KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY,KUMASI.

COLLEGE OF HEALTH SCIENCES

SCHOOL OF MEDICAL SCIENCES

DEPARTMENT OF COMMUNITY HEALTH

BIRTHWEIGHT OF NEWBORNS IN RELATION TO THE NUTRITIONAL STATUS OF PREGNANT WOMEN IN THE ATWIMA NWABIAGYA DISTRICT OF ASHANTI REGION OF GHANA.

A DISSERTATION SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES, KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI IN PARTIAL FULFILMENT OF REQUIREMENTS FOR THE AWARD OF MASTER OF PUBLIC HEALTH (MPH) DEGREE IN POPULATION AND REPRODUCTIVE HEALTH.

BENTUM JOYCE

JUNE, 2011

DECLARATION

I Bentum Joyce, hereby declare that, this is the result of my own hand work and that no previous submission for a degree has been done here or elsewhere. Also the work of others which served as reference has been duly acknowledged.

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Date…….

Bentum Joyce

(Student)

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Date…..... Date…….…….....

Dr. Anthony Edusei Dr. Easmon Otupri

(Academic Supervisor) (Head of Department)

DEDICATION

I dedicate this work to the Almighty God who has seen me through my duration of study.

I also dedicate this work to my mother Mrs. Esther Bentum for her relentless moral, spiritual and financial support.

ACKNOWLEDGEMENT

Through tiring research and several set- backs, I successfully came out with this project work. I show my endless gratitude to the Almighty God for His protection.

Special acknowledgement goes to all the hospital staff of the Nkawie Government Hospital, especially the RCH unit and staff of the Atwima Nwabiagya DHMT. I am also indebted to all pregnant women who voluntarily contributed to the study, without them the study would not have been possible.

My work will not be complete if I fail to give a very special commendation to my academic supervisor Dr. Anthony Edusei, for his guidance and correction which resulted in the success of this work. Special thanks also go to Dr. Samuel Blay of Komfo Anokye Teaching Hospital who helped in the analysis of my research results.

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To all, I say God richly bless you.

DEFINITION OF TERMS

1. The Hospital : This refers to the Nkawie Government Hospital
2. The pregnant women: This refers to pregnant women attending antenatal clinic at the Nkawie government Hospital at Nkawie.

LIST OF ABBREVIATION/ACRONYMS

ANC	Antenatal clinic
ACOG	American College of Obstetricians and Gynaecologists
BMI	Body Mass Index
DHMT	District Health Management Team
DNA	Deoxyribonucleic acid
FAS	Foetal Alcohol Syndrome
GDHS	Ghana Demography and Health Survey
GHS	Ghana Health Service
Hb	Haemoglobin
HPD	Hypertensive Pregnancy Disorders
IDA	Iron Deficiency Anaemia
IPT	Intermittent Preventive Treatment
IOM	Institute of Medicine
ITN	Insecticide Treated Net
IUGR	Intrauterine Growth Retardation
Kg	Kilogramme
LBW	Low Birth Weight
SP	Sulphadoxine Pyremithine
MCH	Maternal and Child Health
MDG	Millenium Development Goal
MUAC	Mid Upper Arm Circumference
MVMS	Multivitamin and Mineral Supplements
RCH	Reproductive and Child Health
RDA	Recommended Dietary Allowance

UK	United Kingdom
US	United States
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization

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ABSTRACT

Background: Several studies have shown an association between gestational weight gain, maternal haemoglobin levels during pregnancy and infant birth weight. Since such an association is influenced by geographical factors, it is important that investigations be carried out in the various districts in Ghana to establish it. This research was therefore conducted to assess the nutritional status of pregnant women in the Atwima Nwabiagya district of Ashanti Region of Ghana. Specifically, gestational weight gains and haemoglobin levels of pregnant women attending antenatal clinics in the Nkawie Government Hospital were assessed to ascertain if they were appropriate as recommended as well as examine the effects of these indicators of nutritional status on infant birth weight, and the frequency of certain foods intake.

Method: The study was observational and the design was a cross sectional prospective survey involving 150 pregnant women aged 15-49 years. Structured questionnaire and records from maternal health record books including body weight and haemoglobin levels were used for the assessment. A recall of the pattern of food intake weekly and quantity of water per day were also used in collecting data from July 2010 to October 2010. A simple random sampling technique was used to select 150 pregnant women attending ANC at the Nkawie Government Hospital, while purposive sampling was used in the choice of the Hospital.

Results: The major findings from the study indicated that 91.2% of women did not gain the recommended weight during second trimester of pregnancy. Mean weight gain during second trimester was 2.2± 2.1kg. Also 95.3% did not gain the recommended weight in their third trimester. Mean weight at third trimester was 2.9± 2.2kg.The prevalence of anaemia at first, second and third trimesters were 63.2%, 80.7% and 88.7% respectively. Mean haemoglobin

levels at first, second and third trimesters were 10.4± 1.8g/dl; 6.1± 1.6g/dl; and 9.9± 1g/dl respectively. An association was found between gestational haemoglobin levels at first and third trimester and infant birth weight (p value = 0.008). There were 12 babies born with LBW. Mean birth weight was 2.9± 0.5kg. Intake of fruits and green leafy vegetables per week were very low. Majority (70%) pregnant women took the recommended quantity of water per day.

Conclusion: Generally, the nutritional status of pregnant women attending ANC at the Nkawie government hospital is poor. This notwithstanding, the effects of the poor nutritional status evidenced by inadequate gestational weight gain and high levels of anaemia on the infants birth weight was minimal, as only 8% of babies born had LBW and this is lower than the LBW rate of 12% in sub Saharan Africa.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND INFORMATION ON NUTRITIONAL STATUS

Nutritional status is the balance between the intake of nutrients by an organism and the expenditure of these in the processes of growth, reproduction, and health maintenance. Because this process is highly complex and quite individualized, nutritional status assessment can be directed at a wide variety of aspects of nutriture. These range from nutrient levels in the body, to the products of their metabolism and to the functional processes they regulate (Latham, 1997).

Nutritional status can be measured for individuals as well as for populations. They can be used to describe nutritional status of the group, to identify populations or population segments at risk for nutrition-related health consequences, and to evaluate interventions. Nutritional status is determined by two elements which are, man's needs (nutrient requirement) and food intake, and the balance between these two ensures optimum nutritional status.

The assessment of nutritional status is the evaluating of the outcome of nutrient intake, requirement and utilization. The various methods for assessing nutritional status include clinical examination, laboratory test, vital statistics, dietary surveys, and anthropometry (Latham, 1997).

Other methods may include economic data related to purchasing power, food practices and distribution. The food availability and market survey including agricultural data, relevant food production and food balance sheets are also sometimes used to assess nutritional status. In

addition to all these methods is the collection of socio-cultural data which consist of food consumption pattern, food practices and beliefs.

Nutritional status assessment is mainly done to check malnutrition. Malnutrition is a range of conditions that occur when intake of one or more nutrients does not meet body requirement and it can be mild, moderate or severe and include multi-nutrient deficiencies (Pelleter et. al., 1994). It impairs the physical, mental and behavioural development of an individual and has a long cascading effect that undermines the economic and social development of a country. It can be in two forms, that is over nutrition and under nutrition which manifest as overweight and underweight, respectively.

Maternal nutrition and health is considered as the most important regulator of human fetal growth. Improved maternal nutrition has been associated with increased fetal growth and a reduction in adverse birth outcomes in developing countries and in populations with nutrient deficiencies (Villar et. al., 2003; Fall et. al., 2003; Rao et. al., 2001). However, if women are not well nourished, they are more likely to give birth to weak babies resulting in high infant mortality rate (Kamla-Raj, 2006). At birth, fetal weight is accepted as the single parameter that is directly related to the health and nutrition of the mother, and on the other hand, is an important determinant of the chances of the newborn to survive and experience healthy growth and development. This is because low birth weight has been shown to be directly related to both immediate, long-term and very long-term development and well-being (Barker et. al., 1990).

WHO has defined low birth weight (LBW) as weight at birth of less than 2 500 grams (WHO b1980). This definition of LBW includes in its total a subgroup of infants who have suffered

varying degrees of nutritional deprivation in utero. The latter subgroup, victims of intrauterine growth retardation (IUGR), constitutes the group at highest degree of risk of both short-term and long-term complications. Fetal growth and birth weight is influenced by a variety of factors, racial, social and economic among others, as well as specific medical conditions that may be present or that may develop during pregnancy.

Pregnancy is the period of dynamic change for a mother requiring a lot of care. During this period the fetus is nourished directly by the mother through placenta, and since the baby totally relies upon its mother for nourishment, the pregnant woman is to be provided with an adequate and well-balanced diet (Mudambi, 1992), to ensure that she attains an adequate weight. Proper dietary balance is necessary to ensure sufficient energy intake for adequate growth of fetus without drawing on mother's own tissues to maintain her pregnancy (Mridula et. al., 2003).

In pregnancy, good nutrition is essential to ensure good maternal health and reduce the risk of birth defects, suboptimal fetal growth and development as well as chronic health problems in their children (Rusescu, 2005).Monitoring gestational nutritional status by taking anthropometric measurements is a promising means of optimizing fetal growth (Padilha et. al., 2009). It is well known that nutritional intervention focused on woman's health during the reproductive stage, not only in the preconception period but also during the prenatal period, helps achieve adequate newborn nutritional status and is reflected in childhood health and nutritional conditions (WHO, 2006).

Several studies have shown an association between anthropometric indicators and pregnancy outcome. Both insufficient and excessive gestational weight gain are strongly associated with maternal–fetal complications such as gestational diabetes, hypertensive pregnancy disorders (HPD), macrosomia, and low birth weight (Mohanty et. al., 2006, Stotland et. al., 2005).

Compared with normal weight, maternal overweight is related to a higher risk of cesarean deliveries and a higher incidence of anesthetic and postoperative complications in these deliveries. Low Apgar scores, macrosomia, and neural tube defects are more frequent in infants of obese mothers than in infants of normal-weight mothers (Galtier- Dereure, et. al., 2000).

This research seeks to assess the nutritional status of pregnant women based on haemoglobin levels and gestational weight in pregnancy in Atwima Nwabiagya district, and establish the association between this state and the pregnancy outcomes in the district.

1.2 PROBLEM STATEMENT

Anaemia and deficiencies of vitamin A and iodine are highly prevalent among women and estimates indicate that almost half of pregnant women and one third of non-pregnant women worldwide have anaemia (WHO, 2009). Globally, an estimated 9.8 million pregnant women have night blindness and 19.1 million pregnant women have low serum retinol concentrations, with Africa and South-East Asia having the highest proportions (WHO, 2009). Maternal deficiencies in micronutrients may affect infant birth weight and survival, and poor vitamin A intake increases the risk of maternal night blindness (WHO, 2009). Anaemia is also the highest cause of hospital admission in Atwima Nwabiagya district (Atwima Nwabiagya district health report, 2009).

About 60-80% of neonatal death is attributed to low birth weight, and low birth weight is highly associated with maternal nutrition. (Lawn et al, 2005). In Africa, 20% of low birth weight is due to maternal malnutrition (WHO, 2009).

Data from the Ghana Demographic and health survey (2008) indicate that in Ghana, 88% of urban pregnant women attend at least four antenatal visits as against 72% in rural pregnant women. Again 2/3 of the urban and ½ of the rural pregnant women attend antenatal clinics in their first trimester. However, 70% of pregnant women in Ghana are anaemic, which is a sign of malnutrition in pregnancy. The same source also reveals that, for every ten maternal mortalities, one is due to anaemia in pregnancy, and one out of every five perinatal deaths is as a result of maternal malnutrition (anaemia) (GDHS, 2008).

Nutritional status in pregnancy is therefore a critical issue that cannot be overlooked when considering the health of a country, especially the developing ones like Ghana. There is still more that needs to be done in terms of nutrition in pregnancy in order to achieve the millennium goals 4 and 5, which is to reduce child mortality and improve maternal health, respectively.

A woman's nutritional status has important implications for her health as well as the health of her children. Malnutrition in women results in reduced productivity, an increased susceptibility to infections, slow recovery from illness, and heightened risks of adverse pregnancy outcomes. For example, a woman who has poor nutritional status, as indicated by a low body mass index (BMI), short stature, or other micronutrient deficiencies, has a greater risk of obstructed labour, of having a baby with low birth weight, of producing lower quality breast milk, of dying from post-partum haemorrhage, and of contracting diseases along with her baby (GDHS, 2008).

The golden interval for intervention extends from pregnancy to two years of age. If under-nutrition is not addressed during these crucial periods of life, it may cause irreversible damage for future development towards adulthood, thus increasing the risk of girls becoming malnourished mothers, who then have a low-birth-weight baby.

1.3 **RATIONALE OF STUDY**

Maternal and neonatal morbidity and mortality as well as the economic ability of the country will always continue to be a problem if the nutritional status of pregnant women is overlooked. When infant and maternal mortalities go high, the government spends money in trying to reduce or prevent them. These monies could have otherwise been used for other developmental works in the country. A rather less expensive way is to ensure good nutrition during pregnancy, although there are other variables responsible for maternal deaths which are currently relatively high for a developing country like Ghana.

The study seeks to assess the nutritional status of pregnant women in order to identify women who have nutrient deficiencies during pregnancies indicated by low haemoglobin levels, inadequate gestational weight gain and pattern of food intake. This will help to identify the trimester at which pregnant women are nutritionally at risk, so that programmes could be geared towards pregnant women found in that particular trimester and improve maternal health as a whole.

1.4 CONCEPTUAL FRAMEWORK

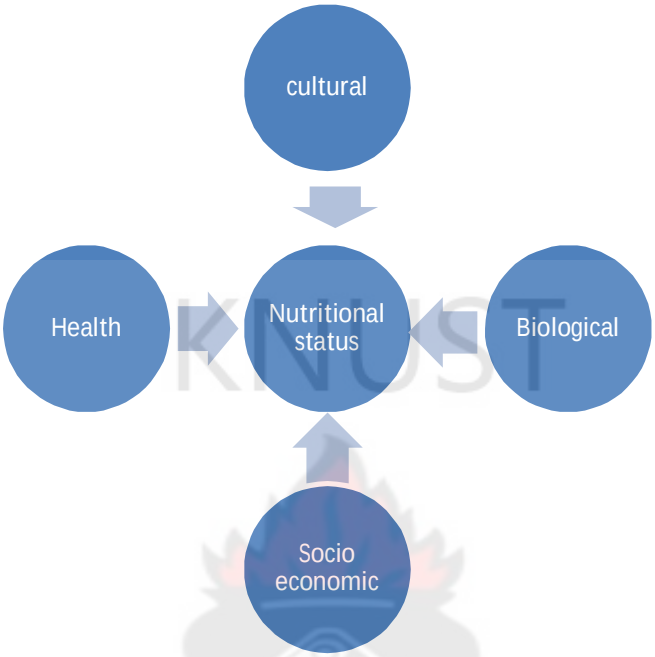


Figure 1.1 Conceptual Framework

1.5 STUDY HYPOTHESIS: Maternal nutritional status is influenced by gestational weight gain, and it affects birth weight.

1.6 RESEARCH QUESTIONS

The research questions of the study are:

1. What is the average weight gain among women attending ANC at Nkawie Government Hospital?
2. Is there any relationship between gestational weight gain and infant birth weight among women attending ANC at Nkawie Government Hospital?
3. What is the prevalence of anaemia among respondents?

4. How does anaemia during pregnancy affect birth weight among women attending ANC at the Nkawie Government Hospital?

1.7 GENERAL OBJECTIVE

To assess the nutritional status of pregnant women attending antenatal clinics at the Nkawie Government Hospital, and examine the effect of the nutritional status on the birth weight of infants delivered.

1.8 SPECIFIC OBJECTIVES

The specific objectives of the study are;

- To determine the mean weight gain and examine the pattern of weight gains in the pregnant women.
- To find out the relationship between maternal weight gain during pregnancy and birthweight.
- To determine the prevalence of anaemia among pregnant women.
- To ascertain the relationship between gestational haemoglobin levels and infant birthweight.
- To identify frequency of various food intake among respondents.

1.9 ORGANISATION OF REPORT

Chapter one consists of the background information of the study, the problem statement, the objectives, research questions, the rational of the study, conceptual framework, and the organization of report. Chapter two presents a review of related literature and chapter three describes the study type and population chosen, the general procedure that the study followed and the profile of study area. Chapter four presents the results, chapter

five consists of the discussions and chapter six , the conclusions and recommendations of the study.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 NUTRITION DURING PREGNANCY

Nutrition is the provision, to cells and organisms, of the materials necessary (in the form of food) to support life (Wikipaedia, 2009). Many common health problems can be prevented or alleviated with a healthy diet. The diet of an organism is what it eats, which is made of nutrients that the body utilizes for the proper functioning of the body.

Nutrients are the chemical components found in food. There are six major classes of nutrients: carbohydrates, fats, minerals, protein, vitamins and water. These nutrient classes can be categorized as either macronutrients (needed in relatively large amounts) or micronutrients (needed in smaller quantities). The macronutrients include carbohydrates, fats, fiber, protein, and water. The micronutrients are minerals and vitamins (Berg et. al., 2002).

The embryo at conception, and in the subsequent weeks afterwards is the time when it is at its most vulnerable, as it is the time when the organs and systems develop within. The energy used to create these systems comes from the energy and nutrients in the mother's circulation, and around the lining of the womb, this is the reason why correct nutrient intake during pregnancy is so important. A daily diet containing only 1000kcal has been shown to greatly retard fetal growth and development (Wardlaw, 1999).During the early stages of pregnancy, the placenta is not formed yet, so there is no mechanism to protect the embryo from the deficiencies which may be inherent in the mother's circulation, so it is critical that the correct amount of nutrients and energy are consumed (Latham, 1997).

A Hungarian study showed that of the 2014 women who had taken additional folic acid, none developed an NTD (neural tube defect), whereas of the 2052 who had not, 6 cases were detected (Czeizel and Dudas, 1992). Several studies have also shown that further anomalies such as heart malformations, lift and palate clefts and urethra malformations can be prevented by an additional intake of folic acid (Czeizel, 1993; Antony, 2000).

Intake of retinol, in extreme cases, has been linked to birth defects and abnormalities. However, regular intake of retinol is not seen as dangerous. It is noted that a 100 g serving of liver may contain a large amount of retinol, so it is best that it is not eaten daily during pregnancy, something which is also the same with alcohol intake in binge drinking (Thompson et. al., 2001).

Excessive amounts of alcohol have been proven to cause fetal alcohol syndrome. It is recommended that alcohol should be avoided entirely during pregnancy, given the relatively unknown effects of even small amounts of alcohol during pregnancy (Kinney, 2000).

2.2 IMPORTANCE OF NUTRITION IN THE THREE TRIMESTERS OF PREGNANCY.

In pregnancy, extra nutrients and energy are used for fetal growth, as well as the changes in the mother's body to accommodate the fetus. The mother's uterus and breasts grow, the placenta develops, her total body fat increase (Wardlaw, 1999).

2.2.1The first trimester

This stage involve the first three months of pregnancy. Nutritional deficiencies at this stage can alter or arrest the progressing phase of development, and these effects may last a lifetime

(Wardlaw, 1999). During the first trimester, the foetus develops so rapidly that if an essential nutrient is not available, the foetus may be affected even before evidence of the deficiency appears in the mother. Due to this, the quality of one's nutritional intake is more important than quantity in this stage of pregnancy. Hence pregnant women should consume nutrient dense food, though the amount should be the same as that before conception. Though some women lose their appetite and feel nausea during the first trimester, they should be careful to obtain adequate nutrition (National Academy of Sciences- Institute of medicine, 1990).

2.2.2The second trimester

From the fourth month to the sixth month of pregnancy consist of the second trimester. Nutritional deficiencies at this stage have a greater effect on the mother than the foetus. For instance if she does not meet her nutritional requirements at this time, her ability to successfully breastfeed her infant may be affected, as fat stored during pregnancy serves as energy reserve for lactation(Worthington-Roberts and Williams,1997).

2.2.3The third trimester

This is made up of the last three months of pregnancy (7-9 months). This trimester is a very crucial stage. At this stage, infants act as parasites with regard to iron, in that they will deplete the stores of the mother. Therefore if the mother is not meeting her iron needs at this time she can end up very depleted after delivery (Kalosa et. al., 1997).

The physiological changes that occur in pregnancy are necessary for the development of the foetus, regulation of maternal metabolism and preparation for parturition and lactation. Pregnancy may result in discomforts such as antenatal nausea, oedema, gestational goitre, anaemia and gestational diabetes (WHO, 1984; Food and Nutrition Board, 1971). The combined

effects of these discomforts can lead to unfavourable alteration in food intake and overall nutritional habits. To meet extra nutritional needs and to ensure good health of both infant and mother, multivitamin and mineral supplements (MVMS) are prescribed for pregnant women on their first attendance to maternal and child health (MCH) centres (Hudson, 2005; Brown, 2005;Parul, 2003).

2.3 **ESSENTIAL NUTRIENTS DURING PREGNANCY**

2.3.1**Protein and Carbohydrates**

The recommended dietary allowance (RDA) for protein increases by 10 to 15 daily (Wardlaw, 1999). This implies that pregnant women should ensure that they meet this requirement by ensuring that they are actually eating enough. Approximately 925g of protein are retained during pregnancy. Protein is not gained at a constant rate; the rate of protein retention increases approximately fivefold from the first to the second trimester and approximately 80% from the second to the third. Research findings indicate that there are substantial increases in protein turnover in pregnancy (Thompson and Halliday, 1992).

Carbohydrates needs are at least 100g daily (Lovelady, 1996). This amount prevents ketosis, which can harm the foetus.

2.3.2**Vitamin**

Generally vitamins increase, especially the need for vitamin D and folate during pregnancy.

2.3.2.1**Vitamin D**

The woman's body increases its calcium metabolism during pregnancy to absorb and distribute extra calcium for forming fetal bones. The mother needs vitamin D to aid the calcium

absorption. Adequate amounts of vitamin D can usually be achieved with approximately 20 to 30 minutes of exposure of sun several times a week to the face, arms and hands (Kalosa et. al., 1997).

Maternal vitamin D deficiency during pregnancy has been linked to maternal osteomalacia as well as to reduced birth weight and neonatal hypocalcaemia and tetany. Low sun exposure, dark skin, and living in northern latitude are risk factors for vitamin D deficiency. Most studies indicate that the placental transfer of vitamin D to the infant is particularly important because of low vitamin D concentrations in human (maternal) milk (Delgado et. al., 1982).

2.3.2.2 Vitamin E

RDA for vitamin E during pregnancy is also higher due to its importance for fetal growth. Most of the vitamin E transfer from mother to fetus occurs in the last quarter of pregnancy, so premature infants may be born with inadequate stores. Haemolytic anaemia in the premature infant is often responsive to vitamin E administration. Inadequate vitamin E status in premature infants has also been linked to broncho- pulmonary dysplasia, retinopathy and intraventricular haemorrage (Latham, 1997).

2.3.2.3 Vitamin K

Vitamin K intake during pregnancy is very essential due to the occurrence of haemorrhagic disease of the new born, which commonly results in intracranial haemorrhage and can be fatal. Researchers have shown that given vitamin K to mothers for a period of time before birth can prevent this problem. Additional result indicates that this strategy improves measures of vitamin K status (Motohara et. al., 1990) and coagulation function (Anai et. al., 1993).

2.3.2.4 Vitamin A

Vitamin A deficiency during pregnancy weakens the immune system, increases the risk of infections and has been linked with night blindness (Katz et. al., 1995), as well as increased rates of intrauterine growth retardation and premature birth (Shah and Rajalakshmi, 1984). Beta- carotene from vegetables may not provide as much retinol as previously thought (De Pee et. al., 1995).

2.3.2.5 **Folate**

Because the synthesis of DNA requires folate, this nutrient is especially crucial during pregnancy, as both maternal and fetal growth in pregnancy depends on an ample supply of folate (Worthington-Roberts and Williams,1997). The need for folic acid increases during times of rapid tissue growth, which during pregnancy includes an increase in red blood cell mass, enlargement of the uterus, and the growth of the placenta and fetus (Bailey, 2000). Insufficient maternal folate intake has been linked to low birth weight, IUGR, and preterm birth (Scholl and Johnson, 2000; Smits and Essed, 2001). The deficiency of folate at conception has also been associated with neural tube defects such as spina bifida (Wardlaw, 1999).

The RDA for folate increases during pregnancy to 600 μg per day. A prenatal vitamin and mineral supplementation may be used to meet the RDA for folate , especially for women with histories of inadequate folate intake, frequent multiple births, folate related anaemia, or use of medications that increase folate needs.

2.3.3 Mineral needs in pregnancy

Generally the needs for minerals increase during pregnancy, especially that for iron, calcium and zinc.

2.3.3.1Iron

Pregnant women need extra iron (30mg/d) during the last two trimesters to synthesize the greater amount of haemoglobin needed during pregnancy and provide iron stores for the foetus (Wardlaw, 1999). Women often need an iron supplement, especially if they do not consume iron fortified foods. Because iron supplements decrease appetite and can cause nausea and constipation, taking them between meals or just before going to bed is best. For better absorption of iron, iron supplements should not be taken with milk, coffee or tea and vitamin C rich foods should be taken along with iron rich foods (Latham, 1997).

Anaemia is the late manifestation of deficiency of nutrient(s) needed for haemoglobin synthesis. Most of the anaemia are due to inadequate supply of nutrients like iron, folic acid and vitamin B12, proteins, amino acids, vitamins A, C and other vitamins of B-complex group like niacin and pantothenic acid are also involved in the maintenance of haemoglobin level (Lee and Herbert, 2006).

Severe iron deficiency anaemia in pregnancy may lead to preterm delivery, low birth weight, and increased risk for fetal death in the first weeks after birth. An inadequate iron intake may actually be more harmful to the mother than the infant (Worthington- Roberts and Williams, 1997).

2.3.3.2 Calcium

This is needed during pregnancy to promote adequate mineralization of the fetal skeleton and teeth. Most calcium is required during the third trimester, when skeletal bones are growing most rapidly and teeth are forming. However, extra calcium intake should start immediately after conception. 1000mg of calcium is required in pregnancy (Wardlaw, 1999).

2.3.3.3 Zinc

Zinc is a mineral important for supporting growth and development. The RDA increases 25% for pregnant women.

The protein foods in the diet of a pregnant woman should be able to provide this amount of zinc. Poor zinc status in pregnancy increases the risk for having a low birth weight infant (Worthington- Roberts and Williams, 1997).

2.3.3.4 Fatty Acids

Certain polyunsaturated fatty acids, omega-6 and omega-3 fatty acids, are essential for human development and health but cannot be synthesized by the human body, so they must be obtained through the diet (Hornstra, 2000; McGregor et. al.,2001).Being important structural elements of cell membranes, these fatty acids are essential to the formation of new tissues, which occurs at an elevated rate during pregnancy and fetal development (Hornstra, 2000; McGregor et. al., 2001; Uauy and Hoffman, 2000; Simopoulos et. al., 1999). Essential fatty acids are crucial to fetal development, particularly for membranes and brain, but until recently have received little attention. There is some evidence from biochemical studies among populations with high marine-food intakes suggesting that higher intakes of long-chain omega-3 fatty acids during

pregnancy may result in an increased duration of gestation and may also improve fetal growth (Olosen et. al., 1991; Grandjean et. al., 2001; Lucas et. al., 2004; Van Eijsden et. al., 2008)).

2.3.4 Water

The latest dietary reference intake report by the United States National Research Council recommended, generally, (including food sources): 2.7 liters of water total for women and 3.7 liters for men. Specifically, pregnant and breastfeeding women need additional fluids to stay hydrated. The Institute of Medicine (IOM) recommends that averagely, women consume 2.2 litres and men 3.0 litres of water daily. For pregnant women 2.4 litres (approx. 9 cups) of water is recommended (National Academy of Sciences – Institute of Medicine, 1990).

2.4 ASSESSMENT OF NUTRITIONAL STATUS

The assessment of nutritional status involves anthropometry measurement, laboratory tests, clinical examination and dietary survey. However, for the purpose of this research, anthropometry (weight measurement) and haemoglobin measurements (laboratory test) were used.

2.4.1 ANTHROPOMETRY MEASUREMENT

The World Health Organization (WHOa, 2002; WHOb, 2006) cites maternal anthropometric aspects and intake of adequate nutrients as determinants of fetal growth, demonstrating a close association with these parameters and weight and gestational age at birth. Anthropometric measurements, among the most frequently applied methods for assessing nutritional status in pregnant women, are recognized as effective tools in the prevention of perinatal morbi-mortality, the prognosis of child health, and the promotion of women's health (Oliveira et. al.,

2004), and have undergone considerable improvement over the past five decades (Coelho et. al., 2002). In addition, their easy application, low cost, and non-invasive nature reinforce their viability as a nutritional assessment method.

Both insufficient and excessive gestational weight gain are strongly associated with maternal-fetal complications such as gestational diabetes, hypertensive pregnancy disorders (HPD), macrosomia, and low birth weight (WHO, 2006; Olsen et. al., 2004; Scotland et. al., 2005; Mohanty et. al., 2006). Hence adequate weight gain is essential during pregnancy.

Monitoring gestational nutritional status by taking anthropometric measurements is a promising means of optimizing fetal growth. It is well known that nutritional intervention focused on woman's health during the reproductive stage-not only in the preconception period but also during the prenatal period, and culminating in assistance to lactating woman-helps achieve adequate newborn nutritional status and is reflected in childhood health and nutritional conditions (WHO, 2006).

According to Coelho et. al.,(2002), research focused on determining the best methodology for anthropometric assessment during pregnancy is a preoccupation of national and international health agencies and non governmental organizations, who justify such efforts as a means of ensuring adequate anthropometric assessment of the nutritional status of pregnant women. This involves measurement of the body such as weight, height, mid-upper arm circumference (MUAC), skinfold thickness, and head and chest circumference. The later is usually used for children.

The weight of a person is the most important single anthropometric measurement that can be taken (Latham, 1997). In pregnancy, weight measurements are very essential as a means of ensuring good health of the mother. Weight should be done with the individual wearing the minimum of clothing (light dress for females), and footwear removed. Balance scales are usually used. A good scale is important for accurate measurement.

Table 2.1 Recommended weight gain during pregnancy based on pre-pregnancy body mass index (BMI) for singleton pregnancies.

BMI category	**Total weight gain in kg**
Low (≤19.8)	12.5 – 18
Normal (19.8 -26)	11.5 – 16
High (26-29)	7 – 11.5
Obese (≤ 29)	≤ 7

For women of normal BMI who are carrying twins, the range should be16 to 20kg.

Source: WHO, 2009

Weight gain is most critical in the 2nd and 3rd trimesters when the mother should gain one pound per week, on average and 1.5-3 lb in the first trimester. Lack of weight gain or loss of weight at these times can result in significant risk to the fetus. Brain development occurs in last trimester. Weight reduction during pregnancy is not recommended, however, a high quality diet to meet the needs of the infant, especially for protein, calcium, folate, and iron is required(Woods, 2006).

A total of 1.2kg of weight is required during the first trimester of pregnancy, and an additional 0.5kg per week during the last two trimesters is recommended during pregnancy by the World Health Organization (WHO, 2006).

The proportion of the total weight gain during pregnancy can be attributed to each of the following components:

Fetus: 25-27%

Placenta: 5%

Expanded blood volume: 10%

Growth of uterus and breast: 11%

Increased extra-cellular fluid: 13%

Increased material fat stores: 25-27%

2.4.2 HAEMOGLOBIN MEASUREMENT

This involves the estimation of oxygen carrying capacity of the blood. It is mainly done to detect anaemia especially during pregnancy, which is a sign of malnutrition. There are different methods and equipment which can be used to determine this. The commonest methods used are the Hb meter to obtain the haemoglobin level or the centrigfuge to estimate the haematocrit or the packed cell volume. The Talquist method is used to compare the colour intensity of a drop of blood on standard blotting paper to a colour code. This gives a rough estimate of the haemoglobin level which is then confirmed by laboratory tests. Other simple, cheap and

accurate methods available for the estimation of haemoglobin concentration include the use of colour scale, HemoCue haemoglobinometer and counter (Van den Broek et. al., 1999).

The commonest method used in Ghana is the direct Cyanmethaemoglobin, due to its timeliness. According to a report of the Ghana Health Service in 2004, the standard haemoglobin, haematocrit and talquist levels for pregnant women are 11.0g/dl, 0.33I/L and 75% respectively. The safe motherhood protocols indicate that haemoglobin measurement should be carried out on pregnant women attending antenatal clinics for the first visit, at 28 weeks and at 36 weeks.

2.4.2.1 CLASSIFICATION OF ANAEMIA

The Ghana health Service classifies anaemia under the three broad headings. These include:

1. Moderate/ mild anaemia (Hb 7.0- 10.9)
2. Severe anaemia (Hb 4.0-6.9g/dl)
3. Very severe anaemia (Hb below 4.0g/dl).

2.5 DETERMINANTS OF MATERNAL NUTRITIONAL STATUS

2.5 .1 Health of mother

The probability of a pregnancy terminating in a full-term, healthy live birth-is a powerful indicator of the health status of its women. However, maternal health is affected by poor or inadequate diet during pregnancy. There is a two-way relationship between women's health and pregnancy outcome. That poor maternal health results in high rates of foetal and early infant death is well known. Iron Deficiency Anaemia (IDA) during pregnancy is widely recognized as one of the major health and nutritional problems among pregnant women in sub-Saharan Africa

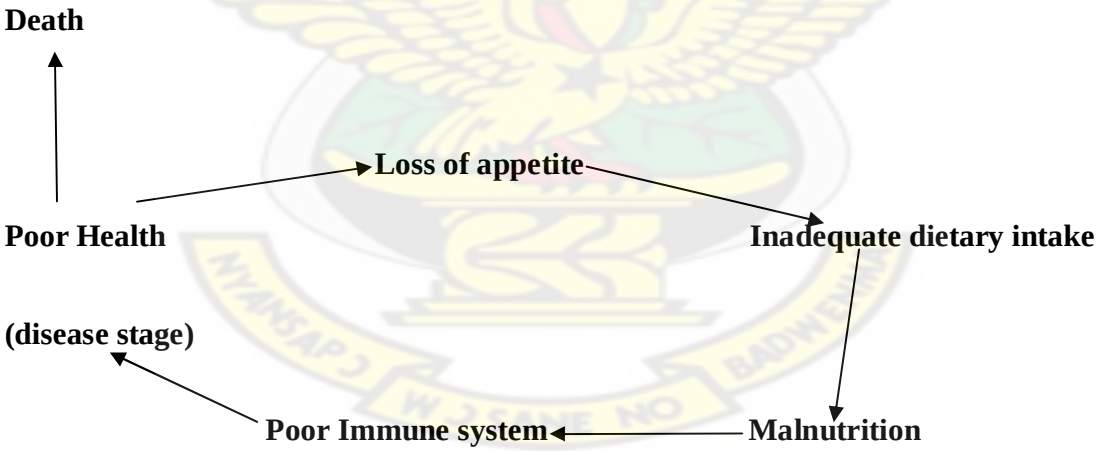
(Royston et. al., 1989).Consequences of IDA include fatigue and reduced work capacity, impaired resistance to infection and greater risk of death associated with pregnancy and childbirth (Stoltzfus et. al., 2003) and low birth weight and preterm deliveries (Scholl et. al., 1992).

When maternal food intake is inadequate, either due to food affordability, accessibility and availability, her immune system is affected, which makes her susceptible to a lot of infections and diseases. The common diseases may include anaemia and malaria. An indicator for anaemia is a haemoglobin level less than 11g/dl (GHS, 2004).

Also, a mother's health is affected if she does not have enough time to recover after delivery.

Thus when food intake is adequate, it may take up to two years to replenish body iron stores after a pregnancy (WHO, 1992).

Figure 2.1 The Link between Maternal Health and Malnutrition



Source: Author's own construct

2.5.2 Socio economic factors

Socio economic factors have been shown to be essential predictors of nutrient intake and diet quality (Kamau- Mbuthia and Elmadfa, 2007). Nutrient deficiencies are generally found in low-socio economic populations, where they are more likely to involve multiple rather than single deficiencies (Fall et. al., 2003). Currently the world has a crisis of high food prices, which affects access to nutritious food (WHO, 2008). Food choices are highly sensitive to price, and dietary diversity, including micronutrient and protein-rich healthy foods, is the first to be dropped from the diet, as these options are usually more expensive. The food crisis is thus a dual threat to the quality and quantity of the diet, resulting in malnutrition. This is particularly true among young children and among people with chronic diseases, such as heart disease, diabetes and some types of cancer. In addition, the food crisis is expected to further increase the burden of malnutrition, particularly among poor people. Women are especially vulnerable, with an increased risk of malnutrition during pregnancy.

2.5.3Cultural Practices

Culture is the way a group of people live and do things together. Every culture is backed by norms and values. Out of these determines the kind of foods an individual will eat. Some communities may regard certain foods as taboos and hence though such foods may be nutritionally good, they will not be considered as food.

Pelto (1987) completed an assessment of available studies targeting cultural issues in maternal and child health and nutrition. Her challenge for social scientists remains true today. We have

yet to thoroughly and empirically examine cultural and behavioral adaptations to the changed energy and nutrient requirements of pregnancy.

Although the literature in anthropology and sociology contains numerous examples of the dietary cravings and food proscriptions attributed to pregnant women, these have almost always been discussed from a symbolic, psychological, or ethno-scientific perspective, rather than in a manner that would allow an assessment of their nutritional consequences (Rosenberg, 1980).

Socio-cultural dimensions that may provide a framework for examining cultural issues related to prenatal weight gain include gathering information on ideological (belief) structures related to appropriate food intake, food proscriptions, activity patterns, weight gain, and body image during pregnancy, as well as the relation of these to household and community characteristics.

Concomitantly, this information must be paired with data on observed patterns of behavioral adjustment, energy expenditure, and weight gain. Finally, both types of data may need to be stratified at the sub-cultural level, even within what at first appear to be fairly homogeneous ethnic and socioeconomic groups.

2.5.3.1Birth spacing

Women with short birth spacing tend not to be able to replenish their nutritional stores after each delivery (ACC/SCN, 1990). Pregnancies among such women tend to be very vulnerable and have a higher risk of anaemia (Latham, 1997). Low availability and poor absorption of iron, and closely spaced pregnancies lead to depleted iron stores of pregnant women(Marti et. al., 2001).

2.5.3.2 Food preparation.

The way food is usually prepared for consumption by pregnant women has a bearing on their nutritional status. For instance, in the preparation of green leafy vegetables, if it is cooked for a long time, the nutrients (iron) may be lost. In some cases, vegetables are washed meticulously, cut into pieces, soaked, overcooked and then reheated. In other instances (in Bangladesh), the cooking water from rice is discarded. Such practices can reduce the quantity of water- soluble, heat – liable vitamins like ascorbic acid, folic acid, and thiamine (Worthington-Roberts and Williams, 1997).

Unhygienic food preparation such as the use of polluted water in food preparation can affect the quality of the food (Woods, 2006).

2.5.3.3Lifestyle

During pregnancy, some women feel strong urges to eat non-food items such as clay, ice, laundry starch, or cornstarch. This is called “pica”. Pica can be harmful to pregnancy. It can affect the intake of nutrients and can lead to constipation and anemia (ACOG 2010). In a study carried out by Gerssler et. al., (1998), at Western Kenya, it was found out that 48% of all soil samples were contaminated with eggs of the round worm- Ascaris lumbricoides and most pregnant women eat soil. This increases the risk of worm infestation and the consequent anaemia.

Smoking is linked to preterm birth and low birth weight and appears to increase the risk of birth defects, sudden infant death, and childhood cancer. Alcohol intake during pregnancy can lead to fetal alcohol syndrome. Alcohol can pass through the placenta to affect the developing fetus and

interfere with normal prenatal development. At birth, infants with FAS are smaller than normal, both in weight and length (Kinney, 2000).

2.5.3.4 Care given to pregnant mother

Care is an essential element in nutritional status of an individual. Pregnant women need more care and support especially first time mothers (primigravidae) concerning their food intake. Most at times due to the physiological change in their bodies, they tend to have special cravings for certain non food substances such as pica (Lovelady, 1996). Reassurance and support given to pregnant women during this time, enables her to make the right food choices.

Morning sickness in pregnancy causes some women to avoid food which the body actually need at such times. They therefore need support from family and friends to ensure that they do not become malnourished.

2.5.4 Biological factors

Biological factors involve the nutritional status of an individual due to hereditary. For instance families of overweight people are likely to have overweight babies. An underweight mother is likely to give birth to underweight babies (short stature). Women with short stature, especially in developing countries with inadequate health care systems and high prevalence of impaired growth during childhood are also at high risk of LBW and preterm delivery and of obstetric complications during labour and delivery (WHO, 1995; Martorell et. al., 1981). Short stature and iron-deficiency anaemia among mothers increase their risk of dying during delivery, accounting for at least one of five maternal deaths (WHO,2009).

About 50% of pregnant women experience nausea during the early stages of pregnancy, which may be related to the increased sense of smell induced by the pregnancy related hormones circulating in the bloodstream (Wardlaw, 1999). This is usually referred to as “morning sickness”, and due to this sometimes cause some women to shy away from food.

2.6 PREGNANCY, NUTRITION AND PARASITIC DISEASES

In the developing world, young women, pregnant women, and their infants and children frequently experience a cycle where undernutrition (macronutrient and micronutrient) and repeated infection lead to adverse consequences that can continue from one generation to the next. Infants born prematurely or with low birth weight (Steketee et. al., 2001) are at increased risk of early death, but are also at risk of poor growth and development in childhood and adolescence. The poor growth resulting in underweight and stunting leaves reproductive-age women at risk in their early pregnancies of delivering premature or LBW infants (Stephenson et al, 2001).

In addition, the micronutrient deficiencies, particularly iron and folate deficiencies (which contribute to anaemia), leave the young women at risk of anemia leading to inadequate oxygen-carrying capacity and risk in pregnancy of delivering premature or LBW infants (Stephenson et. al., 2001). This cycle is affected in each age group (infants, children, adolescents and reproductive-age or pregnant women) by prevalent parasitic infections. Of particular note, malaria and hookworm infections are widely prevalent in poor areas and both are recognized as contributing importantly to this cycle (Steketee et. al., 2001; Stephenson et. al., 2000).

Women who are underweight or stunted, those with anemia from one or more causes (e.g., iron deficiency, malaria, intestinal helminth infection) and those with certain infectious diseases are at increased risk of delivering LBW infants (Stephenson et. al., 2001; Steketee, 2001; Van den Broek, 2001; Shulman, 2001). LBW and premature infants have a much increased risk of early child mortality (Steketee et. al., 1996) and impaired growth and cognitive development (McCormick et. al., 1992, Teplin et. al., 1992).

Malaria infection is endemic across the tropics and subtropics; affects people in more than 90 countries; causes 300–500 million infections each year; and is estimated to lead to approximately 1 million deaths each year, mostly in young children (Breman, 2001; Murphy et. al., 2001). Most infections and the most severe morbidity and mortality are caused by Plasmodium falciparum. The other three human malaria parasites (P. vivax, P. malariae and P. ovale) contribute to fewer infections and to more moderate disease and relatively few deaths (Mendis et. al., 2001). Most P. falciparum infections and consequences are in sub-Saharan Africa. Although a few reports of adverse consequences of P. vivax in pregnancy exist (Nosten et. al., 1999), P. falciparum is the only human malaria parasite that is more common in pregnant than in nonpregnant women and is the only human parasite with a clear and substantial adverse effect on pregnancy, nutrition during pregnancy and pregnancy outcome (Steketee et. al., 2001; Brabin, 1991; McGregor et. al., 1983).

In a recent review of studies of P. falciparum–related anemia in pregnant women, Guyatt and Snow in 2001 suggested that approximately 400,000 pregnant women develop moderate or severe anaemia (hemoglobin, 80 or hematocrit, 0.25) each year in sub-Saharan Africa as a result of malaria infection. Studies have shown that maternal anemia contributes independently to

LBW through IUGR(Ismail et. al., 2000, Brabin et. al., 1997; Verhoeff et. al., 2000) and to infant mortality (Verhoeff et. al., 2000).Treatment of malaria during pregnancy is highly effective in clearing or reducing placental infection, anemia and LBW consequences (Steketee et. al., 2001). Because of the high frequency of P. falciparum infection in many African settings, a preemptive approach using intermittent preventive treatment at regularly scheduled antenatal clinic visits and providing insecticide-treated bed nets for each pregnant woman has been shown to be highly effective; this approach was adopted by the Roll Back Malaria partnership and established as policy in a number of countries (Steketee et. al., 2001; Nahlen, 2000).

Studies have shown that additional supplementation of iron (Mahomed, 2000) and other micronutrients, possibly including vitamin A (Dreyfuss et. al., 2000) and folate (Mahomed, 2000), should be coupled with antimalarial use for anemia and LBW prevention in pregnancy (Dreyfuss et. al., 2000). Intestinal worm infections are common worldwide but thrive in poor communities in the tropics where poor water supply and poor sanitation are common. The burden of infection is estimated to exceed 1000 million infected persons each for roundworm (Ascaris lumbricoides), hookworm (Ancylostoma duodenal and Necator americanus) and whipworm (Trichuris trichiura) (Crompton 1999,2000).

Although acute symptoms of infection are uncommon, numerous studies have shown a consistent association between intestinal nematode infection and diminished food intake and weight loss (Latham et. al., 1990).

Data from the early 1990s suggest that 44 million of the developing world's 124 million pregnant women harbored hookworm infection (WHO, 1994; Beach, 1999). The

gastrointestinal blood loss, malabsorption and appetite inhibition (Cline et. al., 1984) may further aggravate the iron, zinc and protein-energy deficiencies and the anemia of pregnancy. Intervention studies suggest that even relatively light hookworm infections may decrease fetal growth and weight gain in pregnancy (Torlesse et. al., 2001).The World Health Organization recommends four antihelminthic drugs for the control of intestinal nematodes including hookworm and a World Health Organization Informal Consultation suggested that the drugs albendazole, levamisole, mebendazole, pyrantel and praziquantel could be used in strategies designed to improve the health, development and nutritional status of girls and women and that single-dose, oral anthelminthic treatment can also be given to pregnant and lactating women (stressing that these drugs should not be used in the first trimester of pregnancy as a general precautionary measure (WHOa, 1996; WHOb,1998).

CHAPTER THREE

3.0 METHODOLOGY

3.1 STUDY DESIGN AND TYPE

The study was observational and the design was a cross sectional survey to assess the nutritional status of pregnant women attending ANC at the Nkawie government hospital. The study used both qualitative and quantitative techniques. The field work took place from July 2010 to October 2010.

3.2 STUDY POPULATION

The study involved pregnant women attending antenatal clinic at the Nkawie government hospital (district hospital), who were in their third trimester, and had been visiting the ANC at least during the second trimester of pregnancy, and has had haemoglobin levels and weight recorded.

3.3 SAMPLING TECHNIQUE

The sampling techniques used in the study were simple random sampling and systematic sampling with a sampling interval of 2 was used to select 150 pregnant women attending ANC at the Nkawie Government Hospital to determine the variables - Demographic characteristics of the pregnant women, Gestational age at first antenatal care attendance, Haemoglobin level, Weight of pregnant mother, Pattern of food intake, and Baby's weight.

The Nkawie hospital is a district hospital therefore receive pregnant women from most of the communities in the area. Therefore the data obtained is a representation of the general population in the district. Simple random sampling was employed to select pregnant women who had been attending ANC since their first trimester or second trimester, and had had their haemoglobin levels checked as well as records of continual weight measurements taken.

Nkawie Government Hospital, was chosen for this study because it was the largest hospital in the district and was designated as the district hospital in 2000. The target population of the hospital was about 197,874, which is about 97% of the total district population of 204,601, according to the hospital's annual report of 2009.

3.4 SAMPLE SIZE

The sample size was calculated using the probability sampling formula below:

$N= Z^2 pq/d^2$

Where, n = sample size

z = statistical certainty chosen

p = proportion of pregnant women with poor nutritional status

q = 1- p (percentage of pregnant women with good nutritional status)

d = precision desired

If the value of p = 11% or 0.11

$n = z^2 p (1- p) / d^2$

$= 1.96^2 \times 0.11(1- 0.89) / 0.005^2$

$= 3.8416 \times 0.11 \times 0.89 / 0.0025$

$= 150.4$

$= 150$

3.5 DATA COLLECTION TECHNIQUES AND TOOLS

Records of the weight and haemoglobin levels of pregnant women during the first and second trimesters of the pregnant women were obtained from the maternal health record books. Weight and haemoglobin levels were taken at certain points in the third trimester till delivery. The adult weighing scale (seca M215, Fitness Monitors, UK) was used to determine the maternal weight at certain points during the study period, while the direct cyanmethaemoglobin method (Wooton, 1964) was the laboratory method that was used to determine the haemoglobin concentrations of the pregnant women. Birth weights of babies born to these women were also recorded from hospital records after delivery.

This was done to determine the weight gains throughout the pregnancy and if the appropriate weight gain for each trimester was achieved. The birth weights of babies born to these mothers were taken to compare the impact of the weight gains. The haemoglobin levels were assessed to identify the possible level of anaemia among the pregnant women at each trimester, and to find out which time of pregnancy the women were at increased risk.

Qualitative and quantitative methods were used to classify, describe and quantify the variables.

Structured questionnaires were administered to the pregnant women when they reported for antenatal care. This was used to obtain demographic data such as age, occupation, marital status, education as well as the intake of water, fruits, green leafy vegetables and iodised salt during pregnancy. The questionnaire also assessed the frequency of their food intake. The 24 hour dietary recall was also used to determine the quantity of water taken per day. Check list was used to review the maternal health record books of the pregnant women.

Inclusion Criteria

All singleton pregnant woman between the ages of 15-49 years, who did not have any complications in pregnancy and had had antenatal care attendance either in their first trimester or during their second trimester were recruited for the study.

Exclusion Criteria

Pregnant women who had their first ANC attendance during the third trimester, complications during the pregnancy were excluded, and women with multiple pregnancies were excluded from the study.

3.6 ETHICAL CONSIDERATION

Ethics approval was sought and obtained from the ethical review committee (CHRPE/KNUST) for the commencement of this research. A written permission to carry out the research was obtained from the district director of health services, district healthy administration, district assembly and the medical superintendent of the Nkawie government hospital. Verbal consent was also sought from each pregnant woman and other respondents for voluntary participation.

3.7 STUDY AREA

3.7.1 Geographical characteristics

Atwima Nwabiagya District is one of the largest districts in the Ashanti Region. The District lies approximately on latitude 6o 75'N and between longitude 1o 45' and 2o 00' West. It is one of the 27 political and administrative Districts in Ashanti Region.

It is situated in the Western part of the region and shares common boundaries with Ahafo Ano South and Atwima Mponua Districts (to the West), Offinso Municipal to the North, Amansie– West and Bosomtwe-Atwima Kwanwoma Districts to the South, Kumasi Metropolis and Kwabre Districts to the East. It covers an estimated area of 294.84 sq km. The district capital is Nkawie.

The district falls under the West Semi-equatorial zone marked by double maximum rainfall ranging between 170cm and 185cm per annum. The major rainfall season is from March to July and minor season is between August and Mid- November.Temperature is fairly uniform ranging between 27°C (August) and 31°C (March). Relative humidity is generally high throughout the year.

3.7.2 Demographic characteristics

3.7.2.1 Population Size, Age distribution and sex ratio.

The population of the District, according to the 2009 annual report was two hundred and four thousand, six hundred and one (204,601). The district is predominantly urban, 64.0 % live in the urban/peri-urban areas of the District.

Only 36.0% of the population lives in the rural areas. Major settlements in the District include Abuakwa, Nkawie, Toase, Asuofua, Barekese, Atwima Koforidua and Asenemaso Akropong. The proximity of the district to the Kumasi Metropolis greatly accounts for this situation. Kumasi is already choked so people are now moving toward these peri-urban towns. The age structure of the population in the District is skewed towards the youth. The highest proportions are in the Age groups 0-4 years (15.5%) and 5-9 years (15.8%). Cumulatively, 43.2% of the population in the District is below 15 years. This, coupled with a 6.2% population above 64 years means a high potential demand for social services and facilities. The employable age constitute 50. 65%. The employable youth (15-29) constitute 24.1% of the total population. There are slightly more males (51.0%) than females (49.0%).

3.7.2.2 Social and Communication Systems

The main language of the district is Akan. Generally, there is good electricity supply in the district and about 57.30% of total road network are in good condition with 42.70% in bad condition. However, there is an indication that about 97.61% of the farm tracks in the District are in bad condition. There are a number of potable water supply systems in the District. These are pipe borne from Barekese and Owabi Water Works, boreholes and hand dug wells fitted

with pumps. However, about 50% of the rural population in the district still relies on streams and dugouts for their source. Telecommunication facilities are mostly the use of cellular phones that have generally good coverage.

Table 3.1 Population per Sub-Districts – 2010

SUB DISTRICTS	POPULATION
Nkawie	56,060
Abuakwa	52,174
Akropong	43,580
Barekese	26,598
Asuofua	26,189

SOURCE: Annual report (2009), Atwima Nwabiagya District.

3.7.3 Health Profile

There are fifteen (15) health facilities in the district. Nkawie – Toase Government Hospital is the district hospital which severs as the main referral point for the rest of the facilities in the district and other sisters' districts. Out of the fifteen (15) facilities, only five are owned The District has one government hospital, which is the district hospital and two additional private hospitals. There are seven health centres/clinics with three of these being private owned. In addition to these, there are five maternity homes.

Table 3.2 The top ten main causes of hospital admission in the district

Causes	**Number of Admission**
Anaemia	367
Malaria	296
Diarrhea diseases	76
Septicaemia	62
Cellulitis	42
Gastritis	37
Hypertension	32
Hernia Inguinal	28
Pneumonia	28
Upper Respiratory Tract Infection	26

Source : District health Directorate, 2009.

Table 3.3 The top ten out- patient diseases in the district

Diseases	**Reported Cases in 2009**
Malaria	81780
Other ARI (Acute Respiratory Infection)	21478
Diarrhoea diseases	8626
Hypertension	6790
Skin diseases & Ulcer	6678
Acute Urinary Tract Infection	6649
Rheumatic and joint pains	4721
Intestinal worms	3530
Diabetes Mellitus	2124
Home Accidents and Injuries	1770

Source: District Health Directorate, 2009

3.8 STUDY VARIABLES

The dependent variable was nutritional status of pregnant women.

The independent variables were:

- Demographic characteristics of the pregnant women
- Gestational age at first antenatal care attendance
- Haemoglobin level
- Weight of pregnant mother

- Pattern of food Intake
- Baby's weight

Table 3.4 Study variables

VARIABLE	INDICATORS	OPERATIONAL DEFINITION	SCALE OF MEASUREMENT
Demograhic characteristics of pregnant women	Age Marital Status Occupation Education	Age of pregnancy at last birthday Legally, customary or man- woman living together Practicing occupation as of day of interview Level of education of pregnant mother	Continuous Nominal Nominal Ordinal
Gestational age at first antenatal care attendance	First trimester Second trimester	Trimester by which pregnant woman attends first antenatal care	Ordinal
Haemoglobin level	Severe, mild/moderate, Normal	Pregnant mothers haemoglobin level from laboratory analysis	Ordinal
Pattern of food Intake	Not at all Irregular Daily	Frequency of food intake as described by respondents	Ordinal
Weight of pregnant mother		Weight in kilogrammes of pregnant woman	Continuous
Baby's weight	Low birth weight, normal weight	Babies weight at birth as recorded by salter scale.	

3.9 PRETEST OF DATA COLLECTION TOOLS

Data collection tools such as the questionnaire and checklist were pretested at Abuakwa health centre, a sub district in the study district. This town was chosen due to its similarity with Nkawie in terms of socio cultural characteristics. This was done to ensure the validity and

reliability of the instruments. The format or presentation of questionnaire was revised and modified according to reactions of respondents.

3.10 DATA HANDLING AND ANALYSIS

Data collected each day, both qualitative and quantitative, were handed over to principal investigator who entered the various responses onto a computer and preliminary analysis started right away. Copies of data were also sent to the principal investigators email to serve as a backup in case of any data loss.

Data was entered using SPSS version 15 and cleaned for abnormal values at regular intervals. It was then exported to Stata Intercool version 10.1 for analysis. The categorical variables were tabulated and reported as frequencies with their respective percentages. Continuous variables were summarised as means with their standard deviation and ranges. Associations between the categorical variables were determined using the chi square test with p-values less than o.05 considered statistically significant. Relationships between continuous variables were evaluated using linear regression. Coefficients were then determined with their respective 95% confidence intervals.

3.11 LIMITATIONS OF STUDY

The study sought to assess nutritional status of pregnant women, based on haemoglobin levels, weight gains and pattern of food intake. The birth weight of the babies born to these women after delivery were also taken. Some of the respondents did not consistently attend ANC, hence their net weight gain could not be computed, and whiles others who were consistent with the ANC attendance did not come to the hospital to deliver. These coupled with time constraints

could not permit a large sample size to be used in the study. Only pregnant women from the district were used in the study.

3.12 BASIC ASSUMPTIONS

The assumptions made during the study were:

1. The pregnant women in Nkawie attending antenatal clinics were a representative sample of the pregnant women in the study area.
2. Respondents gave honest answers in a way not to distort results of study.
3. Haemoglobin levels and weight measurements recorded in the maternal health record book were true and accurate.

CHAPTER FOUR

4.0 RESULTS

4.1 DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS

Table 4.1 Distribution of Demographic Characteristics of Respondents.

Characteristics	**N = 150**	**%**
Age		
≤ 19	14	9.3
20-29	94	62.7
30+	42	28.0
Total	150	100.0
Marital Status		
Single	24	16.0
Married/cohabiting	122	81.3
Divorced/widowed	4	2.7
Total	150	100.0
Number of Children		
0	29	19.3
1	37	24.7
2	36	24.0
3+	48	32.0
Total	150	100.0

Source: field survey, (2010)

One hundred and fifty pregnant women were involved in the survey with 14(9.3%) of them being teenagers (≤ 19 years), 94 (62.7%) aged 20-30 years, whilst 42 (28%) were above 30 years old. The mean age was 27.0 ± 6.0 years, with a minimum and a maximum age of 17 years and 42 years, respectively. Sixteen percent (16.0%) of the women were single and 81.3% were married/ cohabiting. Also, 29 (19.3%) of the pregnant women had no children, while 37 (24.7%) had one child, and a further 36 (24%) had two children and 48 (32%) had three or more children. The maximum number of children recorded was 8.

4.2 SOCIO – ECONOMIC CHARACTERISTICS OF THE RESPONDENTS.

Forty one (27.3%) of the women were non literates, 49 (32.7%) had primary education and 60 (40%) had junior/middle/SHS/tertiary education.

Thirty (20%) of the women were unemployed, 6 (4%) were government workers and 64 (76%) were self employed. Eight (5.3%) of the partners of the respondents were government workers, 134 (89.7%) were self employed and another 8 (5.3%) were unemployed. 129 (86%) of the pregnant women were Christians and 21(14%) were Muslims.

Table 4.2 Socio – Economic Characteristics of the Respondents.

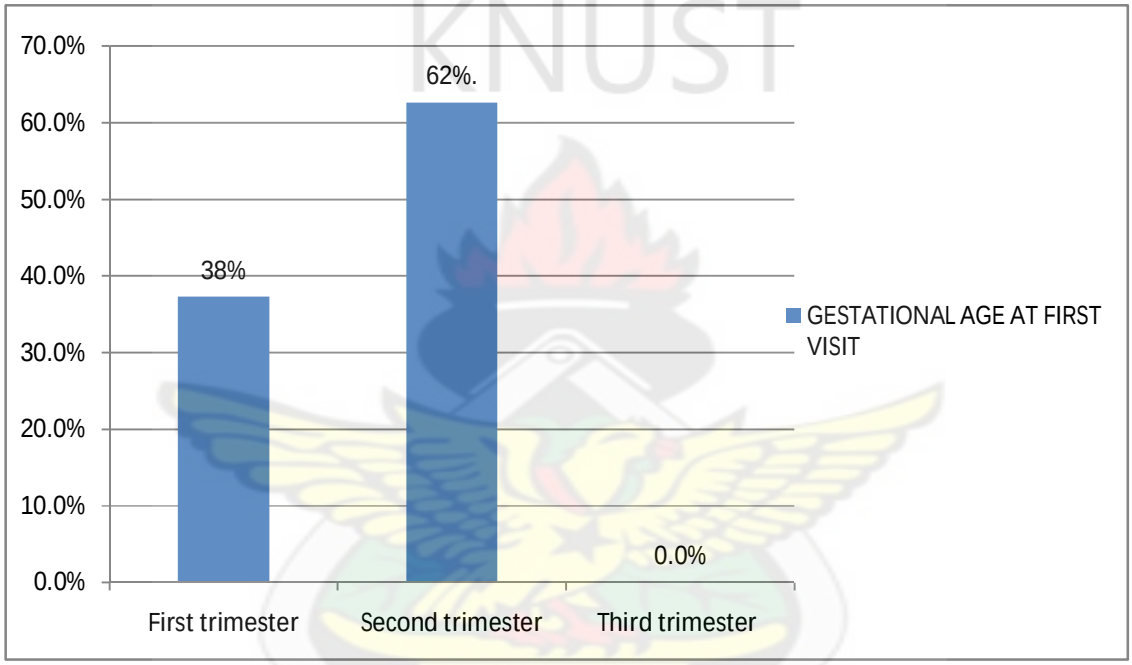
Charateristics	(N= 150)	%
Educational Status		
None	41	27.3
Primary	49	32.7
JHS/middle/SHS/tertiary	60	40.0
Total	150	100.0
Occupation		
Government workers	6	4.0
Self employed	114	76.0
Unemployed	30	20.0
Total	150	100.0
Partner's Occupation		
Government workers	8	5.3
Self employed	134	89.7
Unemployed	8	5.3
Total	150	100.0
Religion		
Christian	129	86.0
Muslim	21	14.0
Total	150	100.0

Source: Field Survey, 2010.

4.3 AGE OF GESTATION AT FIRST ANTENATAL CARE ATTENDANCE

Pregnant women who had their first ANC visit in the first trimester of pregnancy were 57(38%) whilst 93(62%) had theirs during the second trimester of their pregnancy. The results obtained are further represented in Fig 4.1 below.

Figure 4.1 Age of gestation (by trimester) at first antenatal care attendance



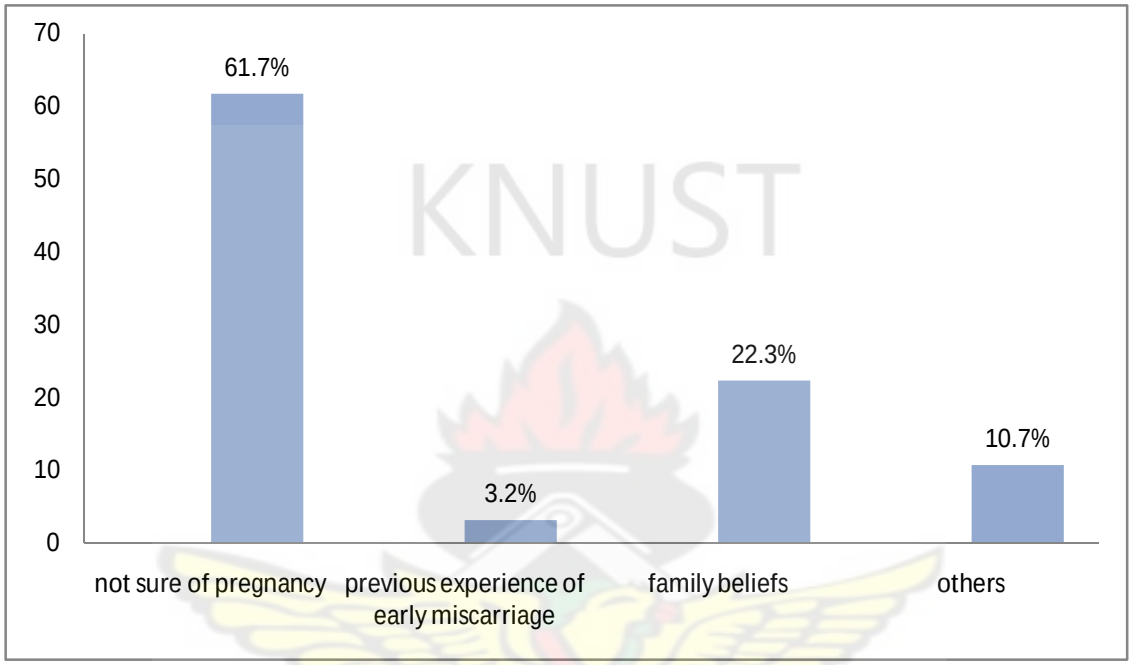
Source: Field Survey, 2010.

4.4 REASON FOR LATE ANTENATAL CARE ATTENDANCE

The reasons given by pregnant women who did not have their first antenatal care attendance during the first trimester of pregnancy, is represented in figure 4.2 below. Majority (61.7%) were not sure if they were really pregnant, 3 (3.2%) said they had had previous experience of early miscarriage, so they wanted to wait and find out if the pregnancy would mature. A further

21(27.3%) said that it was their family belief system to wait for sometime before attending ANC when pregnant and 10 (10.7%) of the pregnant women gave other reasons.

Figure 4.2 Reason for late antenatal care attendance (n = 93)



Source: Field survey, 2010.

4.5 GESTATIONAL WEIGHT GAIN

Out of the fifty seven pregnant women who had their first ANC attendance during the first trimester of pregnancy, 52 (91.2%) of them had less than 6kg weight gain in the second trimester as recommended. Only five (8.8%) however, had a weight gain of more than 6kg during the second trimester. The mean weight gain during the second trimester of pregnancy was 2.2(± 2.1)kg. The minimum net weight was -2kg and a maximum was 8kg.

One hundred and forty three (95.3%), of the pregnant women had less than 6.5kg weight gain in the third trimester. Only seven (4.7%) however, had a weight gain of more than 6.5kg during the third trimester of pregnancy. The mean weight gain during the third trimester of pregnancy was 2.9(± 2.2) kg. The minimum net weight was -3kg and a maximum was 10kg.

4.6 INFANT BIRTH WEIGHT

Twelve (8%) babies were born with LBW signified by a birth weight of < 2.5kg, whiles one hundred and thirty eight (92%) were born with normal weight of ≥ 2.5kg.

4.7 ANAEMIA STATE OF PREGNANT WOMEN

Table 4.3 Degree of anaemia (by trimester), among respondents.

	Pregnancy Trimester					
	First (N = 57)		Second (N = 93)		Third (N = 150)	
	N	%	N	%	N	%
Degree of Anaemia						
Severe	2	3.5	18	5.4	0	0.0
Mild/moderate	34	59.7	70	75.2	133	88.7
No anaemia	21	36.8	5	19.4	17	11.3
Total	57	100.0	93	100.0	150	100.0

Source: Field Survey, 2010.

4.7.1 First trimester

Out of a total of 57 (38%) pregnant women who had their first ANC attendance during the first trimester, 21 (36.8%) of them had no anaemia. Thirty four (59.7%) of the pregnant women had mild/moderate anaemia, whiles 2 (3.5%) of them had severe anaemia categorized by

haemoglobin level <7g/dl. The mean haemoglobin level during first trimester was 10.4(± 1.8) g/dl. The minimum haemoglobin level was 6.1g/dl and the maximum was 14.7g/dl.

4.7.2 Second trimester

Of the 93 (62%) pregnant women who had their first antenatal care during their second trimester, 18(19.4%) had no anaemia, 76 (75.2%) had mild/ moderate anaemia whiles 5 (5.4%) had severe anaemia. The mean haemoglobin level during the second trimester was 9.7(±1.6) g/dl. The minimum haemoglobin level was 4.6g/dl while the maximum was 12.7g/dl.

4.7.3 Third trimester

During the third trimester 17(11.3%) had no anaemia while 133 (88.7%) of the pregnant women had mild/moderate anaemia in their third trimester. There was no record of severe anaemia in the third trimester. The mean haemoglobin level during the third trimester was 9.9(±1) g/dl. A minimum of 7.2g/dl and a maximum of 12.7g/dl haemoglobin level were recorded during the third trimester.

4.8 GESTATIONAL WEIGHT GAIN AND CORRESPONDING BIRTH WEIGHT

4.8.1Gestational Weight Gain during Second Trimester and Corresponding Birth Weight

Out of the fifty seven (62%) pregnant women who had their first ANC attendance during the first trimester of pregnancy, 52 (91.2%) of them had less than 6kg weight gain in the second trimester. Only five (8.8%) however, had a weight gain of at least 6kg during the second

trimester. The pregnant women who gained less than 6kg in the second trimester had the highest number of babies born with LBW. There was however, no record of LBW babies born to women who gained more than 6kg during the second trimester. This is shown in table 4.8 below.

Table 4.4 **Distribution of pregnant women by total weight gain during second trimester and corresponding birth weight.**

N = 57

	Baby's weight at birth				
	<2.5kg		≥2.5kg		Total
	N	%	N	%	N
Total weight gain in 2nd trimester					
<6kg	6	11.5	46	84.5	52
≥6kg	0	0.0	5	100.0	5

Source: Field Survey, 2010

4.8.2 Gestational weight gain during third trimester and corresponding baby's weight

A total of one hundred and forty three (95.3%) pregnant women out of the one hundred and fifty under the survey, who had their first ANC attendance during the second trimester of pregnancy, had less than 6.5kg total weight gain during the third trimester of pregnancy till delivery. The remaining seven (4.7%) pregnant women had more than 6.5kg total weight gain during pregnancy and recorded one baby born with LBW. There were eleven babies born with LBW amongst the women who gained less than 6.5kg weight in the third trimester of pregnancy.

Table 4.5 Total weight gain during third trimester and corresponding baby's weight

N= 150

	Baby's weight at birth				
	<2.5kg		≥2.5kg		Total
	N	%	N	%	N
Total weight gain in 3rd trimester					
<6.5kg	11	7.7	132	92.3	143
≥6.5kg	1	14.3	6	85.7	7

Source: Field Survey, 2010

4.9 RELATIONSHIP BETWEEN GESTATIONAL HB LEVELS AND INFANT BIRTH WEIGHT

Haemoglobin levels at first trimester among respondents compared with infant birth weight showed a correlation coefficient of 0.1 and a p value of 0.008. A coefficient of 0.03 was obtained when haemoglobin levels of pregnant women during the second trimester of pregnancy were compared with infant birth weight, a p value of 0.4 was also obtained. A p value of 0.008 and a coefficient of 0.1 were derived when a relationship between haemoglobin levels at third trimester of pregnancy and infant birth weight were studied.

There was no association between haemoglobin levels at second trimester and infant birth weight (p value = 0.42). However, there was an association between haemoglobin levels of women at first and third trimesters of pregnancy and infant birth weight (p value = 0.008).

4.10 RELATIONSHIP BETWEEN GESTATIONAL WEIGHT GAINS AND INFANT BIRTH WEIGHT

A positive correlation (correlation coefficient = 0.01) was found between gestational weight gain at second trimester and infant birth weight. This indicates that an increase in gestational weight at second trimester is expected to cause an increase in infant birth weight. However, with a p value of 0.68, it is statistically insignificant. A positive correlation (correlation coefficient = 0.02) was found between gestational weight gain at third trimester and infant birth weight. This indicates that an increase in gestational weight at third trimester is expected to cause an increase in infant birth weight. However, with a p value of 0.4, it is statistically not significant.

From regression analysis done, it is expected that an increase in infant weight of 0.01kg is expected for every 1 kg of gestational weight gain in the second trimester of pregnancy, though statistically this was not significant (p value = 0.69). Also, it is expected that for every 1kg of gestational weight gained by a pregnant mother, there was a 0.02kg increment in infant weight at birth, although this was also not statistically significant enough with a p value of 0.36 in the third trimester.

4.11 CULTURAL INFLUENCE ON FOOD INTAKE

There was no special culturally unacceptable food. However choice of food was determined by pregnant mothers' preference of particular foods.

4.12 DISTRIBUTION OF FOOD INTAKE PATTERN OF PREGNANT WOMEN

Table 4.6 Distribution of Food Intake Pattern of Pregnant Women Attending ANC at Nkawie Government Hospital.

Frequency of food Intake by percentage of women (n=150)

	Not at all		Irregular		Daily	
Food Type	N	%	N	%	N	%
Fruits	13	8.6	100	66.7	37	24.7
Green leafy vegetables	0	0.0	123	82.0	27	18.0
Non green leafy vegetables	0	0.0	43	28.7	107	71.3
Meat	0	0.0	146	97.3	4	2.7
Fish	0	0.0	142	53.3	2	46.7
Egg	6	4.0	80	94.7	70	1.3
Iodized Salt	103	68.7	29	19.3	18	12.0

Source : Field survey, 2010.

Few (24.7 %) of the pregnant women took fruits daily during pregnancy, whereas 8.6% never took fruits and more than half (66.7%) took fruits but on an irregular basis. Eighteen percent of the pregnant women took green leafy vegetables daily, whiles majority (82%) took green leafy vegetables but on an irregular base. A majority (71.3%) of the pregnant women ate non green leafy vegetables on a daily base, and only 28.7% ate these irregularly.

Majority (97.3%) of the pregnant women took meat on an irregular base whiles 2.7% of the women took meat daily. Slightly more than half (53.33%) of the respondents ate fish on an irregular base, while 46.7% took fish daily. Four percent of the pregnant women never took egg whiles pregnant, 94.7% took meat irregularly and 1.3% took egg daily. More than half (68.67%)

of the pregnant women never used iodized salt in cooking, whilst 12 % used iodized salt when cooking.

Forty five (30%) pregnant women took at least 2.4 litres of water per day as recommended by the IOM while 105 (70%) of the pregnant women took less than 2.4 litres of water per day. The mean intake of water amongst respondents was 2.2 (±0.6) litres/day. The minimum quantity of water per day taken by the pregnant women was 1.0 litre and the maximum was 4.5 litres.

4.13 CARE PROVIDED TO PREGNANT WOMEN

Table 4.7 Care Provided **n=150**

Type of care	N	%
Intake of SP	150	100.0
Intake of Dewormer	150	100.0
Intake of Iron Supplements	150	100.0
ITN usage	81	54.0

Source: Field survey, 2010

All the pregnant women were given SP during pregnancy as well as iron supplements and dewormer with a 100% coverage among respondents. Eighty one (54%) of the pregnant women slept under an ITN during pregnancy. Of the 69 pregnant women who did not sleep under ITN, 60 (87%) was due to financial constraints, 8(11.6%) said it was as a result of its cumbersome usage and 1(1.4%) said “no reason”.

CHAPTER FIVE

5.0 DISCUSSION

5.1DEMOGRAPHIC CHARACTERISTICS OF THE PREGNANT WOMEN

The pregnant women interviewed were between the ages of 15-49 years and were in their third trimester of pregnancy and have had their first antenatal care attendance during the first trimester or second trimester of pregnancy. From the survey, it was revealed that 14(9.3%) were teenagers, whilst 42(28%) were above 30 years. Majority of the women (62.7%) were between the ages of 20-30 years. This conforms to the Ghana Demographic and Health Survey (GDHS, 2008) report of the most fertile group.

5.2 SOCIO – ECONOMIC CHARACTERISTICS OF THE RESPONDENTS.

Forty one (27.3%) of the pregnant women had no formal education, which is higher than the national average of 21%. Majority (40%) of the women had some high school or tertiary education, contradicting the national average of only 17%. A majority of the respondents, 129(86%) were Christians while the remaining 21(14%) were Muslims. This is in cognizance with the report of the GDHS 2008, which stated that majority of Ghanaians were Christians.

Six (4%) of the respondents were government employees, a majority of 64 (76%) were self employed, and 30 (20%) were unemployed. The percentage of self employed women was slightly higher than the national average (71%) according to GDHS (2008). However, from the study, it still confirms that the highest percentage of self employed were among women of child bearing age.

5.3 AGE OF GESTATION AT FIRST ANTENATAL CARE ATTENDANCE

More than half (62 %) of the pregnant women registered had their first antenatal care attendance during the second trimester of pregnancy, as against 57(38%) who had their first antenatal care attendance in their first trimester of pregnancy. This is not surprising as late booking is a practice in sub Saharan Africa (Kiwuwa and Mufubenga, 2008; Mrisho et. al., 2009). Although early ANC booking has been associated with improvement in haemoglobin concentration and significantly better birth weights (Tayie and Lartey, 2010), in Nigeria, majority (73.6%) of pregnant women booked their first ANC attendance during the second trimester (Ndidi and Oseremen, 2010). In another study done by Singh and Khare (2001) in Zimbabwe, initial ANC attendance was made during the second and third trimester.

5.4 REASON FOR LATE ANTENATAL CARE ATTENDANCE

Most of the pregnant women who attended ANC late gave reasons such as uncertainty of pregnancy, which could probably be due to most pregnancies being unplanned. According to MacDonald et. al.,(1992), irrespective of age and social class, unmarried women were less likely to have planned pregnancy and also to attend ANC. Other reasons given by the pregnant women in this study were family beliefs and previous experience of early miscarriages. Other studies also indicate that pregnant women base their behavior in previous negative experiences and perceptions of care received (Matua, 2004; Starrs, 1997; Ziyani et. al., 2004). Whiles, adolescents might shun ANC services for fear of being labelled promiscuous, older ones who have had uneventful pregnancies and deliveries might see no reason to attend ANC (Matua, 2004).

5.5 GESTATIONAL WEIGHT GAIN

Majority of the pregnant women could not gain the recommended weight during pregnancy. This reflects findings of other studies conducted in developing countries that showed that pregnancy weight gains are generally inadequate, and especially in the wet season (Neumann and Harrison, 1994).

5.6 INFANT BIRTH WEIGHT

This study revealed that 8% of babies born had LBW. This percentage is lower than the LBW rate in sub Saharan Africa of 12%, as well as the developing world rate of 15%. Also, from GDHS 2008, the rate of low birth weight in Ashanti region (11.6%) is higher than that obtained in this study. The mean birth weight was 2.9(±0.5) kg, was lower than that recorded by Spicer et. al., (2005), of 3.2(±0.4) kg.

5.7 ANAEMIA STATE OF PREGNANT WOMEN

The safe motherhood protocol and the GHS anaemia control programme outline that haemoglobin measurement should be carried out on every pregnant woman attending ANC for the first time, at 28 weeks and at 36 weeks (GHS, 2004); however, from this survey done at the Nkawie - Toase Hospital (the district hospital), haemoglobin levels were only checked at first ANC attendance and again at 36 weeks, suggesting non compliance with the protocol.

The prevalence of anaemia among the pregnant women was based on the classification by the Ghana Health Service. These include the following categories:

- Moderate/mild anaemia (Hb 7.0- 10.9g/dl)

- Severre anaemia (Hb 4.0 – 6.9g/dl)
- Very severe anaemia (Hb below 4.0g/dl)

Based on these, anaemia prevalence was identified by trimester of pregnancy.

5.7.1 First trimester

The prevalence of anaemia among women at their first trimester of pregnancy was as high as 63.2%. Thus for every ten woman who attended ANC during the first trimester, about six had some form of anaemia, ranging from mild/moderate to severe. Though the percentage of severe anaemia was 3.5%, that of moderate/mild anaemia was found to be 59.7%. Since most women experience "morning sickness", this affects their food intake and might have resulted in this high prevalence rate. In all, the prevalence of anaemia among the women in this trimester was slightly lower than that stated in the GDHS (2008) identified as 70% among pregnant women. However, from a study done in Nigeria, prevalence of anaemia during the first trimester was 44.6 % (Idowu et. al., 2005).

5.7.2 Second trimester

Anaemia prevalence among pregnant women at second trimester of pregnancy was found to be 80.7%, with 5.4% identified as severe anaemia whereas the remaining 75.3% had mild/moderate anaemia. This is very alarming as the overall prevalence of anaemia among these women is about 10% higher than the national prevalence of anaemia in pregnancy which is 70% (GDHS, 2008). It is possible that this high rate could have been as a result of the late attendance for antenatal care services, as women in this stage of pregnancy attended their first ANC at second trimester.

5.7.3 Third trimester

There was no severe anaemia recorded amongst women during this period of pregnancy, and this could have been as a result of the intake of iron supplements by all the women. This notwithstanding, the prevalence of anaemia was the highest with 88.7%, and this result confirms with the report of WHO in which anaemia is said to be significantly higher in the 3rd trimester of pregnancy than the first two trimesters (WHO,1992).However, this prevalence represents moderate/mild anaemia. This prevalence is almost 20% higher than the national average according to the GDHS 2008.

Furthermore, since a majority of the women were self employed, it was possible that their productivity might have reduced with the stress of pregnancy during this period, and hence resulting in a low income. And low income reduces purchasing power which culminates in low dietary intake and the consequent anaemia in pregnancy.

5.8 GESTATIONAL WEIGHT GAIN AND CORRESPONDING BIRTH WEIGHT

Pre-pregnancy weights of the mothers were unknown, which could have help in determining the exact weight gain's during pregnancy. Therefore weights of the pregnant women were taken at the second and third trimesters.

5.8.1 Gestational weight gain during second trimester and Corresponding Birth Weight

The WHO,(2006) recommends that pregnant women in their second trimester should gain at least 0.5kg per week. Therefore, in total at least about 6kg of gestational weight must be achieved during the second trimester, however from the results obtained from this study, 52

(91.2%) of the respondents did not reach this cut off point and only 5(8.8%) met this cut off point. For women who gained the required weight there was no record of LBW. This is similar to a study by Lawoyin (1991), who concluded that LBW occurred among women who gained less weight than recommended in each trimester.

It was even more surprising that some of the women instead of gaining weight rather lost weight during this period, whiles others were gaining and losing weight intermittently. The maximum weight loss was 2kg; whiles the maximum weight gained by respondents was 8kg for the period. The mean weight gain was 2.2(±2.1) kg. This is not encouraging as a greater majority did not meet the required gestational weight gain as stipulated by the World health Organization which is a body that aims at promoting health for all especially the vulnerable ones like pregnant women.

5.8.2 Gestational weight gain during third trimester and Corresponding birth weight

The WHO, (2006) recommends that pregnant women in their third trimester (last three months of pregnancy) are supposed to gain at least 0.5kg per week. Thus total weight gain during the last three months of pregnancy should be at least 6.5kg, given a 37 week term of pregnancy (WHO, 2006). Results from study indicate that almost all the pregnant women 143(95.3%) did not gain the expected weight. Mean weight gain was 2.9(± 2.2) kg. Furthermore, majority of the LBW babies were found among the women who gained less than recommended. This indicates a slightly higher increment, as compared to respondents in the second trimester who could not gain the required weight. This percentage is still higher as compared to a study by

Ludwig and Currie (2010) on weight gain during pregnancy in the US in which less than half (30-40 %) of the pregnant women did not gain the recommended weight.

Again, respondents who were identified to have gained weight as recommended were 7(4.7%). Though this figure is lower than that during the second trimester of pregnancy, it is not good enough for a developing country like Ghana, who is trying to reach MDG 5 (promotion of maternal health) (UNICEF,2006).

5.9 RELATIONSHIP BETWEEN GESTATIONAL HAEMOGLOBIN LEVELS AND INFANT BIRTH WEIGHT

After analysis, results indicated an association between first and third trimester haemoglobin levels and infant birth weight with a statistical significance of 0.008 for each. The results also indicated that every 1g/dl gain in haemoglobin at first trimester of pregnancy resulted in a 0.08kg in infant birth weight. In third trimester, for every 1g/dl gain in haemoglobin level, there was an increment in infant birth weight of about 0.1kg in infant birth weight. This confirms results of work done by Levy et. al., (2005) on maternal anaemia during pregnancy and low birth weight which indicated an association between these two. Rosenberg et. al.,(2004), in China, also studied the effect of different level of haemoglobin on birth outcome and their findings also showed that mild/moderate anaemia were significantly associated with low birth weight, thus conforming with the findings of this study. However, there was no possible association between haemoglobin level at second trimester and infant birth weight, reflecting the results of a study by Hamaleainen et. al., (2003) that anaemia in the second trimester is not associated with LBW.

5.10 RELATIONSHIP BETWEEN GESTATIONAL WEIGHT GAIN AND INFANT BIRTH WEIGHT

The possible relationship between gestational weight gain and infant birth weight was assessed by the use of linear regression model. It was observed that for a 1kg gestational weight gain at second trimester, there was a likely increase of 0.01kg in infant birth weight. This might have been a possible reason why LBW was common among mothers who could not get the required weight as stipulated by WHO in 2006. However a p value of 0.69 obtained from the analysis does not make this inference conclusive, since it is not statistically significant. A possible reason might have been the sample size used due to the inconsistency of pregnant women attendance at ANC and time constraints concerning this research. This notwithstanding, a study done by the Institute of Medicine (IOM) in 1990 in the US, showed a positive association between maternal gestational weight gain and infant birth weight.

A possible association between gestational weight gain at third trimester of pregnancy and infant birth weight was not statistically significant,(p value = 0.36), contradicting the assertion made by Thomson in 1959 on the relationship between diet, maternal weight and birth weight in the UK that maternal weight dictated birth weight. Furthermore, Stein et. al.,(1995) showed that weight gains below 0.5kg/week in the third trimester were associated with low birth weight. However, from this study, it was observed with interest that women who actually had the required gestational weight gain at the third trimester of pregnancy did not record any infant with LBW. All LBW recorded were prevalent among women who did not obtain the required weight at third trimester of pregnancy.

5.11 CULTURAL INFLUENCE ON FOOD INTAKE

There was no special culturally unacceptable food. However choice of food was determined by pregnant mothers' preference of particular foods.

5.12 DISTRIBUTION OF FOOD INTAKE PATTERN OF PREGNANT WOMEN

The pattern of intake of foods, aside their major staples (root and tubers, cereals) like fruits, vegetables (green leafy and non green leafy), fish, meat, egg were identified. In addition to this, use of iodised salt and quantity of water taken per day were also identified among the pregnant women. The regenerative health and nutrition programme under the Ministry of Health Ghana, recommends increased intake in the quantity of fruits and vegetables to supply the minerals and vitamins needed by the body since it contains fiber that helps eliminate waste from the body thereby contributing to maintain good health and prevent degenerative diseases especially during pregnancy.

Notwithstanding the recommendations made by the Ministry of Health on eating fruits on a daily basis, the percentage of pregnant women who took fruits on a daily bases was only 24.7% which is not encouraging, and is below the average intake of fruits by women which was 28% according to the 2008 Ghana Demography and Health Survey. Although the daily intake of vegetables (non green) was high with a percentage of 71.3%, the intake of green leafy vegetables which are highly rich in iron, was 18%. This low percentage coupled with low intake of fruits daily, might have aggravated the prevalence of anaemia among the respondents.

The daily intake of body building foods, rich in protein like meat, fish and egg (reference protein) was below 50.0% among respondents. Iodized salt which was introduced in Ghana to

check iodine deficiency, since the consumption of iodine was low, is still not being embraced. As low as 12.0% of respondents used iodated salt daily.

Generally, with the exception of non green leafy vegetables daily intake, which was higher than the irregular intake, daily intake of all foods intake was very low as compared to their irregular intake.

Though the IOM (1990) recommends at least 2.4 litres of water per day by every pregnant woman, as many as105 (70%) took less than 2.4 litres of water per day. The mean quantity of water taken per day among pregnant women was 2.2(±0.6) litres/day. The maximum intake was 4.5 litres and the minimum was 1.0 litre per day.

5.13 CARE PROVIDED TO PREGNANT WOMEN

Despite studies done by Skeketee and colleagues in 2001, indicating the treatment of malaria during pregnancy as highly effective in reducing anaemia and LBW consequences, the intake of SP (IPTP) by all the pregnant women still showed a high prevalence of anaemia at all three trimesters of pregnancy.

Again, the use of ITN among pregnant women has been associated with not only lower rate of malaria infection, but also significant reductions in all causes of maternal anaemia in studies of D'Alessandro et. al., (1996), and also by Ter Kuile et. al.,(2003).This reflected in a total reduction of the prevalence of severe anaemia during the third trimester as compared to first and second trimester in this study as a little more than half 81(54%) of the pregnant women used ITN during pregnancy. This percentage is also higher than the national average of ITN usage among pregnant women of 19.9% according to the 2008 GDHS report. The highest rated reason

for non use of ITN was financial constraint which was 60(87%). This percentage is however lower than a 92.0% recorded as financial constraint for the inability to use ITN according to Muller et. al.,(2003).

Furthermore, though Mahomed (2000) and Dreyfuss et. al., (2000) in their study, concluded that iron supplementation coupled with antimalarial reduce anaemia and LBW, from this study, though all the pregnant women had iron supplementation and were also given antimalarials, the prevalence of anaemia was still high, especially during the third trimester of pregnancy.

Studies of Latham (1990), showed a consistent association between intestinal nematode infection and diminished food intake and weight loss; this however does not conform to the findings of this study. This is due to the fact that although all the pregnant women took dewormers during the pregnancy, weight gains for both second and third trimesters of pregnancy was not adequate.

All pregnant women admitted that the antenatal clinics were beneficial to them, also none of the pregnant women said that their work affected their visits to the antenatal clinics.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

At the end of the study, based on results, it was interesting that although all the women took all the supplements given them as well as other drugs like dewormer and SP at the ANC, recommended weight gains for second and third trimester of pregnancy could not be achieved by most pregnant women. As much as 91.2% and 95.3% of the pregnant women could not obtain the expected weight gains during the second and third trimesters respectively. There was no association found between gestational weight gain during second trimester (p= 0.68), third trimester (p = 0.4). Also, the first ANC attendance was mostly found in the second trimester of pregnancy as 62% of the pregnant women had their first antenatal care attendance during the second trimester. The main reasons given by the pregnant women for the late attendance were uncertainty of pregnancy (61.7%), fear of miscarriages due to previous experience (3.2%) and family beliefs (22.3%).

Prevalence of anaemia was high in all trimesters; 63.2%, 80.7%, 88.7% for first, second and third trimester respectively; with the highest prevalence occurring in the third trimester of pregnancy. Mild/moderate anaemia was highest at all three trimesters of pregnancy that is 59.7% during first trimester, 75.2% during second trimester and 88.7% during the third trimester. There was an association found between haemoglobin levels during first and third trimesters of pregnancy and birth weight (p value = 0.008).

Most women (68.7%) did not consume iodized salt. The daily intake of fruits and green leafy vegetables by the pregnant women were as low as 24.7% and 18% respectively. Few (30%) of the pregnant women took the recommended water per day.

Generally, from the results and discussions, the nutritional status of pregnant women attending ANC at the Nkawie government hospital is poor. This notwithstanding, the effects of the poor nutritional status evidenced by inadequate gestational weight gain and high levels of anaemia on the infants birth weight was minimal, as only 8% of babies born had LBW and this is lower than the LBW rate of 12% in sub Saharan Africa.

6.2 RECOMMENDATION

The following recommendations have been made based on the findings of this research.

Husbands

Husbands should be very much concerned about their wives' nutrition during pregnancy and support their wives to attend ANC regularly.

To the Hospital (RCH unit)

The management of the hospital should ensure that antenatal clinics are conducted from Mondays to Fridays. This will spread attendance throughout the week to encourage the turn out rate and also enable midwives to handle smaller numbers of pregnant women at a time.

Awards should be given to women who consistently attend ANC at the hospital to encourage women to attend ANC.

They should also adhere strictly to the GHS protocol for MCH.

To the DHMT

The outreach unit should use all media (radio, television, role plays) to convey a consistent message on nutrition during pregnancy with special emphasis on haemoglobin levels and weight gains in pregnancy. This must be delivered and packaged well in the dialect of the people to ensure its effectiveness. Also, campaigns should be organized to intensify health education on early and regular ANC visits for pregnant women in the district. The monitoring team should routinely see to it that laboratory checks of haemoglobin levels of pregnant women at ANC are done.

To the District Assembly

Female education should be promoted, since about 27% of the respondents had no formal education.

Scholarship packages should be given to girls to encourage female education, especially the brilliant needy ones. The assembly can also collaborate with benevolent organizations to distribute the ITN to the pregnant women free of charge since 46% of the pregnant women were not sleeping in ITN and the highest rated reason for this was financial constraints.

6.3 Areas for Further Research

1. Determinants of anaemia among pregnant women
2. Effectiveness of health education on nutrition during pregnancy.
3. Assessment of dietary intake in pregnancy.

REFERENCES

1. Administrative Committee on Coordination – Sub Committee on Nutrition (ACC/SCN), 1990. Women and nutrition, symposium report, Nutrition policy discussion paper no. 6
2. American College of Obstetricians and Gynaecologists report on nutrition (2010).
3. American Society for Clinical Nutrition (2000).Nutrition during pregnancy. American Journal of Clinical Nutrition: 71(5).
4. Bailey, L.B.,(2000). New standard for dietary folate intake in pregnant women. Am J Clin Nutr 71(5 suppl):1304S–1307S
5. Barker, D.J.P., Bull, A.R., Osmond, C., Simmons, S.J.,(1990).Fetal and placental size and risk of hypertension in adult life.BMJ 301:259–62.
6. Beach, M. J., Streit, T. B., Addiss, D. G., Prospere, R., Roberts, J. M. & Lammie, P. J. (1999) Assessment of combined ivermectin and albendazole for treatment of intestinal helminth and Wuchereria bancrofti infections in Haitian schoolchildren. Am. J. Trop. Med. Hyg. 60: 479–486.
7. Berg J, Tymoczko J.L., Stryer L (2002). Biochemistry (5th ed.). W.H. Freeman. San Francisco: p. 603.
8. Brabin, B., Piper, C. (1997) Anaemia-and malaria-attributable low birth weight in two populations in Papua New Guinea. Ann. Hum. Biol. 24: 547–555
9. Brabin, B. J. (1991) The risks and severity of malaria in pregnant women. World Health Organization Applied Field Research in malaria Reports, No.1. WHO, Geneva, Switzerland

10. Breman, J. G. (2001) The ears of the hippopotamus: manifestations, determinants, and estimates of the malaria burden. Am. J. Trop. Med. Hyg. 64 (Suppl. 1–2), 1–11.
11. Brennand EA, Dannenbaum D, Willows ND.(2005) Pregnancy outcomes of First Nations women in relation to pregravid weight and pregnancy weight gain. J Obstet Gynaecol Can.; 27(10):936-44.
12. Brown, J. E., Murtaugh, A.M., Jacobs, R. D., Margellos, C. H.,(2002). Variation in newborn size according to pregnancy weight charge by trimester Am.J, clin Nutr 76: 2055-9.
13. Brown J (2005) Nutrition and pregnancy: A guide from preconception to post-delivery Available at http://my.webmd.com/content/article/4/1680_51794.htm. Accessed on 01/20/2010.
14. Cedergren M. (2006) Effects of gestational weight gain and body mass index on obstetric outcome in Sweden. Int J Gynaecol Obstet. 93(3):269-74.
15. Cline, B. L., Little, M. D., Bartholomew, R. K. & Halsey, N. A.(1984) Larvicidal activity of albendazole against Necator americanus in human volunteers. Am. J. Trop. Med. Hyg. 33: 387–394.
16. Coelho K.S., Souza A.I., Batista Filho M.(2002) Avaliação antropométrica do estado nutricional da gestante: visão retrospectiva e prospectiva. Rev Bras Saude Matern Infant.2(1):57
17. Copper R.L., DuBard M.B., Goldenberg R.L., Oweis AI (1995) The relationship of maternal attitude toward weight gain to weight gain during pregnancy and low birth weight. Obstet Gynecol 85: 590–5.

18. Crompton, D. W. T. (1999) How much human helminthiasis is there in the world? J. Parasitol. 85: 397–403.
19. . Crompton, D. W. T. (2000) The public health importance of hookworm disease. Parasitology 121: S39–S50.
20. District profile 2009, Atwima Nwabiagya- Ashanti.
21. Dreyfuss, M. L., Stoltzfus, R. J., Shrestha, J. B., Pradhan, E. K., LeClerq, S. C., Khatry, S. K., Shrestha, S. R., Katz, J., Aolbonico, M. & West, K. P.,Jr. (2000). Hookworms, malaria and vitamin A deficiency contribute to anemia and iron deficiency among pregnant women in the plains of Nepal. J. Nutr. 130:2527–2536.
22. Fall CH, Yajnik CS, Rao S, (2003). Micronutrients and fetal growth. J Nutr 133(5 suppl 2):1747S–1756S.
23. Food and Nutrition Board (2009). Dietary Referene Intakes: Water, Potassium, Sodium, Chloride, and Sulfate, Available at www.iom.edu/report.asp?id= 18495 Accessed on 20/04/2010.
24. Food and Nutrition Board (1971). Maternal nutrition and the course of pregnancy. Committee on maternal nutrition. National Academy of Science, N.R.C. Washington D.C.
25. Garner, P. & Brabin, B. (1994) A review of randomized controlled trials of routine antimalarial drug prophylaxis during pregnancy in endemic malarious areas. Bull. World Health Organ. 72: 89–99.
26. Geissler P. W. Shulman C. E. Prince R. J. Mutemi W. Mzani C. Fris H. Lowe B.(1990). Geophagy, iron status and anaemia among pregnant women on the coast of

Kenya. Transaction of the Royal Society of Tropical Medicine and Hygiene 92(5) 549-553.

26. Ghana Demographic and Health Survey, 2008

27. Ghana Health Service, (2004). Training manual, on anaemia control during pregnancy

28. Grandjean P, Bjerve KS, Weihe P, (2001). Birthweight in a fishing community: significance of essential fatty acids and marine food cztaminants. Int J Epidemiol 30(6):1272–1278

29. Guyatt, H. L. & Snow, R. W. (2001). The epidemiology and burden of Plasmodium falciparum-related anemia among pregnant women in sub-Saharan Africa. Am. J. Trop. Med. Hyg. 64 (Suppl.1–2), 36–44.

30.Hadju, V., Stephenson, L. S., Abadi, K., Mohammed, H. O., Bowman, D. D.& Parker, R. S. (1996). Improvements in appetite and growth in helminth infected schoolboys three and seven weeks after a single dose of pyrantelpamoate. Parasitology 113: 497–50

31. Hamalainen H, Hakkarainen K, Heinonen S.,(2003) Anaemia in the first trimester bur not in the second trimester is a risk factor for low birth weight. Clin Nutr 22 (3): 271–275.

32. Hornstra, G. (2000). Essential fatty acids in mothers and their neonates. Am J Clin Nutr 71(5 suppl):1262S–1269S.

33.Hudson T., (2002) Pregnancy and the use of nutritional supplements. Women's health update. Townsend letter for doctors and patients. Available at http://www.findarticles_com/p/articles/mi_m0ISW/is_Jan/ai_8113828. Accessed on 11/02/2010

34. Kahigwa, E., Hirt, R., Cardesa, A. & Alonso, P. L. (2000) Placental pathology in malaria: a histological, immunohistochemical, and quantitative study. Hum. Pathol.31: 85–93.

35. Kalosa K.M., Weismiller D.G.,(1997) Nutrition during pregnancy. American Family Physician 56(1):205.

36.Kamau- Mbuthia, E., Elmadfa, L.,(2007). Diet quality of pregnant women attending an antenatal clinic in Nakuru, Kenya. Ann Nutr Metab 51(4): 324-330.

37.Kamla- Raj (2006). A study of nutritional status of pregnant women of some villages in Balsore District Orisa. Journal of Human Ecology, 20(3):227-232.

38.Kinney J. (2000), Loosening the Grip: a handbook of alcohol information, sixth edition, McGraw- Hill Higher Education USA.

39. Kiwuwa, M.S., Mufubenga, P.,(2008). Use of antenatal care, maternity services, intermittent presumptive treatment and insecticide treated nets by pregnant women in Luwero district, Uganda. Malar J,7:44.

40. Kruger H.S.(2005) Maternal anthropometry and pregnancy outcomes: a proposal for the monitoring of pregnancy weight gain in outpatient clinics in South Africa. Curationis. 28(4):40-9.

41.Lawoyin, T. O., (1991). Maternal weight and weight gains in Africans. Its relatively to birth weight. Journal of Tropical Paediatrics. Oxford University press 37: 166-171.

42. Latham M.C. (1997). Human Nutrition in the Developing World, 3rd edition FAO, Rome

43. Latham, M. C., Stephenson, L. S., Kurz, K. M. & Kinoti, S. N. (1990). Metrifonate or praziquantel treatment improves physical fitness and appetite of Kenyan schoolboys with Schistosoma haematobium and hookworm infections.Am. J. Trop. Med. Hyg. 43: 170–179

44. Lee ,G.R., Herbert V,(2006) .Nutritional factors in the production and function of erythrocytes. Wintrobe's clinical haematology. Baltimore, Maryland USA: William and Wilkins; 1998 p.228-66.

45.Lovelady C. (1996). Nutritional Concerns during Pregnancy and Lactation. In Krummel DA, Kris-Eterton PM (eds): Nutrition in women's health. Gaithersburg, MD: Aspen Publishers.

46.Lucas M, Dewailly E, Muckle G,(2004). Gestational age and birth weight in relation to n-3 fatty acids among Inuit (Canada). Lipids 39(7):617–626.

47. Ludwig, D.S., Currie, J. (2010). The association between pregnancy weight gain and birthweight: a within-family comparison. Lancet, 376 (9745), 984-90.

48. Martorell, R., Delgado, H. L., Valverde, V., Klein, R. E., (1981). Maternal stature, fertility and infant mortality. Hum. Biol, 53: 303- 312.

49. Mahomed, K. (2000). Iron and folate supplementation in pregnancy.Cochrane Database Syst. Rev. 2: CD001135.

50. Marti, A., Pena-Marti, G., Munoz, S, Lauas, F., Comunian, G., (2001). Association between prematurity and maternal anaemia in Venezuelaqn pregnant women during third trimester at labor. Arch Latinoam Nutr, 51:44-8

51.Matua, A.G., (2004). Determinants of maternal choices for place of delivery in Ayiru county, Uganda. Africa Journal of Nursing and Midwifery 6 (1): 33-38

52.MayoClinic.com. (2009), "Water: How much should you drink every day? - MayoClinic.com". http://www.mayoclinic.com/health/water/NU00283. Retrieved 2009-05-21. Accessed on 01/06/10

52. McCormick, M. C., Brooks-Gunn, J., Workman-Daniels, K., Turner, J. & Peckham, G. J. (1992). The health and developmental status of very low-birthweight children at school age. JAMA 267: 2204–2208.

53.McGregor, I. A., Wilson, M. E. & Billewicz, W. Z. (1983). Malaria infection of the placenta in The Gambia, West Africa: its incidence and relationship to stillbirth, birth weight, and placental weight. Trans. R. Soc. Trop. Med. Hyg. 77:232–244.

54. McGregor JA, Allen KG, Harris MA, et al. The omega-3 story: nutritional prevention of preterm birth and other adverse pregnancy outcomes. Obstet Gynecol Surv (2001) 56(5 suppl 1):S1–S13.

55. Mendis, K., Sina, B. J., Marchesini, P. & Carter, R. (2001). The neglected burden of Plasmodium vivax malaria. Am. J. Trop. Med. Hyg. 64 (Suppl. 1–2), 97–106.

56. Mohanty, C., Prasad, R., Srikanth, A.R.,Ghosh, J.K., Singh, T.B., Das, B.K.,(2006) Maternal anthropometry as predictors of low birth weight. J Trop Pediatr. 52(1):24

57. Mridula, D., Mishra, C.P., and Chakravorty, A.,(2003): DietaryIntake of Expectant Mother," Indian Journal of Nutrition and Dietetics, 40(1): 24-30.

58. Mrisho M, Obrist B,Schellenberg A J (2009).The use of antenatal and postnatal care: perspectives and experiences of women and health care providers in rural southern Tanzania. BMC Pregnancy Childbirth ,9:10.

59. Mudambi, R.,(1992).Your foods and its Utilization- Nutrition of the Mother and Child, IGNOU: CFN-2:1-11

60. Murphy, S. C. & Breman, J. G. (2001).Gaps in the childhood malaria burden in Africa: cerebral malaria, neurological sequelae, anemia, respiratory distress, hypoglycemia, and complications of pregnancy. Am. J. Trop. Med. Hyg.64 (Suppl. 1–2), 57–67.
61. Nahlen, B. L. (2000). Rolling back malaria in pregnancy. N. Engl. J.Med. 343: 651–652.
62. National Academy of Sciences- Institute of Medicine(1990): Nutrition during pregnancy. Washington, DC: National Academy of Sciences Press.
63. Neumann, C.G., Harrison, C. G., (1994). Onset and Evolution of Stunting in Infants and Children. Examples from the Human Nutrition Collaborative Research Support Program.Kenya and Egypt Studies. Eur. J. Clin. Nutr. ; 48 Suppl 1: S90-102.
64. Ndidi, E. P., Oseremen, I. G., (2010). Reasons given by pregnanat women for late initiation of antenatal care in the Niger Delta, Nigeria. Ghana Medical Journal, 44(2): 48.
65. Nosten, F., McGready, R., Simpson, J. A., Thwa, K. L., Balkan, S., Cho,T., Hkirijaroen, L., Looareesuwan, S. & White, N. J. (1999) Effects of Plasmodium vivax malaria in pregnancy. Lancet 354: 546–549
66. Nucci, L.B., Duncan, B.B., Mengue, S.S., Branchtein, L., Schmidt, M.I., Fleck, E.T., (2001). Assessment of weight gain during pregnancy in general prenatal care services in Brazil. Cad Saude Publica. 17(6): 1367-74.
67. Ochsenbein –Kölble, N., Roos, M., Gasser, T., Zimmermann, R.,(2007). Cross-sectional study of weight gain and increase in BMI throughout pregnancy. Eur J Obstet Gynecol Reprod Biol. 130(2):180-6.

68. Oliveira, A.F., Gadelha, A.M., Leal, M.C., Szwarcwald, C.L.,(2004) Estudo da validação das informações de peso estatura em gestantes atendidas em maternidades municipais no Rio de Janeiro, Brasil. Cad Saude Publica. 20 Suppl 1: S92-100.

69. Olsen S.F., Hansen H.S., Sommer S,(1991) Gestational age in relation to marine n-3 fatty acids in maternal erythrocytes: a study of women in the Faroe Islands and Denmark. Am J Obstet Gynecol 164(5):1203–1209.

70. Olson C.M, Strawderman M.S, Reed R.G. (2004). Efficacy of an intervention to prevent excessive gestational weight gain. Am J Obstet Gynecol 191(2):530-6.

71. Padilha, P.C., Accioly, E., Libera, B.D., Chagas, C., Saunders, C.,(2009) Anthropometric assessment of nutritional status in Brazilian pregnant women. Rev Panam Salud Publica.25(2):171–8.

72. Parul, C. (2003). Dietary supplements use in women: Current status and future directions. Micronutrients and reproductive health issues: An international perspective. Am Soc Nutr Sc, 23: 1969-1973

73. Pelleter DL, Frongillo E A Jr.Schroeder DG, Habicht J. P.(1994), A methodology for estimating the contribution of malnutrition to child mortality in developing countries. J Nutr 124 (suppl):2106-22

74. .Pelto, G.H.,(1987). Cultural issues in maternal and child health and nutrition. Soc Sci Med 25:553–9.

75. Prasad, R., Srikanth, A.R., Ghosh, J.K., Singh, T.B., Das, B.K.,(2006) Maternal anthropometry as predictors of low birth weight. J Trop Pediatr. 52(1): 24-9.

76. .Rao S, Yajnik CS, Kanade A, et al. Intake of micronutrient-rich foods in rural Indian mothers is associated with the size of their babies at birth: Pune Maternal Nutrition Study. J Nutr (2001) 131(4):1217–1224.

77. Rusescu, A., (2005). Nutritional Status of pregnant women, children under five years old and school children aged six to seven years. Institute for mother and child care, Romania.

78. Scholl TO, Johnson WG. Folic acid: influence on the outcome of pregnancy. Am J Clin Nutr (2000) 71(5 suppl):1295S–1303S

79. Shulman, C. E., Dorman, E. K., Cutts, F., Kawuondo, K., Bulmer, J. N., Peshu, N. & Marsh, K. (2001). Malaria in pregnancy: adverse effects on haemoglobin levels and birthweight in primigravidae and multigravidae. Trop. Med.Int. Health 6: 1–9

80. Simopoulos A.P., Leaf, A., Salem, N. Jr.,(1999) Essentiality of and recommended dietary intakes for omega-6 and omega-3 fatty acids. Ann Nutr Metab 43(2):127–130.

81. Smits LJ, Essed GG.(2001) Short interpregnancy intervals and unfavourable pregnancy outcome: role of folate depletion. Lancet 358(9298):2074–2077

82. Starrs, E. (1997). The safe motherhood action agenda: Priorities for the next decade. New York: Family care International.

83. Stein AD, Ravelli ACJ and L.H. Lumey (1995). Famine, Third Trimester Pregnancy Weight Gain, and Intrauterine Growth: The Dutch Famine Birth Cohort Study. Hum. Biol.;67 (1): 135-144. 5(1).

84. Spicer MT, Kennedy T, Mathule MSL (2005). Predictors of birthweight in healthy woimen attending rural ANC. African journal of Food Agriculture Nutrition and Development 5(1) : 3.

85. Tayie, F. A. K., Lartey, A., (20080. Antenatal care and pregnancy outcome in Ghana, The importance of women's education . African Journal of Food Agriculture Nutrition and Decelopment. 8(3): 291-303.

86. Steketee, R. W., Nahlen, B. L., Parise, M. E. & Menendez, C. (2001) The burden of malaria in pregnancy in malaria-endemic areas. Am. J. Trop. Med.Hyg. 64 (Suppl. 1–2), 28–35

87. Steketee, R. W., Wirima, J. J., Hightower, A. W., Slutsker, L., Heymann, D. L. & Breman, J. G. (1996) The effect of malaria and malaria prevention in pregnancy on offspring birth weight, prematurity, and intrauterine growth retardation in rural Malawi. Am. J. Trop. Med. Hyg. 55 (Suppl. 1), 33–41.

88. Stephenson, L. S., Latham, M. C., Adams, E. J., Kinoti, S. K. & Pertet, A.(1993) Weight gain of Kenyan school children infected with hookworm, Trichuris trichiura, Ascaris lumbricoides is improved following once- or twice-yearly treatment with albendazole. J. Nutr. 123: 656–665.

89. Stephenson, L. S., Latham, M. C. & Ottesen, E. A. (2000) Global malnutrition. Parasitology 121: S5–S22.

90. Stephenson, L. S., Latham, M. C. & Ottesen, E. A. (2000) Malnutrition and parasitic helminth infections. Parasitology 121 (Suppl.), S23–S38.5.

91. Stotland NE, Haas JS, Brawarsky P, Jackson RA, Fuentes-Afflick E, Escobar GJ.(2005) Body mass index, provider advice, and target gestational weight gain. Obstet Gynecol. 105(3):633-8.

92. Teplin, S. W., Burchinal, M., Johnson-Martin, N., Humphry, R. A. & Kraybill, E. N. (1991)Neurodevelopmental, health, and growth status at age 6years of children with birth weights less than 1001 grams. J. Pediatr. 118: 768–777.

93. Ter Kuile, F. O., Terlouw, D. J., Kariuki, S. K., Phillips-Howard, P. A., Mirel,L. B., Hawley, W. A., Friedman, J. F., Shi, Y. P., Kolczak, M. S., Lal, A. A., Vulule, J. M. & Nahlen, B. L. (2003) Impact of permethrin-treated bednets on malaria,anemia and growth in infants in an area of intense perennial malaria transmission in western Kenya. Am. J. Trop. Med. Hyg., in press.

94. Thompson, J.R., Fitz Gerald, P., Willoughby. M.L.N., Armstrong, B. K.,(2001). Maternal folate supplementation in pregnancy and protection against acute lymphoblastic leukaemia in childhood. Lancet 358: 1935- 1940

95. Torlesse, H. & Hodges, M. (2001). Albendazole therapy and reduced decline in haemoglobin concentration during pregnancy. Sierra Leone. Trans. R.Soc. Trop. Med. Hyg. 95: 195–201

96. Uauy, R., Hoffman, D.R., (2000) Essential fat requirements of preterm infants. Am J Clin Nutr 71(1 suppl):245S–250S.

97. United Nations Children's Fund. UNICEF,(2006) Maternal Health. Available at http://www.unicef.org/health/index maternalhealth.html. Accessed on 02/01/11

98. United Nations Children's Fund. UNICEF,(2001). Low birth weight. Available at http://www.unicef.org/specialsession/about/sgreport-pdf/15_lowbirthweight_D734Insert.English.pdf. Accessed on 21/01/11.

99. Van den Broek, N. (2001) Anaemia in pregnancy in sub-Saharan countries. Eur. J. Obstet. Gynecol. Reprod. Biol. 96: 4–6.

100. Van den Broek N. R. Ntonya C, Mhango E., White S. A. (1999). Diagnosing anaemia in pregnancy in rural clinics: assessing the potential of the Haemoglbin Colour Scale Bulletin of the World Health Organization 77(1).

101. van Eijsden M, Hornstra G, van der Wal MF,(2008). Maternal n-3, n-6, and trans fatty acid profile early in pregnancy and term birth weight: a prospective cohort study. Am J Clin Nutr 87(4):887–895.

102. Verhoeff, F. H., Brabin, B. J., Chimsuku, L., Kazembe, P. & Broadhead,R. L. (2000) Malaria in pregnancy and its consequences for the infant in rural Malawi. Ann. Trop. Med. Parasitol. 93 (Suppl. 1), S25–S33.

103. wikipaedia, the free encyclopaedia on nutrition, (2009). Maternal nutrition. Accessed on 01/06/10

104. Woods, M. N. 2006, Nutrition and Medicine, Pregnancy and Lactation: Tufts University School of Medicine

105. WHO.(1980) Division of Family Health. The incidence of low birth weight. Report of a critical review of available information.

106. WHO (1984) World Health Statistics Quarterly, 33:197-224.(1984) Maternal and infant nutrition in developing countries, with special reference to possible intervention programs in the context of health. Food and Nutr Bull, 6(4); 43-60.

107. World Health Organization. (1994). Report of the WHO Informal Consultation on Hookworm Infection and Anaemia in Girls and Women, Geneva.WHO/CDS/IPI/95.1. WHO, Geneva, Swizerland.

108. World Health Organization (1995). Maternal anthropometry and pregnancy outcomes. A WHO collaborative study. Wrld Hlth Org. Bull., 73: 1-98

109. World Health Organization (1995). Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. Technical Report Series No. 854. Geneva: p460

110.World Health Organization. (1999) Monitoring Helminth Control Programs (WHO/CDS/CPC/SIP/99.3). WHO, Geneva, Switzerland

111.World Health Organization(2002). Report of the advisory group meeting on maternal nutrition and low birth weight. Geneva:

112. WHO Expert Committee on Physical Status(2006). The use and interpretation of anthropometrics physical status. The newborn infant. WHO Technical Report Series **55:** 854:121.

113. World Health Organization.(2006) Promoting optimal fetal development: report of a technical consultation. Geneva

114. World Health Organization (2009) fact sheet report on maternal and newborn nutrition and health. 2009. Assessed on 24/04/10

115. Worthington-Roberts B, Williams SR (1997), Nutrition in pregnancy and lactation. Madison, WI:Brown and Benchmark.

116. Wooton, I.D.P., (1964). Micro Analysis in Medical Biochemistry. 4th ed. Churchill, London.

117. Ziyani, I.S., King, L., Ehlers, V.J. (2004). Using triangulation of research methods to investigate family planning practices in Swaziland. Africa Journal of Nursing and Midwifery 6(1): 12-17.

Appendix A : Questionnaire for pregnant women attending ANC at the Nkawie Government Hospital

This questionnaire is going to be used solely to assess the nutritional status of pregnant women attending ANC and all information provided will be kept confidential. Please feel free to answer the questions. However you can opt out if you so desire at any time during the survey.

ID No: ---------- Residence: ……..……..House No: …….

Health facility code……..

SECTION 1: SOCIO – DEMOGRAPHIC DATA

1.1 Age (yrs)

1. 2 Sex [1] female [2] male

1.3 Marital status [1] single [2] married [3] divorced [4] widow

1.4 Is this your first pregnancy?

[1] Yes ☐ [2] No ☐

1.5. How many children do you have? [1] No child [2] 1-3children

[3]4-6children [4]7-9children

1.6. Educational level [1] nill [2] primary [3] junior high/middle school

[4] Senior high [5] tertiary

1. 7. Religious affiliation [1] Christian [2] Muslim [3] none [4] others (specify)

SECTION 2: PAST OBSTETRIC DATA AND MEDICAL HISTORY

2.1. At what gestational age did you start the antenatal clinic visits?

[1]. 1-3months [2]. 4-6months [3].7-9months

2.2. Why did you start at that stage?

[1] not sure of pregnancy [2] previous experience of miscarriages
[3]family beliefs [4] others (specify)

2.3. Have you had any problems with this pregnancy?

[1] Yes ☐ [2]No ☐

2.4. If yes what was/were the problem(s)

[1] Bleeding [2] dizziness [3] abdominal pains [4] waist pains

[5] Headache [6] swollen feet [7] others (specify)

2.5. Have you taken any dewormer throughout your pregnancy?

[1] Yes [2] No

2.6. Were you given any malaria drugs during any of your ANC visits?

[1] Yes [2] No

2.7.Do you sleep in a treated bednet?

[1] yes [2] no

2.8. If no, why?

[1] financial constraints [2] cumbersome to use [3] don't know

[4] others(specify)……

SECTION 3 : ANTHROPOMETRY DATA

Trimester	Total weight gain in kg
First	
Second	
Third	

Baby's weight…….

SECTION 4: HAEMOGLOBIN ASSESSMENT

Level of visit	Haemoglobin level in g/dl
At first visit	
First trimester	
Second trimester	
Third trimester	

SECTION 5 : DIET HISTORY

Foods consumed	Frequency of consumption				
	[1] Daily	[2] 2-3 times/ week	[3] 4-6 times / week	[4] Irregular	[5] Not at all
Fruits					
Green leafy vegetables (kontomire, alefu, lettuce)					
Non green leafy vegetables (garden eggs,carrots,tomatoes)					
Fish					
Meat					
Egg					
Iodized Salt					

Water taken per day/litres……

SECTION 6: DATA ON CULTURAL FACTORS

6.1. Are there any cultural practices that inhibit the intake of certain foods in pregnancy?

[1] Yes ☐ [2]No ☐

6.2 If yes, what are they?

……..

……..

SECTION 7: SOCIO ECONOMIC CHARACTERISTICS

7.1 Are you employed? If yes, what kind of work do you do?

1 Teaching

2. Trading

3. Farming

4. Civil servant

5. Others (specify)…….

7.2 What kind of work does your partner do for a living?

1 Teaching
2. Trading
3. Farming

4. Civil servant

5. Others (specify)…….

7.3 Does your work affect your visits to the antenatal clinics?

1. Yes ☐ 2.No ☐

7.4 If yes, how?

……..

……

7.5 Are the antenatal visits beneficial to you?

Yes ☐ No ☐

7.6 If no, why?

……

……

……

THANK YOU.

Appendix B: Checklist to review records of maternal health record books.

Questionnaire Number:

Date:

Background Information

1. Name……..

2. Address……..

3. Age…….

4. Occupation
   1. Unemployed
   2. Trader
   3. Farmer
   4. Civil servant
   5. Others (specify)…….

5. Marital status
   1. Single
   2. Married
   3. Divorced
   4. Widowed
   5. Cohabiting

6. Month of pregnancy at registration
   1. First trimester
   2. Second trimester
   3. Third trimester

7. Parity
    1. 0
    2. 1
    3. 2
    4. 3 and above

MAP OF STUDY AREA