KAIRUKI UNIVERSITY

DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY

HELICOBACTER PYLORI INFECTION AND ANAEMIA AMONG PREGNANT WOMEN ATTENDING ANTENATAL CARE AT MWANANYAMALA REGIONAL REFERRAL HOSPITAL IN DAR ES SALAAM, TANZANIA

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Dissertation submitted to the school of medicine in partial fulfillment of the requirements for the degree of Master of Medicine in Obstetrics and Gynaecology at Kairuki University

2024

CERTIFICATION

'It is hereby certify that the undersigned have read and hereby recommend acceptance by Kairuki University, a dissertation titled: **Helicobacter Pylori Infection and Anaemia, among Pregnant Women attending Antenatal care at Mwananyamala Regional Referral Hospital in Dar es Salaam, Tanzania** in partial fulfillment of the requirements for the degree of Master in Medicine in Obstetrics and Gynaecology

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DECLARATION

I, Fedy Israel declare that this dissertation is my own effort and original work, and that it has not been presented and will not be presented to any other University for a similar degree or any other academic award.

Being a Student Researcher, enrolled at Kairuki University, I understand that plagiarism is a serious offence, and therefore confirm that the contents of this research are purely my own production.

…… ……

Signature: Date:

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ACKNOWLEDGMENT

I would like to express my gratitude to God for blessings throughout my academic life. Many thanks to my supervisor Dr M. Chiduo and Co- Supervisor Dr. B. Sylvester, staff in the department of Obstetrics and Gynecology at Mwanayamala Regional Referral Hospital, pregnant women who participated in this study, The Ministry of Health and Social Welfare for financial support, and my family for their love and care.

DEDICATION

This work is dedicated to my beloved parents, my relatives and friends who supported me all the way back until now and they are still doing so, are amazing, may almighty God bless them abundantly.

ABSTRACT

Background: Helicobacter pylori (H. pylori) is a gram-negative bacterium commonly associated with gastrointestinal disorders. Its impact on anemia, particularly in pregnant women, is an area of growing interest, as pregnancy introduces additional nutritional and physiological stresses that can exacerbate anemia.

Objective: To investigate the effects of H. pylori infection on anemia in pregnant women attending antenatal care at Mwananyamala Regional Referral Hospital between May and June 2024.

Methods: This study involved a cross-sectional hospital-based analysis of 300 pregnant women attending antenatal clinics. Participants were screened for H. pylori infection using stool antigen tests. FBP was measured to hemoglobin level, and additional tests were a blood sample for malaria parasites and a stool sample for HP infection and intestinal worms. Also, MUAC was done to assess the malnutrition status of the participants. Clinical data, including demographic and obstetric history, were also collected. SPSS version 20 was used for data analysis; bivariate multivariable logistic regression used for confound factors analysis and Chi square were used for exploration of the association of HP infection on anemia in pregnant women.

Results: There were effects of H. pylori infection on increased prevalence of anemia among pregnant women who had H. pylori infection, H.P Infection were 2.4 times (AOR = 2.40, 95% CI = 1.354-3.674) more likely to be anemic than the H. pylori-negative ones. Independent of confounding factors associated with increased anemia were education levels (AOR = 3.24, 95% CI = 1.58-6.63), occupation (AOR = 1.90, 95% CI = 0.99-3.72), third-trimester pregnancy (AOR = 1.97, 95% CI = 1.01-2.2), and history of hyperemesis gravidurum (AOR = 6.42, 95% CI = 2.97-13.91).

Conclusion: H. pylori infection has effects on anemia in pregnant women. The infection appears to exacerbate the risk of anemia, likely through mechanisms related to impaired iron absorption and increased gastrointestinal inflammation. These findings highlight the importance of screening and managing H. pylori infection as part of prenatal care to improve maternal and fetal health outcomes.

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ABBREVIATIONS AND ACRONYMS

ANC - Antenatal Care

MRRH - Mwanayamala Regional Referral Hospital

TDHS - Tanzania Demographic and Health Survey

CI - Confidence Interval

DL - Deciliter

Fe2+ - Iron (in ferrous form)

Gm - Gram

Hb - Hemoglobin

HP - Helicobacter pylori

ID - Iron Deficiency

IDA - Iron Deficiency Anemia

IgG - Immunoglobulin G

IP - Intestinal Parasite

IPG - Inter Pregnancy Gap

LBW - Low Birth Weight

MALT - Mucosal Associated Lymphoid Tissue

MUAC - Mid Upper Arm Circumference

RBC - Red Blood Cells

SPSS - Statistical Package for the Social Sciences

WHO - World Health Organization

DEFINITION OF TERMS

Mild Anaemia: venous blood Hb level of 10-10.9 g/dL

Moderate Anaemia: venous blood Hb level of 7-9.9g/dL.

Severe Anaemia: venous blood Hemoglobin concentration less than 7 g/dL.

Other health related variables: Other health-related variables included in this study's setting are the subjects' demographic information, nutritional status, history of IP infection, and obstetrics.

Inter-pregnancy gap: described as the interval in years between the conception of the current pregnancy and the prior birth.

Low inter pregnancy gap: the inter pregnancy gap is less than 2 years

MUAC is a measurement of the circumference of the upper arm at the midpoint between the olecranon and acromion processes determined in relation to Gestation age as follows as normal ranges in pregnant mother

MUAC less than 25.75 to 28.10cm, normal at GA-(19-21weeks)

MUAC equal to 25.75 to 28.70cm, normal at GA (27-29 weeks)

MUAC equal to 25.75 to 29.45cm, normal at GA (37-39 weeks)

OPERATION DEFINITIONS

Anaemia: Defined as a venous blood Hemoglobin content of < than 11 g/dl.

Low anaemia: 10–10.9 g/dl of hemoglobin in venous blood

Moderate anaemia: Venous blood Hemoglobin level is 7-9.9 g/dl, indicating

severe anaemia: Hb concentration is less than 7 g/dl.

CHAPTER ONE

1.1 Introduction

Anaemia by WHO is defined as hemoglobin levels of 12.0 g/dL in women and < 13.0 g/dL in men (1). That is per the standard definition of anaemia reflecting the hemoglobin levels in mature erythrocytes. Notably, hemoglobin concentration in red blood cells differs not only with sex but also with origin and biological status. Hemoglobin is responsible as an oxygen vehicle in tissues and cells, with low levels of hemoglobin or abnormal levels or shapes of red blood cells also counted as anaemia. By far, anaemia ranks among the commonest nutritional deficiency diseases observed globally. Anaemia affects at least 24.8% of people on the entire globe. Pregnant women and children under five are particularly susceptible to anaemia (1,2). The iron deficiency anaemia is approximated as 50% of all cases of anaemia, and according to the WHO, ID is the most nutritional issue, impacting over a billion people. (3).

The pregnancy state has its unique anaemia Hb cut-off points because it is a changed physiological state of the female organism. Anaemia in pregnancy is specifically characterized as having a venous blood hemoglobin content of < 11 g/dL (4).

Anaemia during pregnancy in low-income countries is caused by a diversity of factors, like diet with deficits in iron, folate, and vitamin B12, along with parasite infections like hookworm and malaria parasites (5). A deficiency in the digestive system's capacity to absorb and use dietary or supplemental iron because of an infection with Helicobacter pylori (HP) is thought to be another factor contributing to the incidence of anaemia during pregnancy (5–8).

The stomach's epithelium is infected with HP, a gram-negative bacteria.it is etiologically associated with gastric cancer, peptic ulcer disease, mucosal-associated lymphoid tissue lymphoma, and chronic active gastritis. It is estimated that over 50% of people on the planet

are infected with HP; however, the frequency is higher in countries that are developing than in developed ones. Many people who have HP are asymptomatic (9). Pregnant women have been found to have a high frequency of HP, which has been associated with an increased risk of anaemia (10). H. pylori competing with the host for iron demand, along with impairing absorption of bioavailable iron in the setting of hypochlorhydria, are thought to be the causes of HP-associated anaemia (10,11). Other gastric lesions due to HP bacterial irritation of the g astric mucosa and bleeding through a peptic ulcer contribute to the development of anaemia.

In underdeveloped countries, the risk factors for anaemia in pregnant women are complex. As a result, factors that influence anaemia include gestation age, marital status, occupation size of the family, educational level, and financial standing (1,12). Evidence-based research indicates that getting enough nourishment is essential to one's health and well-being, especially during pregnancy. It is commonly known that insufficient maternal nutrition raises the risk of premature labor, low birth weight, intrauterine growth retardation, prenatal and neonatal mortality, and morbidity (13). Pregnant women experience major physiological changes so as to support and care for the growing fetus.

1.2 Problem statement

Pregnant women are particularly susceptible to the adverse effects of anemia due to the increased physiological demands of pregnancy(14). The presence of H. pylori infection could potentially aggravate anemia due to its role of impairing the absorption of essential nutrients, including iron and vitamin B12(15)

1.3 Rationale

The Ministry of Health of Tanzania recommends iron supplements for pregnant women, but this recommendation overlooks other causes of anaemia such as Helicobacter pylori infection

which interfere the absorption of it since the prevalence of anaemia in pregnant is still high 57%(16).

This results findings, can help to inform public health policies, healthcare providers in combining H. pylori screening and treatment into prenatal care practices, particularly for pregnant women with anemia.

1.4 Research Objectives

1.4.1 Broad objective

To determine the effects of Helicobacter pylori infection on anaemia among pregnant women receiving ANC at Mwananyamala Regional Referral Hospitals in Dar es Salaam.

1.4.2 Specific objectives

1. To determine the effects of HP Infection on anaemia among pregnant women
2. To determine morphological classification of anaemia among pregnant women with HP infection
3. To determine the association of anaemia in pregnant and other obstetric factors

1.4.3 Research questions

1. What are the effects of HP infections on anaemia among pregnant women?
2. What is the morphological classification of anaemia among pregnant women with H. pylori infection?
3. What is the association of anaemia with other health-related variables?

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

When RBCs oxygen-carrying capacity or quantity is inadequate to meet bodily requirements, the condition is known as anaemia. A decreased hemoglobin concentration in venous blood of < 11 g/dL is considered anaemia during pregnancy. Over 25% of the global population is afflicted by this prevalent disease, which is a result of dietary deficiencies (1,4,17) Anaemia in pregnancy is classified as mild when hemoglobin level is between 10.0 and 11 g/dL, moderate when it falls between 7.0 and 9.9 g/dL, and severe anaemia when hemoglobin concentration is less than 7.0 g/dL (4). It is one of the most prevalent global health issues, particularly affecting pregnant mothers. Anaemia has impacted over half of all pregnant women (3,18). Pregnant women in Tanzania continue to face an unprecedentedly high percentage of anemia, which varies by location. The individual household, reproductive, and child challenges after being controlled, there wasn't any significant reduction in anaemia overall between the two periods. The national TDHS Tanzania Demographic and Health Survey report for 2022–2023 states that 37% of women aged 15–49 have anemia (19).

2.2 Anemia and HP Infection

Globally, HP infection remains a serious public health issue. The study thorough evaluation and meta-analysis revealed the frequency of HP infection worldwide was between 20 and 50 percent in developed countries and between 50 and 80 percent in underdeveloped nations (20). Regionally, the incidence was 10-15% in Australia, 48-95% in Africa, 30-90% in South America, 12-70% in Asia, 50 to 94% in the Middle East, and 15-20% in North America (9,20,21). HP Infection in pregnant women also reported in developing countries, such as 25

percent in Europe, 44 percent in Asia, 50 percent in Africa, and 62 percent in South America. The review also showed that, Sudan has the highest frequency (94%) of H. pylori infection (22).

Additionally, the study carried out in Iran and Sudan revealed that 54.7% of pregnant women had HP (69.8 %) (23). Anaemia also comes on by HP in addition to gastrointestinal issues. Anaemia in children and pregnant women may be caused by HP infection, among other possible factors. Subjects with Helicobacter pylori infection had a greater frequency of IDA than those without the infection, according to a comprehensive review and meta-analysis (20,23). Serum hemoglobin levels were considerably lower in HP-positive persons than in uninfected patients, according to a study done on a thin Turkish population (7). A cross-sectional prospective study done in Butajira, Ethiopia, revealed the magnitude of anaemia was observed in 22.5% of uninfected people and 30.9% of HP-infected patients. The magnitude of anaemia varied statistically significantly between dyspeptic non-pregnant patients with HP infection and those without (21) . Pregnant HP-positive women had a greater prevalence of IDA than pregnant non-infected women, according to an experimental investigation conducted in Pakistan (24). The study also found that pregnant IDA patients had a high frequency of HP infection, though the response to oral iron and folic acid has been improved by treatment of HP infection with triple therapy in the 3rd trimester (9,24). Another study, a cross-sectional investigation of 180 pregnant women in Iran, revealed a strong negative connection between hemoglobin level and serological HP infection. It was discovered that pregnant mothers with H. pylori infection had 3.18 times the risk of getting iron deficiency anaemia in relation to those without the infection (25).

Anemia and other related factors.

Pregnancy-related anaemia risk factors are complex. This covers the mothers' sociodemographic and economic condition, dietary deficits, and parasite infections. Anaemia was linked to the pregnant women's educational status, according to a Pakistani study. This study showed a correlation between a high prevalence of anaemia and less education (26). Women from larger families (≥6) had greater levels of anaemia than women from smaller families (≤2), according to a study done in the Asosa Zone (27). In Gode Town, a cross-sectional study revealed that over 50% of study participants were from large family (more than 5 family members) were anaemic and uneducated, were married at age of 18 or less (82.9%), and belonged to the middle income. Low levels of education and living in rural areas were also linked to anaemia, according to another study (6). A correlation between anaemia and family size and monthly family income was also discovered by the Arba Minch town research (28). The magnitude of anaemia in pregnant in Tanzania by TDHS was 57%. Large families, people without formal education, people who are food insecure, people without health insurance, people who do not take antimalarial medication while pregnant, and people who attend ANC appointments infrequently are more likely to have it (19,29).

2.3 Effects of HP Infection on the Morphology classification of RBCs.

H. pylori infection can influence anemia in several ways, leading to different morphological classifications of anemia based on red blood cell size and hemoglobin content. The key forms of anemia associated with H. pylori infection include microcytic hypochromic anemia due to iron deficiency, macrocytic anemia due to vitamin B12 deficiency, and normocytic normochromic anemia due to chronic inflammation.(30,31).

2.4 Obstetric history and Anaemia during pregnancy.

Significant physiological changes occur in the pregnant mother in order to support and care for the growing fetus (32). Anaemia was found to be significantly correlated with both gestational age and IPG in the Asosa zone study. Compared to mothers discovered in the first trimester of pregnancy, those discovered in the third trimester had 67% lower odds of having anaemia (27).

2.4 Conceptual Frame Work

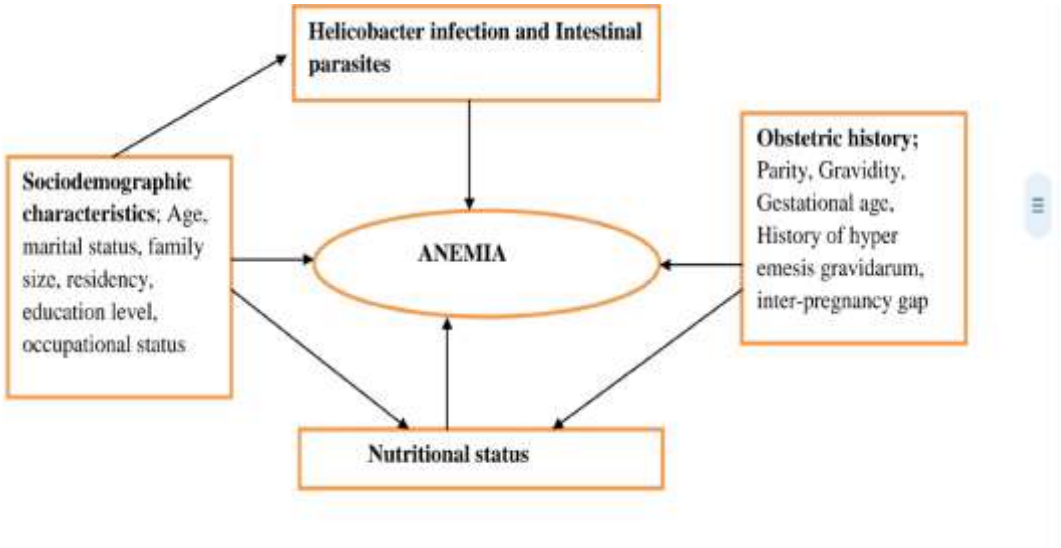


Diagram 1: A schematic illustration of the created conceptual framework that illustrates the possible risk factors for anaemia.

CHAPTER THREE

METHODOLOGY

3.1 Study area

The research study was conducted at the MRRH, which is located in Kinondoni, Dar es Salaam. According to the 2022 census, the population of Kinondoni Municipal is 982,328 and situated on the north shore of the Swahili coast. Dar es Salaam is the highly populated city in Tanzania and the sixth largest in Africa. It is one of the world's fastest-growing cities and a significant economic hub. The population in the region is projected to reach 6.4 million in 2024

Mwananyamala Region Referral Hospitals RCH Clinic provides the following services, ANC, laboratory, pharmacy and outpatient care, 30 to 40 pregnant women every day on average and 600,000 per month receive ANC services**.**

3.2 Study design

A hospital-based cross-section study design was employed.

3.3 Study population

Pregnant women who attended ANC between May and June of 2024 at Dar es Salaam region

3.4 Target population

Pregnant women with Anaemia and Helicobacter pylori infection who attended ANC at Mwananyamala regional referral hospital during the time of study.

3.5 Sample size determination

The calculated sample size done by using Fisher's formula

$$N=Z^2 P (1-P)/E^2$$

While:

N – Minimum sample size

Z- Z-score (1.96)

P = 0.57

E = 0.05

N = 300

Where N is the expected minimum sample size, P is the proportion of anemia during pregnancy, 37% TDHS, 2023); Z is the confidence level at 99 percent (standard value is 1.96); and E is the accuracy at 95% CI = 0.05. For this study, a minimum sample size of 300 pregnant women was needed. Currently 330 participants were recruited after adding 10% non-respondent.

3.5.1 Sampling techniques

The study participants were selected by systemic sampling approach specifically, every third pregnant woman came to the clinic was selected during clinic days until a desired sample size was reached. A total of 300 participants were recruited in eight weeks: 40 or more participants per week and 8 or more per day.

3.6 Inclusion and exclusion criteria

3.6.1 Inclusion criteria

All pregnant women attended ANC at Mwananyamala Hospital in Dar es Salaam regardless their gestation age.

3.6.2 Exclusion criteria:

1. Pregnant women who have received treatment for a Helicobacter pylori infection within the recent two months, or who have a history of bleeding during their current pregnancy, or both
2. The study will not include pregnant women who are extremely ill or who have a history of heart disease, renal disease, liver disease, sickle cell disease, cancer, HIV AIDS, cancer, hemorrhagic condition.

3.7 Study variables

3.7.1 Dependent variables

Anaemia

3.7.2 Independent variables

Infection with Helicobacter pylori, blood smear for malaria parasites, intestinal parasite analysis from stool samples, nutritional status, Parity, gravidity, age, gestation age, iron supplementation, residence, level of education, occupation, Washing hands before meal and after visiting toilet and Source of drinking water.

3.8 Data collection tools

Objective no 1. Questionnaire.

Objective no 2. MUAC tape for assessing nutritional status, light microscopy for specimen examination, microscope slide for malaria parasites and wet smear for stool analysis.

Objective no 3. Hematology analyzer machine for FBP (hemoglobin level estimation) and HP Antigen test kit.

Objective no 4. Hematology analyzer machine for RBC morphology detection.

3.9 Pre testing and Research assistants training

Two midwives and two laboratory technicians who are hospital staff were the study data collectors. The training covered the purpose of the study, data collection methods, and data collection tools during the course of one day.

3.9.1 Data collection procedure

ANC clinic employees who have received training, collected sociodemographic data, information on water sources, nutritional status, and obstetric history through questionnaires. In order to evaluate each participating pregnant woman's level of malnutrition, the midwives additionally measured the MUAC. They tied the MUAC tape around their arm in the middle while keeping their arms loose and dropping next to their bodies. As the image below illustrates, there shouldn't be any space between the skin and the tape, but you also shouldn't wrap the tape.

Diagram 2: Source: UNICEF- Maternal MUAC: measuring mid-upper arm circumference, 2024

3.9.2 Blood and stool sample Collection and Processing

Trained laboratory technicians collected blood and stool specimens. Blood samples for malaria parasites and FBP (Hemoglobin level, RBC morphology), stool routine testing for ova, trophozoites, and/or adult worms also for Helicobacter pylori antigen status.

Stool samples

(i) Stool analysis

Using a wooden stick, a tiny amount of feces samples was removed from the collection container and combined with saline on the microscope slide to create a wet smear. Within 30 minutes, the material was examined as soon as possible under microscope. After examining helminthes ova with 10x objectives and cysts and trophozoites with 40x objectives, a report was made and documented for the presence of ova, trophozoites, and/or adult worms

(ii) Helicobacter pylori antigen test

Procedure by using H. pylori antigen kit contents (1 test cassette, 1 collection stick, and a dropper containing the diluent). The empty tube was opened to remove the stool collector. The collected stool sample was taken from the stool container with a faecal specimen collection stick. Then the stool collection stick with the sample was taken back into the tube and Squeeze the tube wall repeatedly to extract the sample. The extracted sample was held for a minute, then the cap of the extraction tube was opened so as to put 4-5 drops in the S space of the test cassette. Then waited for 15 minutes for the results.

Single (control) line = Negative H. pylori antigens have not been detected in the sample.

Double (test + control) line = Positive Helicobacter pylori antigens have been detected in the sample as procedure no 8 picture below demonstrates

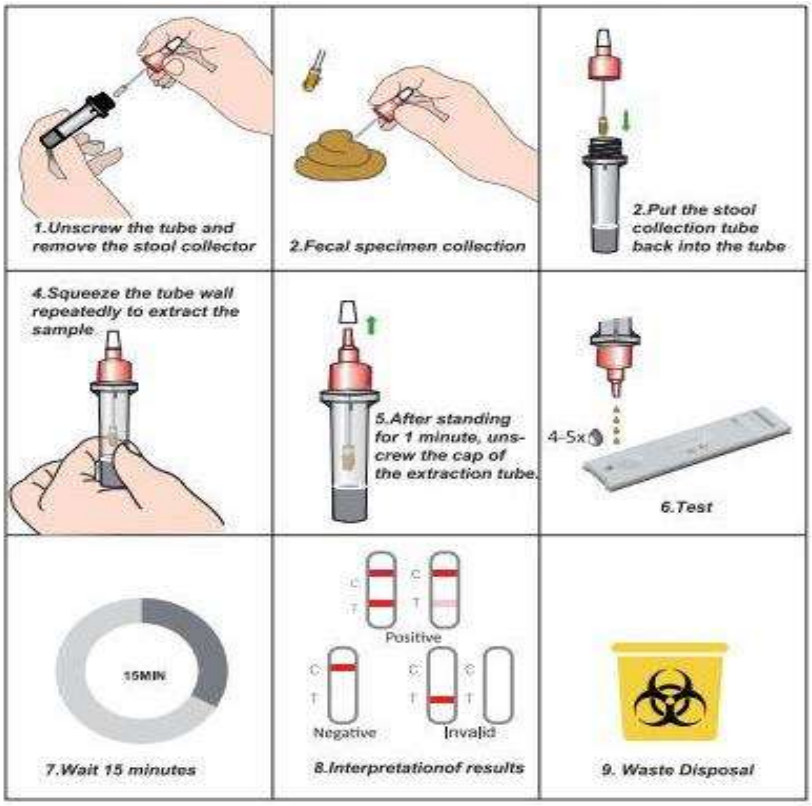


Diagram 3: Source: Shenzhen, operation procedure diagram - 2023

(b) Blood samples.

In order to get blood samples, the phlebotomy site was cleaned with a 70% alcohol swab. A volume of about 4 milliliters was extracted from the blood vein, and to prevent the formation of tiny clots, the venous blood sample was shacked within the test tube 6 up to 8 times right away.

(i) Full blood picture (FBP)

Procedure Steps

- The hematology analyzer machine was started by turning on the power switch, launching its software,
- The correct username and password was entered.
- The system was initialized operations,

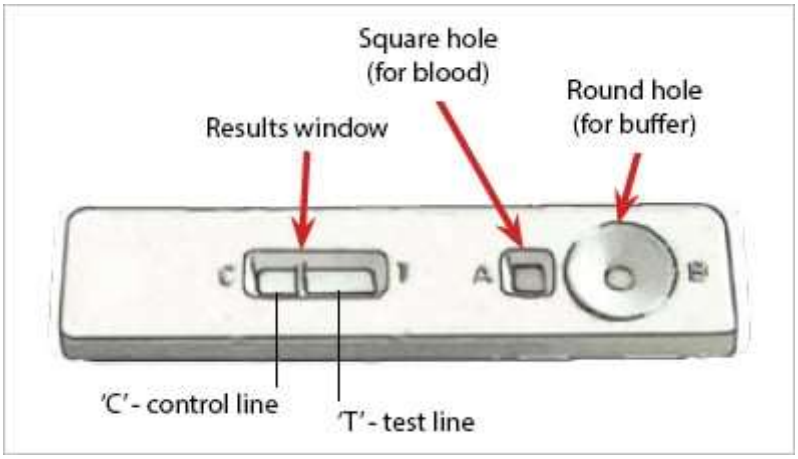
- Sample Analysis, mode, and sample ID were selected.
- The pre-mixed sample was presented on a probe, and aspirated.
- Results were displayed on the screen, with an arrow indicating high or low results.
- The hb level results were reported through a print out from the equipment including the morphology of RBCs.

Procedure for MRDT in diagnosis of malaria parasites

- New gloves were put on for each patient.
- The expiry date was checked on the test packet.
- The packet was opened and remove:
- The patient's name was written on the test.
- The 4th finger on the patient's left hand was grasped. Cleaned the finger with the alcohol swab and allowed the finger to dry before pricking.
- The lancet was opened. Patient's finger was pricked to get a drop of blood. The tip of the lancet was not allowed to touch anything before pricking the patient's finger.
- The capillary tube was used to collect the drop of blood.
- The capillary tube was used to put the drop of blood into the square hole marked "A." Buffer Test packet
- 15 minutes were waited after adding buffer.
- Test results were read.

  (**NOTE:** reading the test sooner than 15 minutes after adding the buffer. You may get FALSE results.)
- A line near letter "C" and a line near letter "T" means the patient was positive for malaria.

How to read the test results:

- POSITIVE A line near letter "C" and no line near letter "T" means the patient has not have malaria.
- NEGATIVE INVALID RESULT No line near letter "C" and one or no line near letter "T" means the test was INVALID.
- Disposing of the gloves, alcohol swab, desiccant sachet and packaging in a non-sharps waste container was done.
- The test results were recorded. Cassette was desposed in non-sharps waste container.
- 

3.9.3 Data quality management

Validated questionnaires were used to guarantee data quality, prior to data collection, training was conducted, and the primary investigator strictly supervised data collection. Total of 10 percent of the sample size was done as pretest, and questionnaires were translated into Swahili and then back into English. The lead investigator reviewed the data every day to ensure that it was accurate, consistent, and comprehensive. If necessary, corrective action was then done.

3.9.4 Data analysis and interpretation

After being verified as complete, the data collected were coded and imported into SPSS version 20 for analysis. Additionally, preliminary data investigation was carried out, which involved compiling the data and doing visual analyses. Categorical data represented by absolute numbers and frequencies wherever were appropriate, the median and interquartile range were used to summarize continuous data. Following the necessary validation of model assumptions, for the exploration of the relationship between the dependent and independent variables, bivariate multivariable logistic regression was employed. P-values less than 0.05 will be considered as statistically significant in all circumstances.

3.10 Ethical consideration

The study was conducted by following ethical guidelines and approved by the institutional review board or ethics committee at Kairuki University. The MRRH management provided a letter of cooperation to the investigator, written informed consent was obtained from all participants, outlining the purpose of the study, procedures, potential risks, and benefits. All participant data were anonymized and stored securely to ensure confidentiality. Personal identifiers were removed from the data set prior to analysis.

The patients with intestinal parasite infections and anemia were referred to appropriate healthcare providers for appropriate intervention in accordance with national treatment guidelines. Patients who withdrew from the study had the right to get the same care without facing any discrimination. The participants with complications following sample collection were treated accordingly by giving medication like painkillers, and bleeding was arrested by gauze and plaster application.

3.11 Dissemination plan of results

One copy of the thesis report will be given to the Kairuki University library for reference, and another copy will be turned into the director of the Postgraduate Studies and Research Institute. At least two Manuscripts will be prepared and submitted for publication in scientific Journals.

CHAPTER FOUR

RESULTS

Table 1: The social demographic characteristic of the study participants (N=300)

Characteristics	Categories	Frequent (n)	Percent (%)
Age (yrs.)	18-23	82	27.3
	24-29	155	51.6
	30-35	53	17.7
	36-41	8	2.7
	Above 41	2	0.7
Marital status	Single	17	5.7
	Married	280	93.3
	Divorced	3	1.0
Education status	Illiterate	3	1.0
	Primary	19	6.3
	Secondary	257	85.7
	Higher education	21	7.0
Occupation status	Employed	33	11
	Self employed	169	56.3
	House wife	98	32.7
Hand wash before meal/after toilet	Yes	299	99.7
	No	1	3
Drinking water	Boiled	8	2.7
	unboiled	274	91.3
	Shop	18	6.0.

4.1: The social demographic characteristic of the study participants

The study recruited a minimum of 330 pregnant women, whose ages ranged from 18 to 43 years old, with a mean age of 26.9 ± 6.3 (SD). The ages of 155 (51.6%) of the pregnant women ranged from 24 to 29. Of the study participants, 280 (93.3%) were married, whereas 3 (1.0%) were divorced.

(Table 2) Obstetrics history, Nutritional status, and laboratory results of the study participants (N=300)

Variables	**Categories**	**Frequencies**	**Percent**
Gravidity	Prime gravida Multigravida	18 282	6.0 94.0
Gestation age	1st trimester 2nd trimester 3rd trimester	33 123 144	11 41 48
Abortion	No Yes	287 13	95.7 4.3
Inter pregnant gap for multipara	Less than < 2yrs More than 2yrs	48 252	16 84
History of hyperemesis gravidarum at the 1st trimester	Yes No	32 276	10.7 89.3
Iron pills taking during pregnant	Yes No	279 21	93.0 7.0
(MUAC) 1ST Trimester(Less than 25.75-28.10cm) 2nd trimester (Less than 25.75-28.70cm) 3dr trimester (Less than 25.75-29.45cm)	yes yes yes	10 26 9	3.3 5.3 3.1
Normal MUAC according to GA (no malnutrition)	No	265	88.3
Intestinal parasites	Yes No	2 298	7.0 99.3
Malaria parasites(MRDT)	Yes No	0 300	0 100
HP infection	Yes No	70 230	23.3 76.7
Anaemia according to trimester	1st trimester 2nd trimester 3rd trimester	19 95 128	6.3 31.6 42.7

4.2: Obstetrics history, nutritional characteristics, malaria parasites and intestinal parasite status of the study participants

The obstetric history of the participants, Multigravida were 282 (94.0%) and prime gravida were 18(6.0%). The majority252 (84%) of the Pregnant women had an interpregnant gap longer than two years, their gestation age, 144 (48%) were in their third trimester, followed by the 2nd trimester 123 (41.0%) and 1st trimester 33 (11.0%); only 10.7% experience hyperemesis gravidarum throughout their current pregnancy and 279 (93%) of the study participants took iron supplements. MUAC was used to determine the nutritional status of all 300 respondents; 35 (11.7%) of them had MUAC readings that were less than 21 cm. There were 242 (80.7%) pregnant women with anemia, 19(6.3%) in 1st trimester, 95(31.6%) in 2nd trimester and 128(42.7%) in 3rd trimester. There were also 70 (23.3%) pregnant women with H.P. infection.

Table 3: Pregnant women with H. pylori Infection in association with Anaemia (N=242)

Variables		**HP infection**		**(X2) p-value**
		Yes	No	
Anaemia	Anaemic (%)	60(24.8%)	182(75.2%)	4.2(0.04)
	Normal (%)	10(17.2%)	48(82.8%)	
Total (%)		**70(100%)**	**242(100%)**	

NOTE; Chi square 4.2 and p-value 0.04

4.3: The effects of HP Infection on anaemia in pregnant women

Anaemia was more common in pregnant H. pylori-positive patients (60)24.8% than in H. pylori-negative patient counterparts (10)17.2%). Table 3 shows that there was a statistically significant difference in the prevalence of anemia between pregnant women with HP infection and H. pylori patients, with a chi-squared value of 4.2 and a p-value of 0.04.

4.4: The morphological classification of anaemia among pregnant women with H. pylori infection

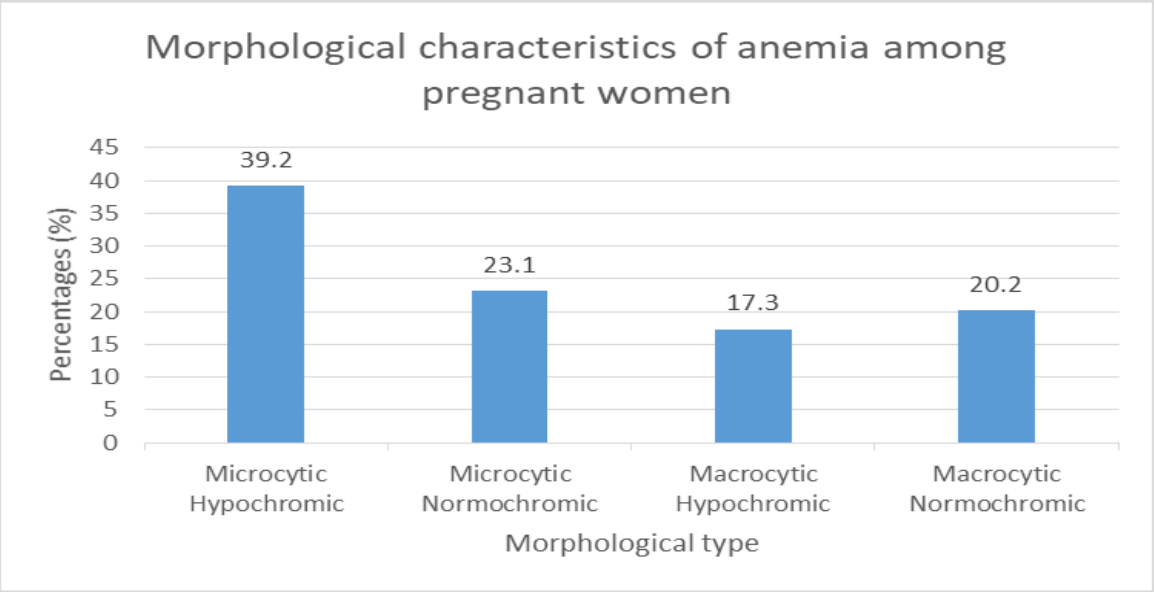


Figure 1: Morphological characteristics of anemia among pregnant women

The most morphological type of anaemic HP-infected pregnant women was microcytic hypochromic anaemia 95(39.2%), followed by Microcytic normochromic anaemia 56(23.1%).

Table 4: Multivariate analysis of anaemia and other heath related factors among Study participant-Logistic regression

Variable	Crude O.R	Analysis 95% C.I	P-value	Adjusted A.O.R.	Analysis 95% C.I.	P-value
Constant	1.00	0.68 – 1.00	0.05	29.9	-	0.163
Age	0.05	0.99-1.13	0.12	0.1	0.94-1.1	0.815
Level of education	4.1	2.9-4.8	0.000	3.24	1.58-6.63	0.001
Occupation	1.98	1.28 – 3.09	0.002	1.9	0.99 – 3.77	0.05
Gestational age (3rd trimester)	2.47	1.66 – 3.1	0.001	1.97	1.01 – 2.2	0.04
Abortion status	1.2	0.14 -2.57	0.71	1.04	0.74 – 2.11	0.95
Inter pregnant gap in Multipara	1.5	0.18 – 13.3	0.699	22.8	1.8 – 287.5	0.02
Hyperemesis Gravidarum in 1st trimester	3.56	1.99 – 6.38	0.000	6.42	2.97 – 13.91	0.000
Iron supplementation	0.58	0.2 – 4.4	0.266	0.62	0.43 – 3.01	0.45
MUAC	4.8	0.6 – 37.1	0.132	3.93	0.35 – 44.0	0.27
HP infection	2.144	1.123-4.332	1.34	2.40	1.354-3.674	0.006

NB: 1 reference, CI=confidence interval, p-value < 0.05; statistically significant at 95% CI, adjusted odds ratio (AOR)

4.5 The association of anaemia in pregnant with other health related factors

Multivariate logistic regression analysis revealed that anaemia was independently correlated with HP infection, gestational age, occupation, level of education, and hyperemesis gravidurum are independently associated with anaemia. Pregnant women with HP infection had a 2.4-fold (AOR = 2.4, 95% CI = 1.354-3.674) more likely to develop anaemia than individuals with no infection. Individuals with hyperemesis gravidarum reported 6.4 times (AOR = 6.42, 95% CL = 2.97–13.91) more likely to developing anaemia compare with no history of hyperemesis, being pregnant in the third trimester is 1.97 times (AOR = 1.97, 95% CL = 1.01–2.2) more likely develop anaemia compare to the 1st trimester. Having a low education level is strongly 3.24 times (AOR = 3.24, 95% CL = 1.58–6.63) more likely to develop anaemia compared to a high level of education, and having no occupation is 1.9 times (AOR = 1.9, 95% CL = 0.99–3.77) more likely to develop anaemia compared to one with an occupation.

CHAPTER FIVE

DISCUSSION

This study demonstrates the notable effects of H. pylori infection on the increased prevalence and severity of anaemia among pregnant women. Anaemia was more common in pregnant H. pylori-positive patients (60) (24.8%) than in H. pylori-negative patient counterparts (10) (17.2%) (Table 3). and there were statistically significant effects on anaemia between pregnant women with HP infection with a chi-squared value of 4.2 and a p-value of 0.04. (Table 3)

By using bivariate multivariate analysis, the study also revealed that those who were infected with H. pylori were 2.4 times (AOR = 2.40, 95% CI = 1.354–3.674) more likely to be anemic than the H. pylori-negative group. (Table 4); this study is supported by the study done by Elsayed and a colleague in Egypt. (33)by Parish in Iran (25) and by Malik in India(15), observed an association of H. pylori infection with anemia. Also according to Wang L, Li Z, Tay CY, Marshall BJ, Gu B, Tian Y, et al , those with H. pylori infection had a 2.53-fold increased risk of anaemia compared to those without the infection (34).other a similar study conducted in Butajira by Shak J among dyspeptic non pregnant patients also found a significant association between anemia and HP infection(35).

However, the study conducted in Butajira among children by Taye B and colleague (36) and in Sudan by Mubarak N,(37) among pregnant women failed to find an association between anemia and HP infection

There are other health-related factors associated with HP infection. This study revealed that occupation status and education level have a significant association with HP infection (AOR = 1.9, 95% CL = 0.99–3.72) and (AOR = 3.24, 95% CL = 1.58–0.63) respectively. The participants with low levels of education were also 3.24 times more likely to be antigen-positive for the H. pylori test compared to those with higher education, and housewives were nearly

twice as likely to have a positive antigen test on the HP infection test as those with occupations. This study report is in the same vein as Zhang et al, who reported that those with a high level of education mostly have a good standard of living and a lower infection rate of H. pylori. But this report does not correspond to the cohort study by H. Jaka, which shows that participants with high education levels also had more H. pylori infection than low-educated participants (39).

Anemia was almost twice as common in third-trimester pregnant women as it was in first-trimester pregnant women. Similarly, a study carried out in Ethiopia's Boditi, Harerge, and Gode discovered a strong correlation between anemia and gestational age in the third trimester with a significant association with HP infection. Dissimilarity to the study conducted in Aymba HC, Amhara region, and Asosa Zone did not reveal an association between anaemia and third-trimester pregnancy (5,27,38)

According to a 2021 meta-analysis conducted in Egypt by Eman Mohammed and colleagues, there is a correlation between exposure to H.P. and a higher risk of HG. The H. pylori infection rate was higher in HG cases (1289/1851) than in non-HG patients (1045/2262), according to the meta-analysis, which included 1851 HG patients, 1289 of whom had developed H.P. infections. This finding was adjusted for confounding characteristics (P-value < 0.001). (11). Another study conducted in Egypt by Elsayed reported a strong association between H.P. infection and HG in pregnant women who were already experiencing hyperemesis. The results are the same as the result of this study, which reported that hyperemesis gravidurum has a significant association with HP infection (AOR= (33)1.97, 95% CL= 2.97–13.91 (33)

According to a study from Al Hussein University Hospitals on the infection and hyperemesis gravidarum occurrence in Egypt, there was no relationship between H. pylori positive and the

duration or timing of hyperemesis gravidarum symptoms (39). The result is not the same from this study, where the hyperemesis gravidarum has revealed a strong correlation between anaemia and gestational age.

In this study, the main dominant morphological type of anaemic HP-infected pregnant women was Microcytic hypochromic anemia 95(39.2%) followed by Microcytic normochromic anaemia 56(23.1), this is in the same vessel from the study done by Asiimwe and colleague in Uganda(40) and by Mohamed in Pakistan(39). This is not corresponding to a study done in Ethiopia by Abey(27), and by Haile.K in Ethiopia both reported Normocytic normochromic anaemia as the major morphological type of anaemia among H. pylori patients(30).

Limitation

- The stool antigen test was the sole approach employed in this investigation to diagnose HP infection. Detecting H. pylori infection is more likely when several diagnostic techniques are used.
- The study was a hospital-based cross-sectional study design, which might not accurately reflect the prevalence of H. pylori in pregnant women throughout the community**.**

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

This study revealed that HP infection significantly has effects on anaemia among pregnant women; level of education, occupation, gestation age, and hyperemesis gravidarum were the independent variables associated with anaemia. The dominant morphological types of anaemic HP-infected pregnant women were microcytic hypochromic anaemia, followed by Microcytic normochromic anaemia.

6.2 RECOMMENDATION

1. Encourage and support further research to confirm the causal relationship between H. pylori infection and anemia in pregnant women.
2. Conduct clinical trials to evaluate the efficacy of different treatment strategies for managing H. pylori infection and associated anemia in pregnancy.
3. Advocate for the development of healthcare policies that include H. pylori screening and management as part of standard prenatal care practices, especially in regions with high prevalence rates of H. pylori infection.

REFERENCES

1. Domenica Cappellini M, Motta I. Anemia in Clinical Practice-Definition and Classification: Does Hemoglobin Change With Aging? Semin Hematol [Internet]. 2015;52(4):261–9. Available from: http://dx.doi.org/10.1053/j.seminhematol.2015.07.006
2. Abdilahi MM, Kiruja J, Farah BO, Abdirahman FM, Mohamed AI, Mohamed J, et al. Prevalence of anemia and associated factors among pregnant women at Hargeisa Group Hospital, Somaliland. BMC Pregnancy Childbirth. 2024;24(1).
3. Davidson EM, Scoullar MJL, Peach E, Morgan CJ, Melepia P, Opi DH, et al. Quantifying differences in iron deficiency-attributable anemia during pregnancy and postpartum. Cell Reports Med [Internet]. 2023;4(7):101097. Available from: https://doi.org/10.1016/j.xcrm.2023.101097
4. Sah SK, Sunuwar DR, Baral JR, Singh DR, Chaudhary NK, Gurung G. Maternal hemoglobin and risk of low birth weight: A hospital-based cross-sectional study in Nepal. Heliyon [Internet]. 2022;8(12):e12174. Available from: https://doi.org/10.1016/j.heliyon.2022.e12174
5. Bekele, Alemayehu; Tilahun, Marelign; Mekuria A. Prevalence of anemia and its associated factors among pregnant women attending antenatal care in health institutions of Arba Minch Town, Gamo Gofa Zone, Ethiopia: a cross-sectional study. Anemia. 2016;1–9.
6. Alene, Kefyalew; Dohe A. Prevalence of anemia and associated factors among pregnant women in an urban area of Eastern Ethiopia. Anemia. 2014;1–7.
7. Azami M, Nasirkandy MP, Mansouri A, Darvishi Z, Rahmati S, Abangah G, et al. Global prevalence of Helicobacter pylori infection in pregnant women: A systematic review

and meta-analysis study. Int J Women's Heal Reprod Sci [Internet]. 2017;5(1):30–6. Available from: http://dx.doi.org/10.15296/ijwhr.2017.06

8. Gedefaw, Lealem; Ayele, Asrat; Asres, Yaregal; Mossie A. Anemia and associated factors among pregnant women attending antenatal care clinic in Wolayita Sodo town, Southern Ethiopia. Ethiop J Heal Sci [Internet]. 2015;25(2):155–62. Available from: ncbi.nlm.nih.gov/pmc/articles/PMC4478267/pdf/EJHS2502-0155.pdf

9. Abdella, Bahredin; Ibrahim, Mohammed; Tadesse, Hassen, Kalkidan and Tesfa M. Association between Helicobacter pylori infection and occurence of anemia among pregnant women attending antenatal care in Kulito Health Centre, Halaba Zone, South Ethiopia, 2018. Anemia [Internet]. 2020;1–10. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7396113/pdf/ANEMIA2020-6574358.pdf

10. Abd Elmottaleb mohamed, Zakaria AM, Saeed A, Abdel Moneim M. The Association Between Helicobacter Pylori Seropositivity And Risk Of Hyperemesis Gravidarum During Pregnancy. Al-Azhar Int Med J. 2022;0(0):0–0.

11. Mohamed eman, ElMallah samira, Mohammed D. The Association between helicobacter pylori infection and hyperemesis gravidarum. Al-Azhar Int Med J. 2021;0(0):0–0.

12. Yalçın EE, Doğaner YÇ, Aydoğan Ü, Karaşahin KE, Demirköse H. INVESTIGATION of ANEMIA and RELATED FACTORS in PREGNANCY A CROSS-SECTİONAL STUDY from TURKEY. 2024;2020(1):733559. Available from: https://doi.org/10.22541/au.170667452.23467210/v1

13. Sharma, Deepak; Shastri, Sweta; Sharma P. Intrauterine Growth Restriction: Antenatal and postnatal aspects. Pediatrics [Internet]. 2016;10:67–83. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4946587/pdf/cmped-10-2016-067.pdf

14. Bwana, Veneranda; Rumisha, Susan; Mremi, Irene; Lyimo, Emanuel and Mboera L. Patterns and causes of hospital maternal mortality in Tanzania: A 10-year retrospective analysis. PLoS One [Internet]. 2019;14(4). Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0214807

15. Malik, Ria; Guleria, Kiran; Kaur, Iqbal; Sikka, Meera and Radhakrishnan G. Effect of Helicobacter pylori eradication therapy in inron deficiency anemia of pregnancy - A pilot study. Indian J Med Res [Internet]. 2011;134:224–31. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3181024/pdf/IJMR-134-224.pdf

16. Msuya SE, Hussein TH, Uriyo J, Sam NE, Stray-Pedersen B. Anaemia among pregnant women in northern Tanzania: Prevalence, risk factors and effect on perinatal outcomes. Tanzan J Health Res. 2011;13(1):40–9.

17. Bansal R, Bedi M, Kaur J, Kaur K, Shergill HK, Khaira HK, et al. Prevalence and factors associated with anemia among pregnant women attending antenatal clinic. Adesh Univ J Med Sci Res. 2020;2(1):42–8.

18. Araujo Costa E, de Paula Ayres-Silva J. Global profile of anemia during pregnancy versus country income overview: 19 years estimative (2000–2019). Ann Hematol [Internet]. 2023;102(8):2025–31. Available from: https://doi.org/10.1007/s00277-023-05279-2

19. ICF M of H (MOH) T mainland; M of H (MOH) ZNB of S (NBS); O of the CGS (OGCS) and. Tanzania Demographic and Malaria Indicator Survey [Internet]. Dar es Salaam; 2022. Available from: https://dhsprogram.com/pubs/pdf/PR144/PPR144.pdf

20. Zamani, M; Ebrahimtabar, F; Zamani, V; Miller, W; Alizadeh-Navaei, R; Shokri-Shirvani, J; Derakhshan M. Systematic review with meta-analysis: the worldwide prevalence of Helicobacter pylori infection. Aliment Pharmacol Ther [Internet]. 2018;47(7):868–76. Available from: https://onlinelibrary.wiley.com/doi/10.1111/apt.14561

21. Smith SI, Ajayi A, Jolaiya T, Onyekwere C, Setshedi M, Schulz C, et al. Helicobacter pylori Infection in Africa: Update of the Current Situation and Challenges. Dig Dis. 2022;40(4):535–44.

22. Abozaid LM. Prevalence and risk factors of helicobacter pylori infection in asymptomatic sudanese population: A cross-sectional study. Epidemiol Biostat Public Heal. 2020;17(2):1–6.

23. Alshareef, Shimos; Rayis, Duria; Adam, Ishag and Gasim G. Helicobacter pylori infection, gestational diabetes mellitus and insulin resistance among pregnant Sudanese women. BMC Res Notes [Internet]. 2018;11:517. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6064092/pdf/13104_2018_Article_3642.pdf

24. Ali M, Mugheri K, Shaikh A, Bhatti AT, Magsi S, Shaikh S. FETO/Maternal Complications in Iron Deficiency Anemia during Pregnancy and Labor. J Heal Rehabil Res. 2024;4(1):1204–8.

25. Parashi, Shayesteh; Bahasadri, Shohreh; Alirezaei M. Assessing the association between iron deficiency anaemia and H.pylori infection among pregnant women referring to a busy antenatal clinic in Tehran, Iran. Shiraz E Med J. 2013;14(3):153–61.

26. Zahmatkeshan M, Karimi M, Geramizadeh B, Eslaminasab S, Esmailnejad A, Safarpour AR. Association between Helicobacter pylori Infection and Iron Deficiency Anemia in School-aged Iranian Children. Indian Pediatr. 2019;56(5):387–9.

27. Abay A, Yalew HW, Tariku A, Gebeye E. Determinants of prenatal anemia in Ethiopia. Arch Public Heal. 2017;75(1):1–10.

28. Bekele A, Tilahun M, Mekuria A. Prevalence of Anemia and Its Associated Factors among Pregnant Women Attending Antenatal Care in Health Institutions of Arba Minch Town, Gamo Gofa Zone, Ethiopia: A Cross-Sectional Study. Anemia. 2016;2016.

29. Sunguya, Bruno; Ge, Yue; Mlunde, Linda; Mpembeni R. High burden of anemia among pregnant women in Tanzania: a call to action. Nutr J [Internet]. 2021;20:65. Available from: https://nutritionj.biomedcentral.com/articles/10.1186/s12937-021-00726-0

30. Haile K, Timerga A. Evaluation of hematological parameters of Helicobacter pylori-infected adult patients at Southern Ethiopia: A comparative cross-sectional study. J Blood Med. 2021;12:77–84.

31. Eyoum Bille BB, Kouitcheu Mabeku LB. Relationship between active Helicobacter pylori infection and anemia, iron deficiency, iron deficiency anemia: A cross-sectional study in a sub-Saharan setting. JGH Open. 2022;6(8):554–68.

32. Development F, Adaptation M. Maternal physiological changes in pregnancy - Wikipedia. 2024;1–26. Available from: https://en.wikipedia.org/wiki/Maternal_physiological_changes_in_pregnancy

33. Elsayed YAE, Ali AE, Elsalam WAA, El-Masry MMO. The Association between Helicobacter Pylori Infection and Hyperemesis Gravidarum. Egypt J Hosp Med. 2022;86(1):561–5.

34. Wang L, Li Z, Tay CY, Marshall BJ, Gu B, Tian Y, et al. Multicentre, cross-sectional surveillance of Helicobacter pylori prevalence and antibiotic resistance to clarithromycin and levofloxacin in urban China using the string test coupled with quantitative PCR. The Lancet Microbe. 2024;5(6):e512–3.

35. Shak JR, Sodikoff JB, Speckman RA, Rollin FG, Chery MP, Cole CR, et al. Anemia and Helicobacter pylori seroreactivity in a Rural Haitian population. Am J Trop Med Hyg. 2011;85(5):913–8.

36. Taye B, Enquselassie F, Tsegaye A, Amberbir A, Medhin G, Fogarty A, et al. Effect of early and current Helicobacter pylori infection on the risk of anaemia in 6.5-year-old Ethiopian children. BMC Infect Dis [Internet]. 2015;15(1):1–12. Available from: http://dx.doi.org/10.1186/s12879-015-1012-y

37. Mubarak N, Gasim GI, Khalafalla KE, Ali NI, Adam I. Helicobacter pylori, anemia, iron deficiency and thrombocytopenia among pregnant women at Khartoum, Sudan. Trans R Soc Trop Med Hyg. 2014;108(6):380–4.

38. Konje ET, Ngaila BV, Kihunrwa A, Mugassa S, Basinda N, Dewey D. High Prevalence of Anemia and Poor Compliance with Preventive Strategies among Pregnant Women in Mwanza City ,. Nutrients [Internet]. 2022;14:e3850. Available from: https://doi.org/10.3390/nu14183850

39. Abd Elmottaleb mohamed, Zakaria AM, Saeed A, Abdel Moneim M. The Association Between Helicobacter Pylori Seropositivity And Risk Of Hyperemesis Gravidarum During Pregnancy. Al-Azhar Int Med J. 2022;0(0):0–0.

40. Asiimwe D, Bangi I, Esanyu J, Ojok D, Okot B, Olong C, et al. Association Between Helicobacter pylori Infection and Anemia Among Adult Dyspeptic Patients Attending Kiryandongo General Hospital , Uganda. 2023;(January):57–66.

APPENDICES

Appendix 1: Informed consent form

As a data collector, I……., the aim of this study is to assess the association between anemia and helicobacter pylori in pregnant women attending ANC at Dar es Salaam regional referral Hospitals. I will ask questions about socio-demographic, hygienic practice, obstetric history, nutritional status, and collect blood and stool samples to determine hemoglobin concentration, helicobacter status, and intestinal parasite infestation.

Date of interview----------

Interviewer name---------- Signature----------

Appendix 2: Questionnaire (English versions available)

Name of Facility: _____year:____ _____, the participant code…… If the response to the question below is different, the data collector should note it in the designated place and check it in the table.

A. Socio-demographic information of study participant

1. 1 Age _____yrs.

1. 2 Resident ……

1. 3 Marital status (tick one)

☐ Single

☐ Married

☐ Divorced

☐ Widowed

Others specify_____

1.4 Level of education (tick one)

☐ Illiterate

☐ Primary education

☐ Secondary

☐ Diploma

☐ Higher

1. 5 Occupational status (tick one)

☐ Employed

☐ Self-employed

☐ House wife

☐ Others

B. Some hygienic Applications habits

2. 1 washing hands before and after meals? (Tick one)

☐ Yes

☐ No

2. 2 washing hands after visiting the toilet? (Tick one)

☐ Yes

☐ No

2. 3 Source of drinking water (tick one)

☐ Boiled

☐ Unboiled

☐ Bottled water from the shop

☐

Others specify _____

C. Obstetrics History

3. 1 Gravidity?) …….

3. 2 Parity?…….

3. 3 Abortion?…….

3. 3 Gestational age in week._____ weeks

3. 4 Inter pregnancy gap in months (tick one)

☐ Less than 2 years

☐ 2 years

☐ More than 2 years

3. 5 History of Hyperemesis gravidarum during this pregnancy (Tick one)

☐ Yes

☐ No

D. Nutritional status Chart review

4. 1 Iron supplementation (tick one)

☐ Yes

☐ No

For official use only

4. 2 MUAC in cm 1._____cm (tick one)

☐ MUAC less than 21(underweight)

☐ MUAC 21-26.9cm (normal)

☐ MUAC 27-29.9cm (overweight)

☐ MUAC 30cm and above (obese)

(b) Lab results

5.1 Hemoglobin (HB) g/dl 1. Hb_____ (tick one)

☐ 9-10.9gm/dl (mild anemia)

☐ 7-8.9 gm. /dl (moderate anemia)

☐ Less than 7gm/dl (severe anemia)

5.2 Stool for H. Pylori test (tick one)

☐ Reactive

☐ Non-reactive

5.3 Stool results for intestinal parasites (tick one)

☐ Yes

☐ No if yes specify

5.4 RBC morphology screening test (tick one)

☐ Positive,

☐ Negative,

If positive specify the type of morphology ……..

5.5 B/s for malaria parasites (tick one)

☐ Positive

☐ Negative

Comments_____

Name of principal Investigator _____Date_____

Appendix 3: Dodoso Ya Kiswahili

Habari! naitwa…… nakusanya taarifa kuangalia kama kuna uhusiano wowote kuhusu maambukizi ya bakteria wa vidonda vya tumbo na upungufu wa damu kwa mama wajawazito wanaohudhuria kliniki katika hospitali za mwananyamala Temeke na Amana,kwenye hii dodoso hautaandikwa jina lako na ningeomba nikuuliza baadhi ya maswali yanayohusiana na demografia ya kijamii ,usafi wa nyumbani,milo yako ya kila siku na historia yako ya mambo ya uzazi,pia tutachukua damu yako kiasi, kwa ajili ya kupima kiasi cha damu na malaria pia sampo ya choo kikubwa kwa ajili ya kupima minyoo na vidonda vya tumbo,unaweza kusitisha haya mahojiano muda wowote ukiona hauridhishwi nayo,lakini utayari wako na majibu yako ya ukweli wanaweza wawezesha wataalamu wa afya na watunga sera za afya kuelewa kama kutakuwa na uhusiano wowote na vidonda vya tumbo na upungufu wa damu kwa mama mjamzito ili kuwez kusaidia jamii kukabiliana nalo,nina Imani kwa uaminifu utashirikiana nami katika haya mahojiano

Unakubaliana name?

(A) Ndio

(B) Hapana,(kama ndio endelea kukusanya taarifa)

Tarehe ya mahojiano……..

Jina na mhoji…….. saini……..

DODOSO LA KISWAHILI

Jina la kituo……tarehe…… lebo ya mgonjwa…….

Weka lama ya tiki panapohusika

1. 1 Umri _____

1. 2 Sehemu unapoishi) …….

1. 3 Umeolewa (Tiki panapohusika

☐ cjaolewa)

☐ nimeolewa

☐ (nimefiwa na mwenza)

Mengineyo_____

1.4 Ngazi ya elimu yako) (Tiki panapohusika)

☐ sijasoma)

☐ elimu ya msingi)

☐ sekondari)

☐ astashahada)

☐ shahada ya juu)

1. 5 Shughuli yako ya kipato) (Tiki panapohusika)

☐ nimeajiriwa)

☐ nimejiajiri)

☐ Mama wa nyumbani)

☐ mengineyo) _____

B. Hali ya usafi wa nyumbani

2. 1 Hua unasafisha mikono kabla na baada ya kula? (Tiki panapohusika)

☐ ndio

☐ hapana

2. 2 Hua unasafisha mikono baada ya kutumia choo (Tiki panapohusika)

☐ ndio

☐ hapana

2. 3 Maji ya kunywa (tiki panapohusika)

☐ Yanachemshwa

☐ hayachemshwi)

☐ maji ya chupa duakani)

☐ mengineyo)_____

C. Historia ya uzazi

3. 1 Hii mimba ya ngapi? …….

3. 2 Umezaa mara nagpi?……..

3. 3 Mimba zilizoharibika ngapi?…….

3. 3 Umri wa mimba yako ya sasa._____ wiki

3. 4 Umbali wa muda wa mimba iliyopita na sasa) (tick one)

☐ Chini ya miaka 2)

☐ Miaka 2)

☐ Zaidi ya miaka 18)

3. 5 Una historia ya kutapita kupita kiasi katika mimba hii? (Tick one)

☐ ndiyo)

☐ hapana)

D. Chati ya lishe

4. 1 Umepata dawa za madini ya kuongeza damu (tick one)

☐ ndiyo

☐ Hapana

For official use only

4. 2 MUAC in cm 1._____cm (tick one)

☐ MUAC less than 21(underweight)

☐ MUAC 21-26.9cm (normal)

☐ MUAC 27-29.9cm (overweight)

☐ MUAC 30cm and above (obese)

(b) Lab results

5.1 Hemoglobin (HB) g/dl 1. Hb_____ (tick one)

☐ 9-10.9gm/dl (mild anemia)

☐ 7-8.9 gm. /dl (moderate anemia)

☐ Less than 7gm/dl (severe anemia)

5.2 Stool for H. Pylori test (tick one)

☐ Reactive

☐ Non-reactive

5.3 Stool results for intestinal parasites (tick one)

☐ Yes

☐ No if yes specify

5.4 RBC morphology screening test (tick one)

☐ Positive,

☐ Negative,

If positive specify the type of morphology ……..

5.5 B/s for malaria parasites (tick one)

☐ Positive

☐ Negative

Comments_____

Name of principal Investigator _____Date_____

_____Date_____

Appendix 4: Ethical Clearance Letter

THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF HEALTH

Telephone Address:

Telephone: 022-2760500

Mwananyamala Regional
Referral Hospital,
P.O.Box 61665
Dar es Salaam.

RE: NO: MA. 59/240/01/37

DATE: 09th May,2024

Director,
Hurbert Kairuki Memorial University,
P.O.BOX 65300,
DAR ES SALAAM.

RE: DR. FEDY ISRAEL - TO CONDUCTI HIS RESEARCH IN MWANANYAMALA REGIONAL REFERRAL HOSPITAL

The captioned subject refers

2. May you be informed that your request to research Titled "***Association Between helicobacter phlori infection and the occurrence of anemia among pregnant women attending antenatal care at Mwananyamala Regional Referral Hospital in Dar es Salaam, Tanzania***" ***Start*** **to 9th May,2024,** is asserted.

3. The Institution charges **50,000/=**, as Research fee as per student spent. The payments are to be made upon reporting.

4. May she report to the Administration and HR department head for further instruction.

Thanks.

Atugonza Kyaruzi
RESEARCH COORDINATOR
FOR: MEDICAL OFFICER INCHARGE
MWANANYAMALA REGIONAL REFERRAL HOSPITAL

MEDICAL OFFICER INCHARGE
MwanayamalaRegionalReferralHospital
P. O. Box 61665
DAR-ES-SALAAM

COPY:
Heads of Obstetrics Department -

MWANANYAMALA REGIONAL REFERRAL HOSPITA

KAIRUKI UNIVERSITY (KU)

70 Chwaku Street,
Mikocheni,
P.O BOX 65300,
Dar es Salaam,
Tanzania.

Tel: +255-22-2700021/4
Fax: +255-22-2775591
Email: irec@ku.ac.tz
Website: www.ku.ac.tz

Ref. No. KU/IREC/27.10/446 **02nd May 2024**

Dr. Fedy Israel,
Kairuki University,
P.O. Box 65300,
Dar es Salaam, Tanzania.

RE: ETHICAL CLEARANCE CERTIFICATE FOR CONDUCTING HEALTH RESEARCH.

I am pleased to inform you that the research titled: **Association Between Helicobacter Pylori Infection and the Occurrence of Anemia Among Pregnant Women Attending Antenatal Care at Mwananyamala Reginal Referral Hospital in Dar Es Salaam (Israel F., 2024)** has been granted ethical approval.

This approval is in effect for one year from the above date. Any changes in the procedures should be reported to the Institutional Research Ethics Committee. Significant changes will require the submission of a revised request for ethical approval. You will be required to submit **study progress report** every six months.

Permission to publish your findings should be sought from the National Institute for Medical Research (NIMR) before submission to a publisher and not concurrently.

CHAIR PERSON

Name: Prof. Fredrick Kaijage

Signature:

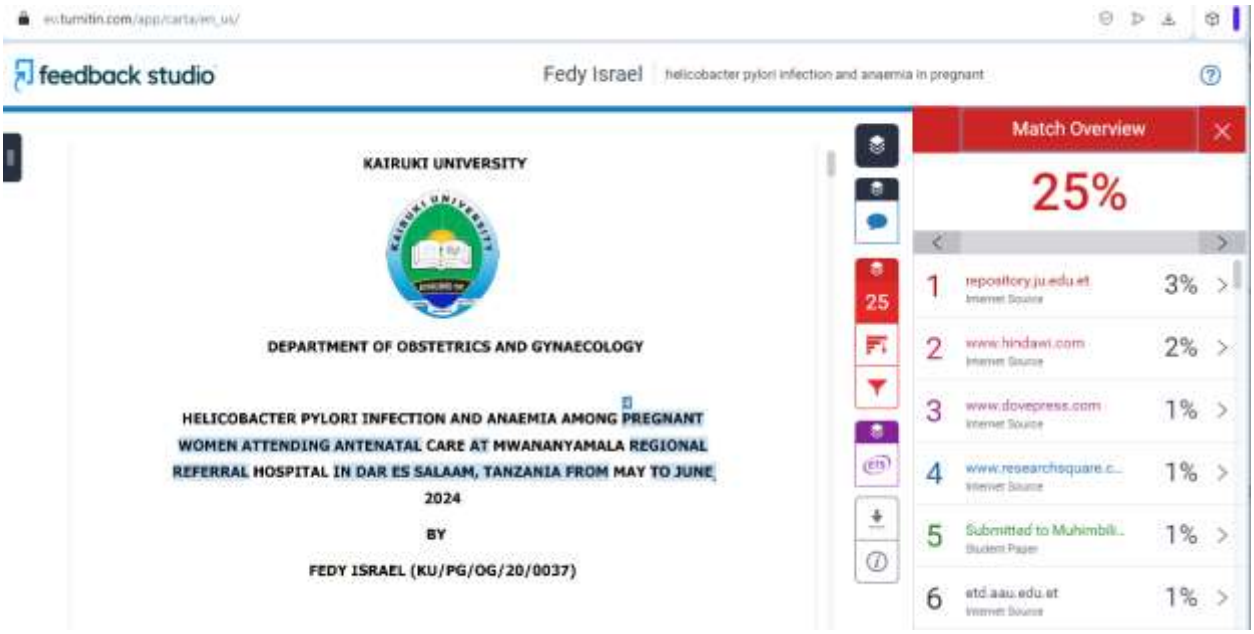
SECRETARY

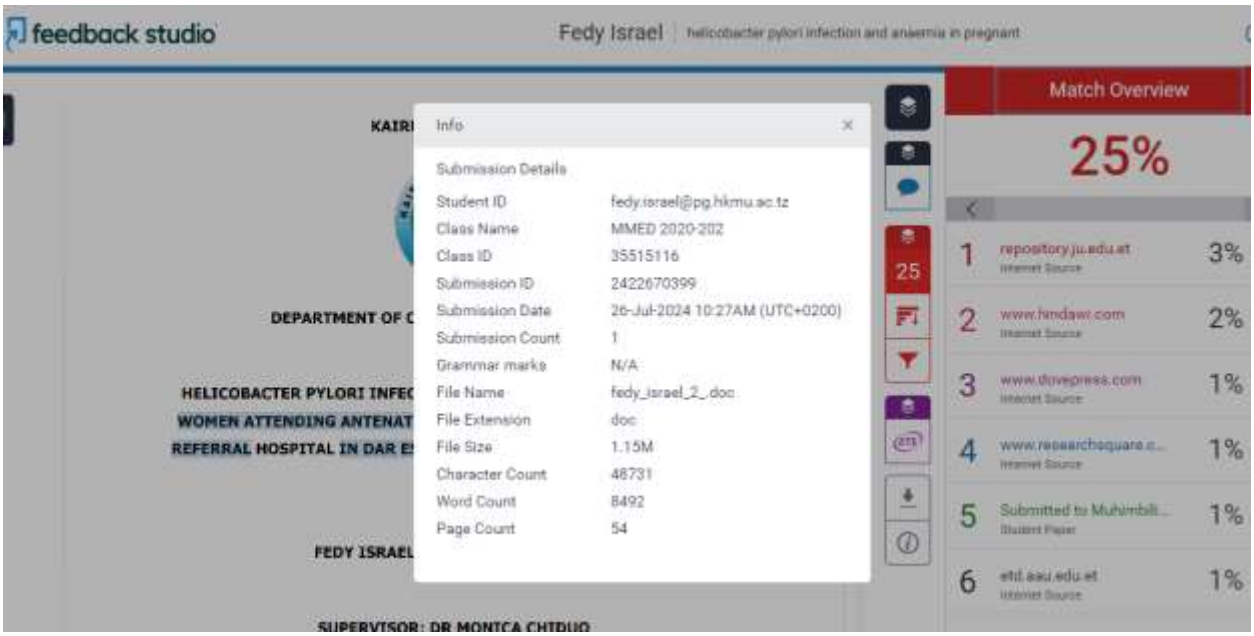
Name: Prof. Columba Mbekenga

Signature:

KAIRUKI UNIVERSITY
P. O. Box 65300
DAR ES SALAAM

Appendix 5: Plagiarism Report





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File size:	16.97M
Page count:	60
Word count:	8,882
Character count:	50,803
Submission date:	28-Aug-2024 11:37AM (UTC+0200)
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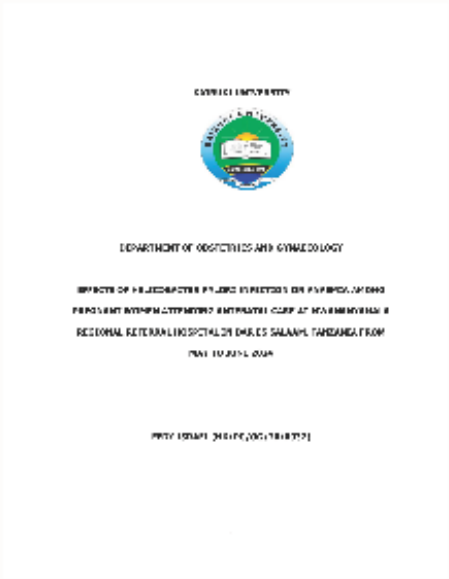

DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY