PREVALENCE OF LOW BIRTH WEIGHT DELIVERIES AND ASSOCIATED FACTORS IN NAROK DISTRICT HOSPITAL, KENYA

BY

MIGWI PAUL MUTUGI

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AUGUST, 2012
DECLARATION

I, Migwi Paul Mutugi, hereby declare that this dissertation is my original work and has not been presented by any other individual for examination in any other university.

Migwi Paul Mutugi
Signature

Date 13/08/2012

This dissertation has been submitted with our approval as University supervisors:

1. Dr. Mwangi A. Mboganie
Signature

Date 13/08/2012

2. Prof. Mbugua Samuel K.
Signature

Date 16/8/10
DEDICATION

I dedicate this work to my late dad Sam Migwi, family and friends.
ACKNOWLEDGEMENT

I would like to express my appreciation to my supervisors Dr. Mwangi, Alice M. and Professor Mbugua S.K for their consistent guidance and support throughout this study. Special thanks to Narok District Hospital management team and staff, and the District Health management Team for their cooperation and support during the study period. I also wish to acknowledge the support extended by ACP/Edulink programme and the HENNA project for financing the research work. I am grateful to the entire staff of the University of Nairobi for their support in different aspects of the study. I am thankful to Terry Wefwafwa the Head of Nutrition Division for her support and encouragement throughout the course. I sincerely appreciate the efforts of my colleagues for their generosity in sharing ideas and experiences. The family of Abari ya Karani is recognized for their support. May God bless you all.
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ACRONYMS AND ABBREVIATIONS

AIDS: Acquired Immune Deficiency Syndrome
ANC: Antenatal Care
APGAR: Appearance (colour), Pulse rate (heart rate), Grimace (reflex irritability), Activity (muscle tone) and Respiration (respiratory effort)
APH: Ante-partum Haemorrhage
BMI: Body Mass Index
DGSDO: District Gender and Social Development Officer
DHMT: District Health Management Team
DNO: District Nutrition Officer
FBO: Faith-Based Organization
FGD: Focus Group Discussion
FP: Family Planning
HB: Haemoglobin
HIV: Human Immuno-deficiency Virus
HMIS: Health Management Information System
IUGR: Intra-uterine Growth Retardation
KII: Key Informant Interview
KDHS: Kenya Demographic and Health Survey
LBW: Low Birth Weight
MOPHS: Ministry of Public Health and Sanitation
MUAC: Mid-upper Arm Circumference
NGO: Non Governmental Organization
SD: Standard Deviation
SGA: Small for Gestational Age
SES: Socio-Economic Status
SPSS: Statistical Package for Social Sciences
STD: Sexually Transmitted Disease
UNICEF: United Nations Children’s Fund
VLBW: Very Low Birth Weight
WHO: World Health Organization
OPERATIONAL DEFINITIONS

Anaemia - A deficiency in the amount of haemoglobin contained in red blood cells (below 13 g/dl in men, 12 g/dl in non-pregnant women and 11 g/dl in pregnant women), which limits the amount of oxygen and carbon dioxide between blood and the tissue cells.

Antenatal care - Services provided to a pregnant woman to ensure that she undergoes a successful pregnancy and safe child delivery process.

Apgar score - Sum of scores on physical tests conducted on a newborn, typically 1 to 5 minutes after birth which ranges from one to ten.

Disability adjusted life-years - A measure of overall disease burden expressed as the number of years lost due to ill-health, disability or early death.

Expected delivery date - The tentative date a woman is expected to give birth estimated using the last date of menstruation by a health worker.

Food avoidance - Refraining from eating certain foods on one's own volition.

Food Restriction - Imposed limitation of food intake.

Gestational age - Estimated time in pregnancy since conception.

Gravidity - The number of pregnancies a woman has carried.

Haemoglobin - The iron containing protein found in red blood cells mainly responsible for transporting, storing and using oxygen throughout the body.

Low birth weight - A weight at birth of less than 2,500 g (up to and including 2,499 g) irrespective of gestational age.
Parity - The number of children a woman has given birth to.

Premature/preterm birth - Delivery which occurs less than 37 weeks of gestational age.

Small for gestational age - A baby born ≥ 2SD below mean birth weight and/or length for that gestational age.
ABSTRACT

World Health Organization defines low birth weight as weight at birth of less than 2,500 grams. Low birthweight infants contribute greatly to disability adjusted life years in developing countries and place great strain on budgets of poor economies like Kenya. Health staff in Narok District Hospital had raised concern about increased low birth weight deliveries while the problem was under-reported in medical reports. The main objective of the current study was to determine prevalence of low birth weight deliveries at Narok District Hospital and associated factors amenable for intervention.

A cross-sectional descriptive study was done in the months of September and October 2011 on all live births delivered at the hospital. Anthropometric measurements of the mother and newborn were taken within 48 hours of delivery and recorded in a pre-tested semi-structured questionnaire. Data on demographic and socio-economic characteristics, morbidity and feeding practices were obtained from medical records and interviews with the mothers. Chi-square and logistic regression were the main statistical measures used for testing association of the dichotomous (low and normal birth weight) outcome and presumed determinant factors.

A total of 348 live births were studied. The prevalence of low birth weight of 16.4% was significantly higher than the national estimate of 8% and the local estimate of 7.1%. Bivariate analysis showed significant association (P<0.05) between birth weight and age of the mother (P=0.032), circumcision status of the mother (P=0.025), mother's education level (P=0.002), father's education level (0.014), household size (P=0.003), residence (P=0.044), household income (P=0.003), amount of money spent on food (P=0.003), food avoidance by the mother (P=0.002) and number of antenatal care visits (P=0.000).
Logistic regression showed significant association between low birth weight ($P<0.05$) and mothers' religion ($P=0.017$), weight ($P=0.045$), gestation period ($P=0.000$) and plurality ($P=0.000$). Higher maternal weight and Christian faith were protective factors against low birth weight, while lower gestation period and plurality were risk factors for neonatal low birth weight. Conversely, higher maternal weight was significantly associated ($P<0.05$) with maternal Christian faith ($P=0.015$) and non-Maasai ethnicity ($P=0.000$). Circumcised mothers also had significantly lower mean weight ($P=0.000$) compared to their uncircumcised counterparts.

The study concludes that the prevalence of low birth weight is higher than the local estimate and exceeds the 15% threshold that indicates a public health problem. A multipronged approach is required to scale up interventions to address the myriad factors associated with low birth weight especially in the areas of maternal nutrition, harmful cultural practices, health seeking behaviours and mainstreaming nutrition in poverty reduction to break malnutrition cycle.
CHAPTER ONE: INTRODUCTION

1.1 Background

Low birth weight (LBW) has been defined by the World Health Organization (WHO) as weight at birth of less than 2,500 grams. This cut-off was arrived at from epidemiological observations which showed that infants weighing less than 2,500 grams have poor prognosis, being more susceptible to foetal and neonatal morbidity and mortality than their heavier counterparts. Low birth weight babies are also at a high risk of inhibited growth and cognitive development, and chronic diseases later in life. It is estimated that about 15.5% of all infants in the world are born low birth weight, 95.6% of them in developing countries (WHO/UNICEF, 2004).

Human costs of compromised birth outcomes are extremely high for the child and its family, as are the monetary costs of medical interventions designed to save low birth weight infants and maintain their health in subsequent months and years. Therefore the understanding of risk factors for low birth weight may enable the identification of factors amenable for policy manipulation. Manipulation of these factors in the desired direction may lead to a reduction in neonatal and infant mortality, as well as in congenital anomalies (Frisbie et al, 1996).

Low birth weight is caused by intra-uterine growth retardation, shortened gestation, or both. Low pre-pregnancy weight and poor pregnancy weight gain of the mother have been identified as the strongest determinants of intrauterine growth retardation leading to low birth weight (Scroll, 2008). Birth weight is a good measure of health status of a child at birth because it represents the outcome of the gestation period. Since birth weight is a measure of the nutritional status of a
baby at birth, it is also a measure of the healthy gestational development of the foetus. (Mwabu, 2008; Kramer, 1987).

1.2 Statement of the Problem

In Narok District Hospital, health staff had raised concern about increased low birth weight deliveries (Oluoch, 2011). The nursery unit had an average of ten babies on any day up from about two five years before. The number was higher than the average of five per day in the neighbouring Bomet District Hospital (Rotich, 2011). Health records and interview with staff at Narok District Hospital maternity indicated that infants born with birth weight between 2000g and 2500g were not recorded as low birth weight. A systematic study was therefore required to establish the actual prevalence in order to gauge the magnitude of the problem for appropriate action.

1.3 Justification

Maternal malnutrition, malaria in pregnancy, alcoholism, smoking, multiple births and either too young or too old mothers are some of the risk factors of low birth weight deliveries. Birth weight is a strong indicator not only of the mother’s health and nutritional status but also a newborn’s chances for survival, growth, long-term health and psychosocial development.

In Narok County, malaria is the second cause of morbidity despite efforts by the government and partners in control of the disease (HMIS, 2010). Malaria has far reaching effects on fetuses even in the sub clinical form. Recurrent droughts in the district increase mothers’ workload as they
trek long distances in search of water increasing their risk of being malnourished (ALRMP, 2010).

Under-reporting of low birth weight at the District Hospital makes this study necessary to establish the actual prevalence and identify factors associated with the prevalence. This is in line with recommendations of a study carried out in Botswana that it is important for the government to come up with location-specific policies and programmes in order to address location-specific problems (Ictamo and Majelantle, 2001).

This study is required in order to recommend science-evidence based intervention strategies to curb priority problems in Narok.

1.4 The Aim of the Study

The aim of the study was to contribute towards improving infant and maternal health.

1.5 Purpose of the Study

The purpose of the study was to provide information on the prevalence of low birth weight and the factors associated with it in Narok, in order to inform stakeholders for appropriate intervention strategies.
1.6. Objectives of the Study

1.6.1 General objective

The general objective of the study was to determine prevalence of low birth weight deliveries at Narok District Hospital and identify associated factors.

1.6.2 Specific objectives

- To determine socio-demographic and economic characteristics of women delivering at the hospital
- To determine the birth weight of newborns delivered at the hospital
- To determine maternal feeding practices of the study population
- To determine maternal nutritional status of the study population.
- To determine maternal morbidity experience during pregnancy
- To establish the association of maternal socio-economic and demographic, nutritional status, dietary practices and morbidity experience with birth weight in the study population

1.7 Hypotheses

Low birth weight is not significantly associated with maternal socio-economic and demographic characteristics, feeding practices, nutritional status and morbidity experience during pregnancy in Narok.
1.8 Research Questions

i. What are the socio-demographic and economic characteristics of women delivering at the hospital?

ii. What is the prevalence of low birth weight deliveries in Narok District Hospital?

iii. What are the maternal feeding practices of the study population?

iv. What is maternal nutrition status of women delivering at Narok District Hospital?

v. What is the morbidity experience of mothers delivering at Narok District Hospital?

vi. Is there relationship between maternal socio-economic and demographic characteristics, feeding practices, nutritional status and morbidity experience and birth weight in the study population?
CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Birth weight is a strong indicator not only of a mother’s health and nutritional status but also a newborn’s chances for survival, growth, long-term health and psychosocial development. A low birth weight (less than 2,500 grams) raises grave health risks for children. Low birth weight is a public health problem in most developing countries. About 15.5 per cent of all babies worldwide are born with low birth weight, 95.6 per cent of them in developing countries. The level of low birth weight in developing countries (16.5 per cent) is more than double the level in developed regions where the prevalence is about 7 per cent (WHO/UNICEF, 2004).

Low birth weight levels in sub-Saharan Africa are around 13 to 15 per cent, with little variation across the region as a whole. While few countries have very high or very low rates, the majority fall between 10 and 20 per cent. The high number of low birth weight infants presents a major challenge in child survival to the developing countries since their management may require delicate specialized care which may be unavailable in most of the settings (WHO/UNICEF, 2004). In Kenya, prevalence of low birth weight is estimated at 8% (UNICEF, 2009).

2.2 Challenges and Methods used in Estimating Prevalence of Low Birth Weight

Studies have shown that over fifty percent of newborns in developing countries are not weighed at birth. Those babies who are weighed on the other hand are generally better off (more likely to be born in health facilities, urban areas and of better-educated mothers), which can lead to an underestimation of the incidence of low birth weight. Misreporting of birth weight in instances where birth weight is available is usually as a result of recording data in multiples of 500. Heaping at 2500g therefore leads to underestimation of the incidence of low birth weight. In their
estimates, UNICEF and the World Health Organization (WHO) have adjusted the underreporting and misreporting of birth weights with results from household surveys - Multiple Indicator Cluster Surveys and Demographic and Health Surveys. The adjustment uses mothers' subjective assessment of birth size; very large, larger than average, average, smaller than average, very small in addition to the birth weight data. The proportion with low birth weight in each category of size is multiplied by the total proportion of births in the corresponding category and summed to obtain overall estimates of the prevalence of low birth weight. To take care of misreporting, a quarter of birth weights recorded as 2500g are re-classified as low birth weight (WHO, 2005; Magadi et al, 2001).

2.3 Risk Factors for Low Birth Weight

Low birth weight is one of the undesirable birth outcomes whose immediate determinants are health and nutrition factors. These factors are to a great extent influenced by socio-economic, cultural and demographic factors as illustrated in figure 1.

Anaemic women may give birth to premature babies or low-birth-weight infants who suffer from infections, weakened immunity, learning disabilities, impaired physical development and, in severe cases, death (UNICEF, 2008). It is estimated that in areas where malaria is endemic, around 19% of infant LBWs are due to malaria and 6% of infant deaths are due to LBW caused by malaria. These estimates imply that around 100,000 infant deaths each year could be due to LBW caused by malaria during pregnancy in areas which are malaria endemic in Africa. Immune responses to malaria parasites in the placenta may trigger labour leading to premature delivery of a low birth weight infant (Guyatt and Snow, 2004).
Figure 1: A conceptual framework for studying determinants of adverse pregnancy outcomes.

Source: Magadi (1999)
Some studies have shown no significant association between socioeconomic indicators and the size of the baby at birth (Magadi et al., 2001); while others have shown that mothers in deprived socio-economic settings frequently have low birth weight infants (Kramer, 1987; Letamo and Majelantle, 2001; Ngare and Newmann, 1998). In those settings, the infant’s low birthweight stems primarily from the mother’s poor nutrition and health over a long period of time, including during pregnancy, the high prevalence of infections, or from pregnancy complications underpinned by poverty. Physically demanding work during pregnancy also contributes to poor foetal growth. Poverty predisposes someone to physically demanding work hence presenting a double risk to a healthy pregnancy.

It has also been demonstrated that for the same gestation age, males weigh more than females, while firstborns weigh less than subsequent infants, and twins less than singletons. Women living in high altitude areas have smaller babies. Maternal education, unmarried motherhood, teenage motherhood and prior termination of pregnancy are significant predictors of low birth weight (Letamo and Majelantle, 2001, Ondimu, 1997). Teenage mothers have high nutrient requirements for their own growth and therefore pregnancy at this age is an added burden since the foetus requires compete for nutrients for nourishment leading to a low birth weight delivery. Mothers who are educated are more likely to lead healthier lifestyles, including better health seeking behavior (Magadi et al., 2001).

A higher proportion of rural mothers deliver low birth weights than urban residents. In urban areas, health services are more accessible and of better quality as compared to the rural areas. Young adolescents aged 10-15 years, single mothers, and those with low level of education are
also more at an increased risk of delivering low birth weight babies (Ondimu, 1997). Other risk factors for low birth weight include short maternal stature, nonwhite race, primiparity, smoking and alcoholism (Kramer, 1987).

A study to identify predictors of low birth weight in rural Kenya, (Ngare and Newmann, 1998) showed that body mass index (BMI), blood haemoglobin levels (HB), mid-upper arm circumference (MUAC) and socioeconomic status (SES), were the best predictors of low birth weight in that order, based on their relative contribution. Higher body mass index, haemoglobin levels, mid-upper arm circumference and socio-economic status were associated with decreased risk of low birth weight delivery.

2.4 Consequences of Low Birth Weight

Babies who are undernourished in the womb face a greatly increased risk of dying during their early months and years. Those who survive have impaired immune function and increased risk of disease (Raqib, et al., 2007). They are likely to remain undernourished, with reduced muscle strength throughout their lives, and to suffer a higher incidence of diabetes and heart disease. Children born underweight also tend to have cognitive disabilities and a lower intelligence quotient (IQ), affecting their performance in school and their job opportunities as adults (WHO, 2005). Low birth weight deliveries also, increase the cost of health care provision in terms of specialized equipment that may be required and treatment for infections (WHO, UNICEF, 2004).
1.5 Birth Weight Measurement

Birth weight should ideally be measured within the first hour after birth before significant weight loss occurs (WHO/UNICEF, 2004). Some studies have taken birth weight within 24 hours (Ahmed et al., 2000) and others within 72 hours (Ngare and Newmann, 1998). Accurate weighing requires regularly calibrated scales with a measurement accuracy of at least 10 g, as well as the correct reading technique. Digit preference is frequently observed in birth weight data, especially around 500 g values. Heaping at these values can substantially affect the actual incidence of low birth weight in the population. Digit preference can only improve by regularly analyzing and presenting data to those who weigh babies. Proxy measures of low birth weight, e.g., chest circumference, have been recommended for assessing birth weight at home. However, they are not a good substitute for growth assessment at the individual level, and cannot be included in the population incidence of low birth weight (WHO/UNICEF, 2004).

2.6 Gaps in Knowledge

Most studies addressing factors associated with unfavourable birth outcomes have almost exclusively been based on secondary data without due regard to primary data. Thus, a qualitative study would be useful in identifying the undesirable cultural practices that need to be discouraged.

In developing countries, maternal anthropometric measurements at birth particularly weight in relation to birth weight of the infant have not been well documented. In Narok, medical reports do not provide the actual prevalence of low birth weight deliveries since only infants weighing less than 2000 g are reported as low birth weight.
CHAPTER THREE: STUDY SETTING AND METHODOLOGY

3.1 Study Setting

The study was conducted in Narok District Hospital, located in Narok town; the headquarters of Narok County in Kenya. The Hospital draws its clients mainly from Narok North District (See Appendix 1). However, it also receives some patients from Narok South and Bomet districts. The northern parts of Narok North district are high altitude areas rising over 2300m and form part of Mau forest. The southern parts are predominantly low lands of 1000m-1500m above sea level. The average annual rainfall here is about 790mm, and is unevenly distributed. The temperatures range from 8 to 28°C with low temperatures reaching 8°C in June to September, while the maximum reach 28°C in November to February (AIRMP II, 2010).

Narok North district has an estimated 46,643 households served by one government level four hospital with one hundred and seventy seven beds, five government health centers with forty five beds, one faith based organization health centre with twelve beds and one private nursing home with twenty seven beds. In addition, there are fourteen government dispensaries with eighteen beds and ten faith-based organization dispensaries with sixteen beds (MOPHS/MOMS, 2010)

The mean household size is six (KNBS, 2007)

In Narok town, trade is the main source of livelihood while areas bordering Mau forest i.e. Olokuru division, Upper Central and Upper Mau divisions are farming dependent livelihoods. On the other hand, southern parts of the district including Lower Central and Lower Mau mainly depend on pastoralism (AIRMPH, 2010)
3.2 Study Population

The study population comprised of mothers who delivered in Narok District Hospital in the Months of September and October 2011.

3.3 Study Design

A cross-sectional study design was used. Mothers delivering in the hospital were interviewed and their health history taken. Their anthropometric measurements i.e. weight, height and MUAC were also taken. Birth weights of the infants were taken within 48 hours after birth to avoid effect on birth weight by postnatal weight loss.

3.4 Sampling

3.4.1 Sample size determination

a. Sample size for mothers

Minimum sample size was determined using the Fisher formula (Fisher, 1981)

\[ n = \frac{z^2pq}{d^2} \]

Where \( z \) = 1.96 (The standard normal deviate at 95% confidence interval)

\( p = \) Prevalence of low birth weight (8%); National Estimate (UNICEF, 2009)

\( q = 1 - p \)

\( d = 0.05 \) (Design effect or the degree of precision desired.)

\[ n = \frac{1.96^2 \times 0.08 \times 0.92}{0.05^2} \]

\( = 113 \)
In the months of September and October, a total of 337 deliveries took place at the hospital and were all included in the study.

h. Sample size for focus group discussions

Five focus group discussions (FGD) were held in the catchment area of the Narok District Hospital. The groups were as follows: two for men and two for pregnant women; one each in an urban and rural set-up. Participants for the fifth FGD were traditional birth attendants and circumcisers. Each group had 8 to 12 participants.

c. Sample size for key informant interviews

A total of six key informant interviews were conducted with the District Nutrition Officer (DNO), the hospital gynaecologist/obstetrician, District Reproductive Health Coordinator (DRHC), the District Gender and Social Development Officer (DGSDO) and two representatives of community health workers from the catchment area.

3.4.2. Sampling procedure

Purposive sampling was used whereby all deliveries taking place during the two months period were investigated.

Sampling for Focus Group Discussion involved identification of the participants through community leaders, health workers and community health workers. The discussions were conducted separately to ensure gender sensitivity. Key informants were purposively selected.
3.5 Research Instruments

Questionnaires, question guide for focus group discussion and key informant interviews were used for data collection. Infants were weighed using infant weighing scales. Mothers' weights were taken using a spring weighing scale. Their heights were taken using a stadiometer while adult MUAC tapes were used to measure their mid-upper arm circumference.

Checklists were used to ensure all preparations, processes and procedures were followed.

3.6 Techniques of Data collection

Both qualitative and quantitative data were collected. The data included socio-demographic and economic characteristics, infant birth weight, maternal feeding practices, maternal nutritional status and maternal morbidity experience during pregnancy.

Socio-economic and demographic characteristics of women delivering at the hospital

This data was collected through interviews with the mothers as respondents using a pre-tested structured questionnaire. The data included age of the mother, marital status, religion, household profile, household size, education status, household income, occupation, residence, parity, gravidity, and the mode of delivery. Married mothers were asked to give details of their spouses as follows: age, occupation, education status and religion.

Birth weights and Apgar Scores of babies born at the hospital

Birth weight was taken for all live births immediately after birth and in any case not later than 48 hours to avoid effect of post natal weight loss on actual birth weight.
The Apgar score at the first minute was taken from the maternity register. An Apgar score of 0-3 indicate severe physical depression; a score of 4-6 indicate moderate depression, while a score of 7-10 indicate that the baby was in good to excellent condition (Mwabu, 2008).

Maternal feeding practices of the study population

Respondents were asked to state whether they experienced food restriction, voluntary food avoidance, induced vomiting, use of food supplements and craving for food and non-food items during pregnancy. They were also asked to state whether they experienced food shortage during pregnancy and the number of meals they had in an ordinary day. Further information was collected through focus group discussions on dietary habits during pregnancy.

Nutrition status/Antropometric measurements

Mothers' mid-upper arm circumference (MUAC) was measured using adult MUAC tapes developed by UNICEF and WHO. The measurement was taken on the left arm at the mid-point between the tip of the acromion process and the olecranon process, to the nearest 0.1 cm.

Mothers' weight was measured immediately after birth using an adult weighing scale with a precision of 0.01 kg. Mothers who delivered through caesarean section were allowed up to 48 hours before their anthropometric measurements were taken to ensure that they were stable for the procedure. Infant weight at birth was taken immediately after delivery using paediatric weighing scale with a precision of 0.01 kg. Mother's height was taken using a stadiometer. The mothers were requested to stand straight up on bare foot, feet together and knees straight with the heels, buttocks and shoulder blades in contact with vertical surface of stadiometer. The
Haemoglobin (Hb) level during pregnancy was used as a proxy for iron status. The most recent measurement was taken from the mothers' health records. Almost all the Hb measurements were taken and recorded when the mother first visited antenatal clinic.

**Maternal morbidity experience during pregnancy**

Data on morbidity was extracted from the mother and child health booklet and maternity register, as well as from interviews with the mothers. Morbidity data included malaria, tuberculosis, diabetes, hypertension, HIV/AIDS, syphilis, antepartum haemorrhage (APH), gonorrhea and any other illnesses. The data was filled in the interviewer administered questionnaire. Mothers were also asked about health seeking behaviours such as the number of antenatal care clinic (ANC) visits they had during pregnancy and use of mosquito nets.

### 3.7 Ethical and Human Rights Considerations

Authority was sought from the District Medical Services Team to conduct the study. The five principles guiding ethics in research were followed. These are scientific merit, equitable selection of subjects, seeking informed consent, confidentiality and avoidance of coercion. Field assistants were well trained to ensure the ethical and human rights component was well understood. During enumeration, they explained to the respondents the objectives of the study and outlined briefly the contents of the questionnaire and expected activities. Written and oral consent was then sought from literate respondents and illiterate respondents respectively. Information obtained from the subjects was held in confidence and used for the purpose of the study only.
Recruitment and Training of Field Assistants

Three field assistants were recruited and trained. These were qualified health workers; two of whom were proficient in the local Maa language. The positions were advertised through chiefs' boracas and posters on public notice boards. Interviews for recruitment were then conducted by the principal investigator and a local leader. The recruited assistants were trained for two days to enhance their skills.

The following areas were covered during the training:

- Title, aim, purpose and objectives of the study.
- Administration of questionnaire (including translation)
- Conducting a Focus Group Discussion and key informant Interview - Duties and responsibilities of team members
- Anthropometry - Taking measurements and recording.
- Ethics in research.

At the end of the training, pretesting of the tools was done at the District Hospital.

3.9 Data Quality Control

Field assistants were carefully recruited to ensure that they had the required levels of proficiency to perform their duties. They were also properly trained.

The questionnaire was well designed for detail and clarity. Questionnaire pretesting was also done to make it more effective.
Spring weighing scales were used to take weight of mothers and infants. They were checked for accuracy daily using a known weight.

Care was taken to ensure accuracy in making readings and recording to avoid digit preference and heaping at 500g in the case of weight. The execution of the study was closely supervised by the principal investigator to ensure that the data was accurately collected and recorded. Regular analysis and presentation of data was done to maternity staff and field assistants to improve data quality.

Analytical statistics were carefully chosen, taking care of outliers in the data sets. Consultation with the supervisors was done throughout the research period for technical backstopping.

3.10 Data Management and Analysis

3.10.1 Data management

Data entry templates were developed using SPSS computer software package through definition of variables immediately after questionnaire pre-testing. Data entry was done daily after thorough checking.

Data cleaning was done through running frequencies and cross tabulation of the various variables using the same computer software package. This enhanced identification of missing values, wrong entries and outliers. The missing values were filled while wrong entries were corrected and outliers verified and omitted.
The information obtained from focus group discussions and key interviews was verified on the same day the information was obtained. This was done through reading the record and asking the study team to confirm whether it was an accurate record. This proved crucial in the case of interpreted information since it ensured precision.

3.10.2: Data analysis

All live births participated in the study. Singletons and multiple births were analyzed together because a previous comparative study on the determinants of low birth weight found that the results were virtually the same whether all births or singletons were examined (Defo and Partin, 1993).

Socio-economic and demographic characteristics

Proportions were calculated for the following characteristics of the mothers: community of origin, residence, age group, marital status, religion, education level, ANC attendance, illness during pregnancy, alcohol and tobacco use. Proportions for household profile and size were worked out. Proportions for infant characteristics were: parity, sex, gestation and APGAR score.

Prevalence of low birth weight

To determine the prevalence of low birth weight (LBW) deliveries at Narok District Hospital, birth weight was divided into two categories namely low birth weight (less than 2500g) and normal birth weight (2500g and above). The prevalence was then calculated as follows:

\[
\text{LBW} = \frac{\text{Total birth weight <2500g} \times 100}{\text{Total live births}}
\]
**Maternal feeding practices**

Proportions of mothers who observed various practices were calculated. These included food restriction, voluntary food avoidance, induced vomiting and pica. Mothers were also categorized by the number of meals that they had in an ordinary day and household food security status.

**Maternal nutrition status**

Mothers were categorized into two categories namely those with less than 23cm mid-upper arm circumference measurement and those 23cm and above. Proportions of mothers in the two MUAC categories were computed.

The body mass index (BMI) of the mothers was worked out using the following formula:

$$\text{BMI} = \frac{\text{Weight (Kg)}}{\text{Height (M)}^2}$$

Mean MUAC and BMI were also calculated.

**Morbidity experience**

Morbidity experience was expressed as proportions of mothers who suffered from different illnesses.

**Association of maternal socio-economic and demographic characteristics, feeding practices, nutrition status and morbidity experience with birth weight**

The tests of association used at the bivariate level of analysis were chi-square ($\chi^2$), ANOVA, Fisher's exact test, likelihood ratio and correlation. Logistic regression was used to identify
factors independently associated with low birth weight. To predict probability of membership to either low birth weight (coded 1) or normal birth weight (coded 0), a model was fitted using the backward fitting method.
CHAPTER FOUR: RESULTS

4.1 Demographic and Socio-economic Characteristics of the Subjects

A total of 348 babies were studied comprising of 327 (94%) singletons, 18 (5.2%) twins and 3 (1%) born triplet. More than half (55.7%) of the infants were male while females comprised 44.3%. Majority of the mothers were from the Maasai community (41%), followed by Kikuyu (28%) and Kisii (8%), as shown in figure 2.

![Figure 2: Distribution of mothers by community of origin](image)

Figure 3 shows the distribution of the mothers by age. It is clear that majority of the mothers (73%) were in the 20-35 age bracket while only 8% were older than thirty five years. The mean age of the mothers delivering at Narok District Hospital was 24.3 years (±6.2) with a minimum of 16 and maximum of 47 years.
The mean age of Maasai mothers was 24.5 (±6.7) while that of non-Maasai was 24.2 (±5.8) years. Of the Maasais, 82.3% were circumcised while this proportion was 41.5% among the non-Maasai.

Table 1 shows a summary of selected demographic characteristics of the study subjects. The distribution of mothers by marital status and age categories was similar between Maasai and non-Maasai, however, the former had larger households with the majority living in the rural areas.

Data showed significant association between education level of the mothers and their religious affiliations ($\chi^2$, P<0.05). About 28% of the non-Christians had no formal education compared to 12% among the Christians.
Table 1: Demographic characteristics of the study population

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Maasai (%)</th>
<th>Non-Maasai (%)</th>
<th>Statistical test (P&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mother's marital status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>83.7</td>
<td>82.1</td>
<td>Likelihood ratio, P=0.697</td>
</tr>
<tr>
<td>Separated</td>
<td>0.0</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Widowed</td>
<td>0.7</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>15.6</td>
<td>16.4</td>
<td></td>
</tr>
<tr>
<td>Divorced</td>
<td>0.0</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td><strong>Mother's age(years)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 20</td>
<td>19.1</td>
<td>19.8</td>
<td>$\chi^2$, P=0.355</td>
</tr>
<tr>
<td>20-35</td>
<td>70.9</td>
<td>74.4</td>
<td></td>
</tr>
<tr>
<td>Above 35</td>
<td>9.9</td>
<td>5.8</td>
<td></td>
</tr>
<tr>
<td><strong>Household size</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-5</td>
<td>61.7</td>
<td>84.1</td>
<td>$\chi^2$, P=0.000*</td>
</tr>
<tr>
<td>5 and above</td>
<td>38.3</td>
<td>15.9</td>
<td></td>
</tr>
<tr>
<td><strong>Household Profile</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monogamous</td>
<td>61.0</td>
<td>78.6</td>
<td>$\chi^2$, P=0.000*</td>
</tr>
<tr>
<td>Polygamous</td>
<td>24.8</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>14.2</td>
<td>17.9</td>
<td></td>
</tr>
<tr>
<td><strong>Mother's Religion</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catholic</td>
<td>12.1</td>
<td>21.3</td>
<td>Likelihood ratio, P=0.008*</td>
</tr>
<tr>
<td>Protestant</td>
<td>70.9</td>
<td>69.6</td>
<td></td>
</tr>
<tr>
<td>Muslim</td>
<td>0</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>Traditionalists</td>
<td>17.1</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td><strong>Mother's Residence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>16.3</td>
<td>70.5</td>
<td>$\chi^2$, P=0.000*</td>
</tr>
<tr>
<td>Rural</td>
<td>83.7</td>
<td>29.5</td>
<td></td>
</tr>
</tbody>
</table>

*Significant association

Table 2 shows the socio-economic status of the study population. The proportion of the Maasai households which spend more than 50% of their income was significantly higher (P=0.029) than that of the non-Maasai. Generally, Christian had better socio-economic status compared to non-Christian households. A higher proportion of non-Christians (42%) spend more than half of their income on food as compared to Christians (35%), although the difference is not statistically significant. On average all households spend 43.1% of their income on food.
Table 2: Socio-economic status of the study population

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Percent income spent on food</th>
<th>Statistical test (P&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less than 50%</td>
<td>50% and above</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maasai (n=141)</td>
<td>70.2</td>
<td>29.8</td>
</tr>
<tr>
<td>Non-Maasai (n=206)</td>
<td>58.7</td>
<td>41.3</td>
</tr>
<tr>
<td>Religion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Christian (N=305)</td>
<td>64.3</td>
<td>35.7</td>
</tr>
<tr>
<td>Non-Christian (N=42)</td>
<td>57.1</td>
<td>42.9</td>
</tr>
</tbody>
</table>

There was a negative (-0.18), though insignificant (P=0.745) correlation between household size and proportion of household income spent on food.

4.2 Behavioural and obstetric Characteristics of the study mothers

Table 3 shows selected behavioural and obstetric characteristics of the study mothers. Seventeen (4.9%) of the mothers smoked tobacco while nine (2.6%) drank alcohol during pregnancy. Eight of those who used alcohol were from an urban set up while one was from a rural set up.

Table 3: Selected behavioural characteristics by residence

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Residence</th>
<th>Statistical test (P&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Urban (N=169)</td>
<td>Rural (N=179)</td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>4.7</td>
<td>5.0</td>
</tr>
<tr>
<td>No</td>
<td>95.3</td>
<td>95.5</td>
</tr>
<tr>
<td>Alcohol use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>4.7</td>
<td>0.6</td>
</tr>
<tr>
<td>No</td>
<td>93.3</td>
<td>99.4</td>
</tr>
<tr>
<td>Mosquito net use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>71.0</td>
<td>46.9</td>
</tr>
<tr>
<td>No</td>
<td>29.0</td>
<td>53.1</td>
</tr>
</tbody>
</table>

$^*$ Significant association

Forty one per cent of the mothers did not sleep under a mosquito net during pregnancy, 42.2% used at least one family planning method and 45.9% had at least four antenatal care visits.
Most of the deliveries were vaginal (93.7%) while the rest (6.3%) were conducted through caesarean section. More than half (57%) of the babies were born pre-term, 5.1% of whom had an Apgar score less than seven at the first minute.

Figure 4 shows the distribution of the mothers by parity. The data showed that most of the mothers (42.2%) delivering at Narok District Hospital were nulliparous, with the number of deliveries decreasing with increase in parity.

![Figure 4: Distribution of the mothers by parity](image)

4.3 Prevalence of Low Birth Weight Deliveries among the Study Subjects

The prevalence of low birth weight deliveries was found to be 16.4%. Out of 348 newborns delivered in the hospital during the study period, 57 were low birth weight.

4.4 Maternal Feeding Practices of the Study Population

Table 4 gives the distribution of the study group by whether they practiced food restrictions or not and ethnicity of the mother. A total of 15.2% of the mothers experienced food restrictions for
different reasons. The practice was more common among Maasai (P<0.05) than non-Maasai women.

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Food restriction</th>
<th>Statistical test (P&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maasai (n=141)</td>
<td>24.1%</td>
<td>75.9%</td>
</tr>
<tr>
<td>Non-Maasai (n=207)</td>
<td>9.2%</td>
<td>90.8%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>15.2%</td>
<td>84.8%</td>
</tr>
</tbody>
</table>

The practice was observed more among rural mothers than their urban counterparts at 21.1% versus 9.5% respectively. Figure 5 illustrates the distribution of mothers practicing food restrictions (N=52) by reasons for this practice. It was observed that the main reason for food restriction was to ensure that the mother gave birth to a small baby. This was mainly the case among the Maasai among whom 88.2% practiced food restrictions for this reason. A focus group discussion in a rural set-up of the Hospital’s catchment area implied that delivering a smaller baby was easier and informed much of the food restrictions on pregnant women. Other reasons for food restrictions included medical, food insufficiency and unspecified taboos.
Animal products, particularly eggs and milk were the foods mainly restricted as shown in table 5.

Table 5: Food types restricted during pregnancy

<table>
<thead>
<tr>
<th>Food items</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eggs</td>
<td>26</td>
<td>49.1</td>
</tr>
<tr>
<td>Milk</td>
<td>12</td>
<td>22.6</td>
</tr>
<tr>
<td>Meat</td>
<td>2</td>
<td>3.8</td>
</tr>
<tr>
<td>legumes</td>
<td>2</td>
<td>3.8</td>
</tr>
<tr>
<td>Others</td>
<td>11</td>
<td>20.8</td>
</tr>
</tbody>
</table>

A total of 42% of the restrictions were enforced by the mother-in-law, 8% by self, 5% by neighbours, 2% by husband and the rest (15%) by other members of the community.

More than half of the mothers (52%, n=181) voluntarily avoided certain foods during pregnancy. The main reason for food avoidance was nausea (Table 6). Others were changed tastes and to give birth to a small baby presumably to avoid delivery complications.
Table 6: Reasons for food avoidance among the mothers

<table>
<thead>
<tr>
<th>Reasons</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vausea</td>
<td>112</td>
<td>59.9</td>
</tr>
<tr>
<td>Changed tastes</td>
<td>44</td>
<td>23.5</td>
</tr>
<tr>
<td>Small baby</td>
<td>29</td>
<td>15.5</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>Total</td>
<td>187</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 7 shows the relationship between food avoidance and mother’s household food security status. It is clear that households of mothers who avoided some foods were more likely to be food secure (P<0.05) than those who did not avoid. On the other hand, the difference in household food security of mothers who experienced food restriction was not statistically significant (P>0.05). It was also observed that 55.7% of the mothers craved for different foods while 51.7% craved for non-food items including rocks and soil.

Table 7: Association of feeding practices and food security

<table>
<thead>
<tr>
<th>Dietary habit</th>
<th>Food secure</th>
<th>Food insecure</th>
<th>Statistical test (p&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food avoidance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (n=180)</td>
<td>93.3</td>
<td>6.7</td>
<td>$\chi^2=4.228$; 1 df: P=0.044*</td>
</tr>
<tr>
<td>No (n=166)</td>
<td>86.7</td>
<td>13.3</td>
<td></td>
</tr>
<tr>
<td>Food restriction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (n=53)</td>
<td>96.2</td>
<td>3.8</td>
<td>Likelihood ratio, P=0.175</td>
</tr>
<tr>
<td>No (n=291)</td>
<td>89.0</td>
<td>11.0</td>
<td></td>
</tr>
<tr>
<td>Pica</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (n=180)</td>
<td>12.8</td>
<td>87.2</td>
<td>$\chi^2=3.050$; 1 df: P=0.081</td>
</tr>
<tr>
<td>No (n=168)</td>
<td>7.1</td>
<td>92.9</td>
<td></td>
</tr>
<tr>
<td>Food Craving</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (n=194)</td>
<td>7.7</td>
<td>92.3</td>
<td>$\chi^2=2.621$; 1 df: P=0.105</td>
</tr>
<tr>
<td>No (n=154)</td>
<td>13.0</td>
<td>87.0</td>
<td></td>
</tr>
</tbody>
</table>
Table 8 shows the distribution of study mothers by MUAC measurements and selected social characteristics. Mothers with mid-upper arm circumference (MUAC) measurements less than 23cm were 23.5%. The difference in nutritional status of the mothers from urban and rural areas was found to be statistically significant ($\chi^2=8.987$, $P<0.05$). Such was also the case between Maasai and non-Maasai women ($\chi^2=16.61$, $P=0.000$).

Table 8: Distribution of study mothers by MUAC measurements and social status

<table>
<thead>
<tr>
<th>Category</th>
<th>MUAC*&lt;23.0cm (%)</th>
<th>MUAC&gt;23cm (%)</th>
<th>Statistical test (P&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban (N=169)</td>
<td>19.6</td>
<td>80.4</td>
<td>0.002**</td>
</tr>
<tr>
<td>Rural (N=179)</td>
<td>34.7</td>
<td>65.3</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maasai (N=141)</td>
<td>38.4</td>
<td>61.6</td>
<td>0.000**</td>
</tr>
<tr>
<td>Non-Maasai (N=207)</td>
<td>19.9</td>
<td>80.1</td>
<td></td>
</tr>
<tr>
<td>All (N=348)</td>
<td>25.5</td>
<td>74.5</td>
<td></td>
</tr>
</tbody>
</table>

*Mid-upper arm circumference  
**Significant at 0.01

Table 9 shows the mean differences of MUAC, BMI and weight of the study mothers by selected social characteristics. The nutrition status was significantly higher (P<0.05) for Christians than non-Christians and non-Maasai than Maasai. Uncircumcised mothers also, had better nutrition status than circumcised mothers.
Table 9: Comparison between mothers' nutrition and social status

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>T-test (P&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MUAC (cm)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Religion</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Christian (N=42)</td>
<td>25.01</td>
<td>2.91</td>
<td>P=0.044*</td>
</tr>
<tr>
<td>Non-Christian (N=302)</td>
<td>24.04</td>
<td>2.86</td>
<td></td>
</tr>
<tr>
<td><strong>Circumcision Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (N=199)</td>
<td>24.33</td>
<td>2.62</td>
<td></td>
</tr>
<tr>
<td>No (N=145)</td>
<td>25.66</td>
<td>3.14</td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maasai (N=138)</td>
<td>24.13</td>
<td>2.77</td>
<td></td>
</tr>
<tr>
<td>Non-Maasai (N=206)</td>
<td>25.40</td>
<td>2.92</td>
<td></td>
</tr>
<tr>
<td><strong>BMI (Kg/M²)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Religion</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Christian (N=303)</td>
<td>23.31</td>
<td>3.53</td>
<td></td>
</tr>
<tr>
<td>Non-Christian (N=43)</td>
<td>21.91</td>
<td>2.99</td>
<td></td>
</tr>
<tr>
<td><strong>Circumcision Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (N=200)</td>
<td>22.31</td>
<td>2.86</td>
<td></td>
</tr>
<tr>
<td>No (N=146)</td>
<td>24.31</td>
<td>3.94</td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maasai (N=139)</td>
<td>21.90</td>
<td>2.62</td>
<td></td>
</tr>
<tr>
<td>Non-Maasai (N=207)</td>
<td>23.99</td>
<td>3.75</td>
<td></td>
</tr>
<tr>
<td><strong>Weight (Kg)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Religion</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Christian (N=303)</td>
<td>59.66</td>
<td>9.65</td>
<td></td>
</tr>
<tr>
<td>Non-Christian (N=43)</td>
<td>56.37</td>
<td>7.82</td>
<td></td>
</tr>
<tr>
<td><strong>Circumcision Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (N=200)</td>
<td>56.39</td>
<td>7.57</td>
<td></td>
</tr>
<tr>
<td>No (N=146)</td>
<td>61.18</td>
<td>10.16</td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maasai (N=139)</td>
<td>56.39</td>
<td>7.57</td>
<td></td>
</tr>
<tr>
<td>Non-Maasai (N=207)</td>
<td>61.18</td>
<td>10.16</td>
<td></td>
</tr>
</tbody>
</table>

*Significant difference

Table 10 shows a comparison of nutrition status between mothers with different food habits. It was found that mothers who voluntarily avoided some foods had significantly higher (P<0.05) nutrition status than those who did not avoid. Mothers who experienced food restriction had lower nutrition status than those who had no food restriction although the difference was insignificant (P>0.05).
Table 10: Mothers nutrition status by food habits during pregnancy

<table>
<thead>
<tr>
<th>Dietary habit</th>
<th>Mean M1/Ac (cm)</th>
<th>SD</th>
<th>T-test, (P&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food avoidance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (N=177)</td>
<td>25.23</td>
<td>2.70</td>
<td>P = 0.039*</td>
</tr>
<tr>
<td>No (N=167)</td>
<td>24.57</td>
<td>3.13</td>
<td></td>
</tr>
<tr>
<td>Food restriction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (N=52)</td>
<td>24.14</td>
<td>2.89</td>
<td>P = 0.143</td>
</tr>
<tr>
<td>No (N=292)</td>
<td>24.99</td>
<td>2.94</td>
<td></td>
</tr>
</tbody>
</table>

Figure 6 shows data on anaemia status among the study mothers mainly upon their first visit to the ANC. A total of 22% of the study mothers (N = 192) had varying severity of anaemia while 77.6% were normal.

Figure 6: Anaemia status among the mothers

4.6 Maternal Morbidity Experience During Pregnancy

Figure 7 illustrates the findings on morbidity of the study mothers during pregnancy. Malaria was the most common disease followed by HIV/AIDS among mothers delivering at Narok.
Typhoid, APH and hypertension were also experienced by small proportions of the mothers. Others included ailments such as liver disorders, diabetes, arthritis, heart and respiratory diseases.

Figure 7: Morbidity status of the mothers

Table 11 gives data on the proportionate share of morbidity experience in the study population by type of disease, residence and community. It is clear that typhoid and malaria were more prevalent in urban than rural areas but HIV/AIDS occurrence was similar among both urban and rural women as well as the Maasai and non-Maasai women. In general, morbidity was higher among non-Maasai than the Maasai women ($\chi^2$, P = 0.054).
Table 11: Distribution of morbidity experience in the study population by residence and community of the mothers

<table>
<thead>
<tr>
<th>Disease/Condition</th>
<th>Residence</th>
<th></th>
<th></th>
<th>Community</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Urban (%)</td>
<td>Rural (%)</td>
<td>Maasai (%)</td>
<td>Non-Maasai (%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N=169</td>
<td>N=179</td>
<td>N=141</td>
<td>N=207</td>
<td></td>
</tr>
<tr>
<td>Malaria</td>
<td>16.6</td>
<td>9.5</td>
<td>9.9</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>TV/AIDS</td>
<td>6.5</td>
<td>6.1</td>
<td>6.4</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>Typhoid</td>
<td>5.9</td>
<td>1.1</td>
<td>1.4</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>0.6</td>
<td>1.7</td>
<td>0.7</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>PH</td>
<td>1.8</td>
<td>2.2</td>
<td>1.4</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>7.7</td>
<td>10.6</td>
<td>9.2</td>
<td>9.2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>39.1</td>
<td>31.3</td>
<td>29.1</td>
<td>39.1</td>
<td></td>
</tr>
</tbody>
</table>

7.7 Factors Associated with Birth Weight

7.1 Association of maternal socio-economic and demographic characteristics with birth weight

Table 12 shows association of selected maternal demographic and socio-economic factors with birth weight. Education level, religion and age of the mother were found to be significantly associated with low birth weight prevalence. Higher maternal age and education attainment were found to be protective against low birth weight. It was also evident that the prevalence of low birth weight was higher among non-Christians than among the Christians.

Father's education was found to have a significant association with low birth weight prevalence (Chi-square, P=0.014). The prevalence was 32.5% for illiterate fatherhood as compared to 14.9% and 6.8% for fathers with secondary and post-secondary education respectively.
It was found that among infant characteristics, only plurality was significantly negatively correlated with birth weight ($r=-0.363, P=0.000$). It also showed a significant negative association with low birth weight prevalence (Table 13). This means that babies born twin or triplet were
low birth weight than singletons. Parity had a positive insignificant correlation with birth weight ($r=0.011$, $P=0.841$).

### Table 13: Association of infant factors with low birth weight prevalence

<table>
<thead>
<tr>
<th>Variable</th>
<th>Low (%)</th>
<th>Normal (%)</th>
<th>Statistical Test (P&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Birth outcome</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Singletons (N=327)</td>
<td>13.5</td>
<td>86.5</td>
<td>$\chi^2=33.818; 1\text{df}; P=0.000$</td>
</tr>
<tr>
<td>Multiple delivery (N=21)</td>
<td>61.9</td>
<td>38.1</td>
<td></td>
</tr>
<tr>
<td><strong>Infant Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (N=194)</td>
<td>13.4</td>
<td>86.6</td>
<td>$\chi^2=2.837; 1\text{df}; P=0.092$</td>
</tr>
<tr>
<td>Female (N=154)</td>
<td>20.1</td>
<td>79.9</td>
<td></td>
</tr>
</tbody>
</table>

Data in table 14 shows that household size was significantly associated with low birth weight (P<0.05). Households with six members or more were had significantly higher cases of LBW newborns. On the other hand, household profile did not appear to significantly affect birth weight.

### Table 14: Association of household characteristics with low birth weight prevalence

<table>
<thead>
<tr>
<th>Variable</th>
<th>Low (%)</th>
<th>Normal (%)</th>
<th>Statistical Test (P&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Household profile</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monogamous</td>
<td>14.3</td>
<td>85.7</td>
<td>$\chi^2=2.649; 2\text{df}; P=0.266$</td>
</tr>
<tr>
<td>Polygamous</td>
<td>10.1</td>
<td>89.9</td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>21.3</td>
<td>78.7</td>
<td></td>
</tr>
<tr>
<td><strong>Household size</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;6* members</td>
<td>13.0</td>
<td>87</td>
<td>$\chi^2=8.567; 1\text{df}; P=0.003*$</td>
</tr>
<tr>
<td>6 and above</td>
<td>26.4</td>
<td>73.6</td>
<td></td>
</tr>
</tbody>
</table>

*significant association

**Mean household size in Narok
The correlation between birth weight and household size was negative \((r = -0.037)\), but it was not significant \((P = 0.489)\). Mean birth weight of babies born of urban mothers was significantly higher than for rural mothers \((P < 0.05)\). A significant difference was also found between mean birth weight of babies delivered by married and single mothers \((\text{ANOVA}, P < 0.05)\). Mean birth weight of children born to circumcised mothers was significantly lower than that of uncircumcised mothers \((P < 0.05)\). A t-test showed significant mean birth weight difference between babies born of teenage mothers and mothers older than nineteen years \((P = 0.019)\). Table 15 contains the details.

### Table 15: Mean birth weights of infants categorized by mothers' characteristics

<table>
<thead>
<tr>
<th>Marital status</th>
<th>Mean weight (g)</th>
<th>SEM</th>
<th>Statistical test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married (N = 287)</td>
<td>2965.3*</td>
<td>33.8</td>
<td>ANOVA, (P = 0.014^*)</td>
</tr>
<tr>
<td>Single (N = 56)</td>
<td>2750.9*</td>
<td>92.6</td>
<td></td>
</tr>
<tr>
<td>Others* (N = 4)</td>
<td>2760.0</td>
<td>273.1</td>
<td></td>
</tr>
<tr>
<td>Residence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban (N = 169)</td>
<td>2994.0</td>
<td>76.9</td>
<td>T-test, (P = 0.044^*)</td>
</tr>
<tr>
<td>Rural (N = 179)</td>
<td>2865.0</td>
<td>84.0</td>
<td></td>
</tr>
<tr>
<td>Circumcision</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (N = 202)</td>
<td>2866.9</td>
<td>89.5</td>
<td>T-test, (P = 0.025^*)</td>
</tr>
<tr>
<td>No (N = 146)</td>
<td>3012.2</td>
<td>98.6</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(&lt; 19) years (N = 68)</td>
<td>2776.3</td>
<td>86.7</td>
<td>T-test, (P = 0.019^*)</td>
</tr>
<tr>
<td>(&gt; 19) years (N = 280)</td>
<td>2964.7</td>
<td>33.5</td>
<td></td>
</tr>
</tbody>
</table>

\(^*\)Significantly different (t-test, ANOVA; \(P < 0.05\))

There was a statistically significant positive correlation between birth weight and household income \((r = 0.160, P < 0.01)\) as well as the amount of money allocated for food in the households \((r = 0.170, P < 0.01)\)
7.2 Association of maternal feeding practices and birth weight

Food restriction, avoidance and pica did not show a significant relationship with low birth weight according to data presented in table 16. It was however noted that the incidence of low birth weight was higher among infants whose mothers experienced restriction, induced vomiting and pica.

Table 16: Association of dietary habits with birth weight

<table>
<thead>
<tr>
<th>Variable</th>
<th>Birth weight</th>
<th>Statistical test (P&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low (%)</td>
<td>Normal (%)</td>
</tr>
<tr>
<td>Food restriction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (n=53)</td>
<td>17.0</td>
<td>83.0</td>
</tr>
<tr>
<td>No (n=295)</td>
<td>16.3</td>
<td>83.7</td>
</tr>
<tr>
<td>Food avoidance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (n=181)</td>
<td>12.7</td>
<td>81.3</td>
</tr>
<tr>
<td>No (n=167)</td>
<td>20.4</td>
<td>79.6</td>
</tr>
<tr>
<td>Induced Vomiting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (n=78)</td>
<td>17.7</td>
<td>83.3</td>
</tr>
<tr>
<td>No (n=270)</td>
<td>15.6</td>
<td>84.4</td>
</tr>
<tr>
<td>Pica</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (n=184)</td>
<td>16.8</td>
<td>83.2</td>
</tr>
<tr>
<td>No (n=164)</td>
<td>15.9</td>
<td>84.1</td>
</tr>
</tbody>
</table>

Residence of the mother and dietary practices did not show a statistically significant association among mothers of low birth weight babies as shown in table 17. It was however noted that mothers who experienced food restriction were mainly rural residents (77.8%) while those who did not voluntarily avoid some foods were from a rural set-up.
<table>
<thead>
<tr>
<th>Dietary practices</th>
<th>Urban (%)</th>
<th>Rural (%)</th>
<th>Statistical test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food restriction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>22.2</td>
<td>77.8</td>
<td>$\chi^2=1.459$: 1 df:</td>
</tr>
<tr>
<td>No</td>
<td>43.8</td>
<td>56.2</td>
<td>$P=0.227$</td>
</tr>
<tr>
<td><strong>Food avoidance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>52.2</td>
<td>47.8</td>
<td>$\chi^2=2.239$: 1 df:</td>
</tr>
<tr>
<td>No</td>
<td>32.4</td>
<td>67.6</td>
<td>$P=0.135$</td>
</tr>
<tr>
<td><strong>Pica</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>48.8</td>
<td>51.6</td>
<td>$\chi^2=1.824$: 1 df:</td>
</tr>
<tr>
<td>No</td>
<td>30.8</td>
<td>69.2</td>
<td>$P=0.177$</td>
</tr>
<tr>
<td><strong>Induced vomiting</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>50.0</td>
<td>50.0</td>
<td>$\chi^2=0.718$: 1 df:</td>
</tr>
<tr>
<td>No</td>
<td>37.2</td>
<td>62.8</td>
<td>$P=0.397$</td>
</tr>
</tbody>
</table>

The mean birth weight of babies whose mothers voluntarily avoided certain foods was 3022g (SD=534) while those who did not avoid had a mean birth weight of 2825g (SD=644). The difference was statistically significant ($P=0.002$). The mean difference was not significant between those who experienced food restriction, pica and induced vomiting, however, mean birth weights were lower for those who observed these practices.

Chi-square test did not show a significant association between food security in the mothers' households and low birth weight prevalence ($P=0.326$). In addition, the number of meals that a mother consumed in a day did not show significant association ($P>0.05$) with low birth weight. However, mothers who had less than two meals had higher rates of low birth weight as shown in table 18.
Table 18: The association of mothers' daily meal frequency and low birth weight

<table>
<thead>
<tr>
<th>Number of meals</th>
<th>Birth weight category</th>
<th>Statistical Test (P&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low (%)</td>
<td>Normal (%)</td>
</tr>
<tr>
<td>1-2 (N=87)</td>
<td>20.7</td>
<td>79.3</td>
</tr>
<tr>
<td>$\geq$3 (N=260)</td>
<td>15.0</td>
<td>85.0</td>
</tr>
<tr>
<td>All (347)</td>
<td>16.4</td>
<td>83.6</td>
</tr>
</tbody>
</table>

4.7.3 Association of maternal nutritional status and birth weight

There was a significant association between low birth weight and MUAC of the mothers as shown in table 19. Mothers with MUAC less than 23 cm were more likely to give birth to a baby with low birth weight.

Table 19: Relationship between MUAC and low birth weight

<table>
<thead>
<tr>
<th>MUAC category</th>
<th>Birth weight category</th>
<th>Statistical test (P&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low (%)</td>
<td>Normal (%)</td>
</tr>
<tr>
<td>MUAC&lt;23 cm (n=94)</td>
<td>24.5</td>
<td>75.5</td>
</tr>
<tr>
<td>MUAC$\geq$23 (n=250)</td>
<td>13.2</td>
<td>86.8</td>
</tr>
<tr>
<td>Total</td>
<td>16.3</td>
<td>83.7</td>
</tr>
</tbody>
</table>

*significant association

Correlation showed a significant association between maternal MUAC ($r=0.121$, $P=0.025$), body mass index (BMI) ($r=0.144$, $P=0.007$) and weight ($r=0.208$, $P=0.000$) with birth weight of the infants. This means that increase in mother's weight and BMI increased birth weight of her infant. Height was not significantly associated with birth weight ($r=0.070$, $P=0.194$).

No significant association was found between haemoglobin (HB) level (anaemia status) at the first visit to ANC and low birth weight prevalence (chi-square, $P=0.771$). The mean birth weight did not show significant difference across levels of haemoglobin (ANOVA, $P=0.297$).
Birth weight and HB were positively correlated ($r = -0.084$), although this correlation did not show statistical significance ($P > 0.05$).

### 4.7.4 Association between maternal morbidity during pregnancy and birth weight

No significant association was found between morbidity experience and low birth weight prevalence ($\chi^2$ square, $P > 0.05$). The data is tabulated in table 20.

#### Table 20: Association of maternal morbidity and birth weight

<table>
<thead>
<tr>
<th>Illness</th>
<th>Birth weight category</th>
<th>Statistical test ($P &lt; 0.05$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illness</td>
<td>Low (%)</td>
<td>Normal (%)</td>
</tr>
<tr>
<td>Yes (N=122)</td>
<td>16.4</td>
<td>83.6</td>
</tr>
<tr>
<td>No (N=226)</td>
<td>16.4</td>
<td>83.6</td>
</tr>
<tr>
<td>Illness type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typhoid (N=12)</td>
<td>33.3</td>
<td>66.7</td>
</tr>
<tr>
<td>Hypertension (N=4)</td>
<td>25.0</td>
<td>75.0</td>
</tr>
<tr>
<td>Malaria (N=45)</td>
<td>15.6</td>
<td>84.4</td>
</tr>
<tr>
<td>HIV/AIDS (N=22)</td>
<td>9.1</td>
<td>90.9</td>
</tr>
<tr>
<td>APH (N=7)</td>
<td>0.0</td>
<td>100</td>
</tr>
<tr>
<td>Others (N=32)</td>
<td>18.8</td>
<td>81.2</td>
</tr>
</tbody>
</table>

Attendance of antenatal care (ANC) was found to have a significant association with low birth weight prevalence ($P = 0.000$) as shown in table 21. Almost half of the mothers who did not attend ANC clinic delivered low birth weight babies.

#### Table 21: Association of maternal ANC visits with low birth weight prevalence

<table>
<thead>
<tr>
<th>Number of ANC visits</th>
<th>Birth weight category</th>
<th>Statistical test ($P &lt; 0.05$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low (%)</td>
<td>Normal (%)</td>
</tr>
<tr>
<td>None (n=11)</td>
<td>45.5</td>
<td>54.5</td>
</tr>
<tr>
<td>1 to 3 (n=170)</td>
<td>21.8</td>
<td>78.2</td>
</tr>
<tr>
<td>4 and above (n=167)</td>
<td>9.0</td>
<td>91.0</td>
</tr>
<tr>
<td>Total (n=348)</td>
<td>16.4</td>
<td>83.6</td>
</tr>
</tbody>
</table>

*Significant association
4.7.5 Factors independently associated with low birth weight

Table 22 shows the factors which were significantly independently associated with low birth weight. Logistic regression showed that only mother’s religion (P<0.05), plurality, gestation and maternal weight were significantly independently associated with low birth weight. One unit increase in gestation decreased the probability that a delivery was low birth weight by 0.64 times. Maternal Christian faith was also negatively associated with low birth weight delivery. Multiple delivery increased the odds of low birth weight delivery more than tenfold. Maternal weight was negatively independently associated with low birth weight. One unit increase in maternal weight reduced the odds of low birth weight by 0.96.

Table 22: Factors independently associated with low birth weight

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>95.0% C.I. for Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestation</td>
<td>-0.445</td>
<td>0.095</td>
<td>22.074</td>
<td>0.000</td>
<td>0.641</td>
<td>0.532-0.771</td>
</tr>
<tr>
<td>Plurality</td>
<td>2.349</td>
<td>0.522</td>
<td>20.274</td>
<td>0.000</td>
<td>10.475</td>
<td>3.768-29.123</td>
</tr>
<tr>
<td>Religion</td>
<td>-1.027</td>
<td>0.428</td>
<td>5.748</td>
<td>0.017</td>
<td>0.358</td>
<td>0.155-0.829</td>
</tr>
<tr>
<td>Mother’s weight</td>
<td>-0.141</td>
<td>0.020</td>
<td>4.011</td>
<td>0.045</td>
<td>0.960</td>
<td>0.923-0.999</td>
</tr>
</tbody>
</table>

The logit model of producing a low birth weight infant was as follows:

Low birth weight = 17.349+2.349(Plurality)-0.445(Gestation)-1.027(Religion)-0.141(Weight)
CHAPTER FIVE: DISCUSSION

5.1 Low Birth Weight Prevalence in the Study Population

The findings of this study indicate that the prevalence of low birth weight deliveries in Narok District Hospital (16.4%) is significantly higher than the estimated Rift Valley and Narok North prevalences. The national prevalence of low birth weight was estimated at 8% (UNICEF, 2009) and 6% was reported among children who had birth weight recorded in the 2008 Kenya Demographic and Health Survey (KDHS). Rift Valley was estimated to have a prevalence of 5.1% in 2008 (KNBS and ICF Macro, 2010) while Narok North was reported to have a prevalence of 7.1% for the year 2011 (HMIS, 2011). The prevalence exceeds the 15% level that indicates a major public health problem. The high prevalence is not only an indicator of undernutrition, morbidity and mortality for the newborn, but also a public health warning that women of child bearing age are undernourished as well (ACC/SCN, 2000).

5.2 Effect of Socio-economic and Demographic Factors on Newborn's Birth weight

Socio-economic and demographic factors impact differently on birth weight. The findings of this study show significant association between education status of both parents of the child and prevalence of low birth weight. Mothers' lack of formal education is significantly associated with small mid-upper arm circumference (MUAC<23cm). These findings are in agreement with findings elsewhere. A study on factors influencing low birth weight and prematurity in Botswana found maternal low or lack of formal education as a positive risk factor for low birth weight. Mothers who had no formal education were 14 times more likely to produce a low birth weight infant compared with those with at least secondary education (Lctamo and Majelantle, 2001). Another study on the demographic and socioeconomic determinants of low birth weight and
preterm births among natives and immigrants in Greece found high educational attainment of a mother to decrease the chances of adverse pregnancy outcomes (Cleon and Georgia, 2011). The findings also mirrored those of another study in Nigeria where higher maternal education was protective against low birth weight delivery (Lawoyin and Oyediran, 1992). Maternal and paternal education is likely to influence the general parental welfare through improved income, better health seeking behavior and lifestyle.

The observed higher risk of delivering a low birth weight baby by single mothers as compared to married mothers (although not statistically significant) is in concurrence with findings of studies done in Tanzania and Botswana (Siza, 2008; Letamo and Majelantle, 2001). The higher incidence of low birth weight among unmarried mothers could be explained by lack of paternal support during pregnancy. Their diets are more likely to be inadequate with little rest since they lack support from a spouse.

Mother’s age influences birth weight. The findings of this study show that low birth weight babies are generally more common among teenage mothers compared with older women. A study in Botswana had similar findings where teenage mothers were 1-3 times more likely to produce premature babies, who in turn were more likely to be low birth weight than term babies (Letamo and Majelantle, 2001). Another study in Uganda also had similar findings (Mbonye, 2009). Teenage mothers have high requirements for their own growth. Pregnancy is an added burden to the needs of the teenager because the foetus competes with the mother for nutrients for its own growth. The partitioning of nutrients between maternal and foetal requirements may lead to inadequate foetal nourishment and hence higher incidences of low birth weight among teenage mothers.
Household size in this study is significantly associated with birth weight. In resource poor settings, larger households experience greater constraints in sharing available resources. This is evidenced by findings in this study of lower per capita allocation for food in larger households than smaller ones. Nutrition status of mothers in smaller households is also better than status of mothers in larger households. This could provide an explanation to the observed disparity in low birth weight in mothers from different household sizes.

There is a significant association between birth weight and circumcision status of the mother. Mean birth weight of babies delivered by uncircumcised mothers is higher than for their circumcised counterparts while at the same time circumcised mothers are more likely to deliver low birth weight infants. A focus group discussion with elderly women, some of whom were circumcisers and traditional birth attendants implied that delivering small babies is easier and is therefore preferred to delivering large babies. A study in Ethiopia showed that circumcised women experienced more delivery complications and unfavorable birth outcomes than the uncircumcised mothers (Hakim, 2001). This provides an explanation as to why mothers in the rural areas are mainly starved to deliver smaller babies.

The observed statistically significant correlation between birth weight and household income and amount of money allocated for food in the households is probably because households with higher incomes allocate more money for food, resulting in better nutrition status than those who are economically underprivileged. The findings agree with those of another study in a rural area in Kenya which identified socio-economic status as a strong predictor of birth weight (Ngare and Newmann, 1998). Households which are better off economically are able to satisfy their food needs and enjoy better health and nutrition status.
Lack of a significant association observed in this study between parity and low birth weight was also documented in a study in Botswana (Letamo and Majelantle, 2001). It was expected that firstborns would have higher incidences of low birth weight than higher order births as observed in other studies (Ondimu, 2001; Lawoyin and Oyediran, 1992). It is however noted that nulliparous mothers in this study are better educated with higher frequency of antenatal care clinic attendance, both of which are found to be protective against low birth weight deliveries. A focus group discussion with pregnant mothers from a rural area also indicates that higher order parity mothers are more likely to deliver in a health facility if they anticipate complications. Such mothers are at a higher risk of delivering a low birth weight baby, which could offer another explanation to the disparity observed in this study.

Males generally weigh more than females. The findings of this study show a higher prevalence of low birth weight among the females than males, although the association is not significant. The findings agree with those of another study in Nigeria which found no significant difference in birth weight between the sexes (Swende, 2011). Another study in Bangladesh on the predictors of low birth weight, however, found a significant association between sex of the baby and birth weight (Ahmed et al. 2000). Male hormones promote masculinity making males generally heavier than females throughout the lifecycle. This could provide an explanation for the observed slightly higher incidence of low birth weight among the females.

Almost half of mothers not attending antenatal clinic in this study delivered low birth weight babies. The findings concur with findings of another study in Botswana which found ANC a protective factor against low birth weight delivery (Letamo and Majelantle, 2001). Mothers not attending ANC clinic are more likely to come from rural areas where Health facilities are far
apart and education levels low. Mothers who attend ANC are given nutrition and health education alongside other services which could be responsible for the higher weight in infants whose mothers have more ANC visits.

5.3 Maternal Feeding Practices and Birth Weight

The incidence of LBW is higher among infants whose mothers experience food restriction, induced vomiting and pica, although the association is not significant. A study in a pastoral community in Kenya found significant association between food restriction and birth weight. Pregnant mothers especially the primigravidae were starved to give birth to small babies to avoid difficulties in delivery (Mammo, 2000). These findings were reinforced by views of a focus group discussion comprising of elderly women in a rural set up of the current study in which it was noted that pregnant women were denied food to avoid delivery of large babies. Since this study was cross-sectional in nature, food amounts consumed during pregnancy were not measured and therefore the degree of restriction might not have been so severe as to cause significant effect on birth weight.

Avoidance of some foods shows a significant association with birth weight. Mean birth weight of babies delivered by mothers who avoid some foods is higher than for those who do not avoid. However, mothers avoiding some foods in this study are more likely to be food secure. This could explain why they have better nutrition status since it is likely that they have a wider variety of food choice even after avoiding foods that make them nauseated.
Maternal Nutrition Status and Birth Weight

This study finds a significant association between maternal nutrition status and birth weight of her infant. Malnourished mothers are more likely to give birth to a low birth weight baby than well nourished mothers, results that concur with findings of studies on low birth weight in East Africa (Siza, 2008; Ngare and Newmann, 1998; Magadi et al., 2003). In another study on determinants of low birth weight among HIV-infected pregnant women in Tanzania, risk of delivering LBW was found not to vary by BMI category (Dreyfuss et al., 2001). A well-nourished mother has adequate reserves for the growing foetus hence higher birth weight than for malnourished mothers.

The lack of a significant association between haemoglobin (HB) level of the mother at the first visit to ANC and low birth weight prevalence observed in this study differs with the findings of another study done in Kenya on the predictors of birth weight which identified HB as a strong predictor of birth weight (Ngare and Newmann, 1998). Some of the mothers who participated in this study did not have HB values in their records while for those who had the value measurement might have been done at different points in gestation. This might have contributed to the observed discrepancy. Given the design of this study, it would not have been possible to obtain uniform HB values in pregnancy.

Maternal Morbidity and Birth Weight

The findings of this study show no significant association between health status of the mother and birth weight. Several studies but a few have demonstrated that chronic infections, malaria and HIV/AIDS have detrimental effect on fetal growth leading to prematurity and low birth weight.
weight (Guyatt and Snow, 2004; Dreyfuss et al., 2001; Mbonye, 2009). The experience of illnesses at different stages in pregnancy at varying levels of severity might have impacted differently on birth weights hence the observed results. This was however beyond the scope of this study.

5.6 Factors Independently Associated With Low Birth Weight

Plurality is a known risk factor for low birth weight delivery. The current study shows significant association between multiple births and low birth weight prevalence. More than 60% of babies born twin or triplets are of low birth weight. The findings are in tandem with a study on factors affecting low birth weight and prematurity in Botswana (Letamo and Majelantle, 2001). In multiple pregnancies, fetuses share maternal nutrients and other requirements for growth and development hence more chances of being born with low birth weight.

The present study shows that mother’s religion and prevalence of low birth weight are significantly associated, being higher among the Muslims, traditionalists and the non-religious. It is however worth noting that the mothers in these religious groupings are of low education and poor nutrition status compared to their Catholic and Protestant counterparts. Hence these are likely to be the contributing factors to low birth weights as opposed to their religious affiliation.

As expected, low gestation age has a significant association with low birth weight incidence as observed in the present study. However the high level of prematurity (58%) raises questions on the accuracy of estimation of gestation. A key informant raised concern about the late attendance of ANC clinic by mothers in the catchment area. This late attendance may make it difficult for
the mothers to remember when they had their last menstrual period and hence underestimation of gestation period. For this reason, low birth weight arising from prematurity and intra-uterine growth restriction have been considered together.

Findings of this study show significant independent association between neonatal low birth weight and weight of the mother, heavier mothers being less likely to deliver low birth weight infants. Heavier mothers have adequate reserves for their own maintenance and foetal development. This could explain the observed higher birth weight with increase in maternal weight.
CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The prevalence of low birth weight in Narok District Hospital is higher than national and local estimates; and also high enough to raise concern as a public health problem. Factors significantly and independently contributing to low birth weight in Narok include religion of the mother, multiple deliveries, gestation period and nutrition status of the mother.

6.2 Recommendations

Given the findings of this study, the following recommendations are made:

- Health data quality should be improved to prevent under reporting of low birth weight. This can be achieved through sensitization of maternity staff through continuous medical education programmes by the district health management team.

- The government and non-state actors should scale-up maternal nutrition interventions. Special interventions to improve maternal nutrition in Narok should be designed taking into consideration the unique challenges facing the pastoralists in the predominantly semi-arid district. This will ensure that mothers get pregnant when they have good nutrition status. They should be followed up to ensure normal progression of pregnancy.

- There should be increased advocacy for family planning in an effort to decrease household sizes. This will ensure that available resources are shared among fewer household members for improved family welfare. Benefits, among them improvement in birth weight of babies born within the household will then be realized. The responsibility lies with the government, Non-Governmental Organizations (NGOs), Faith Based Organizations (FBOs) and Community Based Organizations (CBOs).
More efforts should be put towards eradication of harmful cultural practices such as female genital mutilation and early marriages. Special focus should be directed towards elimination of teenage pregnancies which increase the chances of girls getting pregnant before they complete growth.

There should be increased investment in education by the government and other non-state actors in Narok. This will improve the socio-economic welfare and empower households intellectually for improved health-seeking behavior, such as ANC clinic attendance, and improve overall welfare.

A longitudinal study should be done from the period prior to conception through pregnancy to after delivery to allow for a close follow-up of the subjects and evaluate the factors contributing to low birth weight in a cause-effect model for development of specific interventions.
REFERENCES


Oluoch, J. (2011). Face to Face Interview with the Nutritionist Incharge of Narok District Hospital Maternity Unit held on 16th May 2011.


Rotich, D., (2011). Face to face Interview with Bomet District Nutrition Officer held on 28th May 2011.


APPENDIX 1: MAP OF NAROK NORTH DISTRICT
APPENDIX 2: QUESTIONNAIRE ON THE PREVALENCE OF LOW BIRTH WEIGHT DELIVERIES AND ASSOCIATED FACTORS IN NAROK DISTRICT HOSPITAL

Q/NO..............................................

A. General Information.
Name of Interviewer.......................................................... Date of interview........................./....../2011
District.......................................................... Division...................................................
Location.......................................................... Sub-location........................................ Village...........................................

Respondent's name.......................................................... Sex...
Name of the index child.......................................................... Sex...

Section A: SOCIO-DEMOGRAPHIC CHARACTERISTICS

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>R/ship to the index child</th>
<th>Sex</th>
<th>Age (years)</th>
<th>Marital status</th>
<th>Religion</th>
<th>Education</th>
<th>Occupation</th>
<th>Contribution to HH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R/ship to the index child
- Father
- Mother
- Father's sister
- Grandmother
- Relative others (specify)

Marital Status
- 1 = married
- 2 = separated
- 3 = widowed
- 4 = single
- 5 = divorced
- 6 = not applicable

Religion
- 1 = Catholic
- 2 = Protestant
- 3 = Muslim
- 4 = Traditionalist
- 5 = others (specify)

Education
- 1 = college/university
- 2 = secondary
- 3 = primary
- 4 = literate e.g. adult education
- 5 = illiterate
- 6 = others (specify)

Occupation
- 1 = salaried employee
- 2 = farmer
- 3 = self employment/business
- 4 = casual labourer
- 5 = student
- 6 = housewife
- 7 = unemployed
- 8 = n/a
- 9 = others (specify)

Contribution to HH
- 1 = nothing
- 2 = money
- 3 = labour
- 4 = childcare
- 5 = others (specify)

A2. Household profile 1 = monogamous 2 = polygamous 3 = Single

For preschoolers: under 7 years and aged 5 to 17 years neither in school nor employed
*Start with household head

---

58
A3. Community 1= Maasai 2= Kikuyu 3= Kalenjin 4= Kisii 5= Other (Specify)

A4. Circumcision status 1 = circumcised 2 = uncircumcised

A5. Estimated average household income per month (K.Shs) by source
1 = Animal and animal product sales
2 = Crop sales
3 = Salaries or wages
4 = Trade
5 = Others (Specify)

Total income

A6. Of that income, how much is spent on food?

SECTION B: INFANT’S DETAILS AND ANTE NATA L CARE

B10. Number of antenatal care visits
(Non=99 don’t know=88)

B11. Number of tetanus toxoid injections given during current pregnancy
(Non=99 don’t know=88)

B12. Family planning method used:
1 = coil 2 = Condom 3 = Depo 4 = Pill 5 = Natural 6 = Other (Specify)

B13. Were you dewormed during pregnancy? 1 = Yes 2 = No

B14. Did you sleep under a mosquito net during pregnancy? (Ask about last 3 days before coming to hospital) 1 = Yes 2 = No

B15. Did you smoke (tobacco) during pregnancy? 1 = Yes 2 = No

B16. Pregnancy outcome; 1 = singleton 2 = Twins 3 = Triplets 4 = Quadruplets

B17. Type of fuel used for cooking:
1 = Firewood 2 = Charcoal 3 = Kerosene 4 = Gas 5 = Other (Specify)

SECTION C: MOTHER’S ANTHROPOMETRIC AND BIOCHEMICAL MEASUREMENTS

C6. Mother’s weight gain during pregnancy Kg. Over a period of months
(From MCH booklet)

C7. Pre-pregnancy weight Kg.
SECTION D: MOTHER'S MEDICAL AND SURGICAL HISTORY (From MCH booklet and mother)

D1. Did you suffer from an illness during pregnancy? (if no go to D5)  
1 = Yes  2 = No

D2. Which illness did you suffer from?  
1 = HIV/AIDS  2 = TB  3 = Diabetes  4 = Hypertension  5 = Malaria  6 = Gonorrhea  
7 = Syphilis  8 = other (specify)  

D3. In which trimester did you suffer from the illness?  

D4. Where did you seek care?  
1 = Government facility  2 = Private facility  3 = Traditional remedies  4 = None

D5. How would you describe your own birth weight/size?  
1 = high/big  2 = medium  3 = Low/Small  3 = No idea

SECTION E: DIETARY PRACTICES

E1. How many meals did you have in an ordinary day during pregnancy? 

E2. Was there food that was restricted during pregnancy? (If no go to E7.) 1 = Yes  2 = No

E3. If yes, which foods were restricted?  
1 = Milk  2 = Meat  3 = eggs  4 = Legumes  5 = Cereals  6 = Others (Specify)  

E4. When was it done?  
1 = first trimester  
2 = Second trimester  
3 = Third trimester  
4 = Throughout pregnancy

E5. What were the reasons for the restrictions?  
1 = Medical  
2 = To give birth to a small baby  
3 = To feed other household members  
4 = Don’t know  
5 = others (Specify)  

E6. Who ensured the restriction was enforced?  
1 = Husband  
2 = Mother-in-law  
3 = Co-wife  
4 = Neighbour  
5 = No one  
6 = Other (Specify)  

E7. Were there foods that you voluntarily avoided? (If no go to E10.) 1 = Yes  2 = No

E8. If yes, Which foods?  
1 = Milk  2 = Meat  3 = eggs  4 = Legumes  5 = Cereals  6 = Others (Specify)  

E9. What were the reasons of avoiding those foods?  
1 = Nausea  2 = Changed tastes  3 = To give birth to a smaller baby  3 = Other (Specify)  

E10. Did you experience induced vomiting? 1 = Yes  2 = No (If no go to E13)

E11. If yes, when was it done?  
1 = first trimester  
2 = Second trimester
3. Third trimester
4. Throughout pregnancy

E12. What was the reason(s) for the induction?
1. to deliver a small baby
2. to relieve a full belly
3. don’t know
4. other (specify)..................

E13. Which supplements did you use during pregnancy?
1. Iron and folate
2. Combined multiple micronutrients
3. None

E14. Did you experience craving for non-food items? (If no go to E16)
1. Yes 2. No

E15. If yes which items did you crave for?

E16. Did you experience craving for specific foods? If no go to E18.
1. Yes 2. No

E17. If yes, which foods?
7. Others (Specify) 

E18. Do you use salt? 1. Yes 2. No (If no go to E22)

4. Others

E20. What is the brand name?


E22. Rank in order of importance, what is your source of food for the entire household;
5. Others

E23. Did you experience food shortage during the last one year? (If no skip to E24)
1. Yes 2. No

E24. If yes, what did you do to cope?
1. Borrow on credit
2. Beg
3. Steal
4. Sell valuable assets
5. Skip meals
6. Other (Specify)..................................

E25. In which of these categories would you place your household? 1. Food secure
2. Food insecure 3. Not sure
SECTION F: WATER, SANITATION AND HEALTH FACILITIES

F1. What is your main source of water for domestic use during the wet season?
   ____________________
   1=Tap  2=Borehole  3=River  4= Well (not protected)  5= Well (protected)  6= spring  7= rain water

F2. What is your main source of water for domestic use during the dry season?
   ____________________
   1=Tap  2=Borehole  3=River  4= Well (not protected)  5= Well (protected)  6= spring  7= rain season

F3. Do you treat your drinking water?  
   ____________________
   1=Yes  2=No

F4. If Yes how do you treat it?  
   ____________________
   1=boiling  2=use traditional herbs  3=use chemicals  4= filters/sieves

F5. How much water do you use for domestic purposes in litres per day?  
   ____________________

F6. How far is the water source to and fro?  
   ____________________ minutes (By means mostly used)

F7. Who fetched water when you were pregnant?  
   ____________________
   1=Self (mother)  2= Spouse (Father)  3= children  4=Hired labour  5= others (Specify)

F8. State the means used to transport the water  
   ____________________
   1=human  2=Animal  3= motorised transport  4= Others (Specify)

F9. Do you have access to a sanitation facility (toilet or latrine) at home?  
   ____________________
   1= Yes  2= No

F10. If no, what do you use?  
   ____________________
   1= Bush  2= Dig a hole  3= others (Specify)

F11. Do you have access to health facilities/ health care services?  
   ____________________
   1= Yes  2= No

F12. How far is the nearest health facility, where you get your services?  
   ____________________ Km  
   ____________________ minutes (by means mostly used)

F13. Which means of transport do you use to get there?  
   ____________________
   1= Walking  2= Bicycle ride  3= Matatu ride  4= Motorcycle  5= Cart  4= Others (Specify)

F14. What is your main fuel for cooking?  
   ____________________
   1= Firewood  2= charcoal  3= electricity  4= others (Specify)
APPENDIX 3: FGD QUESTION GUIDE

FACTORS ASSOCIATED WITH THE PREVALENCE OF LOW BIRTH WEIGHT DELIVERIES AT NAROK DISTRICT HOSPITAL

1. What are the common illnesses affecting people in this area?

2. How are these ailments treated?

3. How can these illnesses be controlled?

4. How is the general food security situation in this area?

5. What factors determine food choice?

6. How are pregnant women fed?

7. Are there cultural issues which influence feeding pregnant women?

8. What is your opinion on antenatal care of pregnant mothers?

9. Who conducts deliveries?

10. Are there cultural issues attached to birth outcomes?
## APPENDIX 4: TRAINING PROGRAMME

### DAY ONE

<table>
<thead>
<tr>
<th>TIME</th>
<th>CONTENT</th>
<th>TEACHING METHODS</th>
<th>TEACHING AIDS</th>
<th>FACILITATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.30 - 9.00 am.</td>
<td>Introduction, opening Remarks and Logistics</td>
<td>Ice breaker</td>
<td>Flip Chart</td>
<td>Principal Investigator</td>
</tr>
<tr>
<td>9.30 - 10.30 am.</td>
<td>Title, aim, purpose and objectives of the study.</td>
<td>Lecture/Discussion</td>
<td>LCD projector/Slides</td>
<td>Principal Investigator</td>
</tr>
<tr>
<td>10.00 - 11.00 am.</td>
<td>Tea Break</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.00 - 12.00 pm.</td>
<td>Questionnaire</td>
<td>Discussion</td>
<td>Questionnaires</td>
<td>Principal Investigator</td>
</tr>
<tr>
<td>1.00 - 2.00 pm.</td>
<td>Lunch Break</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.00 - 3.30 pm.</td>
<td>Conducting an FGD</td>
<td>Discussion/Question and answer/Lecture</td>
<td>FGD guide/ LCD projector/ Laptop.</td>
<td>Principal Investigator</td>
</tr>
<tr>
<td>3.30 - 4.30 pm.</td>
<td>Key Informant Interview</td>
<td>Discussion/Lecture/ Q&amp;A</td>
<td>KI Guide/ LCD Projector/ Laptop</td>
<td>Principal Investigator</td>
</tr>
</tbody>
</table>
## DAY TWO

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Materials</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.30 - 9.00 am</td>
<td>Recap</td>
<td>Q&amp;A</td>
<td>Flip charts/ Markers</td>
</tr>
<tr>
<td>9.00 - 10.00 am</td>
<td>Ethics in Research</td>
<td>Brainstorming/ Q&amp;A</td>
<td>Flip chart/ Markers</td>
</tr>
<tr>
<td>10.00-10.15 am</td>
<td>Tea Break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.15 - 1.30 pm</td>
<td>Questionnaire pre testing and anthropometry</td>
<td>Practical exercise</td>
<td>Questionnaire/adult MUAC tapes/ Sandiometer/ weighing Scales</td>
</tr>
<tr>
<td>1.30 - 2.30 pm</td>
<td>Lunch Break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.30 - 4.00 pm</td>
<td>Debriefing and corrections</td>
<td>Discussion</td>
<td>Pretested tools/ flip charts/ marker pens</td>
</tr>
<tr>
<td>4.00 - 4.30 pm</td>
<td>Allocation of duties</td>
<td>Discussion</td>
<td>Flip charts/ marker pens</td>
</tr>
</tbody>
</table>

**DEPARTURE**
APPENDIX 5: INFORMED CONSENT FORM

REQUEST FOR CONSENT TO PARTICIPATE IN THE STUDY ON THE PREVALENCE OF LOW BIRTH WEIGHT IN NAROK DISTRICT HOSPITAL AND ASSOCIATED FACTORS

NAME: _______________________________________

AGE: ___________________________ Years

ADDRESS: _______________________________________

The researcher is an M.Sc student at the University of Nairobi. You are kindly requested to participate in the study.

The study team will ask antenatal mothers to give their personal details and health and nutrition history and take some measurements of the mother and the baby's birth weight.

The purpose of the study is to create an understanding of the relationship between birth weight and the factors associated with it in Narok in order to inform stakeholders for appropriate intervention strategies. The researcher will also use the study for his academic work.

The information you will provide will be held in confidence and used for the purpose of the study only. Personal identity will not be disclosed in any report, publication or to any other parties.

I agree/do not agree to be a respondent in this study.

Signature: ___________________________ Date: ........../........./2011