SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

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INTESTINAL HELMINTHS INFESTATION AMONG PREGNANT WOMEN ATTENDING TAMALE TEACHINGHOSPITAL

PRESENTED

BY

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DECLARATION

This work is the result of my own independent work under the supervision of Dr. Bismark Sarfo with due acknowledgement paid to all reference sources. I declare that this work either in whole or in part has not been presented for the award of any degree nor is currently being submitted in candidature elsewhere for another degree.

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DEDICATION

I dedicate this work to the Almighty God, then to my mother Hajia Damata and father Alhaj Adam Adam and also to my dear wife Mariam

ACKNOWLEDGEMENT

Firstly, my thanks goes to the Almighty God for his blessings, strength and guidance throughout the entire period of this work and my stay in School of Public Health, Legon.

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ABSTRACT

Background

Intestinal helminths are very common in developing countries including Ghana. It is estimated in developing countries that one-third of all pregnant women are infested with helminths. Intestinal helminths infestation during pregnancy may be linked with adverse outcomes including prenatal mortality, maternal anemia, low birth weight and growth restriction.

This study's objective was to determine the prevalence of intestinal helminths infestation among pregnant women attending Tamale Teaching Hospital.

Method

An unmatched retrospective case control study involving reviewing hospital records from January 2015 to December 2016 was applied for this study. Purposive sampling technique was also used to recruit pregnant women who were then interviewed using a structured questionnaire to identify factors associated with helminths infections.

Results

Seven different intestinal helminths species were found with a total prevalence of 6.3%. The predominant species were *Hymenolopis nana, Ascaris lumbricoides* and *Strongyloides stercoralis*. There was no mix infection in the data collected. There were significant associations between intestinal helminths infestation and place of residence, and hand washing after using the toilet. Pregnant women who resided in rural communities were 50.67 times more likely to be infested with helminths as compared to those who reside in urban areas. Women who did not wash their hands after using toilet were 20.98 times more likely to be infested with helminths as compared those who washed their hands after using toilet.

In conclusion, the associations observed between intestinal helminths infestation and place of residence and hand washing after using toilet was significant, indicating that, pregnant women should wash their hands after using the toilet. The dominant intestinal helminths infestation found in this study were *Hymenolepis nana*, *Ascaris lumbricoides* and *Strongyloides stercoralis* respectively.

Key words: Intestinal helminths, infestation, pregnant, associations, prevalence, *Hymenolopis nana, Ascaris lumbricoides, Strongyloides stercoralis,*

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LIST OF ACRONYMS

CI……..…Confidence Interval

CDC……..Center Disease Control

COR …….Crude Odds Ratio

DALY……...Disability Adjusted Life Yea

GSS …….....Ghana Statistical Service

HIV……..…Human Immune Virus

STH……...Soil Transmitted Helminths

TTH…….Tamale Teaching Hospital

UDS…….University for Development Studies

WHO…….World Health Organization

YPLL……...Year of Potential Life Lost

ANC…….....Antenatal Care

AOR…….Adjusted Odds Ratio

R/E……..Routine examination

LC……Life Cycle

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Historically, geo-helminths infestations were prevalent in some parts of the developed world however, continuous controlled efforts and economic development helped to eradicate them. In many areas of **S**outh and Southeast Asia and sub-Saharan Africa, there had until recent times, been few changes in the prevalence of geo-helminths over the last half of the 20th century. However, in the last 14 years, there has been increased political and financial support for the global control of geo-helminths infestation, with a strong focus on deworming pupils (Pullan, 2012).

In the poorest countries, geo-helminths infections are commonly found in places where poor environmental sanitation and human feces pollute the soil. About two (2) billion humans are infested with multiple or single geo-helminthic diseases and the annual death is 135,000 (Paudel, 2014). Intestinal helminths infestations are globally endemic and are indicated as comprising the single most global source of illness and disease. Poor hygiene, illiteracy, Poverty, non availability of treated water and warm and humid tropical climate are some of the major causes of intestinal helminths infestation (Mehraj, 2008)

Trematodes (flatworms), cestodes (tapeworms) and nematodes (roundworms) are part of the commonest helminths that live in the human alimentary canal (Ruffo, 2007). Nematodes have four main species which are also known as soil-transmitted helminths and geo-helminths: *Trichiuris trichiuria* (whipworm), *Ascaris lumbricoides* (roundworm), *Ancylostoma duodenale* and *Necator americanus* (hookworms) are the four most common human intestinal helminths (Bethony, 2006).

Geo-helminths reside in the alimentary canal and their ova (eggs) are excreted through infested person's feces. When an infested person defecates in the open (in bushes, gardens, or fields) or if an infected person's fecal matter is used to fertilize crops, the ova are dumped on the soil. Hookworm and Ascaris ova become infectious as they develop in the soil. Humans becomes infested with whipworm and Ascaris when they ingest their eggs. This can occur when fingers or hands that are contaminated with soil on them are put in the mouth or by eating vegetables or fruits that are raw or have not been properly been cooked, peeled or washed. Hookworm ova are not infectious, unless hatched in the soil and release a larva (immature worms) that develops to forms that can pass through the human dermis. Hookworm infections are transmitted mainly by walking on polluted soil with barefoot. One species of the hookworm (*Ancylostoma duodenale*) can also be transmitted by the ingestion of larvae (CDC, 2013).

Globally, 24% of the world's populations, thus more than 1.5 billion of humans are geo-helminths infested. Infestations are largely found in subtropical and tropical areas of the world, with the most counts occurring in the Americas, East Asia and China and sub-Saharan Africa (WHO, 2016). There are about 800 to 1000 million indicated *Ascaris lumbricoides* cases, 700 to 900 million reported hookworm (*Necator americanus* and *Ancylostoma duodenale*) cases, 500 million reported *Trichuris trichiura* cases (Wekesa, 2014) and 30 to 100 million reported cases of *Strongyloides stercoralis* (Puthiyakunnon, 2014). The global burden by disability-adjusted-life year (DALY) of geo-helminths infections can be compared to malaria and tuberculosis (Jex, 2011).

Normally, there are no observable symptoms for infested people who have contracted milder geo-helminths infections. High infections from either one of the parasites can cause a wide range

of health issues, including abdominal pain, diarrhea, rectal prolapsed, blood and protein loss, and physical and cognitive delayed growth (WHO, 2014).

Though the impact of many infections on maternal (malaria, HIV and tuberculosis) are usually associated with anemia in pregnancy in countries of sub-Saharan Africa has been properly documented, little studies further analyzed the impact and prevalence of helminths infections outcomes on pregnancy (Aderoba, 2015).

Despite the fact that anemia during pregnancy is as a result of many factors, infections and lack of nutrition are main the contributors. In sub-Saharan Africa, geo-helminths including hookworm, and some infections such as malaria and schistosomiasis add to the increasing rates of anemia among women. Prevalence of helminths infections of about 50% was reported in some areas in sub-Saharan Africa (Sousa-Figueiredo, 2012). Estimates suggest that hookworm infestations among pregnant women is greater than 25% which results in bleeding intestine and blood loss, and this is linked with anemia (Elizabeth, 2014).

Globally, anemia affects about25% of all pregnant women and greater than 40% of them are in Sub-Saharan Africa (McLean, 2012). Helminths infestation in pregnancy can be linked with adverse results, including perinatal mortality, low birth weight, fetal growth restriction, and maternal anemia. Deworming during the time of pregnancy has therefore been largely recommended (Ndibazza, 2010**)** **(**Hotez, 2008). In sub-Saharan Africa, helminths infestation especially infestation of hookworm is one of the important contributors to severe anemia among pregnant women (Urassa, 2011).

1.2 Problem Statement

It is estimated in developing countries that, one-third of all pregnant women have hookworm infections, which amounts to about 44 million of developing countries 124 million pregnant women **(**Radhika, 2014)

The prevalence of hookworm is approximately 30% in sub-Saharan Africa and reported to be as high as 50% in Northeastern Ghana **(**Humphries, 2011)

Helminths in general affect both mother and fetus. Although data suggesting increased susceptibility to helminths in pregnant women are conflicting, they have indicated that severe anemia and concurrent infections increases the threat for maternal and infant morbidity. Anemia is common among pregnant women and often is multifactorial. Anemia during pregnancy has been associated with prematurity, still birth and low birth weight. Helminths such as hookworm, trichuriasis and schistomiasis have been demonstrated to directly contribute to severity in anemia in pregnant women through blood loss (Jill, 2014).

Geo-helminthiases are usually transmitted through the common practice of soil eating amongst pregnant women in many areas in developing countries. The high rates of infestations among pregnant women are strong indicative of fecal contamination of soil and household water supply in homes due to improper sewage disposal and poor sanitation (Brooker, 2010). According to the Ghana Statistical Service (2014), 70.9% of rural households and 29.1% urban households in the Tamale metropolis dispose their waste indiscriminately. Pregnant women are also at high risk of infection due to their close relationship with children (Wekesa, 2014) and due to the issues indicated, the Tamale Teaching Hospital conducts a routine stool examination for all pregnant women at their first antenatal visit to the facility. This study identified the prevalence and species

of helminths infestation among pregnant women attending the Tamale Teaching Hospital from January 2015 to December 2016.

1.3 Conceptual framework.

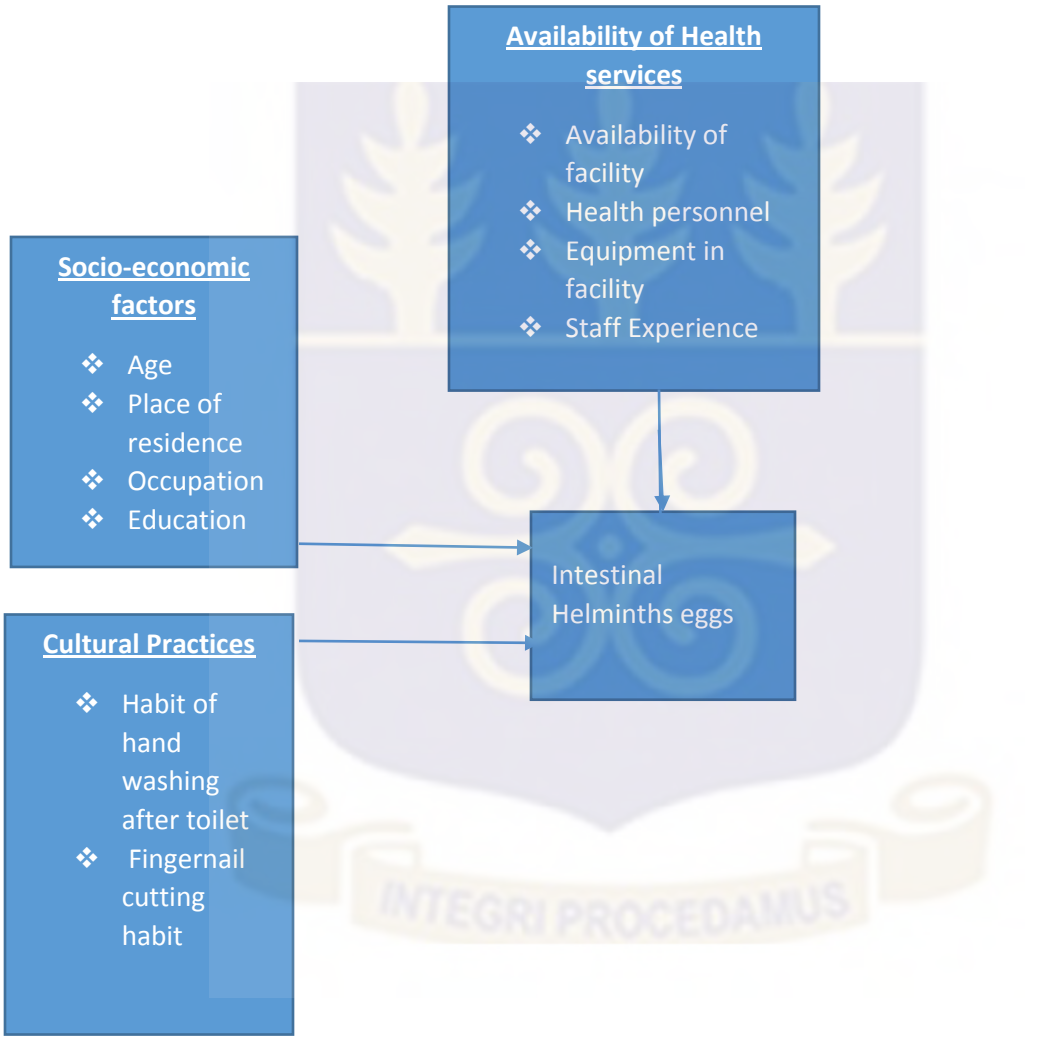


Fig 1: Conceptual framework: Helminths infestation among pregnant women.

1.4 Narrative on the conceptual framework

The frame work in fig 1 addresses the various factors that can cause helminths infestation among pregnant women. The residential area of a woman has more to do with her family income and this can influence their helminths infestation since these parasites thrive well in poor and crowded residential areas, so if she lives in a poor(poor sanitation, overcrowded) neighborhood she is more susceptible to the infestation. Also, if her occupation involves working with soil which harbors these parasites, example, working on the farm, and she does not wash her clothes or hands or even cut her fingernails properly, she will be exposing herself to helminthes infestation. It can be argued that educated women adhere to personal hygiene more since they are formerly educated on the effects of poor hygiene. The following factors can also cause helminths infestation among pregnant women, they were however not looked into due to limited data on them from pregnant women, they includes availability of health facility in a locality which can also shape helminths presence in a community since its presence will be diagnosed and made known to the general community. The availability of well experienced health professionals, presence of quality equipment at the facility are all factors that can influence early diagnoses of helminths infection before a pregnant woman visits any other referral hospital .The quality of equipment presents at the facility, the level of training and experience of these professionals possess to examine the pregnant woman, request for the appropriate laboratory test and to diagnose it appropriately are all factors in the diagnosis.

The framework demonstrates how socio-economic, health services and cultural factors can affect and influence infestation of intestinal helminths in general and among pregnant women in particular.

1.5 Justification

The prevalence of helminths infestation especially in developing countries including Ghana has been neglected for some time now. Heavy infections of these parasites are associated with effects on pregnant women and their fetuses. These effects includes maternal anemia, still birth, prematurity and low birth weight. Surprisingly, the infestation of helminths has been considered neglected tropical disease which attracts less research attention and funding globally and even in Ghana. Against this background, this study aims at determining the intestinal helminths infestation among pregnant women attending Tamale Teaching Hospital.

1.6 General Objective

To determine the prevalence of intestinal helminths infestation among pregnant women attending Tamale Teaching Hospital

1.7 Specific Objectives

1. To determine the proportion of pregnant women infested with intestinal helminths
2. To determine factors associated with the helminths infestation
3. To determine the species of helminths infestation

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Biodiversity of Helminths

Helminths in general are parasitic organisms that are widely described as "worms" because of their elongated body structure, they however have differences in migratory routes, development, shape and the predilection site of the larvae and adults (Makepeace, 2012). They are multicellular organisms and are visible to the eye once they are in the adult stage of their life cycle and they can either be parasitic or free-living.

When in their mature stages, helminths are not able to spread in humans and utilize several processes of transmissions to achieve reproductive success. They actually dwell in and feed on their hosts which enable them to gain nourishment at the same time impeding the absorption of hosts' nutrient. Parasitic worms or helminths are often found inside the intestine and are therefore termed intestinal parasites. Normally, they can live in both animals and humans.

The main kinds of helminthic parasites are: nematodes (roundworms), trematodes (flukes), cestodes (tapeworms), platyhelminths (flatworms) and canthocephalins (thorny-headed worms). The identification and classification of helminths dependents on several factors such as body cavity, body covering, body shape, sex, type of attachment organs and digestive tubing(Steve, 2016). Helminths ova (eggs) contains a resilient resistant walls to shield the embryo as it develops. Hatched mature eggs releases larvae either inside a host or into the surrounding environment. There are four major ways of transmission in which the larvae infect new host are vector-borne, fecal-oral, predator-prey transmission and transdermal (WHO, 2014).

2.2 Difference between cestode, trematode and nematode

Fig 2. Picture of a Cestode

Body features of cestodes

Shape: Tape-like

Sex: They are hermaphrodites

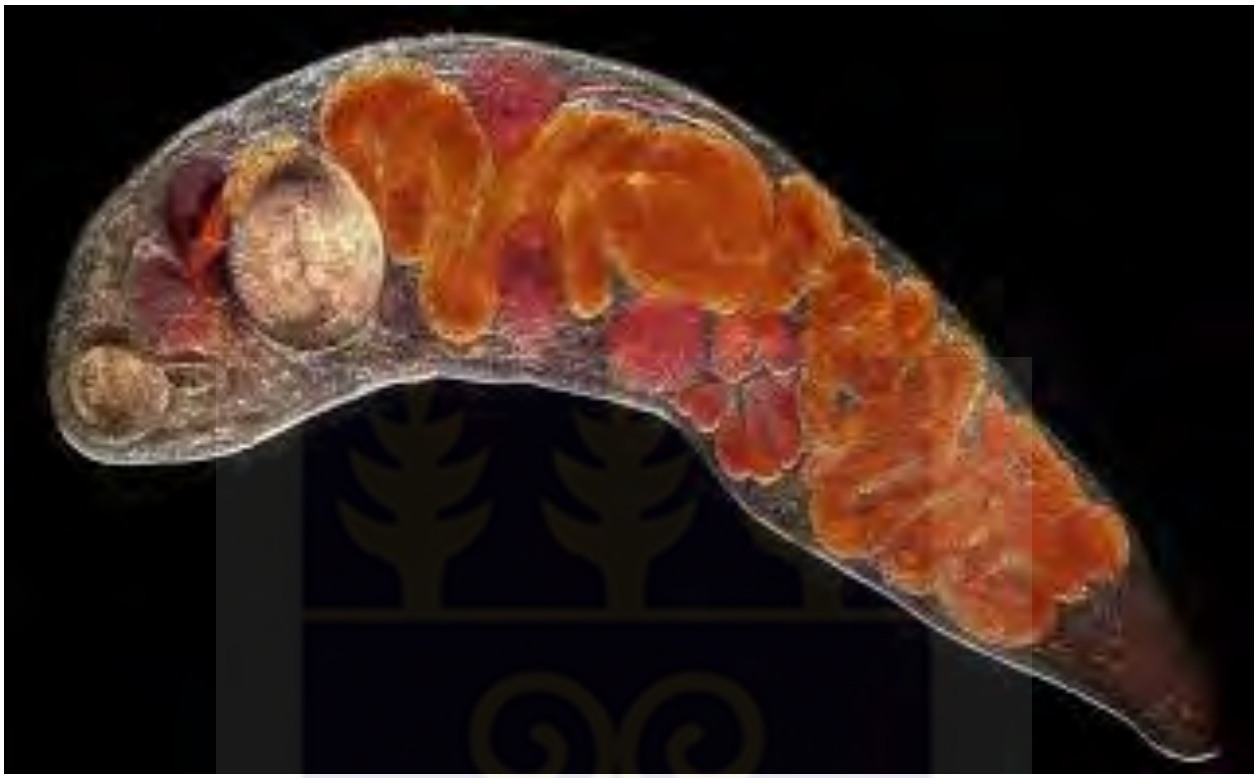
Head: Suckers, usually with hooks

Alimentary canal: Not present

Cavity of body: Not present

(Kaushal, 2016)

Fig 3.Picture of a Trematode



Body features of a Trematode

Leaf like shape

Sexes: Usually not separate

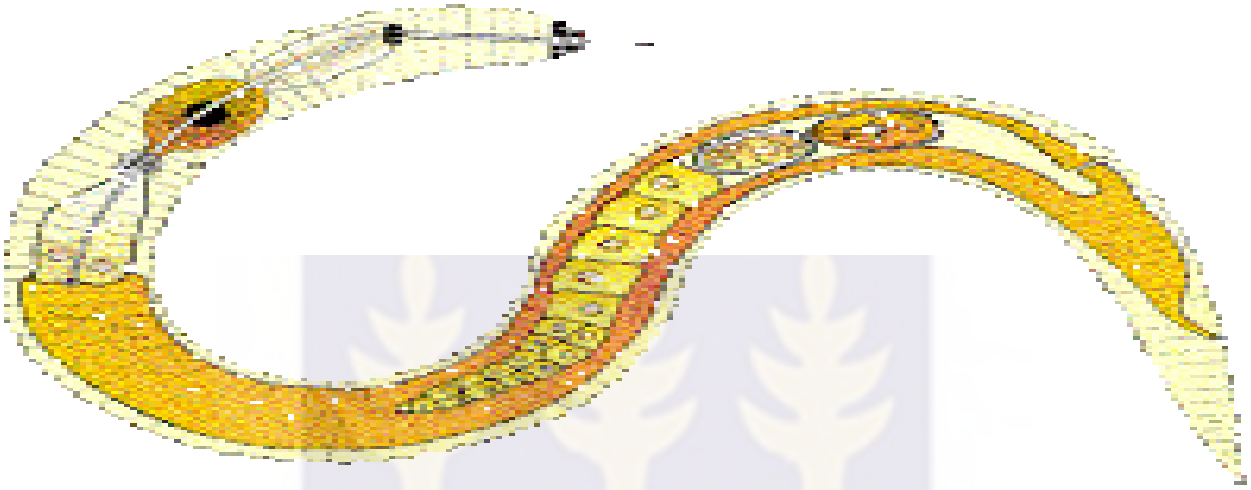
Head: Suckers, but no hooks

Alimentary canal: Incomplete but present; no anus

Body cavity: Not present

(Kaushal, 2016)

Fig 4.Picture of a Nematode



Body features of a Nematode

Shape : Cylindrical, elongated and unsegmented

Sexes: Diecious, thus seperate

Space of head: No hooks, No suckers, well

Alimentary canal: Complete and present; anus present

Present of body cavity

(Kaushal, 2016)

2.3 Life Cycle of Helminths

Clinically, the life cycle of nematode parasites is important. Definitive diagnosis of geo-helminths depends on the host manifestation of the stage of the life cycle**.** Many of the infections can be directly transmitted from an infected person to uninfected person; in others, the eggs will go through a maturation process outside the host in a third stage, these parasites occasionally spend some parts of their development process in the soil prior to becoming infective to their humans host (Ali, 2011)

In general, the life cycle of intestinal helminths is in three forms: these are ova, larvae and adults respectively. Definitive host are normally infected by mature worms, whiles the larval stages can be intermediate or paratenic hosts, free-living or parasitize invertebrate vectors. Nematodes releases eggs that embryonate in utero or outside the host and the larvae that emerges undergoes four metamorphoses (moults) before maturing as adult female or male worms. Cestode eggs produced from gravid segments embryonate to produce 6-hooked embryos (hexacanthoncospheres) which are ingested by intermediate hosts **(** Peter, 2010). The oncospheres penetrate host tissues and become metacestodes (encysted larvae). When the definitive hosts are eaten, they excyst and form adult tapeworms. The life-cycle of Trematodes are more complex, the 'larval' stages goes through asexual expansion in snail which serves as an intermediate hosts. The eggs hatch to produce free-swimming miracidia that actively infect snails and multiplies in sac-like sporocysts to release several rediae. These stages develop to cercariae which are then released from the snails host and either actively infect new hosts **(**definitive) or form encysted metacercariae on aquatic vegetation which is then consumed by definitive hosts.

Life cycle of Nematode, Cestode and Trematode diagrams

Fig 5. Nematode Life Cycle **Fig 6. Cestode Life Cycle** **Fig 7 Trematode Life Cycle**

(Peter, 2010)

2.4 Helminths characteristics

Worms live and feed on their living hosts to receive nourishment and protection which results in illness of the host. They possess an attachment organ that allows them to reside and feed within their human host (Steve, 2016). Hookworm infection is largely connected with iron deficiency anaemia. Their infection causes anaemia in the host through feeding activities and prolonged intestinal blood loss (Bethony, 2016). The longer the host is infected with the parasitic worm, the harder it is for them to replace the lost iron through the feeding and development of the hookworm. They also affect protein levels in the host, which can be excreted rapidly through the host's urine. This can cause depletion in the body's stores which may result in protein energy malnutrition. Stunting and poor cognitive growth can also occur in children because of the chronic malnourishment associated with hookworm infection (Bethony, 2006).

Indicative changes of intestinal helminths infections includes: cytological amendments in the blood eosinophilia which produces an evidence of invasion of tissue by intestinal helminths infection, a white blood cell count reduction which indicates kala-azar, hookworm is a major cause of anemia (Park, et al, 2008).

2.5 Epidemiology

Intestinal geohelminthiases are part of the commonest and widespread of human infections/diseases in developing countries. Thousands of impoverished and rural communities throughout the subtropics and tropics are usually chronically infested with one or more different species of helminths **(** Wekesa, 2014). They are usually linked with low household income, poor environmental and personal sanitation, tropical climate and low altitude **(**Gelaw, 2013). Thus they are infectious disease of poverty. In terms of prevalence, they are more in areas of intense poor communities, low and middle income countries in the subtropics and tropical regions of sub Saharan Africa and Asia. In Europe and North America, the infections are usually prevalent among refugee communities and immigrants (Harhey, 2010).

According to Quihui (2006), intestinal parasitic infections by constitutes a global health burden responsible for clinical morbidity in about450 million humans, much of whom are women of reproductive and child-age in low income countries.

2.6 Helminths infection and pregnancy

Pregnant women in their tens of millions as some of the members of communities are affected by infections of parasites where it directly or indirectly leads to several adverse maternal and placental/fetal effects. Usually, pregnant women encounter more severe infections than their

counterparts who are not pregnant (Derso, 2016). In any of the three stages, parasitic infections can occur in the three trimesters during pregnancy, however, infections in first trimester is more associated with more severe placental and fetal consequences than those occurring in later stages of the pregnancy. In addition, the infection is more intense in women who are pregnant for the first time (primigravida) as compared to other gravidae (Muhangi, 2007).

2.7 Burden of disease

There is an ongoing argument that measurements like the disability-adjusted life year (DALY) do not reflect the actual impact of helminths infections and their subtle morbidities in endemic areas and human development (Payne, 2009). This flaw contributes partly to maintaining their status of negligence, thus slowing the needed global attention to make efforts in controlling them. Calculations of DALYs and years of potential life lost (YLL) are useful, however they are limited in the account of the wide public health and economic burdens of gastrointestinal parasites, especially when applied in areas of poor resource **(**Angel, 2006). In addition, these measurements have been only analyzed for schistosomiasis and nematodes. The resulting numbers produced for these parasites are considered to be minimal as they usually do not result in death, and which is greatly weighted in these measurements, but rather persist chronically, and this makes their burden harder to enumerate. For instance, estimates of intestinal nematode-related deaths differs widely from about 12,000 to about 135,000 and as a result DALY estimations range from about 4.7 to about 39 million (Bethony, 2006)

2.8 Prevention, treatment & control

Mainstream interventions by public-health (such as observation of food hygiene, the availability of health education, maintenance of functioning sanitation systems and provision of clean water) are important for controls in long-term in communities but the applications and sustainability of interventions are complicated, and varies within local settings. Slum dwelling is becoming a common way that is causing a new parasitology in urban areas where multi parasitism is increased, and that will demand a different way of analysis for the development and application of community-based control measures. Wide scale epidemiological surveys with concurrent cartographic modeling applying morbidity structured questionnaires are increasingly applied to guide targets, spatially explicit and cost-effective environmental sanitation (Angeles, 2009), also, pharmaceutical intervention like Mass Drug Administration (MDA). The MDA involves a large scale, usually nationwide campaign, distribution and administration of drugs that are based on local demands gathered from parasitological surveys and geospatial modeling of infested populations (Harhay, 2010).

It is estimated that about two billion humans are infected with geo-helminths and schistosomes and programs such as mass deworming are widely encouraged (WHO, 2008). In the past, deworming used to be avoided among pregnant and lactation women because of safety issues; however, in settings where women are lactating or pregnant for most of their reproductive lives, this can end in treatment delays and morbidity. Furthermore, adverse effects of intestinal helminths on fetal growth, infant mortality and maternal anemia have been discussed. As a result, the World Health Organization in 1994 suggested hookworm infection treatment during pregnancy in communities where hookworm is reported endemic. Also in the year 2002, there

was a suggestion of the administering of praziquantel during pregnancy in communities where schistosomiasis is endemic, in addition to analysis of birth outcomes (Ndibazza, 201)

Many parasitic infections including helminths can be treated with specific chemotherapy. The treatment of helminths infections is normally by drugs which are administered orally for direct action on the parasites. If high parasiticidal effect is to be achieved, it is recommended that the drugs given should not be absorbed and the drugs also should have little or toxic effects on the host.

Measures and steps should be taken against every parasite infecting human. To achieve parasitic eradication, Preventive measures should be designed to halt the transmission cycle. Such steps and measures includes: scaling down the sources of infection and the parasite being attacked in the host, therefore preventing the spreading of the infecting agents. This implies that, a prompt diagnosis and treatment of parasitic infections are crucial component in the prevention of dissemination. Proper waste disposal through establishing safe sewage systems, sanitation control of drinking water and food and screened latrines usage are all encourage (Park, 2008).

It is evident that the cycle of geo-helminths infestations and environmental pollution by these parasites will persist until major measures are taken. Previously, it was indicated that neither sanitation improvements nor the more usage of drugs alone can result in eradication of infection in the possible near future. Sanitation revolutions might and have occurred in some developed countries in this last century, however, this is not possible in the near future in most developing communities. There is an estimation that proposes that environmental sanitation would take between 15 to 25 years to obtain sustain levels of these parasites in the ecosystem, whiles the inclusion of medication and health education would scale down this to a manageable5 to 10 years (Harhay, 2010)

CHAPTER THREE

3.0 METHOD

3.1 Design

An unmatched retrospective case control study design was used to conduct this study by reviewing hospital data and administering questionnaires to study participants.

3.2 Study Area

The study was conducted at the Tamale Teaching Hospital in Tamale. Tamale is the administrative capital of Northern Region, Ghana and is the fourth largest city in the country. Tamale is located 600 km (370 mi) north of Accra. The northern region occupies a total land area of 70,384 km sq and has a population of 2,479,461. Tamale features a tropical wet and dry climate under the Köppen's climate classification. The Tamale metropolis experiences one rainy season from April to either September or October, peaking in July and August. The dry season is often from November to early April. It is influenced by the dry north-easterly (Harmattan) winds, while the rainy season is influenced by the moist south-westerly winds. According to the Ghana Statistical Service (2014), majority of the people live in rural communities and are mostly peasant and cash crop farmers. The Metropolis is located in the center of the Northern Region with an overall estimated landmark of 750 km sq. The Metropolis has a total of 197 communities of which 164 communities are rural. According to the 2010 population census, the total population for Tamale Metro was 371,351, comprising 185,356 males and 185,995 females (GSS, 2011). Also in the metropolis, 70.9% of rural households and 29.1% of urban households dispose their waste by indiscriminate dumping (GSS, 2014).

3.3 Study site

This study took place at the Tamale Teaching Hospital (TTH). The Hospital (TTH) is a 340 bed capacity hospital located in the Tamale Metropolitan area in the Northern Region of Ghana. Apart from offering clinical care to inhabitants of the metropolis and its surrounding districts, it serves also as a referral facility for the two other Upper Regions (Upper West and Upper East). The teaching hospital collaborates with the University for Development Studies in Northern Ghana to offer undergraduate and post-graduate programs in medicine, medical laboratory sciences, nursing and nutrition. TTH runs six clinical departments which include pharmacy, surgery, pediatrics, medicine, obstetrics and gynecology and diagnosis (laboratory, radiology and physiotherapy).

The parasitology unit of the laboratory department where the data was collected has three biomedical scientist and one laboratory assistance. The unit has two microscopes, one centrifuge and one bio-safety cabinet,

Fig 8. A map of Ghana showing Tamale

(Google map, 2016)

Table 1 Study Variables.

Variables	Operational Definitions	Type of variable	Scale of measurement
Intestinal helminths egg infestation	A pregnant woman who has been diagnosed helminths positive	Dependent	Categorical. -Any of the intestinal helminths
Place of residence	The place of residence of a woman at the time of diagnosis	Independent	Categorical 1.Tamale Town 2.Outside Tamale town 3. Urban 4.Rural
Age	Age in years of a woman as at the time of diagnosis	Independent	Continues
Occupation	The occupation of a woman at the time of diagnosis	Independent	Categorical 1.Soil related 2.Not soil related
Educational level	The level of formal education of woman	Independent	Categorical 1.No formal education 2.Formal education
Hand washing after visiting toilet	The culture of personal hygiene by woman	Independent	Categorical 1.Wash hand after toilet 2. Wash sometimes 3.Do not wash

3.4 Study Population

The study population included all pregnant women referred to the Tamale Teaching Hospital laboratory for routine stool examination from January 2015 to December 2016.

3.5 Sample size estimation

From January, 2015 to December, 2016, a total of 4,942 routine stool examination data of pregnant women were available in the parasitology laboratory of the hospital and the 4,942 data were reviewed and evaluated, so there was no need to calculate sample size.

A total of 314 (314/4,942) pregnant women were intestinal helminths positive, thus intestinal helminths found in their stool after microscopic examination and a total of 46 (46/314) of the 314 had their contact address available and consented to participate in the study

A 1:2 an unmatched retrospective case control study was then applied, therefore, 92 (92/4,896-remaining negative cases) were recruited as controls by random selection from the remaining 4,628 data reviewed. Thus, those with available contact address in the hospital and consented to participate in the study.

3.6 Data Collection and Sampling technique

Records of all pregnant women referred to the Tamale Teaching Hospital laboratory for routine stool examination from January 2015 to December 2016 were evaluated and included in the study by reviewing the stool routine examination records books for hospital attendance number, ward (ANC), diagnosis and microscopic results.

All those that were diagnosed with any of the intestinal helminths species in their microscopic results section were recorded as intestinal helminths positive (cases) and those without any of the intestinal helminths species or could have any other infection were considered intestinal helminths negatives (controls). Further review was then carried out on the positive cases to find out which intestinal helminths species was involved **(**for instance, either Hookworm ,

Hymenolepis Nana, Ascaris lumbricoides, Strongyloides Stercoralis, , Dicrocoelium dentriticum, Trichuris trichiura, Schistosoma mansoni, etc)

A purposive sample of 46 (46/314) pregnant women's (intestinal helminths positive) data on sociodemographic factors were collected using structured questionnaires and this was based on those whose contact address were available and consented to participate in the study.

A total of 92 (92/4,628) pregnant women (intestinal helminths negative) were randomly selected as controls and their sociodemographic factors were collected using the same structured questionnaire used for the positive cases, and this was also based on those with available contact address and consented to participate. The questionnaire were closed ended and was administered to the participants. Each participant (women) was given a unique identification.

3.7 Data Processing

Questionnaires assigned to respondents for data collection were coded. Data from each respondent was organized and sorted into groups to allow for efficient and sequential processing. In addition to the questionnaires, all other data were entered into Microsoft Excel database, and imported into STATA 14 IC software. Appropriated label names were assigned to each variable in STATA, before analysis was carried out.

3.8 Analytical Plan.

Data collected with the questionnaire were analyzed using STATA 14 statistical software. The test for association between independent variables and main outcome (helminths eggs infestation) was conducted using the Chi-square test. Multivariate logistic regression analyses were performed with odds ratio (OR) to determine the strength of association between infection

and associated factors. Confidence interval was set at 95% and p-value less than 0.05 was considered statistically significant.

3.9 Data Quality.

Data collected were checked for accuracy and completeness. All necessary corrections were made where possible. Completed forms were coded and entered into Microsoft excel program everyday and imported into stata 14 statistical software.

3.10 Data Storage and Confidentiality

The completed questionnaires are securely kept in locked file cabinets. Access to files will be restricted only to the principal investigator and two field assistants of the study. Data obtained from survey are password protected.

3.11 Ethical Consideration/Issues

Ethical clearance was obtained from Ghana Health Service Ethical Review Board with approval number GHS-ERC: 59/12/16 and approval date, 24th/May/ 2017. Permission was also obtained from the Tamale Teaching Hospital before commencing data collection with approval number TTH/R&D/SR/17/82.

Verbal (Phone calls) and written informed consent was sought from study subjects prior to the study commencement.

3.12 Pre test study

A pilot study was conducted by administering the questionnaires to ANC attendants at the Tamale Central Hospital before going to the field. The pilot study was conducted to test the clarity of the items in the questionnaire tools, the time needed to answer the questions and to identify any difficulties that may arise and need to be handled before applying the questionnaire.

CHAPTER FOUR

4.0 RESULTS

4.1 Prevalence and helminths infections.

A total of 4,942 ANC attendance records were reviewed and evaluated in the study comprising of 2,520 and 2,422 records in 2015 and 2016 respectively, and the total number of women infested with intestinal helminths was 314/4,942 (6.4%) for the two years combined (Table2). The age breakdown revealed that, majority of the attendance were in the age group of 26-30 (27.9%), followed by 31-35 **(**25.7%) while the highest number of parasites were recorded in the age group of 21-25 (26.7%) followed by 16-20 (25.2%) (Table 3).

Hymenolopis nana was the highest number of helminths found followed by *Strongyloides stercoralis* and *Ascaris lumbricoides* for the two years records separately and combined. June recorded the highest number of helminths in 2015 while May recorded the highest in 2016. (Table 4 and 5).

The prevalence of helminths infestation for 2015 and 2016 were 8.3% (208/2,520) and 4.4% (106/2,422) respectively with the overall prevalence being 6.4% (314/4,942). In terms of the various species prevalence, *H. nana* was found to be the highest with 3.9% (193/4,942) followed by *S. stercoralis* 0.8% (41/4,942) and *A. lumbricoides* 0.6% (30/4,942).

Among the age groups, the highest prevalence was 11.2% (79/707), for those between 16-20 years, 10.4% (84/810) for those between 21-25, 8.8% (31/425) for 36-40 and the least was 3.1% (43/1379) for women between 26-30 years. With regard to age, the average intensity of infection turned to be convex, increasing in children and declining in adults. For *Trichuris trichiura and Ascaris lumbricoides* , the most frequent infections occurs in age group from 5 to 15 years, with

a decline in frequency in adulthood however, hookworm frequently shows a consistency rise in intensity of infection with age, peaking in adulthood (Hotez, 2008)

In terms of months, June had the highest prevalence of 13.2% (57/433), followed by May, 12.4% (55/444) and March recorded the least, 1.3 (6/438).

Table 2. Breakdown of Stool routine examination results records between January 2015 to December 2016 .

Months	No. of Stool R/E results from ANC attendance in 2015	No. Infested with Helminths 2015	No. of Stool R/E results from ANC attendance in 2016	No. Infested with Helminths 2016	Total Stool R/E, Results	Total No. Infested
January	232	7	182	3	414	10
February	162	6	139	2	301	8
March	226	4	212	2	438	6
April	216	15	276	14	492	29
May	214	27	230	28	444	55
June	212	43	221	14	433	57
July	190	33	210	15	400	48
August	182	24	208	11	390	35
September	227	14	183	6	410	20
October	219	16	194	8	413	24
November	205	10	192	1	397	11
December	235	9	175	2	410	11
Total	2,520	208	2,422	106	4,942	314

Table 3. Breakdown of parasite prevalence by age distribution

Age Group.	No. of samples	No. of positives	Percentage (%) of positives	Prevalence per age group (%)
16-20	707	79	25.2	11.2
21-25	810	84	26.7	10.4
26-30	1379	43	13.7	3.1
31-35	1270	56	17.8	4.4
36-40	351	31	9.9	8.8
41-44	425	21	6.7	4.9
Total	4,942	314	100	

Table 4. Breakdown of helminths species record, 2015

Months 2015	***Hymenolepis Nana***	***Ascaris lumbricoides***	***Strongyloides Stercoralis***	***Hookworm***	***Dicrocoelium dentriticum***	***Trichuris Trichiura***	***Schistosoma mansoni***	**Total**
January	3	1	1	1	1	0	0	3
February	3	0	0	0	2	1	0	2
March	1	1	0	1	1	0	0	2
April	9	0	3	2	0	1	0	14
May	11	0	11	2	1	2	0	28
June	28	4	7	0	1	3	0	14
July	17	7	4	1	3	1	0	15
August	16	3	2	0	1	2	0	11
September	10	2	1	0	0	0	1	6
October	11	2	0	1	2	0	0	8
November	7	1	2	0	0	0	0	1
December	5	0	0	1	2	1	0	2
Total	121	21	31	9	14	11	1	208

Table 5. Breakdown of helminths species record, 2016

Months, 2016	***Hymenolepis nana***	***Ascaris lumbricoides***	***Strongyloides Stercoralis***	***Hookworm***	***Dicrocoelium dentriticum***	***Trichuris Trichiura***	***Schistosoma mansoni***	**Total**
January	2	0	1	0	0	0	0	3
February	1	0	0	0	1	0	0	2
March	0	0	0	1	0	1	0	2
April	7	1	3	0	2	0	1	14
May	23	3	1	0	1	0	0	28
June	9	2	1	1	1	0	0	14
July	11	1	2	0	0	1	0	15
August	7	1	1	1	1	0	0	11
September	5	0	0	0	0	0	1	6
October	6	0	1	0	0	1	0	8
November	0	1	0	0	0	0	0	1
December	1	0	0	0	1	0	0	2
Total	72	9	10	3	7	3	2	106

4.2 Association between sociodemographic factors and helminths infections

The association between sociodemographic factors and prevalence of helminths infections are shown in table 6. According to their residence, 88/138 (63.8%) were from urban and 50/138 (36.2%) were from rural areas. 13 (14.8%) out of the 88 women from urban and 33 (66.0%) out 50 from rural areas were infested with intestinal helminths and there was significant difference in infestation between urban and rural women ($p<0.05$) (Table 6).

For those with toilet at home77/138 and are using it, 77 (55.8%) were having toilet facility at home, and 61 (44.2%) were not having toilet facilities at home, 11 (14.3%) who were having the toilet at home and 35 (57.4%) who did not have toilet at were infested with helminths and the difference was significance ($p<0.05$) (Table6).

For those who practiced free range defecation, 73/138, thus defecating indiscriminately around their environment or live in such areas, 73 (52.9%) practiced free range defecation and 65(47.1%) did not practiced it, 43(58.9%) who practiced free range or live in such areas and 3 (4.6%) who did not practice or live in such areas were infested with intestinal helminths and the difference was significant ($p<0.05$) (Table 6).

According to their employment status, 40/138 (29.0%) were employed and 98/138 (71.0%) were unemployed. 9(22.5%) of the 40 employed and 37 (37.8%) of the unemployed were helminths positive and there was significant difference between the employed and unemployed women ($p<0.05$) (Table 6).

Among the participants in this study, 24/138(17.4%) washed their hands after toilet usage and 114/138(82.6%) did not wash their hands after toilet usage. 2/24 (8.3%) who washed their hands

after using toilet and44/114 (38.6%) who did not washed their hands after toilet were positive for helminths infection and the difference was significant ($p<0.05$) (Table 6).

For their education status, 40//138 (29.0%) have some form of formal education and 98/138 (71.9%) did not have any form of formal education, and 29/40 (72.5%) who did not have any form of formal education and 17/98 (14.81) who had a formal education were intestinal helminths positive and the difference was significant ($p<0.05$) (Table 6)

However, there was no significant difference between age and helminths infection ($p>0.05$) (Table 6).

In adjusted multivariate analysis of factors associated with helminths infestation, significant associations was observed between intestinal helminths infestation with women's place of residence (OR=50.67, 95% CI 7.42-387.99) and hand washing after using toilet (OR=20.98, 95% CI 2.44-158.95) (Table 7)

Table 6.Associations between sociodemographic factors and helminths infections.

Variable	Negative (%)0	Positive (%)1	Total No. (%)	P-value
Residence				
Rural	17(34.0)	33(66.0)	50(36.2)	<0.001
Urban	75(85.2)	13(14.8)	88(63.8)	
Toilet at Home				
Has toilet	66(85.7)	11(14.3)	77(55.8)	<0.001
Has no toilet	26(42.6)	35(57.4)	61(44.2)	
Free-range Practice				
Practice	30(41.1)	43(58.9)	73(52.9)	<0.001
Don't practice	62(95.4)	3(4.6)	65(47.1)	
Employment Status				0.05
Employment	31(77.5)	9(22.5)	40(29.0)	
Not Employment	61(62.2)	37(37.8)	98(71.0)	
Hand Washing after Toilet				
Wash hands	22(91.7)	2(8.3)	24(17.4)	0.004
Not washing hands	70(61.4)	44(38.6)	114(82.6)	
Education				
Educated	11(27.5)	29(72.5)	40(29.0)	<0.001
Not Educated	81(86.7)	17(17.3)	98(71.0)	

Table7. Socio demographic factors significantly associated with helminths infestation.

Variable	Adjusted OR(95%CI)	P-value
Non residence	Ref	
Residence	50.67 (7.42-387.99)	0.001
No hand wash after toilet	Ref	
Hand wash after toilet	20.98 (2.44-158.95)	0.005

CHAPTER FIVE

5.1 DISCUSSIONS

This retrospective cross sectional studies sheds light on the prevalence of intestinal helminths infestation among pregnant women attending Tamale Teaching Hospital for antenatal care and laboratory investigation for routine stool examination.

Surprisingly, this study showed a low prevalence of intestinal helminths parasites (6.4 %) among pregnant women attending the Tamale Teaching Hospital. The intestinal helminths prevalence identified in this present study (6.4 %) was lower than 14.3 % which was reported among pregnant women at Azezo Health Center of Gondar town, Northwest of Ethiopia (Alem ,2013)and those of 17.6 % and 13 % reported from Sekyere, Ghana (Baidoo, 2010) and Senegal (Binetou ,2011), respectively. This findings is also lower than the findings of other similar studies conducted among pregnant women and reported from Nigeria (43.4 %), (Egwunyenga, 2011), Kenya (76.2 %) (Van Eijk, 2009), and Gabon (65 %) (Adegnika, 2010)

The most common intestinal helminths in sub Saharan Africa are *Ascaris lumbricoides, Trichuris trichiura*, and hookworm, followed by schistosomiasis respectively(Hotez, 2008)

However in this study, the highest prevalence in terms of helminths species was *Hymenolopis nana* (3.9%) followed by *Strongyloides stercoralis* (0.8%) and *Ascaris lumbricoides* (0.6%) respectively, this also differs from many other similar studies on pregnant women in other parts of Africa. Baidoo et al (2010) study in Sekyere in the Ashanti region of Ghana revealed the highest prevalence of hookworm infection (13.9%) followed by *Strongyloides stercoralis* (1.9%) *Ascaris lumbricoides* (0.9%) and *T. trichiura* (0.9%). Also, Wekesa et al (2014) in their study of intestinal helminths infection in pregnant women attending Antenatal clinic at Kitale district hospital, Kenya reported *Ascaris* to be the dominant species followed by hookworm and

Trichuris trichiura respectively. Hookworm infection can result in anemia due to loss of blood and chronic protein deficiency. *Ascaris lumbricoides* and *Strongyloides stercoralis* can cause intestinal discomfort, obstruction, and impaired nutritional status. *Trichuris trichiura* infection can cause blood loss, dysentery, chronic abdominal pain, diarrhea, and rectal prolapsed (CDC,2017).

Differences in findings among various studies can be explained by variations in geography, socio-economic conditions and cultural practices of the population under study. The particular type of study subjects, the timing of the study may have also contributed to the variation. Also, the nature of study design can result in differences.

The low prevalence could also be due to a low prevalence or incidence in the Tamale metropolis. This could also be due to behavioral changes after health information and education on helminths infections. Another explanation for the low prevalence too could be the poor laboratory examination techniques and procedures used in diagnosing stool routine examination for these pregnant women since they only use wet mount technique instead of the formol-ether concentration techniques which could reveal more of the parasites. A normal saline wet-mount preparation will probably only identify few parasite count infections, while a formol-ether concentration test has much higher sensitivity, and a Polymerase Chain Reaction-based (PCR) tests are the most sensitive. This implies that, the reporting of prevalence of intestinal helminths will be dependent on test sensitivity (Bergquist, 20009).

However, the findings from this study regarding associations between helminths infections among pregnant women and their area of residence, having toilet at home, employment status and educational status was consistent with that reported in a similar study among pregnant women in northern Tanzania (Mahande, 2016).

Pregnant women living in rural areas had higher probability of becoming infected with intestinal helminths compared to those in urban areas due to poverty, poor environmental sanitation and poor education on personal hygiene in the rural areas. According to the CDC in 2013, intestinal helminths are soil transmitted and their eggs passes in the feces of infected persons and if an infected person defecates outside (in bushes or fields) or their feces are used to fertilize crops, the eggs get deposited on soil. Hookworm and *Ascaris* eggs become infective as they mature in soil. People are infested with *Ascari*s or *T. trichiura* when they ingest their eggs. This can happen when hands or fingers that have been contaminated with dirt on them are put in the mouth or by eating fruits and vegetables that are raw or have not been cooked carefully or washed. The eggs of hookworm hatch in soil, releasing larvae (immature worms) that mature into forms that can penetrate the skin of humans. Infection of hookworm is transmitted mainly by walking barefoot on contaminated soil.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The overall prevalence of intestinal helminths infection among the pregnant women attending the Tamale Teaching Hospital Laboratory was relatively low compared to other studies across Africa and other parts of Ghana.

H. nana, S. stercoralis and A. lumbricoides were the identified helminths species in this study. Place of residence and hand washing after visiting toilet were the factors that showed strong association with helminths infection in this study

6.2 Recommendations

Government should allocate more resources to equip the Tamale Teaching Hospital Laboratory so that they can perform formol-ether concentration for effective diagnosis of helminths infection, other prospective studies used this technique in processing their samples and this yielded a higher prevalence compared to this study.

Raise pregnant women awareness regarding environmental hygiene and personal hygiene especially on washing their hands after using a toilet.

More research should be conducted on this topic using samples from the rural communities surrounding the Tamale metropolis

A more effective surveillance needs to be maintained to identify the prevalent Helminths infection in the metropolis and surrounding rural communities

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Appendix-Questionnaire

Thank you for taking part in this study. The information you provide will be used in research to investigate the factors contributing to Intestinal helminthes infestation in pregnant women. Any information you provide will remain confidential and anonymous and only relevant to the research. You have the right to withdraw from this study (voluntary)

Please answer all questions that apply to you by putting a tick on the response of your choice

1) Age?

a. <17

b. 17 or more

2) Place of residence?

a. Urban

b. Rural

3) Do you have toilet at home?

a. Yes a. Yes

b. No b. No

4) Do you or people around you practice free range?

5) Are you employed?

a. Yes

b. No

6) What type of employment?

i. self employed

ii. Employed iii. Business

7) What is the nature of your work?

i. Farming

ii. Pot making

8) Do you wash your hands after work?

i, Yes

ii. No

iii. Other (name)…

9) Do you wash your hands after visiting the toilet?

a. Yes

b. No

10) If you wash, do you wash with soap?

a. Yes

b. No

11) Do you inspect your fingernails for dirt?

a. Yes

b. No

12) If yes how frequently?

a. Few times

b. More times

c. Most times

13) Do you cut your fingernails after you see dirt in it?

a. Yes b. No

14) Do you have a formal education?

a. Yes b. No

15) If yes, level?

a. Basic b. Secondary c. Postsecondary

Appendix -Participant Information

Title : INTESTINAL HELMINTHS INFESTATION AND ASSOCIATED PREGNANCY OUTCOMES AMONG PREGNANT WOMEN ATTENDING TAMALE TEACHING HOSPITAL.

Investigator : Mohammed Ezid-Deen Adam

Background of the study.

Soil-transmitted helminthic infections (STH) are very common in the poorest countries where sanitation is poor and human faeces contaminate the soil. Two billion people are affected by single or multiple soil transmitted helminthic diseases and 135,000 died annually (Paudel, 2014). Intestinal helminths infections are endemic worldwide and have been described as constituting the greatest single worldwide cause of disease and illness. Poverty, poor hygiene, illiteracy, lack of access to potable water and hot and humid tropical climate are the factors associated with intestinal parasitic infections.(Mehraj, 2008).

Most women in developing countries spend about half of their reproductive lives pregnant and lactating and a high proportion of these women become anemic during this period. Women of reproductive age who are iron deficient but not anemic may become anemic during pregnancy as a consequence of increased iron requirements and expanded plasma volume. Other causes of anemia include parasitic infestations such as intestinal helminths and malaria(Obiezue, 2013)

Purpose of the Study

You are invited to part take in a research that is aimed at determining the prevalence of intestinal helminths infestation among pregnant women and associated pregnancy outcomes.

This is in partial fulfillment of my Msc. Clinical Trials from the University of Ghana School of Public Health. I am hoping the final work of this research will contribute to the policy makers of Ghana Health Service and the Tamale Metropolis. You were selected as possible participant for this study because you met my selection criteria.

Voluntary Participation

Your participation in this study is voluntary and you will not be affected in anyway if you decide not to participate. You can also withdraw at any time of the study with no adverse consequences. However, if you decide to withdraw after the analysis of the data, nothing could be done to reverse it.

Duration of the study involvement

This research will take approximate 2 days to interact with the study participant and gather all necessary information and data. This will take the form of questionnaire.

Cost/Payment

Kindly be informed that you are not going to be paid or compensated for taking part in this research.

Confidentiality

you are assured that you will remain anonymous as you take part in this study. your identity and personal information will not be disclosed.

Possible Risk

There is no direct risk in this study, however, women who lost their babies or fetus, or had any birth complications during that period at the hospital could react to the memories.

Possible Benefits

The study may help the Ghana health service find better ways to education women and the entire public on the effects of helminths infestation in the Tamale metropolis and Ghana as a whole.

Funding information

This study is an academic research which is solely funded the researcher. As a result there will be no direct or indirect financial burden borne by the participant

Data Sharing Plan

The outcome of this study will be made available to the College of Health Sciences, University of Ghana, Ghana health service and medical research.

Who to contact for any clarification

For any concern or further clarification, you may contact any of the these persons.

Mohammed Ezid-Deen Adam

Researcher

0246804429

Dr. Bismark Sarfo

Supervisor0269343169

Appendix-Inform Consent Form

Full title of Project: **INTESTINAL HELMINTHS INFESTATION AND ASSOCIATED PREGNANCY OUTCOMES AMONG PREGNANT WOMEN ATTENDING TAMALE TEACHING HOSPITAL.**

`**Name of Researcher**: Mohammed Ezid-Deen Adam

Participant code:

1. I understand that I have read and understood the information sheet for the above study and have had the opportunity to ask questions
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving reason
3. I agree to take part in the above study
4. I agree to the interview
5. I agree to the use of anonymised quotes in publications

…….…… ……. ……..

Name of participant Date Signature

…… ……

Name of Researcher Date Signature

Table 8.Appendix-Budget

Item	**Cost**
Printing of data collection tools	600
Stationery	600
Transportation and communication for data collection	1000
Data entering and reporting	800
Printing and binding	800
Assistance (language interpretations)	500
Total	Ghc 4,300

Fig 9.Appendix-Timeliness

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
Tel: +233-302-681109
Fax + 233-302-685424
Email: ghserc@gmail.com

MyRef. GHS/RDD/ERC/Admin/App/17/534
Your Ref. No.

Mohammed Ezid-Deen Adam
University of Ghana
School of Public Health
Legon, Accra

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	**GHS-ERC: 59/12/16**
Project Title	Intestinal Helminths Infestation and Associated Pregnancy Outcomes among Pregnant Women Attending Tamale Teaching Hospital
Approval Date	24th May, 2017
Expiry Date	23rd May, 2018
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report **after completion** of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
DR. CYNTHIA BANNERMAN
(GHS-ERC CHAIRPERSON)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra