DIETARY INTAKE AND NUTRITIONAL STATUS OF PREGNANT WOMEN IN MAGUBIKE VILLAGE, KILOSA DISTRICT

BY

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ABSTRACT

Dietary inadequacy and malnutrition among pregnant women has a direct impact on pregnancy outcome. The causes of maternal malnutrition include inadequate food intake, poor nutritional quality of diets, frequent infections and short inter-pregnancy intervals. Tanzania is faced with high maternal malnutrition especially in the rural areas. The aim of this study was to assess the dietary intake and determine the nutritional status of pregnant women in rural Tanzania. Although pregnancy problems continue to exist among women in rural settings, less has been documented about their dietary adequacy and nutritional status.—_Pregnant women in Magubike village in Kilosa District, Morogoro Region participated in the study. A total of sixty two pregnant women were randomly selected and recruited for the study. Socio-demographic data were collected through interviews using a structured questionnaire. Dietary intake was assessed using the food frequency questionnaire (FFQ) method. Foods consumed by pregnant women in the study area were analysed to determine the nutrient content and composition.. Standard procedures of the Association of Official Analytical Chemists were used to determine the moisture content, fat, protein (N x 6.25), ash, and fibre content. Energy value was calculated using the Atwater's conversion factors. Minerals (iron, magnesium, phosphorous, zinc and calcium) were determined by the Atomic Absorption Spectrophotometer. To assess the nutritional status of pregnant women anthropometric measurements were taken. These included assessing weight gain of the pregnant women. Weight gain was determined using weight gain recommendations from reexamining guidelines of weight gain during pregnancy. Data were analysed using the Statistical Package for Social Sciences version 12.5 for windows. Pregnant women in Magubike had low nutrient intake i.e. they consumed 54 grams of protein in their daily diet which is less compared to the actual required amount of 60 g per day. They also consumed 27 grams of fat in their daily diet which also falls short

of the actual required amount of 43 gms (18% kcal). Total energy intake was 1231.3 kcal per day compared to the recommended energy intake (2500-2700 kcal/day). On average mineral consumption was also insufficient. Zinc consumption was 1.9 mg/day; Calcium between 0.002 mg/day; and iron intake was 7.8 mg/day. The nutritional status of the pregnant women in Magubike village was poor i.e. weight gain per week in the second and third trimesters, was decreased due to poor dietary intake. Therefore, nutritional inadequacies exist among pregnant women in Magubike village. The study recommends that a combination of locally available foods should be made available to get a balanced nutrient meal that can be consumed by pregnant women to provide adequate amounts of iron, zinc and calcium.

DECLARATION

I, MSHIU, BRENDA RAPHAEL, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work, and has not been submitted for a higher degree in any other University.

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The above declaration is confirmed by:

Prof. Joyce Kinabo	Date
(Supervisor)	

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DEDICATION

I would like to dedicate my dissertation to my beloved parents Mr. Raphael and Mrs. Miriam Mshiu and also to my beloved husband Ernest Masandika and my Son Mark-Ryan.

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ABBREVIATIONS

ACC/SCN	Administrative Committee on Coordination/Sub Committee on Nutrition
BMI	Body Mass Index
RDA	Recommended Daily Allowances
FAO	Food and Agricultural Organization
FFQ	Food Frequency Questionnaire
IFPRI	International Food Policy Research Institute
PEM	Protein Energy Malnutrition
NTDs	Neural tube defects
RCH	Reproductive and Child Health care
LBW	Low Birth Weight
TDHS	Tanzania Demographic and Health Survey
TFNC	Tanzania Food and Nutrition Centre
UNICEF	United Nations Children Fund
URT	United Republic of Tanzania
WHO	World Health Organization
IOM	Institute of Medicine
PANTIL	Programme for Agricultural and Natural Resources Transformation for Improved Livelihoods
AOAC	Association of official Analytical Chemist
CSPD	Child Survival Protection and Development

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Malnutrition during pregnancy and a few months prior to pregnancy is an immediate cause of poor pregnancy outcome in Tanzania (URT, 2005). The causes of malnutrition include poor dietary intake, heavy workload and poor access to health services. The importance of nutrition during pregnancy has long been appreciated. A sufficient supply of calories and protein is a major determinant of nutrient intake during pregnancy. Maternal intake of carbohydrates and protein, fatty acids, micronutrients such as zinc, iron, magnesium, calcium, and vitamin C have important effects on foetal growth (Williamson, 2006). Inadequate dietary intake of the above mentioned nutrients compromises maternal and/or feotal health. Therefore, micronutrient supplementation is often recommended during pregnancy (Lourdes *et al.*, 2007).

Pregnancy is a period of dynamic change for a mother requiring a lot of care. During this period the feotus is nourished directly by the mother through the placenta. Since the foetus totally relies upon its mother for nourishment, the pregnant woman is to be provided with an adequate and well-balanced diet (Subarnalata and Basumati, 2006). Dietary recommendations for women before and during pregnancy are in fact very similar to those for other adults, but with a few exceptions. The main recommendation is to eat a healthy and balanced diet. However, there are some specific recommendations which apply during pregnancy, e.g. taking folic acid supplements to help reduce the risk of neural tube defects (NTDs), food safety, iron supplementation and intake of the required amount of vitamin A during the first trimester (Williamson, 2006).

Maternal nutrition and health is considered as the most important regulator of human feotal growth. A healthy mother can produce a healthy child, while a mother with low nutrient stores runs a greater risk of diet-related problems during pregnancy, such as anaemia. Anaemia has a significant impact on the health of the feotus as well as that of the mother. It is the most widespread nutritional disorder in the world, affecting 30 percent of the world's population (Subarnalata and Basumati, 2006). In addition, pregnant women with moderate to severe deficiencies of iron, zinc and folic acid have an increased risk of low birth weight, pregnancy complications and birth defects. Women, who are not well nourished, are more likely to give birth to weak babies, resulting in high infant mortality rates.

The nutritional situation of the population is determined by a variety of social, economic, and political factors that influence the availability of food and the dietary intake of individuals. The principal nutritional problems of women and children in Tanzania continue to be protein-energy malnutrition, especially in children, and also deficiencies of certain specific micronutrients such as vitamin A, iodine, and iron (TDHS, 2005). Iron deficiency occurs mainly in women of reproductive age as well as children. Iron supplementation is a common strategy used to meet the increased requirements of at-risk groups, such as women of childbearing age, especially during pregnancy. Other at-risk groups for which iron supplementation may be appropriate include infants, young children, adolescents and the elderly. However, there is a need to consider iron supplementation as part of a comprehensive strategy for the prevention of iron deficiency, and not just as a treatment for anaemia that is stopped as soon as clinical improvement is noted (Sankaranarayanan *et al*, 2004).

1.2 Statement of Problem and Justification

In Tanzania, malnutrition among mothers, especially in rural areas, is a common phenomenon. The most common types are underweight, anaemia due to malaria and nutritional/dietary deficiencies and iodine deficiency disorders. Most of these deficiency disorders are aggravated by infection and energy drain due to heavy workload (Mason, 1990). Maternal malnutrition is a major factor causing morbidity and mortality among African women. The causes include inadequate food intake, poor nutritional quality of diets, frequent infections and short inter-pregnancy intervals (URT, 2005). Evidence for maternal malnutrition is provided by the fact that between 5 and 20% of African women have a low BMI as a result of chronic hunger (Lartey, 2008). Across the continent the prevalence of anaemia ranges from 21 to 80%, with similar high values for both vitamin A and Zinc deficiency levels. The consequences of poor maternal nutrition are reflected in low weight gain during pregnancy and high infant and maternal morbidity and mortality (Lartey, 2008).

Improving nutrition contributes to productivity, economic development, and poverty reduction by improving the capacity for physical work, cognitive development, school performance and health, while reducing disease and mortality (WHO, 2006). About 8,100 women die of pregnancy and birth-related causes in Tanzania each year. Some 45,000 newborn die, and another 42,500 are stillborn; and 157,100 children die before their fifth birthday (URT, 2008). Tanzania is likely to suffer a substantial decline in its gross domestic product due to problems relating to malnutrition. Malnutrition has a direct bearing on health, education and the economy in general (Peter, 2008).

Although these problems continue to exist among pregnant women in Tanzania, little has been documented about their dietary adequacy and nutritional status. Dietary adequacy

and malnutrition among pregnant women has a direct impact on pregnancy outcome. This study was carried to evaluate the dietary intake and nutritional status of pregnant women. Therefore, the results are intended to be used to implement measures to combat the problem of poor nutrition and its associated factors among pregnant women within Magubike Village.

1.3 Objectives

1.3.1 General Objective

The general objective is to assess the dietary intake and nutritional situation of pregnant women in rural areas of Kilosa district.

1.3.2 Specific Objective

- To assess the dietary intake of pregnant women in Magubike Village
- To determine the nutritional status of pregnant women in Magubike Village
- To determine nutrient composition of foods consumed by pregnant women in Magubike Village
- To assess the adequacy of nutrients in pregnant women’s diet in Magubike Village.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Nutritional Needs during Pregnancy

Pregnancy is an anabolic condition that affects the metabolism of all nutrients in order to support maternal homeostasis, fetal growth and development, and prepare for lactation. In response to these new demands for nutrients, one or more of the following can occur: increased deposition of maternal stores and feotal tissue, redistribution of nutrients, and increase or decrease in nutrient absorption and rate of metabolism. Furthermore, adequate weight gain during pregnancy is important for optimal feotal growth and development and for maternal fat store deposits whereas inadequate weight gain is associated with intrauterine growth retardation and perinatal mortality (WHO, 2005).

In addition, improved maternal and infant outcomes are associated with the recommended weight gains; it is generally recommended that women who begin pregnancy with a normal body mass index (BMI, expressed as kg/m^2; 19.8–26) gain 11–16 kg during pregnancy. Of this weight gain, approximately 4 kg will be deposited as maternal fat stores (King, 2000). Excessive gestational weight gain is a concern because of the increase in obesity across populations worldwide. A review of literature on North American pregnant women from a variety of subpopulations found that a weight gain of more than 16 kg was consistently associated with postpartum weight retention of more than 6 kg (King, 2000).

2.1.1 Maternal Nutrition

–During pregnancy all women need more food, a varied diet, and micronutrient supplements. When energy and other nutrient intake do not increase, the body's own reserves are used, leaving a pregnant woman weakened. Women who are well nourished during pregnancy lay down a store of fat to make breast milk. Women need some extra nutrients for the baby during pregnancy and lactation, but not too much. If mothers continue to eat extra and if they are less active after childbirth, they may not use up the fat stores. Some women gain weight and become obese. The chances of keeping the fat stores or of gaining weight are higher for women who do not breastfeed (King and Burgess, 1995).

Furthermore, poor maternal diet is the major cause of Low Birth Weight (LBW) globally, but its impact on well-nourished populations in developed countries remains unclear. There is currently little evidence that manipulating the diet of already well nourished individuals can influence foetal growth and subsequent birth weight, and therefore it has not been possible to make specific dietary recommendations with the aim of preventing LBW and adult diseases in later life (Williamson, 2006).

A woman's normal nutritional requirements increase during pregnancy in order to meet the needs of the growing foetus and of maternal tissues associated with pregnancy. A proper dietary balance is necessary to ensure sufficient energy intake for adequate growth of the foetus without drawing on mother's own tissues to maintain her pregnancy (Mridula *et al*, 2003).

2.1.2 Weight Gain

Optimal birth weight is influenced by maternal weight gain. In 1990 the Institute of Medicine (IOM) (cited on Shills *et al*., 2006), released weight gain recommendations during pregnancy. These recommendations, based on pre-pregnancy BMI, reflect the total gestational weight gain and rate of weight gain associated with best pregnancy outcome (Table 1). Poor weight gain is associated with poor foetal growth and the risk of pre-term delivery. Low weight gain during pregnancy is also associated with NTDs; if weight gain in the first trimester (when NTD formation occurs) is minimal, it is more likely that lowered weight gain may be a consequence of carrying an NTD-foetus (Shills *et al*., 2006).

Table 1: Weight gain Recommendations

Pre-pregnancy body Mass Index(kg/m^2)	**Recommended Total gain (kg)**	**Recommended rate of gain (kg/wk)(second & third trimester**
<19.8	12.5-18	0.5
19.8-26.0	11.5-16	0.4
>26.0-29.0	7-11.5	0.3
>29.0	≥ 7	

Source: Institute of Medicine (1990)

A birth weight of 3.1-3.6 has been shown to be associated with optimal maternal and foetal outcomes for a full term infant. Macrosomia (birth weight > 4.5kg) is associated with a number of obstetric complications, as well as higher rates of neonatal morbidity and mortality. LBW (birth weight < 2.5 kg) is associated with the increased risk of neonatal morbidity and mortality as well as an increased risk of diseases in later life. Moreover, there are number of risk factors that lead to one having a LBW infant. These include low pre-pregnancy BMI, poor diet, smoking and the use of alcohol or drugs during pregnancy,

and many of these factors are associated with low socio-economic status (Williamson, 2006).

2.1.3 Malnutrition

Malnutrition is now a problem in both poor and rich countries, with the poorest people in both sets of countries affected the most. In developed countries, obesity is rapidly becoming more widespread, especially among poorer people, bringing with it an epidemic of diet-related non-communicable diseases such as diabetes and heart disease, which increase health care costs and reduce productivity. In developing countries, while widespread under nutrition and micronutrient deficiencies persist, obesity is also fast emerging as a problem. Underweight children and overweight adults are now often found in the same households in both developing and developed countries (WHO, 2006).

Poor dietary intake of women during pregnancy frequently results in malnutrition and sickness. Malnutrition in women is frequently the result of a poor diet during infancy, early childhood and adolescence. This is often worsened by poor food intake during the reproductive years, resulting in low birth weight babies (< 2.5 kg), an increased risk of the mother dying and a continuation of the cycle of malnutrition from one generation to the next (Fig. 1).

Figure 1: A malnourished mother

(Source: FAO Afghan Family Nutrition Guide (2007)

Women of child-bearing age (especially pregnant and lactating women), infants and young children are at the most nutritionally-vulnerable stages of the life cycle (Lartey, 2008). Maternal malnutrition is a major factor leading to morbidity and mortality among African women. The consequences of a poor maternal nutritional status are reflected in low pregnancy weight gain and high infant and maternal morbidity and mortality. Suboptimal infant feeding practices, the poor quality of complementary foods, frequent infections and micronutrient deficiencies have largely contributed to the high mortality among infants and young children in the region. Feeding children whose mothers are infected with HIV continues to remain an issue requiring urgent attention (URT, 2005).

2.1.4 Measuring Nutritional status

Several studies have assessed the nutritional status of pregnant women by researching into various indicators and analyzing the prevalence of multiple nutrient deficiencies. The nutritional status of pregnant women in Romania was assessed by WHO/UNICEF/ICCIDD standards and the indicators recommended by WHO and Centre

for Disease Control Atlanta were used as reference parameters (UNICEF, 2005). To obtain the iodine status in pregnant women, the urinary iodine levels were ascertained and values over 100 micrograms per litre were considered to be normal. Furthermore, the prevalence of anaemia was assessed by determining blood haemoglobin levels. Values of at least 11g/dl were considered to be normal in pregnant women. Another study measured the nutritional status of women by assessing chronic energy deficiency malnutrition in women's BMI, also known as the Quetelet index (Marco, 2002). This indicator is the most frequently used standardized indicator of thinness (wasting) and is used to assess the progressive loss of body energy in developing countries. The cut-off points suggestive of chronic energy deficiency in adults is BMI < 18.5.Additionally, height is a measure of past nutritional status and reflects in part the cumulative effect of social and economic outcomes on access to nutritional foods during childhood and adolescence. Women less than 145 centimetres in height are considered stunted; this has been determined to be a useful cut-off point in several studies (ACC/SCN, 1992; Krasovec and Anderson, 1991). Height was also used to assess the relationship between maternal and child nutrition. According to Kinabo and Shirima (2004), nutritional status was assessed by BMI, and haemoglobin concentration was determined by cutoff points provided by the WHO. Weekly weight gain during pregnancy was also measured to determine the nutritional status of adolescent pregnant girls.

2.2 Micronutrients

Little work has been conducted to relate pre-pregnancy micronutrient intakes or status to low birth weight; however, Wynn *et al*. (1991) suggests that acquiring a desirable weight and diet during the weeks before and around conception is highly recommended, especially in industrial populations where only sub-clinical micronutrient deficiencies exist. In developing countries, where a lifetime of a very low intake of micronutrients may

exist, it is important to try to reverse this low intake long before conception, but increasing the intake shortly before and during pregnancy may also help increase birth weight and the chances of survival of infants (Galloway *et al.*, 2002). It should be noted that an inadequate intake of certain micronutrients early in pregnancy has been related to other negative birth outcomes. For example, folic acid deficiency in the first trimester is associated with neurological defects.

2.2.1 Maternal micronutrient requirements

Women's nutrient needs increase during pregnancy and lactation. Some of the increased nutrient requirements protect maternal health while others affect birth outcome and infant health. If the requirements are not met, the consequences can be serious for women and their infants (TFNC, 2006).

During pregnancy all women need more food, a varied diet, and micronutrient supplements. When the intake of energy and other nutrients does not increase, the body's own reserves are used, leaving a pregnant woman weakened. Energy needs increase in the second and particularly the third trimester of pregnancy. Inadequate weight gain during pregnancy often results in LBW, which increases an infant's risk of dying. Pregnant women also require more protein, iron, iodine, vitamin A, folate, and other nutrients. Deficiencies of certain nutrients are associated with maternal complications and death, foetal and newborn death, birth defects, and decreased physical and mental potential of the child (AED, 2004).

2.2.2 Micronutrient deficiencies in pregnant women

Micronutrient deficiencies are major global health problem. More than 2 billion people in the world today are estimated to be deficient in key vitamins and minerals, particularly

vitamin A, iodine, iron and zinc. Most of these people live in low income countries and are typically deficient in more than one micronutrient. Deficiencies occur when people do not have access to micronutrient-rich foods such as fruits, vegetables, animal products and fortified foods, usually because they are too expensive to buy or are locally unavailable. Micronutrient deficiencies increase the general risk of infectious illness and of dying from diarrhoea, measles, malaria and pneumonia. These conditions are among the 10 leading causes of disease in the world today (WHO, 2007). Furthermore, the groups most vulnerable to micronutrient deficiencies are pregnant women, lactating women and young children, mainly because they have a relatively greater need for vitamins and minerals and are more susceptible to the harmful consequences of deficiencies. For a pregnant woman these include a greater risk of dying during childbirth, or of giving birth to an underweight or mentally-impaired baby.

2.2.3 Micronutrient supplementation

Adequate energy intake and a diversified diet that includes fruit, vegetables, and animal products throughout the life cycle help ensure that women enter pregnancy and lactation without deficiencies and obtain adequate nutrients during periods of heightened demand. Some nutrient requirements, particularly iron, folic acid, and vitamin A, are more difficult to obtain than others through food sources. For this reason, supplements including these nutrients are recommended in addition to improved diets. Fortified foods should be promoted through counseling and social marketing in countries where foods fortified with iron, iodine, folic acid, or vitamin A are available and affordable (AED,2004).

According to TDHS, 2005, different developing countries have shown that deficiencies such as vitamin A, zinc, vitamin B12, iodine and folate are also widespread among pregnant women and are known to have a negative impact on pregnancy outcome. It is

widely acknowledged that other micronutrient supplements apart from iron/folate should be provided for pregnant women such as calcium. From a programme point of view it would be efficient to combine different micronutrients into one supplement. Such a multi-supplement specifically designed for women from developing countries does not exist. Current nutritional guidelines on emergency selective feeding programmes advocate iron/folate supplementation for pregnant women and in specific circumstances, supplementation with vitamin C and vitamin A (EDHS, 2000).

2.3 Nutritional status of pregnant women in Tanzania

Tanzanian women also face nutritional challenges. Overall, 10 percent of Tanzanian women are considered too thin (BMI less than 18.5), while 1 percent of women are extremely thin (BMI less than 16). Underweight among women are found most in Singida, where 22 percent of women are too thin. In contrast, almost 18 percent of Tanzanian women are overweight or obese. Women in urban areas and those with higher levels of education and greater wealth are more likely to be overweight or obese (BMI greater than 25) (TDHS, 2004-2005).

According to 2004 Tanzania Demographic Health Survey (TDHS) 19% of women of the age group 15–19 suffer from acute malnutrition (BMI<18.5). Short stature is associated with small pelvis size, which increases the likelihood of difficulties during delivery and the risk of bearing LBW babies. 18% of women are overweight or obese with 4% being obese and 58% of pregnant women are anaemic. Only 10% of pregnant women take iron tablets for at least for 90 days. The prevalence of vitamin A deficiency in pregnant women in Tanzania is such that 69% of lactating women have vitamin A deficiency (breast milk retinol below 1.05 μmol/L) whereas 65% of pregnant women have plasma retinol below

1.05 μmol/L. Maternal malnutrition has consequences for maternal, foetal, and infant health.

Maternal diets during pregnancy need to provide energy and nutrients for the mother as well as for foetal growth. Poor maternal nutrition during pregnancy, particularly during the third trimester, is a major cause of LBW in developing countries (Cheng *et al*, 2009).

According to WHO (2009), LBW is a major determinant of mortality, morbidity and disability in infancy and childhood and also has a long-term impact on health outcomes in adult life. The consequences of a poor nutritional status and inadequate nutritional intake for women during pregnancy not only directly affects women's health status, but may also have a negative impact on birth weight and early development.

Night blindness is an indicator of severe vitamin A deficiency, from which pregnant women are especially prone to suffer. A single postpartum dose of vitamin A given to women within eight weeks of childbirth treats night blindness and increases the vitamin A content of breast milk, which reduces the risk of Vitamin A deficiency among breastfed children. Vitamin A supplementation is more common in urban than rural areas in Tanzania. One in three women in urban settings received a vitamin A supplement, compared with 16 percent of rural women (TDHS, 2005). Furthermore, there is also a variation in supplementation by region. Iringa is the highest with 43 percent of women having received a vitamin A supplement, while Rukwa is the lowest with 3 percent (TDHS, 2005).Other regions which having received vitamin A supplements are Dar-es-Salaam, 32% of women, Morogoro, 19.9 % of women, Dodoma, 17.4% of women and Mbeya, 11.8% of women. In addition, little work has been conducted to relate pre-pregnancy micronutrient intake or status to LBW. Thus, there remains a lack of

understanding as to how pre-pregnancy intake or status relates to LBW in Tanzania. This study is aimed at reducing this gap by assessing the dietary intake and nutritional status of women in rural Tanzania.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Area

Kilosa district is one of the six districts forming Morogoro Region, in Tanzania. It is located 300 km west of Dar es Salaam. It has a population of about 489 513, with an average of 4.6 people per household (CSPD, 2005). The study was conducted in Kilosa District in Magubike Village. The village has a population of about 7349 inhabitants of which 2562 are males and 2861 are females. The population includes 1078 children above five years and 848 children below five years of age (Jumbe~~,2007~~, 2007). The village has various health facilities including a health centre and home-based care services for people living with HIV/AIDS. In addition, World Vision is present in the village and offers technical support e.g. building schools and running development projects in the area. Magubike village in Kilosa district was selected as a case study for this research because the co-sponsor of this study was PANTIL which is operating in Magubike area. Women from this village continue to experience problems during pregnancy.

There are two rainy seasons: the long rains, which start in late March and last till early June and the short rains, which begin in October and end in November. Most dwellers are subsistence farmers growing maize, cassava, and sorghum, and increasing numbers are petty traders. Households often keep domestic animals such as chickens, ducks and a few goats. Food shortage months include February and March (lean season) while adequate food periods include July to September (harvest period).

3.2 Study design

A cross-sectional design was used whereby data was collected once from the respondents and descriptive analysis was carried out to determine the relationship between variables.

3.3 Target Population and Sample size

The sample size for this study was calculated according to Fisher *et al.* (1991) formula for sample size determination for cross-sectional studies as shown in Appendix 2. Based on this calculation, the study hoped to recruit 281 pregnant women. However, there were only sixty-two pregnant women in the village. All of these women agreed to participate in this study. A sub-sample of 40 pregnant women was randomly selected from the sample for assessing the dietary intake using a food frequency questionnaire (FFQ).

3.4 Data collection

A structured questionnaire was used for interviewing pregnant women in Magubike. Interviews were conducted at the Reproductive Child and Health Care (RCH) centre. In addition, anthropometric measurements (weight and height) of the participants were taken using appropriate instruments, the FFQ and direct weighing method.

3.4.1 Dietary Intake

The study included a detailed assessment of dietary intake during pregnancy. Dietary information was collected using the FFQ and direct weighing method.

3.4.1.1 Direct Weighing Method

The researcher visited the respective households to conduct the interviews. During the interviews pregnant women were requested to show the type and amount of food consumed. These were then weighed using a digital weighing scale for solid foods and for liquid foods a graduated measuring cylinder was used.

3.4.1.2 Food Frequency Questionnaire

Food frequency method was employed to estimate how frequently pregnant women had eaten a certain kind of food during the last month. This information was then used to contribute in the assessment of dietary intake. The FFQ consisted of a list of foods available in the study area and a selection of options relating to the frequency of consumption of each of the foods listed (e.g. times per day, daily, weekly, monthly). The questionnaires gathered the information about food intake within a given timeframe and therefore aimed to capture habitual intake. A number of foods were listed as shown in (Appendix 1); respondents were then asked to indicate how frequently they consumed the foods listed in the questionnaire.

3.4.2 Food Sample Collection

Food samples were collected from the households in Magubike Village. Representative samples of cooked foods (dishes) consumed by pregnant women in different households were collected in plastic sterile containers with tight-fitting lids. The food samples were collected once from different households on the same day and chemically analysed separately to determine their nutrient content. Each food or dish sample collected was recorded in the field datasheet. It was then labelled at the point of collection using a permanent ink marker pen. Hot food samples from households were cooled immediately in a cooler box (an insulated plastic box) containing ice blocks and transported to the laboratory at Sokoine University of Agriculture for food analysis of nutrient composition using procedures explained in AOAC, (1990) and Proximate composition and mineral analysis were conducted using a procedure explained by AOAC, (1995). Upon arrival at the laboratory the food samples were kept in a deep freezer at -20^{o}C until analysis.

3.5 Food Analysis

Dry matter, protein, carbohydrate, fat, iron, zinc, calcium, magnesium, potassium, phosphorous, manganese, sodium and copper content were determined. Standard procedures of the Association of Official Analytical Chemists were used to determine the moisture content, crude fat, crude protein (N x 6.25), crude ash, and crude fibre content. Energy value was calculated using Atwater's conversion factor. Minerals (iron, magnesium, phosphorous, zinc and calcium) were determined by the Atomic Absorption Spectrophotometer.

3.6 Determination of Nutritional Status

3.6.1 Anthropometric Measurements

The following anthropometric parameters were measured; weight and height. These were used to determine the nutritional status of pregnant women. These measurements were undertaken at the RCH clinic.

3.6.2 Weight

Weight was measured using an electronic SECA weighing scale (SECA Vogel and Halke, Hamburg, Germany), with a digital display. Participants were requested to wear light clothes and remove their shoes during measurement. Weight was recorded to the nearest 0.1kg.

3.6.3 Height

Height was measured using the Harpenden stadiometer (Holtain Ltd, London, UK). Participants were asked to remove their shoes, heavy outer garments, and hair ornaments before being asked to stand on the Stadiometer. The back of the head, back, buttocks, calves and heels had to be touching the upright, with feet together. The top of the external

auditory meatus (ear canal) was leveled with the inferior margin of the bony orbit (cheekbone). The participant was asked to look straight ahead. The headpiece was lowered so that the hair (if present) was pressed flat. Height was recorded to the resolution of the stadiometer (i.e. nearest 0.1 cm).

3.6.4 Weight Gain Pattern Assessment

The weight gain pattern was obtained from the RCH clinic cards so as to monitor weight change. Monitoring weight gain patterns was of particular interest because these patterns have a great influence on pregnancy outcomes.

3.7 Data Management and Analysis

Data from dietary assessment, anthropometric data and socio-demographic characteristics of the households were analyzed using the Statistical Package for Social Sciences Version 12.5 for Windows. Descriptive statistics was used to obtain the mean, frequencies and link between variables through cross- tabulation.

3 CHAPTER FOUR

4.0 RESULTS

4.1 Demographic Information

This section presents the demographic information of the pregnant women. The demographic information includes age, marital status and education level of respondents.

4.1.1 Age, marital status and education level of respondents

The age of the pregnant women ranged between 15 and 45 years. Slightly less than twenty percent of the women were having age ranging between 36 and 45 years and 34% of the pregnant women were between the ages of 26 and 35 years. Approximately forty-seven percent of the pregnant women were younger than 25 years. Most pregnant women who participated in the study were in their reproductive years (TDHS, 2005). Additionally, 11% of the pregnant women were single and a high proportion of the women (82%) were married. It was observed that 79% of the respondents had received primary education. Only 2% had attained up to secondary education and 19% of the respondents had not been to any type ~~of formal~~of formal education.

4.1.2 Occupation and income of respondents

There was a wide range of occupations amongst the respondents. About 90% of the respondents were farmers, only 2% were employed and 8% of the respondents were businesswomen. Close to 73% of pregnant women were involved in selling the crop produce, 13% in petty business, 7% in selling of livestock and livestock products, 5% were involved in causal labour, only 2% were getting a salary/wages and the remaining 2% had no source of income.

4.1.3 Monthly food Expenditure

About 81% of the pregnant women spent more than 20 000 Tshs a month on food and the rest spent less than 20 000 Tshs a month to buy food and 1% of the pregnant women spent 20 000 Tshs a month to buy food.

4.2 Dietary Intake among Women in Households Involved in the Study

From the results obtained it was shown that most families considered stiff porridge (ugali) as the main source of energy food, compared to sweet potatoes or cassava. Cassava and sweet potatoes were usually taken during breakfast (Appendix 2).

About 36% of the pregnant women involved in the study took milk as their main source of protein. Only 24% of the respondents consumed beans every day. However, 47% of the respondents consumed sardines twice a week and about the same (48%) consumed beef twice a week (Appendix 3).

Vegetables were consumed by respondents more frequently and the most frequently consumed vegetable was sweet potato leaves by 34%. About 19% of the pregnant women consumed amaranthus daily. Eggplants were consumed twice a week by all the respondents. In the case of fruit, pawpaw was consumed every day by about 20% of the interviewed pregnant women (Appendix 4).

Honey was not consumed at all by pregnant women in Magubike village. The village has a lot of sugarcane and therefore all pregnant women who participated in the study indicated during the interview that they consumed sugarcane daily. About 88% consumed sugar daily, and 2% used sugar only three times a week. Some 76% of the respondents

consumed animal fats daily. In addition 9.5% of the pregnant women consumed coconut daily and 33% twice a week (Appendix 5).

4.3 Nutrient Composition of Foodstuff consumed by Magubike Pregnant Women

Table 2 shows the nutrient composition of foodstuff consumed by pregnant women in Magubike village. Sardines mixed with Irish potatoes (10.2 g/100g), sardines alone (9.4 g/100g) followed by sardines mixed with sweet potato leaves (6.2 g/100g) had highest amount of proteins while in potato leaves (1.4 g/100g) and banana (1.2 g/100g) protein concentration is low. High levels of fat were observed in dishes containing sardines (10.2 g/100g), amaranthus (4.6 g/100g) and potato leaves mixed with African egg plant (4.6 g/100g). It should be noted here that the fat content recorded in these food could be due to the added oil used during cooking.

It was also observed that pumpkin leaves had the highest fibre content (7.8 g/100g), followed by sweet potato leaves mixed with African eggplant (5.2 g/100g), and amaranthus had the lowest fibre content (0.03%) an almost negligible amount compared with the other foodstuffs as shown in Table 2. Rice (24 g/100g) and banana (20.2 g/100g) had the highest carbohydrate content followed by maize and beans (18.4g/100g) and stiff porridge as well as amaranthus had the lowest carbohydrate content. Furthermore, pumpkin leaves and sardines had no carbohydrate.

Table 2 also shows the energy levels in different foodstuff consumed by pregnant women in Magubike village. Sardines and rice had the highest amount of energy, 129.2 kcal/100g and 110.5 kcal/100g respectively, followed by beans (97 kcal/100g). Beans mixed with pumpkin leaves and pumpkin leaves alone had the lowest energy content.

Table 2: Mean Nutrient Values per 100g for different Foodstuff (wet basis)

	Protein (g)	Fat (g)	Fibre (g)	CHO (g)	Energy (Kcal)
Beans	6.0^{c}	1.0^{de}	2.4^{bc}	16.1^{b}	97.0^{bc}
Beans and pumpkin leaves	4.3^{d}	0.0^{e}	0.4^{c}	5.2cd^{e}	38.2^{f}
Sardines	9.4^{b}	10.2^{a}	1.9^{bc}	0.0^{e}	129.2^{a}
Sardines and Irish potatoes	10.2^{a}	2.0^{cd}	0.3^{c}	9.5^{c}	97.0^{bc}
Sardines and potato leaves	6.2^{c}	1.4^{de}	4.5^{abc}	7.5^{cd}	67.1^{cdef}
Cassava leaves	4.3^{d}	4.5^{b}	4.0^{abc}	3.1^{de}	70.4^{cde}
Kidney beans and maize dish	2.7^{e}	0.5d^{e}	1.0^{bc}	18.4^{ab}	89.0^{bc}
Potato leaves	1.4f^{g}	3.6^{b}	4.3^{abc}	2.5^{de}	48.2^{ef}
Potato leaves and African eggplant	2.6^{e}	4.6^{b}	5.2^{ab}	4.2^{cde}	68.5^{cde}
Amaranthus	2.4^{e}	4.6^{b}	0.03^{c}	1.6^{de}	57.2^{def}
Pumpkin leaves	2.4^{e}	0.1^{b}	7.8^{a}	0.0^{e}	10.7^{g}
Stiff porridge	1.9^{f}	0.4^{c}	0.2^{c}	23.0^{de}	46.1^{ef}
Cooked rice	2.7^{e}	1.6^{de}	2.1^{bc}	24.0^{a}	110.5^{ab}
Banana	1.2^{g}	0.0^{e}	0.9^{c}	20.2^{ab}	97.0^{bcd}

Values in a column that have the same superscript letters are not significantly different (p= <0.05)

4.4 Mean Nutrient /100g of Food consumed by pregnant women in Magubike

Table 3 shows the mean nutrient intake/100g of food consumed by pregnant women in Magubike village. The food consumed by pregnant women in Magubike had no copper. A dish of sardines mixed with Irish potatoes (0.03 mg/100g) and beans mixed with pumpkin leaves (0.0231 mg/100g) had the highest zinc content followed by stiff porridge (0.02254 mg/100g) and the dish of maize and beans (0.0064 mg/100g), Amaranthus (0.0073 mg/100g) and banana (0.0090 mg/100g) had the lowest zinc content. Also the highest iron content was in Amaranthus (6.52 mg/100g) and sardines (4.19 mg/100g) and the remaining meals had the lowest iron content. Calcium content was highest in potato leaves mixed with African eggplant (0.008 mg/100g) followed by beans mixed with pumpkin leaves (0.00 44mg/100g), while pumpkin leaves, maize and kidney bean dish , stiff porridge , potato leaves, sardines , sardines mixed with potato leaves and Amaranthus had the lowest calcium content (0.0003 mg/100g).

Furthermore as presented in table 3 potato leaves mixed with African eggplant contained 16.70 mg/100g followed by beans alone (13.19 mg/100g). Beans mixed with pumpkin leaves had (1.44 mg/100g) of magnesium and maize and kidney bean dish had the lowest content of magnesium (0.15 mg/100g).

Table 3: Mean mineral content per 100g of different foodstuff

	Zn (mg)	**Fe (mg)**	**Ca (mg)**	**Mg (mg)**	**K (mg)**	**Na (mg)**
Beans	0.02	1.98	0.0017	13.19	337.43	525.51
Beans and pumpkin leaves	0.02	0.02	0.0044	1.43	443.30	1012.50
Sardines	0.15	4.19	0.0003	4.18	44.74	29.30
Sardines and Irish potatoes	0.03	0.01	0.0014	8.19	142.10	394.55
Sardines and Potato leaves	0.02	0.01	0.0003	6.26	74.62	50.70
Cassava leaves	0.02	3.85	0.0004	8.04	267.43	104.14
Kidney beans and maize dish	0.01	0.03	0.0003	0.15	30.83	19.90
Potato leaves	0.01	1.98	0.0003	4.90	47.14	30.43
Potato leaves and African eggplant	0.04	0.04	0.0076	16.69	510.72	1303.47
Amaranthus	0.01	6.52	0.0003	2.61	46.87	27.22
Pumpkin leaves	0.01	3.81	0.0003	2.74	29.98	435.41
Stiff porridge	0.23	1.52	0.0003	4.99	41.46	20.07
Cooked rice	0.01	1.75	0.0022	9.11	236.15	412.21
Banana	0.01	0.90	0.0004	4.85	54.72	23.37

4.5 Adequacy of Nutrients in Pregnant Women's Diet

4.5.1 Mean Daily Nutrients Intakes by Pregnant Women in Magubike

Pregnant women in Magubike village consumed on average 54 grams of protein in their daily diet. This amount is lower by 10% than the required intake of protein intake for pregnant women of 60 g per day (Table 4). They also consume 27 grams of fat in their daily diet which is less than the actual required amount of Fat of 43 gms (18%kcal). The results also show the level of energy intake was 1231.3 kcal per day, which is less by 53% than the required intake of energy intake of 2500-2700 kcal/day. On average, Magubike

pregnant women consumed 2 grams of fibre per day in their daily diet and this is low by 28% when compared with the actual required amount of dietary fibre of 30 grams/day.

Table 4: Mean Daily Nutrients taken in by Magubike Pregnant Women

	Magubike (g)	**RDA (g/d)**	**% deficit.**
Protein	54.1	60	9.8
Fat	27.4	43	36.28
Crude fibre	2.24	30	27.76
CHO	194.1	450	9.8
Energy (kcal)/ (kcal/d)	1231.3	2600	52.64

4.5.2 Mean Mineral Contents of Different Foodstuffs

Table 5 shows the mean daily mineral intake presented in milligrams of dietary nutrient content per day for pregnant women in Magubike village. The mean amount of mineral (Cu, Zn, Fe, Ca and Na) intake among Magubike's pregnant women was generally low in comparison with the recommended daily allowances (RDA).

In the case of iron, pregnant women in Magubike village consume 7.8 mg Fe/day. This level is 74% below the recommended daily allowance of 30 mg/day. Zinc consumption was also inadequate with a mean intake of (1.9 mg/day) similarly below the RDA of 15 mg/day. Calcium consumption was found to be 0.002 mg/day which is also low by 99% compared with the RDA of calcium which is 1200-1500 mg/day.

Unlike the other micronutrients sodium consumption among Magubike pregnant women was higher, i.e 348 mg/day.

Table 5: Mean Daily Mineral Intake by Pregnant Women in Magubike

	Magubike (mg/d)	**RDA (mg/d)**	**% deficit.**

Iron	7.8	30	74
Zinc	1.9	15	87.3
Calcium	0.0017	1200	99.9
Copper	0.0001	2	99.9

4.6 Nutritional status of pregnant women

The nutritional status of pregnant women was explained by height and weight gain .The results for height show that pregnant women with a short stature, i.e less than 151cm, comprised 8 % and those above 151cm comprised 92% of Magubike pregnant women. Weight gain per week (mean ± Standard deviation) are presented in Table 6 according to trimesters. In the second and third trimesters, there was a decrease in weight gain instead of an increase.

Table 6: Weight gain of Magubike Pregnant women

Trimesters	Weight gain/week (Kg/wk)
First	0.23±0.01
Second	0.11±0.08
Third	0.11±0.02

Table 7: Pearson correlation results between weight gain per trimester and nutrient intake

Weight gain per trimester	Food ingredients							
	Fat	Protein	CHO	Energy	Fe	Ca	Cu	Zn
Weight gain between 1st and 2nd trimester	-0.206	-0.122	0.222	0.086	0.048	0.029	0.101	-0.222
Weight gain between 2nd and 3rd trimester	0.065	0.26*	0.081	0.216	0.111	0.049	0.197	-0.019

CHAPTER FIVE

5.0 DISCUSSION

5.1 Demographic Information

About 90% of the household members participating in the study were farmers. This could be a reason for their poor earning opportunities and their getting married at an early age. Most of these women conceive at an age below 25 years and this may lead them to deliver LBW infants. More than three-quarters of these women have attended school up to standard seven only, hence adolescent childbearing is common and this could have a negative effect on future education for girls.

5.2 Dietary Intake and Nutrient composition

A high proportion of pregnant women in Magubike village do not consume enough nutrients, and because of this meeting the RDA of nutrients is not possible through their dietary patterns. The low intakes could also be related to the limitations of FFQs to assess the food and nutrition consumption of individuals which have been summarized recently by Gibson (2005). Dietary intake results show that pregnant women in Magubike village do not consume balanced diets, when you look at the foods they consume. The deficiencies in micronutrients observed in this study could be associated with increased risks of morbidity and mortality as noted elsewhere (Barclay *et al.*, 2003*)*. For example, iron deficiency during infancy impairs cognitive development and immune function and is associated with increased morbidity (WHO, 2001); iodine deficiency during pregnancy and childhood is the single most important preventable cause of brain damage worldwide (UNICEF, 2001); zinc deficiency, even mild-to-moderate, increases the risk of poor growth and development, reduced immune function, increased infectious diseases and mortality (Black, 2002).

The dietary patterns and eating habits of Magubike villagers, as well as the lack of knowledge about the composition of several commonly consumed foods has led to the inadequate intake of nutrients . The dietary intake in this village could not provide sufficient nutrients for pregnant women nor their foetuses. The intake of protein was clearly inadequate for all pregnant women. This could lead to a high proportion of malnourished women. In addition, pregnant women in Magubike village were also noted to crave on non-food items, i.e. during the interview they said that they ate soil (PICA), which was culturally influenced, rather than consuming food containing important nutrients like iron, zinc and calcium. Eating soil put women at risk of parasitic infections

and toxicity and may cause anaemia as well as life-threatening blockages of the intestinal tract (Wardlaw and Kessel, 2002).

5.2.1 Iron

This mineral is essential for the formation of healthy red blood cells. It is difficult for a pregnant woman to consume enough iron from food to maintain an adequate supply, and often may leave her anaemic and exhausted (USDA, 2005). Iron intake in the present study appeared to be inadequate, and the levels were less compared than the RDA for pregnant women. Nevertheless, the high frequency of hookworm infestations and the endemic malaria may also contribute more to anaemia, than to the intake and effects due to the bioavailability of dietary iron. Iron intake does not prevent the high prevalence of anaemia under these circumstances because of ~~the high~~the high rate of infections and a high prevalence of protein-energy malnutrition. Additional iron requirements during pregnancy cannot be met through diet alone and should be attained through supplements containing iron. From the results of this study it was observed that the iron in food stuff consumed by pregnant women in Magubike village was minimal, hence there was a need to synthesize the greater amount of haemoglobin needed during pregnancy and to provide enough iron stores to help the foetus to grow.

5.2.2 Zinc and Copper

When compared with RDAs, the intake of Zinc and Copper in the study appeared to be very low in all pregnant women. Protein-containing foods can be an excellent source of vitamins and minerals such as iron, vitamin B6, and zinc. In evaluating the adequacy of zinc intake, it was necessary to relate it to the intake of protein of the study subjects. The intake of zinc was lowest when protein intake was also low and highest when protein intake was high. Since protein intake in these pregnant women was low, this could also

explain the observed low mean zinc intake in pregnant women which was inadequate with respect to RDA. This may cause birth defects and intrauterine growth retardation during pregnancy.

5.2.3 Calcium

This study observed a low intake of calcium which could be explained by the little or no consumption of milk in the diet of ~~these pregnant~~these pregnant women. Science has shown that, when calcium intake is low the intestinal absorption is increased and renal excretion of this mineral is reduced. So there is a need to improve calcium intake. Calcium is essential for maintaining the bone integrity of a pregnant woman and provide for the skeletal development of the foetus. ~~The RDA~~The ~~for~~RDA for calcium is 1200 mg, which is sufficient to meet ~~both maternal~~both maternal and foetal needs. Thus pregnant women are encouraged to consume calcium-rich foods, such as milk and milk products, green leafy vegetables and shellfish. To get this extra calcium, 3 extra servings (3 cups) of milk or dairy products are usually ~~recommended (~~recommended (Kaiser and Allen, 2002). During pregnancy, calcium is needed for the development of the foetal skeleton and the attainment of peak bone mass during adolescence. In a still-growing adolescent mother calcium intake may be limited by poor diet and the need to retain enough calcium to mineralize two skeletons. Low calcium intake has been shown to be significantly associated with low bone density and an ~~increased risk~~increased risk of ~~osteoporosis and~~osteoporosis and reduced foetal femur length *in utero* in pregnant adolescents (Moran, 2007). The results of this study (Table 5) show ~~that a~~that a high proportion of pregnant women in Magubike village did not take sufficient amounts ~~of calcium~~of calcium and their ~~diet did~~diet did not contain dairy products at all, which is one of ~~the sources~~the sources of calcium. This is also the reason why they need a nutrition education and a

maternal health programme to reach pregnant women about appropriate nutrient consumption.

5.2.4 Sodium

Sodium intake was considerably high in all pregnant women in the study in Magubike which appears to be too much during pregnancy. It should be known that too much salt may lead to hypertension and may be associated with too much weight gain in some women. However, salt should not to be restricted during pregnancy but, excessive use of it is not recommended (USDHHS, 2005). A diet of primarily natural foods can be safely salted “to add taste.”

5.2.5 Protein, Carbohydrate and Energy

The dietary pattern showed a low intake ~~of carbohydrates~~of carbohydrates, protein, and fat. The contribution of plant-based products, animal products, sugar and oils to the diet as illustrated in Appendices 2, 3, 4 and 5 shows that the amounts consumed are relatively small. The mean intake of 54.1 grams for protein in the daily diet of Magubike pregnant women is low when compared with the actual required intake of protein intake for pregnant women of 60 g per day (USDHHS, USDA, 2005). In most cases when adults are able to meet 67% of the RDI, ~~it is~~it is sufficient for physiological functions. Therefore, an intake of 54.1/60g could be considered adequate for these women. Moreover, the food consumed by these pregnant women was more of plant- based protein which is of poor quality than of animal-based protein which is of high quality. The diets of Magubike pregnant women also contained less fat than the recommended daily requirements ~~of 43gms~~of 43gms (18%kcal) (WFP/WHO/UN, 2002). The reasons might be relatively low food intake and seasonal variations in food availability. About three-quarters of the respondents were also selling food crops, and so this tendency of selling too much food for

cash during the harvesting season, and neglecting storage, might be another reason for these insufficiencies. However, through discussions with respondents, it was revealed that there was food shortage at the household level and this made pregnant women change their dietary habits in order to cope with the problem of economic constraints. Hence it was impossible for these women to eat sufficient amounts of foods containing important nutrients. Likewise consumption patterns affected energy intake. In addition to these dietary patterns there may be nausea and vomiting and food taboos that may also lower energy intake. Usually, physiological needs during pregnancy are increased, hence causing increased energy needs.

5.2.6 Dietary Fibre

The results of this study also show that the daily fibre intake level for pregnant women in Magubike village is lower (Table 4) than the actual required amounts of dietary fibre which is 30grams/day (Kaiser and Allen, 2002). Pregnant women in Magubike village are at a higher risk of getting heart disease due to low consumption of dietary fibre. Through interviews some of the respondents declared that they experienced constipation which makes them uncomfortable. This is ~~because low~~because low dietary fibre consumption influences the digestive ~~system that~~system that is also subject ~~to hormonal~~to hormonal changes that occur during pregnancy. It is important that pregnant women in the study ~~area look~~area look into their diets so that ~~they maintain~~they maintain regular bowel movements to avoid unnecessary discomfort. Also these women should make sure their diets are rich in fibre containing foods like cereals, whole-grain bread, fresh fruit, vegetables and take exercise like walking and jogging. Pregnant women need 25 to 35 grams of fibre per day for optimum health and to prevent constipation (Khaleej, 2007). Fibre in the ~~diet help~~diet help to prevent intestinal disorders like constipation and colon

~~cancer ,it~~cancer, ~~improves~~it improves ~~glycemic and~~glycemic and cholesterol control and promote body weight control (Wardlaw and Kessels, 2002).

5.3 Adequacy of Nutrients in Pregnant Women's Diet

The poor nutritional status of pregnant women in this study can be attributed to dietary inadequacy resulting from illiteracy, ignorance and low income ,since the majority of women belonged to the lower and middle classes. This was also observed in a similar study of low income homes conducted by Mridula *et al.* (2003) on 120 expectant mothers which showed that their average energy intake was 1954 k-cal and protein intake 44g per day. The results were also lower than the recommended dietary allowances. Another study conducted by Pallavi *et al*. (2002) on 30 low-income expectant mothers showed that protein intake was 44.6 g/day which was also lower than the RDA. The main reason for the low consumption of food by pregnant women in Magubike could be explained by the fact that most of the women belonged to the low income socio-economic group, i.e. they sell most of their crops and do petty business, ending up having low purchasing power and tending to have ~~a poor~~a poor diet.

Besides income other socioeconomic indicators (i.e., education and occupation,) appear to have similar, but independent, effects on nutrition and diet , although several studies have shown that education is the strongest determinant of socioeconomic differences in diet (Estevez-Irala *et al.*, 2000, Groth, 2001, Friel *et a.l*, 2003). In this study, most of the pregnant women had a poor level of education (primary education 79%), which most likely affected their dietary intake and nutritional status.

Recommended balanced diet for pregnant women

A well-balanced diet should contain something from all the food groups: dairy products, fruit, vegetables, fish, meat, eggs, fats and carbohydrates. A pregnant woman needs to eat something from all these food groups every day in order to get the proper amount of energy and nutrients. Approximately 10 per cent of calories should come from protein. Protein is mainly found in meat, fish, eggs, dairy products and beans. Approximately 35 per cent of calories should come from fat, which is mainly found in butter, oils, margarine, dairy products and nuts. Approximately 55 per cent of calories should come from carbohydrates, which are found in bread, pasta, potatoes, rice, corn and other grain products. (Maniche, 2008) talks about the significance of having a balanced diet and having the right mineral content first. In this study,the mineral content of different food stuffs that was investigated showed that that pregnant women in Magubike village did not eat a well balanced diet and this meant that their intake of nutrient was inadequate.

5.4 Nutritional status of pregnant women

This study illustrates a significant relationship between the nutritional status and dietary intake of pregnant women. Pregnant women in this study lacked knowledge on nutrition especially that concerning the importance of essential nutrients in their diet and therefore women had minimal nutrient intake through their diet. In RCH centres pregnant women did not get enough education on the importance of essential nutrients in their diet like iron, calcium and zinc. The results of this study underscores the important role of, and the need for, nutritional education to help reduce the number of pregnant women who are undernourished and delivering small babies. Hence education is an important element in making maternal nutrition successful. However, the nutritional status of women in developing countries is also aggravated by high birth rates, hookworm infestations and ~~malaria .~~ malaria. Maternal deficiencies of energy ~~and micronutrients~~and micronutrients

may be associated with intrauterine-growth retardation, low birth weight, foetal and newborn deaths, birth defects and reduced physical and mental ~~potential preterm~~potential preterm deliveries~~, in~~, in addition ~~to maternal~~to maternal complications and death (Gautam, 2008). In Magubike village pregnant women did not get enough energy and nutrients from their diets, and deficiencies of micronutrients like iron, calcium and zinc could affect the quality of breast milk after delivery .These deficiencies could be avoided if mothers were to improve their diets before and during pregnancy. Furthermore, high birth rates in Magubike that may be associated with the deficiencies could be reduced by motivating the mothers to use family planning methods. It has been universally accepted that pregnant women need more food for the growing foetus, and considerable attention should be paid to their dietary intake and nutritional status during this ~~period (~~period (Subarnalata and Basumati, 2006).

5.5 Height

Height has been used to screen for risk of poor pregnancy outcome such as LBW, perinatal, neonatal and infant mortality. The contribution of height to pregnancy outcome (birth weight and mortality) has been discussed in several studies (Krasovec and Anderson, 1991 and Keen 2003). Maternal height does not have an effect on infant outcomes (birth weight and recumbent length) independent of maternal weight, muscle or fat reserves, and the influence of height on birth weight is simply a reflection of total maternal body mass. Maternal height is also commonly accepted as a useful clinical indicator concerning the risk of obstetric complications, particularly cephalopelvic disproportion, prolonged labour, or delivery by operative means such as Caesarean section, sympysiotomy or embryotomy (WHO,1991). In this study, 91.9% of pregnant women in Magubike village were shown to be taller than 151 cm, and 8.1% of the participants were shorter than 151 cm suggestive maternal height (Kinabo and Shirima,

2004), hence most of them would probably have no obstetric complications (i.e. would have normal deliveries).Women who are very short are more likely to have difficult labour because of poor childhood growth and bone development, therefore pregnant women who are short are more likely to deliver small babies(Marco,20002).

5.6 Weight gain

The amount and composition of the weight gained during pregnancy are major determinants of energy and nutrient needs, and the amount of weight gained significantly influences pregnancy outcomes. Gestational weight gains are associated with a desirable pregnancy outcome (a term infant weighing between 3 to 4 kg) and are also influenced by pre-pregnancy weight. Weight gains are higher in women with a desirable pregnancy outcome and a low pre-pregnancy BMI than in those with higher pre-pregnancy BMI values (Table 1).The rate of weight gain is not uniform throughout pregnancy. Approximately 5% of the total weight is usually gained in the first 10-13 weeks and the remaining 95% is gained fairly evenly throughout the remainder of the gestation (Garrow, 2000). Women with a BMI <19.8 are at higher risk of delivering a LBW infant if their prenatal weight gain is inadequate (Kaiser and Allen, 2002). According to the results of this study (Table 6), pregnant women of Magubike village did not gain the recommended weight gains per week for pregnant women. This could be due to poor dietary intake, i.e the food consumed by these pregnant women did not contain the necessary nutrients and could result in severe ramifications for the health of the baby and the mother, and also putting the mother at risk of delivering LBW babies. However, even women with a BMI >29 should gain at least 7 kg (15 lb); those who lose weight or gain less than 6 kg are more likely to deliver an infant that is small for the gestational age. Women with a BMI >29 should be advised to gain weight at a rate that does not exceed 11.4 kg (25 lb) throughout the pregnancy to reduce the risk of postpartum weight retention (Kaiser and

Allen, 2002).According to the analysis shown in table 7 indicates the weight gained by the Magubike pregnant women per trimester is weakly related to nutrient intake in varying degrees as measured by Pearson coefficients. The weight of the pregnant women in the first and second trimester was negatively correlated with fat (-0.206), protein (-0.122) and Zinc (-0.222). This means that in the first and second trimester Magubike women's weight gain was not related to food consumption rich in fat, protein and zinc. Therefore nutrient supplements are needed at optimal levels to have a growth impact on both mother and foetus. Nevertheless the same trimester's carbohydrate, energy, iron, calcium, and copper were positively related to the weight gain of the pregnant women. In addition the results showed that protein intake significantly contributed to weight gain between the 2nd and 3rd trimesters.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This study concludes that the dietary intake of pregnant women in Magubike village had very low intake of protein rich foods and low overall energy intake. This study also confirmed the previous findings about the low dietary intake of pregnant women in developing countries. Furthermore, most pregnant women had poor nutritional status which is pre-disposing factor for low birth weight and delivery complications. In addition, nutrient content of food consumed by these pregnant women was low hence low intake. Nutrient intake of pregnant women was inadequate and this resulted to poor weight gain during pregnancy.

6.2 Recommendations

Further research at the village level should be undertaken in order to assess the need for fortification of food with micronutrients like Zinc, and Calcium. Research should also be conducted to evaluate the need for the provision of Zinc and Calcium supplements to pregnant women. It is also recommended that iron supplements in tablet form, preferably together with folic acid, be given to all pregnant women because of the difficulties in correctly evaluating iron status in pregnancy. It is therefore necessary to encourage pregnant women to eat more local foods and be provided with nutritional education, counseling and programmes that emphasize the importance of calcium and dairy product consumption. Also nutritional campaigns should be arranged which will emphasize the need for pregnant women to attend RCH clinics in order to increase their awareness of nutritional needs. Finally, due to the poor nutritional status of the women in this study, it is imperative that health care providers advise pregnant women concerning nutritional status

and dietary intake before and during pregnancy. This will have many benefits such as lowering the risk of delivering LBW babies and reducing complications during pregnancy.

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APPENDICES

Appendix 1: Questionnaire on Dietary Intake and Nutritional Status of Pregnant Women in Magubike Village, Kilosa District.

A. BASIC INFORMATION

1. Respondent number……..

2. Age ……

3. Sex…….

4. Ethnic group ……

5. Division …….

6. Ward ……

7. Village …….

B. SOCIO-ECONOMIC INFORMATION.

(Tick the right answer)

8. Marital status

1) Single

2) Married
3) Divorced
4) Separated
5) Widow

9. Education level

1) No formal education
2) Primary school education
3) Secondary school education
4) Advanced level education
5) Higher level of education

10. Occupation

1) Farmer
2) Employed
3) Student
4) Business woman
5) Others (specify)

11. What is the total number of household members in your family?

1) 3-5
2) 6-8
3) More than 8

12. Relation with the head of the family?

1) Husband
2) Uncle/auntie
3) Sister/Brother
4) Others (specify) …….

13. What is the major source of income for your family

1) Salary/Wages
2) Sales of crop produce
3) Sales of livestock
4) Petty business
5) Casual labour
6) Others (specify)…….

14. How much do you spend to buy food in a month?
    1) Less than 20,000/=
    2) 20,000/=
    3) More than 20,000/=
15. Type of floor used for the house
    1) Mud
    2) Concrete
    3) Wood
16. Type of roof used for the house
    1) Grass
    2) Corrugated iron sheet
17. Type of the wall used
    1) Mud
    2) Cement

C. ASSESSMENT OF FOOD INTAKE

Food Frequency Questionnaire

Please let me know the frequency to which Pregnant women consume the listed foods.

List of foods consumed	**Frequency of consumption**				
	Daily	**5 times/week**	**3 times/week**	**Once/month**	**Occasionally**
Stiff porridge					
Rice					

Cassava					
Sweet Potatoes					
Plantain Banana					
Beef					
Chicken					
Eggs					
Milk					
Beans					
Sardines/Fish					
Amaranthus					
Pumpkins leaves					
S/potato leaves					
Garden egg					
Oranges					
Guava					
Ripe banana					
Pawpaw					
Animal fats					
Honey					
Sugarcane					
Sugar					
Coconut					
(Other)					

D. ANTHROPOMETRIC MEASUREMENTS OF A PREGNANT WOMAN

Age …… (Years)

Weight …… (Kg)

Height ……. (cm)

Weight gain …….. (Kg)

E. FOOD WEIGHING RECORD

Type of food	Food ingredients	Food Quantity	Method of preparation

Appendix 2: Carbohydrate Consumption

Name of the food		Frequency	Percentage
Stiff porridge	Daily	36	58.1
	Five times a week	18	29
	Four times a week	3	4.8
	Three times a week	4	6.5
	Two times a week	1	1.6
Cassava	Daily	17	35.4
	Five times a week	3	6.3
	Four times a week	1	31.3
	Three times a week	7	14.6
	Two times a week	15	2.1
	Once a week	3	6.3
	Once a month	2	4.2
Rice	Daily	2	4
	Four times a week	29	58
	Three times a week	2	4
	Two times a week	4	8
	Once a week	6	12
	Once a month	7	14
Sweet potatoes	Daily	16	34
	Five times a week	4	8.5
	Four times a week	3	6.4
	Three times a week	4	8.5
	Two times a week	17	36.2
	Once a week	3	6.4
Plantain banana	Daily	7	15.9
	Five times a week	1	2.3
	Four times a week	1	2.3
	Three times a week	3	6.8
	Two times a week	20	45.5
	Once a week	8	18.2
	Once a month	4	9.1

Appendix 3: Protein Consumption giving food

Name of the food		Frequency	Percentage
Beef	Daily	1	1.9
	Four times a week	3	5.8
	Three times a week	8	15.4
	Two times a week	25	48.1
	Once a week	5	9.6
	Once a month	10	19.2
Eggs	Daily	2	6.9
	Three times a week	3	10.3
	Two times a week	12	41.4
	Once a week	3	10.3
	Once a month	9	31.0
Milk	Daily	12	36.4
	Five times a week	1	3.0

	Four times a week	1	3
	Three times a week	3	9.1
	Two times a week	13	39.4
	Once a week	1	3
	Once a month	2	6.1
Beans	Daily	13	23.6
	Five times a week	4	7.3
	Four times a week	4	7.3
	Three times a week	17	30.9
	Two times a week	16	29.1
	Once a month	1	1.8
Sardine/Fish	Daily	3	6.1
	Five times a week	2	4.1
	Four times a week	3	6.1
	Three times a week	11	22.4
	Two times a week	23	46.9
	Once a week	5	10.2
	Once a month	2	4.1

Appendix 4: Vegetables and fruits consumption

Name of the food		**Frequency**	**Percentage**
Amaranthus	Daily	9	19.1
	Five times a week	1	2.1
	Four times a week	2	4.3
	Three times a week	7	14.9
	Two times a week	23	48.9
	Once a week	3	6.4
	Once a month	2	4.3
Pumpkin leaves	Daily	9	16.4
	Five times a week	2	3.6
	Four times a week	5	9.1
	Three times a week	12	21.8
	Two times a week	20	36.4
	Once a week	2	3.6
	Once a month	5	9.1
Sweet potato leaves	Daily	14	25.5
	Five times a week	4	7.3
	Four times a week	4	7.3
	Three times a week	12	21.8
	Two times a week	16	29.1
	Once a week	3	5.5
	Once a month	2	3.6
Egg plant	Two times a week	7	58.3
	Once a month	5	41.7
Guava	Five times a week	2	11.8
	Three times a week	2	11.8
	Two times a week	5	29.4
	Once a week	3	17.6
	Once a month	5	29.4

Ripe banana	Daily	16	29.1
	Five times a week	3	5.5
	Four times a week	7	12.7
	Three times a week	8	14.5
	Two times a week	13	23.6
	Once a week	2	3.6
	Once a month	6	10.9
Pawpaw	Daily	9	20
	Five times a week	2	4.4
	Four times a week	3	6.7
	Three times a week	4	8.9
	Two times a week	21	46.7
	Once a week	4	8.9
	Once a month	2	4.4

Appendix 5: Consumption of sugars and oils

Name of the food		Frequency	Percentage
Animal fat	Daily	28	75.7
	Five times a week	3	8.1
	Three times a week	1	2.7
	Two times a week	3	8.1
	Once a month	2	5.4
Honey	Four times a week	1	10
	Two times a week	3	30
	Once a month	6	9.7
Sugarcane	Daily	38	64.4
	Five times a week	2	3.4
	Three times a week	8	13.6
	Two times a week	8	13.6
	Once a week	1	1.7
	Once a month	2	3.4
Sugar	Daily	51	87.9
	Three times a week	1	1.7
	Two times a week	4	6.9
	Once a week	2	3.4
Coconut	Daily	2	9.5
	Three times a week	1	4.8
	Two times a week	7	33.3
	Once a week	1	4.8
	Once a month	10	47.6