INFLUENCE OF MATERNAL GESTATIONAL WEIGHT GAIN ON INFANT BIRTH WEIGHT AMONG WOMEN ATTENDING ANTENATAL CARE AT THIKA DISTRICT HOSPITAL IN CENTRAL KENYA

BY

Susan Kanyua Gitonga

A THESIS SUBMITTED TO THE SCHOOL OF HEALTH SCIENCES OF KENYATTA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTERS OF SCIENCE (MSC)

2007
DECLARATION

This thesis is my original work and has not been presented for a degree in any other University. No part of this thesis may be produced without prior permission from the author and/or Kenyatta University.

SUSAN KANYUA GITONGA
H60/6577/03

Declaration by Supervisors

This thesis has been submitted with our approval as University Supervisors

Dr. Judith Kimiywe
Department of Foods, Nutrition and Dietetics
Kenyatta University

Prof. Judith Waudo
Department of Foods, Nutrition and Dietetics
Kenyatta University
ACKNOWLEDGEMENT

I am grateful to almighty God for His grace, vision and sustenance without which this initiative would have been futile. I appreciate the support, guidance and effective supervision by Dr. Judith Kimiywe and Professor Judith Waudo. Special thanks go to my daughter Nkiro, son Kim, sisters Mary and Monica for their skills and assistance with typesetting and other related computer skills.

I am also indebted to Munene for his statistical skills in data analysis and research assistants Elizabeth and Elidy for collecting data within the stipulated time. Many thanks to the respondents for providing the data needed for this research. Am grateful to Mrs. Gladys Mugambi and the management of the Thika district hospital for facilitating the research at the institution.

It is not possible to thank everyone that helped in the completion of this work. To all others not mentioned by name, your contribution was not in any way less important and a big thanks to you all.
DEDICATION

To my husband Andrew Gitonga for his unwavering moral and financial support.

To my children Nkiro, Kim and Muriithi for their patience and understanding during the writing of this thesis.

To my parents for having wisely invested in my education.
ABSTRACT

Influence of Maternal gestational Weight Gain on Infant Birth Weight

Gestational weight gain in Thika District Hospital is mainly influenced by maternal dietary intake, age, income, education level and supplement use. Low birth weight is associated with increased occurrence of mental retardation, birth defects, growth problems, blindness, autism and cerebral palsy. The primary objective of the study was to determine pregnancy weight gain of women attending antenatal clinic in Thika district hospital and establish its relationship with the birth weight of their infants. The secondary objectives were to analyse demographic characteristics and their influence on maternal gestational weight gain and to determine other factors affecting the birth weight of the infant, in particular the mothers’ nutritional status and the socio-cultural factors. To achieve these objectives, it was hypothesized that, there is a relationship between pregnancy weight gain, other obstetric factors with the birth weight of the infant. Other factors affecting infants’ birth weight were hypothesized as the socio-cultural, nutritional and demographic factors. A descriptive survey was used to gather both qualitative and quantitative data from the district hospital. Non-probability sampling was used to select the sample for the study. Purposive sampling was used to select a sample of 149 pregnant women. This figure represents 10% of all the pregnant women who attended antenatal clinic in the year 2003. This included pregnant women at their third trimester who regularly attended antenatal clinic and delivered at the hospital. Mothers with complications during pregnancy, chronic illnesses and whose children had obvious congenital defects were excluded. A researcher-administered questionnaire was used to collect demographic characteristics, obstetric information, and dietary information during pregnancy and anthropometrics data of the pregnant women and infants weight at birth. Data were analyzed using the statistical package for social scientists (SPSS) and the food UK 0.7 meter software. Spearman rho correlation was used to establish the co-relation between infant birth weight and maternal weight gain during the third trimester as well as the mother’s energy intake 24 hours prior to the study. Krusal Walis on the other hand was used to establish the relationship between infant birth weight and the other variables. The findings of the study indicate that maternal gestational weight gain positively affects the birth weight of the infant at 0.05 level of significance. Of the other factors that influenced the infants’ weight at birth were; mothers height, dietary intake and supplement use. The respondents first visit to the clinic, mother’s income, age and education level and alcohol use during pregnancy were not proven significant. In this study 12.7% of the infants were of low birth weight. Based on the findings, a number of recommendations were finally suggested. They include need to use nutritious foods and regular assessment of the dietary intake of the pregnant mother, the need for the doctors/health care givers to closely monitor the maternal weight gain during the second and third trimesters. Early detection of poor maternal weight gain would enable doctors/health caregivers to initiate interventions that would have positive effects on the infants weight. As such, the issue of low birth weight infants should become a priority to policy makers.
# TABLE OF CONTENTS

DECLARATION .................................................................................................................. II

ACKNOWLEDGEMENT ................................................................................................... III

DEDICATION .................................................................................................................... IV

ABSTRACT ....................................................................................................................... V

TABLE OF CONTENTS .................................................................................................... VI

LIST OF TABLES .............................................................................................................. X

LIST OF FIGURES .......................................................................................................... XI

LIST OF ABBREVIATIONS ............................................................................................. XII

CHAPTER ONE ................................................................................................................ 1

INTRODUCTION ............................................................................................................. 1

1.1 Background ............................................................................................................... 1

1.2 Statement of the Problem ....................................................................................... 7

1.3 Objectives ............................................................................................................... 8

1.4 Research Questions ............................................................................................... 9

1.5 Justification of the Study ..................................................................................... 9

1.6 Conceptual Framework ....................................................................................... 10

1.7 Operational Definition of Key Terms ................................................................... 13

CHAPTER TWO ................................................................................................................ 14

LITERATURE REVIEW .................................................................................................. 14

2.1 Introduction ............................................................................................................. 14

2.2 Factors Affecting Pregnancy Weight Gain and Infant Birth Weight .................. 14
2.2.1 Maternal Nutritional Status ........................................................................... 14
2.2.2 Energy Balance .............................................................................................. 15
2.2.3 Maternal Macronutrients Deficiencies and Infant Birth Weight ............... 16
2.2.4 Mother’s Stature ........................................................................................... 18
2.2.5 Social –Economic Factors .......................................................................... 18
2.2.6 Effects of Alcohol on Infant Birth Weight .......................................................... 19
2.2.7 Effects of cigarette smoking on birth weight ...................................................... 20
2.2.8 Food Taboos and Traditions .............................................................................. 21
2.2.9 Use of Supplements During Pregnancy .............................................................. 22
2.2.10 Maternal Weight Gain and Birth Outcome ....................................................... 23

2.3 Summary of the Literature Review ........................................................................ 28

CHAPTER THREE ........................................................................................................... 30

METHODOLOGY .......................................................................................................... 30

3.1 Introduction .............................................................................................................. 30
3.2 Research Design ..................................................................................................... 30
3.3 Study Area .............................................................................................................. 30
3.4 Study Population .................................................................................................... 31
3.5 Sample Size and Sampling Procedure ................................................................. 31
3.6 Exclusion Criteria .................................................................................................. 32
3.7 Study Assumption .................................................................................................. 33
3.8 Limitation of the Study ........................................................................................ 33
3.9 Data Collection Instruments .................................................................................. 33
3.10 Ethical Considerations .......................................................................................... 34
3.11 Training of Research Assistants .......................................................................... 34
3.12 Pre-Testing of the Research Instruments ............................................................. 34
3.13 Data Collection Procedures ................................................................................ 35
3.14 Data Analysis and Procedure ............................................................................... 36
3.15 Definition of Variables ......................................................................................... 37

CHAPTER FOUR ........................................................................................................... 39

RESULTS AND DISCUSSIONS .................................................................................... 39

4.1 Introduction .............................................................................................................. 39
4.2 Socio- Economic and Demographic Characteristics of Study Subjects ................. 39
4.2.1 Marital Status of Respondents .......................................................................... 40
4.2.2 Respondents Age .............................................................................................. 40
LIST OF TABLES

Table 4.1. Mothers by age .................................................................40
Table 4.2: Parity of mothers .................................................................44
Table 4.3. Mothers distribution by height ............................................45
Table 4.4 Commonly Consumed foods by the pregnant women ............51
Table 4.5 Mothers nutrient intake ........................................................52
Table 4.6. Supplement use and first visit to the antenatal ......................55
Table 4.7 Trimester Weight Changes .....................................................56
Table 4.8 Kruskal Walis Multivariate analysis .......................................58
LIST OF FIGURES

Figure 1: A conceptual framework showing the relationship between maternal weight gain and birth outcome .......................................................... 10

Figure 2: Education levels of mothers .................................................... 42

Figure 3: Income levels of mothers ......................................................... 43

Figure 4: Education levels of fathers/husbands ....................................... 49

Figure 5: Income levels of fathers/husbands ........................................... 50

Figure 6: Baby’s weight at birth in kg ....................................................... 57
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC/SCN</td>
<td>Advisory committee on Co-ordination, Sub committee on Nutrition</td>
</tr>
<tr>
<td>BMC</td>
<td>Body Mineral Content</td>
</tr>
<tr>
<td>BMI</td>
<td>Body Mass Index</td>
</tr>
<tr>
<td>BMR</td>
<td>Basal Metabolic Rate</td>
</tr>
<tr>
<td>CBS</td>
<td>Central Bureau of Statistics</td>
</tr>
<tr>
<td>CHDS</td>
<td>Child Health and Development Study</td>
</tr>
<tr>
<td>IUGR</td>
<td>Intra Uterine Growth Retardation</td>
</tr>
<tr>
<td>IPT</td>
<td>Intermittent Preventive Treatment</td>
</tr>
<tr>
<td>KDHS</td>
<td>Kenya Demographic and Health Survey</td>
</tr>
<tr>
<td>LBW</td>
<td>Low Birth Weight</td>
</tr>
<tr>
<td>LMP</td>
<td>Last Menstrual Period</td>
</tr>
<tr>
<td>MJ</td>
<td>Mega Joules</td>
</tr>
<tr>
<td>NTD</td>
<td>Neural Tube Defect</td>
</tr>
<tr>
<td>NCPP</td>
<td>National Collaborative Perinatal project</td>
</tr>
<tr>
<td>Kcal</td>
<td>Kilocalories</td>
</tr>
<tr>
<td>MOH</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>MOEST</td>
<td>Ministry of Education, Science and Technology</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
</tr>
<tr>
<td>FAS</td>
<td>Fetal Alcohol Syndrome</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package for Social Scientists</td>
</tr>
<tr>
<td>MGWG</td>
<td>Maternal Gestational Weight Gain</td>
</tr>
</tbody>
</table>
CHAPTER ONE

INTRODUCTION

1.1 Background

Pre-pregnancy weight and pregnancy weight gain are important determinants of the health and survival rate of the new born (Rajagopalan, 2003). Generally Maternal Weight Gain (MWG) during the first trimester of pregnancy is unrelated to infant birth weight but not in the second and third trimester (Scholl, Hediger, and Schall 1996). Maternal weight gain does not differentiate between the weight of the mother, the fetus or the various other components such as fat stores, breast and uterine tissue, plasma volume and the fetus. It provides only a general impression of fetal growth. Fetal weight however, increases exponentially with high weight gains in the third trimester, while the overall rate of maternal weight gain is fairly constant after the first trimester (Norton, 1994). However, maternal weight gain and fetal growth vary greatly throughout pregnancy. Low weight gain in early, middle and late pregnancy are likely to affect the fetus differently (Scholl et al, 1999).

Kramer, 1993 reported a twofold increase in the risk of prematurity with low maternal weight gain in the third trimester. Kramer, Haas and Kelly (1998) demonstrated increased weight in twins when higher maternal weight gain occurred both before and after 20 weeks gestation. Low birth weight is used as an indicator for intrauterine growth retardation (IUGR) (Rajagopalan, 2003). Children born with intrauterine growth retardation (IUGR) have increased risk of birth asphyxia and hypoglycemia (Kramer et al., 1998). The causes of intrauterine growth retardation are multi-factorial. Studies
demonstrate an increased risk of intrauterine growth retardation in women who smoke during pregnancy as well as in women with short stature (Kramer, 1987) or low pre-pregnancy weight (Rajagopalan, 2003). Studies of maternal weight gain during pregnancy also reveal an increased risk of IUGR in mothers with low pregnancy weight gain and poor dietary intake (Kramer, 1987; Naeye, 1981; Smith G, Smith M, McNay and Flemming, 1998).

Many women in Africa like in many other developing countries enter pregnancy with moderately severe to severe underweight status and do not therefore gain sufficient weights to allow for fetal growth to continue unimpeded. Low pre-pregnancy weight and low weight gain during pregnancy are independent predictors of poor fetal growth and IUGR (Allen, 2001). In a study done across Egypt, Kenya and Mexico, it was found that women with a higher body mass index (BMI) and skin fold thickness gained significantly less weight during pregnancy. In contrast those with a low BMI gained more weight and consumed significant more energy. Thus, there seems to be a mechanism that regulates food intake and weight gain during pregnancy and this at least in part protects the fetus against low maternal energy and protein intakes (Allen, Lung’alo and Shaheen, 1994).

The early part of pregnancy usually is accompanied by moderate weight loss caused by the woman's lack of appetite and in some cases nausea and vomiting. Between the third and the ninth month of pregnancy most women gain about 9 kilograms (20 pounds) or more. Ideally, during pregnancy, body weight is gained at the rate of about 0.5 kilogram (1 pound) per week for a total of not more than 9 to 11.5 kilograms (20 to 25 pounds). In an average pregnancy, the infant, the afterbirth, and the fluid in the uterus weigh about
4.5 kilograms (10 pounds). The uterus and the breasts together weigh approximately 2.25 kilograms (5 pounds). The remaining 2.25 kilograms consist of stored fluids and fat. Weight gain exceeding 11.5 kilograms usually represents fat and fluids that are in excess of the reserve requirements for a normal pregnancy. A woman loses approximately 7 kilograms (15 pounds) at delivery, and another 2.25 kilograms of stored fluid are eliminated as the uterus shrinks. She does not lose many additional kilograms during the weeks following the delivery of the baby unless she limits her caloric intake. Fat stored during pregnancy is lost more slowly than stored fluids, proteins, and carbohydrates. Excessive weight gain during pregnancy is a matter of concern for both the patient and the doctor. Although it may be only the result of overeating, it may be caused by a disturbance in metabolism and by an abnormal retention of fluids and salts. In the latter instance it may be the first sign of preeclampsia (De Brouwere et al., 1998).

During pregnancy, nitrogen, derived from the metabolism of ingested protein, is needed for growth of the fetus, the placenta, the uterus, and the mother's breasts and other tissues. A considerable amount of nitrogen is also required for the increase in the mother's red cell volume and blood plasma. The fetus's demand for nitrogen is slight at first, but during the last month of pregnancy it acquires almost half of its total protein. In the process of accumulating this store and of building a reserve for the period after delivery, the woman who is on an adequate diet retains between two and three grams of nitrogen daily during her pregnancy; by term she and the fetus will have acquired approximately 500 grams (about 1.1 pounds) of nitrogen (De Brouwere et al., 1998).
Pregnant women normally process greater quantities of blood through the kidneys, but the kidneys are incapable of reabsorbing increased amounts of sugar. Consequently, a lower level of sugar in the blood is tolerated, and slight amounts of sugar are excreted in the urine. Subsequently, during pregnancy the level of sugar in the blood after fasting is slightly lower, probably because there is less usable insulin in the blood to regulate the sugar metabolism. Oral glucose-tolerance tests show a prolonged elevation of blood sugar after ingestion of glucose; this may be an indication that carbohydrate use is less rapid or that the absorption of glucose from the gastrointestinal tract is slower. Glucose-tolerance tests that depend on injection of the sugar solution into the veins show no difference between non pregnant and pregnant nondiabetic women. A few women demonstrate diabetes for the first time when they are pregnant, a condition referred to as gestational diabetes. This occurs because pregnancy taxes insulin productivity in women with a marginal pancreatic islet reserve, so that diabetes may first become evident during gestation (Richard et al, 2001; Microsoft Encarta Encyclopedia, 2005).

The total blood lipids average 600 to 700 milligrams per hundred millilitres of blood in the non-pregnant woman. They increase to approximately 900 to 1,000 milligrams per hundred millilitres of blood during the latter part of pregnancy. This increase, which involves all the lipid fractions, has not been explained, but it is worthy of notice that the gain in fat reaches its peak during the period that the fetus acquires most of its adipose (fatty) tissue (Richard and William, 2001)
Pregnancy is characterized by increases in the amount of body water and in the total volume of body fluid. During pregnancy between 3,500 and 4,000 milliliters of fluid (about 3.2 to 3.6 quarts) will be added to that already present in the tissues of a healthy woman. The uterus, the placenta, the amniotic fluid, and the fetus each account for approximately equal amounts. In addition to the water that increases blood volume, there is also added fluid in the mother's muscles, her pelvic soft tissues, her breasts, and her other tissues (Smith et al, 1998; William, 2002).

Low maternal weight gain during pregnancy has been suggested as a cause of intrauterine growth retardation (IUGR). However, pregnancy weight gain and fetal growth vary greatly throughout pregnancy. In 2005, Nathalie carried out a study to establish the relationship between maternal weight gain in individual trimesters to the risk of IUGR. He had a sample of 10,696 women who had enrolled in the National Collaborative perinatal Project (NCPP) and the Child Health and Development Study (CHDS). Low weight gain was defined as <-0.1kg/wk for the first trimester and <0.3 Kg/wk for the second and third trimester. IUGR was defined as a birth weight < 2500g in full term infants. The findings of the study showed that; low weight gain in the first trimester was not associated with an increased risk of IUGR. From the study, after controlling for confounding factors (maternal height, body mass index, parity, race, toxemia, diabetes) it was found that low weight gain in the second trimester was associated with a relative risk of IUGR of 1.8 (1.3-2.6) in the NCPP cohort and 2.6 (1.6-4.1) in the CHDS cohort. Similarly, low weight gain in the third trimester was associated with a relative risk of IUGR of 1.7 (1.3-2.3) in the NCPP cohort and 2.5 (1.7-3.8) in the CHDS cohort. After
correcting for weight gain in other trimesters, this increased risk remained. Increased risk of IUGR was observed with low second and third trimester weight gain across the spectrum of maternal body mass index. The risk of low weight gain in the second or third trimester was significantly lower in teenagers and significantly greater in overweight women and women aged 35 years or older. Low weight gain in either the second or third trimester was associated with a significantly greater risk of intrauterine growth retardation in two distinct cohorts. The conclusion is that increased awareness of maternal weight gain in mid and late pregnancy is critical to identifying infants at risk for IUGR.

Low birth weight (<2500g or <5.5 lbs.) occurs in seven percent of all infants born in the United States and is associated with a mortality rate during the neonatal period (0 to 27 days of life) that is forty times that of infants with normal birth weight. In Kenya, according to a study done in Nyanza hospital in Kisumu, out of 2025 deliveries at the hospital maternity unit, 304 were low birth weight giving an incidence of 15% (Were and Karanja, 1994). Very low birth weight (<1,500g or <3.3 lbs.) is associated with a neonatal mortality rate two hundred times that of infants with normal birth weight. For low birth weight infants that do survive the neonatal period, the incidence of re-hospitalization is substantially higher than for infants with normal birth weight, as is the risk of neural-developmental disorders (Rajagopalan, 2003). It has also been suggested that the infant birth weight could also be influenced by other factors such as prenatal care, maternal nutrition, use of food supplements; and caloric intake before and during pregnancy (http://ww.reproline.jhu.html)
Adequate prenatal care refers to the number of antenatal visits a pregnant woman has attended during each trimester. Prenatal care is considered inadequate if a woman begins receiving care after the first trimester (Madsen, 2005).

Smoking of tobacco during pregnancy is believed to lower the birth weight of the fetus and is also associated with placenta praevia, abruptio placentae, and elevated maternal blood pressure. Sudden infant death syndrome, delayed mental development in childhood, and spontaneous abortion also has been linked to smoking during pregnancy (Duncan, 2005). Lethal – local brews such as Chang’aa are harmful to the body and more to the un-born baby. Alcohol has been found to be teratogenic (causing developmental malformations in the fetus). Intake of large to moderate quantities of alcohol during pregnancy is responsible for fetal alcohol syndrome, which is characterized by impaired growth and development, facial abnormalities, cardiac defects, and skeletal and joint malformations (Microsoft Encarta Reference Library, 2005).

1.2 **Statement of the Problem**

The weight at birth is a leading determinant of the survival chances of a newborn (UNICEF, 2004). Low birth weight is used as an indicator for intrauterine growth retardation (I.U.G.R) (Rajagopalan, 2003). A low birth weight (L.B.W) baby who has suffered I.U.G.R. as a fetus is effectively born malnourished and is at high risk of dying during this period or later infancy (Bharagava, 2001; Norton, 1994). L.B.W is associated with increased occurrence of mental retardation, birth defects, growth problems, blindness, autism and cerebral palsy and also neonatal and postnatal morbidity and
mortality (Ngare and Neumann, 1998). In developing countries with a high prevalence of low birth weights, infants with IUGR account for the majority of neonatal deaths (Rajagopalan, 2003).

According to UNICEF (2004), developing countries have a 17% of infants with low birth weight while Kenya has a prevalence of 11%. In the year 2003, out of 9147 infants born, 183 (2%) of them were of LBW. The hospital recorded one of the lowest prevalence which is far below the national average in Thika District Hospital, (Thika District Health Activities Annual Report, 2003). Nonetheless these figures refer to the district averages which often hide the facility specific occurrences and are reports based on hospital staffs which may lack the independence of a systematic research. Additionally, even if the figures were reliable the predicament of these minority proportion may not be well understood in the absence of a systematic empirical research. Subsequently, they may be sidelined in national programs aimed at reducing high prevalence of Low Birth Weights.

The goal of the study was therefore to determine the influence of maternal pregnancy weight gain on infant birth weight.

1.3 Objectives

The study was guided by the following objectives

1. To determine pregnancy weight gain of women attending antenatal clinic and its effects on infant birth weight

2. To establish the birth weights of infants of mothers attending antenatal clinic
3. To identify maternal socio-economic and demographic characteristics that influence infant birth weight

4. To determine the pregnant women dietary behaviour and its influence on infants birth weight

1.4 Research Questions

The study sought to answer the following questions

1. What is the pattern of pregnancy weight gain among women attending the antenatal clinic and what are its effects on infants birth weight

2. What are the infants birth weight of women attending the antenatal clinic

3. What are the socio-economic and demographic characteristics of women attending the antenatal clinic and what are their effects on infants birth weight

4. What are the dietary behaviours of pregnant women attending the antenatal clinic and what are their effects on their infants birth weight

1.5 Justification of the Study

Data on birth weight is important because national estimates of the incidence of low birth weight are internationally recognized indicators of the well being of neonates and women of reproductive age (UNICEF, 1998). There have been various cases of low birth weight children and reported infant deaths as a result of poor weight gain during pregnancy. Due to the absence of a systematic empirical research in Thika District Hospital, it was selected as a study hospital.

Increased information of maternal weight gain in mid and late pregnancy is critical to identifying infants at risk of IUGR. Fetal growth may be impaired by relatively short
periods of poor maternal weight gain, even if subsequent weight gain is adequate. The study findings will provide guidance to Thika hospital in planning for strategies to improve the management of mothers who are at child bearing age in order to reduce low weight babies. It could also be used to create a monograph which can be replicated in other areas and to evaluate management of low birth weight babies in other institutions.

1.6 Conceptual Framework
The conceptual framework used in this study begins with Rajagopalan (2003) assertion that proper nutrition for girls is very important for the nutrition and health of their own children. Women who have had chronic malnutrition during childhood grow into small short women. When they become pregnant, they give birth to low birth weight babies who also become small. Hence it becomes a vicious cycle. Energy, fatty acid and micronutrient deficiencies in childhood or early in pregnancy have been implicated in leading to low birth weight babies, which in turn determine the development and survival of children (Merchant, 1994).

Figure 1: A conceptual framework showing the relationship between maternal weight gain and birth outcome.
Adapted and modified from: ACC/SCN (1992)
Chronic infection such as malaria and intestinal worm infestation, which may have been acquired before pregnancy, will severely affect the nutritional status of women. This will consequently lead to a low weight baby. Smoking and alcohol consumption by pregnant women lead to decreased nutrient absorption by the body. This means that the fetus in utero will be deprived of much needed nutrients. This results to I.U.G.R. and thus low weight baby.

Risk factors for IUGR include untreated urinary tract infections (bacterial vaginosis); ascending reproductive tract infections, including syphilis, gonorrhea and chlamydia; low pre-pregnancy maternal weight and height, and low caloric intake and poor weight gain during pregnancy. Intrauterine growth retardation (IUGR) is the most common form of LBW in the developing world (accounting for more than 60%), whereas most low birth weight in infants in developed countries is due to prematurity (Ayisi, 2000). Some women experience “morning sickness” in the first trimester and this may lead to lack of appetite and reduced food intake (Gillespie, 2002). This leads to low weight gain and it results in low birth weight of the baby.

In some instances due to economic constrains especially among the low income earners, enough food cannot be purchased for each household member. Pregnant women in such households do not get enough food and thus have reduced food intake. They also have poor dietary practices. This may contribute to low weight gain during pregnancy and consequently low weight baby.
1.7 Operational Definition of Key Terms

**Birth weight outcome** – measure of the infant’s birth weight and compare with standard reference measurement.

**Low birth Weight**- refers to a birth weight of the infant which is less than 2500g.

**Premature infants** – infants with birth weight less than 2500g and gestation age less than 37 weeks.

**Small for Gestation Age (S.G.A.)** - Infants weighing less than 2500g after attaining gestational age of 37 weeks or greater

**Maternal weight gain** – Refers to the weight gained by a mother during their gestation period.

**Multiple gestations** – Refers to the occurrence of more than one fetus during one pregnancy.

**Infant mortality** - The probability of an infant dying before their first birthday.

**Neonatal mortality** – The probability of an infant dying within the first month of life.
CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction
This section reviews literature on topics related to pregnancy weight gain and birth weight. Literature was reviewed under the following sub-topics; maternal nutritional status, and other attributing factors to low birth weight.

2.2 Factors Affecting Pregnancy Weight Gain and Infant Birth Weight
There are strong indications that pregnancy weight gain could have great influence on infant birth weight. This section discusses some of the major factors that have been identified to be associated with pregnancy weight gain and infant birth weight. These factors include maternal nutritional status, maternal macronutrient intake, mother's stature, socio-economic factors, alcohol use during pregnancy, cigarette smoking, food taboos and traditions, and the use of food supplements during pregnancy.

2.2.1 Maternal Nutritional Status
An adequate maternal diet is necessary to ensure proper fetal development as well as to maintain the health of the mother. The physiological adjustments of a pregnant woman's body are significant, and nutritional requirements increase as a result. In addition to an awareness of the substances that are of benefit during pregnancy, a knowledge of which substances are harmful and should be avoided is equally important (http://www.dcdmctor.com/pages/rightpages,wellnesscenter/pregnancy/birthing process.html). Many studies have related maternal nutritional status during pregnancy to the birth weight of
the baby and most evidence indicate that increased maternal caloric intake during pregnancy has a positive effect on the birth weight of the children (SCN, 1994)

2.2.2 Energy Balance

Pregnancy causes an increase in maternal tissue mass and the total energy cost are assumed to be 200 to 400MJ (85,000 Kcal), with average daily cost of 1.2 MJ (300 Kcal) (Truswell, Dreosti and English, 1990). The additional requirements for energy specific to pregnancy come from the growth and development of the products of conception together with the associated changes in maternal body composition and in maintenance metabolism (Hytten, 1980a). The average diets of pregnant women in poor communities of developing countries provide only about 1500 to 1800 Kcal. (Gopalan and Rao, 1972). This is far below the recommended daily allowance (R.D.A) of 2500 Kcal. Calorie needs must increase to ensure storage (Lederman, 1993).

In undernourished women, it appears that the cost of maintaining pregnancy may be offset by adaptive adjustments balance (Allen, 2001). For an average well nourished woman who gains 12.5Kg in weight of a pregnancy and who has no generalized oedema, the energy equivalent of the tissues deposited throughout pregnancy is estimated to be about 174 MJ (41,500 Kcal), of which about 133 MJ (31,800 Kcal) (about 75%) are assumed to be located as maternal fat stores (Hytten, 1980a)

The feeling of nausea during “morning sickness” in the first trimester may lead to lack of appetite and reduced intake, although this is not well documented (Gillespie, 2002). In Kenya, some women have been found to reduce intake in the last trimester possibly due
to uterine size interfering with the consumption of the bulky maize and bean diet (Kusin, 1984). There is also too much workload placed on women which encroach on the pregnant mother’s energy thus depriving her of the much needed energy for the growth of the fetus. (Kramer 1993).

In Kenya the problem of energy density has now been realized and in some parts of the country especially Embu District, promotion of growth of oil rich crops is being encouraged by the Ministry of Agriculture. This includes Soya beans, sunflower, groundnuts and simsim. Health workers are emphasizing their use and importance to the mothers, in order to promote increased energy intake and vitamin A absorption especially for the children and pregnant women (Waihenya, 1994).

2.2.3 Maternal Macronutrients Deficiencies and Infant Birth Weight

Maternal macronutrient deficiencies may have far reaching effects on infant birth weight. The major macronutrients which have been found to have a great bearing on infant birth weight include protein, lipids, carbohydrates and dietary fiber.

Protein

Requirements for protein are increased in pregnancy due to expansion of maternal blood volume, and growth of the maternal tissues, fetus and placenta (Institute of medicine, 1990). Maternal protein restriction may result in decreased fetal growth and development. However, recent evidence has suggested that decreased fetal growth and development may be due to the complex relationship between protein status and other measures of nutritional status such as BMI (Allen, 2001). Serum protein levels are not
predictive of birth weight or growth retardation independently of other measures of nutritional status (Maher Goldenberg and Tamura, 1993).

**Lipids, carbohydrates and dietary fiber**

There are no particular requirements for extra dietary fat or carbohydrates in pregnancy, which would not be met by a normal balanced diet (Hytten, 1990). However, pregnant women should be encouraged to follow the guidelines as set by the Nutritional Taskforce and aim for carbohydrates intakes of 55 percent of total energy, and fat intake of 30-33 percent of total energy (Hackney Hospital, 1991). New Zealand data indicate that fat intakes during pregnancy range from 37-40 percent of energy, which results in lower percentages of energy, consumed as carbohydrates (Beinner and Lamounier, 2003). This fat intake is higher than recommended by the Nutrition Task Force for healthy women. There is need for improvement in the composition of the diets of the pregnant women, by reducing fat intake, which may be particularly necessary among women with a high gestational weight gain (Allen, 2001).

Adequate amounts of dietary fibre in the diet are necessary to prevent constipation, a common problem during pregnancy. Intakes of 25-30g/day of dietary fibre, acquired by the inclusion of whole grains, vegetables, fruits and legumes in the diet could lessen this problem, and also increase the proportion of energy consumed as carbohydrates thereby decreasing total fat intake.
2.2.4 Mother’s Stature

Women who have had chronic malnutrition during childhood grow into small short women. When they become pregnant, they give birth to low birth weight babies who also become small. Hence it becomes a vicious cycle which perpetuates malnutrition and poor health generation after generation (Rajagopalan, 2003). In developing countries, many women are short and under-weight and the numbers of low birth weight (LBW) babies are particularly high (more than 30% in South Asia, 10-20% in the other regions) (Norton, 1994). Low birth weight in developing countries has been predominantly caused by maternal malnutrition (Merchant, 1994).

The 1998, KDHS survey indicates that 6% of mothers are shorter than 150 cm partly as a result of chronic malnutrition experienced during childhood and partly due to genetic potential. The short height predisposes these women to higher risk of complications during delivery and the risk of giving birth to children with low birth weight. The prevalence of low birth weight babies (less than 2.5 Kg) in Kenya is 11 percent. The child’s size is a reflection of intrauterine and prenatal nutrition status (UNICEF 1988) Underweight prevalence is highly correlated with stunting; much of the growth failure is, or leads to, short stature (Rajagopalan, 2003).

2.2.5 Social –Economic Factors

Poverty exacerbates the problem of low birth weight for the poor have both a “nutritional handicap” and inadequate access to food during pregnancy. Social economic disadvantage may lead to adverse psychological, behavioral or other environmental exposures that restrict fetal growth (Bhargava, 2001). In some instances due to economic
constraints, especially among the low-income earners, enough food cannot be purchased for each household member. This leads to unequal intra-household food distribution. Special consideration must be given to ensure that intra-familial food distribution safeguards the mother’s nutritional status especially when pregnant.

In Africa, women with low socio-economic status are often ignored, even if they need medical support. Employment, educational attainment and availability of sanitary facilities are indicators of women’s socio-economic status. In a study by Taguchi, Kawabata, Maekawa, Maruo, Aditiawarman and Dewata (2003), unemployed women had 4.4 times higher risk for negative birth outcomes than women who were employed. However, there was no significant difference between women educated through primary school and women educated beyond.

2.2.6 Effects of Alcohol on Infant Birth Weight

Drinking alcohol during pregnancy may cause permanent damage to the fetus. Alcohol passes freely across the placental barrier to the fetus, so that alcohol levels in the fetus are similar to those in the mother (PHC, 1994). High alcohol consumption during pregnancy (60g alcohol) is associated with fetal alcohol syndrome (FAS), which is characterized, by impaired growth and development, facial abnormalities, cardiac defects, and skeletal and joint malformations (Morgan, Randolph and Meyer, 2000). It has been suggested that moderate alcohol intakes are associated with a lowered birth weight independent of other factors such as smoking, parity and maternal weight (Larroque, Kaminski and Lelong, 1985). These effects are seen with consumption of two or three alcoholic drinks daily (20-30g of alcohol), but findings are inconsistent when alcohol is consumed at lower
levels. The effects of limited intake of alcohol are not as well known, but avoidance of any amount of alcohol throughout pregnancy is recommended.

2.2.7 Effects of cigarette smoking on birth weight

The relationship between smoking and infant birth weight is clear and well established (Institute of Medicine, 1990). Smoking is associated with reduced pre-pregnancy weight, gestation weight gain and infant birth weight. A large North American study has found that infant of smokers weighed less at birth than those of non-smokers (Picone et al., 1982a). This was despite the fact that the smokers had higher energy intakes than the non-smokers. The major impact of smoking appears to be the increased odds of having an infant of birth weight between 2,000 and 2,499 grams (Kleinman and Madans, 1985), with an increased risk of infant morbidity. Smoking is associated with lower levels of education, lower social-economic status and poor nutrition that contribute to risk of having low birth weight infant.

A study done in Machakos provincial hospital, Kenya, found that smoking patients were younger than non-smokers. The smokers were more often unemployed and married than non-smokers. The study also found a decrease of birth weight with increased cigarette consumption for both primegravidae and multigravidae. There was also an increase in the ultrasound diagnosis of IUGR and a tenfold increase in the diagnosis of small babies amongst patients who smoked (Wanjiku, 1983). Smoking of tobacco during pregnancy is believed to lower the birth weight of the fetus and is also associated with placenta praevia, abruptio placentas and elevated maternal blood pressure. Sudden infant death
syndromes, delayed mental development in childhood, and spontaneous abortion have also been linked to smoking (http://www.dcdoctror.com/rightpages.html; 2005).

2.2.8 Food Taboos and Traditions

The cultural food restriction during pregnancy is common practice, particularly in developing countries. The most common reason for food taboos is fear of difficult delivery as a result of increased size of the fetus due to consumption of nutritious foods (Boucher 1984; Gemebo, 1995). High prevalence of food taboo practice was reported in one of the communities in Nigeria by Ojofeitimi, Ehigie, and Babafemi, (1982). They found that about 66% of women avoided milk. At Shao village, also in Nigeria, Ebomoyi (1987) found that meat was avoided by practically all the pregnant women (98%), whereas rabbit meat was avoided by 93%. However, a study carried out in Hadiya, Ethiopia contrasted these findings. The study findings showed a low prevalence of food taboos (27.1%). This was attributed to better educational standards along with better nutrition education offered by the missionaries in the area.

Traditional beliefs and practices associated with pregnancy and labor are also still in use in Africa. Some of the traditions associated with pregnancy are described thus: Pregnant women (as well as other members of the household) were forbidden in some instances to visit the hospital, so that only the traditional birth attendants were allowed to assist them during labor; pregnant women are not allowed to sit on stones or wood, which were believed to harbor bad spirits; they were forbidden to eat food rich in protein, including meat, fish, and fresh milk, in order to prevent the fetus from becoming over-weight, thereby prolonging labor; and special herbs boiled in water were used to determine the
time of the day that a woman would deliver. In Sudan, fatty foods and sweets are prohibited (Boucher, 1984). In Mauritania, pregnant and lactating women are prohibited from taking eggs and goat meat (Foyta, 1984). In the Meru community, Kenya, bananas are prohibited for fear of delivering twins.

Traditional beliefs and practices associated with labor include the following: Special herbs were given to women when the umbilical cord became wrapped around the neck of the fetus and in instances of breech presentation; hot water was poured on the abdomen and okra smeared on the vagina to expedite delivery; women who retained the placenta were given a bottle into which to blow air in order to force the placenta out, and a calabash of hot water was placed on the abdomen of women who experienced postpartum hemorrhage to stop the bleeding. Some of these practices are constructive while others are very dangerous to the birth outcomes in Africa (Samuel and Jańe, 2005).

2.2.9 Use of Supplements During Pregnancy

Most pregnant women in the developed countries do not use folic acid as recommended, but a dramatic low usage is seen among the African population, indicating that more widespread information is necessary. Furthermore, fortification of cereals with folic acid should be considered to secure a sufficient intake of folic acid in all fertile women. Periconceptional supplementation with folic acid has been shown to decrease the incidence of neural tube defects (NTD). The neural tube is normally closed by week 6 of pregnancy, before pregnancy is recognized by many women. Since 1998, the health authorities in Norway have recommended a daily supplement of 400 mg folic acid from the month before pregnancy and the first 2 to 3 months of pregnancy. Women at high risk are those;
who have NTD, have previously had a child with NTD or who use antiepileptic drugs. In Norway, all pregnant women are offered free antenatal care throughout pregnancy, including a free ultrasound screening in the second trimester. It has been hypothesized that shorter inter-pregnancy intervals can lead to folate depletion and increased risk of unfavorable pregnancy outcome (McNulty, Cuskelly and Ward, 2000).

Data from developing countries suggest that nutritional supplementation in pregnancy leads to significantly increased total pregnancy weight gain and modest increases in birth weight (30–250 g) in women at nutritional risk (http://grants.nih.gov/grants/guide/pa-files/PA-04-027.html; 2005).

2.2.10 Maternal Weight Gain and Birth Outcome

Low maternal weight conception and low weight gain during pregnancy are independent predictors of poor fetal growth and IUGR (Allen, 2001). In a study done across Egypt, Kenya and Mexico, it was found that women with a higher body mass index (BMI) and skin fold thickness gained significantly less weight during pregnancy. In contrast those with a low BMI gained more weight and consumed significant more energy. Thus, there seems to be a mechanism that regulates food intake and weight gain during pregnancy and this at least in part protects the fetus against low maternal energy and protein intakes (Allen et al., 1994).

The early part of pregnancy usually is accompanied by moderate weight loss caused by the woman's lack of appetite and in some cases nausea and vomiting. Between the third and the ninth month of pregnancy most women gain about 9 kilograms (20 pounds) or
more. Ideally, during pregnancy, body weight is gained at the rate of about 0.5 kilogram (1 pound) per week for a total of not more than 9 to 11.5 kilograms (20 to 25 pounds). In an average pregnancy the infant, the afterbirth, and the fluid in the uterus weigh about 4.5 kilograms (10 pounds). The uterus and the breasts together weigh approximately 2.25 kilograms (5 pounds). The remaining 2.25 kilograms consist of stored fluids and fat. Weight gain exceeding 11.5 kilograms usually represents fat and fluids that are in excess of the reserve requirements for a normal pregnancy. A woman loses approximately 7 kilograms (15 pounds) at delivery, and another 2.25 kilograms of stored fluid are eliminated as the uterus shrinks. She does not lose many additional kilograms during the weeks following the delivery of the baby unless she limits her caloric intake. Fat stored during pregnancy is lost more slowly than stored fluids, proteins, and carbohydrates. Excessive weight gain during pregnancy is a matter of concern for both the patient and the doctor. Although it may be only the result of overeating, it may be caused by a disturbance in metabolism and by an abnormal retention of fluids and salts. In the latter instance it may be the first sign of preeclampsia (De Brouwere et al., 1998).

During pregnancy, nitrogen, derived from the metabolism of ingested protein, is needed for growth of the fetus, the placenta, the uterus, and the mother's breasts and other tissues. A considerable amount of nitrogen also is required for the increase in the mother's red cell volume and blood plasma. The fetus's demand for nitrogen is slight at first, but during the last month of pregnancy it acquires almost half of its total protein. In the process of accumulating this store and of building a reserve for the period after delivery, the woman who is on an adequate diet retains between two and three grams of nitrogen
daily during her pregnancy; by term she and the fetus will have acquired approximately 500 grams (about 1.1 pounds) of nitrogen (De Brouwere et al., 1998).

During pregnancy greater quantities of blood are being processed through the kidneys, but the kidneys are incapable of reabsorbing increased amounts of sugar. Consequently, a lower level of sugar in the blood is tolerated, and slight amounts of sugar are excreted in the urine. During pregnancy the level of sugar in the blood after fasting is slightly lower, probably because there is less usable insulin in the blood to regulate the sugar metabolism. Oral glucose-tolerance tests show a prolonged elevation of blood sugar after ingestion of glucose; this may be an indication that carbohydrate use is less rapid or that the absorption of glucose from the gastrointestinal tract is slower. Glucose-tolerance tests that depend on injection of the sugar solution into the veins show no difference between non pregnant and pregnant non diabetic women. A few women demonstrate diabetes for the first time when they are pregnant, a condition referred to as gestational diabetes. This occurs because pregnancy taxes insulin productivity in women with a marginal pancreatic islet reserve, so that diabetes may first become evident during gestation (Richard et al, 2001; Microsoft Encarta Encyclopedia, 2005).

The total blood lipids average 600 to 700 milligrams per hundred millilitres of blood in the non-pregnant woman. They increase to approximately 900 to 1,000 milligrams per hundred millilitres of blood during the latter part of pregnancy. This increase, which involves all the lipid fractions, has not been explained, but it is worthy of notice that the gain in fat reaches its peak during the period that the fetus acquires most of its adipose (fatty) tissue (Richard et al, 2001).
Pregnancy is characterized by increases in the amount of body water and in the total volume of body fluid. During pregnancy between 3,500 and 4,000 milliliters of fluid (about 3.2 to 3.6 quarts) will be added to that already present in the tissues of a healthy woman. The uterus, the placenta, the amniotic fluid, and the fetus each account for approximately equal amounts. In addition to the water that increases blood volume, there is also added fluid in the mother's muscles, her pelvic soft tissues, her breasts, and her other tissues (Smith et al, 1998; William, 2002).

Low maternal weight gain during pregnancy has been suggested as a cause of intrauterine growth retardation (IUGR). However, pregnancy weight gain and fetal growth vary greatly throughout pregnancy. In 2005, Nathalie carried out a study to establish the relationship between maternal weight gain in individual trimesters to the risk of IUGR. He had a sample of 10,696 women who had enrolled in the National Collaborative perinatal Project (NCPP) and the Child Health and Development Study (CHDS). Low weight gain was defined as <-0.1kg/wk for the first trimester and <0.3kg/wk for the second and third trimester. IUGR was defined as a birth weight <2500g in full term infants. The findings of the study showed that; low weight gain in the first trimester was not associated with an increased risk of IUGR. From the study, after controlling for confounding factors (maternal height, body mass index, parity, race, toxemia, diabetes) it was found that low weight gain in the second trimester was associated with a relative risk of IUGR of 1.8 (1.3-2.6) in the NCPP cohort and 2.6 (1.6-4.1) in the CHDS cohort. Similarly, low weight gain in the third trimester was associated with a relative risk of IUGR of 1.7 (1.3-2.3) in the NCPP cohort and 2.5 (1.7-3.8) in the CHDS cohort. After
correcting for weight gain in other trimesters, this increased risk remained. Increased risk of IUGR was observed with low second and third trimester weight gain across the spectrum of maternal body mass index. The risk of low weight gain in the second or third trimester was significantly lower in teenagers and significantly greater in overweight women and women aged 35 y or older. Low weight gain in either the second or third trimester was associated with a significantly greater risk of intrauterine growth retardation in two distinct cohorts. The conclusion is that increased awareness of maternal weight gain in mid and late pregnancy is critical to identifying infants at risk for IUGR.

Low birth weight (<2500g or <5.5 lbs.) occurs in seven percent of all infants born in the United States and is associated with a mortality rate during the neonatal period (0 to 27 days of life) that is forty times that of infants with normal birth weight. In Kenya, according to a study done in Nyanza hospital in Kisumu, out of 2025 deliveries at the hospital maternity unit, 304 were low birth weight giving an incidence of 15% (Were and Karanja, 1994). Very low birth weight (<1,500g or <3.3 lbs.) is associated with a neonatal mortality rate two hundred times that of infants with normal birth weight. For low birth weight infants that do survive the neonatal period, the incidence of rehospitalization is substantially higher than for infants with normal birth weight, as is the risk of neural-developmental disorders (Rajagopalan 2003). Conclusion drawn clearly reveals that inadequate prenatal care or lack thereof contributes to poor birth outcomes. Studies to increase birth weight by lowering maternal malnutrition and under nutrition throughout the life cycle include: evaluation of the safety and efficacy of maternal caloric
supplementation for reducing low birth weight; design of strategies to improve caloric intake before and during pregnancy with the use of locally available and acceptable food supplements; development of methods to reduce maternal anemia through the use of iron supplements, antihelminths and antimalarials; evaluation of micronutrient supplementation (vitamin A, calcium and zinc) for the reduction of LBW, and improved neonatal health; and testing of optimal delivery methods for micronutrient supplementation of children, adolescents and women (http://www.reproline.jhu.html).

2.3 Summary of the Literature Review

From the reviewed literature it is evident that maternal weight gain during pregnancy has an effect on fetal growth and subsequently on childbirth weight. Any baby with IUGR incidence or is born prematurely is more likely to be of low birth weight. The maternal weight gain is mainly influenced by dietary practices and pre-pregnancy weight. Smoking and alcohol consumption has been found to affect child development.

Other factors that can also contribute to the risk of very low birth weight infants include:

Race: African-American babies are twice as likely to have very low birth weight as Caucasian babies.

Age: Teen mothers (especially those younger than 15 years old) have a much higher risk of having a baby with very low birth weight.

Multiple births: Multiple birth babies are at increased risk of very low birth weight because they are often premature. About 10 percent of twins and one-third of triplets have very low birth weight.
Mother’s health: Women who are exposed to drugs, alcohol, and cigarettes during pregnancy are more likely to have low or very low birth weight babies.

Socioeconomic status: Mothers of lower socioeconomic status are also more likely to have poorer pregnancy nutrition, inadequate prenatal care, and pregnancy complications - all factors that can contribute to very low birth weight.
CHAPTER THREE

METHODOLOGY

3.1 Introduction
This section outlines the procedure used in the study. The section focuses on the research design, study area and population sample size and sampling procedure, data collection and data analysis.

3.2 Research Design
The study adopted a descriptive cross sectional survey to investigate the effect of maternal weight gain on birth outcome and other attributable factors to low birth weight. This is because the descriptive survey method elicited both qualitative and quantitative data. Since it was a case study, it helped in generating in-depth information on the relationship between maternal pregnancy weight gain and birth weights of infants (Mugenda, 2003; Orodho, 2003). The information thus obtained can be used to make generalization about pregnancy weight gain and the expected birth weight of infants.

3.3 Study Area
This study was carried out at Thika district hospital, Central province, Kenya. The hospital is situated in Thika town. It serves health facilities to the six divisions within the district. Thika district is one of the seven districts that form Central Province (Appendix II). According to Thika district health activities annual report (2003), the hospital had a 2% prevalence of infants with low birth-weight in the year 2003. Secondly, the hospital has on average a total of 17890 women attending antenatal clinic per year, hence making it easy to access the target population.
On the other hand, it is the second most populated district in the province after Kiambu district. It has a population density of 329 people per kilometer squared and has a high unemployment rate of 21.4% with an average monthly household income of Kshs 6898.10. Most people in the district are mainly small scale farmers growing coffee and tea. The town is one of the major industrialized towns in Kenya with several processing industries. Most of the people in the town are casual laborers in these industries (Thika district health activities annual report, 2003). This means that majority of the women attending the antenatal clinic are of low socio-economic status.

3.4 Study Population

The target population consisted of all the pregnant women attending the antenatal clinic in Thika district hospital. The accessible population consisted of pregnant women during their second and third trimester attending the antenatal clinic in the hospital. These women are those that delivered in the hospital for easier follow up of the infant’s birth weight.

3.5 Sample Size and Sampling Procedure

Non-probability sampling technique was used to select the study sample. In this case purposive sampling was used. Doctors, nurses and nutrition professionals were used as key informants, but did not form the sample size. The expectant women attending the clinic at Thika district hospital during their third trimester were included for the study upon their consent. Only a woman who regularly attended antenatal clinic and delivered at the hospital were included. A sample size of 149 pregnant women was used. This involved selecting the study sample using set criteria (Orodho, 2004). This was
approximately 10% of women attending antenatal clinic in the year 2003 (Thika District Health Activities; Annual Report, 2003).

This sample size (149) was arrived at by the formula;

\[
10\% \left( \frac{N}{m} \right) \text{ where;}
\]

\[
N = (17890) \text{ Total number of pregnant women who attended antenatal clinic in the year 2003}
\]

\[
m = (12) \text{ Total number of months in a year}
\]

According to Kerlinger (1966) 10-30% of the population forms a representative sample.

3.6 Exclusion Criteria

The study did not include the following:

1. Mothers who attended the clinic only at their third trimester of the pregnancy and those who came to the hospital only for delivery and thus never attended the antenatal clinics. This is because it was difficult to follow their weight changes.

2. Mothers who delivered at home and therefore made it difficult to establish the infant’s birth weight.

3. The study did not include mothers with multiple births. Multiple births may be complicated and result in major differences between the weights of the baby’s born to that particular mother.

4. Mothers with complicated pregnancies e.g. gestational diabetes, high blood pressure and eclampsia.
5. Mothers with previously diagnosed, chronic illnesses such as cardiac diseases, diabetes mellitus, Acquired Immune Deficiency Syndrome (AIDS) and tuberculosis.

6. Mothers who did not consent.

7. Premature births.

8. Infants diagnosed with neural tube defect, chromosomal anomaly or other severe congenital disorders.

9. Doctors, nurses and nutritionists who were key informants.

3.7 Study Assumption

It was assumed that all mothers had access to the best antenatal care.

3.8 Limitation of the Study

The sample for this study consisted of pregnant women attending antenatal clinic at Thika District Hospital. Generalization of these results to other hospitals should be done cautiously.

3:9 Data Collection Instruments

The researcher adopted the interview schedule. A researcher-administered questionnaire was used to get data from the expectant mothers. The tool collected demographic characteristics, supplement use, dietary practices during pregnancy and anthropometrics data of mother during pregnancy and the infant’s birth weight. Information on anthropometric and demographic characteristics was obtained from antenatal clinic cards (Appendix IV).
Secondary/documentary data which included hospital records and the antenatal cards was reviewed to compliment primary data. Finally key informant interviews were sought from experts such as the doctors, nurses and nutritionists. These are people who are knowledgeable and in regular contact with the mothers and so were in a position to provide complementary information on variables of interest to the study. Personal observation was also used to confirm the weight and height of selected mothers and that of their infants.

3:10 Ethical Considerations

A permit to carry out the study was obtained from the Ministry of Education, Science and Technology (Appendix III). Ethical clearance was obtained from Ministry of Health in conjunction with Thika District Hospital management. Confidentiality (respondents were informed) was maintained and data collected used only for the purpose of the study. This was in order to maintain objectivity and to eradicate elements of suspicion from the respondents.

3:11 Training of Research Assistants

Two research assistants were trained to assist in the data collection. They were graduates of Bachelor of Science (BSC) in nutrition from Kenyatta University. They were trained on purpose of the study and how to administer the data collection instruments. Close monitoring was maintained so that reliability of the data was maintained.

3.12 Pre-Testing of the Research Instruments

Pre-testing of the instruments was done to test its validity and reliability. Pre-testing procedure helped to ascertain that the instruments for collecting data collected all the
required information. It also helped to reveal if the anticipated analytical techniques were appropriate (Orodho, 2004). The pretest also helps the research assistants to familiarize with the instruments used for data collection. The researchers sampled 5 pregnant women to participate in the pre-testing of the instrument but were not included in the final sample as names were taken. A retest was repeated after two weeks on the same sample and comparison of answers made and analyzed. A Pearson product moment formula for the test-retest was employed to compute the correlation coefficient in order to establish the extent to which the contents of the questionnaire were consistent in eliciting the same responses every time the instrument is administered. A correlation coefficient of 0.8 was obtained. A correlation coefficient of about 0.8 is considered high enough to judge the instrument as reliable for the study (Orodho, 2004). The results of the pretest were used to improve the instruments in order to enhance the reliability and validity of the final instrument to be used in this study.

3.13 Data Collection Procedures

The researcher and research assistants visited antenatal clinic, and identified expectant mothers who met the study criteria. The 24-hour recall method was used to establish dietary practices. Weight and the height of the mothers were recorded from the antenatal visit cards. The weight was taken with minimal clothing and no shoes using a calibrated electronic scale to the nearest 0.5 kg while the height was taken using a stadiometer while standing upright and without shoes. History pertaining to pregnancy was derived from hospital records and recorded. Information from records was clarified from the respondents. The mother was then visited at birth and the weight of the baby taken using an infant beam scale with an accuracy of 0.1 Kg. Second trimester weight gain was
calculated as the weight gain between the end of the first trimester (16th week from LMP) and the end of the second trimester (26-29 week from LMP) while third trimester weight gain was calculated as the weight gain between the end of the second trimester and delivery.

3:14 Data Analysis and Procedure

Once the data collection was complete, the researcher guided the research assistant through the process of data coding and entry into the computer for analysis. The analysis was done using the statistical package for social sciences (SPSS) software. Descriptive statistics (mean and frequencies) and inferential statistics were used to describe the data. Spearman Rho was used to establish the correction between infant birth weight and mothers weight gain during the third trimester and the mother's energy intake 24 hours prior to the study. Krusal Walis on the other hand was used to establish the relationship between infant birth weight and the other variables including use of supplements, mother's height, first visit to antenatal clinic, mother's income, use of alcohol by mothers during pregnancy, mother's age and their level of education. The data from the 24-hour recall was analyzed using Food UK 0.7 meter software to establish the total amount of selected nutrients in the meals consumed per day. The 24 hour recall involved asking the mothers to mention the meals they had taken the previous day prior to admission to the hospital for delivery. They were further asked to mention the ingredients to the meals, amount taken (in household measure), food served, food consumed and food left over. These data from the 24-hour recall was analyzed using food UK 0.7-meter software to establish the total amount of energy in kilocalorie, proteins, fats, carbohydrates and sugars in grams in the meals consumed per day. The body's food requirements are
expressed in terms of recommended dietary allowances, or RDA. These allowances are the amount of essential nutrients that, if acquired daily, are considered to be sufficient to meet the known nutritional needs of most healthy persons. The Recommended Dietary allowances (RDA) for pregnant women are; energy (2285 kcal), proteins (67g), Fats (64g), Carbohydrates (314g) and sugar (25g) (http://www.nutrition.com.sq/he/herada-adt.asp). The amount of nutrient consumed per day was then compared with RDAs to establish whether there was adequate or inadequate consumption by the pregnant mothers.

3:15 Definition of Variables

Maternal gestational weight gain- this was to be taken as the weight gained by the mother in kilograms during pregnancy during the second and third trimester.

Infant weight- referred to the weight of the infant at birth in kilograms.

Marital Status – This was taken to mean either married or single mother.

Mothers Age – This referred to length of time since the mother was born

Mothers Education Level – this was taken to mean the academic level of the mother

Mothers Income – This meant the approximate amount in Kenyan shillings that the mother earns in a single month

Fathers Age- This referred to length of time since the father was born

Fathers Education Level-this was taken to mean the academic level of the father

Fathers Occupation -This referred to the type of employment whether formal or informal

Fathers Income -This meant the approximate amount in Kenyan shillings that the father earns in a single month
Family Size- This was taken to refer to the number of people who stay under the care of individual household head. It consisted of the respondent, his wife/wives and other siblings or relatives dependent on the respondent.

Alcohol Consumption- referred to the type and amount of alcohol consumed by the pregnant woman per day

Nutrition Status of the Mother- this meant the combined index of energy which included proteins, fats, carbohydrates and sugars.

Mothers Height –is the height of the woman taken without shoes from the ground to the top of the head

Trimester Weight Change- this was the measure of the weight changes during the second or third trimester
CHAPTER FOUR
RESULTS AND DISCUSSIONS

4.1 Introduction
The purpose of this study was to investigate maternal pregnancy weight gain and its relationship with infant birth weight in Thika District Hospital of Kenya. To achieve this purpose, the study sought to achieve the following objectives: first, to determine pregnancy weight gain of women attending antenatal clinic; second, establish the birth weight of infants; third; to identify demographic characteristics and their influence on maternal weight gain and fourth, to assess the relationship between selected behavioural factors and infant birth weight. In particular, the selected variables included; the dietary intakes of the mother, socio-cultural factors, supplement use during pregnancy, and the anthropometric.

This chapter presents the results of the study and specifically it details the socio-economic and demographic characteristics, dietary intake, supplement use and pregnancy weight gain of the respondents. Birth weight results of the infants are also presented.

4.2 Socio- Economic and Demographic Characteristics of Study Subjects
The socio-economic characteristics assessed in the study focused on background details of the mother and those of the father. In particular, mothers’ marital status, age, age at first birth level of education, income, ethnicity, parity, mortality and disease suffered during pregnancy are presented. Partners’ details that were of interest included the level of education and income.
4.2.1 Marital Status of Respondents

The results showed that 84.6% of the respondents were married while those who were single accounted for 15.4%. Single motherhood is a deviation from the traditional social trends as in the past it was uncommon to find unattached single mothers.

4.2.2 Respondents Age

The age of the mothers ranged from 18 - 44 years as can be seen from the Table 4:1. This is the reproductive age of most women. Mothers’ age between 21-25 represented 46.3% followed by those aged 31-35 years and above and those below 20 years who accounted for 16.1% each. Those aged 26-30 years accounted for 14.1% while those aged 36 years and above represented 7.4%. These ages represented those attending the antenatal clinic and does not necessarily represent the age at first birth.

Table 4.1: Mothers Age

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 20 Years</td>
<td>24</td>
<td>16.1</td>
</tr>
<tr>
<td>21-25 Years</td>
<td>69</td>
<td>46.3</td>
</tr>
<tr>
<td>26-30 Years</td>
<td>21</td>
<td>14.1</td>
</tr>
<tr>
<td>31-35 Years</td>
<td>24</td>
<td>16.1</td>
</tr>
<tr>
<td>36 and Above Years</td>
<td>11</td>
<td>7.4</td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td>100</td>
</tr>
</tbody>
</table>
4.2.3 Respondents Age at First Birth

Results show that 26.8% of the mothers had first birth at between 15-19 years. The biggest concentration however was between 20-24 years of age where 63.1% mothers reported first birth. These are the prime ages where most women get married. Age 30-34 years has 0.7% mothers whereas age 25-29 had 9.4% mothers. This is the age when college and university graduates finish schooling and are now available for marriage.

4.2.4 Education Level of Respondents

The study results in Figure 2 shows that one percent of the mothers did not have formal education, 42.5% of the mothers had complete primary education whereas 40% had secondary and college education.
Figure 2: Education level for mothers

4.2.5 Respondents Monthly Income

The result presented in Figure 3 indicates that mothers who earned less than Kshs.1000 per month were 57% of the sample population. This implies that a number of mothers received little pay which could hardly sustain them and their families throughout the month and hence depended on their husbands for subsistence needs. Mothers in high income categories, that is, those who earned over Kshs10,000 per month comprised of 8.1% of the population. Those earning KShs.1,001-5,000 and KShs.5,001-10,000 were 15.4% and 19.5% respectively. Income is important because poverty exacerbates the problem of low birth weight due to nutritional handicaps and inadequate access to food during pregnancy (Rajagopalan, 2003).
4.2.6 Distribution of Mothers by Ethnicity

The results showed that, 78.5% of the mothers were Kikuyus and 12.8% were Kambas, while the remaining 9% were a mixture of Luos (3.4%), Kisiis (2%), Luhyas (1.3%) and Merus (1.3%). Kikuyus and Kambas were the majority largely because Thika District hospital is in the Central Province of Kenya whose original inhabitants are the Kikuyu. There is a high percentage of Akamba because they live in Eastern Province which neighbours Central province near Thika district. Different ethnic groups in Kenya have different cultures and food taboos which could have a bearing on infant birth weight (K.D.H.S. 2003).

4.2.7 Parity of Mothers

Parity refers to the number of children a particular woman has given birth to. This was important since large families quickly exhaust family income and resources.
Table 4.2: Parity of mothers

<table>
<thead>
<tr>
<th>Number of children</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>12</td>
<td>8.1</td>
</tr>
<tr>
<td>1-3</td>
<td>113</td>
<td>75.8</td>
</tr>
<tr>
<td>4-6</td>
<td>17</td>
<td>11.4</td>
</tr>
<tr>
<td>7 and Above</td>
<td>7</td>
<td>4.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>149</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

These factors tend to limit food availability at household level. As a result, this might affect the feeding habits of the expectant mother and hence the infant birth weight. Table 4.2 shows that mothers who had 1-3 children represented 75.8%. This category had the highest percentage although the number of children is slightly smaller than that indicated in KDHS (2003) which showed that the mean ideal family size is 3.9 children. The difference in the figures could be as a result of the differences in the sample studied. This study focused on Thika district while the KDHS (2003) was a nation wide study which often conceals regional disparities.

4.2.8. Mothers’ Stature

Mother’s stature is a significant factor in determining infant birth weight. Stunting has generally been considered as predetermined by a kind of a vicious cycle that involves small babies who grow to become small adults, who subsequently give birth to small babies (Merchant, 1994).
Table 4.3 Mothers distribution by height

<table>
<thead>
<tr>
<th>Mothers Height (cm)</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>145-148</td>
<td>3</td>
<td>2.0</td>
</tr>
<tr>
<td>148.1-151</td>
<td>5</td>
<td>3.4</td>
</tr>
<tr>
<td>151.1-154</td>
<td>12</td>
<td>8.1</td>
</tr>
<tr>
<td>154.1-157</td>
<td>20</td>
<td>13.4</td>
</tr>
<tr>
<td>157.1-160</td>
<td>24</td>
<td>16.1</td>
</tr>
<tr>
<td>160.1-163</td>
<td>30</td>
<td>20.1</td>
</tr>
<tr>
<td>163.1-167</td>
<td>31</td>
<td>20.8</td>
</tr>
<tr>
<td>170.1-173</td>
<td>6</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Mean mothers height = 160.107 cm

The results presented in Table 4.3 shows that 5.4% of the women were below 150 cm. with a majority (94.6%) measuring above 150 cm in height. The mean mother’s height was 160.1 cm. This is approximately the same with the national mean height for a woman which was 159 cm according to KDHS 2003 survey. Similarly, KDHS (1998) indicates that 6% of mothers were shorter than 150 cm. The short stature among the mothers was attributed partly to malnutrition experienced during childhood and also partly to genetic factors. Be that as it were, short height often predisposes women to higher risk of complications during delivery and the risk of giving birth to children with low birth weight.
4.2.9. Infant mortality

The results of the study indicated that 23.5% of the mothers reported that they had children who had died. Premature birth, fetal malnutrition, and failure to exclusively breastfeed were largely cited by the key informants (doctors, nurses and nutritionists) as the leading risk factors for the early death. Other indirect causes of prenatal and neonatal death were cited as severe illness in a newborn, poor care-seeking behavior, and inadequate access to good quality medical care. Underlying these direct and indirect causes is widespread poverty, illiteracy and gender discrimination faced by both mother and her female children in developing countries. However, majority of the mothers (80.5%) indicated that they had experienced no problem with the delivery and only 19.5% indicated that they had suffered a problem during pregnancy. Infant mortality rates tend to be lower in developing countries in which women have some education, even if incomes are low. However, as a result of poor nutrition and health problems, infant mortality rates among the poor are higher, and life expectancies are lower (Menge, Esamais, Van and Anabwani, 1992). Maternity facilities in Kenya are also equipped to assist in delivery of the new born babies and this explains the low incidence of maternal delivery problems. Among those who had complications included stillbirth, blood transfusion, abortion, prolonged labor and abdominal pains. Pregnant women can help prevent birth defects by observing proper prenatal care and seeking genetic counseling (Microsoft Encarta Encyclopedia, 2005).
4.2.10 Disease Suffered by Respondents During Pregnancy

The study results showed that the most prevalent disease during pregnancy was malaria (14.8 %). This is essentially because malaria is one of the tropical diseases prevalent in most parts of Kenya with its prevalence in Central Province standing at 49% of population with malaria symptoms. This places the region second after Nyanza province in occurrence of the disease (K.D.H.S, 2003). The prevalence of malaria among pregnant women had fallen significantly due to prescription of two doses of intermittent preventive treatment (IPT) in the second and third trimester. The hospital records indicated further that only, 2% of the respondents had anemia which could develop when the body's iron loss is high and its iron stores are depleted. This may happen especially during pregnancy and can be worsened by malarial infections (Encyclopedia Britannica, 2001).

There were other diseases which were reported among pregnant women in the region such as hypertension, eclampsia and diabetes, but the prevalence of these diseases could not be established since those with these diseases were excluded from the study since they could tilt the findings because of their known effects on pregnancy birth outcomes. Nonetheless, those who suffered from malaria were included in the study.

4.2.11 Smoking and Alcohol use by Respondents

All of the interviewed respondents did not report to have smoked cigarettes during their pregnancy. From the analysis 97.3 % of the mothers did not consume alcohol while 2.7% used alcohol at one point during pregnancy. This concurs with study findings at Muhumbili hospital in Dar-es-Salaam, Tanzania where 90.4% of mothers never took
alcohol while 9.6% took alcohol (Mandia, 1996). The type of alcohol the mothers reported to have taken are the regular over-the-counter beers’ and the local brews.

4.2.12 Education level of the Fathers/Husbands

The study results presented in Figure 4 shows that the percentage of the fathers/husbands who had more than secondary education was 67%. This percentage is higher than that of the mothers (Figure 4). There is a probability that the higher the fathers education level, the better the intra household food distribution which benefits the pregnant mother. Most men than women participated in either formal or informal employment. The ratio of unemployed men to women was 13:88 and the ratio of employed men to women was 109:62. This shows that more women than men were unemployed (10.7% of the men were unemployed in contrast to 59.1% of the women). Furthermore, Rono (2002) argues that foodstuffs such as meat or fruits may be considered as ‘luxurious’ by the less educated but are considered essential for the highly educated. These results indicate that there could be an indirect relationship between mothers’ weight and hence infants’ birth weight.
Figure 4: Education level of fathers/husbands

4.2.13. Income Levels of Fathers/Husbands

Income is money or other gain or return resulting from goods or services produced in a given period of time, usually measured annually. Although data was collected on father income wherever possible, exaggerations could not be ruled out due to mothers' unwillingness to be interviewed on matters on partners/fathers income.
Figure 5: Income levels of fathers/husbands

The results in Figure 5 shows that the highest proportion (37.3%) earned income in the range of 8,000-14,999 while those who earned above 30,000 were only 4.0%. The informal sector’s contribution to total employment was 86.2 % with the formal employment contributing only 3.3%. The highest fathers’ income recorded by the study was KShs.40,000 per month. Generally, husbands who had higher education (More than form four education) and age (more than 32 years of age) earned more income compared to those who had less education (primary level) or no education at all.

4.3. Pregnant Women Dietary Intake

Dietary intake during pregnancy was assessed using a weekly food frequency and the 24-Hour recall method from which the consumption of essential nutrients was established.
4.3.1 Weekly Food Frequency

The results presented in Table 4.4 indicate that the most popular foods consumed by the pregnant women attending antenatal clinic at Thika hospital include sugar (87.3%) vegetables (83.9%) and milk (76.5%). The percentages of sugar and milk were high because most pregnant women took tea for breakfast, during the mid-morning snack and before going to bed. The tea was made with milk and sugar was added. Other commonly consumed foods as is shown in Table 4.4 included beans (68.5%), fat (45.0%), potatoes (55.0%), bread (53.0%), maize (45.0%) ugali (42.35), porridge (40.3%), meat (32.2%), fruits (26.95), rice (26.3%) chapati (6.1%), green bananas (10.7%) and eggs (7.4%). ‘Ugali’ is a gruel made from maize flour while ‘chapati’ is made from wheat flour by kneading the flour and then cooked with a frying pan using cooking oil.

Table 4.4: Commonly consumed foods by the pregnant women

<table>
<thead>
<tr>
<th>Type of food</th>
<th>% of respondents who consumed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>26.2</td>
</tr>
<tr>
<td>Milk</td>
<td>76.5</td>
</tr>
<tr>
<td>Porridge</td>
<td>40.3</td>
</tr>
<tr>
<td>Chapati</td>
<td>16.1</td>
</tr>
<tr>
<td>Bread</td>
<td>53.0</td>
</tr>
<tr>
<td>Green bananas</td>
<td>10.7</td>
</tr>
<tr>
<td>Ugali</td>
<td>42.3</td>
</tr>
<tr>
<td>Meat</td>
<td>32.2</td>
</tr>
<tr>
<td>Fat</td>
<td>67.1</td>
</tr>
<tr>
<td>Beans</td>
<td>68.5</td>
</tr>
<tr>
<td>Vegetables</td>
<td>83.9</td>
</tr>
<tr>
<td>Eggs</td>
<td>7.4</td>
</tr>
<tr>
<td>Potatoes</td>
<td>55.0</td>
</tr>
<tr>
<td>Sugar</td>
<td>87.3</td>
</tr>
<tr>
<td>Fruits</td>
<td>26.9</td>
</tr>
<tr>
<td>Maize</td>
<td>45.0</td>
</tr>
</tbody>
</table>

N=149
*Multiple responses allowed.
4.3.2 Consumption of Essential Nutrients

The amount of food consumed within a period of 24 hours prior to the study time was recorded using the 24-Hour recall method. From these quantities the amount consumed was computed using the Food Meter UK-07 and the amount of nutrient consumed per day was compared with the RDAs to establish whether there was adequate or inadequate consumption by the pregnant mothers. The Recommended Dietary allowances (RDA) for pregnant women are; energy (2285 k/cal), proteins (67g), Fats (64g), Carbohydrates (314g) and sugar (25g) (http/ww.nutrition.com.2005).

Table 4.5: Mothers nutrient intake

<table>
<thead>
<tr>
<th>Nutrients/Energy Intakes</th>
<th>&lt;RDA n (%)</th>
<th>&gt;RDA n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>95 (63.8)</td>
<td>54 (46.2)</td>
</tr>
<tr>
<td>Fat</td>
<td>74 (49.7)</td>
<td>75 (50.3)</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>72 (48.3)</td>
<td>87 (51.7)</td>
</tr>
<tr>
<td>Sugars</td>
<td>52 (34.9)</td>
<td>97 (65.7)</td>
</tr>
<tr>
<td>Energy</td>
<td>53 (35.6)</td>
<td>96 (64.4)</td>
</tr>
</tbody>
</table>

The results in Table 4.5 indicate that mothers with less than 67g of protein comprise 63.8% of the respondents. Food rich in proteins such as meat, fish and poultry were considered expensive to purchase and so not affordable to most mothers whose income were relatively low. As depicted earlier (Figure 3), most mothers were low-income earners. Nonetheless, protein is required for the growth of new tissues in pregnant women and its consumption in sufficient quantities is therefore essential for the growth and development of the fetus.
The results further indicate that mothers who did not consume the recommended quantities of fats and carbohydrates RDAs were 49.7% and 48.3% respectively. Fat and Carbohydrates such as animal cooking fats, *ugali* (gruel of maize flour) are more readily available compared to proteins. It was however unfortunate that slightly below half of the mothers could still not afford to consume adequate quantities of carbohydrates and fats.

Those who were under the required sugar RDA comprised of 34.9% of the population. The total energy count had 35.6% of the respondents below the acceptable RDA. This is in contrast to a study done by Kusin in 1984 who argues that energy attainment during the last trimester go down due to uterine size interference with consumption of bulky diets (such as maize and beans common in Kenya).

A pregnant mother needs more calories (about 250 K/cal.) than an adult who works at a desk. Proteins, fats and carbohydrates are macro nutrients which when taken by pregnant women result in weight increase. This translates to infants with higher birth weight outcome (Mathews, 2005).

### 4.3.3 Use of Supplements During Pregnancy

The result presented in Table 4.6 indicates that most pregnant women (47%) used iron folate, followed by iron (28.9 %). The least used supplements by the respondents were iron sulphate folate and iron multivitamin folate which comprised of 0.7% each. Supplement intake especially iron and iron folate were common among the respondents.
(85.9%) to supplement the iron deficiency among pregnant women. This is attributed by the fact that the respondents were those that regularly attended antenatal clinic and during their visits, they were given the supplements. Folic-acid-deficiency anemia is as a result of a deficient intake of folic acid which is needed for the formation of heme, the pigmented, iron-containing portion of the hemoglobin in red blood cells. This explains the doctors’ prescription of iron and folic acid supplements intake as shown in table 4.7.

Some studies have indicated that pregnant women who consume too little folate have an increased risk of bearing a child with spina bifida (Manisha, 2005). For this reason many women are advised to take a folate tablet regularly while pregnant. Results show that 90.1% of the women reported using supplements during pregnancy. Over half of the respondents (63.7%) started taking the supplements in their 6th and 7th months. This is also the case with the first visit to the clinic with the pregnancy. Mothers who visited the antenatal clinic in the 6th month form 31.5% of the population while those who visited the clinic during the 7th month form 28.5%. These two categories total to 61.4%, which is over half of the sample population. Those who went to the clinic early enough in their pregnancy between the first and fourth month represent only 20.8% of the respondents. This clearly shows the need to educate mothers at the Thika District and its environs the advantages of early antenatal care.
### Table 4.6 Supplement use and first visit to the antenatal clinic

<table>
<thead>
<tr>
<th>Obstetric Characteristic</th>
<th>Frequency n=149</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Supplement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron folate</td>
<td>70</td>
<td>47.0</td>
</tr>
<tr>
<td>Iron</td>
<td>43</td>
<td>28.9</td>
</tr>
<tr>
<td>Iron folic acid</td>
<td>7</td>
<td>4.7</td>
</tr>
<tr>
<td>Folic acid</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>Iron sulphate folate</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Multivitamin</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>Iron vitamin</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>Folate</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Iron multivitamin folate</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Missing</td>
<td>20</td>
<td>13.5</td>
</tr>
<tr>
<td><strong>Period at the start of use of supplements</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Months</td>
<td>4</td>
<td>2.7</td>
</tr>
<tr>
<td>3 Months</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>4 Months</td>
<td>17</td>
<td>11.4</td>
</tr>
<tr>
<td>5 Months</td>
<td>9</td>
<td>6.0</td>
</tr>
<tr>
<td>6 Months</td>
<td>41</td>
<td>27.5</td>
</tr>
<tr>
<td>7 Months</td>
<td>45</td>
<td>30.2</td>
</tr>
<tr>
<td>8 Months</td>
<td>13</td>
<td>8.7</td>
</tr>
<tr>
<td>Missing</td>
<td>19</td>
<td>12.8</td>
</tr>
<tr>
<td><strong>First visit to the clinic with the pregnancy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Month</td>
<td>3</td>
<td>2.0</td>
</tr>
<tr>
<td>2 Months</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>3 Months</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>4 Months</td>
<td>25</td>
<td>16.8</td>
</tr>
<tr>
<td>5 Months</td>
<td>18</td>
<td>12.1</td>
</tr>
<tr>
<td>6 Months</td>
<td>47</td>
<td>31.5</td>
</tr>
<tr>
<td>7 Months</td>
<td>43</td>
<td>28.9</td>
</tr>
<tr>
<td>8 Months</td>
<td>6</td>
<td>4.0</td>
</tr>
<tr>
<td>9 Months</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Missing</td>
<td>3</td>
<td>2.0</td>
</tr>
</tbody>
</table>

### 4.4 Pregnancy Weight Gain

The results in Table 4.7, indicate that in the 2nd trimester weight change were grossly misrepresented largely because the cards were lacking data on the second trimester weight changes since fewer mothers begin their clinics during the first trimester. Because of this only data for the third trimester weight gain were used in further analysis.
purposes of description we include data on 2nd and 3rd trimesters weight changes but for analysis we considered only the 3rd trimester weight change. 50.3% of the pregnant women gained between 0.01 – 3.5kg. A quarter of the respondents (14.1%) lost weight during the third trimester. This could be due to several factors, such as the chronic disease, hyper emesis, gravidarum, errors and malnutrition.

Table 4.7 Trimester weight changes

<table>
<thead>
<tr>
<th>weight changes interval</th>
<th>Second trimester weight change in Kg</th>
<th>Third trimester weight change in Kg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>percentage</td>
</tr>
<tr>
<td>-1.50-0</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>0.01-3.5</td>
<td>19</td>
<td>38</td>
</tr>
<tr>
<td>3.51-5.0</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>5.01-7.5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>7.51-9.0</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>9.01-11.5</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Mean baby's weight = 3.12 kgs

This means that if the mother does not eat small meals frequently and does not have sufficient food reserves, this is likely to negatively affect birth outcome (Kusin et al, 1984). Between the third and the ninth month of pregnancy most women gain about 9 kilograms (20 pounds) or more (Encyclopedia Britannica, 2001; Simon and Schuster, 2005).

4.5. Infants' Birth Weight

The results in Figure 6 shows that 12.7% of the babies were of LBW while 81.7% had normal weight at birth and 5.6% were overweight. A baby weighing between 2.5-4.4kgs
is of intermediate weight and is more likely to survive. Babies with larger birth weight and intermediate birth weight have more chances of survival and are more likely to survive to reproductive age (Madaras and Lynda, 1983; Manisha, 2005).

Figure 6: Baby’s weight at birth

4.6 Correlates of Infants Birth Weight

Spearman rho was used to establish the correlation between infant birth weight and mothers gestational gain during the third trimester and the mothers’ energy intake 24-hours prior to the study. Kruskal Walis on the other hand was used to establish the relationship between infant birth weight and the other variables including use of supplement, mothers’ height, first visit to antenatal clinic, mothers income, use of alcohol by mothers during pregnancy, mothers age and mothers level of education.
Table 4.8 Kruskal Wallis Multivariate analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>H</th>
<th>df=</th>
<th>P=</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother’s height</td>
<td>34.081</td>
<td>8</td>
<td>0.000</td>
</tr>
<tr>
<td>Supplement use</td>
<td>5.99</td>
<td>1</td>
<td>0.014</td>
</tr>
<tr>
<td>First visit to clinic</td>
<td>2.420</td>
<td>2</td>
<td>0.298</td>
</tr>
<tr>
<td>Mother’s income</td>
<td>2.067</td>
<td>3</td>
<td>0.559</td>
</tr>
<tr>
<td>Alcohol consumption</td>
<td>2.37</td>
<td>1</td>
<td>0.124</td>
</tr>
<tr>
<td>Mother’s age</td>
<td>8.878</td>
<td>4</td>
<td>0.064</td>
</tr>
<tr>
<td>Mother’s level of Education</td>
<td>0.073</td>
<td>2</td>
<td>0.964</td>
</tr>
</tbody>
</table>

4.6.1 Third Trimester Weight Change and Infants’ Birth Weight

The Spearman’s rank order bivariate correlations indicating trimester weight gain is positively associated with baby’s weight at birth ($r_s = 0.086$; $p=0.314$; $n=140$). However the relationship is not significant at 0.05 level of significance. This is not in line with Allen (2001) findings which indicated that there was a significant positive correlation between pregnancy weight gain and infants birth weight. The observed difference could be attributed to the fact that in this study as indicated earlier over 90% of the women did not obtain the recommended weight gain during their third trimester. The low weight gain was very hard to explain since many of the mothers begun their antenatal clinics late in their second trimester or at the beginning of the third trimester. Consequently, the study did not include the first and the second trimester weight changes since most mothers attended the clinic from the seventh month, and so information for the first and second trimesters was lacking from the antenatal clinic cards.
4.6.2. Mothers' Height and Infants Birth Weight

The results of Kruskal Walis test indicated that there was a significant relationship between the mothers height and infants birth weight. Mothers who had shorter stature had lower mean rank scores relative to their tall counterparts. This is concurrent with the findings in the report in Comptons Interactive Encyclopedia, (1998) that shows that in a study done in the USA shorter women recorded less babies' weight at birth than taller women in the ratio of 5:2. The increased risks among women of shorter stature, the authors note, is that women with shorter stature have hormonal predispositions that models a kind of a cycle that results in stunted growth even for future generations. In addition, women’s diminutive height is an indication of poor nutrition (International Family Planning Perspectives, 2001).

4.6.3 Supplement use and Infants' Birth Weight

The results of Kruskal Walis test indicated that there is a significant relationship between the use of supplement during pregnancy and the infants’ birth weight. Those who used supplements had a relatively lower mean rank (68.2) relative to those who did not use supplements (93.61). Thus those who used supplements during pregnancy had lower infants birth weight than those who did not use any at all. The results are different from other studies (http://grants.nhi.gov) where the use of supplements had a significant influence on the mothers weight gain but moderate influence on the infants birth weight. The differences in the influence of the use of supplement could be attributed to the tendency of many pregnant women to attend antenatal clinics during the third trimester. The use of supplements had a negative influence on the birth weight since many women began its use later in their pregnancy.
4.6.4 First Visit to the Clinic and Infants’ Birth Weight

The results of Kruskal Walis test showed that there is no significant relationship between the time for the first visit to the antenatal clinic. Nonetheless the results indicated that those who attended the antenatal clinic during the first trimester, though few, had a higher mean rank score (82.08) followed by those who attended during the second trimester (73.13) while those who attended in the last trimester had the lowest mean rank score (63.35). thus those who attend the antenatal clinic earlier in their pregnancy had better chances of improving their infants’ birth weight. However some women do not recognize these benefits, receiving inadequate prenatal care or no prenatal care at all. Thus most women in the study received inadequate care.

4.6.5 Dietary Intake and Infants Birth Weight

The results of Spearman’s rank order bivariate correlations ($r_s = 0.191; p = 0.023$) indicated that mothers dietary intake is significantly and positively correlated with the infants birth weight at 0.05 level of significance. This means that mothers with better nutritional status gave birth to babies with higher birth weight. An individual needs varying amounts of each essential nutrient, depending upon such factors as gender and age. Specific health conditions, such as pregnancy and breast-feeding make unusual demands on the body and increase its need for nutrients. Dietary guidelines, which take many of these factors into account, provide general guidance in meeting daily nutritional needs (Manisha, 2005).
4.6.6 Mothers’ Income and Infants’ Birth Weight

The results of Kruskal Walis test indicated that there is no significant relationship between the mothers’ income and infants birth weight. Those mothers who earned more than KShs 10,000 had the highest mean rank score (84.94) followed by those who earned KShs 1,001-5000 (77.61), less than KShs 1000 (70.20) and Kshs 5,001-10,000 (65.98). This means that those who earned more than ten thousand had better chances of giving birth to infants with relatively higher weights. The relatively low influence of the mothers’ income on the infants birth weight could be attributed to high dependency of most women upon their husbands since many are likely to be unemployed.

4.6.7 Alcohol Consumption and Infants Birth Weight

The results of Kruskal Walis test showed that there was no significant relationship between alcohol consumption and infants birth weight at 0.05 level of significance. However those who had not used alcohol recorded a higher mean rank score than those who had taken alcohol during their pregnancy. These results are different from a US study that showed smoking and alcohol consumption during pregnancy are significantly related to the occurrence of low birth weight (Faden and Dufour, 1997). The observed difference could be as a result of low alcohol consumption among women in this study. Moreover, those using alcohol may be from affluent families and may have had controlled consumption.

4.6.8 Mothers’ Age and Infants Birth Weight

The results of Kruskal Walis test indicated that mothers age was not significantly related to the infants’ birth weight at 0.05 level of significance. Nonetheless, mothers who were
aged 35 years and above had the highest mean rank score (88.36) followed by those aged 21-25 years, those aged 31-35 years, 26-30 years and below 20 years. These results slightly differ with those of the Kenya Demographic and Health Survey (2003) and International Family Planning Perspectives (2001) in Kenya, who gathered information on women's background characteristics, as well as on pregnancies and births that occurred during the previous five years. A total of 5,295 births for which complete information was available were included in the analyses of factors associated with adverse birth outcomes. According to the women's accounts, 4% of these births were premature, 5% of the deliveries were by cesarean and 15% of the infants were smaller (weighed less) than average. The younger the mother, the higher were the chances of giving birth to smaller infants. This concurs with study findings done in Muhimbili hospital Dar-es-Salaam Tanzania, where it was found that the number of low birth weight babies decreased with mothers age (Mandia, 1996). These differences could be as a result of the variations in the study subjects. In the current study premature births and still births were not included while in the KDHS (2003) all the pregnancies were accounted for.

4.6.9 Mothers’ Level of Education and Infants Birth Weight

The relationship between the mothers’ level of education presented one of the most astonishing results. The results of analysis carried out by Kruskal Walis test indicated that there was no relationship between the mothers level of education and the infants birth weight. Surprisingly, those with class 8 or below had the highest mean rank score (71.24) followed by secondary level (69.4) and secondary with some college training (68.9) This was a strange occurrence and phenomenal as more educated mothers have access to information on better nutrition. This could suggest that traditional foods which are relied
upon by less educated mothers were more nutritious compared to modern foods. There is also a probability that the less educated have time for kitchen gardening where they grow nutritious foods. This contrasts with study findings at Korle-Bu teaching hospital in Ghana whose results showed that those pregnant mothers who had never been to school had a significantly lower mean birth weight (Klukio, Lassey, Annan and Wilson, 2001).
CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION
This section presents summary, conclusion and recommendations of the study. It reviews the major findings relating them to each other and to other studies before drawing a conclusion and presenting recommendations for practice and further research.

5.2 SUMMARY
The purpose of this study was to investigate maternal pregnancy weight gain and its influence on infants birth weight. The study results showed that 92.1% of the women in the study sample did not attain the recommended weight gain for their third trimester. Moreover, 20.7% of the mothers either did not add any weight or lost weight instead.

The infants birth weight indicated that 12.7% of the infants born in the study cohort were of LBW. This was above the 11% national average indicated by KDHS (2003).

The study however found a weak positive correlation between the mothers third trimester weight gain and the infants birth weight. These were not in line with the findings by Allen (2001). This low correlation could have been as a result of the high number of women failing to obtain the required weight gain during pregnancy.

Mothers’ height proved to be a significant predictor of infants birth weight. This is in line with the findings of Nam and Philliber (1984). Mothers with shorter stature were at
greater risk of giving birth to babies with low birth weight. The nutritional behaviour of mothers during pregnancy did not change the influence of this biological factor.

The use of supplements was a significant predictor of the infants birth weight. However, it had a negative influence on the infants birth weight. This was a contradiction with other findings (http://www.grants.nih.gov). There has been results indicating modest change in infants birth weight of mothers using food supplement and a significant increase in weight gain on mothers using food supplements. This was not the case here since many mothers did not gain the recommended 0.3 Kg/Week during their third trimester. Moreover, many of the pregnant mothers begun following up their antenatal clinics during the last part of their second trimester or during the third trimester of their pregnancy.

The timing of the mothers first visit to the antenatal clinic did not however, have a significant relationship to the infants birth weight. Nonetheless, there were stronger indications that those who had began their clinics earlier had relatively higher infants birth weights followed by those who begun in the third trimester. The infant birth weight thus modestly improved for those beginning their clinics earlier.

The intake of energy giving food 24-hours prior to the study by the pregnant women had a significant positive correlation with the infants birth weight. This was in line with the findings of Manish (2005) who found the intake of energy giving food an important predictor of the infants birth weight.
The mother's income levels was found not to have a significant relationship with the infants birth weight. This was expected since in many developing countries there is high dependency of women on their husbands since many of them are unemployed.

The use of alcohol also presented a different result with those of PHC (1994) who indicated that those using alcohol during pregnancy are more likely to have low birth weights. In this study very few pregnant women consumed alcohol. Alcohol consumption did not have a significant relationship to infants birth weight. The difference in the findings could be attributed to the low prevalence (3%) of alcohol consumption during pregnancy in this cohort.

The mother's age did not have a significant relationship with the infants birth weight. However, those who were elderly recorded high mean rank score than those in the other age categories. The influence of age was however mixed with those with lower age especially 21-25 doing better than those between ages 26-30 and 31-35 years. This was however different from Mandia (1996) findings that showed the number of low birth rates reduced by the mother's age.

5.3 CONCLUSION

From the study findings there was inadequate weight gain among women in the study sample. However, this did not adversely affect the birth weight of infants who recorded a larger majority as having normal birth weight or higher except for 12.7% of the infants who were of LBW. The major positive predictors of infants birth weight included the mother's stature, and dietary intake. The use of supplements was found to be a negative
predictor largely because most women begun their usage late in their pregnancy. Other factors gave some stronger indications though were found not to be significant at 0.05 level of significance. These included, third trimester weight gain, timing of first visit to the antenatal clinic, mothers’ income, use of alcohol by mothers during pregnancy, mothers’ age, and level of education.

5.4 RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made:

1. There is need to educate mothers at the Thika District and its environs the advantages of early antenatal care.

2. The Nutritionists at Thika District Hospital need to assess the dietary intake of the pregnant mothers every time they attend the antenatal clinic. This would help in identifying mothers with low energy intake, hence initiate interventions that would benefit the infant.

3. There is need for the doctors/health care givers to closely monitor pregnant women weight gain during the second and third trimester in order to identify those women whose weight does not increase at 0.3kg/week. This way it is possible to initiate an intervention early enough that would prevent IUGR hence low birth weight infant.

5.5 SUGGESTIONS FOR FURTHER RESEARCH

It is recommended from the findings of this study that further research should be carried out in the following areas
1. This study was limited to Thika District Hospital, thus similar studies are needed for other district hospitals.

2. A study on the effects of HIV/Aids on birth weight outcome is recommended.

3. A study on maternal micro nutrient intake and birth outcome.

4. A study should be carried out on pregnancy weight gain from conception and its effect on birth weight.

5. There is need to conduct a study on the determinants of low pregnancy weight gain among pregnant women.

6. A study need to be conducted on the health seeking behaviour of pregnant women to establish why they begin much later during their pregnancy.
REFERENCES


Hackney, Hospital (1999). A Think Tank on Nutrition in the Primary Prevention of Low Birth Weight, Cerebral Palsy and related Handicaps Institute of Brain Chemistry and Human Nutrition, Hackney Hospital.


http://ih.jhsph.edu/chr/fhacs/neonatal2.htm as retrieved on 9 Sep 2005 05:46:38 GMT.


Hytten, F. (1990). "Is it important or even useful to measure weight gain in pregnancy?" *Midwifery* 6(4):28-32


Appendix I: The Study Questionnaire

MATERNAL PREGNANCY WEIGHT AND BIRTH OUTCOME: A CASE STUDY OF THIKA HOSPITAL.

Questionnaire No. _____ Name of the Interviewer _______________________

Date of the interview ____________
Date checked by researcher ____________

Demographic Data

<table>
<thead>
<tr>
<th>Name</th>
<th>Sex</th>
<th>Age</th>
<th>Religion</th>
<th>Education Level</th>
<th>Occupation</th>
<th>Income</th>
<th>Tribe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Husband/partner</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Obstetrics Data

1. How many months is your pregnancy?
   a. First trimester (0 – 3 months) □
   b. Second trimester (4 – 6 months) □
   c. Third trimester (7 – 9 months) □

2. How old were you when you gave birth to your first child?
   a. 15 – 19 □
   b. 20 – 24 □
   c. 25 – 29 □
   d. 30 – 34 □
   e. 35 – 39 □
   f. 40 – 44 □
   g. 45– 49 □

3. How many children do you have?
   a. 1 – 3 □
   b. 4 – 6 □
   c. 7 – 9 □
   Other (specify)
4. How many pregnancies have you had?
   a) 1
   b) 2
   c) 3
   d) 4
   e) More than 4

5. Out of these pregnancies are all the children living?
   a. YES
   b. NO

6. If no, how many have died?
   a. 1
   b. 2
   c. 3
   d. Other (specify)

7. Did you have any problems with any of the deliveries?
   a. Yes
   b. No

8. If yes, what were the problems?

9. When did you first visit the clinic with this pregnancy?

10. Have you suffered from any of the following problem during your pregnancy?
    a) Anaemia
    b) Hypertension
    c) Eclampsia
    d) Malaria
    e) Swelling of feet
    f) Diabetes
    g) Other (specify)
SOCIAL AND CULTURAL DATA

1. Do you have any food taboos during pregnancy?
   a. Yes □
   b. No □

2. If yes what are they?

3a) Are there any cultural practices or beliefs known to you, which stop you from eating certain foods?
   a. Yes □
   b. No □

5. If yes what type of foods.

5. What type of foods do you crave for during pregnancy?
   a. Yes □
   b. No □

6. What kinds of foods do you dislike to eat during pregnancy?

7. Do you smoke cigarettes
   a. Yes □
   b. No □

8. If yes, how many cigarettes per day?

9. Do you take alcohol?
   a) Yes □
   b) No □

10. Please tick any of the drinks below that you have used during this pregnancy.

<table>
<thead>
<tr>
<th>Name of drink</th>
<th>Amount in household measure</th>
<th>Amount in metric measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whisky</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brandy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local brew</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Pregnant woman food intake: 24-hour Recall**

Please let me the foods that you consumed in the last 24 hours, the amounts, ingredients, the amounts served, amount consumed and the left over.

<table>
<thead>
<tr>
<th>Meal</th>
<th>Dish</th>
<th>Name of ingredient</th>
<th>Amount in household measure</th>
<th>Amount in metric measure</th>
<th>Amount of food served</th>
<th>Amount of food consumed</th>
<th>Amount of food left over</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Do you use supplements during pregnancy?
   a) Yes ☐
   b) No ☐

2. If yes at what period do you start using the supplements? _________

3. What type and amount?
   i) Type __________________________
   ii) Amount _______________________

4. At what frequency do you use the supplements? _____________________
Mothers anthropometry and baby’s weight at birth

Mother’s height ______________________

Trimester weight changes measurements of mother

i) 2\textsuperscript{nd} trimester weight changes (0.1kg) average reading at the end of the month

<table>
<thead>
<tr>
<th>4\textsuperscript{th} month (kg)</th>
<th>5\textsuperscript{th} month (kg)</th>
<th>6\textsuperscript{th} month (kg)</th>
<th>Weight changes (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ii) 3\textsuperscript{rd} trimester

<table>
<thead>
<tr>
<th>7 month (kg)</th>
<th>8 month (kg)</th>
<th>9\textsuperscript{th} month (kg)</th>
<th>Average weight changes (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

iii) Baby’s weight at birth --------------- kilograms

iv) Gestation period at time of birth ________
Appendix II: Map of Thika District

Source: Thika District Health Annual Activities Report, 2003
# APPENDIX IV: THE ANTENATAL VISIT CARD

| Name of Mother | Age | Parity | Last Menstrual Period | Present Height | Last Body Weight | Present Body Weight | Present BMI | Baby Growth in Previous Visit | Present Fetal Heart Rate | Present Fetal Movement | Present Complaints | Present Observations | Present Prognosis | Pregnancy Outcome | Delivery Method | Complications | Recommended Follow-Up |
|----------------|-----|--------|-----------------------|----------------|-----------------|--------------------|---------------|-------------------------------|------------------------|----------------------|-------------------|---------------------|-------------------|-----------------|------------------|----------------|----------------|----------------|
| Mary Brown     | 32  | 2      | 2023-03-15            | 160 cm         | 52 kg           | 56 kg              | 18.5          | Normal                        | 140                    | 1                    | Headache          | None               | Normal           | Normal          | Normal          | Normal         | Normal          |

**Notes:**
- Mary Brown is a 32-year-old, 2-parity mother with her last menstrual period on 2023-03-15.
- She is 160 cm tall and weighed 52 kg last body weight, currently weighing 56 kg with a BMI of 18.5.
- Her baby growth in the previous visit was normal.
- Her present fetal heart rate is 140 ppm with 1 fetal movement.
- She has no complaints and no observed problems.
- Recommended follow-up includes normal pregnancy outcome, delivery method, complications, and normal follow-up.