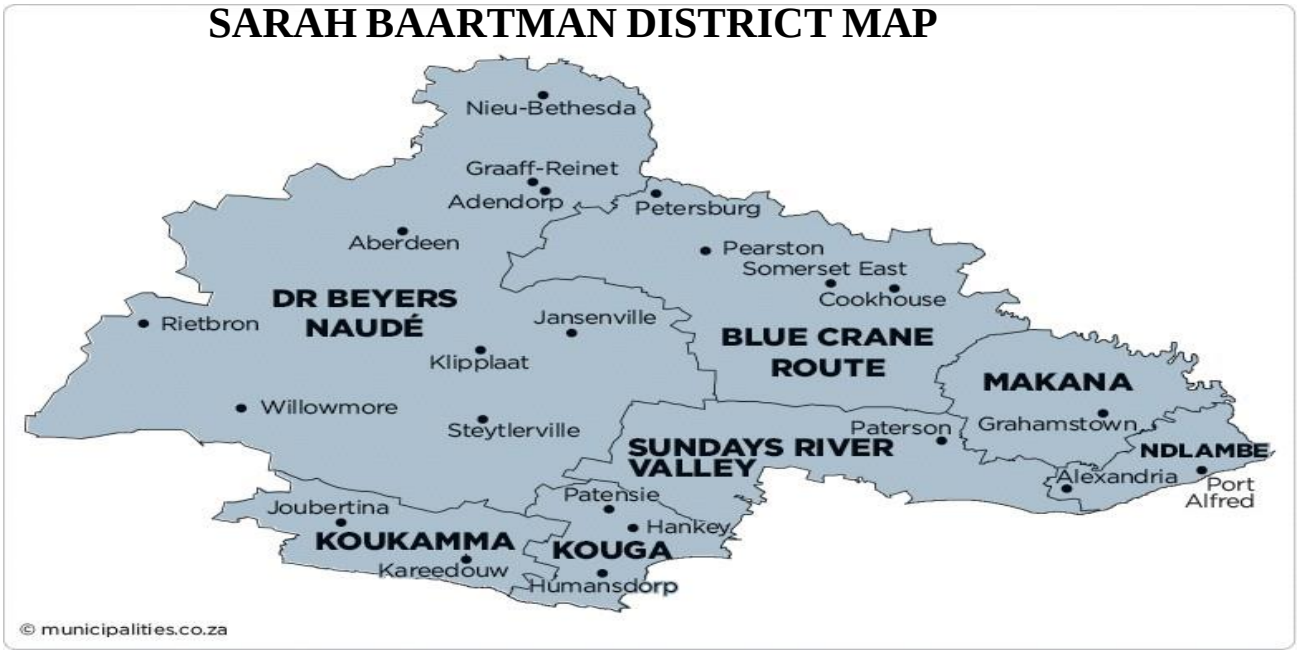
3.3. MATERIALS AND METHODS

3.3.1. Study area

SBDM is located in the western side of the Eastern Cape province. A district municipality mostly provides support to local municipalities that are small within its area, this includes poor or rural communities.

SBDM, with geographical coordinates: $33^{0}57'S$ $25^{0}36'E$ consists of seven local municipalities, namely, Koukamma, Dr Beyers Naude, Kouga, Blue crane route, Sundays River Valley, Ndlambe and Makana (Sarah Baartman District Municipality, 2016) (See Fig. 2.1). Kouga local municipality was used for the Knowledge, attitudes and practices study, the local municipality was used due to

its industrial nature, most of its industries' employees come from surrounding small townships (See Fig. 2.2). Kouga local municipality consists of both low-middle socio-economic areas, and middle socioeconomic areas, formal settlements consisting of brick houses and informal settlements consisting of shacks; it is categorised as a warm and moist region. During a visit to the study area in 2021 it was noted that there were several factors associated with the occurrence of intestinal parasite in the SBDM area, among which is inadequate sanitation and poor hygiene. For example, it was observed that the bucket system toilets were still in use in some residential areas in the study area, this could have an impact on the hygiene and sanitation practices of people.



Fig

2.1: A map depicting Sarah Baartman District, the study area (https://www.municipalities.co.za-Sarah Baartman District -Eastern-Cape)

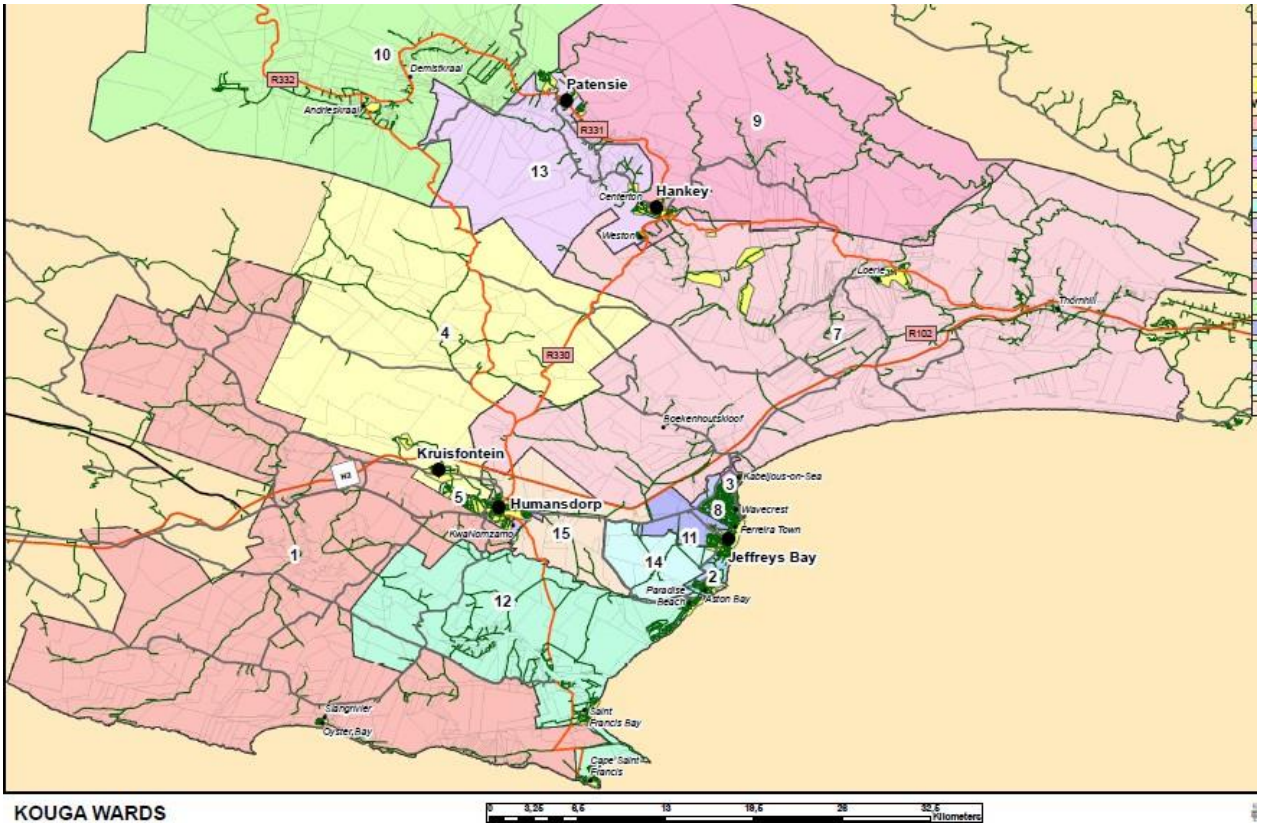


Fig 2.2: A map of Kouga local municipality, a local municipality in the study area (Obtained from the Sarah Baartman District GIS, 01 November 2021)

An informal settlement residential area was observed also during the same visit which is a factor that contributes towards socio-economic factors that are associated with intestinal parasites. The EPWP and CWP programmes aim for the provision of skills development. EPWP and CWP general workers perform amongst many functions; agricultural work (planting vegetation), see Fig. 2.3 Fig 2.4, cultivating land, clearing illegal dumping sites, see Fig 2.5 and 2.6, this function poses a risk of being infected by intestinal parasite as a source of intestinal parasite transmission is contaminated soil.

Fig 2.3: A picture of a residential area where functions are performed in the study area (Source: the picture was captured by the researcher during a site visit conducted in November 2021)

Fig 2.4. A picture of the study participants irrigating and harvesting vegetables in one of the sites (Source: The picture was taken by the CWP Manager during one of the monthly site visits in April 2022, permission was obtained to use pictures)

Fig 2.5: A picture of the study participants clearing illegally dumped waste in one of the residential areas in the study area (Source: The picture was captured by the CWP Manager during one of the monthly site visits in April 2022).

Fig 2:6: An animal spotted scavenging in one of the dumping sites on which the study participants work (Source: The picture was captured by the CWP Manager during one of the monthly site visits in April 2022)

3.3.2. Study design

A quantitative cross-sectional research design was used in the study, where a structured questionnaire of 31 close-ended questions categorised as demographics, knowledge, attitudes, and practices was used for data collection.

3.3.3. Study population

According to the 2019 statistics the SBDM has 527,000 residents, it covers 7.2% of Eastern Cape population Kouga local municipality was used to collect data on the KAP of EPWP and CWP general workers. According to the Kouga Sub District District Health Information System (DHIS) (2020), the SBDM has 50 EPWP general workers and 210 CWP. SBDM was used for the prevalence study. The EPWP and CWP general workers work two days per week- Mondays and Tuesdays, while another group works on Thursdays and Fridays. The study was therefore done on the days during which the EPWP general workers and CWP general workers were not at work. Fifty (50) EPWP general workers and two hundred and ten (210) CWP general workers participated in the study; considering the inclusion and exclusion criteria and the participants who have consented to be part of the study.

The group of EPWP and CWP general workers that were included in the study were public workers comprising EPWP and CWP general workers from 18 to 60 years (retirement age), and those who consented to participate in the study. The excluded group from the study were public workers comprised of EPWP and CWP general workers of ages below 18 years and above 60 years, which amount to 15, or EPWP and CWP general workers who did not consent to participate in the study.

3.3.4. Sampling method and sample size determination

The sample size was determined using Slovin's formula (Rono, 2018)

n= The sample size

N=The population size :260

e=Margin of error:5%

$n = N / (1+Ne^2)$

n=158

Also based on the population of 260 public workers made up of 50 EPWP general workers and 210 CWP general workers, and an acceptable margin of error of 5% at a 95% level of confidence, a minimum sample size of 158 public workers was used for the KAP phase (first phase).

3.3.5. Questionnaire design

Data was collected using the telephonic interview method, a structured KAP questionnaire was used (Annexure A (1&2). The questionnaire was adapted from a previous study conducted at the Nelson Mandela Bay Municipality, under the Nelson Mandela University (Gall et al., 2017). The questionnaire which was administered telephonically using the interview method consisted of thirty-one (31) questions grouped into four sections, namely-: the demographics section, knowledge section, attitudes section, and the practices section. It took on average 15-20 minutes for the participants to telephonically answer the questionnaire. The demographics section consisted of six (6) close-ended questions, the knowledge section consisted of nine (9) close-ended questions, the attitudes section consisted four (4) close-ended questions, the practices section consisted thirteen (13) close-ended questions, the questions were categorised using coding. The language that was used on the questionnaire for Xhosa-speaking participants was IsiXhosa, which is the researcher's Home/Native Language. The Language to which the researcher translated the questionnaire responses, was English which is the researcher's First Additional Language, English-speaking participants were

interviewed using the English questionnaire. The researcher has previous experience in response translation between IsiXhosa and English, this was acquired during her fourth year of study in the Bachelor of Environmental Health Undergraduate Studies, this ensured accurate translation and back translation.

3.3.6. Pilot study

The questionnaire for data collection was tested through a pilot study in the study area. The pilot study was conducted in SBDM with a group of randomly selected six (6) EPWP general workers who were excluded from the main study. The pilot study was conducted telephonically by the researcher. The feedback and findings obtained from the pilot study was vital in updating the questionnaire for use in the main study. The pilot study was used to assess ambiguity of questions and to highlight unclear questions for correction and proper interpretation where needed.

3.3.7. Validity and reliability

Validity is the extent to which the methods measure what they are supposed to measure (Mohajan, 2017). Reliability is the extent to which the results can be reproduced when the research is repeated under the same conditions (Sürücü & Maslakçi, 2020). Reliability is about how consistent the method will be, and validity is about how accurate the method will be (Heale & Twycross, 2015). To ensure reliability, the same questionnaire was used for all participants. Prior to the interview, the researcher confirmed with each participant whether they were in a conducive environment, to hear and give response to the questions. A second measure to ensure the reliability of the responses was to inform each participant that they need to solely answer the questionnaires by themselves, this was monitored through consistency in the voice responding from the participant's side. To ensure reliability the questions were designed in simple terms for ease in understanding and were written in isiXhosa, for the elimination of the chances of misinterpretation of questions.

To ensure content and face validity the data collecting questionnaires were submitted to five Environmental Health Practitioners who are familiar with the content of intestinal parasites and the supervisory team for review. The questionnaire did not consist of sensitive content, which could make participants feel discriminated, and was also designed to ensure ease of response, no ambiguity was on the questions in the questionnaire and lastly, the questionnaires were designed in a way that corresponded to the objectives of or in a way that was relevant to the desired end results of the study.

To ensure that the participants do not bear the cost of the telephonic interview, the researcher contacted the participants using normal phone calls which only were at the cost of the researcher who was initiating the call. In order to ensure participants' responses were well captured, the telephonic interviews were recorded using a recorder after participants were informed of the recording.

3.4. DATA COLLECTION

The data collection was done using the telephonic interview method, a structured KAP questionnaire was used. Consent forms for EPWP workers who would like to participate in the study were handed to the EPWP and CWP general workers manager during a monthly meeting held between the manager and the EPWP and CWP general workers who in turn handed the informed consent forms to the EPWP and CWP general workers, the consent forms were then collected by the researcher from the EPWP and CWP manager. To ensure covid 19 compliance during this step, a sanitizer was provided by the researcher to the EPWP general workers' Manager and was used to sanitize hands between the handing of consent forms.

The informed consent forms handed to the participants indicated that participants would be contacted telephonically and provision would be made in the form for the proposed participants to indicate their contact numbers, if they would like to participate in the study. After receiving consent, the researcher contacted participants using normal phone calls; and a recorder was used to record the phone calls. Filled-in consent forms were returned to a secured box in the EPWP workers meeting hall, the box was secured in a way that only the researcher could be able to open it and to ensure that the researcher was the only one who had access to the completed consent forms.

The public workers in the study area were mostly IsiXhosa speaking so the researcher asked the questions in iSiXhosa, following the collection of data, the researcher back translated the answers to English and noted down all the responses of the participants. The questionnaires were developed and amended based on a questionnaire that was previously used for a similar study, conducted under the Nelson Mandela University (Gall et al., 2017). Data collection was done over 14 weeks, this was done taking into consideration the participants' availability.

3.5. DATA ANALYSIS

Data was analysed using descriptive and inferential statistics. The participants responses were captured and analysed on Microsoft Excel. A Biostatistician conducted the data analysis. Data was analysed using SPSS version 16.1 software. Processing and analysis of data is elaborated on below:

In order to process the data the data errors had to be checked first and calculation of scores from Part A: Demography, Part B: Knowledge, Part C: Attitudes and Part D: Practices were summed up from a total of 260 public workers comprised of EPWP and CWP general workers in SBDM– Participants who gave consent for the study were 170; 160 participants participated in the study. Public workers that were excluded from the study as a result of inclusion/exclusion criteria were 10. The following steps were followed to process the quantitative data. Data cleaning: Data cleaning and data exploration was the first step employed in data processing as means to rectify inconsistencies in the data. It involved data inspection and the questionnaire scrutiny for data errors. Data cleaning was done through the verification of all questionnaire responses to check for repetitions, and possible errors.

Data coding: The step implemented after data cleaning was data coding. Data under each section of the questionnaire was transformed into simplified numbers to allow for capturing and analysing data. Data coding was done for all the KAP sections in the questionnaire.

Data capturing: The researcher captured the data; this was done using an Excel spreadsheet which was formulated using pre-coded data from the data collection tool.

Scores calculated for the KAP factors: For descriptive statistics, the following were reported: the frequency distributions, percentage, cumulative percent, and valid percent. Inferential statistics were calculated in order to check if there was a relationship between the different sections of the study, for example the Pearson Chi-Square, p-value/ Asymptotic Standard error.

Under knowledge, the following scores were given; for questions that had Yes, No and Not sure responses, 1 was given for yes, which is the 'Right answer' and 2 was given to No and Not Sure, which are the 'Wrong answers', for Q9 which was "which options can help prevent or control the occurrence of Intestinal parasites" and Q10 which was "which groups are highly susceptible to intestinal parasites", a full score of 6 was given for correctly mentioning all six responses, which were; pregnant women, children, elderly people, sick people, illiterate people, people who don't practice hygiene Halfalf the score was given for correctly mentioning three (3) of the responses. Each correct response scores one mark. Asymptotic Standard error was used to check how accurate the mean of the sample from the population is likely to be, compared to the real population mean. The asymptotic significance is the p-value. Pearson Chi-Square tests were conducted to investigate the further association between different variables. Furthermore, hypothesis testing was conducted with a significance level of $p = 0.05$. If the p-value is less than 0.05 ($p < 0.050$) it indicates that there is a

statistically significant relationship between different variables. If the p-value is more than 0.05 (p>0.050), it indicates that there is no significant relationship between variables.

3.6. RESULTS AND DISCUSSION

3.6.1. Demographic and associated risk factors among participants

The study was comprised of a total of 160 study participants, consisting of 136 (85%) females and 24 (15%) males. Most of the study participants were female participants. Public workers comprising EPWP and CWP general workers had the questionnaire telephonically administered to them. Study participants were grouped into four age-groups, namely 18-28 years, 29-39 years, 40-50 years and 51-59 years, as shown in Table 1. Most of the study participants 55 (34.4%) were between ages of 29-39 years. The majority 89 (55.6%) of the study participants resided in townships. A total of 98 (61.3%) participants used piped water into building as a water source, while 14 (18.8%) participants made use of jojo tanks. A majority of the study participants 78 (48.8%) had flush toilets and a total of 5 (3.1%) participants did not have toilet facilities and therefore practiced open defecation (Table 1). A previous study in Yemen, revealed that a total of 50.6% of the study participants resided near a sewerage. A study conducted in Iran in 2022 on intestinal parasite infections among patients referred to hospital revealed that age and gender may be a risk factor for higher intestinal parasite infections, with people between the ages of 7 and 15 years and people above 50 years being most at risk. males have been found to be the ones who get infected with intestinal parasites most easily. Underlying health conditions and a compromised immune system also form part of the intestinal parasite infection risk factors (Teimouri, 2022).

Table 1: The Demographic characteristics of the study participants

Characteristic	Number of Participants	Percentage
Gender		
Female	136	85.0
Males	24	15.0
Total	160	100
Age		
18-28	28	17.5
29-39	55	34.4
40-50	48	30.0

51-59	29	18.1
Total	160	100
Residence		
Township	89	55.6
Suburb	20	12.5
Rural	6	3.8
Other	45	28.1
Total	160	100
Water source		
Private tap	98	61.3
Private tap, Tanker-truck	1	.6
Private tap, bought	1	.6
Public tap, private tap	1	.6
Tanker-truck	6	3.8
Tanker-truck, bought	4	2.5
Bought	3	1.9
Jojo tank	14	8.8
Public tap	29	18.1
Public tap, Tanker-truck	2	1.3
Missing	1	.6
Total	160	100
Toilet		
Flush toilet / Pour flush	78	48.8
Pit latrine	8	5.0
Composting toilet	3	1.9
Bucket	64	40.0
Hanging toilet	5	3.1
Missing	2	1.25
Total	160	100

3.6.2. Intestinal parasites awareness of participants

A total of 103 (64.4%) of study participants admitted had the correct knowledge of intestinal parasite infection and 56 (35.6%) of the study participants had incorrect knowledge relating to intestinal parasites (See Table 2). Out of the 103 study participants who admitted to have the correct knowledge about intestinal parasites, 86 (53.8%) participants said they knew about the tapeworm which falls under a category of intestinal parasites, and 6 (3.8%) study participants knew about the soil transmitted intestinal parasites (See Figure 3.1). A study conducted in Yemen in 2020 found that a percentage of (40.5%) of the participants between ages of 18 and 60 years had poor knowledge about intestinal parasites. The study also perceived that a high number of participants were unaware of the intestinal parasite modes of transmission (65.7%), a total of 47.3% of the participants knew about the symptoms of the infection, this limited or lack of knowledge was associated with a lack of health education and ignorance (Alharazi et al., 2020).

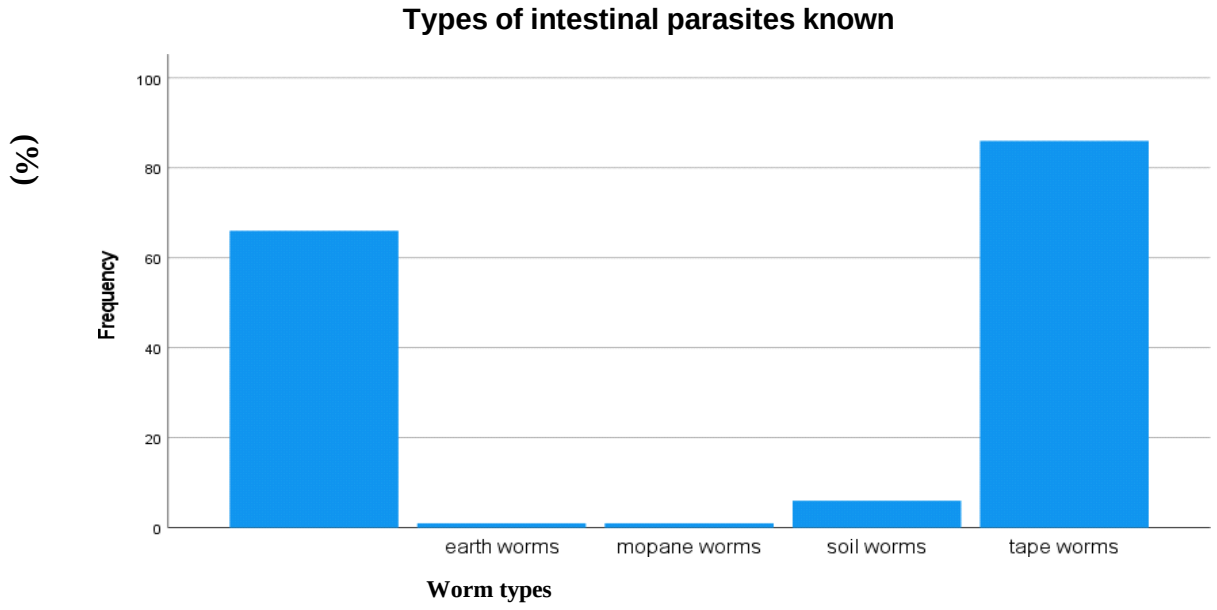


Figure 3.1: Other Intestinal parasite types known to study participants

A total of 139 (86.9%) study participants knew about the correct sources of intestinal parasite infection, and the remaining total of 20 (12.5%) study participants gave incorrect responses that intestinal parasites were transmitted through excess candy consumption. Most of the study participants 62 (38.8%) gave responses that they had heard about intestinal parasites from friends and relatives (See Table 2), who were not reliable sources unless they had a background of the

infection knowledge. Out of the total of 160 (100%) study participants 118 (74.1%) responded correctly that they knew about the practice of hand-washing before preparing food inorder to prevent infection with intestinal parasites, whereas 42 (25.9%) of the study participants did not list hand-washing before food preparation as a practice for intestinal parasite prevention (See Table 2).

Table 2: Knowledge of participants on intestinal parasites

Knowledge Question	Number of Participants	Percent
Knowledge on intestinal parasites		
Yes	136	85.0
No	24	15.0
Not sure	0	0
Total	160	100
Source of intestinal parasite knowledge		
Community meetings	20	12.5
Hospital/clinic	20	12.5
Relatives/friends	62	38.8
Media	8	5.0
Total	160	100.0
Intestinal parasite human-to-human transmission		
Yes	39	24.4
No	68	42.5
Not sure	52	32.5

Missing	1	.6
Total	160	100.0
Intestinal parasite zoonotic transmission		
Yes	66	41.3
No	50	31.3
Not sure	41	25.6
Missing	3	1.9
Total	160	100.0

Most of the study participants correctly responded that children, followed by sick people were individuals most at risk of being infected by intestinal parasites. A total of 68 (42.5%) study participants had inadequate knowledge on whether intestinal parasites could not be transmitted from person to person, whereas a total of 52 (32.5%) study participants responded that they were not sure if intestinal parasites could be transmitted from one person to another, apart from this number a total of 39 (24.4%) participants correctly responded that intestinal parasites were transmittable from person to person (See Table 2). When asked about the zoonotic transmission of intestinal parasites, 66 (41.3%) study participants had adequate knowledge on intestinal parasites being zoonotic (Hailegebriel, 2017). A total of 82 (60%) of the study participants correctly indicated that ingestion was the route of transmission of intestinal parasites, whereas 19 (14%) of the study participants also had adequate knowledge on absorption being a route of transmission for intestinal parasites (See Figure 3.2).

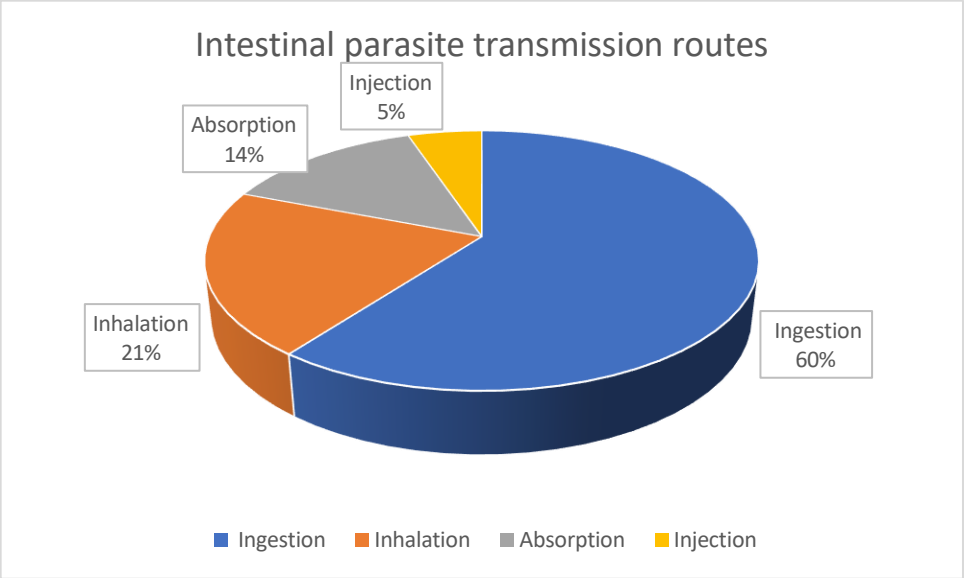


Figure 3.2: Knowledge of participants on the transmission routes of intestinal parasites

A total of 42 (26.3%) study participants correctly indicated abdominal pain as a symptom of intestinal parasite infection, 69 (43%) of the study participants correctly indicated ringworms as symptoms of the intestinal parasite infection. Previous literature has indicated that 52.7% study participants had the correct knowledge on the symptoms of intestinal parasites, 55.6% study participants had the correct knowledge about the intestinal parasite prevention measures, a total of 65.7% of the study participants however did not have the correct knowledge on the modes of transmission through which intestinal parasites can be transmitted (Gebreyohanns et al., 2018).

3.6.3. Attitudes towards intestinal parasites among participants

A total of 61 (38%) of study participants correctly responded that the health workers are responsible for ensuring that they know of hygienic practices that help prevent intestinal parasites at work, in addition to these, 19 (11.9%) study participants correctly responded that their supervisor was responsible for ensuring that as employees they know about hygienic practices that prevent the occurrence of intestinal parasites. A majority of the study participants 89 (55.6%) correctly responded that intestinal parasites were an important infection people need to know about (See Figure 3.3). Similar trends were found in a study in Yemen, the trends were associated with a lack of knowledge and education on the participants (Alharazi et al., 2020).

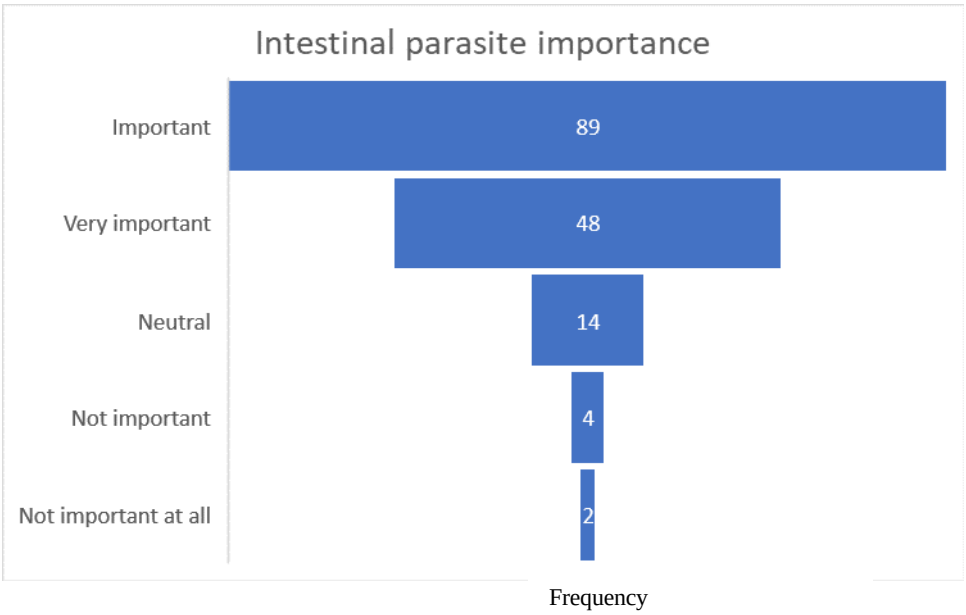


Figure 3.3: Attitudes of participants on intestinal parasite importance

3.6.4. Practices relating to intestinal parasites among participants

Table 3: Practices on intestinal parasite prevention

Practices	Number of Participants (N)	Percentage (%)
Washing of fruit and vegetables before consumption		
Yes	135	84.4
No	16	10.0
Sometimes	7	4.4
Missing	2	1.25
Total	160	100
Nail Cutting Intervals		
Daily	38	23.8

Once a week	58	36.3
Once a month	8	5.0
I do not cut them	1	.6
Other	55	34.4
Total	160	100
Handwear at work		
Construction gloves	52	32.5
Construction gloves, rubber gloves	2	1.3
Construction gloves & Surgical gloves	1	.6
Rubber gloves	48	30.0
Surgical gloves	24	15.0
Nothing	33	20.6
Total	160	100

Out of 160 (100%) study participants, a total of 135 (84.4%) of participants correctly expressed that they wash fruit and vegetable before they eat, whereas 16 (10%) incorrectly said they do not (See Table 3). Most participants 58 (36.3%) correctly said they cut their nails once weekly. Intestinal parasites can stay under unclean or unwashed nails following an act in which one became in contact with contaminated soil, contaminated water, contaminated vegetables and contaminated feaces. A total of 52 (32.5%) study participants correctly said they wore construction gloves when performing their duties, and 48 (30%) participants correctly said they wore rubber gloves when performing their duties, and 33 (20.6%) participants incorrectly responded that they wore nothing when performing duties (See Table 3). A total of 101 (63.1%) study participants correctly responded that they washed their hands with water and soap. A total of 115 (71.9%) participants correctly said they had never been infected with intestinal parasites before (See Figure 3.4). 98 (68.3%) participants correctly responded that they had never been dewormed for intestinal parasites, while 21 (13.1%) provided

information that they had been dewormed when they were younger but could not remember the exact time period. A total of 54 (34%) study participants performed safe intestinal parasite preventative practices, as they wore construction gloves when on duty. A previous study on the same subject found similar results, where 25.7% participants responded that they 'sometimes' washed their hands before eating, and a total of 26% participants were not washing their hands after using the toilet, these practices put individuals on a higher risk of getting infected with intestinal parasites, as they get exposed to sources of the intestinal parasite infection. A total of 43.4% of the study participants said they wore shoes 'sometimes' when they go outside, the same study also revealed that 68.6% of the study participants did cut their nails regularly (Gebreyohanns et al., 2018). This information was associated with a lack of sanitation services and a lack of knowledge relating to intestinal parasite prevention.

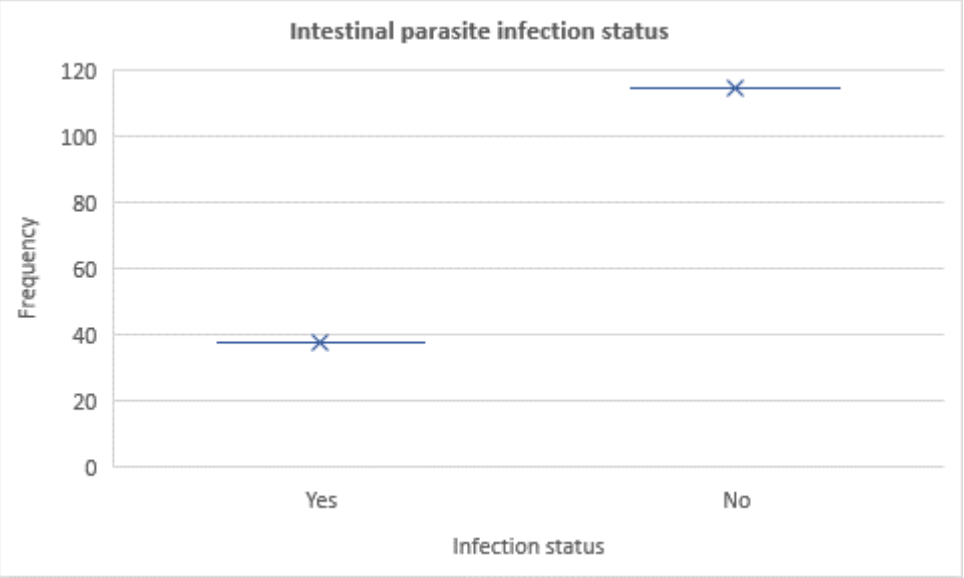


Figure 3.4: Participants knowledge on their history of intestinal parasite infection

3.6.5. Comparative evaluation of Knowledge and attitudes relating to intestinal parasites and the demographic variables among participants

The relationship between the age of participants and how they responded to the questions was assessed using Chi square test and there was no significant relationship (i.e. p=>0.05) between age and the response to the question of knowledge about intestinal parasites types, 75.9% of Age-group 4 (51-59years) participants knew about intestinal parasites, while 50 % of Age-group 1 (18-28years) study participants knew about intestinal parasites, while 39% of Age-group 2 (29-39years) knew about intestinal parasites and 30% of Age-group 3 (40-50years) knew about intestinal parasites. This suggests a possibility that the older they get, the better they know and the younger they are the

lesser they may know about intestinal parasites The relationship between the age of the study participants and their knowledge of prevention measures for intestinal parasites was assessed and there was a significant relationship between age and knowledge of study participants on prevention measures $p<0.05$ ($p=0.048$). Age group 1 (18-28years) (80.8% of study participants) showed more knowledge on the prevention of intestinal parasites compared to Age group 4 (51-59 years). Association between the age of the study participants and who the participants think is at risk of getting intestinal parasite infection showed no significant relationship ($p>0.05$). Age group 4 (51-59years) had a total of 75.9% participants who had positive attitudes on who is at risk of getting infected with intestinal parasites. A total of 79.6% of the study participants within Age group 2 (29-39years) did not have positive attitudes to intestinal parasites being transmitted from one person to another, the relationship between intestinal parasite transmission from one person to another and the responses was therefore statistically insignificant ($p>0.05$). This brings the assumption that participants are likely to be more aware of intestinal parasites preventative measures when they exit their teenage years. Previous studies have revealed that health education plays a huge role on the general practices of communities inorder to prevent intestinal parasites, this can lead to the conclusion that age alone cannot determine the amount of knowledge an individual has, as knowledge can be obtained at any age (Bhat et al., 2013). There is therefore no statistically significant relationship between age and knowledge.

3.6.6. Gender related differences in knowledge and practices of study participants

A relationship between the gender of the study participants and participant's knowledge about intestinal parasites was assessed using Chi Square test, and a significant relationship was discovered ($p<0.05$) $p=0.010$. Females (68.9%) gave more correct responses to the question. A statistically insignificant ($p>0.05$) relationship was observed between Gender and knowledge of preventative measures. A total of 62.5% male study participants had more correct knowledge on the preventative measures of intestinal parasites as compared to females (37.5%). The relationship between gender responses and the responses to the knowledge question on who is at risk of getting infected with intestinal parasites was statistically significant ($p<0.05$). The gender that gave most of the correct responses to who is at risk of getting infected with intestinal parasites were females with a percentage of 72.4%. Most male study participants responded that they did not know whether they had been infected with intestinal parasites in the past. A total of 74% male study participants did not follow the correct practices for the prevention of intestinal parasites, such as the washing of hands after using the toilet, washing hands after cleaning. A total of 62% of males in the study gave

responses that they do not wear any gloves when performing their duties. A total of 64% females gave responses that they cut their nails once weekly, whereas 34% males gave responses that they cut their nails once every week, and the remaining 66% gave responses that they cut their nails once monthly. Previous literature reveals that females individuals had the highest infection of intestinal parasites as compared to males. In a study conducted in Yemen, the intestinal parasites with more female cases were *Entamoeba histolytica* followed by *Hymenolepis nana, Giardia lamblia, A. lumbricoides, Enterobius vermicularis, and Trichuris trichiura.* A study conducted in Mthatha, South Africa on the prevalence of intestinal parasites revealed that a majority of female participants did not have the correct knowledge on intestinal parasites (Bhat et al., 2013). The same study further revealed that *A. lumbricoides* was the most common parasite amongst participants, followed by *Giardia lamblia, Entamoeba histolytica, followed by Hymnelopis nana, Iodamoeba butschlii, Trichuris trichiura, Taenia spp, Chilomastix mesnili, Fasciola spp, Entamoeba coli, Endolimax nana*. In a study conducted in Yemen, most females were infected with *Entamoeba histolytica* followed by *Hymenolepis nana, Giardia lamblia, A. lumbricoides, Enterobius vermicularis, and Trichuris trichiura.*

3.6.7. Residence related differences in knowledge, attitudes and practices of participants

A total of 83.3% participants who reside in informal settlements new about the different types of intestinal parasites. The relationship between the type of residence and the responses on the knowledge and the practices of intestinal parasites was assessed. There was a statistically significant relationship ($p<0.05$) $p=0.022$ discovered between the type of residences the study participants resided in and the participants' responses to whether they know about the different types of intestinal parasites. A previous study revealed that individuals who reside in informal settlements close to sewerage manholes gave 68% correct knowledge responses on how to the control and prevent infection with intestinal parasites (Teimouri, 2022). A total of 58% study participants in the same study had adequate responses to the attitude's questions relating to the infection with intestinal parasites, but due to the location of the residences of these individuals, the practices which they performed, such as walking barefoot outside, when there could be possible infection through sewer overflows, this therefore made the study participants more prone to getting infected with intestinal parasites (Hailegebriel, 2017).

3.7. CHAPTER SUMMARY

This chapter has presented the findings of the current KAP of the study participants in the study. The study participants response rate to the KAP among study participants together with demographic details among the study participants, together with the environmental and associated risk factors

which surround study participants were outlined. The results of the study revealed that the overall knowledge, attitudes and practices of the study participants minimal and poor. On the knowledge section, the more elderly participants seemed to know more about intestinal parasites than the younger participants. Participants between age group 18 and 28 years had adequate knowledge on the prevention of intestinal parasites compared to age group 51 to 59 years. Based on the knowledge results of the sampled population the researcher can conclude that the knowledge of the study participants relating to intestinal parasites is poor. Surprisingly enough, the study participants revealed that their attitude towards intestinal parasites was that intestinal parasites are an important infection that all people need to know about. A majority of the participants followed the correct hygiene practices to avoid infection with intestinal parasites which included washing fruit and vegetables before eating them, washing hands after using the toilets, washing hands before preparing food, and by not walking barefoot. Based on the practice results the researcher can conclude that the sampled participants practices are fairly good. This was also confirmed by previous studies that most participants who are above the age of 18 years performed safe hygiene practices to prevent intestinal parasites (Gebreyohanns et al., 2018). Regarding knowledge on intestinal parasites responses relating to age, it was observed that participants of the Age-group 51-59 years had more knowledge about intestinal parasites compared to Age-group 18-28 years study participants. The findings also revealed that there was no significant relationship ($p=>0.05$) between age and the response to the question of knowledge about intestinal parasites types. Age group 18-28years study participants showed more knowledge on the prevention of intestinal parasites compared to Age group 51-59 years. The findings further revealed that there was a significant relationship between age and knowledge of study participants on prevention measures $p<0.05$ ($p=0.048$). These findings are important to help come up with health education programmes which can help play an effective role, especially those between the ages 18 and 59 years. These programmes can help enhance knowledge, attitudes and improve practices of participants in order to prevent and control intestinal parasites. In addition to this, channels which can be more effective which can used to communicate this is disseminating information through radio stations, health facilities; in the form of pamphlets. In order to achieve this there must be a link between EPWP and CWP Managerial committee, health workers and the media. The overall recommendations, synthesis and limitations are to be provided in Chapter five.

CHAPTER FOUR

PREVALENCE STUDY OF INTESTINAL PARASITES IN SARAH BAARTMAN DISTRICT FROM 2012 TO 2020

ABSTRACT

Background: Intestinal parasites also known as parasitic worms affect at least 3.5 billion people with more than 200,000 deaths worldwide yearly. Using secondary data, the researcher established the prevalence of intestinal parasites in SBDM from 2012 to 2020.

Methods: Data on the prevalence of intestinal parasites was obtained from the SBDM NHLS and was captured on an excel spreadsheet and analysed using Statistica version 13 software.

Results: The findings revealed that from the year 2012 to 2020 96 (46.3%) people in SBDM were infected with intestinal parasites. This meant that there was prevalence of below half of the population in the study area from 2012 to 2020. The prevalence population ranged from 1 year to 86 years. The average mean age in the study area was 25.16 with the age median being 27.50. Forty-four (44) females and fifty-two (52) males formed part of the study. The findings revealed that males were more (53.1%) infected with intestinal parasites than females (46.9%) from the year 2012 to 2022. The age group with the highest number of intestinal parasite infection were ages 31 to 36 years. The leading intestinal parasites in SBDM were found to be *Cytoisospora belli* (35.4%) and *Giardia lamblia* (35.4%), followed by *A. lumbricoides* (17.7%), *Trichuris trichiura* (3%), Taenia species (2%). Makana local municipality reported the highest number of intestinal parasites infections, followed by Kouga local municipality. The findings revealed that there is no statistically significant relationship between intestinal parasite infection and age.

Conclusion: The findings brought the researcher to the conclusion that *Cystosoisospora belli* and *Giardia lamblia* were the most common intestinal parasites from 2012 to 2020 in SBDM. The highest infection was found amongst individuals of ages 31 to 36 years from 2012 to 2020, also more males were found to have the infection in the study area.. Makana local municipality and Kouga local municipality were the two local municipalities with high intestinal parasites infection. These findings are vital in designing interventions for intestinal parasites prevention and control in the study area.

Keywords: Intestinal parasites, Prevalence, Sarah Baartman District Municipality, Kouga local municipality, Makana local municipality, Ndlambe local municipality, Blue crane local municipality,

Sundays River Valley local municipality, Koukamma local municipality, Dr Beyers Naude local municipality.

4.1. INTRODUCTION

This chapter will focus on the description of the research design and the methods used in assessing the retrospective prevalence of intestinal parasites in the study. Findings from secondary data collection based on the objective of this chapter will also be discussed.

4.2. BACKGROUND

Intestinal parasites, also known as intestinal worms are of global concern and are caused by nematodes acquired through unhygienic practices. According to Hajare et al., (2021) intestinal parasites affect around 3.5 billion people with more than 200,000 deaths reported yearly worldwide. Intestinal parasites pose a serious public health burden, and the most common species of intestinal parasites include Blastocystis hominis, *Giardia lamblia*, *Entamoeba histolytica*, *Enterobius vermicularis*, *Hymenolepis nana*, *Echinococcus species*, *Hymenolepis diminuta*, *Ascaris lumbricoides*, *Trichuris trichiura*, *Cystoisospora belli*, *Hymenolepis nana*, *Schistosoma haematobium*, *Taenia species* and hookworms (Teimouri et al., 2022). Humans could be infected via contact with contaminated soil, direct or indirect contact with contaminated food, vegetables contaminated with human feces and through walking bare footed on contaminated soil (CDC, 2020). Intestinal parasites infect both adults and children, these infections are caused by intestinal helminths and intestinal protozoan (Eyayu et al., 2021). Worldwide, intestinal parasites have become a global health challenge and are highly prevalent, especially in developing countries (Teimouri et al., 2022).

Intestinal parasites pose a serious public health burden, and the most common species of intestinal parasites include *Blastocystis hominis*, *Giardia lamblia*, *Entamoeba histolytica*, *Enterobius vermicularis*, *Hymenolepis nana*, *Echinococcus species, Hymenolepis diminuta, Ascaris lumbricoides*, *Trichuris trichiura*, *Cystoisospora belli*, *Hymenolepis nana*, *Schistosoma haematobium, Taenia species* and hookworms (Teimouri et al., 2022).

Intestinal parasite infections are prevalent in subtropical countries because of, amongst many reasons this is due to an increase in population density, poor sanitation conditions, poor public hygienic practices, inadequate toilet/ ablution facilities, contaminated food or water, malnutrition, low host resistance and changes in the environment. Lack of safe drinking water supplies and poor environmental sanitation conditions also form part of the sources of increased infection of intestinal parasites (Tigabu et al., 2019).

Intestinal parasites live in gastrointestinal tracts of the human host and can lead to infections such as amoebiasis, giardiasis, hookworm infections, strongyloidiasis, trichuriasis, ascariasis, tapeworm infection, trichinosis, and echinococcus infection. Ascariasis, trichiurasis, and amoebiasis are amongst common intestinal parasitic infections in the world (Eyayu et al., 2021). Symptoms of intestinal parasites include diarrhea, abdominal pain, weight loss, vomiting, loss of appetite, indigestion, bloating, constipation, nausea, weight loss, and intestinal blood loss. A prevalence of 30-60% has been reported globally on intestinal parasites (CDC, 2020). The study aim is to assess the prevalence of intestinal parasites over eight years in the SBDM.

4.3. MATERIALS AND METHODS

4.3.1. Study setting

SBDM is a district municipality located at the centre of the Eastern Cape province. SBDM is the largest district in land mass in the Eastern Cape. It covers about 58 242km^2. SBDM consists of seven local municipalities: Koukamma, Dr Beyers Naude, Kouga, Blue crane route, Sundays River Valley, Ndlambe and Makana. SBDM is surrounded by one metropolitan municipality and six district municipalities, namely, Nelson Mandela Bay Municipality, Chris Hani District Municipality, Amathole District Municipality, Pixley Ka Seme District Municipality, Eden District Municipality, Garden Route District Municipality, and Central Karoo District Municipality. SBDM is known for its scenery, agricultural, and wildlife culture. According to Wicaksana, (2016), 92% of the population in SBDM reside in houses, the same percentage gets clean water from the service provider. A total of 125 000 households had flush toilets and there were 14700 households without flush toilets. A sum of 129 200 households received refuse removal services and there are 22 800 households which do not have waste removal services (Wicaksana, 2016). NHLS receives samples from 30 health care facilities in the SBDM. These health facilities were distributed amongst the different local municipalities.

4.3.2. Study design

The study was quantitative and secondary data on intestinal parasites in the study area was collected from the NHLS, within SBDM region. The data provided details on the prevalence of intestinal parasites in SBDM from the year 2012 to 2020.

4.3.3. Sampling and data collection

Data on the prevalence of intestinal parasites in the study area was obtained from NHLS in SBDM region. This data made it possible to determine the demographic details of the patients and to the

prevalence of intestinal parasites in the study area from 2012 to 2020. SBDM NHLS provided complete and comprehensive enough data, which was then analysed in order to determine the prevalence of intestinal parasites in SBD from 2012 to 2020.

4.3.4. National Health Laboratory Service (NHLS)

4.3.4.1. Validity and reliability

The validity of the study was determined through face and content validity. Face validity was ensured by consulting a Statistician from the Nelson Mandela University who assisted in processing and analysing data from SBDM NHLS. Content validity of test items was based on the judgement of a panel of experts (Mohajan, 2017). The obtained data from SBDM NHLS was reviewed by the Supervisor and the Statistician in order to check if the data as retrieved was sufficient to achieve the research objective of the study. This ensured the content and face validity of the obtained data.

4.4. DATA ANALYSIS

The data from NHLS was captured on Microsoft excel and was analysed using Statistica version 13 software. The steps which were taken to process and analyse the quantitative data are determined below:

4.4.1. National Health Laboratory Service (NHLS)

Data cleaning: The obtained data was cleaned to remove incomplete information or details not relevant for the study. Only data relevant to the research objective and which met the inclusion and exclusion criteria was extracted and captured in a new spreadsheet for further analysis. The extracted data provided the demographic details and information on prevalence among patients aged 1 year to 86 years in SBDM over the period 2012 to 2020.

Data coding: Coding included changing the data into numerical values before data analysis. Coding was conducted for the demographic details of individuals in the study area who tested positive for intestinal parasites from 2012 to 2020.

Data capturing: The data from NHLS was then captured by the researcher in an excel spreadsheet using the codes determined from the pre-coding phase.

Descriptive statistics summarised and described the data, after an analysis was conducted using Statistica version 13 software. Inferential statistics calculations were made to give sample population statistics, and to determine the Chi^2 square values. Chi square tests were used to test relationships

between the different variables. The average mean, standard deviation, median, range, minimum and maximum were also derived from the obtained data.

Prevalence = number of existing cases/ total people tested x 100

=96/270 x 100

=46.37%

4.5. RESULTS AND DISCUSSIONS

This section of the study gives a description of the results of data obtained from NHLS and its discussions. This is presented below:

4.5.1. National Health Laboratory Service (NHLS)

4.5.1.1. Demographic characteristics

A total of 96 individuals' test results for intestinal parasites in SBDM were retrieved from year 2012 to 2020 as captured by the NHLS. The ages of individuals ranged from 1 year to 86 years. The average mean age in the study was 25.16 with the age median being 27.50. The age standard deviation of the study was 21.62. Out of 207 samples that were analysed by NHLS the results revealed a total prevalence of 46.37% (96) from 2012 to 2020 in SBDM.

Forty-four (44) females and fifty-two (52) males formed part of the study. Males were the ones who were most infected with intestinal parasites from 2012 to 2022 with a percentage of 53.1% and females had a percentage of 46.9% (See Fig 4.3). A study conducted in Biyem-Assi Younde, Cameroon in 2018 on human intestinal parasites reported a prevalence of 52,5% on males and 47,5% on females, this was because men were known to consume roasted beef & pork and other types of food on the roadside. Sometimes this was because the food had helminth eggs and protozoan cysts, because the food they consumed had been cooked under unhygienic conditions (Ekwale, 2019).

4.5.1.2. Common intestinal parasites in SBDM

SBDM has seven local municipalities Koukamma, Dr Beyers Naude, Kouga, Blue crane route, Sundays River Valley, Ndlambe and Makana, and out of the seven local municipalities, five local municipalities had positive intestinal parasite cases reported by NHLS. The leading intestinal parasites in the District and were *Cytoisospora belli* (35.4%) and *Giardia lamblia* (35.4%), followed by *Ascaris lumbricoides* (17.7%), *Trichuris trichiura* (3%), *Taenia species* (2%), followed by the rest

of the intestinal parasites and protozoa at 1%. A study conducted in Port Elizabeth, Eastern Cape on intestinal parasites in school children from 9 to 14 years in 2018 reported *Ascaris lumbricoides* as the most common intestinal parasites followed by *Trichuris trichiura*, there were no identified suspected causal factors associated to these infections (Htun et al., 2018). Common intestinal parasites which were reported in a study conducted among food handlers at Ethiopia in 2021 were *Entamoeba histolytica* and *Giardia lamblia,* these were said to be common due to low socio economic status indicators like the use of borehole water and poor personal hygiene (Hajare et al., 2021).

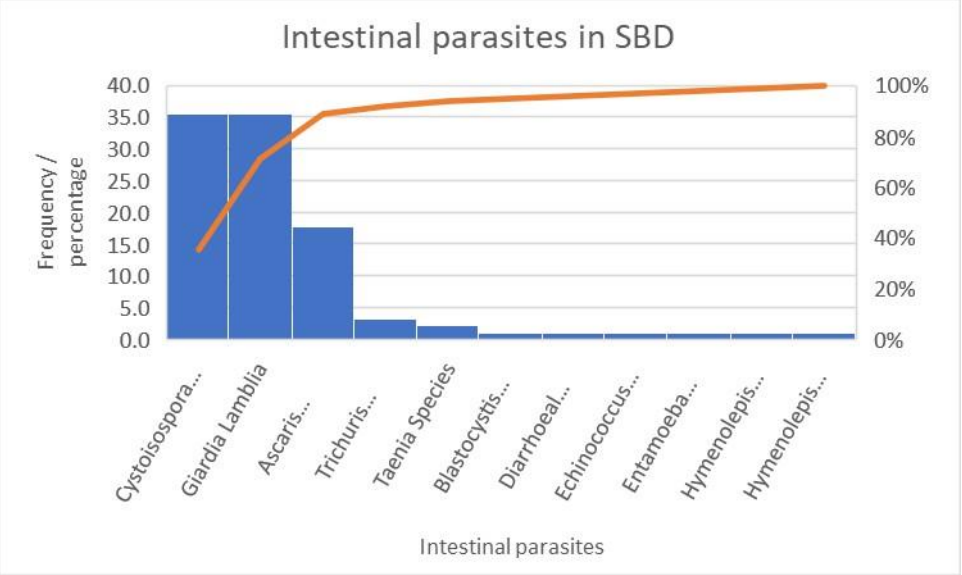


Figure 4.1: Common intestinal parasites in Sarah Baartman District Municipality

The intestinal parasite results received from NHLS consisted of hospital-diagnosed cases and results from stool samples. Cases of dual infection with more than one parasite were observed. Amongst the results of hospital diagnosed intestinal parasites from NHLS were *Cystoisospora belli* (36%), *Giardia lamblia* (35%), *Ascaris lumbricoides* (18%), *Trichuris trichiura* (3%), *Taenia species* (2%), *Entamoeba histolytica* (1%), *Echinococcus species* (1%), *Blastocystis hominis* (1%), *Hymenolepis nana* (1%), *Hymenolepis diminuta* (1%), and *diarrhoeal parasites*, which include *Cryptosporidium species*, *Giardia lamblia*, *Entamoeba histolytica* (1%).

4.5.1.3. Local municipalities in SBD with most cases of intestinal parasites

A total of 44.8% infections was reported from Makana local municipality and 31.3% of intestinal parasite cases was from Kouga local municipality, followed by Blue Crane Route local municipality with a percentage of 13.5%, Dr. Beyers Naude local municipality with 8.3% and Sundays River Valley

local municipality with 2.1%, Koukamma local municipality and Ndlambe local municipality had a prevalence of zero (0) (See Fig 4.2).

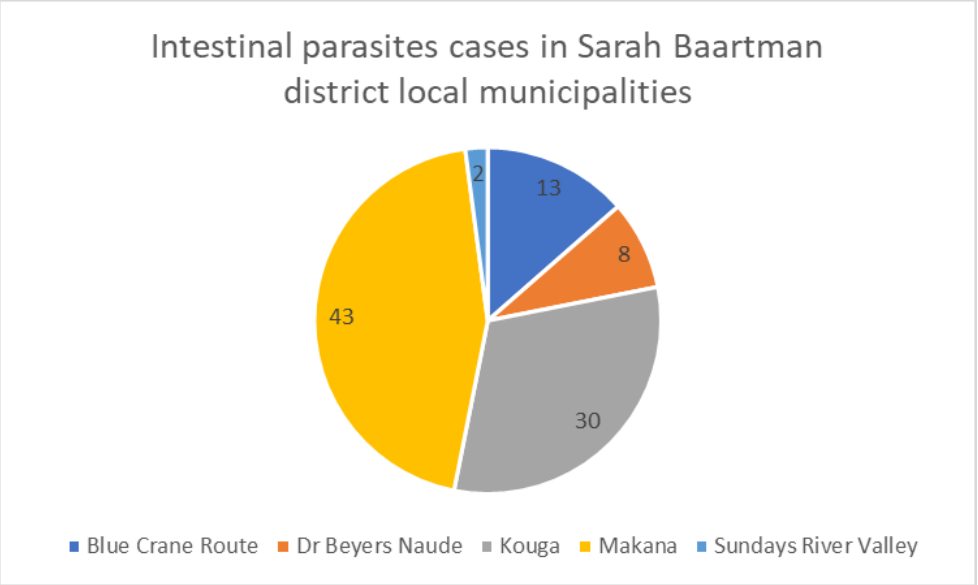


Figure 4.2: Intestinal parasite infections from 2012 to 2020

The secondary intestinal parasite data from the SBDM NHLS showed that Kouga local municipality was the second local municipality with high intestinal parasite infections in the SBDM. Figure 4.3 shows the different types of intestinal parasites that were found in Kouga local municipality from 2012 to 2020. *Giardia lamblia* was the most commonly found intestinal parasite in Kouga local municipality, followed by *Ascaris lumbricoides*, *Cystoisospora belli*, *Trichuris trichiura*, Diarrhoeal parasites, *Entamoeba histolytica* and *Hymenolepis diminuta*. Giardia lamblia is associated with easy spread through contact with contaminated surfaces including cold soil and water (Alharazi et al., 2020). The suspected associated cause in the study area is stagnant water which was observed during a visit by the researcher. Results from NHLS revealed that following the high intestinal parasite infection of children between ages one and six years the next age group with a high intestinal parasite infection were individuals between the ages of thirty-one and thirty six years, there was also a spike between age 21 and 26 years as compared to infection to other age group (See Fig. 4.1), this suggests that there is no statistically significant relationship between intestinal parasite infection and age for this study. However other factors such as the knowledge and attitudes of an individual relating to intestinal parasites, their practices, socio-economic factors as well as the demographics may have an impact on infection and transmission of intestinal parasites.

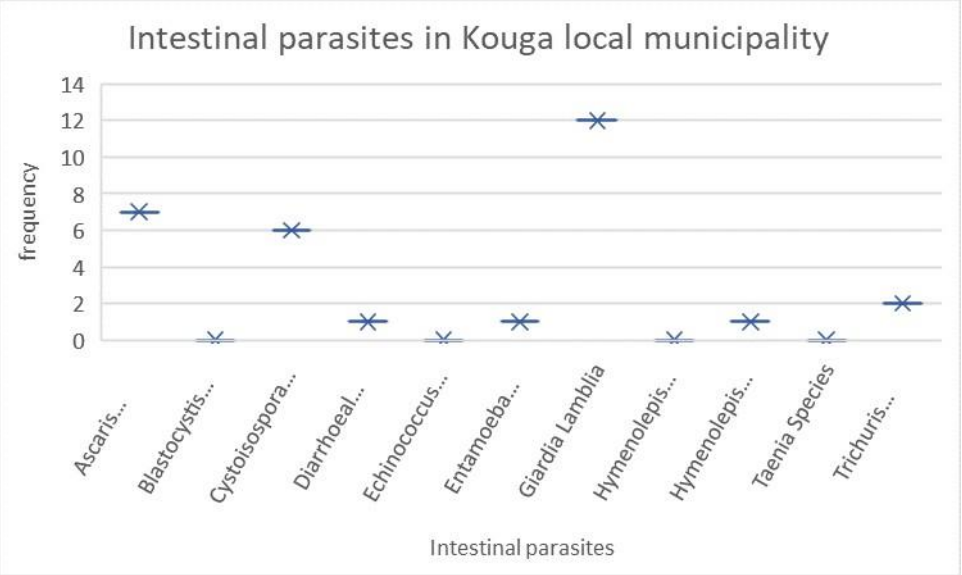


Figure 4.3: Intestinal parasite common in Kouga local municipality from 2012 to 2020

Previous literature has revealed that children between ages one (1) and six (6) are most at risk of getting infected with intestinal parasites, some studies have revealed that children have been mostly diagnosed with intestinal parasites. These results were obtained through stool sample evaluation and some through clinical diagnosis. A study conducted in Iraq in 2018 on the prevalence of intestinal parasites among participants between the ages of 1 year to 60 years had a *Giardiasis* prevalence of 9.7% for children between the ages of 1 to 10 years, 5.2% for participants of ages 11 and 15 years, and a prevalence of 2.9% for participants between 15 and 60 years. (Alsadoon et al., 2018). A study on intestinal parasites in Port Elizabeth, Eastern Cape amongst schoolchildren aged 9 to 12 years had a *Trichuris trichiura* and *Ascaris lumbricoides* prevalence of 60% in one school and 72% in another school (Müller, 2016).

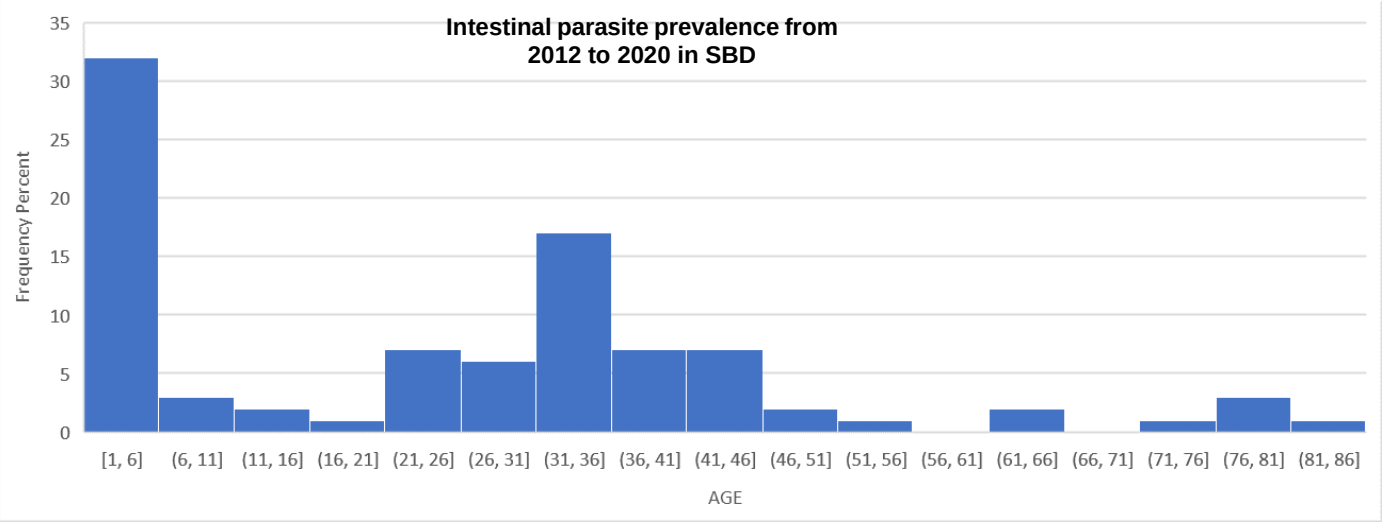


Figure 4.4: The ages of individuals who were positive for intestinal parasites from 2012 to 2020

The age with the most intestinal parasite infections was age group of 1 year to 6 years, followed by 22 to 35 years which was followed by individuals in the age group 36 to 60 years. These age groups were followed by individuals older than 60 years (See Fig 4.5).

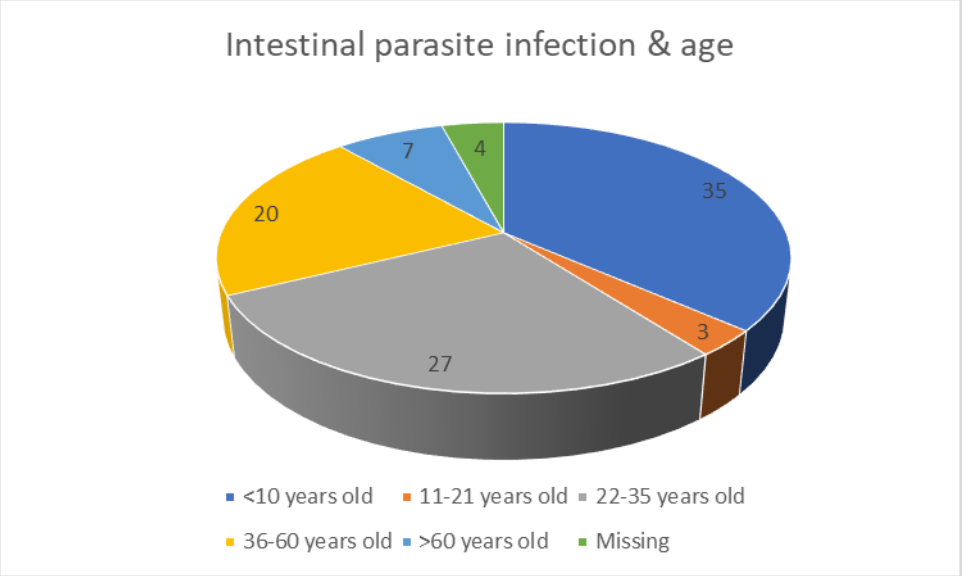


Figure 4.5: Intestinal parasite infection and ages infected from 2012 to 2020

During the collection of the KAP data by the researcher, it was observed that most male study participants gave responses of not having the correct knowledge on intestinal parasite infection. Most males (62%) gave responses that they practiced hand washing before eating and after using the toilet, which were correct responses. This may be a possible reason why more males had a high prevalence of intestinal parasites as observed in the current study as compared to females. Previous literature has revealed that both males and females remain at a high risk of being infected by intestinal parasites, depending on their environmental, demographic, socio-economic and health behavior (Teimouri et al., 2022). An investigation on intestinal parasites which was conducted in Masjed Soleyman, Iran in 2020 reported a prevalence of 5,6% male intestinal parasite infections and a prevalence of 4,1% for females. The most common intestinal parasites which were found in Iran were *Giardia lamblia* and *Amoebas*. These intestinal parasites are directly spread, they do not need an intermediate host. Most infections occurred in summer and the high intestinal parasite prevalence in males was associated with nomads who travel on animals in Iran from city to city as seasons change, with the aim of looking for pastures for their livestock and food for themselves. During hot

seasons, the nomads and the animals move back to the city, some nomads come back infected with intestinal parasite from other cities, intestinal parasites are therefore introduced or increase in the area (Mazhab-Jafan et al., 2020).

In age group 22 to 35 years most infection have been found to be for *Cystoisospora belli* with 55.6% people infected, *Cystoisospora belli* infection is often found in fresh feaces on the form of oocysts. A total of 50% of the people infected with intestinal parasites were infected through contact with contaminated feaces, the prevalence from the current study can be associated with demographic and socio-economic characteristics of the tested individuals. *Cystoisospora belli* infections were followed by *Ascaris lumbricoides* with 18.5% infected people. *Ascaris lumbricoides* are transmitted through contaminated foods, contaminated water and contaminated vegetables, exposure to these is a possible cause of the rise on this age group in intestinal parasite infections. *Giardia lamblia* followed these two infections with a percentage of 11.1%, previous literature has stated that the *Giardia lamblia* infection with Giardia does spread easily, and they can be spread from person to person, through contaminated water, food, surfaces, or contaminated objects. The most common way people get infected with intestinal parasites is by drinking contaminated drinking or recreational water. These were followed by *Blastocystis hominis*, diarrhoeal parasites, Taenia species and *Trichuris trichiura*, the infection of all these was 3.7%. Previous literature has revealed that Taenia species is transmitted through the ingestion of larval cysts that are in undercooked pork or infected pork. *Blastocystis hominis* are transmitted through ingesting food and water contaminated with human or animal feaces and so is *Trichuris trichiura* (Roopal et al., 2020). Within this age group there were no infections for *Hymenolepis, nana*, *Entamoeba histolytica*, *Echinococcus species, Hymenolepis diminuta* (See Fig 4.6).

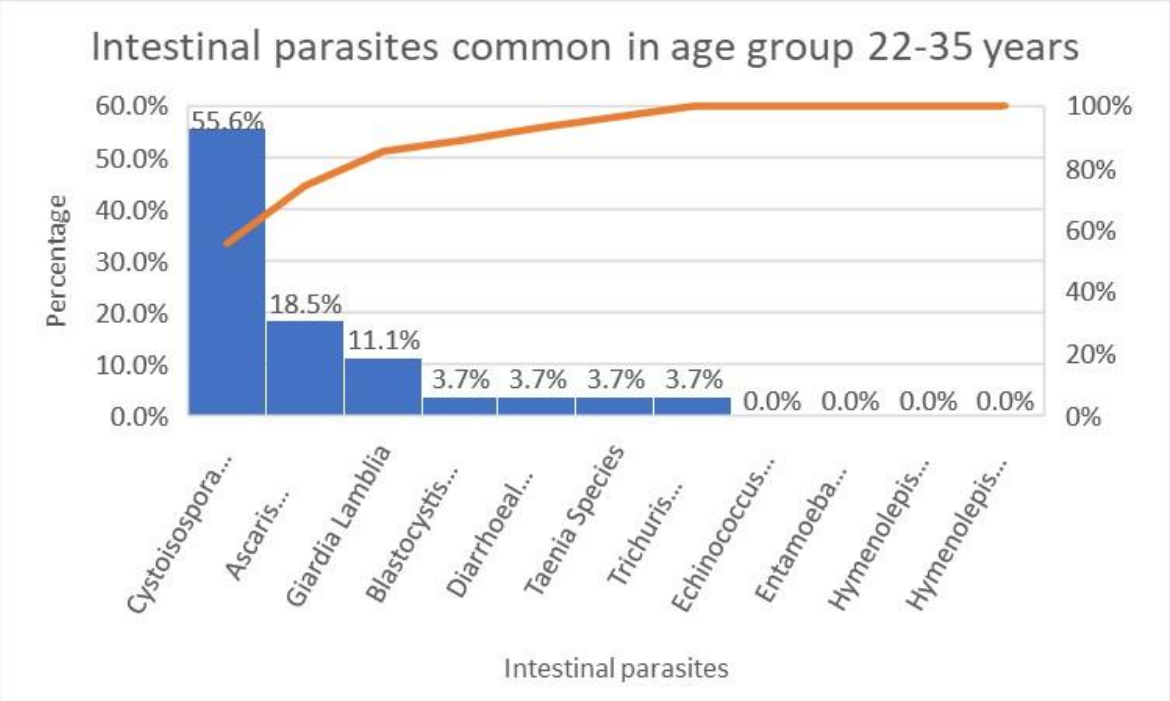


Figure 4.6: Intestinal parasites common among ages 22-35 years from 2012 to 2020

For the age groups 36 to 60 years of age *Cystosoispora belli* infections were high, with a percentage of 70%, as stated above previous literature has revealed that *Cystoisospora belli* is transmitted through contaminated food and water and most infection occurs through contact with contaminated feaces. *Giardia lamblia* followed with a percentage of 20%, *Giardia lamblia* is associated with contact with any contaminated surface and it therefore becomes spread easily. Even though *Cystoisospora belli* is spread indirectly (through food and water) and *Giardia lamblia* is spread through direct contact with surfaces, both *Cystoisospora belli* and *Giardia lamblia* can survive in cold water and soil for long periods. *Giardia lamblia* and *Cystoisospora belli* infections mostly affect immunocompromised individuals, and they can be characterised by gastrointestinal symptoms such as diarrhea, vomiting and abdominal cramps (Hajare et al., 2021). These two parasite infections were followed by *Ascaris lumbricoides*, and *Entamoeba histolytica* both with a percentage of 5% from 2012 to 2020 (See Fig. 4.7). According to a study conducted in 2017 on current and future challenges pertaining to *Cryptosporidium* and *Giardia* in Africa, *Giardia lamblia* and *Cystoisospora belli* mostly affects children between the ages of 6 years and 16 years, people who are infected with HIV/AIDS and those who are malnourished (Zacarias Cerveja et al., 2017). A study conducted in the United States in 2022 on past and new perspectives of the detection of *Giardia spp.* and *Cryptosporidium spp.* reported that intestinal parasites can highly infect immunocomprised individuals, of which from ages 36 years to 60 years people's immune systems tend to be suppresses (Fradette, 2022).

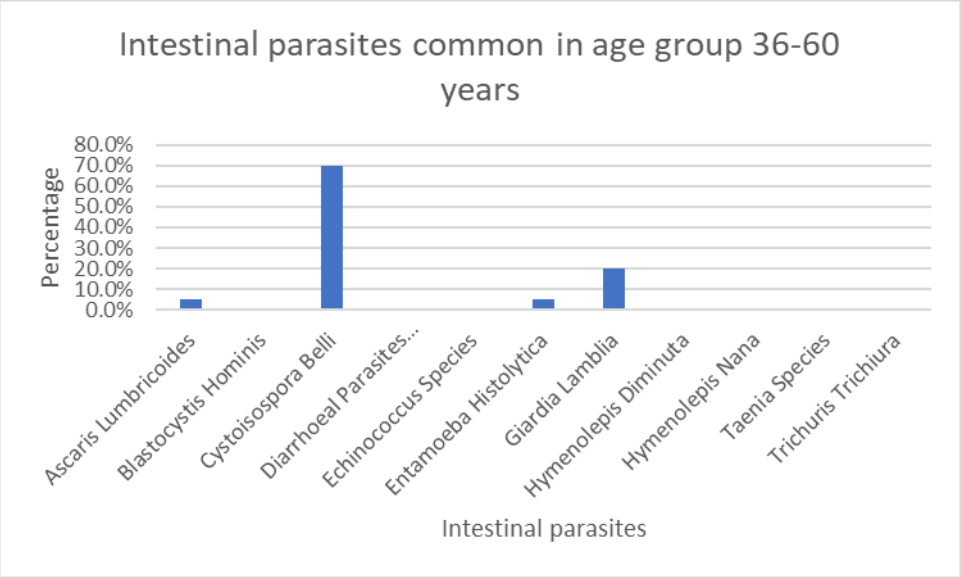


Figure 4.7: Intestinal parasites common among ages 36-60 years from 2012 to 2020

The types of intestinal parasites which infected more males was *Giardia lamblia* with a percentage of 32%, followed by *Cystoisospora belli* with a percentage of 27%, *Ascaris lumbricoides* at 22%, followed by *Trichuris trichiura*, *Taenia species*, *Blastocystis hominis*, *Hymenolepis diminuta*, *Hymenolepis nana*, *Echinococcus species*, and Diarrhoeal parasites all at less than 10% (See Fig. 4.8). The above intestinal parasites have the following in common; they are all zoonotic, they are spread through contaminated feaces (Funso-Aina et al., 2020).

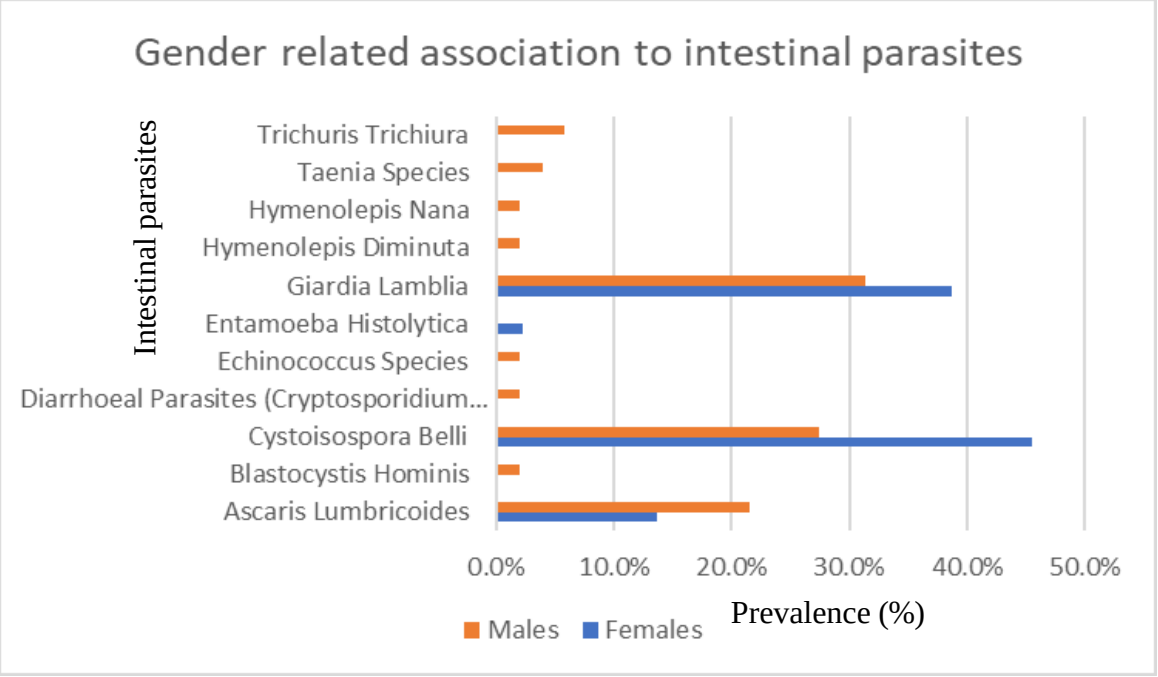


Figure 4.8: Gender-related association with different types of intestinal parasites from 2012 to 2020

4.6. CHAPTER SUMMARY

This chapter presented the findings relating to the prevalence of intestinal parasites in SBDM, Eastern Cape from 2012 to 2020. The two most common intestinal parasites in SBDM were *Cystoisospora belli*, followed by *Giardia lamblia*. The two leading local municipalities with most intestinal parasite cases located within SBDM were Makana local municipality and Kouga local municipality with a prevalence of 44.8% and 31.3%. The intestinal parasite secondary data for SBDM was captured by the SBDM NHLS. The results from the study revealed that intestinal parasites are a challenge in SBDM as there had been an increase in the number of intestinal parasite infections over the assessed years. The current study observed that males were the most infected by intestinal parasites from 2012 to 2022, this was associated with a lack of knowledge on the prevention of intestinal parasites.

These results were similar to those of a study conducted in Biyem-Assi Younde, Cameroon in 2018 on human intestinal parasites, which reported a prevalence of 52,5% on males and 47,5% on females. A study conducted in Port Elizabeth, Eastern Cape in 2018 reported *Ascaris lumbricoides* as the leading most common intestinal parasites followed by *Trichuris trichiura*, there were no identified suspected causal factors for these leading infections. Another study conducted in Iran reported a high prevalence of intestinal parasites on males as compared to females. Most of the infections in the city occurred in summer, and the high prevalence on males was associated with nomads; whom are people who travel on animals from city to city in Iran as seasons change. A study conducted among food handlers in Ethiopia in 2021 identified common intestinal parasites in the study area as *Entamoeba histolytica* and *Giardia lamblia,* these were said to be common due to low socio economic status indicators like the use of borehole water and poor personal hygiene.

CHAPTER 5

SYNTHESIS OF THE FINDINGS AND RECOMMENDATIONS

5.1. INTRODUCTION

The details of the findings on the study objectives were presented in chapters three and four, the chapters respectively correspond to the two phases of the study that is phase one and phase two. Chapter five provides an overview and the synthesis of the study and highlights the conclusions made by the researcher as well as study limitations and recommendations for future research. All Chapters contained herein explain the relationship between the collected data and the research questions.

5.2. OVERVIEW

This study was conducted to investigate the KAP of public workers comprising EPWP and CWP general workers and to evaluate the prevalence of intestinal parasites in SBDM from 2012 to 2020. The overview of each chapter is herein summarised below:

Chapter one:

Chapter one of the study provided the background and literature review of the study. These were done based on the aim, problem statement and objectives of the study. The generic methodology, research questions, explanation of the research design, methods and ethical considerations were discussed as well. The chapter also elaborated on the importance of the study.

Chapter two:

Chapter two gave further details of the literature review as well as health problems associated with intestinal helminths and intestinal protozoa. Furthermore, ways to prevent and control the occurrence of intestinal parasites were discussed. Previous literature on the knowledge, attitudes and practices and prevalence of intestinal parasites; globally, regionally and locally were reviewed and presented in this chapter. Possible risk factors which impact the occurrence of intestinal parasites were discussed as well as ways which other countries have used to rid intestinal parasites.

Chapter three:

The third chapter of the study presented details on phase one, which was addressing the KAP of the study participants. This chapter evaluated the KAP of the study participants in the study area on intestinal parasites. The study methodology were highlighted reflecting details on the study area,

study design and the study population. The chapter further discussed the sampling method and how the sample size were determined. Details on the questionnaire design, the data collection tool as well as the inclusion and exclusion criteria which were presented. The process that was followed in conducting the pilot study was explained. The measures followed to ensure maintenance of the validity and reliability of the study was discussed. The data collection process followed was elaborated on, this included the handing out and return of informed consent forms, the handing out of the data collection tool, the capturing of data and its analysis. The results and discussion of the analysed data was discussed, this was divided into three sections, that is; demographic characteristics of the study participants, the graphical presentations of the knowledge status of study participants on intestinal parasites, representations of the attitudes of the study participants on intestinal parasites were made. Practices of the study participants in relation to intestinal parasites were discussed. Based on the knowledge results of the sampled population the researcher can conclude that the knowledge of the study participants on intestinal parasites is poor. The study participants showed positive attitude towards the need to have a better understanding on intestinal parasites and the transmission pattern. A majority of the participants followed the correct hygiene practices to avoid infection with intestinal parasites which included washing fruit and vegetables before eating them, washing hands after using the toilets, washing hands before preparing food, and by not walking barefoot, this was due to their high knowledge of the preventative measures of intestinal parasites. Based on the practice results the researcher can conclude that the sampled participants practices are fairly good.

Chapter four:

Chapter four of the study discussed phase two which answers the second objective on the prevalence of intestinal parasites between 2012 and 2020 in the study area. The study setting, study design and the data collection process employed were discussed in this chapter. The sources from which the secondary data was obtained were indicated. The procedures followed to ensure the validity and the reliability of the collected data were explained. The process of data analysis was also explained in the study using graphical representations to explain the demographics amongst the participants as well as the different conclusions drawn from the obtained data. The results from the study revealed that intestinal parasites are a challenge in SBDM as there had been an increase in

the number of intestinal parasite infections over the assessed years. The current study observed that males were the most infected by intestinal parasites from 2012 to 2022, this was associated with a lack of knowledge on the prevention of intestinal parasites. The prevalence of the current study from 2012 to 2020 was 0,018%. These results were similar to those of a study conducted in Biyem-Assi Younde, Cameroon in 2018 on human intestinal parasites, which reported a prevalence of 52,5% on males and 47,5% on females. Another study conducted in Iran reported a high prevalence of intestinal parasites on males as compared to females.

5.3. SYNTHESIS OF THE FINDINGS IN TERMS OF THE RESEARCH OBJECTIVES

Findings from the study allowed the researcher to answer the research objectives which were as follows:

- To assess the prevalence of intestinal parasites in SBDM retrospectively from 2012-2020.
- To assess the KAP of public workers comprising EPWP and CWP general workers in SBDM regarding intestinal parasites.

5.3.1. KAP among public workers comprising EPWP and CWP general workers

The researcher grouped the summary findings of the second objective into the following headings:

- Demographic and associated environmental factors relating to intestinal parasites among participants.
- Knowledge, attitudes and practices on intestinal parasites among participants.
- Gender-related differences in practices relating to intestinal parasites among participants
- Comparative evaluation of Knowledge and attitudes relating to intestinal parasites and the demographic variables among participants

5.3.1.1. Demographic and associated environmental factors among participants

The study had more female participants than males. The majority of the study participants within the inclusion criteria were between the age of 22 and 35 years. Risk factors associated with intestinal parasites included behavioral activities which include improper handwashing after defecating and before preparing meals, improper handwashing after harvesting vegetables, improper handwashing after cleaning, improper washing of vegetables before consumption, not cutting nails when necessary, walking outside barefooted (Sibiya & Gumbo, 2013). These factors were associated with a higher risk of intestinal parasite infections. Environmental factors included no access to safe drinking water, limited access safe sanitation and the proximity of residential areas to sewerage

plants, these factors are also associated with a high risk of contracting the intestinal parasite infection (Kotingo et al., 2014).

5.3.1.2. Knowledge, attitudes and practices among participants

The results revealed that the knowledge, attitudes and practices of the study participants were overall poor. The study also perceived that a high number of participants were unaware of the intestinal parasite modes of transmission, and that almost half of the participants knew about the symptoms of intestinal parasite infection, this limited or lack of knowledge was associated with a lack of health education and ignorance. Most of the study participants had heard about intestinal parasites from friends and relatives, who were unreliable sources with hearsay information. Most of the study participants responded that they knew about the practices of handwashing before preparing food and less than half of them did not mention hand-washing before food preparation as a practice for intestinal parasite prevention.

5.3.1.3. Gender-related differences in practices among participants

More than half study participants had the correct knowledge on the preventative measures of intestinal parasites. There was a statistically insignificant ($p>0.05$) relationship between gender and knowledge of preventative measures. However, a statistically significant ($p<0.05$) relationship between gender and the knowledge of who is at risk of getting infected with intestinal parasites was established. The gender that gave most correct responses to the question of who is at risk were females. Most male participants responded that they had no knowledge on whether they had been infected with intestinal parasites in the past. Previous literature had revealed that females individuals had more knowledge on intestinal parasite infection as compared to males.

5.3.1.4. Comparative evaluation of Knowledge and attitudes relating to intestinal parasites and the demographic variables among participants

The relationship between the demographic characteristics of participants and how they responded to the questions was assessed using Chi square test and there was no significant relationship (i.e. $p=>0.05$) between age and the response to the question of knowledge about intestinal parasites types, most participants within the age-group 51-59 years knew about intestinal parasites, while half of the participants within the age-group 18-28 years knew about intestinal parasites. The relationship between the age of the study participants and their knowledge of prevention measures for intestinal parasites was assessed and there was a statistically significant relationship between age and

knowledge of prevention measures p<0.05 (p=0.048). Age group 18-28 years showed more knowledge on the prevention of intestinal parasites compared to age group 51-59 years.

Association between the age of study participants and who is at risk showed no statistically significant relationship (p>0.05). Age group 4 (51-59years) had more participants who gave right responses about who is at risk of getting the infection. Most of the study participants within age group 29-39 years provided wrong responses knowing whether intestinal parasites are transmitted from person to person and the relationship between the variable and response was found to be statistically insignificant (p>0.05). The relationship between the gender of the study participants and participant's knowledge about intestinal parasites was assessed using Chi Square test, and a significant relationship was discovered (p<0.05) p=0.010. Females (68.9%) gave more right responses to the question. A statistically insignificant (p>0.05) relationship was observed between Gender and knowledge of preventative measures. The relationship between the type of residence and the responses on the knowledge and the practices of intestinal parasites was assessed. There was a statistically significant relationship (p<0.05) p=0.022 discovered between the type of residences the study participants resided in and the participants' responses to whether they know about the different types of intestinal parasites.

5.3.2. A prevalence of intestinal parasites in SBDM from 2012 to 2020

The findings obtained for the first objective were summarized and structured to the following headings:

- Demographic characteristics of the participants involved in the secondary data
- Intestinal parasites common in SBDM
- Local municipalities in SBDM with the most intestinal parasites
- Conditions clinically diagnosed together with intestinal parasites

5.3.2.1. Demographic characteristics of the participants involved in the secondary data

The ages of individuals ranged from 1 year to 82 years. The average mean age in the study was 25.16 with the age median being 27.50. The age standard deviation of the study was 21.62. A study conducted in 2018 among participants between the ages of 1 year to 60 years in Iraq on the prevalence of intestinal parasites had an average mean age of 3 years. A study on intestinal parasites in Port Elizabeth, Eastern Cape which was conducted amongst school-children aged 9 to 12 years had a mean average of 11 years.

Forty-four (44) females and fifty-two (52) males formed part of the study. Previous literature has revealed that children between ages one (1) and six (6) are most at risk of getting infected with intestinal parasites, some studies have revealed that children have been mostly diagnosed with intestinal. These results had been obtained through stool sample evaluation and some through clinical diagnosis. Results from NHLS revealed that following the high intestinal parasite infection of children between ages one (1) and six (6) years the next age group with a high intestinal parasite infection were individuals between the ages of thirty-one (31) and thirty six (36) years, there was also a spike between age 21 and 26 years as compared to infection to other age group. There is no statistically significant relationship between intestinal parasite infection and age in the study area. However factors like the level of knowledge of an individual relating to intestinal parasites, the attitudes of an individual relating to intestinal parasites, their practices, socio-economic factors as well as the demographics can have an impact on infection of individuals by intestinal parasites.

5.3.2.2. Intestinal parasites common in SBDM

The leading intestinal parasites in the District and in the municipalities with high intestinal parasite cases were *Cytoisospora belli* (35.4%) and *Giardia lamblia* (35.4%), followed by *Ascaris lumbricoides* (17.7%), Trichuris trichiura (3%), Taenia species (2%), and the rest of the intestinal parasites and protozoa at 1%

5.3.2.3. Intestinal parasites prevalence relative to municipalities in SBDM

The study recorded a total intestinal parasite prevalence of 46.37% in SBDM. A prevalence of 44.8% was further recorded in Makana local municipality which is located in SBDM followed by 31.3% in Kouga local municipality . This was followed by Blue Crane Route local municipality with a prevalence of 13.5%, Dr. Beyers Naude local municipality with 8.3% and Sundays River Valley with a prevalence of 2.1%, zero for Ndlambe local municipality andKoukamma local municipality.

Most of the study participants on the KAP study mentioned Kouga local municipality as their residential municipality and the secondary intestinal parasite data from the SBDM NHLS disclosed that Kouga local municipality was the second local municipality with the highest intestinal parasite infection in SBDM. Figure 4.2 shows the different types of intestinal parasites that were found in Kouga local municipality from 2012 to 2020. *Giardia lamblia* was the most commonly found intestinal parasite in Kouga local municipality, followed by *Ascaris lumbricoides*, *Cystoisospora belli*, *Trichuris trichiura*, Diarrhoeal parasites, *Entamoeba histolytica* and *Hymenolepis diminuta.*

5.3.2.4. Intestinal parasites clinically diagnosed in SBD

A percentage total of 74% of the patients diagnosed with intestinal parasites had other suspected diseases which were categorised as unspecified for both *Giardia lamblia* and *Cystoisospora belli* which were common in the SBDM. This was followed by intestinal parasites diagnosed on patients with no clinical history supplied, where 6% of the individuals were infected with *Giardia lamblia* and 3% were infected with *Cystoisospora belli*. This gives the assumption that an individual can get infected by with intestinal parasites even when they don't have a clinical history of other underlying conditions.

5.4. RECOMMENDATIONS

Considering the findings from the study, the following is recommended to the Department of Public Works, Health establishments (nursing), Environmental Health Profession, Sarah Baartman District Municipality, and recommendations for further research in the Environmental Health field of research.

5.4.1. Department of Public works

Findings of this study highlight the need to enhance knowledge about intestinal parasites in order to enhance the attitudes together with the practices to control intestinal parasites:

- The Department of Public works needs to make sure that all employees are trained on the control of intestinal parasites and the training must be done regularly.
- The health education on intestinal parasites must be done in a structured way, to assist in this, pamphlets with information relating to intestinal parasites can be given to the Department of Public works employees, posters can be displayed on the Department of Public works offices.
- The EPWP and CWP Supervisors can also conduct the trainings on their monthly meetings with the employees, addressing the above-mentioned key points relating to intestinal parasites.
- Health education on intestinal parasites can also be done via media platforms such as WhatsApp, televisions and radios which the EPWP and CWP workers have access to.
- The Department of Public works must provide the necessary Personal Protective Equipment (PPE) to its employees, e.g. rubber gloves, overalls where needed, hats etc, this can aid in preventing infection with intestinal parasites.

5.4.2. The Nursing department

Recommendations to health establishments were made, especially Professional Nurses and those who take care of patients' health:

- The existing guidelines of the infection and control of intestinal parasites must be revised to address the current challenges faced in relation to intestinal parasites in health facilities, this can be done by using the World Health Organisation and the Centre for Disease Control and Prevention (CDC), the efforts to eradicate NTDs in the WHO ROADMAP by the year 2030 can also be used in SBDM (Ifeoma, Apalata, Aviwe, Oladimeji, & Abaver, 2022).
- Workshops on intestinal parasite prevention and control can be organized for teams involved in outbreak response and prevention and control of infections, e.g. Professional Nurses, Assistant nurses, etc.
- Internal trainings can also be conducted to enlighten staff on the transmission routes of intestinal parasites, sources of intestinal parasites, the different types of intestinal parasites, prevention strategies, the life cycle of intestinal parasites and who is at risk of being infected by intestinal parasites.
- Deworming treatment(malbendazole) must be made present in the health establishments and must be provided for all patients including adult patients concentrating on *Cytoisospora belli*, *Giardia lamblia*, *Ascaris lumbricoides*, *Trichuris trichiura* and Taenia species.
- Posters and pamphlets on intestinal parasites prevention and control must be made available and on display in clinics and hospitals.
- Stool samples should be collected from patients who present symptoms relating to intestinal parasites and submitted to the NHLS in the SBDM for intestinal parasite related analysis of the samples.
- Community and high-risk adult workplace-based prevention and control interventions can be conducted by Professional Nurses to prevent the intestinal parasite infection concentrating on *Cytoisospora belli*, *Giardia lamblia*, *Ascaris lumbricoides*, *Trichuris trichiura* and Taenia species, with the focus on the correct attitudes and practices for intestinal parasite prevention.

5.4.3. Environmental Health Profession

The following recommendations were made to the Environmental Health Profession in relation to the findings obtained from the study:

- According to the Health Professions Act 1974, Environmental Health Practitioners (EHPs) play a huge role in the prevention and control of diseases, this function can be performed by

implementing the guidelines set out by WHO and CDC for the prevention and control of infections and diseases, and also by implementing efforts to eliminate NTDs set out in the WHO ROADMAP by the year 2030.

- Another function of EHPs is to conduct health education and promote a healthy and hygienic living to communities, in order to prevent and control diseases and infections, this can be done by facilitating health education in communities during community meetings and in all workplaces, but giving a special focus to workplaces which pose a high risk to infection by intestinal parasites.
- EHPs need to formulate pamphlets and posters relating to intestinal parasites and make them available to institutions, communities and workplaces.
- EHPs also need to attend workshops pertaining to intestinal parasite prevention for equipping purposes and for them to better understand the concept of intestinal parasite awareness on the routes of transmission, lifecycles, intestinal parasite control and its prevention.

5.4.4. Sarah Baartman District Municipality

The following recommendations were made to SBDM using the findings obtained from the study:

- The SBDM and the responsible local municipalities within it must make sure that latrine bucket system toilets are emptied when full or when they start to emit excessive foul odor, this is usually done once a day for large families and once a week for smaller families. . This must be done inorder to prevent communities from practicing open defeacation as a result of their bucket toilets being full or not collected.
- SBDM must ensure that it displays posters in relevant offices and makes pamphlets relating to intestinal parasites available to the public.
- SBDM must ensure that sewerage plants located close to residences are not leaking and drains in public roads must not overflow with sewerage as this increases the chances of intestinal parasite infection.
- Water bodies located in the District must be fenced and signage must be hung on water bodies with stagnant water to prevent swimming illegally, as this may lead to infection with intestinal parasites such as schistosomiasis.
- The District must ensure that treated swimming pools are provided in all local municipalities for community members who would be interested in swimming.

5.4.5. Recommendations for further research

The purpose of this study was to build the body of knowledge on intestinal parasites. The findings from the study can be used as a foundation by undergraduate students doing research as well as postgraduate students to conduct further studies on intestinal parasites. To aid in future research on the topic, below are some recommendations for future research:

- Further research is needed to determine and compare the difference in the level of knowledge between adults of ages 18-28 years and age groups 51-59 years about intestinal parasites on public workers in Sarah Baartman District Municipality. The rationale of the study would be; in the current study, participants of ages 51-59 years had more knowledge relating to intestinal parasites as compared to those of ages 18-28 years, the new study would evaluate the patterns in the level of knowledge over the years.
- Another research can be done on the same public workers comprising EPWP and CWP general workers, to evaluate changes in the level of knowledge, attitudes and practices of the participants relating to intestinal parasites in Sarah Baartman District Municipality since the occurrence of the current study.
- Further studies can be conducted specifically at Makana local municipality in the Sarah Baartman district to assess the relationship between the KAP of EPWP and CWP general workers in that local municipality and the high prevalence of intestinal parasites from 2012 to 2020.
- More research studies can be conducted to assess if there has been a difference in the number of people who have approached health establishments in Sarah Baartman District for intestinal parasites testing, following the awareness created by the current study.
- Further research on intestinal parasites can be conducted to assess the KAP of other adults apart from public workers comprising EPWP and CWP general workers in the Sarah Baartman District.
- More research can assess the risk factors which cause *Cystoisospora belli* and *Giardia lamblia* to be the most common parasites in Sarah Baartman District.
- The same study can be repeated in other places in the Eastern Cape, in South Africa and regionally, to assess the knowledge, attitudes, practices and the prevalence of participants in these areas on intestinal parasites, in order to get a holistic overview of the current status of intestinal parasites.

5.5. LIMITATIONS

- Secondary data on the prevalence of intestinal parasite in SBDM was sought from the SBDM DHIS, but no intestinal parasite data from previous years was present on the system, this led to the data obtained from the SBDM NHLS being the only data used to determine the prevalence of intestinal parasites in SBDM. There was therefore no comparison done on the data received from the two institutions.
- Intestinal parasite prevalence data of a total of 96 individuals was obtained from NHLS, the data was enough, there was however a concern to numbers of people who have taken tests for intestinal parasites, the total number of positive cases obtained from NHLS may not be a true reflection of the total number of people who have tested positive for intestinal parasites.
- The study data collection was conducted making use of telephonic interviews, the results may have been different if other data collection methods were used, as no face-to-face contact was made with participants and therefore the researcher couldn't determine if the people responding were the targeted study participants.
- Information of the analytical method used by NHLS to analyse the prevalence data collected from hospitals is unknown by the researcher, this could have also been a limitation.

5.6. CHAPTER SUMMARY

The researcher presented the limitations encountered during the study and highlighted areas which may be of interest for future research as well as recommendations to different stakeholders for possible and to inform policy. These recommendations were made based on the findings of the study. The recommendations were put in place to increase the awareness of communities on the prevention and control strategies relating to intestinal parasites, so as to enhance the knowledge and the attitudes of communities on intestinal parasites as well as to improve the practices relating to the prevention of intestinal parasites. Listed below, are references and appendices used in the study.

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ANNEXURES

Annexure A (1): Questionnaire (isiXhosa version)

Ikhweshine ngeeNtshulube (isixhosa version)

Date:

	Iinkcukacha ngendawo yokuhlala	
1	Inombolo enikwe umphenduli	
2	Isini	
3	Iminyaka	
4	Uhlala komphi umasipala?	1.Kouga 2.Makana 3.Blue Crane Route 4.Dr Beyers Naude 5.Koukamma 6.Ndlambe 7.Sundays River Valley
4	Uhlala kwindawo enjani?	1.Kwilokishi 2.Edolophini 3.Elalini 4.Kwindawo engabizwanga (Chaza):……..
5	Chaza ukuba niwafumana phi amanzi okusela **(ungakhetha ngaphezu kwempendulo enye)**	1. Amanzi ahamba ngophayiphi 2. Itanki lakwa Jojo 3. Itepu esetyenziswa ekuhlaleni 4. Kumngxuma 5. Kumthombo owembiweyo 6. Ninamanzi eniwagcina kwisixhobo esisecaleni 7. Kwichibi elukheselekileyo 8. Kwichibi elingakhuselekanga 9. Nikhongozela amanzi emvula 10. Nisebenzisa amanzi eebhotile 11. Nisebenzisa isikhoji kunye netanki okanye ipheyile 12. Nisebenzisa itrakhi yetanki 13. Amanzi ahleli ekhona (umlambo, ichibi, idama, umthombo) 14. Akukho manzi kwindawo enisebenza kuyo 15. Okunye 16. Okunye (chaza) ……
6	Yeyiphi oyisebenzisayo apho uhlala khona?	1. Indlu yangasese egungxulwayo 2. Umngxuma 3. Indlu yangasese esetyenziswa njenge komposti 4. Ipheyile 5. Hanging toilet, 6. Akukho ndawo, Ehlathini, Ebaleni 7. Enye (chaza): …….

<table>
<tr><td></td><td colspan="2">Imibuzo ngolwazi Ngeetshulube</td></tr>
<tr><td>7</td><td>Uyazi ngeentshulube (intestinal parasite)?</td><td>• Ewe
• Hayi
• Andiqinisekanga</td></tr>
<tr><td>7.1.</td><td>Ukuba ewe, wazi eziphi?</td><td></td></tr>
<tr><td>7.2</td><td>Uve phi ngazo?</td><td>• Kwiintlangano zasekuhlaleni
• Esibhedlele onanye ekliniki
• Ngezihlobo okanye ngeosapho
• Ngezopapasho
• Ngamaqumrhu ezophenyo</td></tr>
<tr><td>8</td><td>Ucinga ukuba umntu wosuleleka njani ziintshulube? (ungakhetha ngaphezulu kwenye impendulo)</td><td>
<table>
<tr><td>1.</td><td>Ngokuhlamba Ngamanzi amdaka</td><td>2.</td><td>Ngokusela amanzi amdaka</td><td>3.</td><td>Ngokutya iziqhamo nemifino engahlanjwanga</td></tr>
<tr><td>4.</td><td>Ngokuhamba ngeenyawo</td><td>5.</td><td>Ngokudlala ngomhlaba ongcolisekileyo</td><td>6.</td><td>Ngokungahlambi zandla phambi kokutya</td></tr>
<tr><td>7.</td><td>Ngokungahlambi zandla emva kokusebenzisa indlu yangasese</td><td>8.</td><td>Ngokuzinceda emathafeni</td><td>9.</td><td>Ngokungahlambi zandla phambi kokubamba ukutya</td></tr>
<tr><td>10.</td><td>Enye (chaza) ……</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>9</td><td>Yeyiphi kwezi enokuthintela iintshulube</td><td>• Ukuhlamba izandla phambi kokulungisa ukutya.
• Ukuhlamba izandla emva kokusebenzisa indlu yangasese.
• Ukunxiba izihlangu xa uphandle.
• Ukusebenzisa indlu yangasese efanelekileyo(Making use of toilets)
• Ukubilisa amanzi phambi kokuwasela.
• Ukuhlamba iziqhamo nemifuno phambi kokuyitya.</td></tr>
<tr><td>10</td><td>Ngabaphi abona bantu basemngciphekweni wokosulelwa ziintshulube (ungakhetha ngaphezu kwempendulo enye)</td><td>• Abantu abadala
• Abantu abakhulelweyo
• Abangenalwazi ngesisifo
• Abantwana
• Abantu abagulayo
• Abangalulandeliyo ucoceko</td></tr>
</table>

11	Ingaba iintshulube ziyosulela ukusuka kumntu omnye ukuya komnye? **(Iyosulela)**	• Ewe • Hayi • Andiqinisekanga
12	Ingaba iintshulube ziyosulela ukusuka kwizilwanyana ukuya ebantwini? **(Ivela kwizilwanyana)**	• Ewe • Hayi • Andiqinisekanga
13	Zeziphi iindlela ezingena ngayo iintshulube ezosulela ngomhlaba emntwini**(ungakhetha ngaphezu kwempendulo enye)**	• Ngokutya/ukusela • Ngokuphefumla • Ngokutshona kwisikhumba • Ngokutofwa ngenaliti
14	Zeziphi iimpawo ezibonakala ngazo iintshulube emntwini **(ungakhetha ngaphezu kwempendulo enye)**	• Utyatyazo • Ukuqaqamba kwesisu • Ilindle elinegazi • Izitshanguba • Ukuphelelwa ngumdla wokutya • Ukubuyisa ukutya • Ukuphelelwa ngamandla • Intloko ebuhlungu • Enye...(chaza)…. • Andazi
	Imibuzo ngeengcinga ngembaluleko yeentshulube	
15 Ucinga ukuba ngubani onexanduva lokuqinisekisa ukuba nina ningabasebenzi ninalo ulwazi malunga nococeko oluthintela iintshulube? **(ungakhetha ngaphezu kwempendulo enye)**		• Ngurhulumente • Ngusibonda • Ngooceba • Ngabasebenzi bezempilo • Zizikolo • Ngamaphepha ndaba
16 Ingaba ngubani onexanduva lokuba ningabasebenzi nibe niyazi ngeenzuzo zokulandela ucoceko ukuthintela iintshulube? **(ungakhetha ngaphezu kwempendulo enye)**		• Ngurhulumente • Ngusibonda • Ngooceba • Ngabasebenzi bezempilo • Zizikolo • Ngamaphepha ndaba
17 Ucinga ukuba ngubani onexanduva lokuqinisekisa ukuba abahlali nabantwana basekuhlaleni bayazi		• Ngurhulumente • Ngusibonda • Ngooceba • Ngabasebenzi bezempilo • Zizikolo

malunga nococeka oluthintela iintshulube? **(ungakhetha ngaphezu kwempendulo enye)**		• Ngamaphepha ndaba
18 Ingaba iintshulube zisisifo ekubalulekiyo ukuba abantu bazi ngaso?		• Sibaluleke kakhulu • Sibalulekile • Ndimbaxa • Asibalulekanga • Asibalulekanga kwaphela
Imibuzo ngeezenzo Ezinxulumene neentshulube		
19	Uyazihlamba iziqhamo nemifino phambi kokuba uzitye?	1.Ewe 2.Hayi 3.Ngamanye amaxesha
20	Xa kungekho manzi kwindawo eniwafumana kuyo nisebenzisa ntoni efikelelekayo ngexabiso ukuhlamba izandla?	1. Uhlamba izandla kwisitya seplastiki esinamanzi anesepha. 2. Nisebenzisa into yokugale amanzi nesitya seplastiki (umntu omnye agalele amanzi omnye abe ehlamba izandla) 3. Itipi tap 4. Okunye (Chaza)…….
21	Uyawohlula amanzi okusela nalawo okuhlamba iziqhamo nemifino kulawo okuhlamba izixhobo zokuvala imingxuma nalawo okuhlamba izixhobo zokusebenza?	1. Ewe 2. Hayi
22	Ingaba amanzi asebenzileyo xa nisemsebenzini niwalahla ngendlela ekhuselekileyo?	1. Ewe 2. Hayi
23	Ukuba ewe, ingaba niwalahla phi?	• Kwidreyni • Niwalahla phantsi • Niwabeka kwisitya ze ninkcenkeshe ngawo • Okunye
24	Uwacheba kangaphi amazipho?	• Yonke imihla • Kanye ngeveki • Kanye ngenyanga • Andiwachebi • Okunye(chaza)….
25	Unxiba ntoni ezandleni xa	• Iglavzi zoonokontraka • Iiglavzi zeplastic • Iiglavzi zasesibhedlele

	usebenza emsebenzini?	• Andinxibi nto
26	Uzihlamba nini izandla zakho? **(ungakhetha ngaphezu kwempendulo enye)**	• Emveni kokuba nditshayele endlwini • Emva kokulahla umgqomo • Emva kokusebenzisa indlu yangasese • Phambi kokulungisa ukutya • Phambi kokutya • Emva kokuvala imingxuma emsebenzini • Emva kokusebenzisa umhlakulo • Andizihlambi
27	Usebenzisa ntoni ukuhlamba izandla?	• Amanzi nesepha • Amanzi wodwa • Isicoci tsholongwane (ibhlitshi)
28	Uzihlamba kangaphi izandla ngesixhobo osichaze kunombolo 27	• Rhoqo • Kanye ngemini • Andizihlambi
29	Wawukhe wosulelwa ziintshulube?	1. Ewe 2.Hayi
30	Wawukhe wagonyelwa iintshulube?	• Ewe • Hayi
31	Ukuba ewe, nini?	• Kwiveki enye edlulileyo • Kwiinyanga ezimbini ezidlulileyo • Kunyaka omnye odlulileyo • Okunye, Chaza….

Annexure A (2): Questionnaire (English version)

INTESTINAL PARASITE Questionnaire English version

	Demographic Information	
1	Participant no.	
2	Gender	
3	Age	
4	In which municipality are you residing	1.Kouga 2.Makana 3.Blue Crane Route 4.Dr Beyers Naude 5.Koukamma 6.Ndlambe 7.Sundays River Valley
4	What kind of area do you reside in?	• Township • Suburb • Rural • Other
5	Identify the drinking water source available which you use in your work space **(more than one answer allowed)**	1. Piped water into building 2. Jojo tank 3. Public tap/standpipe 4. Tubewell/borehole 5. Protected dug well 6. Water stored in containers 7. Protected spring 8. Unprotected spring 9. Rainwater collection 10. Bottled water 11. Cart with small tank/drum 12. Tanker-truck 13. Surface water (river, dam, lake, pond, stream, canal, irrigation channels) 14. No water available in or near building 15. Other 16. Other (please specify) ……
6	Which of the following do you use at home?	1. Flush toilet / Pour flush 2. Pit latrine 3. Composting toilet 4. Bucket 5. Hanging toilet, 6. No facility, Bush, Field 7. Other (specify): …….
	INTESTINAL PARASITE Knowledge Questions	

<table>
<tr><td>7</td><td>Have your heard about Inestinal parasites?</td><td>• Yes
• No
• Not sure</td></tr>
<tr><td>7.1</td><td>If yes, which parasite did you hear about?</td><td></td></tr>
<tr><td>7.2</td><td>From which source did you hear about intestinal parasite?</td><td>1 Community meetings
2 Hospital/clinic
3 Relatives/friends
4 Media
5 Research organisations</td></tr>
<tr><td>8</td><td>How does a person get infected with Intestinal parasites?</td><td>
<table>
<tr><td>1.</td><td>Washing with dirty water</td><td>2.</td><td>Drinking dirty water</td><td>3.</td><td>Eating unwashed fruits and vegetables</td></tr>
<tr><td>4.</td><td>Walking barefoot</td><td>5.</td><td>Playing with contaminated soil</td><td>6.</td><td>Not washing hands before eating</td></tr>
<tr><td>7.</td><td>Not washing hands after using the toilet</td><td>8.</td><td>Open defeacation</td><td>9.</td><td>Not washing hands before preparing food</td></tr>
<tr><td>10.</td><td>Other (please specify) ……</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>9</td><td>Which of the following can help prevent or control the occurrence of Intestinal Parasites</td><td>• Washing hands before preparing food
• Washing hands after using the toilet
• Wearing shoes when walking outside the house
• Practising proper defeacation(Making use of toilets)
• Boiling water before drinking
• Washing fruits and vegetables before eating them</td></tr>
<tr><td>10</td><td>Which groups are highly susceptible to intestinal parasite (more than one answer accepted)</td><td>• Elderly people
• Pregnant women
• Illiterate people
• Children
• Sick people
• People who don’t follow hygiene practices</td></tr>
</table>

11	Is intestinal parasite a disease a disease than can be transmitted from one person to another? **(Communicable)**	• Yes • No • Not sure • Definitely
12	Is intestinal parasite a disease that can be transmitted from animals to humans? **(Zoonotic)**	• Yes • No • Not sure
13	What are the routes of entry for intestinal parasite **(more than one answer accepted)**	• Ingestion • Inhalation • Absorption • Injection
14	What are the signs and symptoms of intestinal parasite **(more than one answer accepted)**	• Diarrhoea • Abdominal pain • Bloody stools • Ringworm • Loss of appetite • Vomiting • Abdominal distention • Body weakness • Headache • Do not remember
	Intestinal Parasite attitudes questions	
15 Who do you think is responsible for ensuring that you as workers are aware of the hygienic ways to prevent INTESTINAL PARASITE?		• The Government • Community leader • Ward councilors • Health workers • News paper • Schools • Other… (mention)
16 Who do you think is responsible to ensure that you as workers are aware of the benefits of proper hygienic practices to prevent INTESTINAL PARASITE?		1.The Government 2.Community leader 3. Ward councilors 4. Health workers 5. News paper 6.Schools • Other… (mention)
17 Who do you think is responsible to ensure that children and people in the community are aware of hygienic principles to prevent INTESTINAL PARASITE?		1. The Government 2.Community leader 3. Ward councilors 4. Health workers 5. News paper 6.Schools 7.Other… (mention)

18 Is INTESTINAL PARASITE an important disease that people need to know about?		• It is very important • It is important • I am neutral • It is not that important • It is not important at all
Intestinal Parasite practices Questions		
19	Do you wash vegetables/fruits before eating	• Yes • No • Sometimes
20	Where no running water is available, which type of low-cost hand washing points do you use?	1. Do you wash hands in a plastic bowl with soap 2. Do you wash hands in a plastic bowl with detergents 3. A pitcher of water and a basin (one person can pour the water for another to wash their hands) 4. Tippy tap 5. Other
21	Do you separate drinking water from water intended for other uses such as washing hands, closing potholes and washing tools?	1. Yes 2. No
22	Is wastewater from the workspace disposed of safely?	1. Yes 2. No
23	If yes, where do you dispose the water?	• In a drain • On the ground • Kept in a container and used to irrigate • Other
24	How often do you cut your nails?	• Daily • Once a week • Once a month • I do not cut them • Other (specify)
25	What do you wear on your hands when you conduct your work duties	• Construction gloves • Plastic gloves • Surgical gloves • Nothing
26	When do you wash your hands	• After sweeping and cleaning • After throwing out the garbage • After using the toilet • Before preparing food • Before eating • Before distributing food • After enclosing potholes

		• After making use of a spade • Not at all
27	What do you use to wash hands	• Soap and water • Water only • Disinfectant
28	How often do you use your option from 27	• Always • Sometimes • Never
29	Have you been infected with INTESTINAL PARASITE before	• Yes • No
30	Have you ever taken measures to have yourself dewormed	• Yes • No
31	If yes, when?	• One week ago • During the past 2 months • During the past year • Other, specify….

Annexure B (1): Consent form to EPWP and CWP general workers (English version)

INFORMED CONSENT FORM

Dear Participant,

Sisanda Mrwebi (214247554), an msc student (Environmental Health) at the Nelson Mandela University is doing research entitled**:**

Assessment of Knowledge, Attitudes and hygiene Practices of Expanded Public Works Programme and Community Work Programme general workers and the prevalence of intestinal parasites in Sarah Baartman District, Eastern Cape, to assess the Knowledge, Attitudes and Practices (KAP) of EPWP **and CWP** general workers in, Sarah Baartman District, Eastern Cape, South Africa.

You are invited to participate in this study. The study will be carried out via the completion of a questionnaire on your Knowledge, Attitudes and Practices on INTESTINAL PARASITE. The researcher will administer the questionnaire to you on a telephonic interview which will be recorded. The researcher will be happy to explain any question where explanation is required. The questionnaire consists of 31 questions. The questionnaire will take about 15-20 minutes to complete.

Participation is voluntary and you can withdraw at any time you want to without penalty or any negative consequence for discontinuing from the study. Similarly, there is no penalty for unwillingness to participate. Participation in the study is completely anonymous, meaning that your personal details will be protected and not made available to a third party. Your identity will not be revealed to anyone and your name will not be used in the reports. All information provided by participants is treated confidentially. This implies that such information will only be known to you, the researcher and her supervisors. The data will be stored in a secured and safe place for five years.

There is no financial benefit or reward for participation in the proposed study. However, your participation in the study will assist us to develop health messages and intervention plans to enhance control interventions of INTESTINAL PARASITE infection in South Africa.

I (name) …….. Hereby agree to participate in this research and to have my interview recorded with an audio device. I understand that my participation is voluntary and I am free to withdraw anytime I want to without penalty and that my personal information will be kept confidential. My contact number for the telephonic interview is…….

_____	_____	_____
Participant's initials and surname	Signature	Date
_____	_____	_____
Researcher	Signature	Date

Annexure B (2): Consent form for EPWP and CWP general workers (isixhosa version)

Consent form for EPWP and CWP general workers (isixhosa version)

Mthathi-nxaxheba Obekekileyo,

Usisanda Mrwebi (214247554), umfundi ofunda iMsc (Environmental Health) eNelson Mandela University wenza uphando olunesihloko esithi**:**

Uvavanyo lolwazi, Izimvo, Nezenzo zabasebenzi ii-Expanded Public Works Programme necommunity Work Programme general nojongo lwezinga lwesifo /iintshulube eSarah Baartman District, eMpuma Koloni, kuvavanywa ulwazi, Izimvo, Nezenzo zabasebenzi ii-Expanded Public Works Programme **nee Community Work Programme** general nojongo lwezinga lwesifo iintshulube esarah Baartman Distrikthi, empuma Koloni.

Uyamenywa ukuba ube yinxalenye yezizifundo. Ezizifundo zizakuphathwa ngokubuzwa kwemibuzo ngolwazi, izimvo nezenzo ngokunxulumene neentshulube Ezosulela Ngomhlaba. Umphathi zifundo uzakuziqhuba ezizifundo nge mfono-mfono kunye nawe, ucingo olo oluzokube lushicilelwa, kwaye yonke imibuzo izakucaciswa, apho kudingeka ingcaciso. Ikhweshine le yezizifundo iqulathe imibuzo engamashumi amathathu ananye (31). Kwaye ukuyishicilela lekhweshine kuzakuthatha imizuzu elishumi elinesihlanu ukuya kumashumi amabini, imizuzu eyi 15-20 ukutsho.

Ukuthatha inxaxheba kwezizifundo akunyanzeliswa kwaye ungayeka nangaliphi na ixesha ukuphendula ungakhange uthathelwe nqaku. Kananjalo akukho nqaku lizakuthathwa ukuba awunqweneli ukuthatha inxaxheba kwezizifundo. Akukho nkcukacha zakho zizakuvezwa kwezizifundo. Igama lakho alizukuvezwa nakubani na, kwaye alizukufumaneka kwii reporti. Oku kuthetha ukuthi iinkcukacha zakho zizakwaziwa nguwe nomphathi zifundo Iinkcukacha zisakugcinwa ngokukhuselekileyo iminyaka emihlanu, ukuvumela uhlolo lwenzeke kakuhle.

Ngokuthatha inxhaxheba kwezizifundo akukho kurhuma ozakufumana. Ukuthatha kwakho inxaxheba kwezizifundo kuzakongeza ulwazi kwezempilo ukuncedisana nothintelo lweentshulube Ezosulela Ngomhlaba.

Mna (igama).....Ndiyavuma ukuthatha inxaxheba kwezizifundo. Ndiyaqonda ukuba ukuthatha inxaxheba kwam kwezizifundo ndizikhethele ndinganyanzelwanga, kwaye ndingayeka ukuphendula nangaliphi na ixesha ndingaziva ndihululekile, ndiyaqonda ukuba iinkcukacha zam zizakugcinwa ngendlela ekhuselekileyo. Inombolo yemfono-mfono yam yokunxibelelana ku-buzo mibuzo lwekhweshine ithi…….

_____	_____	_____
I-inishiyali Nefani yomthathi-nxaxheba	Sayina	Umhla
_____	_____	_____
Umphathi zifundo	Sayina	Umhla

Annexure B (3): Permission request to the Eastern Cape Provincial Department of Health

Permission request to the Eastern Cape Provincial Department of Health and National Health Laboratory Services

Sisanda Mrwebi

MSc Environmental Health Student

Tel: +27 (0)71 029 9167

E-mail: sisamr.web@gmail.com

Eastern Cape Department of Health

Sisanda Mrwebi (214247554) is doing research entitled**: Assessment of Knowledge, Attitudes and hygiene Practices of Expanded Public Works Programme and Community Work Programme general workers and the prevalence of Intestinal parasites in Sarah Baartman District Municipality, Eastern Cape,** to assess the Knowledge, Attitudes and Practices (KAP) of EPWP **and CWP** general workers in Sarah Baartman district, Eastern Cape, South Africa. As the principal investigator for this project, I am hereby seeking your permission to and consent to obtain the prevalence of intestinal parasites in Sarah Baartman District from 2012-2020.

The data will be kept safe and confidential, no identity from the data will be disclosed in the study. For audit and reference purposes a copy of the data will be kept in a laptop with a password to which only I, the Principal Investigator and the Primary Responsible Person/Supervisor will have access. For audit and reference purposes the data will be kept for a period of five years for reference and audit purposes.

I (name) .....On behalf of the Eastern Cape Department of Health hereby consent to the above-mentioned researcher's access to the ten-year prevalence of intestinal parasites in Sarah Baartman district , to be used for the specified research project. I understand that personal information will be kept confidential.

ECDOH Representative initials and surname	Signature	Date
Researcher	Signature	Date

Annexure C: Request for permission to conduct study

Request for permission to conduct study from Gatekeeper

EPWP **and CWP** general Workers Manager

Kouga municipality

6300

REQUEST FOR PERMISSION TO CONDUCT RESEARCH ON EXPANDED PUBLIC WORKS PROGRAMME (EPWP) AND COMMUNITY WORK PROGRAMME GENERAL WORKERS, IN KOUGA MUNICIPALITY

Sisanda Mrwebi (214247554) is doing research entitled**: Assessment of Knowledge, Attitudes and hygiene Practices of Expanded Public Works Programme and Community Work Programme (CWP) general workers and the prevalence of Intestinal parasites in Sarah Baartman District, Eastern Cape. The aim of the study is** to assess the Knowledge, Attitudes and Practices (KAP) of EPWP **and CWP** general workers in Sarah Baartman district, Eastern Cape, South Africa. As the principal investigator for this project, I am hereby seeking your permission to access the Kouga municipality Expanded Public Works Programme (EPWP) **and Community Work Programme (CWP**) general workers in the proposed project. Only participants who consented to participate will be involved in the proposed study.

Upon completion of the study, I undertake to provide the Kouga municipality EPWP **and CWP** general workers and the Kouga municipality with findings and recommendations as well as intervention strategies from the study. If you require any further information, please do not hesitate to contact me via the details below.

I am looking forward to a response from you.

Thank you for consideration on the subject.

Yours sincerely,

Sisanda Mrwebi

MSc Environmental Health Student

Tel:+27 (0)71 029 9167

E-mail: sisamr.web@gmail.com

Annexure D: Ethics approval letter from REC-H

NELSON MANDELA UNIVERSITY

PO Box 77000, Nelson Mandela University, Port Elizabeth, 6031, South Africa mandela.ac.za

Chairperson: Research Ethics Committee (Human)
Tel: +27 (0)41 504 2347
sharlene.govender@mandela.ac.za

NHREC registration nr: REC-042508-025

Ref: [H20-HEA-ENV-006] / Approval]

20 January 2021

Prof P Melariri
Faculty: Health Sciences

Dear Prof Melariri

KNOWLEDGE, ATTITUDES AND HYGIENE PRACTICES OF EXPANDED PUBLIC WORKS PROGRAMME WORKERS AND THE PREVALENCE OF SOIL TRANSMITTED HELMINTHS IN HUMANSDORP, EASTERN CAPE

PRP: Prof P Melariri
PI: Ms S Mrwebi

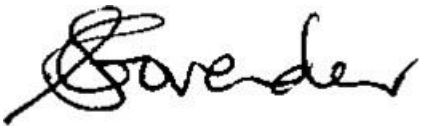
Your above-entitled application served at the Research Ethics Committee (Human) (*25 November 2020*) for approval. The study is classified as a medium risk study. The ethics clearance reference number is **H20-HEA-ENV-006** and approval is subject to the following conditions:

1. The immediate completion and return of the attached acknowledgement to Imtiaz.Khan@mandela.ac.za, the date of receipt of such returned acknowledgement determining the final date of approval for the study where after data collection may commence.
2. Approval for data collection is for 1 calendar year from date of receipt of above mentioned acknowledgement.
3. The submission of an annual progress report by the PRP on the data collection activities of the study (form RECH-004 available on Research Ethics Committee (Human) portal) by 15 November this year for studies approved/extended in the period October of the previous year up to and including September of this year, or 15 November next year for studies approved/extended after September this year.
4. In the event of a requirement to extend the period of data collection (i.e. for a period in excess of 1 calendar year from date of approval), completion of an extension request is required (form RECH-005 available on Research Ethics Committee (Human) portal)
5. In the event of any changes made to the study (excluding extension of the study), completion of an amendments form is required (form RECH-006 available on Research Ethics Committee (Human) portal).
6. Immediate submission (and possible discontinuation of the study in the case of serious events) of the relevant report to RECH (form RECH-007 available on Research Ethics Committee (Human) portal) in the event of any unanticipated problems, serious incidents or adverse events observed during the course of the study.
7. Immediate submission of a Study Termination Report to RECH (form RECH-008 available on Research Ethics Committee (Human) portal) upon expected or unexpected closure/termination of study.
8. Immediate submission of a Study Exception Report of RECH (form RECH-009 available on Research Ethics Committee (Human) portal) in the event of any study deviations, violations and/or exceptions.
9. Acknowledgement that the study could be subjected to passive and/or active monitoring without prior notice at the discretion of Research Ethics Committee (Human).

Please quote the ethics clearance reference number in all correspondence and enquiries related to the study. Forspeedy processing of email queries (to be directed to Imtiaz.Khan@mandela.ac.za), it is recommended that the ethics clearance reference number together with an indication of the query appear in the subject line of the email.

We wish you well

with the study.



Yours sincerely

Dr S Govender
Chairperson: Research Ethics Committee (Human)

Cc: Department of
Research Development
Faculty Manager:
Health Sciences

Appendix 1: Acknowledgement of conditions for ethical approval

Annexure E: Study amendment approval letter from REC-H

NELSON MANDELA UNIVERSITY

PO Box 77000, Nelson Mandela University, Port Elizabeth, 6031, South Africa mandela.ac.za

Chairperson: Research Ethics Committee (Human)
Tel: +27 (0)41 504 2347
sharlene.govender@mandela.ac.za

NHREC registration nr: REC-042508-025

Ref: [H20-HEA-ENV-006 / Amendment]

30 September 2021

Prof P Melariri
Faculty: Health Sciences

Dear Prof Melariri

ASSESSMENT OF KNOWLEDGE, ATTITUDES AND PRACTICES AND THE PREVALENCE OF INTESTINALPARASITES IN SARAH BAARTMAN DISTRICT, EASTERN CAPE

PRP: Prof P Melariri
PI: Ms S Mrwebi

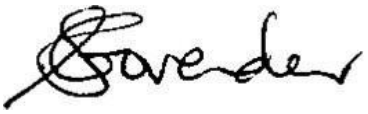
The request for an amendment to the above-entitled study served at the Research Ethics Committee (Human) (22 September 2021) for approval. We take pleasure in informing you that the Research Ethics Committee (Human) approved the amendment. The ethics number remains **[H20-HEA-ENV-006]**; approval is subject to the following conditions:

1. The immediate completion and return of the attached acknowledgement to Imtiaz.Khan@mandela.ac.za.
2. The submission of an annual progress report by the PRP on the data collection activities of the study (form RECH-004 available on Research Ethics Committee (Human) portal) by 15 November this year for studies approved/extended in the period October of the previous year up to and including September of this year, or 15 November next year for studies approved/extended after September this year.
3. In the event of a requirement to extend the period of data collection (i.e. for a period in excess of 1 calendar year from date of approval), completion of an extension request is required (form RECH-005 available on Research Ethics Committee (Human) portal)
4. In the event of any changes made to the study (excluding extension of the study), RECH will have to approve such amendments and completion of an amendments form is required PRIOR to implementation (form RECH-006 available on Research Ethics Committee (Human) portal).
5. Immediate submission (and possible discontinuation of the study in the case of serious events) of the relevant report to RECH (form RECH-007 available on Research Ethics Committee (Human) portal) in the event of any unanticipated problems, serious incidents or adverse events observed during the course of the study.
6. Immediate submission of a Study Termination Report to RECH (form RECH-008 available on Research Ethics Committee (Human) portal) upon expected or unexpected closure/termination of study.
7. Immediate submission of a Study Exception Report of RECH (form RECH-009 available on Research Ethics Committee (Human) portal) in the event of any study deviations, violations and/or exceptions.
8. Acknowledgement that the study could be subjected to passive and/or active monitoring without prior notice at the discretion of Research Ethics Committee (Human).

Please quote the ethics clearance reference number in all correspondence and enquiries related to the study. For speedy processing of email queries (to be directed to Imtiaz.Khan@mandela.ac.za), it is recommended that the ethics clearance reference number together with an indication of the query appear in the subject line of the email.

We wish you well with the study.

Yours sincerely



Dr S Govender
Chairperson: Research Ethics Committee (Human)

Cc: The Office of Research Development
Faculty Manager: Health Sciences

Appendix 1: Acknowledgement of conditions for ethical approval

Appendix 1

ACKNOWLEDGEMENT OF CONDITIONS FOR ETHICS APPROVAL – AMENDMENT

I, Prof P Melariri (PRP) of the study entitled **ASSESSMENT OF KNOWLEDGE, ATTITUDES AND PRACTICES AND THE PREVALENCE OF INTESTINAL PARASITES IN SARAH BAARTMAN DISTRICT, EASTERN CAPE** [H20-HEA-ENV-006], do hereby agree to the following approval conditions:

1. The submission of an annual progress report by myself on the data collection activities of the study by 15 November this year for studies approved in the period October of the previous year up to and including September of this year, or 15 November next year for studies approved after September this year. It is noted that there will be no call for the submission thereof. The onus for submission of the annual report by the stipulated date rests on myself. I am aware of the guidelines (available on Research Ethics Committee (Human) portal) pertinent to the submission of the annual report.

2. Submission of the relevant request to RECH in the event of any amendments to the study for approval by RECH prior to any partial or full implementation thereof. I am aware of the guidelines (available on Research Ethics Committee (Human) portal) pertinent to the requesting for any amendments to the study.

3. Submission of the relevant request to RECH in the event of any extension to the study for approval by RECH prior to the implementation thereof.

4. Immediate submission of the relevant report to RECH in the event of any unanticipated problems, serious incidents or adverse events. I am aware of the guidelines (available on Research Ethics Committee (Human) portal) pertinent to the reporting of any unanticipated problems, serious incidents or adverse events.

5. Immediate discontinuation of the study in the event of any serious unanticipated problems, serious incidents or serious adverse events.

6. Immediate submission of the relevant report to RECH in the event of the unexpected closure/discontinuation of the study (for example, de-registration of the PI).

7. Immediate submission of the relevant report to RECH in the event of study deviations, violations and/or exceptions. I am aware of the guidelines (available on Research Ethics Committee (Human) portal) pertinent to the reporting of any study deviations, violations and/or exceptions.

8. Acknowledgement that the study could be subjected to passive and/or active monitoring without prior notice at the discretion of RECH. I am aware of the guidelines (available on Research Ethics Committee (Human) portal) pertinent to the active monitoring of a study.

Signed: _____ Date: 01 October 2021

Annexure F: Study closure letter from REC-H

NELSON MANDELA
UNIVERSITY

PO Box 77000, Nelson Mandela University, Port Elizabeth, 6031, South Africa mandela.ac.za

Chairperson: Research Ethics Committee (Human)
Tel: +27 (0)41 504 3624
Dalray.Gradidge@mandela.ac.za

NHREC registration nr: REC-042508-025

Ref: [H20-HEA-ENV-006/ Closure]

19 April 2023

Prof P Melariri
Faculty: Health Sciences

Dear Prof Melariri

ASSESSMENT OF KNOWLEDGE, ATTITUDES AND PRACTICES AND THE PREVALENCE OF INTESTINALPARASITES IN SARAH BAARTMAN DISTRICT, EASTERN CAPE

PRP: Prof P Melariri
PI: Ms S Mrwebi

The above-entitled progress and closure reports were reviewed by the Research Ethics Committee (Human) (17 March 2023) for approval. We take pleasure in informing you that REC-H has approved the reports. We note that your study is now successfully closed and thank you for conducting your research ethically and with integrity.

If you have any queries, please quote your ethics clearance reference number in all correspondence and enquiries related to the study. For speedy processing of email queries (to be directed to Imtiaz.Khan@mandela.ac.za), it is recommended that the ethics clearance reference number together with an indication of the query appear in the subject line of the email.

Thank you for your participation in the

ethics process.Yours sincerely

Dr D Gradidge
Chairperson: Research Ethics Committee (Human)

Cc: The Office of Research DevelopmentFaculty Manager: Health Sciences

Annexure G: Request for permission to conduct study from Gatekeeper

Kouga EPWP and CWP general Workers Manager

Kouga local municipality

6300

REQUEST FOR PERMISSION TO CONDUCT RESEARCH ON EXPANDED PUBLIC WORKS PROGRAMME (EPWP) AND COMMUNITY WORK PROGRAMME GENERAL WORKERS IN KOUGA LOCAL MUNICIPALITY

Sisanda Mrwebi (214247554) is doing a research titled: Assessment of knowledge, attitudes, practices and the prevalence of intestinal parasites in Sarah Baartman District, Eastern Cape. , The aim of the study is to assess the Knowledge, Attitudes and Practices (KAP) of Expanded Public Works Programme (EPWP) and Community Work Programme (CWP) general workers in Sarah Baartman district, Eastern Cape, South Africa. As the principal investigator for this project, I am hereby seeking your permission to access the Kouga local municipality EPWP and CWP general workers in the proposed project. Only participants who consented to participate will be involved in the proposed study.

Upon completion of the study, I undertake to provide Kouga local municipality EPWP and CWP with findings and recommendations of the study. If you require any further information, please do not hesitate to contact me via the details below.

I am looking forward to a response from you.

Thank you for consideration on the subject.

Yours sincerely,

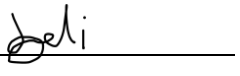
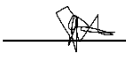
Sisanda Mrwebi

MSc Environmental Health Student

Tel: +27 (0)71 029 9167

e-mail: s214247554@mandela.ac.za

I (name) ..Nqabisa Mvimbeli.. On behalf of the Kouga local municipality EPWP and CWP hereby consent to the above-mentioned researcher's access to EPWP and CWP general workers in Kouga local municipality who consent to form part of the study. I understand that their personal information will be kept confidential.

_N. Mvimbeli		12-02-2021
Kouga CWP and EPWP Representative initials and surname	Signature	Date
Sisanda Mrwebi		12-02-2021
Researcher	Signature	Date

Annexure H: Permission from the Eastern Cape Department of Health to obtain data

Province of the
EASTERN CAPE
HEALTH

Enquiries: Yvonne Gixela Tel no: 079 074 0859

Email: Yvonne.Gixela@echealth.gov.za / ygixela@gmail.com

Date: 18 October 2021

ASSESSMENT OF KNOWLEDGE, ATTITUDES AND PRACTICES AND THE PREVALENCE OF INTESTINAL PARASITES IN SARAH BAARTMAN DISTRICT, EASTERN CAPE (EC_202110_005)

Dear Miss S. Mrwebi

The department would like to inform you that your application for the abovementioned research topic has been approved based on the following conditions:

1. During your study, you will follow the submitted protocol with ethical approval and can only deviate from it after having a written approval from the Department of Health in writing.

2. You are advised to ensure, observe and respect the rights and culture of your research participants and maintain confidentiality of their identities and shall remove or not collect any information which can be used to link the participants.

3. The Department of Health expects you to provide a progress update on your study every 3 months (from date you received this letter) in writing.

4. At the end of your study, you will be expected to send a full written report with your findings and implementable recommendations to the Eastern Cape Health Research Committee secretariat. You may also be invited to the department to come and present your research findings with your implementable recommendations.

5. Your results on the Eastern Cape will not be presented anywhere unless you have shared them with the Department of Health as indicated above.

Your compliance in this regard will be highly appreciated.

SECRETARIAT: EASTERN CAPE HEALTH RESEARCH COMMITTE

Annexure I: Approval to access NHLS data

Academic Affairs and Research
Modderfontein Road, Sandringham, 2031
Tel: +27 (0)11 386 6142
Fax: +27 (0)11 386 6296
Email: babatyi.kgokong@nhls.ac.za
Web: www.nhls.ac.za

01 July 2021

Applicant: Sisanda Mrwebi Institution: Nelson Mandela University Department: Health Sciences
Email: sisamr.web@gmail.com
Cell: 071 029 9167

Re: Approval to access National Health Laboratory Service (NHLS) Data

Your application to undertake a research project "Knowledge Attitudes and Practices of Expanded Public Works Programme general workers on Soil Transmitted Helminths and the five year prevalence of Soil Transmitted Helminths in Humansdorp, Eastern Cape, Ref No: PR2116824" using data from the NHLS database has been reviewed. This letter serves to advise that the application has been approved and the required data will be made available to you *without patient names* to conduct the proposed study as outlined in the submitted application. Submissions should be made annually on the AARMS system – https://aarms.nhls.ac.za.

Please note that approval is granted on your compliance with the NHLS conditions of service and that the study can only be undertaken provided that the following conditions have been met.

- **Processes are discussed with the relevant NHLS departments (i.e. Information Management Unit and Operations Office) and are agreed upon.**
- **Confidentiality is maintained at participant and institutional level and there is no disclosure of personal information or confidential information as described by the NHLS policy.**
- **NHLS Data cannot be used to track patients as no pre-approval/consent is obtained from Patients.**
- **All data requested should be in accordance with the research protocol submitted and approved by the relevant Ethics Committee.**
- **Request for the inclusion of the NHLS as a source of data in the original protocol to be approved by Ethics as NHLS does not have a Human Research Ethics Committee.**
- **A final report of the research study and any published paper resulting from this study are submitted and addressed to the NHLS Academic Affairs and Research office and the NHLS has been acknowledged appropriately.**

Please note that this letter constitutes approval by the NHLS Academic Affairs and Research Office. Any data related queries may be directed to NHLS Corporate Data Warehouse, contact number: 011 386 6074 email: zarina.sabat@nhls.ac.za

Dr Babatyi Malope-Kgokong
National Manager: Academic Affairs and Research

Chairperson: Prof Eric Buch CEO: Dr Karmani Chetty
Physical Address: 1 Modderfontein Road, Sandringham, Johannesburg, South Africa Postal Address: Private Bag X8, Sandringham, 2131, South Africa
Tel: +27 (0) 11 386 6000/ 0860 00 NHLS(6457) www.nhls.ac.za
Practice number: 5200296

Annexure J: Approval of amended data request from NHLS to obtain data 11

Academic Affairs and Research
Modderfontein Road, Sandringham, 2031
Tel: +27 (0)11 386 6142
Fax: +27 (0)11 386 6296
Email: babatyi.kgokong@nhls.ac.za
Web: www.nhls.ac.za

27 October 2021

Applicant: Sisanda Mrwebi
Institution: Nelson Mandela University
Department: Health Sciences
Email: sisamr.web@gmail.com
Cell: 071 029 9167

Re: Approval of amended request to access National Health Laboratory Service (NHLS) Datafor Research purposes

Your application to undertake a research project titled "ASSESSMENT OF KNOWLEDGE, ATTITUDES AND PRACTICES AND THE PREVALENCE OF INTESTINAL PARASITES IN SARAH BAARTMAN DISTRICT, EASTERN CAPE" Ref No: PR2116824 has been reviewed. This letter serves to advise that your request to access additional data from the NHLS for you research has beenapproved. The required data will be made available to you to conduct the proposed study as outlined in the submitted amended application. The conditions stated in your prior approval are still applicable.

Please note that this letter constitutes approval by the NHLS Academic Affairs and Research Office. Any data related queries may be directed to NHLS Corporate Data Warehouse, contact number: 011 386 6074 email: zarina.sabat@nhls.ac.za

Dr Babatyi Malope-Kgokong
National Manager: Academic Affairs and Research

Chairperson: Prof Eric Buch CEO: Dr Karmani Chetty
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Annexure K: Summary of Turnitin report

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