KIBOGORA POLYTECHNIC

FACULTY OF HEALTH SCIENCES

DEPARTMENTOF BIOMEDICAL LABORATORY SCIENCES

PREVALENCE AND RISK FACTORS ASSOCIATTED WITHSOIL TRANSMITTED HELMINTHS INFECTIONS AMONG SCHOOL-AGE CHILDREN

Case study: Nkombo Island

Period:22nd September-5th October, 2021

Undergraduate thesis presented in partial fulfillment of the requirements for the Bachelor's degree with honor in Biomedical Laboratory Sciences.

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DECLARATION

Declaration by the candidates

We, Jean Alceste IRADUKUNDA and NISARO Sonia Parfaite we hereby declare that this is our original work and not a duplication of any similar academic work. It has therefore not been previously or concurrently submitted for any other degree, diploma or other qualification to Kibogora Polytechnic or any other institution. All materials cited in this paper which are not our own have been duly acknowledged.

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I declare that this work has been submitted for examination with my approval as a KP supervisor.

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ABSTRACT

The study aimed to determine the prevalence and risk factors associated with soil transmitted helminthes infections among school-age children at Nkombo Island, in Western Rwanda.

The study adopted cross-sectional study and quantitative approach. During our study 100 stool samples were collected from 100 children in age of five to sixteen years old and all 100 stool samples were examined by Kato Katz concentration technique and then analyzed by an optical microscope. The Data analyses were done by using Microsoft Excel and statistical package for social sciences (SPSS) software, Version 20.The study shows that the overall prevalence of STH among school-age children at Nkombo Island was 52 (52%), with Ascaris lumbricoides being the most prevalent 27(27%) followed by Trichuris trichiura 21(21%)and Hookworm with a prevalence of 4(4%). The knowledge was statistically significant at a p-value of 0.006; it was increasing within the age groups of the study respondents. There was no statistical relationship between being infected with STH and some of the risk factors of STH. The findings show that there was a statistical relationship between being infected with STH and washing hands after defecation with a p-value of 0.018. Not washing hands after defecation should lead to infections of STH in the school age children. Health promotion activities to enhance awareness are important in ensuring that the risks for being infected with soil-transmitted helminthes are minimal. Regular mass treatment anti-helminthic drug administration should be maintained so as to ensure that the prevalence of soil-transmitted helminthes goes at a lower rate. We recommended nkombo health center to increase the education to the entire population about the cause and prevention of soil transmitted helminthes mainly school-age children; integrating methods of controlling soil transmitted helminthes which include health education so as to ensure health practices and to reduce risk factors for transmission of STH.Ministry of health in Rwanda and Rwanda education board have to build sufficient toilets at their schools and providing hygiene related material at schools for the prevention of soil transmitted helminthes.

DEDICATION


Dedication
To the almighty God,
To our beloved families,
To our sisters and brothers,
To our classmate and friends

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First and foremost; we are thankful to the almighty God for blessing each day of our life more especially during our studies.

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ACRONYMS

CDC: Centers for Disease Control

CI: Confidence Interval

DF: Degree of Freedom

HC: Health Center

MDA: Mass Drug Administration

P1: Primary One

P6: Primary Six

P-value: Probability Value

SPSS: Statistical Package for Social Sciences

STH: Soil Transmitted Helminthes

WHO: World Health Organization

CHAPTER ONE: GENERAL INTRODUCTION

1.0 INTRODUCTION

This chapter contains the background of the study, problem statement, objectives of the study including general objectives and specific objectives, the significance of the study, limitations of the study and the scope of the study.

1.1 DEFINITION AND DESCRIPTION OF SOIL TRANSMITTED HELMINTHES

Soil transmitted helminthes (STH) are intestinal nematodes whose part of their development takes place outside the body of the host. These organisms make soil as their intermediate host before they infect the individual (Grang *et al.,* 2003). The three most common STH are the large intestinal round worm (*Ascaris lumbricoides*), whipworm (*Trichuris trichiura*) and the anthropophilic hookworms (*Nectar americanus* and *Ancylostoma duodenale*).

Intestinal parasitic infections are highly prevalent in developing countries, mainly due to deficiency in sanitary facilities, unsafe human waste disposal systems, inadequacy and lack of safe water supply and low socio-economic status (Savoili, *et al.,* 1992). It is estimated that soil transmitted helminthiasis and shistosomiasis present more than 55% of the disease burden due to all tropical diseases, excluding malaria. Most morbidity is seen in pre-school children, school-age children and women of child-bearing age (WHO, 1999).

Trichuris and Ascaris infections often found together and they have similar mode of transmission. Adult worms live in the lumen of the small intestine. A female may produce eggs which are passed with the feces. Unfertilized eggs may be ingested but are not infective. Fertile eggs embryonate and become infective after several weeks, depending on the environmental conditions (optimum: moist, worm, shaded soil). After infective eggs are swallowed, the larva hatch, invade the intestinal mucosa and are carried out via portal, then systemic circulation to the lungs. Upon reaching the small intestine, they develop into adult worms. Between 2 and 3 months are required from the ingestion of the infective eggs to oviposition by the adult female. Adult worms can live 1 to 2 years.

The life cycle of Hookworm is quite different from Trichuris and Ascaris. Eggs passed with the feces develop to rhabditiform larva in moist shaded soil and it feeds on the bacteria, moults to filariform larva. Under favorable conditions (shade, moist soil & warmth 25°C- 35°C), filariform larva can survive for 3-6 weeks. Filariform larva ascends vertically 60-90 cm & laterally about 30 cm in sandy loamy soils. Therefore wet type earthen floor pit latrines or shallow pits for defecation allow penetration of Hookworm to the top. Filariform larvae penetrate human skin and are carried by blood circulation to the lungs. They travel and reach the trachea and through coughing they are swallowed and reach the small intestine then develop to the adult worms and female lay eggs.

Prevalence of these intestinal worms varies according to the hygienic conditions and socio-economic status of the area and occurs in all age of the groups and sex but it is highest among children. In areas where feces are used in agricultural fertilizer, infection is common in farm workers. It has been estimated that almost two billion people are infected with one or more of these soil transmitted helminth which account for up to 40% of the universal morbidity (Hotez, *et al.,* 2003). STH infections rarely cause death. Instead, the burden of the disease is related to less to mortality than to the chronic on the hosts' health and nutritional status (Stephenson *etal.,* 2000). Hookworms have been long recognized as an important cause of the intestinal blood loss reading to iron deficiency and protein malnutrition. The iron deficiency anemia that accompanies moderate and heavy hookworms burdens is sometimes referred as hookworm disease (Hotez *et al.,* 2004).

Rwanda has been having the prevalence of the soil transmitted helminthes infections, but the government in partnership with the child development agencies carried out an extensive operational research, training teachers to administer Albendazole to treat intestinal nematodes. The government is committed to control shistosomiasis and the spread of entire STH among children. Since transmission is most common among school-age children who bear the heaviest burden of the disease, the implementation strategy using large scale mass drug administration (MDA).The immediate broad objective of the program was to reduce the prevalence and the intensity by 50% in 4 years at least one third of the districts in Rwanda mainland. The intermediate objective was to set up the sustainable mechanism for the delivery of the Praziquantel and Albendazole to school-age children and other vulnerable age groups and to promote personal hygiene and sanitation. Development of the sustainable national control

program to reduce morbidity due to shistosomiasis and STH to level where it is no longer a public health problem was taken as a long term objective.

Health education targeted school children through their teachers who were responsible for encouraging personal and the environmental hygiene within the schools and at home. Work was carried out in primary schools, with the aim of improving children's personal hygiene in general, and with particular reference to the need to encourage the aspects of personal hygiene relevant to the control of helminthes infection for instance using latrines, hand-washing, keeping the latrines and the general school environment cleanliness, wearing footwear, and being aware of the dangers of contaminated water (Nyandindi *et al.,* 1995)

1.2 BACKGROUND

The updated global distribution of soil-transmitted helminthes revealed that the tropics and subtropics have widespread infection of all the three soil-soil transmitted helminths. Estimate suggest that A.lumbricoides infects 1.221 billion people. Trichiura 795 million, and hookworms 740 million worldwide (Silva, *et al.,* 2003).The greatest numbers of geohelminths infection occur in the Americas, China and East Asia, and Sub-Saharan Africa. *Strongylloidesstercolaris* is also a common STH in some of these regions, although detailed information on the prevalence of strongyloidiasis is lacking because of the difficulties in diagnosing human infection. Also it has been estimated that over one billion people who are infected with *Ascaris lumbricoides* worldwide the school children are being the mostly affected (Ogbe, *et al.,* 2002). Also the WHO (2006) report shows that the prevalence of STH is high among children in rural areas of developing countries where 400 million school-age children who are infected are physically and intellectually affected by malnutrition, leading to cognitive deficits, learning disabilities and high school absenteeism (WHO,2006).

In most countries where soil-transmitted helminthes are endemic, school age children experience the highest prevalence and the intensity of infection, particularly with *Ascaris lumbricoides* and *Trichuris trichiura* (Hall, *et al.,* 1997). Morbidity has been traditionally considered a result of heavy geo-helminth infections; children with light infections were thought to suffer no ill effects. There is increasing evidence however, that even low or a moderate intensity infection significantly retards childhood growth and development (Stephenson, 1994).

Chronic STH infections resulting from Ascaris, Trichuris, and hookworm can dramatically affect physical and mental development in children (WHO, 2002). Studies also show that the growth and physical fitness deficits caused by chronic STH infections are reversible following treatment with anthelmintic drugs (Stephenson, *et al.,* 2000). The effects on growth are most pronounced in children with the heaviest infections may also contribute to growth deficits if the nutritional status of the community is poor. Soil transmitted helminthes infections rarely cause death thus, the burden of STH disease is related less to mortality than the chronic effects on the hosts' health and nutritional status (Stephenson, *et al.,* 2000). Hookworms have been recognized as the important cause of the intestinal blood loss leading to iron deficiency and protein malnutrition. The iron deficiency anemia that accompanies moderate and heavy hookworms burden is sometimes referred to as hookworm disease (Hotez, *et al.,* 2004)

Soil transmitted helminthes infect more than one third of the African continent's population at any one time and the prevalence of *Ascaris lumbricoides* and *Trichuris trichiura* is greatest in the equatorial, central and west Africa, eastern Madagascar, and southeast Africa, whereas hookworm is more widely distributed across the continent (Brooker, *et al.,* 2006). Study done by (Brooker, *et al.,* 2000) among school children in Busia District Kenya showed that 91.7% of children were infected with hookworm or *Ascaris lumbricoides* or *Trichuris trichiura*. They concluded that helminth infection were exceptionally common among the school children in Busia District, thus confirming the good sense of the school based approach adopted by the control programme. The study also showed that there was an association between concurrent infection and the intensity of infection, which might have consequences for nutritional and educational status.

(Chukumwa, *et al.,* 2009) in Nigeria showed that 53.6% soil and 87.7% stool samples were positive. The recovery rates from stool samples were; eggs of *Ascaris lumbricoides* (54.1%). Hookworm (45.5%), and *Trichuris trichiura* (18%). Prevalence from soil samples showed (24.0%) of Ascaris eggs, (25.9%) of hookworm eggs. The wide and unrestricted spread of the infection was attributed to failure to wear footwear in school, lack of functioning toilet facilities, geophagia and preference of the pupils to defecate in the bush leading to indiscriminate defecation in and the school yard (Chukumwa, *et al.,* 2009).

Associated factors for soil transmitted helminthic infection usually related to hygiene, sanitation and environmental conditions. In a study done in Uganda, having a pit latrine or toilet versus no toilet showed a protective effect against some hygiene-related helminthic infection (Woodbum, *et al.,* 2009). Use of unprotected water source, such as river water and the lack of drinking water treatment were seen to be associated with at least one soil-transmitted helminthes species (Van Eijk, *et al.,* 2003). Geophagy is also associated with infection with *Ascaris lumbricoides* and *Trichuris trichiura* (Luoba, *et al.,* 2005). The absence of clean water to wash vegetables and fruits properly and the lack of knowledge on intestinal helminthic infection may increase the infection rate in rural and poor community. Eating without washing hands and not washing hands after using toilets are also the risk factors for having geohelminths.

In Rwanda a preventive chemotherapy is a WHO-recommended core intervention measures to evaluate soil transmitted helminthes as a public health problem by 2020, defined as a reduction in prevalence to less than 1% of moderate or high intensity infection. The conducted cross-sectional study to investigate the prevalence of STH after a decade of preventive chemotherapy in Rwanda by Joseph Kabatende,Lazare Ntirenganya from Department of laboratory Medicine, Division of clinical Pathology, Karolinska Institute, Karolinska University Hospital Huddinge, 14186 Stockholm, Sweden;(J.K.);. A total of 4998 school children (5-15 years old) from four districts along Lake Kivu in Western province were screened for STH using Kato-Katz, the overall prevalence of soil transmitted helminthes among the school children was 77.7%.*Trichuris trichiura* was the most common STH 66.8% followed by *Ascaris lumbricoides* 49.9% and hookworms 1.9%.

1.3 PROBLEM STATEMENT

The cross-sectional study conducted in 2020, investigated the prevalence, intensity and the associated risk factors for STH infections (ascariasis, trichuriasis and hookworms) among school children 5-15 years old attending eight primary schools in four rural districts in western province of Rwanda (Michael Mugisha *et al.,* 2020). The study districts (Rusizi, Nyamasheke, Rubavu and Rutsiro) lay on the belt of lake Kivu, which is among the most STH endemic region in Rwanda. The main findings of the study included;(a) a high overall prevalence (77.7%) of STH infection, though prevalence significantly varies between study districts(ranging from 54% to 92%) and between study schools (ranging from 54% to 93%); (b) *Trichiura* (66.8%)was the

most prevalent STH parasite species followed by *A. lumbricoides* (49.9%), and hookworms (1.9%); (c)a high prevalence of multiple parasites coinfection (> 50%) mostly with *T.trichiura* and *A.lumbricoides*, (d) stunting, male sex, living districts, school and shistosomiasis were significant predictors of high infection intensity, particularly for T.trichiura and *A .lumbricoides* infections.

Historically NKOMBO Island has been having high prevalence of soil-transmitted helminthes. This is due to poor sanitation, favorable climatic and soil conditions as the island is surrounded by Lake Kivu. The Mass Drug Administration (MDA) intervention started in 2008 and the implementation was the administration of Ivermectin and Albendazole twice per year to primary school children. This intervention has been carried regularly but in some years no biannual but at least once a year. Additionally, every year new pupils start primary school, thus it is important that these new pupils are also given the intervention.

MDA intervention by administration of anti-helminthic drugs has a key role in reduction of soil-transmitted helminths however this program seems not sufficient alone to faster a speed reduction or complete eradication of these intestinal worms unless other programs like clean water supply, poverty reduction, education are also put into place.

Therefore the main goal of our study was to determine the prevalence and risk factors associated with soil transmitted helminthes infectionsamong school age children at Nkombo as one important place among region with high prevalence STHs at national level.

1.4. PURPOSE OF THE STUDY

Soil transmitted helminthes are common health problems of children. Children at school-age are at risk of developing clinical manifestation, because helminthic infections such as *Trichuris trichiura* and *Ascaris lumbricoides* reach maximum intensity at 5-16 years of age. Chronic infections resulting from Ascaris, Trichuris, and hookworm can dramatically affect physical and mental development in children.

This study willdetermine the prevalence of soil transmitted helminthes infections among school age children at Nkombo Island, in western Rwanda. Moreover it will assess the knowledge and factors associated with STH intervention.

1.5. RESEARCH OBJECTIVES

1.5.1 General objectives

To evaluate impact of chemotherapy preventive program of soil transmitted helminthes infections among school-age children at NKOMBO Island, in western Rwanda.

1.5.2. Specific objectives

1. To determine the most prevalent soil transmitted helminth NKOMBO Island after chemotherapy preventive program.
2. To determine knowledge of school children on soil transmitted helminthes at NKOMBO island
3. To identify the risk factors associated with soil transmitted helminthes infections among school children in NKOMBO Island.

1.6 RESEARCH QUESTIONS

1. What is the most prevalent of soil transmitted helminth among school-age children in NKOMBO Island after chemotherapy preventive program?

2. Which level of knowledge do school children have about soil transmitted helminthes infections at NKOMBO Island, in Western Rwanda?

3.What are the risk factors associated with soil transmitted helminthes infection among school children in NKOMBO Island?

1.7 SIGNIFICANCE OF THE STUDY

The findings from the research will be important as the following:

1.7.1 to the researchers

We will gain more knowledge about soil transmitted helminthes among school children, and we will have an opportunity to practice the knowledge acquired during our studies, especially the study will help us to fulfil the requirement to get bachelor's degree with honors in Biomedical Laboratory Sciences.

1.7.2. To the institution

Kibogora Polytechnic community and the other researchers who will be interested in this area of the study will use this for the purpose of acquiring information and the practical knowledge. It will also provide them a basis for the additional literature for their future research about soil transmitted helminthes among school-age children.

1.7.3 To NKOMBO Health Center

The people living at NKOMBO Island will benefit from this study, since they will know the prevalence and the risk factors associated with soil transmitted helminthes. This will help the directions of the NKOMBO Health Center to know the gap in the reduction or complete eradication of soil transmitted helminths therefore the findings of our research will help them to take measures and strategies to reduce or eradicatethe soil transmitted helminthes among school-age children in NKOMBO Island. Furthermore the results from the study will help the policy makers and strategic planning.

1.8 LIMITATIONS OF THE STUDY

The transportation means to cross the Lake Kivu to the island was very fearful. Some of the children failed to provide the necessary information which could be retrieved from the questionnaires, therefore reducing the number of participants and may resulted into miss of some information..

1.8 SCOPE OF THE STUDY

1.8.1Content Scope

This study will cover only *Ascaris lumbricoides, Trichuris trichiura* and *Ancylostoma duodenale.*

1.8.2 Geographical Scope

The study will be carried out in NKOMBO Island, Located in Western-Rwanda, RUSIZI district, NKOMBO Sector. The Island located in Lake Kivu, the later links two countries Democratic Republic of Congo and Rwanda

1.8.3 Time Scope

This study will be conducted from July to October 2021.

CHAPER TWO: LITERATURE REVIEW

2.0 INTRODUCTION

The literature review explores the analysis of existing literature on the subject with the objective of revealing contribution, weakness and gaps.

2.1 DEFINITION OF KEY TERMS

2.1.1Soil Transmitted Helminthes(STH): The centers for disease control and prevention (CDC) defines soil transmitted helminthes as the intestinal worms infecting humans that are transmitted through contaminated soil(helminth means parasitic worm) *Ascaris Lumbricoides* just called Ascarism, Whipworm (*Trichuris trichiura*) and hookworm (*Ancylostoma duodenale* and *Nectar americanus*)

2.1.2 Risk factor: A risk factor is any attribute, characteristic or exposure of an individual that increases the likelihood of developing a disease or an injury (Yang *et al,* 2018)

2.2 CAUSES AND CHARACTERISTICS OF HELMINTH INFECTION

Emphasis is placed on four most common STH infections and the three most common schistosome infections. Together, these infections account for most of the global helminthes disease burden. STH infections rarely cause death. Instead the burden of the disease is related less to mortality than to the chronic and insidious effects of the hosts' health and the nutritional status (Latham, 2000; Stoltzfus, 1997). Hookworms have long recognized as an important cause of intestinal blood loss leading to iron deficiency and protein malnutrition. The iron deficiency anemia that accompanies moderate and heavy hookworms burdens is sometimes referred to as hookworms disease (Hotez, 2014).

When host iron stores are depleted, the extent of iron deficiency anemia is linearly related to the intensity of hookworm infection (stoltzfus, 1997). Because of their underlying poor iron status, children, women of the reproductive age, and pregnant women are frequently the ones most susceptible to developing hookworm anemia (Brooker, 2004). Iron deficiency anemia during

pregnancy has been linked to adverse maternal-fetal consequences, including prematurity, lowbirth weight, and impaired lactation (WHO, 2002).

Chronic STH infections resulting from Ascaris, Trichuris, and hookworm can dramatically affect physical and mental development in children (WHO, 2002).studies have also shown the growth and the physical fitness deficit caused by chronic STH infections are sometimes reversible following treatment with anthelminthic drug. The effects on growth are most pronounced in children with the heaviest infections, but light infections may also contribute to growth deficit if the nutritional status of the community is poor (Stephenson, 2000).

2.3. CONTROL OF SOIL-TRANSMITTED HELMINTHS

Among the strategies of integrated control of neglected tropical diseases, deworming programme represents one of the most efficient and cost-effective to improve child health and education, pregnancy outcome, reducing anemia, improve worker productivity,and prevent blindness and the diseases. Single-dose anthelminthic treatment, usually without prior diagnosis administered to high risk groups, is the strategy of choice. This approach has been termed preventive chemotherapy (Knopp*et al.,* 2007)

Chemotherapy with single dose, broad-spectrum, safe and low cost anthelminthic drugs is the support of programmes aimed at the control of the morbidity due to intestinal nematodes (Savioli *et al.,* 1992). Chemotherapy targeted at school children has been considered one of the most cost effective strategies to control helminthic infections in endemic areas (Anderson, et al.1985), (Bundy*et al.,* 1990).

Field experiences in different countries confirmed the mathematical models predictions that relatively short intervals between treatments (i.e. 2-6 month) are required in areas of moderate to high transmission in order to reduce the prevalence of helminthic infections to very low levels(Anderson,1989)

STH infections can be controlled cost effectively using anthelminthic (World Bank, 1993). Albendazole has been found to be most appropriate for mass chemotherapy however its efficacy against different geohelminths has been variable (Ismail*et al.,* 1991; Albonico, *et al.,* 1994).

Study done by Elmar *et al.,* (2004) in Kwazulu-Natal South Africa showed that single dose treatment with Albendazole was very effective against hookworms and *A. lumbricoides.*

The integrated methods of controlling soil transmitted helminthes is an effective measure in control programs, chemotherapy must be accompanied with health education to ensure good health practices. (Sufiyan*et al*., 2011) did the study in Nigeria to evaluate the effectiveness of deworming and participatory hygiene education strategy in controlling anemia among children aged 6-15years. They concluded that including the participatory hygiene education to deworming programmes is an effective approach to improve the hemoglobin level of children in areas where there is a high prevalence of hookworms infections, especially as a short-term preventive measure for anemia in children.

2.4. RESEARCH GAP

Based to the information obtained to the literature review we can say that there is a gap where there is no current information regarding to our study in the area of study.

2.5. LITERATURE RELATING TO THE FIRST OBJECTIVE (the prevalence of soil transmitted helminthes)

In the study conducted in Columbia, aimed to establish the prevalence of soil transmitted helminthes (STH) intestinal infections, nutritional status, and anemia in school children aged 7-10 years old in the biogeographic provinces of Colombia in 2012-2013. STH prevalence in the country has not been described within the last 30 years and it is needed in order to establish policies its control in the country.

Stool samples were collected from 6045 children in eight out of nine biogeographic provinces. The combined prevalence of STH in the country was 29.6%. T.trichiura was the most prevalent helminth (18.4%) followed by *A.lumbricoides* (11.3%) and hookworms (6.4%). For *A.lumbricoides* and hookworms, the highest prevalence values were found in the Amazonia province (58.0% and 35.7% respectively). Regarding STH intensity, most cases showed moderate intensity (41.3%) for *A.lumbricoides*, and light intensity, for *T.trichiura* and hookworms. The national prevalence of anemia in school aged children was 14.2% lowest in Nor-Andina province (3.5%) and highest in the Territorios Insulares oceanicos del Caribe province(45.1%)(Gonzalez, 2020).

2.6. LITERATURE RELATED TO THE SECOND OBJECTIVE (to determine the knowledge of the school children on soil transmitted helminthes)

Helminthes infection rates in grade three children are used as proxy indicators of community infection status and to guide treatment strategies in endemic areas. However knowledge, attitudes and practices of this target age group (8-10 years) in relation to shistosomiasis, soil transmitted helminthiasis, and malaria is not known at a time, the study was conducted in order to establish an effective school based health education for disease transmission control. Grade 3 children (n=172) attending four randomly selected primary schools(one in rulers and 3 in the commercial farming areas) in Zimbabwe were interviewed using the pre-tested interviewer administered questionnaire.

It was observed that 32.0%, 19.2% and 4.1% of the respondents had correct knowledge about the causes of shistosomiasis, malaria and soil transmitted helminthes, respectively, whilst 22.1%, 19.2% and 5.8% knew correct measures to control shistosomiasis, malaria and soil transmitted helminthes. 62% and 44.8% did not use soap to wash hands after toilet and before eating food respectively, whilst 33.1% never wore shoes. There were no functional water points and soap for hand washing after toilet at all schools. (Midzi, 2011)

2.7 LITERATURE RELATING TO THE THIRD OBJECTIVE (to identify the risk factors associated with soil transmitted helminthes)

The study conducted in an agricultural area of North Sumatera, Indonesia enrolled 468 school children between 6 and 12 years of age. Among those children (57.24%) were positive for one or more STH infections. Approximately 62.39% of children played with soil/dirt every day and only 50% regularly washed their hands after activities. Most of the children wore shoes/slippers when going outside (87.82%) and used latrine for defecation (85.04%). Playing with soil/dirt has been shown to increase the risk of STH infections 7.53 times, while hand washing habits and latrine usage decreased the risk of STH infections 0.16 times each(Brooker, 2014).

2.8 CONCEPTUAL FRAMEWORK

This section shows the relationship between independent variables and dependent variables.

First of all, we start with definition: A variable is an object, event, idea, feeling, time period, or any other type of category you are trying to measure.

An independent variable is exactly what it sounds like. It is a variable that stands alone and isn't changed by the other variables you are trying to measure as well as it can cause corresponding changes in other variables.

A dependent variable is exactly what it sounds like. It is something that depends on other factors and it can take different values only response to an independent variable.

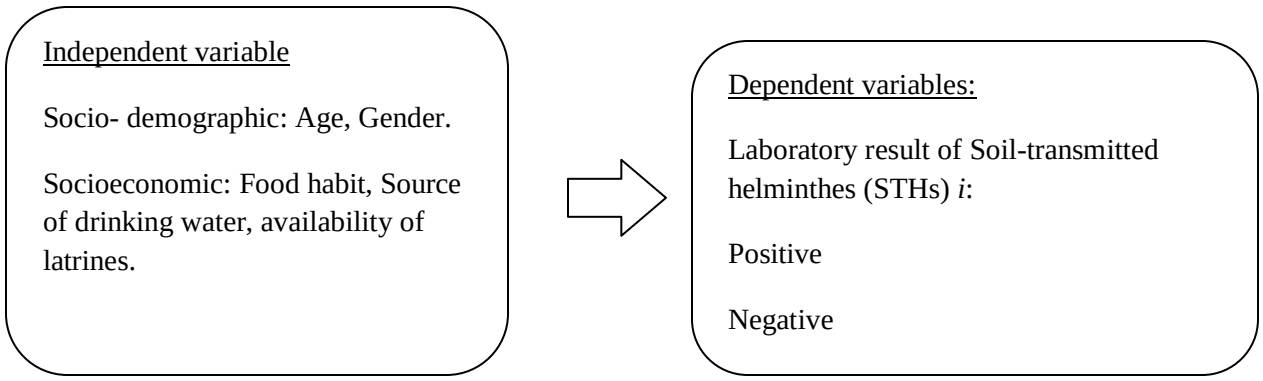

Figure 1: Conceptual frame work

CHAPTER THREE: RESEARCH METHODOLOGY

3.0. INTRODUCTION

This chapter explains well what to be done, who were the respondents in the study, the order in which it was done and what the approach was considered to the most appropriate one in carrying this study. It explains the research setting, the study design, the sample size and the data collection methods and the data analysis procedure.

This study was carried out at NKOMBO Island located in Western Province, Rusizi district, Nkombo sector.

3.1. RESEARCH APPROACHES AND DESIGN

Cross-sectional study and quantitative approach were used for the determination of the level of knowledge of the school-age children at NKOMBO Island. It was carried out from September to October 2021 at NKOMBO Island.

The study population was the pupils, mostly pupils of the nursery and primary schools in NKOMBO Island.The study population consisted of the children of nursery and primary 1-primary 6 (P1-P6). The children were chosen because of their age since soil-transmitted helminthes reach its maximum intensity at the age of 5-16 Years and from the school records most of the children falling in that range are in P1-P6.

3.2. TARGET POPULATION, SAMPLING PROCEDURES AND SAMPLE SIZE.

The pre-prepared questionnaires were given to school-age children respondents. School children were interviewed using a questionnaire so as cope with the collection of stool specimen for worm identification. The questionnaire had 15 questions,In order to obtain socio-demographic characteristics, factors that can expose and individual to soil transmitted helminthes infection. Each study participant was asked for a fresh stool (< 24hours) sample for a parasitological work. Each one was given a special sealed and labeled container with an identification number corresponding to the questionnaire. The completed questionnaires received from the participants were stored safely for the processing.

The target population was the children of nursery and primary school; the study population was 1100 the school-age.

The sample size was reduced according to the Slovin's formula

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

Where, **n**: sample size **N**: total population **e**: marginal error (0.1)

n=1100/1+1100(0.1)2 n=99.9 approximately equal to 100 k=N/n, 1100/100=11

3.3. DATA COLLECTION TOOLS AND PROCEDURES

The data collection started after obtaining the approval letter from Kibogora polytechnic and the permission letter to do the microscopic examination from the direction of NKOMBO Health Center.

The study participants were found in their homes with their parents. The participants were explained briefly about the objectives and the significance of the study. The participants were helped in responding to the questionnaire in case of complications in responding. Privacy and confidentiality of the respondent information were ensured.

3.3.1. Technique used

Stool samples were analyzedusing Kato-Katz concentration technique. stool samples examination was done in the Laboratory at NKOMBO health center.

Kato Katz techinique is used for qualitative and semi quantitative diagnosis of intestinal helminthic infestations; caused by *Ascaris lumbricoides, Trichuris trichiura*, hookworm, and especially Schistosoma spp.

3.3.2 Principle of Kato Katz

People infected with STH or intestinal schistosomes pass the eggs of the worms through their feces. In the Kato Katz technique, feces are pressed through the mesh screen to remove large particles. A portion of these sieved samples is then transferred to the hole of a template on a slide. After filling the hole, the template is removed and the remaining sample is covered with a piece of cellophane soaked in glycerol. The glycerol clears the fecal material from around the eggs. The eggs are then counted and the number calculated per gram of feces.

3.3.3. Procedure for Kato Katz Technique

- A small amount of the faecal material is placed on the scrap paper and small screen was pressed on the top of the faecal material so that some of the feces to be sieved through the screen and accumulated on the top of the screen.
- Use a flat sided spatula to scrap across the upper surface of the screen so that the sieved feces accumulate on the spatula.
- A template with a hole is places on the center of the microscopic slide and faecal matter is added from the spatula until the hole is completely filled. The side of the spatula is passed over the template to remove excess feces from the edge of the hole.
- Template is then removed carefully from the slide so that the cylinder of feces is left completely on the slide.
- Faecal material is covered with the pre-soaked cellophane strip.
- Microscope slide is inverted and the faecal sample is pressed firmly against the hydrophilic cellophane strip on another microscope slide. With that pressure the faecal material was spread evenly between the microscopic slide and cellophane strip.
- Remove the slide carefully by gently sliding it sideways to avoid separating the cellophane strip or lifting it off. Slide was places on bench with the cellophane upwards. Water evaporates while glycerol clears the feces.
- Then the slides are examined twice by two observers after preparation. Time must be considered because hookworm eggs clear rapidly within 30-60 minutes after slides preparation.

3.4 DATA ANALYSIS

After Data collection, Microsoft excel 2013 and statistical package for social sciences (SPSS) were used, then after the results were presented in terms of frequency tables and percentages.

3.5RELIABILITY AND VALIDITY MEASURES

To accomplish the objectives that apprehensive with our research about the evaluation of chemotherapy preventive program of soil transmitted helminthes at NKOMBO Island. There is need of the people (school children and parents) and also the money to be used to get some documents and accessing the internet and transport fees, hence contributing to our research.

CHAPTER FOUR: DATA PRESENTATION, ANALYSIS, INTERPRETATION AND SUMMARY

4.0INTRODUCTION

Chapter four contains data obtained from the patients have to be presented, analyzed and interpreted. The chapter gives an overview of the results and discussion. The results are presented in terms of tables relating the study findings with the objectives of the study. The results on the prevalence and associated risk factors on soil transmitted helminthes infections among school-age children at Nkombo Island, in western Rwanda. The findings from the study are discussed in accordance with the existing evidences that have been found in the same area of interest, the chapter also contains the summary of findings. Microsoft excel and statistical package for social sciences (SPSS) software, version 20, were engaged in the analysis of the data. A p-value of < 0.1 was considered to be statistically significant with 90%, in order to establish relationship between variables.

4.1 DEMOGRAPHIC INFORMATION

Among 100 children school thatwere enrolled in this study 59 % were females and 41 % were males, only 84% of them were able to provide full information on the questionnaire, 16% failed to provide the information. All the participants were attending the primary school at this island. The mean age of the children in the study was 10.5 years. The demographic information is shown in the Table 1.

Table 1: Demographic characteristics of the study participant in the study by age groups and sex

Age groups	**Sex**		
	Female	**Male**	**Total**
5-7	18(60%)	12(40%)	30(100%)
8-10	23(60.53%)	15(39.47%)	38(100%)
11-13	11(64.7%)	5(35.3%)	17(100%)
14-16	7(46.7%)	8(53.3%)	15(100%)
Total	59(59%)	41(41%)	100(100%)

4.2 THE PREVALENCE OF SOIL TRANSMITTED HELMINHS

The table 3 above shows the distribution of the children who got tested for soil transmitted helminth in the study based on gender. The proportion of the female children was 59% and that of males was 41% of males.

The prevalence of soil transmitted helminth among school-age children who have intervened in chemotherapy preventive program for the infections of soil transmitted helminthes at Nkombo Island. The overall prevalence of STHwas 52%. Among them Ascaris lumbricoides was the most prevalent occupying 27% Trichuris trichiura was 21% and that of hookworm was 4%.

Table 2: Gender distribution of STH infections

STH	**Frequency**	**Percent**
Ascaris lumbricoides		
Females	17	62.9%
Males	10	37.1%
Total	27	100%
Trichuris trichiura		
Females	15	74.42%
Males	6	28.57%
Total	21	100%
Hookworm		
Females	2	50%
Males	2	50%
Total	4	100%

The table 2 above shows gender distribution of the children confirmed for STH. In this study, the females who were infected with *A.lumbricoides* were more than males with 17(62.9%) and 10 (37.1%) respectively. For *T.trichiura,* females were also more than males with 15(74.43%)

and 6 (28.57%) respectively but for Hookworm, females were equal to males with 2 (50%) and 2(50%) respectively.

4.3 LEVEL OF KNOWLEDGE ON SOIL TRANSMITTED HELMINTHS

The administered questionnaire to 100 study participant only 84 responded well. The questionnaire covered the awareness of the disease, type of worms which they were familiar with and the source of the worms and other hygiene related details.

Table 3: Level of knowledge with respect to age group

	Level of knowledge			
Age group	**Low**	**Moderate**	**High**	**Total**
5-7	17 (70.8%)	5 (20.8%)	2 (8.3%)	24 (100%)
8-10	21 (63.3%)	7 (21.1%)	5 (15.1%)	33 (100%)
11-13	8 (53.3%)	2 (13.3%)	5 (33.3%)	15 (100%)
14-16	2 (16.6%)	2 (16.6%)	8 (66.6%)	12 (100%)
Total	**48 (57.14%)**	**16 (16%)**	**20 (23.8)**	**84 (100)**

Chi square 18.205^{a}

df= 6

P-value = 0.006

It was statistically significant at a p-value (0.006) that the level of knowledge was increasing within the age groups.

The level of the knowledge was measured by answering three questions that covered the following aspects: awareness of the disease, type of the worms and the source of the worms. The level of the knowledge was categorized as high when the child answered all the three questions correctly; Moderate when the child answered two questions correctly and low when the child answered only one question.

4.4 RISK FACTORS OF SOIL TRANSMITTED HELMINTHES

Table 4: Risk factors associated to soil transmitted helminthes

Risk factor	Frequency	Percentage
Washing hands after defecation		
Always	5	6.0%
Occasionally	12	14.3%
Never	67	79.8%
Total	84	100.%
Eating raw food		
Yes	73	86.9%
No	11	13.1%
Total	84	100%
Water source at home		
Springs/lake	16	19.0%
Wells/pomp	68	81.0%
Total	84	100%
Using animal/human feces as fertilizer		
Yes	76	90.5%
No	8	9.5%
Total	84	100%
Drinking potable water at home		
Always	7	8.3%
Occasionally	9	10.7%
Never	68	81.0%
Total	84	100%
having toilets at home		
No	19	22.6%

Yes	65	77.4%
Total	84	100%
Putting on the foot wear/wearing shoes		
Always	42	50.0%
Occasionally	8	9.5%
Once in a while	32	38.1%
Never	2	2.4%
Total	84	100%

The table above shows the risk factors which are associated to soil transmitted helminthes among school-age children at NKOMBO Island.

Based on washing hands after defecation, among 84 respondents only 5 (6.0%) washed their hands; 12 (14.3%) occasionally washed their hands and 67 (79.8%) did not wash their hands after defecation. the study participants who were keen on eating raw food/uncooked food. Among 84 study respondents 73 (86.9%) confirmed that they have eaten raw food and 11 (13.1%) did not eat raw food.Among 84 study participants 16 (19.0%) of the participants used water from the lake/springs and 68 (81.0%) used water that they have fetched from the wells /pumps. between 84 study participants, most of them 76 (90.5%) used animal/human feces as the source of the fertilizer but 8 (9.5%) did not use such feces as their source of the fertilizer. Based on drinking potable water at home, 7 (8.3%), 9 (10.7%) and 68 (81.0%) always, occasionally and never drunk potable water respectively. Only 65 (77.4%) study participants had toilet at their homes and 19 (22.6%) had no toilets at their homes.42 (50.0%), 8 (9.5%), 32 (38.1%) and 2 (2.4) wore shoes always, occasionally, once in a while and never wore shoes respectively.

4.5. ASSOCIATION BETWEEN THE RISK FACTORS AND SOIL TRANSMITTED HELMINTH INFECTIONS

Table 5: Association between the risk factors and being confirmed with STH infections

Risk factors	**STH infections**	
	Chi-square	**P-value**
Eating raw food	3.410[a]	.492
Water source	1.100[a]	.894
Using animal/human feces as fertilizer	6.016[a]	.198
Washing hands after defecation	18.490[a]	.018
Drinking potable water	9.254[a]	.321
Having toilets at home	5.398[a]	.249
Wearing shoes	11.708[a]	.469

Pearson's Chi-square Tests was used and the significance level was set at a p<0.05 at 95 CI.

Using the Chi-square test there was no statistical relationship between the risk factors which are associated withsoil transmitted helminthes and being confirmed for having a soil transmitted helminth. The risk factors included eating raw food with the chi-square value of 3.410 and a p-value of 0.492, water source with a chi-square value of 1.100 and a p-value of 0.894,using animal/human feces as the sources of the fertilizer with a chi-square value of 6.016 and a p-value of 0.198; drinking Potable water with a chi-square value of 9.254 and a p-value of0.321, having toilets at home with a chi-square value of 5.398 and a p-value of 0.249 and wearing shoes with a chi-square test value of 11.708 and a p-value 0.469.

The findings show that there was a statistically significant association between being confirmed with STH and washing hands after defecation, with a chi-square value of 18.490 and a p-value of 0.018.

4.6 DISCUSSION OF THE FINDINGS

This study has the target of determining the prevalence and risk factors associated with soil transmitted helminthes infections among school-age children at Nkombo Island, in western Rwanda. The study found that among the study participants the females were more than males with 59% and 41% respectively. The findings from this study shows a great difference compared to the study findings from the study conducted in kakamega count Kenya,where females were equal to males (Mwandawiro *et al*, 2016).

In this study the overall prevalence of STH was 52 %, with the A.lumbricoides being the most prevalent with 27 % and T.trichiura 21 % and then hookworm with4%, and this is lower compared to the study conducted in some district of Western province-Rwanda where the overall prevalence was 77.7% with the T.trichiura being the most prevalent 66.8% in accordance with A.lumbricoides 49.9% and the Hookworm 1.9% (Kabatende *et al*,.2020) Also this differs from the conducted study in Southern Thailand on STH with the overall prevalence of 15.7% where Hookworms where the most prevalent with 10.9% followed by Strongylloides stercolaris 3.4% and T.trichiura 2.1%. (Punsawad *et al.,* 2020).

Statistically significant at a p-value of 0.006, the knowledge of the school-age children at Nkombo Island was increasing by age-groups in the current study; it shows that the level of knowledge was high in the age-group of 14-16 at 66.6% and high at 8.3% in the age-group of 5-7. This increase is same as the increase revealed in the study conducted in Nigeria (Oyebamiji *etal.,* 2018) knowledge, attitude and practice with respect to soil contamination of soil-transmitted helminthes in Ibadan, southwestern Nigeria. This study showed that majority of the study participants (62.6%) had knowledge on the parasitic worms.

Using the Chi-square test there was no statistical relationship between the risk factors which are associated with soil transmitted helminthes and being infected with the soil transmitted helminth. The risk factors included eating raw food with the chi-square value of 3.410 and a p- value of 0.492, water source with a chi-square value of 1.100 and a p-value of 0.894, using anima/human feces as the source of the fertilizer with a chi-square-value of 6.016 and a p-value of 0.198;

drinking potable water with a chi-square value of 9.254 and a p-value of 0.321, having toilets at home with a chi-square value of 5.398 and a p-value of 0.249 and wearing shoes with a chi square value of 11.708 and a p-value of 0.469.

The findings show that there was a statistically significant association between being confirmed with STH and washing hands after defecation with a chi-square value of 18.490 and a p-value of 0.018. Not washing hands after defecation should read to infections of soil transmitted helminth in the school age children, this study is different with other conducted studies (Elodie *et al*,.2015).

4.7 SUMMARY OF FINDINGS

The study enrolled 100 school-age children, the females were more than males 59(59%) and 41(41%) respectively. The overall prevalence of soil transmitted helminthes at Nkombo island among school-age children was 52 % where A.lumbricoides was the most prevalent STH (27%) followed by T.trichiura (21%) and Hookworm with (4%).

Regarding the knowledge of the children on STH. Among 84 respondents only 16% of the children were aware of STH and mentioned A.lumbricoides and soil as the type and the source of the worms they knew respectively. It was statistically significant at p-value (0.006) that the level of knowledge was increasing within the age groups.

This study show that there were more factors influencing STH infections in the school age children at Nkombo island because they were more exposed to it. 6% always wash their hands after defecation 14.3% occasionally and 79.8% never washed their hands after defecation, 86.9% of the children ate raw food and 13.1% did not eat raw food, 19% used water from the springs/lake and 81% used water from well/pomp, 90.5% used animal/human feces as the source of fertilizers and 9.5 did not use it, 8.3% always drunk potable water 10.7% occasionally drunk it and 81% never drunk potable water, 22.6% did not have toilets at their homes and 77.4% had toilets, 50 % of the study participant wore shoes always, 9.5% occasionally, 38.1% once in a while and 2.4 never wore shoes.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

5.0 INTRODUCTION

This chapter deals with the conclusion on the study objectives on the for prevalence and risk factors associated with soil transmitted helminth infection among the school-age children at Nkombo Island, in western Rwanda.

5.1 CONCLUSION

Mass drug administration can be a successful approach in the control of STH worms, this program in association with other preventive program like education program will bring a sustainable answer for the eradication of soil transmitted helminthes; still the overall prevalence is 52% with 27% of *A.lumbricoides*, 21% of *T.trichiura* and 4% of Hookworm. Moreover MDA should be accompanied with health education because knowledge, geographical location and the practices regarding STH infections were observed to be poor amongst the study population. Children are treated but return to the same environment and continue practicing in a way that makes then vulnerable to STH infections. Control programs should focus on the environmental and the hygiene factors to reduce the cost of carrying out regular treatment.

5.2 RECOMMENDATIONS

To nkombo health center

The health staff of nkombo health center should increase the education to the entire population about the cause and prevention of soil transmitted helminthes mainly school-age children.

Integrating methods of controlling soil transmitted helminthes which include health education so as to ensure health practices and to reduce risk factors for transmission of STH.

To ministry of health in Rwanda and Rwanda education board

To build sufficient toilets at their schools and providing hygiene related material at schools for the prevention of soil transmitted helminthes.

The factors do put these children at risk, needs to be further assessed and explored and more data needed so as to draw reasonable conclusion.

Further studies for assessing the effectiveness of STH intervention with chemotherapy are needed using the larger sample size and in different areas of the country to conclude nationally.

Proper awareness creations aiming to change the knowledge, attitude, practices of the community should be strengthened in the study area.

5.3 SUGGESTION FOR FURHER STUDY

Cross sectional study on the prevalence and associated risk factors of soil transmitted helminthes among students of ordinary level to assess the difference and similarities by relating to the current study.

Other researcher can evaluate the knowledge related to soil transmitted helminthes in the ages of 30-40 years old.

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APPENDICES

APPENDIX 1: QUESTIONNAIRE

IDENTIFICATION INFORMATION

Questionnaire on the evaluation of chemotherapy preventive program on soil transmitted helminthes among school-age children in NKOMBO Island.

PART ONE: BACKGROUND INFORMATION.

Identification number……

Age of participant….....

Gender of participant M ……F……

Date of interview……

PART TWO: FACTORS OF SOIL-TRANSMITTED HELMINTHS INFECTION.

A. KNOWLEDGE ON STHs INFECTION

1. Have you ever heard about soil transmitted helminthes
    1) Yes
    2) No

    If yes go to qn. 2 and 3; if no go to qn 4
2. What type of soil transmitted helminthes that you are aware of?
    1) *T.trichiura*
    2) *A.lumbricoides*
    3) *A. duodenale*
3. What are the potential sources of STH infection?
    1) Feces
    2) Soil
    3) Food/vegetables
    4) Don't know

B. RISK FACTORS ON SOIL TRANSMITTED HELMIMTHES

4. Drinking unboiled water at home

    1) Always

    2) Occasionally

    3) Never

5. Washing hand before meals

    1) Always

    2) Occasionally

    3) Never

6. Washing hand after defecation

    1) Always

    2) Occasionally

    3) Never

7. Do you wash hands with soap?

    1) Yes

    2) No

8. How frequently do you put footwear outside the house?

    1) always

    2) occasionally

    3) Once in a while

    4) Never

9. Eating row food at home

1) Yes

2) No

10. Water sources at home

1) Springs

2) Wells or rivers

11. Using human or animal faces as fertilizer

1) No

2) Yes

12. Availability of latrine at home

1) Yes

2) No

13. Availability of hand washing site at home

1) Yes

2) No

14. Availability of utensils dry site at home

1) Yes

2) No

15. Do you share the toilet with the neighbor?

1) Yes

2) No

APPENDIX 2: STOOL ANALYSIS FORM

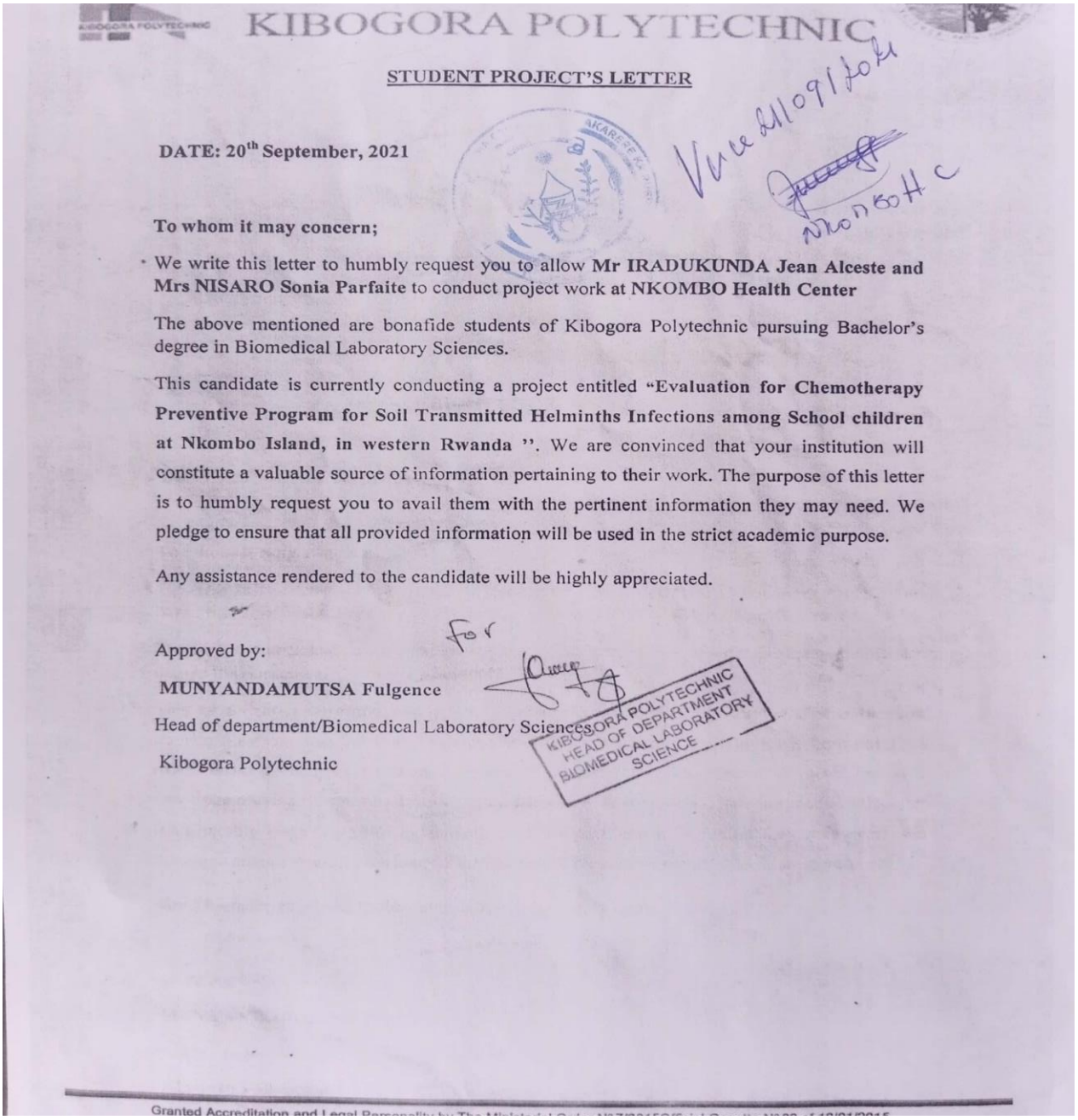
Date of examination……..

Parasitological findings of stool examination

Kato-Katz technique

ID	Age	A.lumbricoides	Trichuris trichiura	Hookworm	Other parasites	Negative

APPENDIX 3: STUDENT PROJECT LETTER



KIBOGORA POLYTECHNIC

STUDENT PROJECT'S LETTER

DATE: 20th September, 2021

To whom it may concern;

We write this letter to humbly request you to allow **Mr IRADUKUNDA Jean Alceste and Mrs NISARO Sonia Parfaite** to conduct project work at **NKOMBO Health Center**

The above mentioned are bonafide students of Kibogora Polytechnic pursuing Bachelor's degree in Biomedical Laboratory Sciences.

This candidate is currently conducting a project entitled **"Evaluation for Chemotherapy Preventive Program for Soil Transmitted Helminths Infections among School children at Nkombo Island, in western Rwanda "**. We are convinced that your institution will constitute a valuable source of information pertaining to their work. The purpose of this letter is to humbly request you to avail them with the pertinent information they may need. We pledge to ensure that all provided information will be used in the strict academic purpose.

Any assistance rendered to the candidate will be highly appreciated.

Approved by:

MUNYANDAMUTSA Fulgence

Head of department/Biomedical Laboratory Sciences

Kibogora Polytechnic

KIBOGORA POLYTECHNIC HEAD OF DEPARTMENT BIOMEDICAL LABORATORY SCIENCE

Granted Accreditation and Legal Personality by The Ministerial Order