PREVALENCE, KNOWLEDGE AND ATTITUDE OF PREGNANT WOMEN ON CONTROL MEASURES OF ANAEMIA IN MBULU DISTRICT, TANZANIA

JUSTINA AMU MARGWE

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN PUBLIC HEALTH AND FOOD SAFETY, SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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ABSTRACT

Anaemia in pregnancy is the leading cause of maternal morbidity and mortality, poor birth outcomes worldwide. Despite national and international efforts to redress this problem, maternal mortality and morbidity rates are far beyond the target of the fifth Millennium Development Goal particularly in developing countries. The current study aimed to assess the prevalence; knowledge and attitude of pregnant women towards control measures of anaemia in Mbulu District, Tanzania. This cross-sectional survey was conducted from November 2014 to July 2015 in Mbulu District in three health facilities whereby 354 pregnant women aged 15-49 years were involved. The anaemia status of the pregnant women was determined based on Hb cut-off value of <11g/dl as recommended by WHO. Malaria infection was tested by using Ag.pLDH/HRP2 MRDT. Socio-demographic factor and anaemia information were gathered by using semi-structured questionnaire. Statistical analyses were done by SPSS version 16.0 and results were presented as percentages, frequencies to describe social demographic characteristics. Knowledge and attitudes of pregnant women on anaemia were assessed using the index scale and Likert scale respectively. Fisher's exact test was used to determine associations between variables at statistical significance level of <0.05. Multivariable logistic regression was run to quantify the risk factors for occurrence of anaemia. The overall prevalence of anaemia was 38.7% while the prevalence of malaria was 7.1%. Generally, the study revealed that pregnant women had low knowledge and negative attitude towards control measures of anaemia in Mbulu district. High parity was found to be a risk factor for anaemia in pregnancy (OR=13, 95% CI: 5.7-47 for 3-4 parity and OR=25, 95% CI: 12.5-37 for parity ≥ 5). Therefore, there is a need for strengthening health education on anaemia and related determinants to pregnant and non-pregnant women of child bearing age and sensitization on the usage of family planning method.

DECLARATION

I, Justina A. Margwe do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

_____ _____

Justina Amu. Margwe Date

(MSc. Candidate)

The above declaration is confirmed

_____ _____

Dr. Athumani. M. Lupindu Date

(Supervisor)

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LIST OF ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
ANC	Antenatal Clinic
Bs	Blood slide
CDC	Centres for Disease Control
Hb	Haemoglobin
HCT	Haematocrit
HIV	Human Immunodeficiency Virus
IDA	Iron Deficiency Anaemia
IPT	Intermittent Preventive Treatment
ITNs	Insecticide Treated Nets
MDG'S	Millennium Development Goals
MoHSW	Ministry of Health and Social Welfare
MRDT	Malaria Rapid Diagnostics Test
RBCs	Red Blood Cells
RCH	Reproductive and child health
SSA	Sub Saharan Africa
UNICEF	United Nations Children Fund
USAID	United States Agency for International Development
W H O	World Health Organization

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Anaemia has been defined by the World Health Organization (WHO) as "a condition in which the number of red blood cells (RBCs) or their oxygen-carrying capacity is inadequate to meet physiologic demands in the body, in which the haemoglobin level may vary by age, sex, altitude, smoking, and pregnancy status" (Gogoi *et al.,*2013). Anaemia in pregnancy is identified by the WHO as haemoglobin level less than 11g/dl and is divided into three levels of severity, Mild anaemia (Hb level, 9 - 10.9g/dl), Moderate anaemia (Hb level, 7 - 8.9g/dl) and severe anaemia (Hb level 7 - 4.5 g/dl) (Nkegoum *et al.*, 2009). Pregnancy is a period of a significant increase in iron requirement, and hence the risk of suffering from anaemia is higher than in non-pregnant state. Although iron requirements are reduced in the first trimester because of the absence of menstruation, they rise steadily thereafter from approximately 0.8 mg per day in the first month to approximately 10 mg per day during the last 6 weeks of pregnancy (Tay *et al.,* 2013). The demand is higher due to physiological changes in maternal red blood cell mass and also due to the needs of the development and growing of the placenta and foetus (Dim *et al.,* 2007). Despite increased iron requirements, pregnancy is also a period of increased risk for anaemia; so far reduction and control of anaemia prevalence among women remains prioritized as a public health problem, especially in women of childbearing age worldwide (Noronha *et al.,* 2012).

Anaemia constitutes a public health problem worldwide, in both developed and developing countries with major consequences for human health, economic and social development (Oyedeji, 2012). Anaemia affects over two billion people globally, among

whom over 40 million are pregnant women, where iron deficiency is thought to be the most common cause of anaemia and it's account for 75% - 95% of cases (Osungbade *et al*., 2012). Iron deficiency and other micronutrients are the main cause of anaemia throughout the world and it's common in women of reproductive age where these deficiencies may lead to birth defects, preterm labour, low birth weight and resulting in an increase in perinatal death (Karaogulu *et al.,* 2010). Moreover, malaria infection contributes to anaemia throughout the life, especially during pregnancy, and it is estimated that in sub-Saharan Africa 23 milion pregnant women are exposed to malaria infection annually and approximately 400 000 pregnant women develop moderate or severe anaemia each year (Getachew *et al.,* 2012). Despite anaemia having been identified as a global public health problem for several years, no rapid progress has been observed, and the prevalence of the disease is still high globally (Ghislain *et al*., 2012). The WHO and the United Nations Children's Fund have stated that there is an immediate need to reduce the prevalence of anaemia and highlighted the importance of identifying its numerous determinants, in order to reach the global nutrition targets of 50% reduction of anaemia in women of reproductive age by 2025 (WHO,2014). Recent statistics indicate that anaemia affects 57% of pregnant women globally with the highest prevalence in sub-Saharan Africa (Abriha *et al.,* 2014). In India, a study identified that iron deficiency anaemia is the risk factor of preterm delivery, low birth weight and prevalence of anaemia among pregnant women ranged from 33.0% to 89.0 % (Viveki *et al*., 2012).

In Africa, the prevalence of anaemia in pregnant women is reported to be 66.8% (Niguse *et al.,* 2013). Furthermore, other studies in Africa have shown high prevalence of anaemia in pregnancy ranging from 41 to 84% in different settings (Alem *et al*., 2013; Haggas *et al*., 2010; Abdehefaz *et al.,* 2012). WHO identifies and categorizes anaemia prevalence as a mild public health problem when it is between 5.0% and 19.9%, a moderate public

health problem when it is between 20.0% and 39.9% and a severe public health problem when the prevalence is ≥40.0% (Rosmawati *et al.,* 2012). A study done by Abdelhameed *et al.* (2012) revealed that multiparity, poor socio-economic and educational statuses are the principal reasons for high prevalence of anaemia in pregnancy in developing countries. In Tanzania, prevalence of anaemia among pregnant women is estimated to be 51% (WHO, 2012). However, the prevalence of anaemia during pregnancy shows great variations in different geographical settings. Urassa *et al.* (2002) has reported a high prevalence of anaemia in pregnant women in Rufiji District, where the rate ranged from 50 to 60%. In Dar es Salaam, a study identified that iron deficiency, malaria and other infections are major causes of anaemia and its prevalence was 68% (Kidanto *et al*., 2009). In Kilimanjaro Region, Msuya *et al*. (2004) reported that 47.4% of pregnant women had anaemia. In Manyara Region, a study by Hinderaker *et al*. (2001) indicated that prevalence of anaemia in pregnant women in Hanang and Mbulu districts was 36%.

Improving maternal health is a high priority for the United Nations international development agenda, as part of the fifth Millennium Development Goal (MDG) set in year 2000. Maternal mortality is targeted for substantial reduction by 2015, and unfortunately progress in sub-Saharan Africa towards this target has stalled (WHO, 2014). Tanzania Demographic and Health Surveys report exemplifies this lack of progress in recent years, with an estimated maternal ratio of 578 deaths per 100 000 live births reported for 2004-2008 compared to 454 deaths per 100 000 live births mortality in 2010, but the figure is still high and far beyond attainment of the fifth Millennium Development Goals (MDGs) of reduction of maternal mortality ratio to 193 per 100,000 live births by 2015 (MoHSW, 2010). The Tanzania government, through the Ministry of Health and Social Welfare, has been implementing a public health package to combat anaemia in pregnancy through public and private healthcare facilities. The public health package includes

supplementation with iron and folic acid, promotion of antenatal care, prevention and control of malaria infection with intermittent preventive treatment (IPT), use of insecticide treated mosquito nets (ITNs), treatment and control of helminths infestation (MoHSW, 2009-2015).

1.2 Problem Statement and Justification

Anaemia in pregnancy is a worldwide public health problem affecting both developing and developed countries with significant impact on the health of mothers and foetus (Erharbor, 2013). Anaemia is an indicator of nutritional deficiencies that significantly contribute to birth defects, preterm labour and low birth weight, hence it causes global public health problem. However, iron deficiency anaemia is a leading cause of maternal morbidity and mortality, prenatal and perinatal infant loss; physical and cognitive losses thus in developing countries stall social and economic development. In sub-Saharan countries the magnitude of anaemia in pregnancy is quite alarming, whereby its prevalence is widely contributed by poor nutrition, iron and other micronutrients deficiencies, parasitic infestations, chronic infections, illiteracy, and short pregnancy intervals (Okeke, 2011). According to the WHO classification, any prevalence level of anaemia that exceeds 40% in any population group is an indicator of a severe public health problem, for which Tanzania qualifies.

Despite the national health policy of routine iron supplementation and intermittent preventive treatment for malaria with anti malarial drugs, still maternal anaemia continues to be a common cause of morbidity and mortality. In Manyara region, a study by Hinderaker *et al.* (2001) indicated that prevalence of anaemia in pregnant women in Hanang and Mbulu Districts was 36%. Despite interventions of treating and preventing maternal anaemia, still many pregnant women are affected by anaemia related health

problems and the contributing factors for the persistence of high incidences are not empirically known. Therefore, the aim of the study on which this dissertation is based was to determine the current status of anaemia in pregnant women in Mbulu District and assess its association with knowledge, attitude towards anaemia control in pregnancy. The findings from this study will help to improve control of maternal anaemia and reduce anaemia related health problems in Mbulu District and other areas of similar settings.

1.2 Objectives

1.2.1 Overall objective

To determine the prevalence of anaemia and asses the knowledge and attitude of pregnant women towards control measures of anaemia in pregnancy in Mbulu District, Tanzania.

1.2.2 Specific objectives

i. To determine the prevalence of anaemia among pregnant women in Mbulu health facilities.
ii. Assess the level of knowledge on anaemia and attitude of pregnant women towards control measures of anaemia in pregnancy, in Mbulu District, Tanzania.

1.3 Research questions

i. What is the magnitude of anaemia in pregnant women in Mbulu District health facilities?
ii. What knowledge do pregnant women have about causes, symptoms, complications, interventions, and experiences about anaemia during pregnancy?
iii. What are the fillings of pregnant women regarding the current interventions measures

CHAPTER TWO

2.0 LITERATURE REVIEW

Anaemia is a global public health problem affecting both developing and developed countries and its prevalence in pregnant women has been estimated to be 51% (Melku *et al*., 2014). Sub-Saharan Africa is the most affected region with an estimated anaemia prevalence of 57% pregnant women which corresponds to about 17.2 million affected women with severe consequences for human health as well as social and economic development. Anaemia occurs at all stages of the life cycle, but is more prevalent among pregnant women (Abriha *et al.,* 2014).

2.1 Causes of Anaemia in Pregnancy

Globally, the most common cause of anaemia is iron deficiency, which is responsible for about half of anaemia cases in pregnancy, and it is estimated that in developed countries 38% of pregnant women have iron depletion (Jack *et al.,* 2014). In sub-Saharan Africa, there are multiple causes of anaemia in pregnancy, which include inadequate diet, iron, folate and vitamin B12 deficiencies, impaired micronutrient absorption, blood loss resulting from haemorrhage, and helminth infestation (Olubukola *et al*., 2011). A research done by Buseri *et al*. (2012) revealed that, in developing countries, the major causes of anaemia in pregnancy are nutritional deficiencies, parasitic infestations, HIV infection, haemorrhage and some chronic medical disorders like renal and hepatic diseases. However, infectious diseases have been reported to cause a high prevalence of anaemia in sub-Saharan Africa (Alem *et al.,* 2013). Malaria is considered to be the principal cause of severe anaemia in malaria-endemic areas in Africa (Imelda *et al.,* 2011). In each year more than 30 million African women in malaria-endemic areas are at a high risk and it is estimated that malaria contributes for 3 to 5% of maternal anaemia, 8 to 14% of low birth

weight and 3 to 8% of infant mortality (Akinleye *et al*., 2009). The other non-nutritional causes of anaemia include thalassemia, malaria and genetic blood disorders such as sickle cell diseases (Adam *et al.,* 2011).

2.2 Development of Anaemia

The first stage of iron deficiency known as iron depletion occurs when iron stores are low and serum ferritin concentrations drop. The second stage is iron deficient erythropoiesis. This occurs when iron stores are depleted and the body does not absorb iron efficiently. Iron deficient erythropoiesis is characterized by a decrease in transferring saturation and increases in transferrin receptor expression and free erythrocyte protoporphyrin (FEP) concentration. Iron-deficiency anaemia (IDA) is the third and most severe stage of iron deficiency and is characterized by low haemoglobin and hematocrit values. Erythrocytes are hypochromic and microcytic during IDA and haemoglobin concentration falls (Shah *et al.,* 2001). Iron deficiency is the most common cause of anaemia, although there are other nutritional and non-nutritional causes of anaemia (Rakick *et al.,* 2013). As illustrated in Fig. 1, not all anaemia is caused by iron deficiency, and not all iron deficiency results into anaemia. For example, inadequate intakes of folate and vitamin B12 can also cause anaemia. Parasitic infestations, HIV infection, inflammatory condition such as renal diseases, Hemoglobinopathies and genetic disorders may also contribute to anaemia (Klemman *et al.,* 2011). A number of non-iron deficiency causes of anaemia are summarised in Fig. 1, according to Klemman *et al.* (2011).

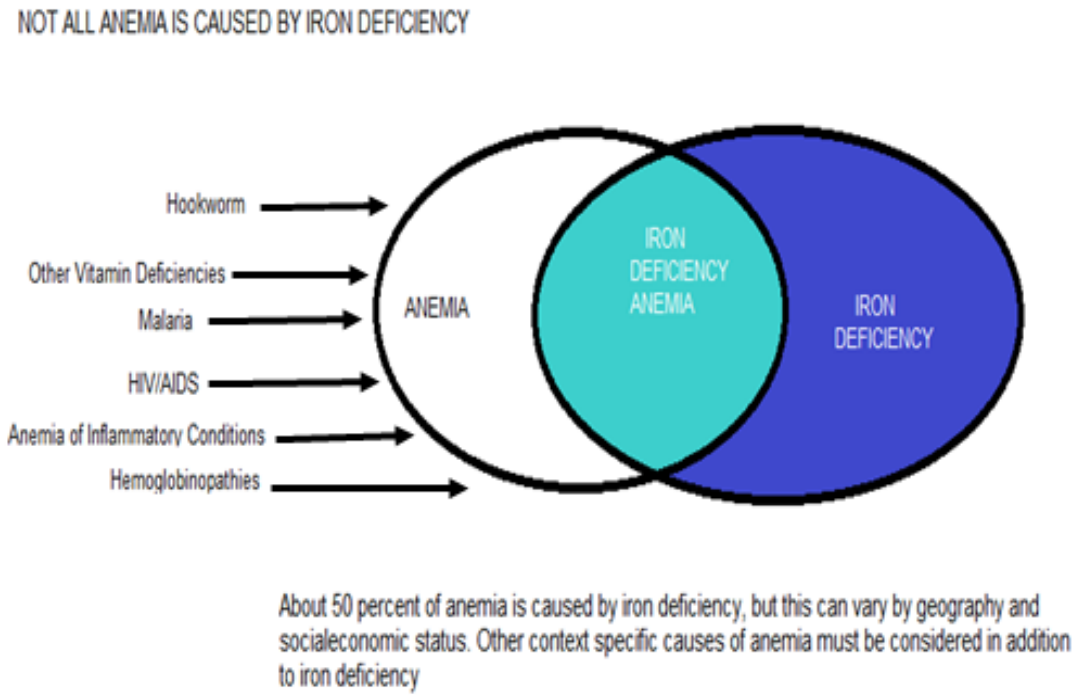

Figure 1: Summary of anaemia aetiology

Source Klemman *et al.* (2011).

2.3 Risk Factors for Anaemia in Pregnancy

Pregnant women in developing countries are at risk of anaemia due to poverty, grand-multiparity, too early pregnancies, too many and too frequent pregnancies spacing of < 1 year, low socioeconomic status, illiteracy, and late booking of pregnant women at antenatal care units (Jufar *et al.,* 2014). However, women's behaviour of soil eating during pregnancy may contribute to anaemia due to worms' infection. Mainly due to the above factors, the prevalence rates of anaemia were 65% in Kenya, 46% in Ghana 42% in Namibia, and 28% in Tanzania (Kawai *et al.,* 2009). Furthermore, other risk factors are parasitic infestations, season, geographical location, food habits, gestational age, parity and pregnancies at early age (de Benoist *et al.,* 2006).

2.4 Diagnosis of Anaemia in Pregnancy

Because of its low cost and feasibility, WHO has included clinical assessment of palmar pallor as an initial tool to detect severe anaemia. Although clinical examination is not accurate enough to detect mild to moderate anaemia with a sensitivity of 65% and specificity of 82%, the sensitivity and specificity were better in severe anaemia, 84% and 99% respectively (WHO, 2001) The clinical signs and symptoms of anaemia vary among pregnant women; the most common ones are weakness, fatigue, the skin appear pallor, and paleness of the conjunctiva and palm, shortness of breath and heart palpitations. In severe conditions it is associated with dizziness, chest pain; fainting and the patient may experience circulation disturbances and tachycardia (Vanden, 2014).

2.5 Management of Anaemia in Pregnancy

There is a marked increase in folate use during pregnancy, due to the acceleration of reactions requiring single-carbon transfer, the rapid rate of cell division in maternal and faetal tissues, and deposition in the foetus (Amoran *et al.,* 2012). The study by Hoque *et al.* (2009) revealed that taking folic acid supplements before conception and at the first four weeks of pregnancy lowers risk of genetically predisposed women having a baby with a neural tube defect. Currently, WHO recommendation for treatment of anaemia in pregnancy is through improvements in dietary diversity; food fortification with iron, folic acid and other micronutrients; daily supplementation of iron and folic acid to each pregnant women and control of infections (WHO, 2011). Most sub-Saharan African countries, including Tanzania, currently, have national policies to prevent and treat anaemia and malarial prophylaxis for all pregnant women (Mutagonda, 2012).

2.6 Prevention of Anaemia in Pregnancy

Centres for Disease Control and Prevention (CDC) recommend screening for anaemia in pregnant women and universal iron supplementation to meet the iron requirements in pregnancy (Dwumfour, 2013). The interventions required to be delivered in health systems

include general supportive measures to improve environmental and social conditions as well as interventions that address maternal nutrition (Brooker *et al.*, 2008), and use of insecticide treated nets and case management of pregnant women with clinical signs of malaria (Simon *et al.,* 2009). However, anaemia prevention programmes can contribute significantly in achieving the Millennium Development Goals (MDGs) including MGD-4 that is about child mortality reduction, and MGD-5 that is about improved maternal health (de Benoist *et al*., 2008).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Study Area

The study was conducted in three health care centres: Mbulu District Hospital, Haydom Lutheran Hospital and Yaeda Chini Dispensary in Mbulu District. Mbulu is located in the North-eastern part of Tanzania. It lies between latitudes 3.25^{o} to 4.125^{o}S and longitudes 34.95^{o} to 36.05^{o}E. The altitude lies on plateau, 1600 to 2200 metres above sea level. Mbulu has an annual rainfall of 400 to 1200 mm, with two rainfall seasons: an intense one observed from the month of March to May and mild one in November to December. The district has a land area of 4.452 square kilometres. It is bordered to the North by Karatu district to the East by the Babati District, to the South by Hanang District, and to the West by Iramba District. According to Tanzania National Bureau of Statistics (2013), the district had a population of 343 115 (males 172,349 and females 170 766). The district has a fast growing population; the average growth rate is 3.8% per annum which is higher than the National average of 2.8 percent. The main economic activities are agriculture and keeping livestock, but also hunting and gathering are done, particularly by indigenous people belonging to the Hadzabe tribe. The indigenous population in study area consists of ethnic groups that speak different languages; they are Hamitic, Cushitic speaking Iraqw, the Nilo- Saharah speaking Datoga also called the Barbaig or Mang'ati and Hadzabe who are also called the Tindiga. The study area is shown in Fig. 2.

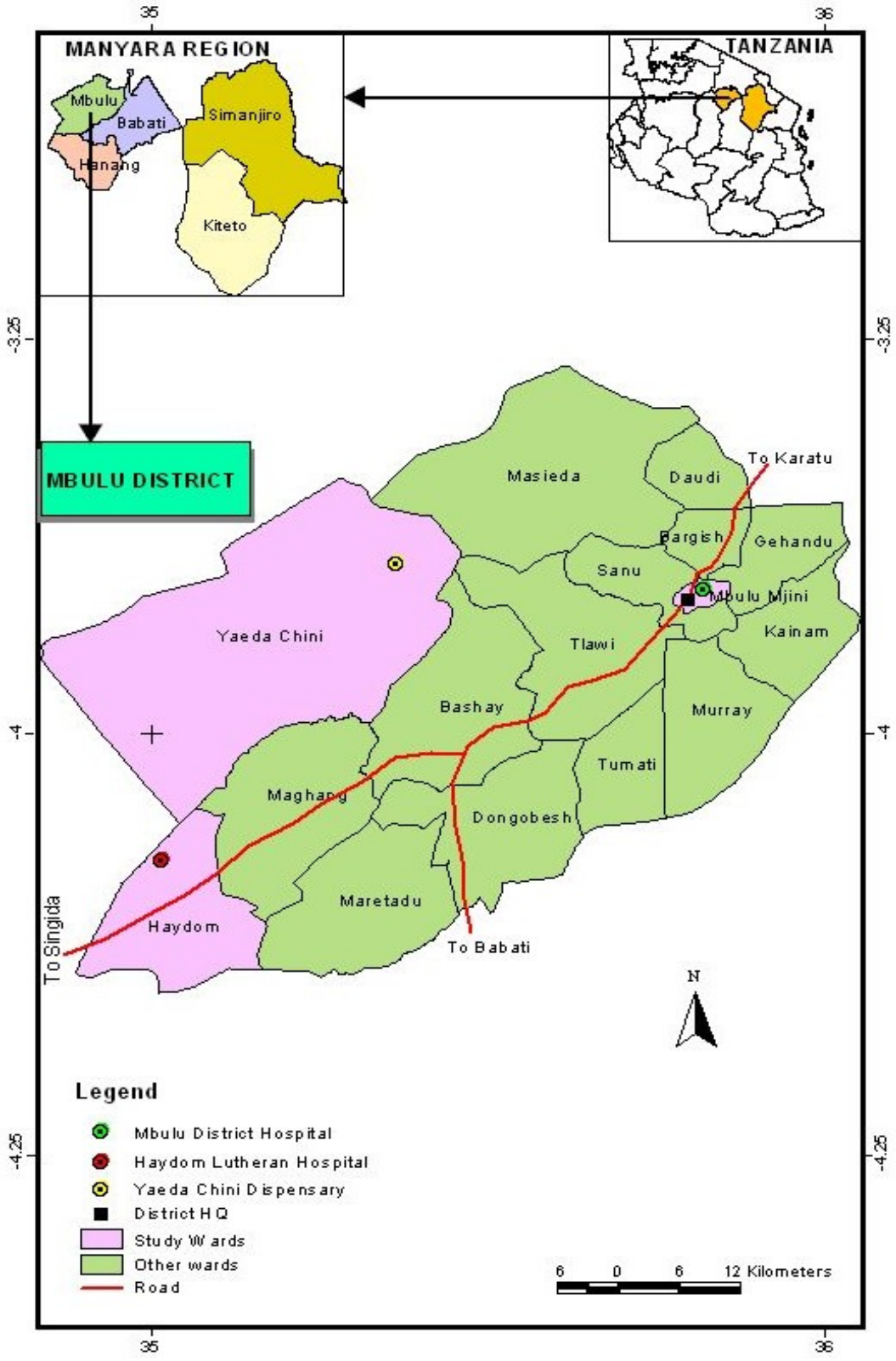

Figure 2: The map of Mbulu District indicating key health facilities

3.2 Study Design and Population

The study was a cross sectional one; it was conducted from November 2014 to July 2015 in three health care facilities in Mbulu District. The study population involved primigravid and multigravid pregnant women aged 15 to 49 years who came for their antenatal visit at selected health facilities during the study period.

3.3 Inclusion and Exclusion Criteria

All pregnant women aged 15 to 49 years who were attending antenatal clinics in selected health care centres in Mbulu District at the time of data collection were potential respondents. However, the study excluded those women who fulfil the inclusion criteria and those pregnant women who refused to participate in the study.

3.4 Sample Size

The required sample size for this study was calculated using the formula for cross-sectional study based on results of a study which was previously done in Hanang and Mbulu districts. In that study the prevalence of anaemia among pregnant women was found to be 36% (Hindaraker *et al.,* 2001).

The formula that was used for sample size calculation was:

$$n = \frac{Z_{\alpha}^{2} \times P(1- P)}{d^{2}}$$

Where:

n = Minimum sample size

Z_{α} = Point on standard normal distribution curve corresponding to significance level of 5% (its values is 1.96).

d = marginal error 5%,

P = Previous prevalence of anaemia among pregnant women 36%

Therefore, the sample size (n) = $\frac{(1.96)^2 \times 0.36(1- 036)}{(0.05)^2} = 354$

Therefore, minimum of sample size of 354 pregnant women was required in this study.

3.5 Sampling Method

The district has a total of 40 health facilities, among them two are hospitals, and four are health centres and thirty four are dispensaries. All hospitals, health centres and most of dispensaries offer antenatal clinic services. Purposive sampling was used to select two hospitals (Mbulu District Hospital and Haydom Lutheran Hospital) and one dispensary (Yaeda chini Dispensary). The hospitals were selected for better presentation of study subject to represent the entire population in Mbulu District. Yaeda chini Dispensary was included because there are several ethnicities living in this area; these ethnic groups were Datoga tirbe and Hadzabe tribe. Study participants were selected using simple random sampling techniques whereby numbers 1 to 20 were written on small pieces of paper, and then the paper pieces were folded and put in a box. The box was thoroughly shaken and one piece of paper after another one was randomly picked to select the study participants. Pregnant women who picked number 1 to 15 were included in the study in that particular day of study; a total of 354 pregnant women were recruited.

3.6 Data Collection Methods

Data collection methods included a semi-structured questionnaire and blood sampling. The questionnaire contained, among other questions, an index summated scale to measure knowledge about anaemia, and a Likert scale to measure attitude towards anaemia control in pregnancy.

3.6.1 Structured questionnaire

Semi-structured questionnaires written in Kiswahili language which containing both close ended and open ended questions were used to interview and generate data from pregnant women attending antenatal clinics (ANC), only those pregnant women who were willingly to participate in the study were given the questionnaires and those women who cannot able to read and write they were assisted . All health care providers (Nurses) working at ANC were involved in the study and trained on how to administer the questionnaires. The questionnaires are attached as (Appendix1), where information on Socio-demographic characteristics was collected and women's knowledge on causes, clinical signs, treatment, prevention and complications of anaemia in pregnancy was tested. Knowledge about anaemia was determined using an index summated scale which was made up of a series of 11 questions seeking whether the respondents had correct knowledge about anaemia. For each correct answer, a respondent scored 1, while for each wrong answer, a respondent scored 0. Based on the 11 statements, the minimum and maximum possible scores were 0 and 11, respectively. Zero meant having no knowledge of anaemia, while 11 meant having the highest knowledge about anaemia. The average overall score point was computed, and the respondents were grouped into three categories; 0 score represented having no knowledge about anaemia; 1 to 6 represented having low knowledge about anaemia, and 7 to 11 represented having high knowledge about anaemia.

Attitude of pregnant women towards control and prevention measures on anaemia was determined using a Likert summated scale, which was made up 8 items translating into 40 points. To each of the items of the Likert summated scale, the respondents were required to give one of the following alternatives: 1 (strongly disagreed), 2 (disagree), 3 (neutral), 4 (agree), and 5(strongly agree). For ease comparison, the responses were re-grouped into three categories: strongly disagree and disagree into disagree, agree and strongly agree

into agree, and neutral remained as it is. The minimum and maximum possible scores on the Likert summated scale were 8 and 40 points, denoting the most unfavourable and the most favourable attitudes. A score of 24 denoted a neutral attitude. Therefore, 8.0 to 23.0 points, 24.0 points and 25.0 to 40.0 points meant unfavourable, neutral and favourable attitudes, respectively.

3.6.2 Pre-testing of the Questionnaire

The questionnaire was pre-tested at antenatal clinic in Mbulu District Hospital. The people interviewed during the pre-testing found that the instructions and the language of the tool were clear and understandable and time taken to complete the questionnaire was 20 minutes. Women involved in questionnaire pre-testing were not allowed to participate in the study.

3.6.3 Blood sampling and sample handling

The Laboratory Scientist is the responsible person to check malaria parasites and Haemoglobin concentration, but all Nurses involved in the study were trained and capable to collect blood samples from the study participants.

3.6.3.1 Haemoglobin measurement

Haemoglobin was measured by HemoCue Hb*20 machine (Haemocue AB, Angelholm, Sweden). The tip of the middle finger was cleaned with an alcohol swab, and capillary blood samples were obtained via a finger prick with a sterile lancet. The microcuvette 201* was filled with a drop of whole blood and then microcuvette was placed in the device tray and the holder was pushed gently into the Heme analyser; a reading was obtained within 45 seconds, and the results were recorded from the digital display.

Pregnant women with Hb less than 11g/dl were categorised as anaemic, and those with Haemoglobin 11g/dl and above were considered as non-anaemic.

3.6.3.2 Malaria testing

Malaria was tested by using Malaria Ag.pLDH/HRP2, (MRDT Standard Diagnostic India). The capillary blood sample was collected by finger prick method whereby the tip of the middle finger was cleaned with an alcohol swab; the test device was placed on a clean, flat surface and 5µl of whole blood was added into the respective test device by using micropipette supplied with the test device. Two drops of assay buffer were added into the sample device; for the positive results test two lines were observed; one line was for the control and the second line was for the reactive sample. For the negative results test, only control line was observed on the device, and the results were read within 20 minutes and recorded.

3.7 Ethical Consideration

The ethical clearance for conducting this study was granted by Medical Research Coordinating Committee of the National Institute for Medical Research (reference number NIMR/HQ/R.8a/Vol. IX/1901). Permission from Mbulu District Council to conduct the study in the health facilities was granted by the District Medical Officer. All subjects were offered information about the study, including the general purpose, possible risks and benefits of the study. Thereafter, a written consent form was obtained before the questionnaire was administered and before blood samples were collected. The consent form was read in local language and a copy was given to the women up on request. To ensure confidentiality, participants' data were linked to a code number, and the results of every participant with parasitic infection, especially malaria and low HCT level were sent as soon as possible to Medical Doctor for further investigation in the ANC, while those

women who attended outreach mobile clinic were sent to nearby health facilities for treatment and medical consultation.

3.8 Data and Analysis

The data collected using a questionnaire were compiled, coded by using Microsoft excel and analysed using Statistical Package for Social Sciences (SPSS) version 16. Descriptive statistics were performed, and statistical significance was determined at p-value <0.05. Means and frequencies were used to describe social demographic data and other related information about anaemia in pregnancy. Fisher's exact test was used to determine associations between variables at statistical significance level of <0.05.

The haemoglobin (Hb) levels determined using laboratory means were analysed descriptively to determine average, minimum and maximum amounts of Hb in terms of grams per decilitre (g/dl). On the basis of Hb cut-off recommended by WHO as explained in Pg.1 section 1.1.

On the summated scale index that was used to measure knowledge about anaemia based on the 11- items, descriptive statistics were used to compute the average overall points scored, as explained in Section 3.6.1.

On the Likert summated scale that was used to determine attitude towards anaemia control in pregnancy, the average overall points scored were computed in terms of descriptive statistics analysis, as explained in Section 3.6.1.

Multivariable logistic regression was run in EpiData to assess association of anaemia as (anaemic or non-anaemic) with possible risk factors (predictor variables). The predictor

variables included malaria, age of respondents, education, marital status, occupation, gestation age and gravidity. The model was fitted by backward step wise approach, with cut-off point for univariable analysis at 0.25 and 0.05 during multivariable analysis. The final model had one predictor variable, gravidity.

CHAPTER FOUR

4.0 RESULTS

4.1 Socio-Demographic Characteristics of the Study Population

The sample for the study was 354 pregnant women, and a high proportion 238 (67.2%) of them were in the age group of 21 to 34. The mean age was 27.41 $\pm$ 6.83 with the minimum age of 15 years, while the maximum age was 49 years. Most of the respondents 259 (73%) were in the 3rd trimester of their pregnancies, the mean gestation age being 7.41$\pm$3.78 months for all women, and 109 (30.8%) of the participants had five children or more. The majority of the participants 171 (48%) had primary level of education; 17.5% of them had secondary school level of education, and 114 (32.2%) participants had no formal education. Most women 202 (57%) were peasants and the majority 289 (82%) were married, as shown in Table 1.

Table 1: Social demographic characteristics of the study population (n=354)

Characteristics	n (%)	Mean±SD
Age category		
15-20	60 (16.9)	27.41 (6.83)
21-34	238 (67.2)	
35-49	56 (15.8)	
Gravidae	154 (44)	
Gravid 1-2	91 (26)	
Gravid 3-4	109 (30.8)	
Gravid 5& above		
Gestation age		
1st Trimester	11 (3)	
2nd Trimester	84 (24)	7.41 (3.78)
3rd Trimester	259 (73)	
Parity	100 (28.2)	
Primigravida	254 (71.8)	
Multigravida		
Level of education		
Informal education	114 (32.2)	
Primary education	171 (48.3)	
Secondary education	62 (17.5)	
Diploma	5 (1.4)	
University degree	2 (0.6)	
Occupation		
Teacher	26 (7.4)	
Health worker	5 (1.4)	
Peasant	202 (57.2)	
Business	19 (5.4)	
Keeping livestock only	101(28.6)	
Marital status		
Married	289(81.6)	
Single	64(18.1)	
Widow	1(0.3)	
Religion		
Muslim	15 (4.2)	
Christian	236 (66.7)	
None	103 (29.1)	

4.2 Prevalence of Anaemia among Studied Population

A sample of 354 women was investigated at three health care facilities in Mbulu District. Based on Haemoglobin level, the overall prevalence of anaemia among the studied sample was 38.7% (137/354; 95% CL: 0.34-0.44) Out of the 354 women, 61 (17.2%) had mild anaemia; 46 (13%) had moderate anaemia and 30 (8.5%) had severe anaemia, as shown in Fig. 3.

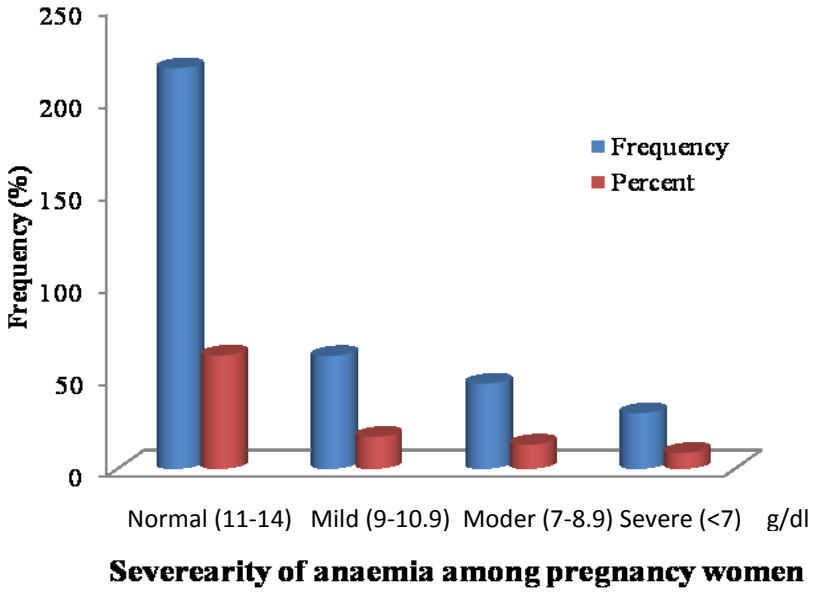

Figure 3: Prevalence of anaemia in the studied sample (n = 354)

4.3 Association of Social Demographic Variables with Anaemia in the Study Area

Anaemia was more prevalent among pregnant women of age group 21 to 34 years: 82 (35.5%) and among women who were in gravid five and above 98 (89%) compared to primigravida and multigravida mothers who were 24.2% and 11% respectively (Fisher's exact, p-value<0.001). Furthermore, the prevalence of anaemia was higher among pregnant women who were illiterate (72.8%) as compared to those women with secondary educational and higher education levels who had low proportion of anaemia (Fisher's exact, p-value<0.001). Notably, it was also demonstrated that anaemia was commoner

among women who came from families that engaged in certain. For example, in families keeping livestock anaemia prevalence was 73.3%, compared to families where the people were mainly peasant (28.7%). Also, anaemia was more prevalent among women who were in second trimester (22%) and third trimester (43.8%) of pregnancy and the association was found to be statistically significant (Table2).

Table 2: Association of anaemia with selected social demographic characteristics (n=354)

Variables	Total	Anaemia Hb <11g/dl No-n (%)	Yes -n(%)	Fisher' p-value
Age categories				
15-20	60	51 (85.0)	9 (15.0)	<0.001
21-34	238	156 (65.5)	82 (35.5)	
35-49	56	10 (17.9)	46 (82.1)	
Gravidae				
Gravid 1-2	154	137 (89.0)	17 (11.0)	<0.001
Gravid 3-4	91	69 (75.8)	22 (24.2)	
Gravid 5 & above	109	11 (10.1)	98 (89.9)	
Gestational age				
First trimemister	10	9 (90.0)	1 (10.0)	0.024
Second trimemister	84	62 (73.8)	22 (26.2)	
Third trimemister	260	146 (56.2)	114 (43.8)	
Education level				
Illiteracy	114	31 (27.2)	83 (72.8)	<0.001
Literacy	240	186 (77.5)	54 (22.5)	
Occupation				
Teacher	26	24 (92.3)	2 (7.7)	<0.001
Health worker	5	4 (8.0)	1 (20)	
Peasant	202	144 (71.3)	58 (28.7)	
Business	19	17 (89.5)	2 (10.5)	
Keeping livestock	101	27 (26.7)	74 (73.3)	
Marital status				
Married	289	159 (55.0)	130 (45)	<0.001
Single	64	58 (90.6)	6 (9.4)	
Widow	1	0 (0.0)	1 (100.0)	

4.4 Prevalence Rate of Malaria Infection among Pregnant Women

The study participants were grouped into primigravidae and multigravidae women; 100 (28.2%) were primigravidae while 254 (71.8%) were multigravidae. In this study the overall prevalence rate of malaria infection was 25 (7.1%). The results confirmed that multiparous women had higher prevalence (9.1%) of malaria antigenemia compared to nulliparous women (2%) (Fishers' exact test p-value is 0.009 (OR = 0.205, 95% CI = 0.47 - 0.886). Therefore, malaria was more prevalent in multigravidae women than in primigravidae women, as shown in Table.3.

Table 3: Prevalence rate of malaria infection among pregnant women (n- 354)

		Malaria test				
Gravidae	**No,**	**Pos-%**	**Neg-%**	**OR**	**CI**	**P-value**
Primigravid	100	2 (2)	98(98)	0.205	0.47-0.886	0.009
Multigravid	254	23(9.1)	231(90.9)			
Total	354	25(7.1)	329(92.9)			

4.5 Association between Anaemia and Selected Independent Variables

Univariate analyses were carried out to elicit the impact of each factor on prevalence of anaemia among pregnant women. The findings showed that anaemia was more prevalent among women who had high parity (89.9%) and short inter pregnancy intervals (67.1%) compared to women who were Primigravid and who had long inter pregnancy intervals, respectively, as shown in Table 4. The respondents who reported to have no land at home had high proportion 65.8% of anaemic women compared to (25.6%) of women who had enough food or land (Fisher's exact, p-value 0.001). Generally, anaemia was seen to be less common in pregnant women from households where ownership of land was 5 and more acres (n = 17, 39.7%) Fisher's exact, p-value <0.001.

Table 4: Association between anaemia and selected independent variables in the study (n=354)

Variable	Total	Hb<11g/dl		Fisher's (P-Value)
		No-n (%)	Yes- n (%)	
Acres ownership				
None	111	38 (34.2)	73 (65.8)	
1-2	99	79 (79.8)	20 (20.2)	<0.001
3-4	101	74 (73.3)	27 (26.7)	
5 & above	43	26 (60.3)	17 (39.7)	
Enough food at home				
Yes	246	183 (74.4)	63 (25.6)	
No	108	33 (30.6)	75 (69.4)	<0.001
Pregnancies interval				
< 2 years	164	54 (32.9)	110 (67.1)	
2-3 years	82	68 (82.9)	14 (27.1)	< 0.001
> 3 years	8	2 (25)	6 (75)	
Knowledge on anaemia				
Yes	125	105 (84)	20 (16)	
No	229	112 (48.9)	117 (51.1)	< 0.001
Knowledge on hookworms				
Yes	166	133 (80.1)	33 (19.9)	
No	188	84 (44.7)	104 (55.3)	<0.001
Malaria test	354	329 (92.9)	25 (7.1)	<0.025
Gravidae				
Gravid 1-2	154	137 (89)	17 (11.0)	
Gravid 3-4	91	69 (75.8)	22 (24.2)	<0.001
Gravid 5 & above	109	11 (10.1)	98 (89.9)	

4.6 Multivariate Analysis of Independent Variables among Women

The Multivariate analysis shows that only one factor was found to be independent predictor of anaemia in women and this was further presented in the table 5 above. The results shows that adjusting for potential confounders which were age, marital status, education level, occupation, malaria infection and gestation age, almost all variables in the table were not significantly associated with anaemia except for gravidity among women which remained significantly associated with anaemia even after adjusting for known confounders in the model as seen in the Table 5 below. Therefore an independent risk factor for anaemia was level of gravidity among women, which shows that the woman who had gravidity 3-4 was significantly 13 times more likely to suffer from anaemia compared to a woman who had gravidity 1-2 (OR: 13.09; 95%CI [5.68-47.04]; p-value < 0.001), women who had gravidity of 5 and above were significantly 25 times more likely to suffer from anaemia compared to women who had gravidity 1-2 (OR: 25.16; 95%CI [12.46-37.13]; p-value 0.007). Generally risks of developing anaemia among women were significantly increased with increasing parity and age among pregnant women.

Table 5: Multivariate analysis of risk factors for anaemia in women

Crude Odds Ratio for risk factors for anaemia among women.				Risk factors for anaemia adjusted for age, marital status, occupation, malaria test		
Variable	**Crude OR**	**95% CI**	**P-value**	**Adjusted OR**	**95% CI**	**P-value**
Malaria test						
Positive	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Negative	0.23	[0.09,0.60]	0.003	0.14	[0.02,1.24]	0.078
Age – group						
15-20years	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
21-34years	2.26	[1.40,3.67]	0.001	0.74	[0.15,3.76]	0.716
35-49years	6.66	[3.31,13.40]	0.000	1.47	[0.14,15.18]	0.748
Education level						
Informal	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Primary	0.03	[0.01,0.07]	0.000	0.17	[0.02,1.81]	0.143
Secondary	0.01	[0.01,0.04]	0.000	0.24	[0.01,4.35]	0.336
Diploma	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Degree	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Marital status						
Married	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Single	0.13	[0.06,0.29]	0.000	0.36	[0.06,2.06]	0.248
Widow	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Occupation						
Teacher	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Health worker	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
Peasant	9.83	[1.30,74.24]	0.027	1.14	[0.04,36.15]	0.942
Business	2.94	[0.25,35.06]	0.394	0.16	[0.00,6.07]	0.326
Keeping livestock only	1237.5	[107.84,142]	0.000	4.807	[0.00,.]	0.986
Gestation age						
1st trimester	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
2nd trimester	4.48	[0.55,36.87]	0.163	0.33	[0.06,1.66]	0.178
3rd trimester	10.39	[1.31,82.37]	0.027	1.00	[1.00,1.00]	.
Gravidity						
1-2	1.00	[1.00,1.00]	.	1.00	[1.00,1.00]	.
3-4	4.82	[2.67,8.68]	0.000	13.09	[5.68,47.04]	0.001
5 & above	20.63	[10.92,38.9]	0.000	25.16	[12.46,37.23]	0.007

4.7 Respondents' Knowledge about Anaemia

The respondents were asked eleven questions, which are listed in appendix 2 (among other questions) to find out whether they had correct knowledge about anaemia. Only 35.0% of the respondents were able to define anaemia correctly, "anaemia is a decrease number in concentration of red blood cells in the blood" and other statements considered as incorrect, while high proportions (65.0%) of the respondents were unable to give the correct definition of anaemia. About two-fifths (36.7%) of the respondents were able to mention the causes of anaemia as poor diet, parasitic infestations, genetic factors and chronic infections as identified in literature, meanwhile only few (36.7%) of the respondents were able to identify correctly some of the food sources enriched with iron, including green leafy vegetables, fruits and protein rich foods that are recommended for anaemia treatment and prevention. Only 35.9% of the respondents were knowledgeable and knew that anaemia has adverse effect for both health of mother and foetus, while a high proportion (64.1%) of the respondents were unable to provide correct responses on anaemia complication in pregnancy, as shown in Appendix 2.

As seen in Section 3.6.1, the questionnaire which was used for the research included an 11-point scale on which everyone would score 0 to 11 points, 0 representing having no knowledge about anaemia, 1 to 6 representing having low knowledge about anaemia, and 7 to 11 representing having high knowledge about anaemia. On the basis of the methodology used to determine knowledge about anaemia, as explained in the methodology section (Section 3.6.1), the overall points scored on the 11-point scale was 4.2 out of 11.0, which shows that knowledge about anaemia was low. The knowledge being low was also shown by the proportion of respondents who had no knowledge about anaemia (42.1%), and the proportions of respondents who had other levels of knowledge about anaemia as shown in Fig. 4.

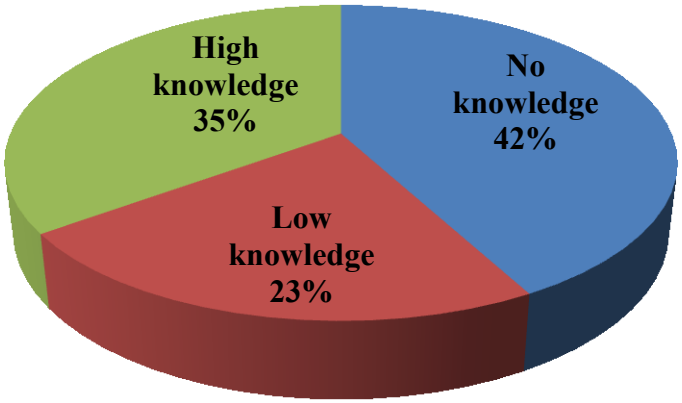

Figure 4: Proportions of respondents with various levels of knowledge about anaemia

4.8 The Level of Knowledge on Anaemia with Respect to Socio-demographic Characteristics

The background characteristics of the respondents showed a negative implication on awareness regarding anaemia whereby a high proportion 54% of the respondents with non-formal education together with respondents who had primary education 87 (44%) had lacked knowledge on anaemia. Also the knowledge was low in family occupation particularly among those who were keeping livestock only (1%) compared to those who were doing trade (89.5%) and peasant occupational groups (39.5%). Generally, the respondents with secondary education (38%) and those of higher level of education (100%) had higher level of knowledge and awareness on anaemia, as shown in Table 6.

Table 6: The levels of knowledge about anaemia with respect to social demographic variables of pregnant women

Variable	Total	Knowledge on anaemia		Fisher's (p-value)
		No-n (%)	Yes-n (%)	
Age group (n=354)				
15-20	60	38 (63.3)	22 (36.7)	(0.127)
21-34	238	146 (61.9)	90 (38.9)	
34-49	56	42 (76.4)	13 (23.6)	
Education level (n=354)				
Informal	114	107 (54.0)	6 (4.0)	
Primary	171	87 (44.0)	83 (54.0)	
Secondary	62	3 (2.0)	58 (38.0)	(<0.001)
Diploma	5	0 (0.0)	5 (100.0)	
Degree	2	0 (0.0)	2 (100.0)	
Occupation (n=353)				
Teacher	26	1 (3.8)	25 (96.2)	
Health worker	5	2 (40.0)	3 (60.0)	
Peasant	202	121 (60.5)	79 (39.5)	(<0.001)
Business	19	2 (10.5)	17 (89.5)	
Keep livestock	101	99 (99.0)	1(1.0)	
Gestation age (n=354)				
1st trimester	10	2 (20.0)	8 (80.0)	
2nd trimester	84	45 (54.2)	38 (45.8)	(0.06)
3rd trimester	260	150 (58.1)	108 (41.9)	
Parity (n=354)				
Gravid 1-2	154	78 (51.3)	74 (48.7)	
Gravid 3-4	91	57 (62.6)	34 (37.4)	(<0.001)
Gravid 5 & above	109	91 (84.3)	17 (15.7)	
Village of residence (n=354)				
Yaeda chini	100	98 (50.0)	4 (3)	
Haydom	104	56 (36.0)	48 (24)	(<0.001)
Mbulu	150	94 (61.0)	51 (26)	
Marital status				
Married	289	194 (67.4)	94 (32.6)	
Single	64	32 (51.6)	30 (48.4)	(0.002)
Widow	1	0 (0.0)	1 (100.0)	

4.9 Respondents' Opinions and Attitude towards Control Measures and Prevention of Anaemia in Pregnancy

On the basis of the methodology described in Section 3.6.1, the overall number of points scored on the 8-item (40-point) Likert summated scale was 21.7 out of a possible maximum of 40.0 points. Since on the scale 8.0 to 23.0 points, 24.0 points and 25.0 to 40.0 points meant unfavourable, neutral and favourable attitudes, respectively; overall, the respondents had an unfavourable attitude towards anaemia control and prevention in pregnancy. The highest proportion (37.6%) of the respondents (pregnant women) disagreed with the following statement: "Do you think that you are at risk of getting anaemia in pregnancy". Furthermore, the respondents were not aware that adherence to having sufficient diet with iron taking is important to achieve better health. On the other hand, the respondents disagreed on using contraceptives or family planning methods as a way to achieve recommended inter pregnancy interval. This is denoted by the overall score being between 8.0 to 23.0 points.

However, 31.4% of the respondents had favourable attitude towards anaemia control, whereby the women agreed and were aware that taking iron tablets with proper diet is necessary during pregnancy. Furthermore, the women were aware of negative consequences of anaemia that treating and preventing anaemia in pregnancy is good for both health of mother and foetus as seen in Fig.5, which shows the proportions of the responds who had unfavourable, neutral and favourable attitudes towards control measures of anaemia in pregnancy. This indicates the need to sustain campaigns for health education and awareness creation among pregnant women because the women's attitudes towards anaemia control during pregnancy was unfavourable. The proportions of the respondents who had various attitudes towards control of anaemia are presented in Fig. 5.

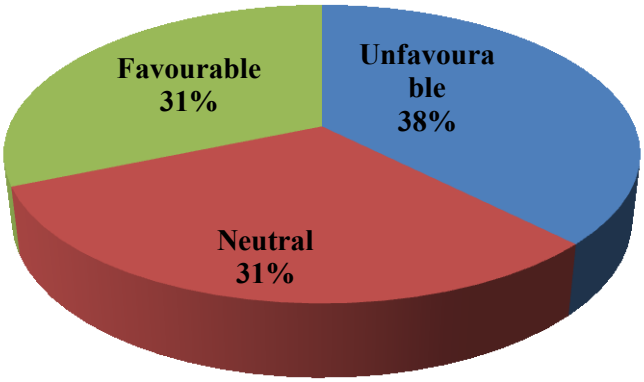

Figure 5: Respondents' opinions and attitude regarding anaemia in pregnancy

CHAPTER FIVE

5.0 DISCUSSION

Anaemia among pregnant women poses a real health threat worldwide, especially in developing countries. The current study aimed to assess the prevalence, knowledge and attitude of pregnant women towards control measures of anaemia in urban and rural areas in Mbulu District. According to the WHO classification on the prevalence of anaemia the outcome of this study has shown that anaemia is a moderate public health problem among pregnant women in Mbulu District in Manyara Region, with 30.2% being anaemic among pregnant women at ANC and 8.5% being severely anaemic. The results are almost similar to those of various studies done previously in sub-Saharan Africa which reported prevalence rates of anaemia among pregnant mothers ranging from 33% to 75 % (Abriha *et al.,* 2014; Oliver *et al*., 2012; Vanden*,* 2014).

Other regions in Tanzania did show a high prevalence of anaemia, e.g. in Dar es Salaam Region, Rufiji District and Kilimanjaro Region, the identified percentages were 68%, 50 to 60% and 47.4% respectively. The prevalence of anaemia on which this dissertation is based is lower than what has been found in other regions and coastal regions because it could be due to variations in geographical settings which harbour parasitic infections such as malaria infection and helminth infections. On the other hand, the lower prevalence of anaemia among Mbulu pregnant women might be that, the surveys was conducted at a higher altitude areas and the climate is cooler, which was less suitable for the breeding of mosquitoes, so that malaria was not holo-endemic in that geographical area. Another reason for the low prevalence of malaria observed in this study could be attributed to a relatively high coverage of intermittent preventive treatment of malaria and the wide use of insecticide treated mosquito bed nets. However, the overall malaria prevalence was

(7.1%) where the infection is higher in multiparous women (9.1%) which are contrary to the finding that malaria infection was higher in primigravida (2%) women than in multiparous women. The latter was explained by the fact that women with successive births are believed to have had exposure to a variety of strains of malaria parasites thereby developing somehow efficient immunity against most strains of the parasites. In addition, peripheral and placental parasitaemia have been reported to decrease with increasing parity among pregnant women. These findings are also in agreement with results of studies done on anaemia in other sub-Saharan countries, e.g. 68% in Bernin by Koura *et al*. (2012) and 65% in Nepal by Raut *et al*. (2014). The prevalence rate of anaemia for pregnant mothers in this study is close to WHO estimation for developing countries, but far behind the prevalence in economically developed countries such as Europe, where the prevalence was 25.1% (WHO, 2012).

The study on anaemia in pregnancy was previously done in similar areas by Hinderaker *et al*. (2001) who reported anaemia prevalence of 36% among pregnant women in Mbulu and Hanang Districts, but in the current study the overall prevalence was 38.7% which is elevated compared to the previous. However, this study indentified that on the nutrition or diet, there is very low awareness level (23%) of the respondents on the food sources that can fight against anaemia apart from parasitic infestations and other chronic infections. Furthermore, (42%) of the respondents had no knowledge on anaemia meanwhile (38%) of the respondents had unfavourable attitude towards anaemia control in pregnancy. Therefore the survey revealed low level of knowledge on anaemia aetiology, treatment and prevention among illiterates' respondents compared to the respondents who had secondary education. This finding was comparable to the finding in a study conducted in Kano Northern Nigeria by Nwizu *et al*. (2011) who identified that anaemia was significantly higher among women with no formal education compared to women with formal

education. Other similar study done in Aurangaband in India by Pushpa *et al*. (2012) reported that the lower the education levels of the women, the higher the probability of suffering from anaemia during pregnancy. Therefore, participants' knowledge about anaemia causes, treatments and prevention needs to be addressed, as it was generally poor, if knowledge is lacking this could be problematic for participants to make decisions based on sound information to reduce anaemia risk. This calls for increased health education on anaemia causes treatment and prevention to the illiterate women and those with low level of education. The study also showed that the majority of the respondents had negative attitude towards control and prevention of anaemia in pregnancy. This finding was similar to Mirzoyan (1999) who indicated that the majority of women had negative attitude regarding the main contributing factors which causes anaemia among pregnant women. This shows that health care providers need to mobilize communities and increase awareness among pregnant women through mass health education for a sufficient length of time in Mbulu health care facilities. Furthermore, the other reasons identified were short intra pregnancy interval, older maternal age with increasing number of gravidity of more than five children.

Anaemia severity in pregnancy was also related to different socio-demographic factors, whereby the study revealed that the severity of anaemia was inversely related to education level, socio-economic status, age of respondents (pregnant mothers), lager family size greater than five and family occupation, particularly among members of the Datoga ethnic group. This high prevalence of anaemia among the pregnant women interviewed might be due to inadequate knowledge on factors causing anaemia and on how to prevent the risk factors. Obstetric factors are known to be determinants of anaemia; it was found in this study that there was significance association between pregnancy and anaemia. About one hundred and eight were grand-multgravida mothers who had a high rate of anaemia 98

(89.9%) during pregnancy compared to primigravida and multigravida mothers. More than one hundred seventy of them had less than 2 years of birth spacing, and the differences were statistically significant. This may be due to the fact that multiparity and grand multigravidity induce anaemia by reducing maternal iron reserves at every pregnancy and causing blood loss at each delivery, thus this indicates the need for proper follow up of pregnant women at ANC. Furthermore, this was also found in a previous study done in similar areas by Hinderaker *et al*. (2001) who reported that there was an increased risk of maternal anaemia with increasing age and parity. This is similar to what was found in the previous study done in Kisumu, Western Kenya by Ouma *et al*. (2007) who revealed that the prevalence of anaemia was higher in women with high parity greater than seven compared to women with low parity. The direct relationship of family size with anaemia could be associated with inadequate food to feed the large family size. This finding was comparable to the finding in a study conducted in West Ethiopia by Niguse *et al*. (2013) who identified that pregnant women with family size greater than five were 2.7 times more anaemic than women with family size less than five. These findings were explained by Schweitzer (2006) who pointed out that the prevalence of iron deficiency anaemia increased with parity women with more than four children. However, this could be due to repeated pregnancies at shorter intervals without allowing for replenishment of the iron stores. Therefore, the possible reason could be that child spacing minimizes bleeding during delivery and enhances iron reserves in the body.

Other similar studies conducted in East Anatonian Province Turkey, Saud Arabia, Malaysia, and Jimma Ethiopia showed prevalence levels of 27.1%, 41.3%, 57.4% and 74.3% respectively. This inconsistency may be because of strengthened health education given on risk factors and prevention of anaemia and interventions given at health institutions during ANC follow up in an attempt to reduce the burden of diseases among

pregnant mothers. Therefore, as anaemia prevalence increases with maternal age and parity, community health education is needed on importance of using hormonal contraceptives as protective against iron deficiency in women and, if promoted, could contribute to reduction of anaemia among pregnant women. In addition, it will be important to emphasise on early booking for antenatal care which would enable early treatment of anaemia and timely provision of malarial chemo prophylaxis.

On the other hand with regard to social issues and norms among Mbulu societies, there was gender inequality, whereby women lacked ability to command resources and make independent decisions about their healthcare and their reproductive health, which implies an impact on maternal anaemia. Also women had a lower status than men in society and their health needs were often neglected, and existing health facilities may not be accessed by women in need. In addition, women have lack of access to education and understanding about health related issues, something which can contribute to delays in seeking antenatal care and make them prone to self-medication at home. Also traditionally, people of the Datoga ethnic group had no behaviour of seeking health services compared to people of the Iraqw ethnic group.

The findings from this study emphasise the need to intervene and prevent anaemia, as a parasitic infestations and chronic infections associated with an increased risk of maternal anaemia in tropical settings. Also, due to the seriousness of the infectious disease during pregnancy, the WHO recommends that iron supplementation, intermittent preventive treatments (ITP), ITNs and anti-helminthic treatment should be given to all pregnant mothers. WHO and USAID recommends the measures for control of anaemia in women of reproductive age in most sub-Saharan Africa, the rationale for control of anaemia in non-pregnant women has been to prevent maternal anaemia in a subsequent pregnancy. The

recommended measures includes universal daily iron and folic acid supplementation for pregnant women for six months, weekly supplementation for women of reproductive age, and the aim being to improve the iron status of the women prior to conception as well as to provide folic acid in efficacious ways to prevent neural tube defects (WHO, 2014 and Klemman *et al.,* 2011). But the performance of this target was a challenge because only pregnant women are targeted in many countries in sub Saharan Africa, and the current study also emphasises on the need to improve nutritional status of women through providing health education to pregnant women and to the entire community, as anaemia caused by dietary factors is a preventable medical condition through public health interventions which are potentially feasible and cost-effective. Also, to enhance the level of awareness among pregnant women on anaemia causes in pregnancy is important, so as to enable them take measures to mitigate the anaemia related health problem. However, the success of these strategies depends on the ability of health services to strengthen planning and management of all possible underlying causes of anaemia and to provide the standard quality of antenatal programme services.

The first prerequisite for appropriate management in antenatal care is availability of the method to identify the women with severe anaemia; few of the government dispensaries can perform a haemoglobin investigation, but some of the government dispensaries especially Yeada Chini Dispensary could not perform even a simple assessment of haemoglobin. Thus, for the majority of anaemic pregnant women, their health problems would not even be detected, therefore the alternative way would be to apply Tallqvist method, which is very commonly used even in remote areas when the laboratory resources are poor. The method can seriously underestimate the most severe cases of anaemia and that also for moderate anaemia. Probably the Tallqvist method is more reliable than clinical assessment of pregnant women for diagnosis of anaemia in areas where the

screening instruments were inadequate. It is possible to reduce the prevalence of anaemia through improving level of knowledge of pregnant women, as well as changing attitudes through provision of health education that constitutes an important approach to increase awareness about anaemia in terms of exposure, risk factors, essential nutrition ingredients and the importance of taking iron supplementation effectively because many women lacked knowledge about their medical condition or the risk factors which could threaten their life.

5.1 Study Limitations

The study was not able to examine all possible aetiologies of anaemia, such as helminth infection, chronic inflammation, other nutritional deficiencies such as folate, vitamin B_{12}, and vitamin A deficiency, genetic disorders or acquired disorders that affect red blood synthesis, or red blood survival which can all causes anaemia were not addressed. In addition, in this study, anaemia in pregnancy was not standardized for residential elevation above sea level (altitude).

Despite the limitations, the results of the present study elucidate our understanding on factors associated with anaemia among pregnant women in Mbulu District. The findings of this study could raise concerns of decision makers and assist health authorities in planning interventions and implementation of continuous activities in Mbulu District and control programmes for anaemia. However, further laboratory research is required to evaluate other underlying causes of anaemia, particularly for HIV/AIDS infection.

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

The study revealed that low level of knowledge and negative attitude were some of the factors among others that contributed to the increased prevalence of anaemia among Mbulu pregnant women. Therefore, all these factors need to be addressed through vigorous health education in private and public health institutions, in order to prevent risk factors of anaemia and mitigate the adverse effect of anaemia in pregnancy. Furthermore, low level of education was found to be a major drawback for effective control of anaemia among study participants. Also advancing maternal age and high parity were associated with increasing risk of anaemia in pregnancy.

Despite free and routine prescription of haematinic, ITP and ant-helmenthic drugs at ANC clinics, but anaemia burden still remains high. Therefore, supplementation during pregnancy alone is inadequate to improve the situation; there is a need to promote other strategies to improve the nutrition and general health before pregnancy. These should include supplementation of lactating women and women of reproductive age. On the other hand, effective implementation of family planning services is recommended. Moreover, anaemia in pregnant mothers needs to be tackled seriously by health care workers, especially at the primary health care level because of possible health implications to the mothers and babies, though adequate supplies of iron medication were freely available at all levels of health care facilities but there are still many reasons that prevent mothers from taking the supplies regularly. Therefore, it is important to address the haematinic compliance by giving adequate counselling and health education to women concerning the importance of taking iron throughout the pregnancy and the health care workers should provide health education that focuses on antenatal care and family planning to enhance

effective birth interval among women and affordable contraceptive methods should be made available at all levels of health care.

As more than three quarters of the study participants indicated that they could get more information about anaemia at antenatal clinics or hospitals (95.7%), the health facility environments would be ideal to address anaemia causes, prevention, and treatment. In addition education should include antenatal care that focuses on intake of iron rich foods, on the importance of early booking when the woman becomes pregnant, iron supplementation, malaria prophylaxis and anti-helminthes. As iron deficiency anaemia is a diet related micronutrient deficiency, so it is important to clarifying and encourage a wide variety of locally or seasonal available foods. Moreover, the health care provider needs to mobilize community and increases an awareness of pregnant women on anaemia prevention through mass health education. Sensitization on usage of family planning method and low cost nutritious foods. Where these interventions could restore appropriate haemoglobin concentrations in individuals and reduce the prevalence of anaemia in the population. Also use of community health workers should be highly encouraged since they are the ideal people to disseminate information on anaemia management in the community. Furthermore, Medical doctors should endeavour to do further investigation on anaemic pregnant women to identify the aetiology whenever possible.

The study had some limitations; all causes of anaemia were not identified, hence further laboratory evaluation for other underlying causes of anaemia, especially infection such as HIV/AIDS could be done in the future. Also there is a need to do further study on the assessment of the public knowledge on different health interventions in order to identify the gaps in knowledge so as to institute the appropriate interventions where necessary.

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APPENDICES

Appendix 1: Questionnaires on knowledge and attitude of pregnant mothers on anaemia and risk factors of anaemia in pregnant

PART ONE: PERSONAL PARTICULAR

1) Participant no…… Age ……Religion.....

Tribe..... Village..... .....

2) Level of education

a) Informal education (b) Primary school (C) Secondary school (d) Diploma

(e) University

3. Marital status

a) Married (b) Single (c) Widow (d) Divorced

4. Occupation (a) Teacher (b) Health worker (c) Peasant (d) Business (e) other specify

5. (a) Gravid .....(b) Para..... (c) Gestational age.....

PART TWO

Questionnaires knowledge on anaemia.

6. Haemoglobin status.....

7. Malarial status positive..... Negative.....

8 How many acres of shamba does the family of this household have? _____

9. Does the household have enough food for their own needs? Yes___ No___

10. If no, what do they do when they need extra food? Specify: _____

11. How long was the interval between your previous and current pregnancy?

_____ Years _____Months

(Don't ask question #9 if the woman is primigravida)

12. Keeping a certain interval between two pregnancies is important in order to prevent IDA development. Is this statement true or false?

13. Do you know the syndrome called anaemia in pregnancy? YES ( ) NO ( )

14. If yes what is anaemia? (a) Is a decrease number of white blood cell count in the body (b) is the inability of the heart to pump blood to the peripheral part of the body. (d) Is a decrease in concentration of red blood cells or haemoglobin level in the blood. (d) Other. Specify

15. How can one get anaemia?

(a) Poor dietary intake, parasitic infections, chronic infection i.e. TB and HIV, reproductive cause and genetic blood disorders (b) witchcraft (c) contact with infected person (d) Other. Specify

16. How can one know that she is suffering from anaemia?

(a) Reduced body weight (b) the skin appear pallor and paleness of the conjunctiva, palm, tongue, general body malaise, heart palpitation and fatigue (c) coughing up blood.

17. Can anaemia be treated? Yes..... No.....

18 If yes how is anaemia treated?

(a) Using hospital treatment

(b) Using traditional healers (c) Other. Specify

19. How can one protect herself from getting anaemia?

(a) Eating high carbohydrate diet (b) eating meat, eggs, green vegetables and fruits (c) eating high fat diet (d) Other. Specify

20. Can anaemia causes a serious problem in your health and for expected baby

Yes ... No....

21. Mention complications of anaemia for both mother and foetus

(a) Low birth weight, preterm delivery, still birth and death may occur

(b) Unhealthy baby (c) Coughing up blood (d) other. Specify

22. Where did you get information about the following health issues?

	1. ANC	2. RADIO/TV	3. Friends
Malaria			
Anaemia			
Hookworm infestation			

23. Have you ever suffered from malaria during current pregnancy? Yes..... No.....

24. If yes did you seek medical attention? (a) Health institution (b) Traditional healer c) use herbal medical (d) other specify

25. Does this antenatal care unit gave insecticide treated nets to each individual Yes.....No...

26. Do you use insecticide treated nets Yes.....No...

27. Have you ever heard about hook worm infection Yes.....No.....?

28. If yes in which way do people get worm infection? A) Eating meat which is not cooked well, unwashed fruits and using unsafe dirking water (b) close contact with infected person (c) other specify.....

29. Where do you get water for domestic use?

a) Pumped into residence (b) Public tape (c) River/stream (d) Shallow well

30. What type of toilet do you have at home a) Pit latrine b) flash toilet c) other specifies.....?

31. In antenatal clinic, the health care provider usually provide health education did you put the information into practice? Yes.....No.....

The Likert scale that was used to determine attitude of pregnant women towards anaemia control

Attitudinal statement	**Strongly disagree (1)**	**Disagree (2)**	**Undecided (3)**	**Agree (%4)**	**Strongly disagree (5)**
32. Do you think that you are at risk of getting anaemia during pregnancy?					
33. In your opinion is anaemia a serious problem in your community?					
34. If you were anaemic, would you taking iron tablets combined with vitamins and proper diet to achieve better results					
35.Do you think that boiled water at required temperature for drinking may contribute in prevention of worms and other infections					
36. Do you think that you can contribute in prevention of anaemia for yourself?					
37.Is it recommended that pregnant woman must sleep under insecticide treated nets for malaria prevention					
38. Do you plan to use contraceptives after delivery to achieve at least two year interval of pregnancy					
39. Are you interested in preventing anaemia?					
Total score					

Appendix 2: Reported knowledge on Anaemia among Pregnant Women in Mbulu District

	Variables	Levels	Number of respondent	Percentages
1.	Do you know the syndrome called anaemia in pregnancy?	Yes	125	35.3
		No	229	64.7
2.	If yes what is anaemia?	1. Decrease number of WBC	16	4.5
		2. Inability of heart to pump blood to peripheral parts	203	57.3
		3. Decrease in concentration of RBCs/HB level in blood	124	35.0
		4. Others specify	11	3.2
3.	How can one get anaemia?	1. Poor dietary intake, parasitic infestation, Chronic infection	130	36.7
		2. Witch craft	151	42.7
		3. Contact with infected persons	64	18.1
		4. Others specify	9	2.5
4.	How can one know that she is suffering from anaemia?	1. Reduced body weight	134	37.8
		2. Paleness of mucus membrane	133	37.6
		3. Coughing up blood	87	24.6
5.	Can anaemia be treated?	Yes	123	34.7
		No	232	65.5
6.	If yes how is anaemia treated?	1. Using hospital treatment	132	37.3
		2. Using traditional healers	162	45.8
		3. Others specify	60	16.9
7.	How can one protect herself from getting anaemia?	1. Eating high carbohydrate diet	139	39.3
		2. Eating meat, eggs, green vegetables and	130	36.7
		3. Eating high fat diet	73	20.6
		4. Others specify	12	3.4
8.	Can anaemia causes a serious problem in your health and for expected baby	Yes	129	36.4
		No	225	63.55
9.	Mention complications of anaemia for both mother and foetus	1. Low birth weight, Abortion	127	35.9
		2. Unhealthy baby	148	41.8
		3. Coughing up blood	65	18.4
		4. Others specify	14	3.9
10.	Have you ever heard about hook worm infection	Yes	166	47.3
		No	185	52.7
11.	If yes in which way do people get worm infection?	1. Eating uncooked meat, Using unsafe water, walking with bear feet, eating contaminated food.	157	44.4
		2. Close contact with infected person	158	44.6
		3. Others	9	11.0
12.	Source of information about anaemia	1 ANC	243	95.7
		2 RADIO/TV	10	4.0
		3 Friends	1	0.3

Appendix 3: Clearance certificate for conducting medical research in Tanzania

THE UNITED REPUBLIC OF TANZANIA

National Institute for Medical Research
P.O. Box 9653
Dar es Salaam
Tel: 255 22 2121400/390
Fax: 255 22 2121380/2121360
E-mail: headquarters@nimr.or.tz
NIMR/HQ/R.8a/Vol. IX/1901

Ministry of Health and Social Welfare
P.O. Box 9083
Dar es Salaam
Tel: 255 22 2120262-7
Fax: 255 22 2110986

11th February 2015

Justina Amu Margwe
Sokoine University of Agriculture
Department of Veterinary and Public Health
P O Box 3012 MOROGORO

CLEARANCE CERTIFICATE FOR CONDUCTING MEDICAL RESEARCH IN TANZANIA

This is to certify that the research entitled: Prevalence, Knowledge, and Attitude of pregnant women on risk factors of anaemia in Mbulu district, (Margwe J A *et al*), has been granted ethical clearance to be conducted in Tanzania.

The Principal Investigator of the study must ensure that the following conditions are fulfilled:

1. Progress report is submitted to the Ministry of Health and the National Institute for Medical Research, Regional and District Medical Officers after every six months.
2. Permission to publish the results is obtained from National Institute for Medical Research.
3. Copies of final publications are made available to the Ministry of Health & Social Welfare and the National Institute for Medical Research.
4. Any researcher, who contravenes or fails to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine. NIMR Act No. 23 of 1979, PART III Section 10(2).
5. Sites: Mbulu, Manyara.

Approval is for one year: 11th February 2015 to 10th February 2016.

Name: Dr Mwelecele N Malecela

Signature
CHAIRPERSON
MEDICAL RESEARCH
COORDINATING COMMITTEE

Name: Dr Margaret E Mhando

Signature
Ag CHIEF MEDICAL OFFICER
MINISTRY OF HEALTH, SOCIAL WELFARE

CC: **RMO**
DED
DMO