KNOWLEDGE OF PREGNANT WOMEN REGARDING EFFECTS OF ANAEMIA ON PREGNANCY OUTCOMES IN VHEMBE DISTRICT, SOUTH AFRICA

by

Rudzani Maumela

Student Number: 14010284

Dissertation Submitted in Fulfilment of the Requirements for the Degree:

Master of Nursing Science (MNurs)

Department of Advanced Nursing Science

Faculty of Health Sciences

University of Venda

Supervisor	**Co-Supervisors**
Dr T. Malwela	Prof M.S. Maputle
	Prof Berggren (Karolinska Institutet, Sweden)

November 2022

DECLARATION

I, **Rudzani Maumela**, hereby declare that the dissertation, "**Knowledge of Pregnant Women Regarding Effects of Anaemia on Pregnancy Outcomes in Vhembe District, South Africa**," submitted to the **University of Venda** for the **Master of Nursing Science (MNurs)** degree, is my own work and that all sources used have been duly acknowledged in the text and the list of references. This thesis has not been submitted previously for a degree at this or any other institution.

Name	**:**	Rudzani Maumela 
Student Number	**:**	14010284
Place	**:**	University of Venda
Date	**:**	November 2022

DEDICATION

I dedicated this dissertation to my late mother, Mrs Avhapfani Florence Maumela, for raising me to be a professional someone, for encouraging me to study and to further my studies, for inspiring me to work hard beyond my limits and for all the support and the sacrifices she made. May her soul continue to rest in peace.

ACKNOWLEDGEMENTS

I would like to thank the following individuals who helped me in any way throughout this project and for rendering it successful:

- All the pregnant women in Vhembe District for their genuine participation in this project.
- All the staff members in all the health care facilities visited for welcoming me.
- My family, friends, mentors and significant other for their support, guidance and encouragement.
- My supervisor, Dr T. Malwela, for encouraging me not to give up in my most difficult times, for her patience and support, for guiding and advising me and for believing in me and in this project.
- My co-supervisors, Prof M.S. Maputle and Prof V. Berggren, for making this project a significant journey of discovery.
- Prof Donavon Hiss, for editing and typesetting the dissertation (Annexure 9).

ABSTRACT

Introduction: Over the past 30 years, anaemia in pregnancy has remained a major problem worldwide, mostly in developing countries. The World Health Organization (WHO, 2015) defines anaemia as a condition in which the number of red blood cells or haemoglobin concentration is lower than normal. The normal Hb level for men is considered 13.2 g/dl and above and 11.6 g/dl and more in women. In pregnancy, Hb between 8-9.9 g/dl is considered mild anaemia and Hb less than 7.9 g/dl is considered moderate to severe anaemia.

Methods: A quantitative research approach with a descriptive and cross-sectional design was used to conduct the study. This research was conducted in the health care facilities in Vhembe district within certain geographic areas, so the findings may differ if the sample is transformed. Consequently, the study was conducted at the selected clinics of Vhembe district, so the results may also change if the research was conducted at some other areas. The target population was pregnant women. Slovin's formula was used to recruit 133 respondents from the selected health facilities. A self-developed structured questionnaire was used as the data collection tool.

The Statistical Programme for the Social Sciences (SPSS) version 28 was used to analyse collected data, while frequencies and percentages were used to present the data in tabular format. Validity and reliability were ensured by pre-testing the tool and any necessary modifications were carried out with the assistance of the supervisors. The significance of the study was to determine the knowledge of pregnant women regarding effects of anaemia on pregnancy outcomes.

Results: The results of the study showed that more than 50% of pregnant women who participated in the study did not have sufficient knowledge regarding the effects of anaemia on pregnancy outcomes.

Recommendations: Through the recommendations offered, the study's findings may help mothers understand how anaemia affects the course of their pregnancies. The debarment of health may get new evidence to include in the drafting and updating policies addressing the management anaemia in pregnancy.

Keywords: anaemia, effects, pregnancy outcomes, women, knowledge

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

ACD	Anaemia of Chronic Disorders/Disease
AI	Anaemia of Inflammation
AIDS	Acquired Immune Deficiency Syndrome
ANC	Antenatal Care
APH	Antepartum Haemorrhage
DoH/NDoH	Department of Health/National Department of Health
Hb	Haemoglobin
HCTREC	Human and Clinical Trials Research Ethics Committee
HIV	Human Immunodeficiency Virus
IDA	Iron Deficiency Anaemia
IUFD	Intrauterine Foetal Death
IUGR	Intrauterine Growth Retardation
LMIC	Low- and Middle-Income Countries
PPH	Postpartum Haemorrhage
SCDs	Sickle Cell Disorders
WHO	World Health Organization

CHAPTER 1

OVERVIEW OF THE STUDY

1.1 Introduction

Anaemia is defined as a haemoglobin (Hb) levels of less than 11 gram per decilitre in pregnancy and is divided into three degrees - mild (9.0–10.9 g/dl), moderate (7.0-8.9g/dl) and severe (<7.0 g/dl) (WHO, 2015). A study done by Sadore, Hussen and Gebretsadik in 2015 showed that 12.8% and 3.7% of maternal mortality in Asia and Africa, respectively, is associated with anaemia. Anaemia in pregnancy has remained a major problem worldwide, mostly in developing countries, over the past 30 years. The prevalence of anaemia among pregnant women is estimated to be 24.1% in the Americas, 48.2% in South East Asia, 25.1% in Europe, 44.2% in the Eastern Pacific and is the highest in Africa at 57.1%.

Countries worldwide are implementing the recommended remedy of iron supplementation programmes, but only a few countries have reported notable improvement in anaemia management and prevention. Most community-based programmes have not been effective, as they have not decreased the incidence and prevalence of anaemia when implemented in the field. In South East Asia, Latin America and a few African countries one of the most common reasons the programmes have been less effective than expected is poor compliance of women with taking daily iron supplements (Taye, Abeje and Mekonen, 2015).

A study done in India showed 1903 out of 2985 pregnant women were diagnosed with anaemia, 723 had mild anaemia, 647 had moderate anaemia and 533 had severe anaemia (Gopinath, Dhananjaya, Sreelasya and Krishna, 2018). The results also showed that in

cases of pregnancy and maternal outcomes related to anaemia, there were 202 cases of preterm labour, 42 of postpartum haemorrhage, 52 of intrauterine growth retardation, 21 of

intrauterine foetal death, 36 of placenta abruptio, 3 of placenta previa, 39 of puerperal sepsis, 4 of cardiac failure, 3 of maternal mortality and 104 cases of pre-eclampsia (Gopinath, Dhananjaya, Sreelasya and Krishna, 2018). In cases of perinatal outcomes related to anaemia there were 42 cases of intrauterine foetal death (IUFD), 83 of neonatal admissions,14 of neonatal death and 102 cases of low birth weight (Gopinath, Dhananjaya, Sreelasya and Krishna, 2018).

1.2 Background

Anaemia in pregnancy is a major public health problem causing significant levels of maternal morbidity and mortality. The most common cause of anaemia in pregnancy is iron deficiency. Factors contributing to iron deficiency anaemia (IDA) in pregnancy include poor diet and parasitic infection such as hookworm and bilharzia. Other causes of anaemia in pregnancy include folate deficiency, malaria and chronic infections such as human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS) (Di Renzo, Spano, Giardina, Brillo, Clerici and Roura, 2015).

The average maternal mortality caused by anaemia in Asia is estimated to be 7.26% and causes negative health risk to the foetus, such as preterm birth and low birth weight. The most common anaemia in pregnancy is IDA. Prevention is always better than treatment for controlling the disease and the compliance rate for taking iron supplements increases when the women are informed. The challenge, however, is trying to improve the effectiveness of the supplementation strategies in developing countries (Ghimire and Pandey, 2013).

It is believed that women who have knowledge utilizes maternal health services effectively, hence, bringing about a reduction in most complications that comes with poor utilization of maternal health services. The majority of women in low- and middle-income countries (LMIC) were not utilizing maternal-health services effectively, due to many factors, amongst them; lack of knowledge regarding advantages of maternal-health services was one of the main causes for underutilization of maternal services. Most women in most LMIC communities, due to gender issues have less privileges in accessing education resulting in

them having low literacy levels (Lubbock and Stephenson, 2008). This further predisposes them to low levels of maternal health knowledge, although there are maternal health education programmes in communities (Lubbock and Stephenson, 2008). In LMIC there is a reasonable improvement in health educating for women on maternal and child health worldwide, however, many women remain uninformed about significant factors that impact negatively on their pregnancy outcomes.

This is usually linked to women's low literacy level, traditional and cultural norms that value males more than females, especially, in the Middle East countries. Srivastava *et al. (*2015) showed that traditional practices see women as assets in the kitchen, among some of the same factors that prevent them from seeking more knowledge on issues that can affect them and their unborn babies, including seeking knowledge regarding the effects of anaemia. Women as the primary role players in their own maternal health and well-being need to have knowledge regarding pertinent issues like anaemia and its effects on their health.

Women need to know that during pregnancy there is a physiological haemodilution, with a peak during 20-24 weeks of gestation and Hb varies through trimesters, although it is well established that there is a physiological drop in Hb in mid-trimester (Di Renzo, Spano, Giardina, Brillo, Clerici and Roura, 2015). This physiological drop is due to the higher increase in plasma volume, compared with red blood cell mass, which slightly increases during pregnancy. This physiological process produces relative haemodilution blood viscosity, helping the blood circulation in the placenta. During pregnancy, iron deficiency is relatively common because of the increased iron demand, with a minimum iron requirement of 4.4 mg/day and this is because many women start pregnancy with poor or deplete iron stores. In addition, the amount of iron absorbed from the diet, together with that mobilized from the body's stores, is usually insufficient to meet the maternal demands imposed by pregnancy. The WHO (2016) recommendations on antenatal care (ANC) for positive pregnancy experience recommends that the prevention of anaemia requires midwives and other health care professionals to be trained to give health education on dietary intake and

to recognize anaemia so that appropriate action can be taken by them. In addition, health care facilities need to be available for testing of Hb levels and for screening for malaria and other parasitic diseases. Vitamin C, iron and folic acid supplements have to be available for pregnant women, as well as an appropriate referral system has to be in place. Vitamin C is essential for tissue repair and important for immune system function; iron helps the body to make haemoglobin; iron supplements are essential for preventing IDA; and folic acid is essential to prevent folate deficiency anaemia and is prevents neural tube defects in the unborn baby.

The effects of anaemia in pregnancy include cardiac disease, spontaneous abortion, antepartum haemorrhage (APH), preterm labour, intrauterine growth retardation, intrauterine death, maternal distress, postpartum haemorrhage and a compromised immune system (McCall Sellers, 2013). Anaemia causes cardiac distress through tachycardia and increased stroke volume; it can cause reduced renal blood flow and fluid retention which can result in hearth failure (Silverberg, Wexler and Iaina, 2002). Women who are anaemic are vulnerable to hypoxia after postpartum haemorrhage (PPH), because anaemia reduces the capacity of oxygen carried in the blood to vital organs and this can lead to maternal distress and maternal death (Yip, 2000).

Reduced oxygen in the maternal circulatory system results in reduced oxygen to the placenta and this can lead to chronic foetal hypoxia which can cause intrauterine growth restriction (Hutter and Jaeggi, 2010). Iron deficiency increases oxidative damage to erythrocytes and foetoplacental unit, this can cause placental abruption which can lead to APH, preterm delivery, foetal distress, intrapartum foetal death and perinatal death. Iron deficiency increases the risk of maternal infections which can stimulate the production of corticotropin-releasing hormone, a major risk for preterm delivery (Allen, 2001). The nutritional status of the expectant mother is the most important determinant of her pregnancy outcome, including the birth weight of the newborn. In developing countries, maternal undernutrition is a significant cause of maternal mortality, low birth weight and stillbirth. Data from the National Nutrition Survey (2001-2002) revealed that iron-deficiency

anaemia remains a major problem; 45% of women suffer from anaemia during pregnancy and most studies have confirmed that more than 80% of the causes of anaemia in pregnancy are triggered by IDA. Cases of PPH were high in cases of moderate to severe anaemia as compared to mild anaemia in maternal complications. Low APGAR score, preterm labour and low birth weight were significantly high in cases of moderate to severe anaemia compared to cases of mild anaemia in perinatal-related complications (Youssry, Radwan, Gebreel and Patel, 2018).

A study done in Kathmandu in India by Ghimire and Pandey (2013) showed that anaemia during pregnancy contributes to high maternal and perinatal morbidity and mortality. The cases of anaemia in pregnancy in developing countries ranges from 40-80% compared to 10-20% in developed countries; 20% of maternal deaths in developing countries are caused by anaemia. The study concluded that most mothers who delivered at Tribhuvan University Teaching Hospital did not have adequate knowledge about the prevention of anaemia. Antenatal mothers did not have good practices for the prevention of anaemia, although, most of them knew that the use of iron supplements is essential during pregnancy; in the study it came out that all the mother participants did not take the complete course of iron supplements recommended during pregnancy.

Iron supplements during pregnancy are essential for the maintenance of a normal Hb; poor compliance exposes pregnant women to the risk of developing anaemia (Ghimire and Pandey, 2013). Research done in India revealed that pregnancy makes women more vulnerable to infection and parasites sequester in the placenta, which puts women at risk of severe anaemia during pregnancy and their babies at risk of being born with low birth weight (Shulman and Dorma, 2014). In Africa, at least 50% of pregnant women are affected by anaemia, putting them at greater risk of morbidity and mortality, prenatal and perinatal infant loss and preterm labour. Physical and cognitive losses due to IDA cost developing countries up to 4.05% losses in gross domestic product per annum, therefore, delaying social and economic development. Anaemia is highly prevalent in pregnant women, especially in LMIC. According to WHO more than half of pregnant women in these countries

are anaemic. In South African studies, anaemia has been found in 7-29% of pregnant women; in other parts of sub-Saharan Africa, the prevalence ranges from 22% in Kenya to 69% in Malawi. Factors causing anaemia include nutritional deficiencies, furthermore, the effects of dietary deficiencies can be aggravated by external factors such as poor socio-economic status which include lack of knowledge (Mamabolo, Albert, Steyn, Levitt and Delemarre-Van De Waal, 2004).

A study done in Brosonkro Health Centre between August to September 2011 by Bismark, (2013), showed that most pregnant woman are aware of anaemia and its causes in pregnancy and only very few are not aware of this fact. The study shows that some cultural practices and religious beliefs do not subscribe to this connection, hence, there are several pregnant women who are denied relevant dietary nutrients due to this restriction. Potential health risks during pregnancy, including anaemia, are associated with cultural practices and religious beliefs on food restrictions in communities (Bismark, 2013).

Results from a study done in South Africa on HIV and anaemia by Mbhenyane and Cherane, (2017), shows that the mean Hb concentration was 10,6 g/dl at baseline and 262 out of 408 women were diagnosed with anaemia in pregnancy. A low CD4 count and higher gravidity were high risk factors for anaemia in pregnancy. After adjusting for antiretroviral regimen, CD4 count remained a significant risk factor for anaemia in pregnancy. In sub-Saharan Africa, anaemia in HIV-infected women has been associated with adverse maternal and foetal outcomes in pregnancy. In 2012, The Saving Mothers Report in South Africa concluded that HIV infection at 70% and anaemia at 30% were the most common conditions among women who died during pregnancy or puerperium (Moodley, *et al.,* 2014). A study done by Mbhenyane and Cherane (2017) in Northwest shows that there has been little improvement in the management of anaemia in pregnancy over the past years; this means there is still a need to keep on searching for new strategies to prevent and manage anaemia in pregnancy.

In 2002, South Africa had 8.3% low birth weight infants associated with anaemia in

pregnancy and in North-West Province it was 9.1%. It has been reported that the whole of South Africa had 2.4% IDA in pregnant women and North-West Province had 28.6% in 1995, while in 2005 South Africa had 27.9% and North West had 28.1%; this shows little progress over the years. In 2013, the South African National Health and Nutrition Examination Survey reported IDA in pregnant women at national level to be 23.1% and 16.9% in North-West Province (Mbhenyane and Cherane, 2017).

A study by Motadi, Matsea, Mogane, Masidwali, Makwarela and Mushaphi (2019) on the assessment of nutritional status and dietary intake of pregnant women in Vhembe district shows that poor dietary intake during pregnancy can cause poor weight gain, preterm labour, low birth weight and birth defects. Regardless of the government's effort to provide vitamins and mineral supplements for pregnant women, malnutrition and poor micronutrients intake remains a major public health problem in South Africa. The mean energy and carbohydrate intake were 2248 kCal and 372.1 g, respectively. Prevalence of underweight, overweight and obese using BMI was 16.3%, 24.2% and 8.7%, respectively (Motadi, Matsea, Mogane, Masidwali, Makwarela and Mushaphi, 2019).

South Africa's National Department of Health (NDoH) has implemented measures to prevent and manage anaemia in pregnancy and related complications. According to the Department of Health (2016), all pregnant women should have their blood taken for Hb measurements at the first antenatal booking and if Hb levels are normal, the test should be repeated at 28, 32 and 36 weeks. Dispensing Ferrous Sulphate 200 mg orally daily and Folic Acid 5 mg oral daily was required for all pregnant women with Hb above 10 g/dl throughout pregnancy for prevention of anaemia.

There should be increment of ferrous sulphate and folic acid frequency in mild, moderate and severe cases of anaemia in pregnancy as well as blood transfusion for patients who do not respond to retreatment. This was the recommended treatment for women with severe anaemia, in labour and women who have moderate anaemia and are going for emergency caesarean section (Department of Health, 2016).

Through the literature reviewed, the researcher discovered that many studies conducted about anaemia during pregnancy do not focus on the knowledge of pregnant women regarding effects of anaemia on pregnancy outcomes. Another study in Limpopo Province, by Cape et al (2004) on Evaluation of the effectiveness of iron and folate supplementation during pregnancy however, showed that there has been a decrease, over the years, in cases of anaemia in pregnancy due the DoH's introduction of routine iron supplement dispensing for all pregnant women. The main cause of anaemia in pregnancy has been attributed to iron deficiency due to poor dietary intake, despite the dispensing of iron supplements to all pregnant women visiting antenatal clinics; other possible risk factors include the problem of infectious disease and parasites such malaria (Department of Health, 2016).

1.3 Problem Statement

The effects of anaemia in pregnancy outcomes include cardiac disease, spontaneous abortion, APH, preterm labour, intrauterine growth retardation, intrauterine death, maternal distress, PPH and compromised immune system (WHO, 2012).

During community service rotation in the maternity unit, the researcher observed that more than 50% of the women who were coming for antenatal visits had poor knowledge about anaemia and its effects on pregnancy outcomes. The researcher observed that more than 50% of women who were diagnosed with anaemia in early pregnancy were given dietary health education and iron supplements to take home; in their next antenatal visit it was discovered that their Hb levels had dropped or had not improved compared to the last level due to poor compliance with taking iron supplements and maintaining a proper diet. The researcher also observed that health education given is mostly about iron supplements compliance and iron rich diet and not about the effects of anaemia on pregnancy outcomes. The researcher was intrigued by the situation, hence, the motivation to determine the knowledge of pregnant women regarding the effects of anaemia on pregnancy outcomes in the rural areas in Vhembe District, South Africa.

Hypothesis: Knowledge of pregnant women regarding effects of anaemia on pregnancy outcomes is influenced by socio-economic status.

1.4 Rationale of the Study

Anaemia in pregnancy is a worldwide health problem and without proper management it can cause adverse effects on pregnancy outcomes. It is essential, therefore, for strategic monitoring of Hb and dispensing of iron supplements for all pregnant women, if necessary, to prevent and manage anaemia and its effects on pregnancy outcomes. In 2012, the Saving Mothers Report in South Africa concluded that HIV infection at 70% and anaemia at 30% were the most common conditions among women who died during pregnancy or puerperium.

Studies done over the years showed that women are aware of anaemia in pregnancy, however, there are high incidences of poor compliance to iron supplements and dietary intake. This has prompted the researcher to assess the level of knowledge of pregnant women regarding anaemia and its effects. The average maternal mortality caused by anaemia in Asia is estimated to be 7.26% and this has a negative health risk on the foetus, such as preterm birth and low birth weight. In Malaysia, the prevalence of IDA was at 35% and mostly of the mild type.

Prevention is always better than treatment for controlling the disease; the compliance rate for taking iron supplements increase when the women are informed. Iron supplementation is needed for pregnant women; the challenge remains to improve the effectiveness of the supplementation strategies in developing countries (Theng, Jalihahzakaria and Yusof, 2017). The researcher sought to assess the knowledge of pregnant women regarding the effects of anaemia on pregnancy outcomes in rural areas in Vhembe District, South Africa.

1.5 Purpose of the Study

The purpose of this study was to determine the knowledge of pregnant women regarding

the effects of anaemia on pregnancy outcomes.

1.6 Objectives of the Study

The objective of this study was to:

- Assess the knowledge of pregnant women regarding the effects of anaemia on pregnancy outcomes.

1.7 Significance of the Study

The significance of the study was to determine the knowledge of pregnant women regarding effects of anaemia on pregnancy outcomes. The results of the study showed that more than 50% of pregnant women who participated in the study did not have sufficient knowledge regarding the effects of anaemia on pregnancy outcomes. The results of study may be of benefit to pregnant women by enhancing their knowledge on the effects of anaemia on pregnancy outcomes, the need for iron-rich diet and to fully comply with instructions for taking iron supplements. The results of the study may be of benefit to the Department of Health, midwives and relevant health care professionals through new information discovered and recommendations made. Through the findings, future researchers will know what has been researched, what is known and not known about the topic and other related topics, therefore, they will be able to identify gaps.

1.8 Definition of Terms

1.8.1 Knowledge

Knowledge is defined as the awareness or familiarity gained by experience of a fact or situation (Chikonzo, 2012). In this study, knowledge, means the information pregnant women have about the effects of anaemia on pregnancy outcomes.

1.8.2 Effects

An effect is a change which is a result or consequence of an action or other causes (Oxford Dictionary, 2013). In this study, effects, means the complications of anaemia in pregnancy.

1.8.3 Anaemia

Anaemia is a condition in which there is a reduced number of red blood cells or the haemoglobin concentration within the red blood cells is lower than normal (WHO, 2016). Anaemia in this study means a haemoglobin concentration lower than 10 g/dl for a pregnant woman, at any stage of pregnancy.

1.8.4 Pregnancy

This is a term used to describe the period in which a foetus develops inside a woman's womb or uterus (WHO, 2015). Pregnancy in this study refers to a foetus growing in utero at any stage, until delivery.

1.8.5 Women

Women are adult female human beings, as distinguished from a girl or a man (Cambridge Dictionary, 2013). Women in this study mainly refer to pregnant women attending ANC in health care facilities within the Vhembe District.

1.8.6 Pregnancy Outcomes

Pregnancy outcomes are results of a fertilization event, including live full-term birth, live preterm birth, stillbirth, spontaneous and induced abortion (Springer Nature Limited, 2020). Pregnancy outcomes in this study refer to the end stages of pregnancy (live birth, still birth and abortion/miscarriage) and maternal and foetal complications related to anaemia.

1.9 Research Methodology

A quantitative descriptive cross-sectional design was used in this study to capture a large

amount of data within a limited time. The design allowed the researcher to do random sampling and to minimize bias. Purposive sampling to sample pregnant women from 20 weeks gestation and above was used.

Slovin's formula was employed to estimate the sample size. A total of 133 women participated in the study. A structured questionnaire was used to collect data. The questionnaire was translated in common local languages within the selected district.

To ensure reliability and validity the researcher pre-tested the instrument in one of the health-care facilities within the Vhembe District which offers antenatal booking and was not one of the selected facilities for the study. The pre-test was 10% of the actual size of the respondents in the study, meaning that respondents who took part in pre-testing were 20. The reason for pre-testing was to check if the questions would produce results that meet the objectives of the study. The questionnaire was reviewed by the supervisors and statistician for any errors and ambiguity.

To manage the data, all the completed questionnaires were cleaned, then captured in an Excel sheet in the form of binary workbook. The Excel binary workbook format was used as it is easy to compress data to manageable size and allows for easy uploading of raw data into the management system of the Statistical Package for the Social Sciences (SPSS) version 28. Questionnaires with errors or those not fully completed were not entered into the system. Descriptive statistics was used to describe and summarize the data collected; frequency distributions were used, where the data was arranged systematically from lowest to highest order through percentages.

1.10 Ethical Considerations

Ethical clearance was obtained from the University of Venda Health, Research Ethics Committee; permission to collect data was sought from the Limpopo Province Department of Health and the Nursing Manager of PHC facilities in Vhembe district. Informed consent was obtained from the pregnant women who volunteered to participate in the study. The

identities of the participants were hidden and only codes were attached to the questionnaires. Ethical principles such as right to information, privacy, confidentiality, justice and fairness were adhered to and are detailed in *Ethical Considerations* in Chapter 3.

1.11 Dissertation Layout

Chapter 1 Overview of the Study

This chapter provides an overview of the study, introduction, background, problem statement and research rationale, purpose, objective and significance of the study, definition of terms, research methodology and ethical considerations.

Chapter 2 Literature Review

This chapter presents the literature review focusing on the concept of anaemia in pregnancy, conceptualization for the analysis of anaemia risk factor in pregnancy, factors that cause anaemia in pregnancy, the effects of anaemia on pregnancy outcomes and prevention of anaemia in pregnancy.

Chapter 3 Research Methodology

This chapter outlines the research design and methodology, indicating the research approach in terms of how the sample was selected, the steps followed to collect the data, the reasons for using particular methods of analysis and how the data were analysed to ensure reliability and validity as well as ethical considerations that guided this study.

Chapter 4 Data Presentation and Interpretation

This chapter presents the results and analysis thereof, specifically with in the context of the objectives of the study. The chapter showcases the demographic profile of respondents, the respondents' knowledge related to anaemia in pregnancy, the respondents' knowledge on the effects of

anaemia on pregnancy outcomes and the respondents' knowledge on the causes of anaemia on pregnancy outcomes and correlates the results by applying regression analysis of the variables.

Chapter 5 Discussion of Results, Conclusions and Recommendations

This chapter offers an overall summary of the implications, applications, recommendations and limitations of the study results with regard to knowledge related to anaemia in pregnancy.

1.12 Summary

This chapter presented information about the background of the study, problem statement, purpose of the study, objectives of the study, significance of the study and definitions of key terms. It also outlined the dissertation layout encompassing the 5 chapters and their content.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The researcher has provided a historical history of anaemia in pregnancy, with a full overview for a better grasp of the concept. The researcher then went on to introduce the study's issue, outlining the research problem in full detail. Furthermore, the researcher has described the study's objective, significance and operational definitions in Chapter 1. A literature review is an overview of the past published works on a specific topic (Torraco, 2005). So, in this chapter, the researcher reviewed related literature to this topic "knowledge of pregnant women regarding the effects of anaemia on pregnancy outcomes". This chapter aims to discuss past studies by scholars concerning the study's variables: knowledge of anaemia, effects of anaemia, effects of anaemia on pregnancy outcomes and consequences of anaemia.

2.2 The Concept of Anaemia in Pregnancy

The term "anaemia" refers to a decrease in the blood's ability to carry oxygen as a result of abnormally few circulating erythrocytes (red blood cells) or a drop in haemoglobin (Hb) levels (Hoque and Worku, 2005). Red blood cell production is decreased, or red blood cell loss is increased, which causes the deficiency. Pregnant women are thought to be the most vulnerable category because of the increased demands placed on their maternal reserves at this time, which reveal the different hidden deficiencies that appear as anaemia (Hoque and Worku, 2005). When the haemoglobin level is less than 11 g/dl, anaemia should be taken into consideration, according to the World Health Organization (WHO, 2015).

If the haemoglobin level is less than 10 g/dl, anaemia is regarded during pregnancy in South Africa (SA). In SA, in 2000, between 9 and 12% of pregnant women were reported to have iron deficiency anaemia (IDA). Clinically, anaemia in pregnancy has prevalence rates ranging from 35 to 70% (Kabatereine, Broker and Koukounari, 2007). In most underdeveloped nations, this makes a significant contribution to maternal and perinatal mortality and morbidity. Every year, difficulties related to pregnancy and childbirth claim the lives of almost 600 000 women between the ages of 15 and 44 worldwide. An estimated 390 deaths due to maternal causes are recorded for every 100 000 live births worldwide, with developing nations accounting for most of these cases. The rates are as high as 700/100 000 live births in most African nations and few Asian countries (Kabatereine, Broker and Koukounari, 2007).

Individuals' views and knowledge are shaped by their understanding of anaemia during pregnancy. The researcher has therefore thoroughly examined this idea. According to the World Health Organization (WHO, 2014), anaemia is a condition when the amount and quality of haemoglobin fall below a set cut-off value. The WHO (2015) defines iron deficiency in pregnancy as haemoglobin levels below 11 g/dl and categorizes the severity into three categories: mild frailty (Hb levels 9-10.9 g/dl), moderate pallor (Hb levels 7-8.9 g/dl) and extreme anaemia (Hb levels 4.57-7 g/dl) (Margwe, 2015).

Iron insufficiency sickness frequently results from dietary iron intake that is inadequate for haemoglobin synthesis (Mawani, Ali, Bano and Ali, 2016). Dietary deficiencies, iron loss from red blood cell haemolysis, or increased demands during pregnancy in young women are the causes of iron deficiency paleness (Camaschella, 2015). Iron deficiency is a major medical problem that affects both developing and established nations, having a significant negative impact on social and economic advancement as well as human well-being. It occurs at every stage of the life cycle, but is more common in pregnant women and young children (Prakash, Yadav, Bhardwaj and Chaudhary, 2015). Iron deficiency is the primary cause of anaemia and is more prevalent in developing nations. The health care system is further burdened by anaemia.

Children and women are more vulnerable due to physiological reasons (Mawani, Ali, Bano and Ali, 2016). Additionally, the World Health Organization lists poor pregnancy outcomes, physical disabilities and delayed cognitive development as the main health effects of IDA in pregnancy. In children, iron anaemia raised the chance of morbidity and in pregnant women, it decreased productivity. IDA is the primary cause of about 20% of maternal fatalities (WHO, 2011). Pregnant women in one area of Pakistan had poor understanding about normal prenatal examinations and government health services and they had unfavourable attitudes toward them (Ghaffar and Pongpanich, 2012). Moreover, it's important to get regular check-ups when pregnant.

Routine ANC was not mentioned as a crucial milestone for pregnant mothers as the researcher described the notion. Pregnant women received a wide range of preventative and advancement services for their health, including advice on appropriate pregnancy habits, dietary assistance and prevention of IDA (Ghaffar and Pongpanich, 2012). Othman (2016) stated in his essay that pregnant women must develop proper eating habits in order to consume a balanced amount of iron from food and supplement (Othman, 2016). Also, pregnant women's attitudes on IDA and supplement use are significant. This includes serving as a deterrent or incentive to take iron supplements (Gowri, Sakthi and Palanivel, 2017).

A recent article focuses on helping pregnant women understand how iron supplementation and health education can significantly lower the frequency of IDA, preventing anaemia-related death and morbidity (Balasubramanian, Aravazhi and Sampath, 2016). Like this, complete nutritional information regarding an iron-rich diet and supplements should be included as part of prenatal visits. Effective nutritional strategies and the advantages of iron supplementation should be explained to women. Individuals should be encouraged to increase their intake of foods high in iron and decrease their consumption of tea and coffee, which prevent the absorption of iron (Rizvi, 2012). A study showed that a woman's attitude toward prenatal appointments, the significance of a healthy diet and her intake of iron and folic acid throughout pregnancy could have a significant impact on her haemoglobin levels

(Margwe, 2015). Pregnant women's knowledge and behaviour had an impact on IDA (Namazi and Alizadeh, 2016). According to a recent study, pregnant women should refrain from drinking tea since it has negative effects on the health of the foetus, this study set out to determine how pregnant women felt about IDA and how they behaved in relation to it. Regarding IDA, this study has improved pregnant women's knowledge, attitudes and practices. For expectant women living in remote areas, a health education workshop was held. Additionally, as a nurse, I find this study to be of tremendous importance. The ratio of pregnant women's knowledge, attitudes and practices about IDA is identified by the woman (Paula, 2017).

Anaemia is a serious health problem (Paula, 2017). It affects both developed and developing countries and it's thought to affect pregnant women at a rate of 51% (Melku, Addis, Alem and Enawgaw, 2014). Any stage of life can experience anaemia, but pregnant women are more likely to experience it (Abriha, Yesuf and Wassie, 2014). Asia has the highest anaemia prevalence rates in the world. In 88% of the universe's pregnant anaemic women live on the Indian subcontinent (Melku, Addis, Alem and Enawgaw, 2014. Anaemia is largely brought on by iron deficiency in underdeveloped nations. About half of anaemia cases during pregnancy are caused by IDA and in affluent nations, it is estimated that 38% of pregnant women have iron depletion (Fiedler, 2015).

According to the National Nutrition Survey, 45% of pregnant women get IDA. However, numerous studies have demonstrated that iron deficiency is linked to more than 80% of anaemia occurrences in women, particularly in pregnancy (Rizvi, 2012). Knowledge also has meaningful associations. Only 52.4% of women in India, according to research, are aware of the benefits of taking iron supplements while pregnant and eating foods high in iron (Nivedita, 2016). Like this, pregnant women's health is negatively impacted by their lack of information about anaemia, foods high in iron and the significance of iron supplements (Nivedita 2016). Similarly, Pakistani medical practitioners frequently see the habit of pregnant women eating less during pregnancy to avoid complications with delivery. In his study, Rizvi found that 25% of women use iron supplements generally and that

pregnant women have a favourable view about them (Rizvi, 2012). According to recent statistics, anaemia is linked to drinking tea, coffee, eating few eggs and eating red meat. Red meat contains a protein that binds to iron, inhibiting proper absorption of iron (Baig-Ansari and Badruddin, 2008). Pregnant women who drink a lot of coffee have a high chance to have anaemia because caffeine inhibits proper absorption of iron. To prevent IDA during pregnancy, iron and folate supplements are crucial. Iron supplementation during pregnancy is strongly enforced in underdeveloped nations. Iron supplementation is considered a normal and common procedure for the prevention of anaemia (Chacko and Premkumar, 2016).

2.3 Conceptualization for the Analysis of Anaemia Risk Factor in Pregnancy

Anaemia in pregnant women continues to be a significant global issue, affecting nearly millions of pregnant women globally (Ratledge, 2007). According to the most current data, women under 35 have the lowest mean haemoglobin concentrations and the highest frequency of anaemia (Galea, Ahern and Karpati, 2005). The complicated aetiology of anaemia and the inherent difficulty of executing numerous, integrated health and nutrition interventions at scale are major contributors to the slow rate of progress in anaemia control initiatives.

However, the effects of anaemia on women and the growth and survival of their unborn child are alarming and spur researchers to create more practical solutions (Galea, Ahern and Karpati, 2005). As a method of lowering anaemia, anaemia control initiatives have traditionally concentrated on lowering the prevalence of risk factors (Ratledge, 2007). Reduced anaemia is anticipated as a result of fewer women being exposed to iron-deficient diets and parasitic illnesses (such as malaria or hookworm). Anaemia is brought on by a combination of immediate, underlying and fundamental reasons that interact, like the UNICEF theoretical framework for the causes of undernutrition (Figure 2.1). Many factors affect how a risk factor exposure affects the person who is exposed (Ratledge, 2007). Women exposed to comparable risk factors respond to that exposure in varying degrees

depending on individual, home and societal factors that interact in complicated ways to either raise or decrease their vulnerability (Galea, Ahern and Karpati, 2005).

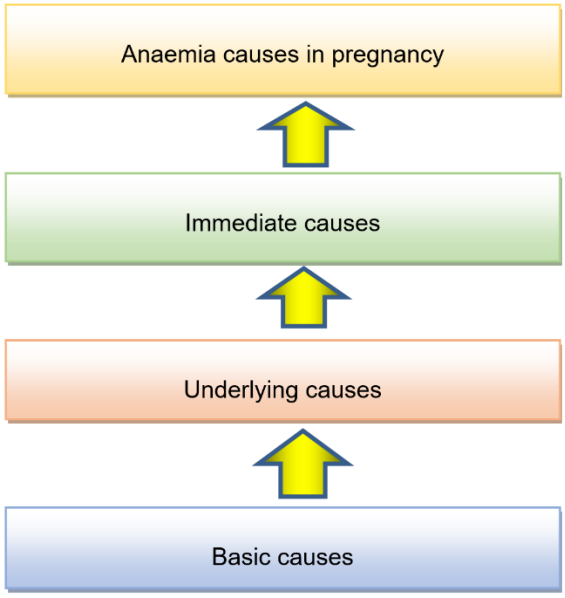


Figure 2.1: Conceptualization for the analysis of anaemia risk (Siekmans, Receveur and Haddad, 2014)

Therefore, the model of this study also depicts how different levels of exposure and vulnerability play a role in influencing varied levels of health outcomes (Thurnham and Nothrdrop-Clewes, 2004). The idea of vulnerability includes both internal strategies for managing risks without suffering harm and external exposure to risk factors. Late pregnancy is a time when women are most exposed to external stressors in LMIC, including as nutrient-deficient diets and infectious illnesses (Thurnham and Nothrdrop-Clewes, 2004). Since older women are more prone than other members of the general population to be damaged by these stressors, they are frequently seen as being vulnerable. However, a variety of factors, such as personal characteristics (such as biological immunity), household factors (such as caregiver expertise) and institutional factors (such as the sufficiency of health facilities), contribute to the heterogeneity observed in the impact of

disease on young children (Ratledge, 2007). It is possible to predict the anticipated outcome of an intervention or series of interventions over time given that exposure, whether to risk factors like infectious agents or protective events like deworming campaigns, interacts with underlying capacities to shape child vulnerability at any given point in time (Thurnham and Nothrdrop-Clewes, 2004). Anaemia control strategies may be able to change the risk association between exposure and effect even without lowering the level of exposure for women to direct sources of anaemia like iron-deficient diets or malaria infection (Thurnham and Nothrdrop-Clewes, 2004).

By addressing the underlying and fundamental causes of anaemia at the home, community and/or institutional levels, community-based health and nutrition interventions increase capacity while lowering susceptibility (Pedro, Madriaga, Barba, Habito and Gana, 2004). For instance, in research in Ethiopia, teaching mothers with low levels of education how to care for their sick children and providing them with suitable medications for at-home treatment reduced the risk association between malaria and death in intervention communities (Pedro, Madriaga, Barba, Habito and Gana, 2004). Without affecting the degree to which the children were exposed to malaria infection, the intervention in this case decreased the vulnerability of these women to malaria-related mortality by acting at the household capacity level (mothers' knowledge) and the institutional/systemic capacity level (access to malaria medication) (Osorio, Lira and Ashworth, 2004).

One would anticipate a similar buffering (or moderating) effect on the risk of anaemia related with undernutrition and morbidity in settings where a package of integrated health and nutrition treatments is delivered, in addition to a direct decrease in the incidence of risk factors (Osorio, Lira and Ashworth, 2004). Public health nutrition initiatives may improve the ability of children, their families, communities and the larger system in which they live by acting at various levels along the causative route (Osorio, Lira and Ashworth, 2004). No matter how much exposure women receive to established anaemia risk factors, this would lessen their vulnerability to the condition (Payne, Koski, Ortegan-Barria and Scott, 2007). One particular study was conducted to see whether the provision of numerous, integrated

health and nutrition treatments in three African nations improved capacity and decreased child anaemia vulnerability at multiple levels (Osorio, Lira and Ashworth, 2004). This specifically aids the researcher in outlining the risks associated with the factors. Another study looked at how different therapies that deal with anaemia's immediate, underlying and fundamental causes all at once might change these risk correlations. Therefore, the aim was to determine whether the lower mean Hb associated with established risk factors in 2000 would be similar in 2004. The authors hypothesized that there would be a ''buffering'' of risk associated with known causes of anaemia among children living in areas benefiting from a community-based health and nutrition programme intervention, due to reduced child vulnerability (Agho, Dibley and Ashworth, 2004).

In KwaZulu-Natal, an examination of the nutritional condition of children and their mothers revealed that 24% of pre-schoolers, 22% of children aged 6 to 11 and 22% of their mothers were anaemic. The primary cause of anaemia in pregnancy in developing nations is a dietary iron deficit (Kabatereine, Broker and Koukounari, 2007). Important known risk factors for anaemia in pregnant women include folate and vitamin A deficiency, parasite infestation (helminthiasis, urinary schistosomiasis), haemoglobinopathies (sickle cell disease, thalassaemia), HIV and malaria infection, multiparity and seasonal variation. Most sub-Saharan African nations, including South Africa, already have national policies for malaria prophylaxis for all expectant women and the prevention and treatment of anaemia (Guyatt, Brooker, Kihamia, Hall and Bundy, 2001). However, it was found that the rural population of KZN had a high rate of anaemia in pregnancy (57% according to WHO criteria and 30% according to national definition (Ezzati, Lopez, Rodgers and Murray, 2004).

Several studies, particularly in rural areas, have thoroughly examined the aetiological variables causing anaemia in pregnancy in South Africa. The most common cause of anaemia in sub-Saharan Africa is thought to be iron deficiency (nutritional deficiency) during pregnancy (Stoltzfus, 2003). Deficits in vitamins A and B12 are also listed as risk factors for anaemia in pregnancy (Park, 2000). Studies conducted in West Africa have also reported cases of folate deficiency (Department of Health, 2004).

Anaemia can also be brought on by parasite diseases and HIV. The risk factors for anaemia, especially during pregnancy, are numerous and complex and it is recognized that their relative contributions change depending on the region and the season (Jinabhai, Taylor, Coustsoudis, Coovadia, Tomkins and Sullivan, 2010). Therefore, understanding the relative importance of the various hazards or aetiological factors should serve as the foundation for any clinical or public health intervention to reduce anaemia in pregnancy in various contexts and populations (Ann, Strat, Chitsulo, Engels, Montresor and Savioli, 2000).

2.4 The Factors That Cause Anaemia in Pregnancy

2.4.1 Anaemia Associated with Various Diseases

Anaemia from chronic illness is mild-to-moderate in nature, typically normocytic, with a low reticulocyte count (Hb values 8–10 g/dl) (Walker, Wachs, Meeks and Gardner, 2007). Iron metabolism is altered by proinflammatory cytokines, which are released in the host defence response to infection, but other cytokines are also involved. As a result, iron is sequestered within cells of the reticuloendothelial system (liver, spleen and intestinal enterocytes) and production and lifespan are decreased (Stevens, Finucane and De-Regil, 2013). Inflammatory cytokines enhance the production of hepcidin, which then suppresses the expression of ferroprotein in intestinal enterocytes, macrophages and hepatocytes. This prevents iron absorption and prevents the mobilization of iron from storage into circulation (WHO, 2015).

Additionally, inflammatory cytokines decrease the lifespan of women (perhaps by activating macrophages) and disrupt the formation and function of normal erythroid progenitor cells which, in turn, prevents them from proliferating and differentiating normally (Stevens, Finucane and De-Regil, 2013). Although diseases and infections are the leading causes of anaemia, this has been cited as the second most prevalent cause. The percentage of worldwide anaemia caused by inflammation is unknown and probably varies by setting and the prevalence of the underlying diseases (Walker, Wachs, Meeks and Gardner, 2007).

In research studies, anaemia was typically linked to inflammation (Walker, Wachs, Meeks and Gardner, 2007). Inflammation was linked to anaemia in the high- and very high-infection burden groups, but not in the low- and moderate-infection groups, according to a pooled analysis of countries by infection burden (reflecting sanitation, drinking water quality and prevalence of malaria, diarrhoea, or schistosomiasis) (Walker, Wachs, Meeks and Gardner, 2007). Inflammation (of any degree) was present among anaemic people in nations with low, moderate, high and extremely high infection burdens, respectively (Suchdev, Namaste and Aaron, 2016). Therefore, it is likely that inflammation plays a larger role in nations with higher infectious illness burdens than it does in countries with lower infectious disease burdens (Walker, Wachs, Meeks and Gardner, 2007).

In countries with high and low (but not moderate) infectious disease burdens, inflammation was significantly linked to anaemia; the odds of anaemia among these factors with inflammation were higher than the odds among other factors without inflammation in high- and low-infection countries, respectively. Although there are many additional reasons of anaemia, including iron deficiency and other illnesses, that grow more common with advancing age in women, it is believed that anaemia in the elderly is caused by inflammation, as circulating IL-6 levels rise with increasing age (Walker, Wachs, Meeks and Gardner, 2007).

2.4.2 Soil Consumption

The main soil-transmitted helminthic linked to anaemia in pregnant women is hookworm (Schreir, 2018). According to the underlying iron status, other risk factors present and the hookworm's ability to attach to and feed from the intestinal mucosa, blood (and iron) loss might result, which may have the consequence of anaemia (Schreir, 2018). An estimated 576–740 million infections are brought on by hookworms each year in sub-Saharan Africa and Southeast Asia, mainly in places with poor infrastructure, water, sanitation and hygiene (Centers for Disease Control, 1989). The degree of infection (e.g., the number of hookworms a person harbours), the species of hookworm, and if a concoction contains

numerous parasites, are all factors that affect the risk of blood loss and consequent anaemia (Schreir, 2018). In school-aged children, moderate- and heavy-intensity hookworm infections are linked to decreased Hb, whereas in adults, any level of infection is linked to lower Hb. However, even mild hookworm infections can have a deleterious impact on children and women who already have low iron levels (Balarajan, Ramakrishnan and Zaltin, 2011). Due to a five-fold larger blood loss than with other conditions, the duodenal infection is linked to a higher risk of anaemia (Balarajan, Ramakrishnan and Zaltin, 2011).

It has been demonstrated that co-infection with multiple parasites, such as Schistosoma sp., *Ascaris lumbricoides* (roundworm), *Trichuris trichiura* (whipworm), or *Plasmodium falciparum*, increases the risk of anaemia more than would be predicted if these species affected anaemia independently (Balarajan, Ramakrishnan and Zaltin, 2011). Hb benefits from anthelminthic therapy, especially when albendazole and albendazole given with praziquantel are used. Hookworm infection was ranked as the third and fourth most common cause of anaemia among males and females, respectively, in a systematic analysis that ranked the causes of the world's anaemia burden in 2010 by prevalence.

However, anaemia caused by hookworm decreased between 1990 and 2010, especially for females (WHO, 2003). In East Asia and Oceania, anaemia brought on by a hookworm infection was the most common type. Primary sclerosing cholangitis (PSC) tends to have lower rates than hookworm infections; for example, in Malawian children, hookworm infections were more prevalent and severe in children with severe anaemia and three-fourths of infected children were under the age of two (and so would not be the target of current treatment regimens) (WHO, 2005). The authors made a speculative claim that younger children may be more susceptible to serious haematologic problems from extensive hookworm infections (Schreir, 2018).

2.4.3 Infectious Diseases: Malaria, Tuberculosis, HIV and AIDS

Severe anaemia can result from the Plasmodium parasite that causes malaria, in addition

to other negative effects like mortality (Chalco JP, Huicho and Alamo, 2005). *Plasmodium falciparum* is the most common malaria parasite in Africa and is primarily responsible for mortality from malaria outside of sub-Saharan Africa (Chalco, Huicho and Alamo, 2005). The WHO African region faces a disproportionately high burden of malaria, accounting for 90% of cases and 92.0% of malaria fatalities, even though nearly half of the world's population is at risk (as of 2015). Infants and pregnant women are among those who are more likely to get malaria and develop a severe illness; more than two-thirds of malaria deaths occur in children under the age of five (Chalco, Huicho and Alamo, 2005).

Malaria is frequently found in locations with prevention measures in place; these measures may protect against severe human malaria and the connection between iron and malaria is complicated (Chalco, Huicho and Alamo, 2005). Malaria severely disrupts iron metabolism and distribution in several ways, including through haemolysis, the release of faulty erythropoiesis, increased iron in macrophages and decreased iron absorption. The parasite needs iron for growth (Dewey and Chaparro, 2007). Multifaceted factors contribute to the development of anaemia in malaria, including increased haemolysis of parasitized cells, but, more significantly, increased destruction of nonparasitized cells (Dewey and Chaparro, 2007).

Increased red cell clearance and limited erythrocyte survival, as well as decreased production (suppressed erythropoiesis) during and for days or weeks after severe malaria all contribute to anaemia (Dewey and Chaparro, 2007). Anaemia brought on by malaria is not due to blood loss. Malaria infection causes an increase in hepcidin, which most likely also causes anaemia (Jopling, Henry and Wiedmeier, 2009). In endemic areas, malaria prevention can reduce anaemia and severe anaemia in children under 5 by 27% and 60%, respectively. One of the main causes of anaemia worldwide and a major factor in the development of severe anaemia is malaria. In sub-Saharan Africa, particularly west sub-Saharan Africa, where malaria accounted for 25% of anaemia prevalence, malaria is an even more frequent cause of anaemia (Jopling, Henry and Wiedmeier, 2009). Malaria was consistently linked to anaemia in all surveys done in endemic areas among those examined

in the BRINDA experiment (Jopling, Henry and Wiedmeier, 2009). Anaemia is one of the most common haematological abnormalities among individuals infected with HIV; it is typically characterized as a normochromic and normocytic anaemia with a low reticulocyte count, normal iron stores and an impaired response (Chalco, Huicho and Alamo, 2005). Anaemia prevalence in HIV-positive individuals increases with advancing progression of the disease and is thought to result from several factors, both indirectly and directly related to the virus. HIV infection causes a chronic acute phase response, elevated hepcidin and altered iron metabolism (Chalco, Huicho and Alamo, 2005). Opportunistic infections common among HIV-positive patients can also lead to anaemia (e.g., malaria and hookworm) as do nutritional deficiencies resulting from the virus.

The haematopoietic progenitor cells are affected by the HIV virus, which also appears to have an immediate impact on anaemia by reducing responsiveness (Jopling, Henry and Wiedmeier, 2009). Antiretrovirals have been demonstrated to lower anaemia incidence and raise Hb levels. Finally, anaemia in HIV patients is a predictor of the development of AIDS since it is independently correlated with mortality and is correlated with the advancement of the disease (Jopling, Henry and Wiedmeier, 2009).

Patients with tuberculosis (TB) frequently experience anaemia and those who have both TB and HIV infection may experience anaemia more frequently. In a Malawian study, 88% of TB/HIV coinfected patients had anaemia, compared to 77% of TB patients without HIV. Anaemia affected 60% of malnourished TB patients in Indonesia, while it affected 71% of TB/HIV coinfected patients in Uganda (Chalco, Huicho and Alamo, 2005).

In addition to decreased production, increased haemoptysis (blood in sputum) and poor appetite and food intake, anaemia among pulmonary TB patients is likely to be caused by anaemia of inflammation (AI)/anaemia of chronic disorders/disease (ACD). This, in turn, results in poor nutrient status (of iron, but also of other nutrients, including selenium). In Tanzania, Gambia and South Africa, anaemia in TB patients was primarily brought on by AI (Jopling, Henry and Wiedmeier, 2009).

2.4.4 Genetic Disorders, Cell Disorders and Congenital Cardiovascular Diseases

An estimated 330 000 children are born every year with a significant inherited Hb condition worldwide (83% with sickle cell anaemia or one of its variants; 17% with a form of thalassaemia) and about 80% of these births take place. A substantial Hb variant, such as a gene variant that can lead to a serious condition like sickle cell disease or a form of thalassaemia, is estimated to affect roughly 5% of the world's population; the percentage is much greater in Africa (18%) and Asia (7%) (Lynch, 2007). The most prevalent hereditary Hb condition, sickle cell disorders (SCDs), which are linked to chronic haemolytic anaemia, are predominately found in sub-Saharan Africa and are principally concentrated in Southeast Asia (Lynch, 2007).

The distribution of deficiency, one of the most prevalent hereditary enzyme defects in humans, seems to coincide with regions where malaria is predominant, however, it is not covered in detail here. Acute haemolytic anaemia may develop in reaction to specific triggers, such as consumption of fava beans and exposure to the antimalarial primaquine; deficiency is thought to be among the leading causes of anaemia worldwide (Chalco, Huicho and Alamo, 2005). As other causes (such dietary inadequacies and viral diseases) are better addressed, the proportion of anaemia in SCDs caused by genetic Hb disorders—which are currently unchangeable causes of anaemia—is only anticipated to increase.

A recent study from Malawi found that 60% of the samples analyzed for inherited blood disorders (sickle cell deficiency and thalassaemia) among factors in the Malawian Demographic and Health Survey had at least one abnormal result. This calls for a greater understanding of the contribution of inherited blood disorders to anaemia burden (Chalco, Huicho and Alamo, 2005). Sickle cells, which are sickle-shaped and formed as a result of a faulty globin chain, induce chronic haemolytic anaemia by blocking small blood arteries, harming major blood vessels, causing excruciating pain, leaving behind residual organ damage and living considerably shorter lives (Lynch, 2007).

SCD patients are more likely to contract infections and suffer from malnutrition, both of which can have detrimental effects on their health, including painful episodes and increased haemolysis, which can result in severe acute anaemia (Lynch, 2007). In 2010, SCDs ranked as the fifth and seventh most common cause of anaemia in men and women, respectively.

2.4.5 Thalassaemias

A set of genetic diseases known as thalassaemias are characterized by problems in the synthesis of one or more of the globin chains that make up haemoglobin (Hb); thalassaemia is brought on by the absence or reduction in the synthesis of the globin chain (Miller, 2014). According to the severity of the gene defect, this group of autosomal recessive disorders range from carriers of the trait who are asymptomatic to those who experience severe anaemia, poor growth and skeletal abnormalities and death (in the cases of thalassaemia major). These disorders are characterized by haemolytic anaemia and impaired erythropoiesis, among other complications (Miller, 2014).

Globally, it is estimated that 1.7% of the population (i.e., asymptomatic carriers) carries the thalassaemia trait; however, within specific ethnic groups, people from Africa and Southeast Asia are more likely to have the condition than people from the Mediterranean, Africa, or Southeast Asia; the rate can range from 5 to 30% (Miller, 2014). Thalassaemias were listed higher in Australasia, Central and Eastern Europe, Central and Southeast Asia, North Africa and the Middle East, where they were projected to be the sixth and ninth most common causes of anaemia among females and males, respectively (Lynch, 2007).

2.5 The Effects of Anaemia on Pregnancy Outcomes

Unquestionably, both the mother and the foetus suffer negative repercussions from severe anaemia. Additionally, there is proof that less severe anaemia is linked to poor pregnancy outcomes (Butcher, Richards, Stanworth and Klein, 2017). Women with a haemoglobin level more than 6 g/dl are less likely to experience severe maternal problems that are

directly connected to anaemia. Even lower Hb levels can cause serious morbidity in pregnant women, including infections, longer hospital admissions and other general health issues. This clinical state may be accompanied by several symptoms and indicators, with varying degrees of consequence (Butcher, Richards, Stanworth and Klein, 2017). Headache, weariness, lethargy, paraesthesia and the clinical symptoms of tachycardia, tachypnea, pallor, glossitis and cheilitis are the most frequent of these. There may be substantial life-threatening complications as a result of high-output congestive heart failure and poor oxygenation of tissues, including heart muscle, in more severe cases, especially in pregnant women with low haemoglobin levels. Such situations are uncommon when a pregnant woman takes iron supplements or suffers from nutritional deficiency anaemia, at least in affluent nations (Butcher, Richards, Stanworth and Klein, 2017).

However, pregnancy difficulties, including placenta previa or abruptio placenta, surgical birth and postpartum haemorrhage (PPH) can cause severe IDA or haemorrhagic anaemia. If these disorders are not addressed with blood transfusions or iron supplements, serious consequences may result (Munoz, Laso-Morales, Gomez-Ramirez, Cadellas, Nunez-Matas and Garcia-Erce, 2020). There are numerous signs that severe maternal anaemia during pregnancy is linked to a poor pregnancy outcome, while the reason for this association is still unclear (Munoz, Laso-Morales, Gomez-Ramirez, Cadellas, Nunez-Matas and Garcia-Erce, 2020). However, various reports in the literature link the drop in haemoglobin level to prematurity, spontaneous abortions, low birth weight and foetal mortality. The effects of maternal anaemia on the foetus are not fully understood (Munoz, Laso-Morales, Gomez-Ramirez, Cadellas, Nunez-Matas and Garcia-Erce, 2020).

While some scientists maintain a clear link between anaemia and foetal distress only when the maternal Hb level, other experts disagree, believing that even a slight fall in Hb level (8–11 g/dl) may develop a propensity to these disorders. To draw firm and accurate management conclusions, it is crucial to understand how the mother's iron status affects the foetus' iron status (Richards, Baikady and Clevenger, 2020). There are differing views on this; some researchers discovered that the amount of iron in the mother has minimal

impact on the iron status of the newborn at delivery. However, research on the iron levels in cord blood serum has revealed a direct link between maternal and foetal iron levels. Additionally, it was discovered that kids delivered to mothers who did not take iron supplements throughout pregnancy had lower iron levels at birth when serum ferritin was utilized as a marker of iron status (Richards, Baikady and Clevenger, 2020). The majority of scientists concur that mild to moderate maternal iron shortage does not appear to have a substantial impact on foetal haemoglobin concentration and that only severe anaemia may have direct detrimental consequences on the foetus and neonate (Richards, Baikady and Clevenger, 2020).

Numerous studies link anaemia during pregnancy to preterm and low birth weight babies, proving a causal link between low birth weight and low maternal haemoglobin levels (Richards, Baikady and Clevenger, 2020). The risk of a premature delivery was shown to be elevated by 20% in pregnancies with Hb levels between 10 and 11 g/dl and by 60% in pregnancies with Hb levels between 9 and 10 g/dl; for pregnancies with Hb levels below 9 g/dl, the risk was more than doubled. Another significant epidemiologic investigation indicated that neonatal mortality increased when maternal haemoglobin levels were below 8 g/dl as opposed to above 11 g/dl (Richards, Baikady and Clevenger, 2020).

It has been shown that low maternal Hb levels are associated with unfavourable pregnancy outcomes, including preterm, low birth weight, foetal death and other medical anomalies with rising complication rates (Churchill, Nair, Stanworth and Knight, 2019). These research studies strongly suggest that maternal anaemia has a negative impact on foetal growth and pregnancy outcomes. Nevertheless, it would be better, at least in cases of mild to moderate maternal anaemia, to characterize these simply as possible risk factors rather than as an adequate evaluation indicating an obvious ad-verse impact on the foetus (Churchill, Nair, Stanworth and Knight, 2019). Moreover, it is important to stress that low maternal Hb levels are often associated with other pathologic conditions, so it is difficult to be sure whether maternal anaemia per se causes or even contributes directly to the in-creased mortality and morbidity rates.

Thus, low Hb levels are frequently secondary phenomena brought on by antecedent infections or chronic illnesses, which may then result in serious pregnancy difficulties independent of the pregnant woman's haematologic profile (Churchill, Nair, Stanworth and Knight, 2019). It is difficult to diagnose real anaemia and pinpoint the cause of anaemia because of the typical physiological changes that occur during pregnancy that influence the haematocrit and specific markers such haemoglobin, reticulocytes, plasma ferritin and unsaturated iron-binding capacity (Mei, Cogswell and Looker, 2011). Megaloblastic anaemia and iron-deficiency anaemia are the two most prevalent of anaemia (Churchill, Nair, Stanworth and Knight, 2019).

Women with poor diets and those who do not take prenatal iron and folate supplements are more likely to develop this anaemia. Aplastic anaemia and haemolytic anaemia are two additional less frequent forms of acquired anaemia during pregnancy (Mei, Cogswell and Looker, 2011). Additionally, anaemia such as thalassaemia and sickle cell disease might affect the mother's and foetus's health. Nutritional deficits are the most common cause of genuine or absolute anaemia, as was previously mentioned. The clinical presentation may be worsened by accompanying infections, often poor nutrition, or inherited diseases such haemoglobinopathies when these deficiencies are present in multiples (Mei, Cogswell and Looker, 2011). However, inadequate intake, poor absorption, increased losses, increased needs and insufficient use of haemopoietic elements constitute the fundamental components of nutritional anaemia.

Iron deficiency is the cause of about 75% of all anaemia identified during pregnancy. Characteristic hypochromic, microcytic erythrocytes are seen on the peripheral blood smear in cases of severe iron shortage (Pratt and Khan, 2016). Haemoglobinopathies, inflammatory processes, chemical toxicity, malignancy and pyridoxine-responsive anaemia are only a few other reasons of hypochromic anaemia that should be taken into account. The megaloblastic anaemia of pregnancy caused by folic acid insufficiency and, to a lesser extent, by vitamin B12 deficiency, make up most of the remaining cases of anaemia in pregnancy other than the iron-deficiency variety (Miles, Kunz, Na, Braat, Burbury and Story,

2019). Humans rarely get anaemia brought on by nutrient or vitamin deficits. In the populations of wealthy countries, nutritional anaemia is not a widespread issue. It remains a concern for many people in these nations and it is undoubtedly a serious health issue in developing, underprivileged nations (Miles, Kunz, Na, Braat, Burbury and Story, 2019). In third-world nations, as well as in the United States and Europe, pregnant women, menstrual women and children make up the segment of the population that is impacted by nutritional inadequacy, which is occasionally accompanied by frank anaemia (Frise and Robbins, 1985). Without precluding a priori alternative, less prevalent types of anaemia, the examination of acquired anaemia during pregnancy is crucial given that poor nutrition and nutritional deficiencies have a negative effect on the outcome of pregnancies (Houston, Hurrie and Graham, 2018).

2.6 Prevention of Anaemia in Pregnancy

The amount of food consumed by women and children that promotes haemoglobin production is important for treating anaemia (Brodsky and Jones, 2005). In general, foods that are strong providers of iron, copper, zinc, folic acid, vitamin B-12 and protein should be prioritized for treating anaemia. Iron and B vitamins work particularly well together to treat anaemia (Brodsky and Jones, 2005). Consequently, pernicious anaemia can be caused by low amounts of vitamin B12. Taking vitamin B12 pills is a common treatment for this kind of anaemia. Breakfast cereals with fortified vitamin B12, meats such as cattle liver, poultry and fish, eggs and dairy products (such as milk, yogurt and cheese) are some food sources of this vitamin as are foods like soy-based drinks and vegetarian burgers that have been fortified with vitamin B12 (Brodsky and Jones, 2005).

Additionally, diets include foods that contain folic acid (folate), a type of vitamin B. Folic acid is required by their body to create and sustain new cells. Additionally, folic acid is crucial for expectant mothers. It aids in preventing anaemia and encourages the foetus' proper growth. Black-eyed peas and dried beans, beef liver, eggs, bread, pasta and rice with added folic acid, spinach and other dark green leafy vegetables, bananas, oranges

and several other fruits and juices are also excellent sources of folic acid (Ezzati, Lopus, Dogers, Vander and Murray, 2002). Thus, vitamin C aids in the body's absorption of iron. Vegetables and fruits, particularly citrus fruits, are excellent sources of vitamin C. Oranges, grapefruits, tangerines and other similar fruits are examples of citrus fruits. Fruits, vegetables and liquids that are fresh or frozen often provide more vitamin C than those that are canned. Kiwi fruit, strawberries and cantaloupes are other fruits high in vitamin C. Broccoli, peppers, Brussels sprouts, tomatoes, cabbage, potatoes and leafy green vegetables like turnip greens and spinach are among the vegetables high in vitamin C. (Ezzati, Lopus, Dogers, Vander and Murray, 2002).

Foods to eat for anaemia are characterized by the deficiency of the quality and quantity of haemoglobin, a molecule found in the red blood cells. Haemoglobin is important as it carries oxygen from the lungs to the heart and from there to all the tissues in the human body (Harper and Emmanuel, 2015). When the haemoglobin is unable to carry oxygen to the body's tissues, the body develops anaemia (Kapur, Agarwal, Sharma, Kela and Kaur, 2002). Anaemia in women can cause symptoms like extreme fatigue, sleeplessness, light-headedness, pale skin and shortness of breath, irregular menstruation cycles and an extremely fast heartbeat (Kilbridge, Bakea, Parapia, Khoury, Shugaidef and Jerwood, 1999).

Fruits that are high in iron, including tomatoes and apples, are excellent for curing anaemia. When consumed in significant quantities, plums, bananas, lemons, grapes, raisins, oranges, figs, carrots and raisins are other fruits that can effectively treat anaemia (Ministry of Family and Health Welfare, 2002/2003). A powerful supplier of iron, copper and manganese is honey. These components help to synthesize haemoglobin when combined. Honey is also an effective tool in the fight against anaemia, but red meats like liver, heart and kidney are useful for curing anaemia (Mukherjee and Ghosh, 2012). Additionally, useful against anaemia are poultry, salmon and oysters. Iron-rich, energizing greens including kale, spinach, lettuce, beets, broccoli, fenugreek and celery can effectively heal anaemia. In addition to being high in iron, these veggies are also a good source of vitamin B12 and

folic acid, which give the body the energy it needs to recover from anaemia (Mukherjee and Ghosh, 2012). Those with anaemia can consume beetroot juice, a vegetable juice high in iron, as a tonic against fatigue and sluggishness. The symptoms and causes of anaemia can be effectively treated with legumes and nuts, such as pulses, almonds, whole grain cereals, dry dates, peanuts and walnuts (Natasha and Yasmin, 2010).

2.7 Summary

The chapter illuminated the entire concepts in relation to anaemia in pregnancy as they are the instrumental elements in this study about knowledge of pregnant women regarding the effects of anaemia on pregnancy outcomes in Vhembe District, South Africa. The researcher also went on to discuss the risk factors of anaemia in pregnancy and illustrated the measures that can help to prevent anaemia. Moreover, various treatments of anaemia were also discussed. Consequently, the researcher outlined the causes and consequences of anaemia and summed up with the figure that grounded the literature (i.e., Figure 2.1).

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

Research methodology is the process or plan for conducting the specific steps of the study (Grove and Gray, 2019). This chapter outlines the research design, the research population, sampling frame, sample size, data-collection methods, validity and reliability of the data collection instrument, data processing and analysis, ethical considerations and plan for dissemination of the findings.

3.2 Research Approach

In this research study, a quantitative approach was used; this is a formal, objective, rigorous and systematic process for generating numerical information about the world. Quantitative research is conducted to describe new situations, events, or concepts, examine relationships among variables and determine the effectiveness of interventions and, in this case, on selected health outcomes (Grove and Gray, 2019). The researcher used the quantitative approach in this study to ascertain the knowledge of pregnant women regarding the effects of anaemia on pregnancy outcomes.

3.2.1 Descriptive Design

A descriptive design was used in this study; this design is an exploration and description of phenomena in real-life situations. Descriptive studies are usually conducted with large numbers of subjects or study participants, in natural settings, with no manipulation of the situation (Grove and Gray, 2019).

This design helped the researcher to categorize the information pregnant women have regarding the effects of anaemia on pregnancy outcomes in the Vhembe District, South Africa.

3.2.2 Cross-Sectional Design

A cross-sectional study is non-current in nature, hence, it is done at a specific point in time (Grove and Gray, 2019). A cross-sectional design was used in this study as it was considered appropriate for the researcher to describe the knowledge of women regarding the effects of anaemia on pregnancy outcomes. The proposed study focused on pregnant women between the ages of 18 to 35 years with a foetus gestational age from 20 weeks.

3.2.3 Study Setting

According to Burns and Grove (2015), a research setting is the specific place or places where data are collected. This study was conducted in primary health-care facilities in Vhembe District (Figure 3.1).

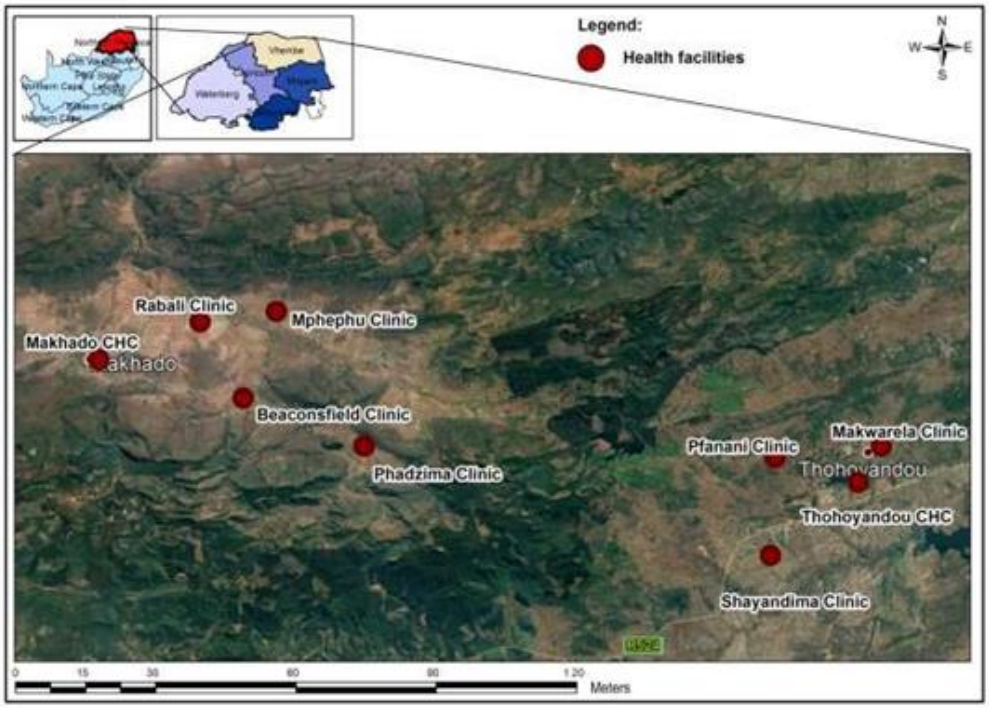


Figure 3.1: A map of Vhembe District, primary health care facilities.

Vhembe District is a category C municipality located in the Northern part of Limpopo Province, South Africa, sharing borders with Zimbabwe, Botswana, Mozambique and North-West Province. It is the 19th largest district with four local municipalities, namely, Collins Chabane, Makhado, Thulamela and Musina. In terms of population size, in 2019, Vhembe District had a total of 1 402 779 people, with 416 728 residing in Makhado, 497 237 in Thulamela, 347 974 in Collins Chabane and 32 009 in Musina. Makhado is the most populated municipality in the District, while Musina is the least.

There are 7 470 child- headed households in the District; this is about one quarter of the figure for Limpopo Province and less than 10% of the whole country. About 51% of these households are headed by women. Within the Vhembe District Municipality, the number of people without any schooling decreased from 167 166 (2009) to 92 469 (2019), while in the same period the number of people within the 'matric only' category, increased from 75 567 to 174 521. The number of people with 'matric and a certificate/diploma' increased from 25 736 to 55 648 in the same period, while the number of people with a 'matric and a Bachelor's degree increased from 2 669 to 26 563. The overall improvement in the level of education is visible with the increase in the number of people with 'matric' or higher education.

With regard to the economy, with a GDP of R 63.4 billion in 2018 (up from R 27.8 billion in 2008), the District contributed 17.71% to the Limpopo Province GDP of R 358 billion in 2018, increasing its share of the Limpopo's GDP from 17.09% in 2008. In the report - The District Profile - the Vhembe District Municipality contributes 1.30% to the GDP of South Africa which was R 4.87 trillion in 2018. In terms of employment, the number of formally employed people in Vhembe was estimated at 202 000 in 2018, which is about 67.20% of the total employment, while the number of people employed in the informal sector accounted for 98 800 or 32.80% of the total employment.

Informal employment in Vhembe increased from 62 100 in 2008 to an estimated 98 800 in 2018. Health services are delivered by - 1 Regional Hospital, 6 District Hospitals, 1

Specialized Psychiatric Hospital, 8 Community Health Centres, 112 clinics and 22 mobile clinics. The health facilities are run by the Province. Makhado and Thulamela appear to have well distributed PHC facilities, whilst Mutale, based on its population seems to need additional facilities. Musina has a low population and the available facilities render reasonable services according to the Provincial District Health Plan.

3.3 Study Population

Burns and Grove (2015) stated that a population comprise all elements (individual, objects or substances) that meet the criteria for inclusion in the study. The target population in this study was pregnant women attending ANC in primary health-care facilities in Vhembe District, Limpopo Province, South Africa. The study target population from the clinic registers consisted of a maximum of 200 pregnant women who were recorded and were eligible to participate. The researcher, therefore was focusing on pregnant women from 20 weeks gestational age because anaemia in pregnancy can be diagnosed as early as from the beginning of the pregnancy.

3.4 Sampling Method and sample size

Grove and Gray (2019) explained sampling as a process of selecting a group of people, events, behaviours, or other elements that are representative of the population being studied.

3.4.1 Sampling of Health Facilities

Non-probability purposive sampling was used to select health care facilities that offer antenatal care (ANC) within Vhembe District. Purposive sampling allowed the researcher to select the sample based on the knowledge of the study population and phenomena under study. Facilities were selected because they all offered ANC and are located in rural areas in Vhembe where anaemia in pregnancy seems to be a problem. Literature reviewed on studies done showed women in the area lack knowledge regarding the impact of anaemia on the outcomes of pregnancy.

The researcher purposively selected 9 health care facilities that offers ANC in Vhembe District, 4 health care facilities under Thulamela Municipality which are Thohoyandou Community Health Centre, Pfanani Clinic, Makwarela Clinic and Shayandima Clinic, and 5 under Makhado Municipality which are Makhado Community Health Centre, Mphephu Clinic, Rabali Clinic, Beacon's Field Clinic and Phadzima Clinic. The researcher selected these facilities because the statistics in the antenatal clinic register revealed a high incidence of anaemia in pregnancy and most of the women in the surrounding areas are unemployed with less social and economic stability. Therefore, the circumstances pose them at risk of anaemia in pregnancy due to lack of adequate information and the condition is also triggered by their lifestyle during pregnancy.

3.4.2 Sampling of Respondents and sample size

A probability sampling procedure is more likely to be representative of the population and to reflect its variations. The process allows all elements in the population to have an equal chance of being included in the sample. Probability sampling permits the researcher to estimate the sampling error; it reduces bias in the sample or sampling and facilitates the correct use of inferential statistics by the researcher (Brink, Van der Walt and Rensburg,

According to Brink and Van Rensburg (2018), representativeness means that the sample should be similar to the entire population in as many ways as possible. The sample should, thus, replicate the population variables in approximately the same proportion as they occur. The demographic information that researchers commonly examine includes educational level, gender, ethnicity, age and income level, as these tend to influence the variables. A representative sample helps the researcher to generalize from the sample to the target population by drawing conclusions about the population from which the sample was derived.

The researcher used probability sampling so that all elements in the population can have equal chances of participation, also to estimate sampling error and to reduce sampling bias. The researcher worked with a representative sample because it allowed the researcher to

extend the collected information to a larger population.

However, the sample size was calculated using Slovin's formula as shown below:

n = sample size of the adjusted population

N=population size

e=accepted level of error set 0.05

$$n = \frac{N}{1 + Ne^2}$$

$$n = \frac{200}{1 + 200(0.05)^2}$$

$$n = \frac{200}{1 + 0.5}$$

$$n = 133$$

Table 3.1 shows the sampling frame, the number of respondents in each health facility and the number of respondents who participated in each health facility and their percentages.

Table 3.1: Sampling frame

Name of health facility	Number of pregnant women who attend ANC in the selected facilities, per day.	Number of respondents who participated in the study	Percentage
Makwarela Clinic	27	27/200x133=18	13.5%
Makhado CHC	30	30/200x133=20	15%
Thohoyandou CHC	40	27/200x133=27	20.3%
Phadzima Clinic	15	15/200x133=10	7.5%
Shayandima Clinic	15	15/200x133=10	7.5%
Beacons Field Clinic	20	20/200x133=13	17.4%
Pfanani Clinic	35	35/200x133=23	9.7%

Rabali Clinic	10	10/200x133=6	5.3%
Mphephu Clinic	8	8/200x133=6	3.8%
Total	**200**	**133**	**100%**

3.4.3 Inclusion and Exclusion Criteria

Inclusion criteria are the requirements identified by the researcher that must be present for participants or elements to be considered part of the target population for possible selection for a study sample (Grove and Gray, 2019)**.** The inclusion criteria considered the following:

- All pregnant women with gestational age starting from 20 weeks and attending ANC visits in selected health care facilities in the Vhembe District.
- Pregnant women who were willing to participate.

Exclusion criteria are potential study participants who meet the inclusion criteria but present with additional characteristics that could interfere with the success of the study (Grove and Gray, 2019). The exclusion criteria considered the following:.

- All pregnant women who meet the inclusion criteria but did not give consent for participation

3.5 Measuring Instrument

A self-developed and administered questionnaire was used as the data collection tool (Annexures 8A and 8B). The questionnaire was developed based on the literature review, other previous questionnaires relevant to the study and with the assistance of a statistician. The questionnaire comprised of closed-ended questions because this format increases the reliability of the responses and biased is reduced; it is also time efficient as well as easy to code and interpret. The questions focused on:

- Biographical information

- Knowledge regarding causes of anaemia
- Knowledge on the effects of anaemia on pregnancy outcomes

3.6 Pre-Testing the Instrument

A pre-test was done to investigate for possible flaws in the data-collecting instrument, such as ambiguous instructions or wording, inadequate time limits and so on, as well as whether the variables defined by operational definitions are observable and measurable (Brink and Rensburg, 2012).

The pre-test was 10% of the actual size of the respondents in the study, meaning that respondents who took part in pre-testing were 20. The reason for pre-testing was to check if the questions would produce results that meet the objectives of the study. The questionnaire was reviewed by the supervisors and statistician for any errors and ambiguity.

3.7 Plan for Data Collection

Data collection is the process of gathering and measuring information on variables of interest, in an established fashion that enables one to answer stated research questions (Brink, 2012). The researcher obtained permission to conduct study from the Limpopo Province Department of Health (Annexure 4) and the Vhembe District Department of Health (Annexure 5). The researcher reached out to the managers of the facilities and made arrangements in line with the pregnant women's ANC visits. Data were collected in all facilities according to ANC visits days, researcher visited four facilities in two days and managed to collect data from two facilities a day. The researcher explained the purpose and process of the study to pregnant women who were willing to participate (Annexures 6A and 6B). Questionnaires were handed out personally by the researcher to all pregnant women who were available and willing to participate at the sampled health care facilities, the research was available for questions and clarity throughout the process,each respondents took about 10-20 minutes to answer the questionnaire. The data collection

happened before ANC consultations and the researcher was given consultation rooms for privacy in all facilities. 133 pregnant women participated in the study and division according to facilities is as follows, 18 from Makwarela clinic, 20 from Makhado CHC, 27 from Thohoyandou CHC, 10 from Phadzima clinic, 10 form Shayandima clinic, 13 from Beacons field clinic, 23 from Pfanani, 06 from Rabali clinic and 06 from Mphephu clinic. The researcher adhered to all Covid-19 protocols, such as ensuring that all respondents were wearing masks that covers both nose and mouth, sanitizing their hands, maintaining social distance of more than 1.5 metres from each another before entering the venue in which the data were collected to minimize the risk of contracting the corona virus.The researcher showed gratitude to all participants by thanking them all and answering all the questions they had related to anaemia in pregnancy and pregnancy in general.

3.8 Plan for Data Management and Analysis

To manage the data, all the completed questionnaires were cleaned, then captured in an Excel sheet in the form of binary workbook. The Excel binary workbook format was used as it is easy to compress data to manageable size and allows for easy uploading of raw data into the management system of the Statistical Package for the Social Sciences (SPSS) version 28. Questionnaires with errors or those not fully completed were not entered into the system. Categorical data were interpreted using tables. Descriptive statistics was used to describe and summarize the data collected; frequency distributions were used, where the data were arranged systematically from lowest to highest order through percentages.

3.8.1 Reliability

Reliability is the level of consistency with which an instrument measures quality (Pilot and Beck, 2012). Test-retest is the process of measuring the stability of test over time by corresponding the scores from repeated measurements; the results of the test-retest should be that attributes to be measured remain the same at two testing times and that any change in the value indicates a random error (Grove and Gray, 2019). The test-retest

method was done to determine the reliability of the questionnaires and was by filling out of the questionnaires by respondents who were not part of the study. Reliability analysis using Cronbach's Alpha is a measure of internal consistency of a set of test items (Taber, 2018). The minimal tolerable measure of reliability was 0.70 (Pallant ,2016). The internal consistency (reliability) coefficients using Cronbach's Alpha for the items used (consequential anaemia and factor anaemia) were found well above the level of 0.5. Anaemia knowledge had an Alpha of 0.443 which are lower than 39, the minimum required reliability. However, it can be accepted as the instruments used consequential anaemia and factor anaemia that had more items than knowledge anaemia by 4 and 6, respectively, which might be the cause of lower Cronbach's Alpha (Kline, 2015). A summary of the regression coefficients is given in the Table 4.13.

3.8.2 Validity

Validity refers to the extent to which an instrument or measurement method accurately reflects or is able to measure a construct (or concept) being examined (Grove and Gray, 2019). Validity was ensured by the researcher through refining the questionnaire, utilizing the feedback from the pre-test to modify the questions, with the assistance of the supervisors.

3.8.2.1 Content Validity

Content validity refers to the extent to which items on a scale include the major elements relevant to the construct being measured (Grove and Gray, 2019). Pre-testing of the scale was done to ensure the validity of the instrument. To ensure that all the necessary variables are included in the questionnaire, relevant literature was reviewed before developing the instrument. The instrument/questionnaire contained items that reflected the research purpose.

3.8.2.2 Face Validity

Face validity is a subjective determination that an instrument is adequate for obtaining the

desired information (Brink and Rensburg, 2012). The data-collecting instrument was developed with the aim of answering the research question and was reviewed by the supervisor, co-supervisors and a statistician to ensure face validity before distributing them to the respondents. The instrument contained instructions and headings that guided the respondents (Annexures 8A and 8B).

3.9 Ethical Considerations

According to Polit and Beck (2012), research ethics refers to a system of moral values that are concerned with the degree to which the research procedures adhere to professional, legal and social obligations towards the study participants. The proposal was submitted to University of Venda Department of Advanced Nursing, Faculty of Health Sciences Higher Degrees Committee and to the Human and Clinical Trials Research Ethics Committee (HCTREC) for ethical clearance (Annexure 1). Permission to conduct the study was requested from Limpopo Department of Health Provincial Research Committee (Annexure 2) and the Vhembe District Health Department (Annexure 3), and the respective letters of approval were received (Annexures 4 and 5). Appointments were made with the managers of the selected facilities to explain the purpose and request for permission to conduct the study. The following ethical considerations were adhered to:

3.9.1 Right to Self-Determination

The respondents were informed that participating in the study was voluntary. Voluntary participation enhances honesty in the study. The researcher explained to respondents that participating in the study is out of their free will, hence, they have the right to withdraw from the study anytime and not be subjected to any penalty. The research process concerning the participation was explained, comprehensively, to the respondents (Annexures 6A and 6B).

3.9.2 Informed Consent

The research purpose and process were explained in detail to the respondents and consent

was given by the respondents in a written form. The researcher gave respondents a chance to ask questions regarding the study, to clear any issues that respondents had. Respondents were only allowed to sign consent (Annexures 7A and 7B) when they understood the purpose and process of the study and what was expected of them; that ensured that participation was voluntary and they could withdraw from the study anytime.

3.9.3 Confidentiality

Confidentiality was maintained by keeping the names of the respondents anonymous. Alphabets and numbers - Respondent A, Facility 1 - were used to label facilities and respondents. The researcher will keep the information of the respondents safe and will not leak any information to outsiders not connected with the research.

3.9.4 Prevention from Harm

Questions were carefully structured and respondents were monitored for any signs of distress; had this occurred, the researcher would facilitate debriefing by giving participants opportunity to ask questions, take a break and even refer them for counselling, if necessary.

3.9.5 Rights to Privacy

Leedey and Ormrod (2013) stated that any research involving human beings should respect the respondents' rights to privacy. Right to privacy was maintained by conducting data collection in a private space and further maintaining confidentiality by not exposing the respondents' personal details.

3.10 Plan for Dissemination of Information

The findings of the study will be disseminated through research workshops and presentations at research conferences. The thesis will be made available in the University of Venda library. Results of the study will also be published in accredited journals.

3.11 Summary

The study was conducted in health care facilities in the Vhembe District, Limpopo, South Africa. Nine health care facilities offering ANC services were purposively sampled – 4 facilities under Thulamela municipality and 5 facilities under Makhado municipality. Health facilities that took part in the proposed study fall within Vhembe District - Makhado Community Health Centre, Mphephu Clinic, Rabali Clinic, Beacon's Field Clinic, Phadzima Clinic, Pfanani Clinic, Thohoyandou CHC, Sibasa Clinic and Shayandima clinics, Makwarela clinic. The study sample size consisted of 133 pregnant women attending ANC visits in the selected health care facilities; respondents were selected through probability sampling from the selected health care facilities. A descriptive cross-sectional quantitative method was used in this study to assess the knowledge of pregnant women regarding anaemia on pregnancy outcomes. Data were collected through a self-administered questionnaire that was designed to achieve the research objective and were interpreted through tables (frequencies and percentages, and correlation coefficients). Recommendations from the findings of the study are made in Chapter 5.

CHAPTER 4

DATA PRESENTATION AND INTERPRETATION

4.1 Introduction

The previous chapter outlined the research design, the research population, sampling frame, sample size, data-collection methods, validity and reliability of the instrument, data processing and analysis, ethical considerations and plan for dissemination of the findings. The researcher presented all the accurate data collected through questionnaires from the various health care facilities in Vhembe district, where 135 questionnaires were distributed to the respondents to allow attrition and only 133 questionnaires were collected.

Data were collected to achieve the main purpose of the study “to determine the knowledge of pregnant women regarding the effects of anaemia on pregnancy outcomes”. Therefore, received survey questionnaires were used in this study as they were presenting the entire population. Researcher obtained data below. From the abovementioned research aim, this objective was outlined:

- Assess knowledge of pregnant women attending antenatal care in health facilities within Vhembe District, regarding the effects of anaemia on pregnancy outcomes.

The chapter comprises of 6 sections. In Section A, the descriptive statistics which describe the personal characteristics of respondents are summarized in tables and discussed, Section B covers the respondents’ knowledge related to anaemia in pregnancy, Section C deals with the respondents’ knowledge on the effects of anaemia on pregnancy outcomes,

Sections D contains data on the respondents' knowledge on the causes of anaemia on pregnancy outcomes, Section E entails a synthesis of the correlation results and hypotheses testing and Section F embodies the regression analysis to determine the variable that most predicts knowledge on the effects of anaemia on pregnancy outcomes.

4.2 Section A: Demographic Profile of Respondents (Descriptive Statistics)

4.2.1 Age of the Respondents

Table 4.1 summarizes the ages of the respondents.

Table 4.1: Ages of the respondents

Category	Frequency (n)	Percentage (%)
15-20	9	6.8%
21-30	93	70.0%
31-40	31	23.2%
Total	**133**	**100%**

The majority of pregnant women who experienced anaemia were in the age group 21-30 years (n=93; 70.0%), followed by the 31-40 year age group (n=31; 23.2%), whereas women ranging in age from 15-20 years represented the least affected group (n=9; 6.8%).

4.2.2 Educational Levels of the Respondents

Table 4.2 summarizes the educational levels of the respondents. Participants with secondary education were in the majority within the district since 50 women (37.6%) have achieved this level of education. Moreover, tertiary level was obtained by 12 participants (9.0%), whereas primary education was obtained by 46 females (34.6%). Lastly, 25 (18.8%) pregnant women did not attend school at all.

Table 4.2: Educational levels of the respondents

Category	Frequency (n)	Percentage (%)
No schooling	25	18.8%
Primary	46	34.6%
Secondary	50	37.6%
Tertiary	12	9.0%
Total	**133**	**100%**

4.2.3 Religion of the Respondents

Table 4.3 summarizes the religious affiliations of the respondents.

Table 4.3: Religion of the respondents

Category	Frequency (n)	Percentage (%)
Christianity	105	78.9%
Traditional	28	21.1%
Total	**133**	**100%**

The majority of pregnant women (n=105; 78.9%) were affiliated to Christianity while those affiliated to Traditional religion constituted the remainder (n=28; 21.1%).

4.2.4 Employment Status of the Respondents

Table 4.4 summarizes the employment status of the respondents. The majority of the respondents were unemployed (n=77; 58%).

Table 4.4: Employment status of the respondents

Category	Frequency (n)	Percentage%
Yes	56	42%
No	77	58%
Total	**133**	**100%**

4.2.5 Income Sources of the Respondents

Table 4.5 summarizes the income sources of the respondents.

Table 4.5: Income sources of the respondents

Category	Frequency (n)	Percentage (%)
Formal employment	46	34.6%
Grant	63	47.4%
Labourers	10	7.8%
Self-employment	14	10.5%
Total	**133**	**100%**

Pregnant women who earned income from social grant were in the majority (n=63; 47.4%). This means that most participants were receiving money from government grants to support their families. Other participants received income as labourers (n=10; 7.8%), being formally employed (n=46; 34.6%) or self-employed (n=14; 10.5%).

4.2.6 Number of Pregnancies (Parity) of the Respondents

Table 4.6 summarizes the parity of the respondents.

Table 4.6: Parity intervals of the respondents

Category	Frequency (n)	Percentage (%)
1-3	42	31.6%
4-6	91	68.4%
7 and above	0	0.0%
Total	**133**	**100%**

The majority of pregnant women had a parity score/interval of 4-6 (n=91; 68.4%), followed by those with a parity interval of 1-3 (n=42; 31.6%). None of the women fell pregnant more than seven times.

4.2.7 Appetite and Cravings of the Respondents

Table 4.7 summarizes the appetite and cravings of the respondents.

Table 4.7: Appetite and cravings of the respondents

Category	Frequency (n)	Percentage (%)
Soil	72	54.1%
Ice cubes	24	18.0%
Dry foods	37	27.8%
Total	**133**	**100%**

Pregnant women who developed appetite and cravings for soil were in the majority (n=72; 54.1%), compared to those who craved for ice cubes (n=24; 18.0%) and dry food (n=37; 27.8%.

4.2.8 Food Preferred by the Respondents

Table 4.8 summarizes the foods preferred by the respondents. Most pregnant women preferred fruit (n=47; 35.3%), followed by the ones for meat (n=45; 33.8%), vegetables (n=17; 12.8%) and porridge (n=24; 18%).

Table 4.8: Foods preferred by the respondents

Category	Frequency (n)	Percentage (%)
Fruits	47	35.3%
Meat	45	33.8%
Vegetables	17	12.8%
Porridge	24	18.0%
Total	**133**	**100%**

4.3 Section B: Respondents' Knowledge Related to Anaemia in Pregnancy

Table 4.9 summarizes the respondents' knowledge on the causes of anaemia.

Table 4.9: Respondents' knowledge related to anaemia

Item	Knowledge related to anaemia	Frequency (n)	Percentage (%)	Variance
9	What is anaemia in pregnancy?	47	35%	0.501
10	What are the risk factors of anaemia in pregnancy outcomes?	7	5%	0.498
11	What are the signs?	27	20%	0.490
12	How is anaemia in pregnancy prevented?	19	15%	0.502
13	How is anaemia in pregnancy treated?	33	25%	0.502
Total		**133**	**100%**	

The findings revealed pregnant women in Vhembe district had an inadequate understanding regarding anaemia in pregnancy as depicted by the statistics as follows: what is anaemia–35%, what could be the treatment at–25%, signs of anaemia–20% and prevention of in pregnancy–15%. However, the study showed that very few had knowledge regarding the effects of anaemia in the pregnancy outcomes–5%.

4.4 Section C: Respondents' Knowledge on the Effects of Anaemia on Pregnancy Outcomes

Table 4.10 summarizes the respondents' knowledge on the effects of anaemia on pregnancy outcomes. Table 4.10 depicts the statistical variance which is a dispersion measurement that accounts for the spread of each data point in a data set. Along with the standard deviation, which is just the square root of the variance, it is the measure of dispersion that is most frequently employed. In this study, the variances of the variables under study are depicted below. For instance, Spontaneous abortion, also known as miscarriage, is reported as the maternal/labour-related outcome has a variance of 0.130.

Table 4.10: Respondents' knowledge on the effects of anaemia on pregnancy outcomes

Item	Maternal/labour-related outcomes	Frequency (n)	Percentage (%)	Variance
14	Spontaneous abortion	17	12%	0.130
15	Preterm labour	57	43%	0.429
16	Antepartum	41	31%	0.311
17	Postpartum haemorrhage	55	41%	0.417
18	Maternal morbidity	55	43%	0.413
19	Maternal mortality	69	52%	0.522
Item	**Neonatal-related outcomes**	**Frequency (n)**	**Percentage (%)**	**Variance**
20	Low birth weight	44	33	0.333
21	Neonatal morbidity	59	43	0.443
22	Neonatal mortality	58	43	0.436
23	Neonatal anaemia	70	52	0.523
24	Intrauterine growth restrictions	57	43	0.434
25	Still birth	41	35	0.356

It is followed by antepartum, where patients have a variance of 0.130. Preterm labour can have an impact on how a pregnancy turns out. Early birth of a baby might result in anaemia (0.429). However, bleeding also has consequences (0.417). The death of a woman after giving birth also has a significant impact (0.522).

4.5 Section D: Respondents' Knowledge on the Causes of Anaemia on Pregnancy Outcomes

Table 4.11 summarizes the respondents' knowledge on the causes of anaemia on pregnancy outcomes. Table 4.11 depicts that women are connected to the factors that can result in anaemia in a pregnancy. Anaemia was brought on by consuming soil (0.512), raw, unwashed produce (0.434), worm infestations (0.544), diseases like malaria and HIV (0.555), continuous use of traditional remedies (0.413), many pregnancies (0.413) and congenital cardiovascular disease (0.413).

Table 4.11: Respondents' knowledge on the causes of anaemia on pregnancy outcomes

Item	Causes of anaemia on pregnancy outcomes	Frequency (n)	Percentage%	Variance
26	Worm infestation	54	41	0.544
27	Eating raw vegetables	43	32	0.434
28	Eating unwashed fruit and vegetables	43	32	0.434
29	Eating soil	51	39	0.512
30	Infections such as malaria	55	41	0.555
31	Infections such as HIV	55	41	0.555
32	Prolonged use of traditional herbs	41	30	0.413
33	Multiple pregnancy	41	30	0.413
34	Congenital cardiovascular disease	41	30	0.413

4.6 Correlation Results: Hypotheses Testing

Table 4.12 explains the means and standard deviations of the overall respondents / participants (females in this study). Age of female (x 2.86, SD 1.16), consequential anaemia of female (x 1.48, SD 0.20) and total consequential anaemia in terms of female (pregnant women) aptitude were less satisfied with anaemia factor (x 1.56, SD 0.50). Female aptitudes were more knowledgeable, anaemia equipped in their respective areas (x 1.47, SD 0.50). Hypotheses were analyzed using the Pearson's correlational analysis.

The results of the study indicate that there is a strong positive, statistically significant relationship amongst Knowledge on the effects of anaemia on pregnancy outcomes, Knowledge on the causes of anaemia on pregnancy outcomes and Knowledge related to anaemia in pregnancy ($r=1$, $p<0.01$). There will be positive intention to understand anaemia outcomes from pregnant women in Vhembe district. The researcher predicted that — There will be negative impact of Knowledge related to anaemia in pregnancy if pregnant women fail to disclose the outcomes of giving birth. Meaning they should provide information about the effects and consequences on a newborn.

Table 4.12: Zero-order correlation among variables

Variables	x̄	1	2	3	4	5	6	7	8
Age	2.86	1	0.009	-0.098	0.008	-0.061	0.009	-0.125	-0.004
Types of food	2.14	0.009	1	-0.075	0.052	0.075	-0.023	0.133	-0.009
Educational level	2.37	-0.098	-0.075	1	-0.075	-0.038	-0.044	-0.065	-0.044
Pregnancy	2.00	0.008	0.052	-0.075	1	0.149	-0.151	0.019	-0.133
Weight	2.02	-0.061	0.075	-0.038	0.149	1	-0.010	0.164	-0.031
KEAPO	1.48	0.009	-0.023	-0.044	-0.151	-0.010	1	-0.055	0.066
KRAP	1.47	-0.125	0.133	-0.065	0.019	0.164	-0.055	1	-0.17*
KCAPO	1.48	-0.004	-0.009	-0.044	-0.133	-0.030	0.066	-0.17*	1

**Correlation is significant at the 0.01 level (2-tailed); ** = p < 0.01 level; * = p < 0.05 level; KEAPO = Knowledge on the Effects of Anaemia on Pregnancy Outcomes; KCAPO = Knowledge on the Causes of Anaemia on Pregnancy Outcome; KRAP = Knowledge Related to Anaemia in Pregnancy.

However, Knowledge related to anaemia in pregnancy was an independent variable and Knowledge on the effects of Anaemia on pregnancy outcomes was dependent variable together with Knowledge on the causes of Anaemia on pregnancy outcome. The findings indicated that there was a significant negative relationship between the knowledge anaemia and consequential anaemia ($r=-0.18$, $p<0.05$), hence, there was a positive relationship between Knowledge related to anaemia in pregnancy and Knowledge on the effects of anaemia on pregnancy outcomes ($r=0.6$, $p<0.05$).

4.7 Regression Analysis

To check which variable between Knowledge on the Effects of Anaemia on Pregnancy Outcomes and Knowledge on the Causes of Anaemia on Pregnancy Outcomes is the most reliable predictor of Knowledge Related to Anaemia in Pregnancy in pregnant women in the Vhembe district, regression analysis was conducted. Table 4.13 summarizes Knowledge on the effects of anaemia on Pregnancy Outcomes and Knowledge on the causes of anaemia on Pregnancy Outcomes *as predictors of* Knowledge Related to

Anaemia in Pregnancy.

Table 4.13: Regression Coefficients

Unstandardized Coefficients			Standardized Coefficients		
Model	**β**	**Std. Error**	**β**	**T**	**Sig.**
1 constant	1.122	0.074		13.344	0.000
Consequential anaemia and effects anaemia	0.551	0.034	0.216	13.561	0.000
Knowledge anaemia	2.606	0.157	0.715	15.081	0.000

Dependent Variable: Knowledge Anaemia

Regression analysis was carried out to determine which variable amongst the two independent variables namely, Consequential Anaemia and Effects Anaemia is the most predictor of the dependent variable (Knowledge Anaemia). Results in Table 4.13 shows that Consequential Anaemia is the only Knowledge Anaemia (β=0.551, p=0.000).

4.8 Summary

This chapter embodied the data presentation and interpretation of the demographic profile of respondents (descriptive statistics) wherein age, educational, food, appetite and craving, religion, pregnancy and income source were all outlined. The researcher also interpreted “Knowledge on the causes of anaemia on pregnancy outcomes together with knowledge of anaemia effects on pregnancy outcomes”. The relationship between the variables have been tested and presented in the correlation tables to depict the results and lastly, regression analysis checking variables between Knowledge on the effect of anaemia pregnancy and Knowledge on the causes of anaemia on the pregnancy outcomes to determine the most reliable predictor of Knowledge related to anaemia pregnancy.

CHAPTER 5

DISCUSSION OF RESULTS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The previous chapter outlined the descriptive statistics which described the personal characteristics of respondents summarized in tables. The knowledge profiles on the causes of anaemia were presented in a table format and discussed. The knowledge on the effects of anaemia pregnancy outcomes have been tabulated and explained as per the results from data analysis. The researcher has outlined hypotheses testing (correlations) and the regression analysis to check the variable that most predicts knowledge on the effects of anaemia on pregnancy outcomes was presented. In this chapter, a discussion of the results presented in Chapter 4 is composed. Additionally, a discussion of descriptive statistics, reliability results, correlation results, regression analysis results and conclusions, limitations of the study and recommendations for future studies and the summary of the study are given.

5.2 Discussion of the Results

The following section discusses the descriptive statistics, reliability analysis, correction and regression analysis results.

5.2.1 Demographic and Biographical Data

5.2.1.1 Age

In the Vhembe district, pregnant women between the ages of 21 and 30 predominated in

terms of being the ones most affected by anaemia. The researcher completed the data analysis and discovered that pregnant women between the ages of 31 and 40 are at an increased risk of an anaemia consequence as well. Nearly 600 000 women between the ages of 15 and 44 worldwide lose their lives each year due to complications associated to pregnancy and childbirth. Globally, there are an estimated 390 maternal deaths per 100 000 live births, with the bulk of these occurrences occurring in underdeveloped countries (WHO, 2015). Most African countries and a few Asian counterparts have rates as high as 700/100 000 live births (Kabatereine, Broker and Koukounari, 2007). According to Kabatereine, Broker and Koukounari (2007), who reported the cases of anaemia impact, the total range of women who had anaemia effects could die from the ages 21 to 50 years.

5.2.1.2 Education

In order to determine and analyze whether education is a significant factor in the effects of anaemia on women, the researcher has divided educational levels into no formal education, elementary, secondary and tertiary. The only women who do not experience more of the anaemia effects, according to the researcher, are those who have completed their tertiary education, the researcher found only 12 of the 133 in this investigation. Out of 133 people, 25 did not attend any school at all. This means that women in the secondary education level are the ones who are most affected by anaemia and primary education comes in second with 46 women affected.

In order to decrease anaemia-related death and morbidity, Balasubramanian's study focused on educating pregnant women about how iron supplementation and health education can greatly reduce the frequency of IDA (Balasubramanian, Aravazhi and Sampath, 2016). Since just 17 of the 430 women who were affected were tertiary educated, the anaemia did not affect them as severely. Only 12 out of 133 participants in this trial, according to the researcher, were affected by the anaemia impact.

5.2.1.3 Food

The researcher has analyzed the eating preferences of pregnant women and from them discovered foods that are nearly consumed daily. Since 47 of the women were shown to favour fruits, just 45 of them eat meat. The researcher observed that vegetables were the least preferred food according to the response of the pregnant women on the questionnaires, only 17 respondents stated that they consume vegetables. At least 24 respondents ate porridges which is more nutritious than vegetables alone. The types of food that women eat have been described by Mukherjee and Ghosh (2012), namely, beetroot juice and vegetable juice high in iron can be consumed by persons who have anaemia as a tonic against fatigue and sluggishness. In this study, the researcher discovered that the majority of women eat fruit.

5.2.1.4 Religion

There were only two types of religion that were identified and the dominant one was seen to be consistent with the anaemia impact as religion can potentially have a significant role. The researcher discovered that women who identify as Christians are more likely to be impacted than women who identify as traditional believers, who make up 28 of the total. In this study, the researcher discovered that more Christian women were indeed experiencing the anaemia impact in the Vhembe district. The researcher has discovered 105 of them, therefore this is consistent with the African study. A study done on Maternal knowledge, food restriction and prevention strategies related to anaemia in pregnancy at the university of Uyo teaching hospital shows that the respondents had good knowledge of anaemia in pregnancy, however, restriction of nutritious food was a common practice, customs and religious beliefs were a major influence, this food restrictions of the respondents is a cause for concern as this is a potential risk for anaemia in pregnancy (Ekwere T.A, Ekanem A.M, and Ekwere T.A, 2015). In Ghana, traditional practices and religious beliefs influence pregnant women, practices include food taboos which prevent pregnant women from eating certain foods which may be of high nutrient value, as a result of these practices, pregnant women may suffer from iron and protein deficiencies which could result in anemia in

pregnancy which increases the risk of hemorrhagic shock and death, especially from bleeding during delivery (Otoo P, Habib H, and Ankomah A, 2015).

5.2.1.5 Appetite and Cravings

Women frequently develop appetites for things like soil, ice cubes and dry foods. These foods are recognized as some of those that can have an adverse influence on anaemia. The researcher discovered that 72 out of 133 women experienced cravings and an increased appetite for soil. This is a health concern because the researcher connects the problem to local women who consume soil daily and suffer anaemia as a result without considering the effects of consuming soil daily during pregnancy. Additionally, 24 women who developed desires and an appetite for ice cubes were discovered and only 37 had an appetite and preferences for dry foods.

Hookworm is the primary soil-transmitted helminthic parasite associated with anaemia in expectant mothers (Schreir, 2018). Anaemia may ensue from blood (and iron) loss, which depends on the underlying iron status, other risk factors present and the hookworm's capacity to attach to and feed on the intestinal mucosa (Schreir, 2018). Each year, hookworm infections are thought to cause between 57 and 740 million infections in sub-Saharan Africa and Southeast Asia, mostly in areas with inadequate infrastructure, water, sanitation and hygiene (Centres for Disease Control, 1989). Given that 72 women out of 133 consumed dirt, the association between Schreir's (2018) study and the researcher is thus favourable.

5.2.1.6 Frequency of Pregnancy

In order to find the precise figures, the researcher has divided the groups according to pregnancy patterns into three categories. About 49 of the women who were pregnant for the fourth to fifth time reported difficulty coping with the anaemia effect, according to the researcher. As a result, 42 women who were pregnant for the seventh time or more agreed that their experiences were comparable to those of women who were pregnant for the first

to third time. In the late stages of pregnancy, the researcher discovered the idea of a sixth child.

Therefore, in low and middl- income countries late pregnancy is the period during which women are most vulnerable to environmental stresses, such as nutrient-deficient diets and infectious diseases (Thurnham and Nothrdrop-Clewes, 2004). According to Richards, Baikady and Clevenger (2020), pregnancies with Hb values between 10 and 11 g/dl and between 9 and 10 g/dl are associated with a 20% increased risk of premature delivery and pregnancies with Hb levels below 9 g/dl are associated with a 60% increased risk. These risk factors are thought to have an impact on women who are believed to be pregnant four to six times or more. From third to sixth, the researcher discovered 49 and 42 women, respectively.

5.2.1.7 Economic Support (Income Sources)

The researcher has chosen to include the section on economic support since it is crucial to comprehend where a person gets the money to support their family and determine whether this has any bearing on the anaemia effect. The results of the study show that most women depend on government social grants to support their respective families, grant money alone cannot help these women prevent and treat anaemia, the study shows that 63 women depend on grant money. Then came individuals with superior employment who received salaries and pay. The researcher discovered 46 women are employed and receives pay and salaries, 14 women are informally employed and self-employed, and 10 women were discovered to garden work for an extra income. According to Thurnham and Nothrdrop-Clewes (2004), anaemia was a problem in LMIC due to nutrient-deficient diets, infectious diseases and anaemia impact.

5.2.2 Knowledge Related to Anaemia in Pregnancy

5.2.2.1 What is Anaemia?

According to the study's results as analyzed in Chapter 4, 35% of pregnant women are

aware of what anaemia is. A decrease in the blood's capacity to carry oxygen as a result of unusually few circulating erythrocytes or a dip in haemoglobin (Hb) levels is referred to as "anaemia" (Hoque and Worku, 2005). This study's variance for this explanation of knowledge is 0.501.

The anaemia impact was a product of this limited knowledge of anaemia. Additionally, anaemia is a significant medical issue (Paula, 2017). Pregnant women are expected to be affected at a rate of 51% in both industrialized and developing nations.

5.2.2.2 Risk Factors

If therapies are not given, these are the factors that can be identified in anaemia and consequently cause death or major problems. The findings of this study indicate that 5% of women with a variance of 0.498 are on the verge of these dangers. An important global problem that affects nearly millions of pregnant women worldwide is anaemia in pregnancy (Ratledge, 2007). These findings contradicted those of the current study for a number of reasons. According to the most recent data, women under 35 had the lowest mean haemoglobin concentrations and the highest prevalence of anaemia, thus this could be one of them (Galea, Ahern and Karpati, 2005). In this study, the researcher had a greater number of pregnant women under 35. Consequently, this enhanced the study's case in a positive way.

5.2.2.3 Signs

Using the study's symptoms as a guide, the researcher discovered 20% of women to be at a variance of 0.490. As the symptoms of the harmful impacts on their health grew, these women were brought to the medical facilities. These women were among the group who did not comprehend anaemia, therefore, when they were asked a question about it, they were unable to respond. From that point forward, medical facilities began to treat all expectant women with the intention of minimizing the anaemia effect because of signs and the women were not aware of. The study by Munoz, Laso-Morales, Gomez-Ramirez,

Cadellas, Nunez-Matas and Garcia-Erce (2020) which found numerous indications that severe maternal anaemia during pregnancy was linked to a poor pregnancy outcome, though the cause of this association is still unknown, was comparable to the researcher's findings.

5.2.2.4 Prevention

Most countries in sub-Saharan Africa, including South Africa, currently have national anaemia policies that include all expecting women as well as the prevention and treatment of anaemia (Guyatt, Brooker, Kihamia, Hall and Bundy, 2001). However, it was discovered that anaemia in pregnancy affected a substantial percentage of KwaZulu-Natal's rural population (57% by WHO standards and 30% by national definition) (Ezzati, Lopez, Rodgers and Murray, 2004). According to the study's findings, 15% of the respondents were aware of prevention, which implies that the remaining 85% were not. The latter is one of the causes of the anaemia impact in women.

5.2.2.5 Treatment

Numerous measures have been taken to combat anaemia's impact on pregnant women's outcomes in the Vhembe area. According to the study, 25% of women were receiving treatments to recover from anaemia. There were women who adhered to the nurses' instructions on when, how and what they ate and drank at the variance of 0.502. This has received support from the analysis of a previous study (Brodsky and Jones, 2005). This type of anaemia is typically treated by taking vitamin B12 supplements. Some food sources of this vitamin include breakfast cereals with added vitamin B12, meat (beef, chicken and fish, eggs) and dairy products (milk, yogurt, cheese).

5.2.3 Knowledge on the Effects of Anaemia in Pregnancy

5.2.3.1 Labour-Related Outcome

The researcher has listed the results of labour in terms of spontaneous abortion, which had

a variance of 0.130, preterm labour (0.429), antepartum haemorrhage (0.311), postpartum haemorrhage (0.417), maternal morbidity (0.413) and maternal mortality (0.522). By elaborating on these components, the researcher continued to make sense of the findings. Spontaneous abortion, also known as miscarriage, is reported as the maternal/labour-related outcome and has a variance of 0.130, followed by APH (0.130). It is critical to assess the body at this time. Preterm labour can have an impact on how a pregnancy turns out. Early birth of a baby might result in anaemia (0.429). However, bleeding also has consequences (0.417). When the researcher examined the difference, she discovered that the variance was 0.12. The death of a woman after giving birth also has a significant impact (0.522). Another consequence mentioned is a direct link between pregnancy and/or childbirth and a physical or mental sickness or disability. Due to the increasing demands imposed on their maternal reserves during pregnancy, which disclose the various hidden inadequacies that manifest as anaemia, pregnant women are regarded to be the most vulnerable group (Hoque and Worku, 2005).

5.2.3.2 Neonatal Outcome

Significant epidemiologic research revealed that maternal haemoglobin levels below 8 g/dl were associated with higher newborn mortality than maternal haemoglobin levels above 11 g/dl (Richards, Baikady and Clevenger, 2020). Low maternal haemoglobin levels have been linked to undesirable pregnancy outcomes, such as preterm birth, low birth weight, foetal death and other health issues with growing complication rates (Churchill, Nair, Stanworth and Knight, 2019). The researcher discovered that the variance for intrauterine growth was 0.434, low birth weight (0.333), neonatal morbidity (0.443), neonatal mortality (0.436), neonatal anaemia (0.523) and stillbirth (0.356).

5.2.4 Knowledge on the Causes of Anaemia in Pregnancy

The researcher has examined the information gathered regarding the causes of anaemia in pregnant women, where worm infestation was found to have a variance of 0.544. This has implied that a lot of women fit within this category. The degree of infection (such as the

number of hookworms a person harbours), the species of hookworm and whether a concoction contains many parasites are all factors that affect the risk of blood loss and subsequent anaemia, according to the researcher's comparison of the results with this literature (Schreir, 2018). While any level of hookworm infection is connected to lower Hb in adults, moderate- and heavy-intensity infections are linked to lower Hb in school-aged children. However, children and women who already have low iron levels might suffer negative consequences from even moderate hookworm infections (Balarajan, Ramakrishnan and Zaltin, 2011).

The duodenal infection is associated with a higher risk of anaemia because it causes a blood loss that is five times more than that of other illnesses (Balarajan, Ramakrishnan and Zaltin, 2011). The researcher continued to focus on the effect of eating raw veggies as the cause of anaemia at a variance of 0.434 as this was at the same peak as consuming unclean produce. Citrus fruits include oranges, grapefruits, tangerines and other similar fruits, according to Ezzati, Lopus, Dogers, Vander and Murray (2002), who provided evidence for their findings. Fruits, vegetables and liquids that are fresh or frozen often provide more vitamin C than those that are canned. Kiwi fruit, strawberries and cantaloupes are other fruits high in vitamin C. Broccoli, peppers, Brussels sprouts, tomatoes, cabbage, potatoes and leafy green vegetables like turnip greens and spinach are among the vegetables high in vitamin C. All these should be consumed for good health.

According to the researcher's analysis of soil consumption using SPSS version 27, the variance was 0.512. Hookworm is the primary soil-transmitted helminthic parasite associated with anaemia in expectant mothers (Schreir, 2018). This may also have an impact on women's anaemia. The outcomes with 0.555 variances were the same for infections like HIV and malaria, which have both been discussed. This demonstrated how virulent and successful the virus is in causing anaemia. In addition to other detrimental effects like death, the Plasmodium parasite that causes malaria can also result in severe anaemia (Chalco JP, Huicho and Alamo, 2005).

The most prevalent malaria parasite in Africa, *Plasmodium falciparum*, is mostly to blame for malaria deaths outside of sub-Saharan Africa (Chalco, Huicho and Alamo, 2005). This has been shown to be consistent with findings regarding malaria and HIV as causes of anaemia. Congenital cardiovascular disease, several pregnancies and continuous use of traditional herbs combined produced a variance of 0.413.

5.3 Descriptive Statistics Results

Since questions were created to learn more about pregnant women's anaemia, 133 participants in the study, or 100% of the total, were female. This suggested that there were more women in the Vhembe district health care facilities who were struggling with anaemia during and after pregnancy. This could be as a result of the fact that diseases generally affect pregnant women. The findings also showed that respondents who took part in the study were mostly between the ages of 15 and 20 (6.8%), 21 and 30 years (70.0%) and 31 and 40 (23.2%).

The respondents who were 15-21 years of age had the lowest percentage of respondents (6.8%%), followed by those who were between the ages of 31-40 (23.2%%). This shows that the majority of pregnant women in the medical facilities in the Vhembe district belong to a cluster of middle-aged people. However, complications during pregnancy and labour result in the deaths of almost 600 000 women between the ages of 15 and 44 each year throughout the world (Kabatereine, Broker and Koukounari, 2007). This suggests that women between the ages of 15 and 44 do indeed have an increased chance of developing anaemia.

The study's findings also revealed that many of the respondents (n=50; 37.0%) had attended school and received a secondary education. According to the idea that many women prefer to advance to tertiary level to get degrees, this might be expected. This suggests that the majority of them attended high secondary school. Therefore, the lowest category in this survey is respondents who attended a university, of whom there were less than 12 (8.9%). Additionally, the study indicated that elementary school dropouts were

comparable to secondary school dropouts (n=46; 34.1%)), meaning that 25 (18.5%) respondents did not attend any school at all. The human health practices of health facilities in the Vhembe district are affected by appetite development. The findings demonstrated that 72 respondents, or 53.3%, consumed soil. It suggests that the health facilities and health department should start platforms that educate pregnant women about how and what to eat in order to provide healthy alternatives to mothers and unborn children. This could then affect how much they comprehend anaemia and how it affects both them and unborn children. Therefore, Othman (2016) asserted in his essay that in order for pregnant women to obtain a healthy amount of iron from food and supplements, they must establish good eating habits.

Most of the respondents (n=63; 46.7%) have received social support grants from the government in order to sustain their families. This suggests that the majority of them are unemployed. Since they lack the funds to obtain the tools, they need to combat it, the majority of pregnant women suffer from anaemia. As a result, grants alone cannot satisfy all needs. They often feel pressured by this to consume anything they can.

The majority of pregnant women in the Vhembe district are more aware of the effects of anaemia on pregnancy outcomes. Understanding this tends to make women aware of its impacts as well as other anaemia-related complications. Pregnant women in one region of Pakistan had negative perceptions of government health facilities and had little awareness of standard prenatal tests (Ghaffar and Pongpanich, 2012). Additionally, it is crucial for pregnant women to get regular check-ups. This demonstrates that fewer women have a clear grasp of anaemia, compared to the other nearly 66% of women in the Vhembe district, which has an impact on pregnancy outcomes.

At least 35% of women were aware of how anaemia affects the course of a pregnancy. Maternal mortality causes significant suffering for the majority of pregnant women. Some pregnant women experienced APH and premature labour, while others experienced PPH. The prevalence rates of anaemia in pregnancy are shown to range from 35 to 70%, making

it a common clinical problem (Kabatereine, Broker and Koukounari, 2007). This has a considerable impact on maternal and perinatal mortality and morbidity in the majority of impoverished countries. In addition, for every 100 000 live births worldwide, an estimated 390 maternal fatalities are reported, with developing countries accounting for the majority of these cases.

5.4 Reliability Results

The reason for testing the reliability of each variable was to ensure the reliability of the instrument. Reliability results revealed that the variables' Cronbach Alpha coefficients were between 0.5 and 0.7. The Cronbach's Alpha coefficient for anaemia knowledge was 0.443 and consequential anaemia was 0.611. From the findings of the research, all instruments used were reliable and can be adopted in future studies in the South African context (Teseema and Soeters, 2006).

5.5 Correlation Results

To answer the study objectives, research hypotheses were tested. The relationship among anaemia knowledge, consequential anaemia and effects anaemia was tested and the results are discussed below. The results are shown in Table 4.12. The results of the study indicate that there is a strong positive, statistically significant relationship amongst Anaemia Effects, Consequential Anaemia and Knowledge of Anaemia ($r=1$, $p<0.01$). There will be positive intention to understand anaemia outcomes from pregnant women in Vhembe district.

The researcher predicted that there will be negative impact of anaemia knowledge if pregnant women fail to disclose the outcomes of giving birth. Therefore, knowledge anaemia was an independent variable, whereas consequential anaemia and effects anaemia were dependent variables. The findings indicated that there was a significant negative relationship between the knowledge anaemia and consequential anaemia ($r=-0.18$, $p<0.05$), hence, there was a positive relationship between knowledge anaemia and

effects anaemia (r=0.6, p<0.05).

5.6 Regression Analysis Results

Last hypothesis states that both consequential anaemia and effects anaemia are predictors of knowledge anaemia of pregnant women in the health facilities in Vhembe district. The regression results revealed that consequential anaemia is the only predictor of knowledge anaemia (β=0.551, p=0.000) (Table 4.13). Similarly, Rahman and Chowdhuri (2018) concluded that there is a positive significant effect of consequential anaemia on knowledge anaemia. Contrary to this notion, Ahmed (2016) revealed that there is no significant relationship between effects anaemia and knowledge anaemia. However, Nikolett and Nawangsari (2019) found that both consequential anaemia and effects anaemia are significant predictors of knowledge anaemia.

5.7 Conclusions of the Study

The findings of the study revealed that there is a connection between consequential anaemia and effects anaemia. Therefore, it is concluded that consequential anaemia has an impact on knowledge anaemia of pregnant women in the health facilities in Vhembe district. Regression analysis was also conducted to indicate which independent variable between consequential anaemia and effects knowledge is the most reliable predictor of knowledge anaemia. The results show that consequential in use is the only predictor of knowledge anaemia. This means that consequential anaemia plays a key role in motivating pregnant women to gain more knowledge about anaemia.

5.8 Limitations of the Study

This research was conducted in the health care facilities in Vhembe district within certain geographic areas at a single point of time, so the findings may differ if the sample is transformed. The study is cross-sectional and may suffer from some assumptions which can be overcome in the study. Due to this limitation, the researcher has recommended further research in terms of a longitudinal study with different geographic areas and

samples. This research also suggests exploring other potential variables that influence knowledge, effects and consequences of anaemia.

5.9 Implications of the Study

The significance of the study was to determine the knowledge of pregnant women regarding effects of anaemia on pregnancy outcomes. The study shows that more than 50% of pregnant women who participated in the study do not have sufficient knowledge regarding the effects of anaemia on pregnancy outcomes. The findings of the study will help improve the knowledge of future pregnant women regarding the knowledge of effects of anaemia on pregnancy outcomes through the recommendations made. There are various geographical areas in Limpopo Province which other researchers may focus on to educate future pregant females about the knowledge of anaemia in pregnancy. Other researchers can also research the massive impact of anaemia on teenage pregnancy in South Africa's poorest regions.

5.10 Recommendations

Midwives should give health education about the causes, sign and symptoms, prevention, management, effects on pregnancy outcomes of anaemia and importance of iron supplements compliance and iron rich diet to all pregnant women at every ANC v isit. Midwives can also compile handouts pamphlets containing all the important information regarding anaemia in pregnancy and its effects on pregnancy outcomes and hand them out to every pregnant women and the community to create awareness about the adverse effects of anaemia on pregnancy outcomes. The DoH should implement mobile clinics to facilitate ANC visits and adherence for pregnant women who are in deep rural areas and facing challenges accessing health care facilities. The DoH policymakers should implement programmes to provide nutritional food parcels for pregnant women who have difficulties in maintaining a healthy nutritional status during pregnancy. The guidelines for maternal care in South Africa should update ANC visits to 4-week intervals for all pregnant women to give them more time to be exposed to information regarding anaemia in pregnancy and other

pregnancy-related conditions. The DoH policymakers should include information about anaemia and its effects on pregnancy outcomes on the pregnant women's maternity case register book for all pregnant women.

The DoH should create a system that automatically registers all pregnant women to MomConnect (https://www.health.gov.za/momconnect/) at first ANC visit and information on anaemia and its effects on pregnancy outcomes should be included in MomConnect. The DoH should publish information regarding anaemia in pregnancy and its effects on pregnancy outcomes on public platforms such as billboards, posters and media. The DoH should also hire more health care professionals for efficient and effective health services delivery, including promoting health education. The researcher recommends that future researchers conduct similar studies and other content related to anaemia in different districts in other provinces.

5.11 Summary

The main purpose of the study was to determine the knowledge of women attending health care facilities regarding the effects of anaemia on pregnancy outcomes in Vhembe district in South Africa. The chapter expounded the demographic information of respondents such as gender, age, educational level, appetite development and sources of income of pregnant women. Throughout this chapter, discussion of descriptive analysis, knowledge causes and knowledge of anaemia effects on pregnancy outcomes, correlation coefficients, regression analysis and hypotheses were made. Lastly, limitations, implications, recommendations for future research and practice and conclusion of the study were discussed.

REFERENCES

Abd El Hameed, H., Mohammed, A. and Abd El Hameed, L. (2012). Effect of nutritional educational guideline among pregnant women with iron deficiency anaemia at rural area in Kalyobia governorate. *Life Science Journal,* 9(2), 1212-1217.

Abriha, A., Yesuf, M. E. and Wassie, M. M. (2014). Prevalence and associated factors of anaemia among pregnant women of Mekelle town: a cross-sectional study. *BMC Research Notes*, 7(1), 888.

Agho, K.E., Dibley, M.J., D'Este, C. and Gibberd R. (2008). Factors associated with haemoglobin concentration among Timor-Leste children aged 6-59 months. *Journal of Health Population Nutrition*, 26, 200-209.

Ahmed, N.O.A. (2016). Impact of human resource management practices on organisational citizenship behaviour: An empirical investigation from the banking sector of Sudan. *International Review of Management and Marketing*, 6(4), 964-973.

Allen, L.H., 2001. Biological mechanisms that might underlie iron's effects on foetal growth and preterm birth. *The Journal of Nutrition*, 131(2), 581S-589S.

Anguzu, R., Tweheyo, R., Sekandi, J.N., Zalwango, V., Muhumuza, C., Tusiime, S. and Serwadda, D. (2014). Knowledge and attitudes towards use of long-acting reversible contraceptives among women of reproductive age in Lubaga division, Kampala district, Uganda. *BMC Research Notes,* 7(1), 1-9.

Ann, T.P., Chitsulo, L., Engels, D., Montresor, A. and Savioli, L. (2002). *The global status of schistosomiasis and its control*. *Acta Tropica,* 77(1), 41-51.

Arega Sadore, A., Abebe Gebretsadik, L. and Aman Hussen, M. (2015). Compliance with iron-folate supplement and associated factors among antenatal care attendant mothers in Misha District, South Ethiopia: community based cross-sectional study. *Journal of Environmental and Public Health,* 2015.

Baig-Ansari, N., Badruddin, S. H., Karmaliani, R., Harris, H., Jehan, I., Pasha, O. and Goldenberg, R. L. (2008). Anaemia prevalence and risk factors in pregnant women in an urban area of Pakistan. *Food and Nutrition Bulletin*, 29(2), 132-139.

Balarajan, Y., Ramakrishnan, U. and Özaltin, E. (2011). Anaemia in low-income and middle-income countries. *Lancet*, 378, 2123–2135.

Balasubramanian, T., Aravazhi, M. and Sampath, S. D. (2016). Awareness of anaemia among pregnant women and impact of demographic factors on their haemoglobin status. *International Journal of Scientific Study*, 3(12), 303-305.

Bopape, M.M., Mbhenyane, K. and Alberts, M., 2008. The prevalence of anaemia and selected micronutrient status in pregnant teenagers of Polokwane Municipality in the Limpopo Province. *South African Journal of Clinical Nutrition*, 21(4), 332-336.

Camaschella, C. (2015). Iron-deficiency anaemia. *New England Journal of Medicine*, 372(19), 1832-1843.

Cape, W., Mamabolo, R.L., Alberts, M., Steyn, N.P., de Waal, H.D.V., Nthangeni, N.G. and Levitt, N.S., 2004. Evaluation of the effectiveness of iron and folate supplementation during pregnancy in a rural area of Limpopo province. *South African Journal of Clinical Nutrition*, *17*(1), pp.15-21.

Centers for Disease Control. (1989). CDC criteria for anaemia in children and childbearing-aged women. MMWR Morb. Mortal. *Weekly Report*, 38, 400–404.

Chalco, J.P., Huicho, L. and Alamo, C. (2005). Accuracy of clinical pallor in the diagnosis of anaemia in children: a meta-analysis. *BMC Pediatrics,* 5, 46–46.

Churchill, D., Nair, M., Stanworth, S.J. and Knight, M. (2019). The change in haemoglobin concentration between the first and third trimesters of pregnancy: a population study. *BMC Pregnancy and Childbirth*, 19, 359.

Department of Health. (2006). Saving mothers: *Third report on confidential enquiries into maternal deaths in South Africa*. Department of Health: Republic of South Africa, Pretoria.

Dewey, K.G. and Chaparro, C.M. (2007). Session 4: mineral metabolism and body composition iron status of breast-fed infants. *Proceedings of the Nutrition Society*, 66, 412–422.

Di Renzo, G.C., Spano, F., Giardina, I., Brillo, E., Clerici, G. and Roura, L.C., 2015. Iron deficiency anaemia in pregnancy. *Women's Health*, *11*(6), pp.891-900.

Dwumfour-Asare, B. and Kwapong, M.A., (2013). Anaemia awareness, beliefs and practices among pregnant women: a baseline assessment at Brosankro community in Ghana. *Journal of Natural Sciences Research,* 3(15), 1-10.

Ekwere, T.A., Ekanem, A.M. and Ekwere, T.A., 2015. Maternal knowledge, food restriction and prevention strategies related to anaemia in pregnancy: a cross-sectional study. International Journal of Community Medicine and Public Health, 2(3), pp.331-338.

Ezzati, M, Lopus, A.D., Dogers, A., Vander, H.S. and Murray, C., (2011). Selected major risk factors and global and regional burden of disease. Lancet 360: 1347-60 Guidelines for the management of iron deficiency anaemia, *British Society of Gastroenterology,* 60(360), 1347*.*

Ezzati, M., Lopez, D., Rodgers, A. and Murray, C.J.L. (2004*). Comparative quantification of health risk: Global and regional burden of disease attributable to selected major risk factors*. Geneva: World Health Organization.

Frise, M.C. and Robbins, P.A. (2015). Iron, oxygen and the pulmonary circulation. *Journal of Applied Physiology*, 1, 21– 31.

Galea, S., Ahern J. and Karpati, A. (2005). The model of underlying socioeconomic vulnerability in human populations: evidence from variability in population health and implications for public health. *Social Science for Medicine*, 60, 2417–2430.

Gebremedhin, S., Samuel, A., Mamo, G., Moges, T. and Assefa, T. (2014). Coverage, compliance and factors associated with utilization of iron supplementation during pregnancy in eight rural districts of Ethiopia: a cross-sectional study. *BMC Public Health,* 14(1), 1-8.

Ghimire, N. and Pandey, N. (2013). Knowledge and practice of mothers regarding the prevention of anaemia during pregnancy, in teaching hospital, Kathmandu. *Journal of Chitwan Medical College*, 3(3), 14-17.

Gopinath, S., Dhananjaya, B., Sreelasya, K. and Krishna, C., (2018). Prevalence of anaemia in pregnancy and its outcome in rural Tertiary Care Centre in India. *Indian Journal of Obstetrics and Gynaecology Research*, 5(1), 104-108.

Gowri, D., Sakthi, D. and Palanivel, C. (2017). Influence of Awareness and Attitude about Anaemia and Iron Supplements on Anaemic Status of Pregnant Women Attending a Tertiary Care Centre in South India. *Journal of Contraceptive Studies*, 2(1), 3.

Guidelines for Maternity Care in South Africa, 4th Edition. (2016). *A manual for clinics, community health centres and district hospitals*, 12-13.

Guyatt, H.L., Brooker, S., Kihamia, C.M., Hall, A. and Bundy, D.A.P. (2001). *Evaluation of efficacy of school-based antehelmintic treatments against anaemia in children* in the United Republic of Tanzania. Bull World Health Organ.

Harper, J.L., Marcel, E.C. and Emmanuel, C.B. (2015). Iron Deficiency Anaemia: Practice essentials, Pathophysiology and Etiology. Medscape.

Hoque, A.K.M. and Worku, Z. (2001). *The cholera epidemic in KwaZulu-Natal: Implication for health promotion and education*. *Health South Africa Gesondheid*, 10(4), a208.

Houston, B.L., Hurrie, D. and Graham, J. (2018). Efficacy of iron supplementation on fatigue and physical capacity in non-anaemic iron-deficient adults: a systematic review of randomised controlled trials. *British Medical Journal Open*, 8, 19-24.

Hutter, D. and Jaeggi, E., 2010. Causes and mechanisms of intrauterine hypoxia and its impact on the foetal cardiovascular system: a review. *International Journal of Pediatrics*, 2010, Article ID 401323.

Jinabhai, C.C., Taylor, M., Coustsoudis, A., Coovadia, H.M., Tomkins, A.M. and Sullivan, K.R. (2010). *The mental and nutritional profile of rural school children*. KwaZulu-Natal, South Africa. *Annals of Tropical Pediatrics,* 21, 50-58.

Jopling, J., Henry, E. and Wiedmeier, S.E. (2009). *Reference ranges for hematocrit and blood haemoglobin concentration during the neonatal period: data from a multihospital health care system*. *Pediatrics*, 123(2), e333-e337.

Kabatereine, N.B., Broker, S. and Koukounari, A. (2007). *Impact of a national helminth control programme on infection and morbidity in Ugandan school children*. *Bulletin of the World Health Organization*, 85(2), 91-99.

Kapur, D., Agarwal, K.N., Sharma, S., Kela, K. and Kaur, I. (2002). Iron status of children aged 9-36 months in an urban slum Integrated Child Development Services project in Delhi. *Indian Pediatrics*, 44, 136-139.

Kilbridge, J., Bakea, T.G., Parapia, L.A., Khoury, S.A., Shugaidef, S.W. and Jerwood, D. (1999). Anaemia during pregnancy as a risk factor for iron-deficiency anaemia in infancy: a case-control study in Jordan. *International Journal of Epidemiology*, 28, 461.

Kline, R. B. (2015). Principles and practice of structural equation modeling. New York: Guilford publications.

Lubbock, L.A. and Stephenson, R.B. (2008). Utilization of maternal health care services in the department of Matagalpa, Nicaragua. *Revista Panamericana de Salud Pública*, *24*, 75-84.

Lynch, S. (2007). *Indicators of iron status of populations: red blood cell parameters. In Assessing the Iron Status of Populations: Including Literature Reviews: Report of a Joint World Health Organization/Centers for Disease Control and Prevention Technical Consultation on the Assessment of Iron Status at the Population Level, Geneva Switzerland*, 6–8 April 2004 2nd ed. Geneva: World Health Organization.

M'Cormack, F.A. and Drolet, J.C. (2012). Assessment of Anaemia Knowledge, Attitudes and Behaviors Among Pregnant Women in Sierra Leone. *Health Educator,* 44(2), 9.

Mamabolo, R.L. and Alberts, M. (2013). '*Prevalence of anaemia and its associated factors in African children at one and three years residing in the Capricorn District of*

Limpopo Province, South Africa', *Curationis* 37(1), Art. #1160, 9 pages. http://dx.doi.org/10.4102/ *Curationis,* v37i1.1160.

Margwe, J. (2015). Prevalence, knowledge and attitude of pregnant women on control measures of anaemia in Mbulu District, Tanzania. (Doctoral dissertation, Sokoine University of Agriculture).

Mbhenyane, X. and Cherane, M. (2017). Compliance with the consumption of iron and folate supplements by pregnant women in Mafikeng local municipality, North West Province, South Africa. *African Health Sciences,* 17(3), 657-670.

Mei, Z., Cogswell, M.E. and Looker, A.C. (2011). Assessment of iron status in US pregnant women from the National Health and Nutrition Examination Survey (NHANES), 1999–2006. *American Journal of Clinical Nutrition*, 13, 12–20.

Melku, M., Addis, Z., Alem, M. and Enawgaw, B. (2014). Prevalence and predictors of maternal anaemia during pregnancy in Gondar, Northwest Ethiopia: an institutional based cross-sectional study. *Anaemia*, 2014.

Miles, L.F., Kunz, S.A., Na, L.H., Braat, S. and Burbury, K. (2018). Story DA. Postoperative outcomes following cardiac surgery in non-anaemic iron-replete and iron-deficient patients – an exploratory study. *Anaesthesia*, 8(73), 450.

Miles, L.F., Litton, E. and Imberger, G. (2019). Story D. Intravenous iron therapy for non-anaemic, iron-deficient adults. *Cochrane Database of Systematic Reviews*, 12(1), 30-84.

Miles, L.F., Sandhu, R.N. and Grobler A.C. (2019). Associations between non-anaemic iron deficiency and outcomes following surgery for colorectal cancer: an exploratory study of outcomes relevant to prospective observational studies. *Anaesthesia and Intensive Care*, 47, 152–159.

Millennium Development Goals: Country report (2015). *Statistics South Africa*. Pretoria: Statistics South Africa.

Miller, E.M. (2014). Iron *status and reproduction in US women: National Health and*

Nutrition Examination Survey, 1999–2006. *PLoS One*, 9: e112216.

Ministry of Family and Health Welfare. (2003). *District-Level Household Survey*. New Delhi, Government of India.

Morsy, N. and Alhady, S. (2014). Nutritional status and socio-economic conditions influencing prevalence of anaemia in pregnant women. *International Journal of Scientific & Technology Research,* 3(7), 54-60.

Motadi, S.A., Matsea, Z., Mogane, P.H., Masidwali, P., Makwarela, M. and Mushaphi, L., 2020. Assessment of Nutritional Status and Dietary Intake of Pregnant Women in Rural Area of Vhembe District, Limpopo Province. *Ecology of Food and Nutrition*, *59*(3), 229-242.

Mukherjee, K.L. and Ghosh, S. (2012). Medical laboratory Technology. *Procedure Manual for Routine Diagnostic Tests*, 1, 263-266.

Munoz, M., Laso-Morales, M.J., Gomez-Ramirez, S., Cadellas, M., Nunez-Matas, M.J. and Garcia-Erce, J.A. (2017). Pre-operative haemoglobin levels and iron status in a large multicentre cohort of patients undergoing major elective surgery. *Anaesthesia*, 72, 826–834.

Namazi, A. and Alizadeh, S. (2016). "Health Knowledge of Pregnant Women on Anaemia and its Complication in Pregnancy." *Journal of Holistic Nursing and Midwifery,* 26(2), 98-106.

Nandlal, V., Moodley, D., Grobler, A., Bagratee, J., Maharaj, N.R. and Richardson, P. (2014). *Anaemia in pregnancy is associated with advanced HIV disease*. *PloS One,* 9(9), e106103.

Natasha, S. and Yasmin, G. (2010). Inkosi Albert Luthuli Central Hospital. Proceedings of South African Thalassaemia Association. Pasricha SR, Flecknoe-Brown SC, Allen KJ, et al; Diagnosis and management of iron deficiency anaemia: a clinical update. *Medical Journal*, 1(9), 525-532.

Nikolett, V and Nawangsari, L.C. (2019) Impact of human resource management practices:

Factors influencing organisational citizenship behaviour at Kelapa Gading Mall. *International Journal of Scientific and Research Publications*, 9(2), 2250-3153.

Nilsson-Ehle, H., Jagenburg, R. and Landah, S. (2000). Blood haemoglobin declines in the elderly: implications for reference intervals from age. *Journal of Haematology,* 65, 297–305.

Osorio, M.M., Lira, P.I. and Ashworth A. (2004) Factors associated with Hb concentration in children aged 6-59 months in the State of Pernambuco, Brazil. *Journal of Nutrition*, 91, 307–315.

Othman, M., Alghamdi, A., Alghamdi, M., Alkhuraimi, W., Alshihri, A. and Alghamdi, A. (2015). Pregnant women knowledge of nutritional iron deficiency anaemia in Al-Baha area. *Journal of Education*, 35, 36, 4, 53.

Park K. (2000). *Park's Text Book of Preventive and Social Medicine.* 16th edition. Banarsidas Bhanol, Jabalpur.

Paula, T. d. M. D. (2017). "Caffeine Intake during Pregnancy: What Are the Real Evidences?" *Journal of Pharmacy and Pharmacology,* 5, 249-260.

Payne LG, Koski KG, Ortega-Barria E. and Scott M.E. (2007). Benefit of vitamin A supplementation on ascaris reinfection is less evident in stunted children. *Journal of Nutrition*, 137, 1455–1459.

Pedro, M.R., Madriaga, J.R., Barba, CV., Habito, R.C. and Gana A.E. (2004). The national Vitamin A Supplementation Program and subclinical vitamin A deficiency among preschool children in the philippines. *Food Nutrition Bulletin,* 25, 319– 329.

Prakash, S., Yadav, K., Bhardwaj, B. and Chaudhary, S. (2015). Incidence of Anaemia and its Socio-demographic determinants among pregnant women attending for antenatal care: A cross-sectional study. *International Journal of Medical and Health Research*, 1(3), 12-17.

Pratt, J.J. and Khan, K.S. (2016). Non-anaemic iron deficiency – a disease looking for recognition of diagnosis: a systematic review. *European Journal of Haematology*,

96, 618–628.

Rahman, H.A. and Chowdhuri, M.B. (2018) Effect of employee compensation on organisational citizenship behaviour: a study on private commercial banks in Bangladesh. *International Journal of Economics, Commerce and Management*, 6(5), 848-863.

Ratledge C. (2007). Iron metabolism and infection. *Food Nutrition Bulletin,* 28, S515–523.

Raut, B.K., Jha, M.K., Shrestha, A., Sah, A., Sapkota, A., Byanju, S. and Malla, S.S. (2014). Prevalence of iron deficiency anaemia among pregnant women before iron supplementation in Kathmandu university Hospital/Dhulikhel *Hospital. Journal of Gynaecology and Obstetrics,* 2(4), 54-58.

Richards, T., Baikady, R.R. and Clevenger, B. (2020). Preoperative intravenous iron to treat anaemia before major abdominal surgery (PREVENTT): *a randomised, double-blind, controlled trial. Lancet*, 396(13), 53–61.

Rizvi, F. (2012). Impact of maternal education and socioeconomic status on maternal nutritional knowledge and practices regarding iron rich foods and iron supplements. *Annals of Pakistan Institute of Medical Sciences*, 8(2), 101-105.

Schreir, S.L. (2018). *Approach to the Adult Patient with Anaemia Mentzer WC, Ed*. Waltham, MA: Up-to-date Inc.

Silverberg, D.S., Wexler, D. and Iaina, A., 2002. The importance of anaemia and its correction in the management of severe congestive heart failure. *European Journal of Heart Failure*, *4*(6), 681-686.

Srivastava, A., Avan, B.I., Rajbangshi, P. and Bhattacharyya, S. (2015). Determinants of women's satisfaction with maternal health care: a review of literature from developing countries. *BMC Pregnancy and Childbirth*, 15(1), 1-12.

Stevens, G.A., Finucane, M.M. and De-Regil, L.M. (2013). Global, regional and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995–2011: a systematic

analysis of population-representative data. *Lancet Global Health*, 1, 16–25.

Stoltzfus, R.J. (2003). *Update on issues related to iron deficiency and anaemia control. Report of the International Nutritional Anaemia consultative group*. The INACG Symposium, “Integrating programmes to move Iron Deficiency and Anaemia Control Forward”. Marrakech, Morocco, International life Science Institute.

Suchdev, PS., Namaste, S.M. and Aaron, G.J. (2016). Overview of the Biomarkers Reflecting Inflammation and Nutritional Determinants of Anaemia (BRINDA). *Advanced Nutrition Projects*, 7, 349–356.

Taber, K. S. (2018). The use of Cronbach’s alpha when developing and reporting research instruments in science education. *Research in Science Education*, 48(6), 1273-1296.

Taye, B., Abeje, G. and Mekonen, A. (2015). Factors associated with compliance of prenatal iron folate supplementation among women in Mecha district, Western Amhara: a crosssectional study. *Pan African Medical Journal,* 20, 1.

Tessema, M., Soeters, J. (2006). Challenges and prospects of human resource management in developing countries: Testing the Human Research Management-performance link in Eritrean civil service. *International Journal of Human Resource Management*, 17(1), 86-105.

Theng, C.E., Zakaria, N.S. and Yusof, H.M. (2017). Knowledge and attitude on consumption of iron supplement among pregnant women In Kuala Terengganu, Terengganu. *Malaysian Applied Biology Journal,* 46(3), 105-12.

Thurnham, D.I. and Northrop-Clewes, CA. (2007). *Infection and the etiology of anaemia*. In: Kraemer K, Zimmerman MB, editors. Nutritional Anaemia. Basel: SIGHT AND LIFE Press.

Walker, S.P., Wachs, T.D and Meeks, G.J. (2007) Child development: risk factors for adverse outcomes in developing countries. *Lancet,* 369, 145–157.

World Health Organization, 2012. *The WHO application of ICD-10 to deaths during*

pregnancy, childbirth and puerperium: ICD-MM. World Health Organization.

World Health Organization. (2003). *Pregnancy, childbirth, postpartum and newborn care: a guide for essential practice* Geneva: World Health Organization.

World Health Organization. (2005). *Handbook: IMCI integrated management of childhood illness* Geneva: World Health Organization.

World Health Organization. (2011). *Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity*.

World Health Organization. (2012). *WHO guidelines: daily iron and folic acid supplementation in pregnant women*. Geneva (Switzerland): World Health Organization.

World Health Organization. (2014). *Global nutrition targets 2025*: anaemia policy brief.

World Health Organization. (2015). *The global prevalence of anaemia in 2011* Geneva: World Health Organization.

World Health Organization. (2016). *Daily iron supplementation in adult women and adolescent girls.* Geneva, Switzerland.

Yadav, R.K., Swamy, M. and Banjade, B., 2014. Knowledge and Practice of Anaemia among pregnant women attending antenatal clinic in Prabhakar Kore hospital, Karnataka - A Cross-sectional study. *Literacy,* 30, 34, 18.

Yip, R., 2000. Significance of an abnormally low or high haemoglobin concentration during pregnancy: special consideration of iron nutrition. *The American Journal of Clinical Nutrition*, *72*(1), 272S-279S.

Youssry, M.A., Radwan, A.M., Gebreel, M.A. and Patel, T.A., 2018. Prevalence of maternal anaemia in pregnancy: the effect of maternal haemoglobin level on pregnancy and neonatal outcome. *Open Journal of Obstetrics and Gynaecology*, 8(7), 676-687.

ANNEXURE 1

ETHICAL CLEARANCE

ETHICS APPROVAL CERTIFICATE

RESEARCH AND INNOVATION
OFFICE OF THE DIRECTOR

NAME OF RESEARCHER/INVESTIGATOR:
Ms R Maumela

STUDENT NO:
14010284

PROJECT TITLE: Knowledge of pregnant women regarding anaemia on pregnancy outcomes in Vhembe District, South Africa.

ETHICAL CLEREANCE NO: **FHS/21/PDC/27/0212**

SUPERVISORS/ CO-RESEARCHERS/ CO-INVESTIGATORS

NAME	INSTITUTION & DEPARTMENT	ROLE
Dr Malwela T	University of Venda	Supervisor
Prof MS Maputle	University of Venda	Co - Supervisor
Prof V Berggren	University of Venda	Co - Supervisor
Ms R Maumela	University of Venda	Investigator – Student

Type: Masters Research
Risk: Minimal risk to humans, animals or environment (Category 2)
Approval Period: November 2021 – November 2023

The Human and Clinical Trails Research Ethics Committee (HCTREC) hereby approves your project as indicated above.

General Conditions
While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, please note the following.

- The project leader (principal investigator) must report in the prescribed format to the REC:
  - Annually (or as otherwise requested) on the progress of the project, and upon completion of the project
  - Within 48hrs in case of any adverse event (or any matter that interrupts sound ethical principles) during the course of the project.
  - Annually a number of projects may be randomly selected for an external audit.
- The approval applies strictly to the protocol as stipulated in the application form. Would any changes to the protocol be deemed necessary during the course of the project, the project leader must apply for approval of these changes at the REC. Would there be deviated from the project protocol without the necessary approval of such changes, the ethics approval is immediately and automatically forfeited.
- The date of approval indicates the first date that the project may be started. Would the project have to continue after the expiry date; a new application must be made to the REC and new approval received before or on the expiry date.
- In the interest of ethical responsibility, the REC retains the right to:
  - Request access to any information or data at any time during the course or after completion of the project,
  - To ask further questions; Seek additional information; Require further modification or monitor the conduct of your research or the informed consent process.
  - withdraw or postpone approval if:
  - Any unethical principles or practices of the project are revealed or suspected.
  - It becomes apparent that any relevant information was withheld from the REC or that information has been false or misrepresented.
  - The required annual report and reporting of adverse events was not done timely and accurately.
  - New institutional rules, national legislation or international conventions deem it necessary

ISSUED BY:
UNIVERSITY OF VENDA, RESEARCH ETHICS COMMITTEE
Date Considered: October 2021

Name of the HCTREC Chairperson of the Committee: Dr NS Mashau

Signature

UNIVERSITY OF VENDA
OFFICE OF THE DIRECTOR
RESEARCH AND INNOVATION
2021 -12- 01
Private Bag X5050
Thohoyandou 0950

ANNEXURE 2

REQUEST TO DEPARTMENT OF HEALTH TO CONDUCT THE STUDY

P.O. Box 1177
Nzhelele
0993
21 May 2021

Limpopo Province
Department of Health
Private Bag X9302
Polokwane
0700

Dear Sir/Madam

REQUEST FOR PERMISSION TO CONDUCT A RESEARCH

I, MAUMELA RUDZANI, a postgraduate student doing a Master's Degree in Nursing at University of Venda, hereby, request permission to conduct research in the Vhembe District, Limpopo Province, South Africa. The topic of the study is*: Knowledge of pregnant women regarding effects of anaemia, on pregnancy outcomes in the rural areas of the Vhembe District, Limpopo Province.*

The purpose of this study is to determine the knowledge of pregnant women, in the rural areas of South Africa, regarding anaemia outcomes. Complete anonymity and confidentiality of every response is guaranteed to all respondents. No names will be required. No rewards will be given to respondents for participating in research. For more information, please feel free to contact the researcher at 0818825118 or email: rhoodzanie@gmail.com

I hope that my request will be taken into consideration.

Yours faithfully

_____

ANNEXURE 3

REQUEST TO CONDUCT STUDY IN HEALTH FACILITIES IN VHEMBE DISTRICT

P.0. Box 1177
Nzhelele
0993
21 May 2021

Vhembe Department of Health

Dear Sir/Madam

APPLICATION FOR PERMISSION TO CONDUCT RESEARCH

I MAUMELA RUDZANI, a postgraduate student doing a Master's Degree in Nursing at University of Venda hereby request permission to conduct research in your institution. The topic of the study is: *Knowledge of pregnant women regarding effects of anaemia, on pregnancy outcomes in the rural areas of the Vhembe District, Limpopo Province.*

The purpose of this study is to determine the knowledge pregnant women in rural areas of South Africa have, regarding the effects of anaemia on pregnancy. I assure you that there will be no disturbances to the facilities' functioning when conducting the research. A complete anonymity and confidentiality of every response is guaranteed to all respondents. No names will be required. No rewards will be given to respondents because of participating in the research. For more information, please feel free to contact the researcher at 0818825118 or email: rhoodzanie@gmail.com.

I hope that my request will be taken into consideration.

Yours faithfully

_____

ANNEXURE 4

PERMISSION LETTER FROM THE LIMPOPO DEPARTMENT OF HEALTH

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

Department of Health

Ref : LP-2022-01-001
Enquires : Ms PF Mahlokwane
Tel : 015-293 6028
Email : Phoebe.Mahlokwane@dhsd.limpopo.gov.za

Maumela Rudzani

PERMISSION TO CONDUCT RESEARCH IN DEPARTMENTAL FACILITIES

Your Study Topic as indicated below;

Knowledge of pregnant women regarding effects of Anaemia on pregnancy outcomes in Vhembe District

1. Permission to conduct research study as per your research proposal is hereby Granted
2. Kindly note the following:
   a. Present this letter of permission to the institution supervisor/s a week before the study is conducted.
   b. The approval is **ONLY** for Beaconfield Clinic; Makhado Clinic; Mphephu Clinic; Pfananani Clinic; Phadzima Clinic; Radali Clinic; Shayandima Clinic; Sibasa Clinic.
   c. In the course of your study, there should be no action that disrupts the routine services, or incur any cost on the Department.
   d. After completion of study, it is mandatory that the findings should be submitted to the Department to serve as a resource.
   e. The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
   f. The approval is only valid for a 1-year period.
   g. If the proposal has been amended, a new approval should be sought from the Department of Health
   h. Kindly note that, the Department can withdraw the approval at any time.

Your cooperation will be highly appreciated

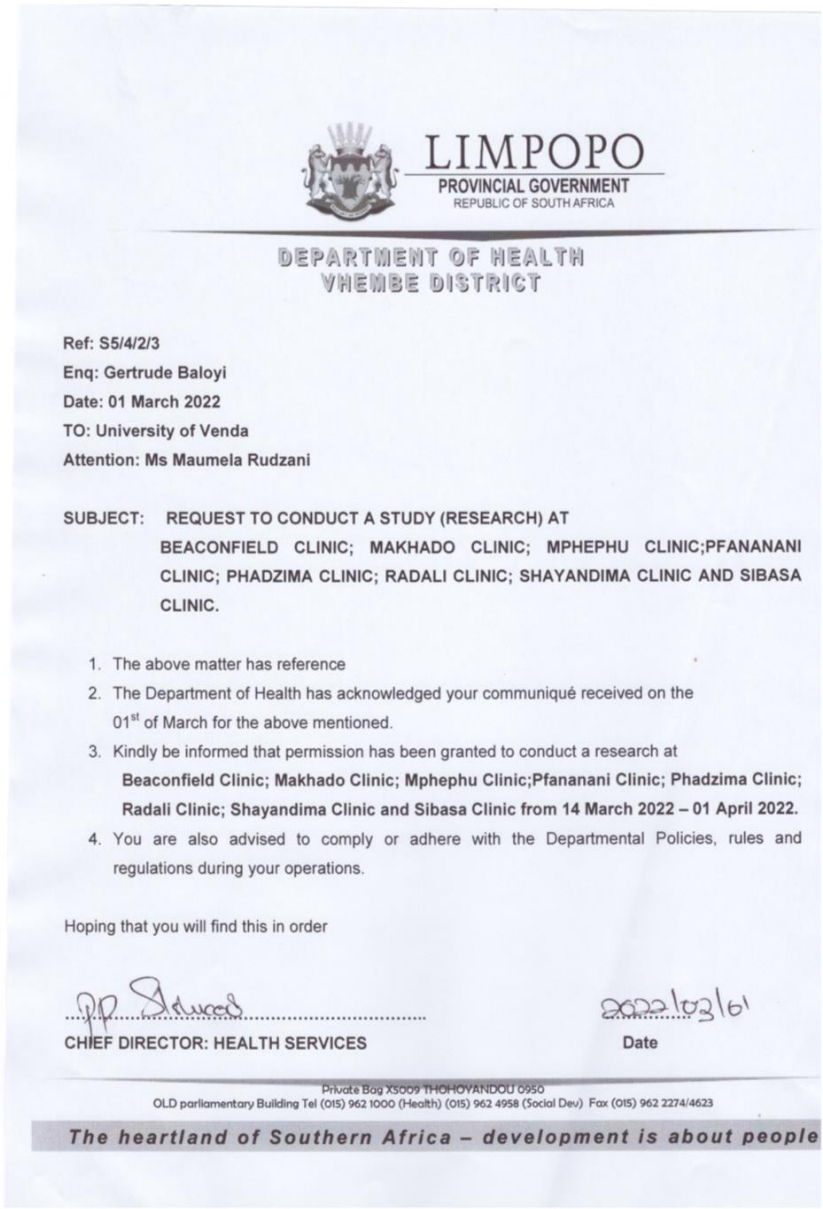
pp **Head of Department** 07/02/2022 **Date**

Private Bag X9302 Polokwane
Fidel Castro Ruz House, 18 College Street. Polokwane 0700. Tel: 015 293 6000/12. Fax: 015 293 6211.
Website: http/www.limpopo.gov.za

The heartland of Southern Africa – Development is about people!

ANNEXURE 5

PERMISSION LETTER FROM VHEMBE DISTRICT DEPARTMENT OF HEALTH



LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH
VHEMBE DISTRICT

Ref: S5/4/2/3
Enq: Gertrude Baloyi
Date: 01 March 2022
TO: University of Venda
Attention: Ms Maumela Rudzani

SUBJECT: REQUEST TO CONDUCT A STUDY (RESEARCH) AT BEACONFIELD CLINIC; MAKHADO CLINIC; MPHEPHU CLINIC;PFANANANI CLINIC; PHADZIMA CLINIC; RADALI CLINIC; SHAYANDIMA CLINIC AND SIBASA CLINIC.

1. The above matter has reference
2. The Department of Health has acknowledged your communiqué received on the 01st of March for the above mentioned.
3. Kindly be informed that permission has been granted to conduct a research at **Beaconfield Clinic; Makhado Clinic; Mphephu Clinic;Pfananani Clinic; Phadzima Clinic; Radali Clinic; Shayandima Clinic and Sibasa Clinic from 14 March 2022 – 01 April 2022.**
4. You are also advised to comply or adhere with the Departmental Policies, rules and regulations during your operations.

Hoping that you will find this in order

CHIEF DIRECTOR: HEALTH SERVICES — Date 2022/03/01

Private Bag X5009 THOHOYANDOU 0950
OLD parliamentary Building Tel (015) 962 1000 (Health) (015) 962 4958 (Social Dev) Fax (015) 962 2274/4623

The heartland of Southern Africa – development is about people

ANNEXURE 6A

LETTER OF INFORMATION (ENGLISH)

Title of the Research Study: Knowledge of pregnant women regarding the effects of anaemia on pregnancy outcomes in the rural areas in Vhembe district, South Africa.

Principal Investigator/s/researcher: Maumela Rudzani, Masters in Nursing Science

Co-Investigator/s/supervisor/s: Dr Malwela, Thivhulawi, supervisor, Prof Maputle MS Co-Supervisor

Brief Introduction and Purpose of the Study: Anaemia is a global health problem, especially, in pregnant women. Worldwide, close to 33% of non-pregnant women suffer from anaemia. Anaemia is a decrease in the circulating red blood cells (RBCs) mass, with haemoglobin (HB) of less than 12 g/dl in women and less than 14 g/dl in men. The causes of anaemia in pregnant and non-pregnant women are similar and are divided to acquired and hereditary causes. Anaemia in pregnancy is a risk factor causing poor pregnancy outcomes and can threaten the life of mother and foetus (Alia, Mahmoudb, Ahmedc and Rahman, 2018).

The purpose of this study is to determine the knowledge women have regarding the effects of anaemia, in the rural areas in the Vhembe District.

Outline of the Procedures: Once approval has been granted to conduct the study, the project will be explained to the respondents. The study objectives, aims, benefits of the study will be explained to the respondents to establish a rapport; those who are willing will be selected to participate in the study. This study will involve available respondents, during visitation to the selected health care facilities. The researcher will use self-administered questionnaires to collect data; these will be completed in venues that will be given in each facility. The questionnaire will probably take 15-20 minutes to complete.

Risks or Discomforts to the Participant: No risks

Benefit: The study will be published in accredited journals and participants will gain knowledge through this encounter

Reason/s the Participant May Be Withdrawn from the Study: Non-compliance, illness, adverse reactions, among others. There is a need to state that there will be no adverse consequences for participants should they choose to withdraw.

Remuneration: No remuneration, but there will be knowledge acquisition by both parties.

Costs of the Study: None

Confidentiality: The names of the respondents who will take part in the study, will remain anonymous. The researcher will use alphabets to represent respondents, for example, Respondent A, Respondent B and so on. The researcher will keep the information confidential and will not link the respondents' information to any biographical details.)

Research-related Injury: It is anticipated that there will be no injuries since respondents will be filling in questionnaires so it is unlikely there would be any administration of treatment. No sensitive or offensive information will be probed from the respondents).

Persons to Contact in the Event of Any Problems or Queries:

Please contact the researcher (0818825118), the supervisor (0827572013) or the University Research Ethics Committee Secretariat on 015 962 9058. Complaints can be reported to the Director: Research and Innovation, Prof GE Ekosse on 015 962 8313 or Georges Ivo.Ekosse@univen.ac.za

General:

Potential participants will be assured that participation is voluntary and the approximate number of participants to be included would be disclosed. A copy of the information letter would be issued to participants; this, plus a consent form will be translated into the primary spoken language of the research population

ANNEXURE 6B

LINWALO LA MAFHUNGO/ZWIDODOMBEDZWA (TSHIVENDA)

Thoyo ya ngudo: Ndivho ya vhaimana malugana na vhulwadze ha u tahelelwa nga malofha musi muthu a muimana kha mashango a muvhudu wa Vhembe, Afririka Tshipembe.

Mutodulusi: (Maumela Rudzani*, master's in nursing science*)

Vhadededzi nav ha eletshedzi : (*Dr Malwela, Thivhulawi, supervisor, Prof Maputle MS core-supervisor*)

Thaluso na vhundeme ha ngudo: vhulwadze ha u tahelelwa nga malofha muvhilini ndi thaidzo ya dzhango lothe nga maanda kha vhaimana. Kha lifhasi lothe tshivhalo tshino swika 33% ya vhafumakadzi vha tswenywa nga hovhu vhulwadze. Zwi vhangi zwa vhulwadze ha u tahelelwa nga malofha muvhilini kha vhafumakadzi vha vhaimana na vhasi vhaimana zwi a fana. Vhulwadze ha u tahelelwa nga malofha muvhilini kha vhaimana vhukhombo kha mutakalo na vhutshilo ha mme na nwana asathu thu bebwaho (Alia, Mahmoudb, Ahmedc and Rahman, 2018).

Vhu ndeme ha ngudo iyi ndi u toda u wanulusa ndivho ya vhaimana malugana na vhulwadze ha u tahelelwa nga malofha muvhilini musi muthu a muimana kha mashango a muvhundu wa Vhembe.

Zwi dodombedzwa zwa tsedzuluso: Nga murahu ha musi thendelo yono newa ya u ita tsedzuluso nga ha ngudo iyi, ngudo iyi ido taluswa kha vha toduluswa. Zwi pikwa na vhudi ha ngudo iyi hudo dovha hafho ha talutshedzwa kha vha toduluswi avho, hu u itela u vhumba vhushaka vhukati ha mutodulusi nav ha toduluswa. Ngudo iyi ido katela vha toduluswa vho topolwaho, musi hutshi itwa madalo kha zwi imiswa zwa mutakalo zwo topolwaho. Mutodulusi udo nea vhatoduluswa siatari la dzimbudziso hu u itela uri vha aravhe mbudziso ngaha ngugo iyi. Mbudziso idzo dzi do aravhwa nga vha toduluswa nga zwi imiswa zwo topolwaho. Mbudziso idzi dzi do dzhia miathethe iswikaho fumithanu uya kha fummbili u fhimbula .

Vhuvhi ha u vha tshipida tsha ngudo iyi: ahuna.

Zwivhuya zwa uvha tshipida tsha ngudo iyi: ngudo iyi ido andadzwa kha manwalo adivheaho nahone vha toduluswa vha do wana ndivho nga u dzhenelela kha ngudo iyi.

Zwi itisi zwine zwi nga vhanga uri vha toduluswa vha bviswe kha ngudo iyi: usa tevhedza milayo ya ngudo iyi, Malwadze, u sa dipfa zwavhudzi ngaha ngudo iyi. huna vhu ndeme ha uri motodulusi a talutshedze vha toduluswa uri ahuna masiandoitwa a ututshela ngudo iyi.

Mbadelo: ahu nga do vha na mbadelo, fhedzi hudo vha na ndivho ine ido wanwa nga mutodulusi na vha tudulwa.

Tshiphiri: madzina vhukama avha toduluswa vhane vha do vha tshipida tsha ngudo iyi hanga do shumiswa mutodulusi udo shumisa maledere u talusa vha toduluswa , tsumbo mutoduluswa A, mutoduluswa B, uya nga u ralo nga u ralo mutodulusi udo fara mafhungo o newaho nga vha toduluswa nga ndila ya tshiphiri na hone mafhungo ayo hanga do kwakwanywa na madzina avha toduluswa avhu kuma.

Mapfuvhadzo a vhangwaho nga ngudo: zwito u vha khagala uri ahu nga dovha na mapfuvhadzo sa izwi vha toduluswa vha tshi do vha vhatshi kho to u fhindula dzi mbudziso, ahu ngado vha na mafhungo ane ado vhudziseswa ane ado siya atshi kho u vhaisa vhatoduluswa

Vhathu vhane vhanga kwamwa musi hu na mathada kana dzimbudziso.

Mutodulusi kha: 0818825118

Mudedzi kha: 0827572013

Kana (University research ethics secretor) 015 962 9058

Mahulwane (director and innovation) Prof GE Erosse: 015 962 8313

Nga u angaredza:

Vha toduluswa vha do vhudzwa uri u vha tshipida tsha ngudo iyi asi khombe khombe ha hone tshivhalo tsha vha toduluswa tshi do bviselwa khagalo, se linwalo la zwi dodo mbedzwa li do newa vha to duluswa, izwi zwitsha katela linwalo la thendelano lo nwalwano nga luambo la vha toduluswa

ANNEXURE 7A

CONSENT FORM (ENGLISH)

RESEARCH ETHICS COMMITTEE

UNIVEN Informed Consent

Appendix 2

Statement of Agreement to Participate in the Research Study:

- I, ……., hereby confirm that I have been informed by the researcher (*Maumela Rudzani*), about the nature, conduct, benefits and risks of this study (Research Ethics Clearance Number: _)
- I have also received, read and understood the above written information (*Participant Letter of Information*) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerized system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation, will be made available to me.

Full Name of Participant Date Time Signature

I, …… …… …… ……

I, *Maumela Rudzani*, herewith confirm that the above participant has been fully Informed about the nature, conduct and risks of the above study.

Full Name of Researcher	Date	Time	Signature
I, ……	……...	……	……

Full Name of Witness (If applicable)	Date	Time	Signature
I, ……	……...	……	……

Full Name of Legal Guardian (If applicable)	Date	Time	Signature
I, ……	……...	……	……

Please note the following:

Research details must be provided in a clear, simple and culturally appropriate manner and prospective participants should be helped to arrive at an informed decision by use of appropriate language (Grade 10 level - use Flesch Reading Ease Scores on Microsoft Word), selecting of a non-threatening environment for interaction and the availability of peer counselling if required (Department of Health, 2004)

If the potential participant is unable to read/illiterate, then a right thumb print is required and an impartial witness, who is literate and knows the participant, for example, a parent, sibling, friend, or pastor, should verify in writing, duly signed, that informed verbal consent was obtained (Department of Health, 2004).

If anyone makes a mistake completing this document, for example, a wrong date or spelling mistake, a new document has to be completed. The incomplete original document has to be kept in the participant's file and not thrown away; copies, thereof, must be issued to the participant.

References:

Department of Health: 2004. *Ethics in Health Research: Principles, Structures and Processes* http://www.doh.gov.za/docs/factsheets/guidelines/ethnics/

Department of Health. 2006. *South African Good Clinical Practice Guidelines*. 2nd Ed. Available at: http://www.nhrec.org.za/?page_id=14

ANNEXURE 7B

THENDELANO (TSHIVENDA)

RESEARCH ETHICS COMMITTEE

Univesithi ya Venda

Appendix 2

Linwalo la thendelano: tshitatamende tsha thendlano ya uvha tshipida tsha ngudo.

- Nne ……..ndi hafhano ndi a tenda uri ndo vhudzwa nga mutodulusi ngaha vhuvha , vhudifari , zwivhuya na zwivhi zwa ngudo iyi.
- Ndo dovha fhaho nda newa, nda vhala nda pfesesa mafhungo manwalwa (linwalo la mafhungo/zwidodombedzwa) ngaha ngudo iyi.
- Ndi a zwi divha uri mawanwa a ngudo, zwo katela na zwidodombedza zwino nga madzina minwaha na duvha lamabebo zwidovha tshiphiri.
- Uya ngaha thodea dza ngudo iyi, ndia tenda uri mafhungo o dzhiwabo nga kha nne anga sedzuluswa na u talutshedwa nga (system) ya dzi (computer) nga mutodulusi.
- ndo tendelwa u tutshela u vha tshipida tsha ngudo iyi tshifhinga tshinwe na tshinwe hu sina u hatulwa.
- Ndo vha na tshifhinga tsho edanaho tsha u vhudzisa dzi mbudziso ndi a tenda uri ndo di imisela u vha tshipida tsha ngudo iyi.
- Ndia pfesesa uri mawanwa a ndeme nga ha ngudo eyi ane kwamana na uvha tshipida tsha ngudo iyi hanga a do itwa uri ndi kone u a swikelela.

Madzina nga vhudalo a mutoduluswa:

Duvha na Tshifhinga:

Tsaino:

Nne **Maumela Rudzani,** ndi hafhano ndi a tenda u ri mutoduluswa o ambwaho hafho nntha o talutshedzwa nga vhu dalo vhuvha,vhudifara, zwivha na zwivhuya zwaq ngudo iyi.

Madzina nga vhudalo a mutodulusi:

Duvhana Tshifhinga:

Tsaino:

Kha vha dzhiele ntha zwitevhelaho.

Zwidodombedzwa zwa ngudo iyi zwi tea u bveledzwa nga ndila I pfeseseaho nahone ino thonifha siala la.vhatoduluswa. vhatoduluswa vha fanela u thuswa kha u dzhia tsheo dzo fanelano nga luambo lune vha lupfesesa.

A rali munwe wav ha toduluswa asa koni u vhala kanau nwala tshigando tsha gunwe la tshanda tsha ula tshi a todea na thanzi I divhaho mutoduluswa, thanzi iyo hu fanela uvha hu muthu ane a divha mutoduluswa, tsumbo mubebi, shaka, khonani kana mufunzi wa mutudoluswa. Muthu oyo ane avha thanzi u fanela u nwala fhasi thendelano ya u uri mutoduluswa o fha thendelano nga u to amba (Department of Health, 2004).

Arali munwe wa vha toduluswa anga ita phosho atshi kho u dadza siatari la dzimbudziso tsumbo u khakha date naka u pelete u fanela u newa siatari liswa. Siatari lo khakhea ho alingo tea u latiwa li tea u dzula nga ngomu ha faila (file) ya mutoduluswa. Mutoduluswa u fanela u fhiwa khophi ya siatari le a dadza.

References:

Department of Health: 2004. *Ethics in Health Research: Principles, Structures and Processes* http://www.doh.gov.za/docs/factsheets/guidelines/ethnics/

Department of Health. 2006. *South African Good Clinical Practice Guidelines*. 2nd Ed. Available at: http://www.nhrec.org.za/?page_id=14

ANNEXURE 8A

QUESTIONNAIRE (ENGLISH)

SECTION A - DEMOGRAPHIC AND BIOGRAPHICAL DATA

Put a mark (for example, X) next to the most relevant answer.

SECTION A		**Tick**
1. How old are you?	15-20	
	21-30	
	31-40	
	41-50	
	51-60	
	>60	
2. What is your educational level?	No formal schooling	
	Primary level	
	Secondary level	
	Tertiary level	
3. Religious affiliation. Please state it.		
4. Are you employed?	Yes	
	No	
5. What is your source of income?	Formal employment	
	Labourer	
	Pension/grant	
	Self employed	

6. How many times have you been pregnant?	1-3	
	4-6	
	>7	
7. Do you crave to eat any of the listed items during your pregnancy?	Soil	
	Ice blocks	
	Dried food only	
8. What type of food do you include in your diet?	Fruits	
	Meat	
	Vegetables	
	Porridge	
SECTION B: KNOWLEDGE RELATED TO ANAEMIA IN PREGNANCY		
9. What is anaemia in pregnancy?		
10. What are the risk factors of anaemia in pregnancy?		
11. What are the signs of anaemia in pregnancy?		
12. How is anaemia in pregnancy prevented?		
13. How is anaemia in pregnancy treated?		
SECTION C: KNOWLEDGE ON THE EFFECTS OF ANAEMIA ON PREGNANCY OUTCOMES		
Maternal/ Labour-related outcomes		
14. Spontaneous abortion		
15. Preterm labour		
16. Antepartum		
17. Postpartum haemorrhage		
18. Maternal morbidity		
19. Maternal mortality		
Neonatal-related outcomes		
20. Low birth weight		

21. Neonatal morbidity		
22. Neonatal mortality		
23. Neonatal anaemia		
24. Intrauterine growth restrictions		
25. Still birth		
SECTION D: KNOWLEDGE ON THE CAUSES OF ANAEMIA IN PREGNANCY		
26. Worm infestation		
27. Eating raw vegetables		
28. Eating unwashed fruits or vegetables		
29. Eating soil		
30. Infections such as malaria		
31. Infections like HIV		
32. Prolonged use of traditional herbs		
33. Multiple pregnancy		
34. Congenital cardiovascular disease		

Thank you for your participation.

ANNEXURE 8B

QUESTIONNAIRE (TSHIVENDA)

Ndumeliso! Dzina langa ndi _____. Rine ri wanala kha Department ya Advanced Nursing Science hafha University ya Venda. Ri khou ita tsedzuluso ya masiandoiwa a vhulwadze ha thahelelo ya malofha kha vhaimamana. R do takalela uri vha ri vhudze zwinw vha divha na kuvonele kune vha vha nakwo malugana na vhulwadze ha thahelelo ya malofha kha vhaimamana . THeyi ndivho inea do iwana kha heyi tsedzuluso I do thusedza uri ri kone u disa dzilafho na thikhedzo yo teaho kha vhainana havha na vhana vhavho hafha muvhunduni hoyu. mbudziso dzi nga vha dzhiela mithethe yono swika 45. Khumbelo ndi ya uri vha fhindule mbudziso dzothe, vha songo sia gake.

Vha vhee tshifhambano phanda ha thaluso yo bulwaho/newaho. Tsumbo

TSHIPIDA TSHA A – ZWIDODOMBEDZWA NGA HA MUBVUMBEDZA

TSHIPIDA: A		**Kha vha vhee tshifhambano**
1. Vhana minwaha mingana?	15-20	
	21-30	
	31-40	
	41-50	
	51-60	
	>60	
2. Vho swika kha murole ufhio tshikoloni?	A thin go ya tshikoloni	
	Ndo guma primary	
	Ndo guma Seconady	
	Ndo vuledza Pfunzo dza ntha	
3. Vha tenda kha tshikriste kana kha zwa hashu naa		

4. Vha a shuma/vho tholwa ngafhi?	Ee	
	Hai	
5. Vha wana ngafhi masheleni a u unda muta?	Ndi na mushumo	
	ndi mushumi wa dzingadeni/nduni	
	Ndi hola mundende	
	Ndi tou u di shuma	
6. Vho no diwana vhe muimana kana u di hwala lungana?	1-3	
	4-6	
	>7	
7. Vha a di wana vha nalutamo lwa u la zwitevhelaho musi vho di hwala	Mavu	
	Ice buloko	
	Zwliwa zwo omiswah fhedi	
8. Zwiliwa zwine vhala zwone zwikatela mini	Mitshelo	
	Nama	
	Miroho	
	Vhuswa	
TSHIPIDA TSHA B: NDIVHO MALUGANA NA VHULWADZE HA U TAHELELWA NGA MALOFHA		
9. Vha nga talusa uri vhulwadze ha thahelelo ya malofha ndi mini		
10. Vha nga ri nea mutevhe wa Zwivhangi zwa vhulwadze uvhu		
11. kha vha do mbudza tsumba dwadze dza uvhu vhulwadze		
12. vhanga thivhela hani uvhu vhulwadze		
13. Vhulafhiwa nga ndila-de		

TSIPIDA C: NDIVHO MALUGANA NA MASI TO ITWA A VHULWADZE HA THAHELELO YA MALOFHA		
Kha mme a nwana		
14. U tshinyalelwa		
15. Ubeba maduvha a sa athu swika		
16. U bva malovha u sa athu beba		
17. U bva mlofha mnzhi u tshi tou fhedza u bvisa nwana		
18. U lovha nga u beba		
19. Uvha na malwadze a sa langei		
Kha nwana		
20. Nwana ha nga dadzi tshikalo		
21. A nga vha na malwadze		
22. A nga lovha		
23. Na ene a nga vha na thahelelo ya malofha		
TSHIPIDA TSHA D: NDIVHO NGA ZWINO VHANGA VHULWADZE HOVHU		
24. Manowana thumbuni		
25. U la miroho I songo bikwa		
26. U la miroho ya mitshelo I songo tamba		
27. U la mavu		
28. Dwadze tshifu la HIV		
29. Malaria/Dali		
30. Manowana o no da nga u wa la mavu		
31. U shumisa mishonga ya Tshivenda		
32. Manwe malwadzevho		

Ndo livhuwa u tenda na u difha tshifhinga tshavho vha dadza heino bambiri.

ANNEXURE 9

CONFIRMATION BY LANGUAGE EDITOR

CONFIRMATION BY LANGUAGE EDITOR

Prof Donavon C. Hiss

Cell: 072 200 1086 | E-mail: hissdc@gmail.com or | dhiss@outlook.com

16 January 2023

To Whom It May Concern

This serves to confirm that I have edited the language, spelling, grammar and style of the **Master of Nursing Science (MNurs)** thesis by **Rudzani Maumela**, titled: "**Knowledge of Pregnant Women Regarding Effects of Anaemia on Pregnancy Outcomes in Vhembe District, South Africa**" The manuscript was also professionally typeset by me.

Sincerely Yours

Cert. Freelance Journalism, Dip. Creative Writing, MSc (Medicine), PhD