

**DIETARY DIVERSITY, NUTRIENT INTAKE AND NUTRITIONAL STATUS
AMONG PREGNANT WOMEN IN LAIKIPIA COUNTY, KENYA**

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**A RESEARCH THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
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JUNE, 2016

DECLARATION

This thesis is my original work and has not been presented for a degree in any other university or any other award.

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DEDICATION

I am privileged to dedicate this piece of work to my wife Esther, my mum Mrs. Jenifer Wanjiku Kiboi and my late dad Mr. Sammy Kiboi Kahanya for their love, encouragement and unwavering support.

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I would like to give all glory to the Almighty God for His mercies and grace which has seen me this far.

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OPERATIONAL DEFINITION OF TERMS

Dietary diversity: the number of different foods or food groups consumed over a given reference period which in this study was 24 hours.

Dietary diversity score: the sum total of the number of food groups consumed over a reference period of 24 hour by an individual relative to a scale of 14 food groups (Cereals, vitamin A rich vegetables and tubers, dark green leafy vegetables, other vegetables, white roots and tubers, vitamin A rich fruits, other fruits, flesh meat, organ meat, eggs, fish, pulses/legumes, nuts and seeds, milk and milk products, oils and fats) which were used in the study (FAO, 2008).

Morbidity Pattern: In this study was presence of illness/disorder and its duration among the pregnant women two weeks prior to the day of interview.

Nutrient intake: the intake of energy, macronutrients and micronutrients (carbohydrates, protein, fat, zinc, iron, folate, calcium, vitamin C and A).

Nutrient adequacy: The ability of a diet to meet the recommended nutrient intakes

Nutritional status: In this study nutritional status was assessed by mid upper arm circumference (MUAC) and haemoglobin level (Hb) as influenced by nutrient intake.

ABBREVIATIONS AND ACRONYMS

| | | |
|---------------|---|---|
| ASAL | : | Arid and Semi Arid Land |
| ANC | : | Antenatal Clinic |
| ANOVA | : | Analysis of Variance |
| BMI | : | Body Mass Index |
| CSPRO | : | Census and Survey Processing |
| DDS | : | Dietary Diversity Score |
| FAO | : | Food and Agriculture Organization |
| FGD | : | Focus Group Discussion |
| HB | : | Haemoglobin |
| GOK | : | Government of Kenya |
| IDDS | : | Individual Dietary Diversity Score |
| KDHS | : | Kenya Demographic and Health Survey |
| KNBS | : | Kenya National Bureau of Statistics |
| MOH | : | Ministry of Health |
| MUAC | : | Mid Upper Arm Circumference |
| RNI | : | Recommended Nutrient Intake |
| SES | : | Socio-Economic Status |
| SPSS | : | Statistical Package for Social Sciences |
| SD | : | Standard Deviation |
| UNICEF | : | United Nations Children's Fund |
| WHO | : | World Health Organization |

ABSTRACT

Pregnancy is a critical period during which adequate nutrition is considered an important factor that affects birth outcome and the health of the mother. Research has clearly shown that a diverse diet is strongly associated with nutrient adequacy. In Kenya, there is paucity of scientific data on dietary diversity and nutrient intake among pregnant women and the relationship to their nutritional status. This study therefore aimed at determining dietary diversity, nutrient intake and nutritional status of pregnant women in Laikipia County. The study adopted a cross-sectional analytical design. A researcher-administered questionnaire was used to collect information on demographic, socio-economic, dietary diversity, nutrient intake, morbidity and nutritional status for a total of 254 pregnant women attending antenatal clinic at Nanyuki Teaching and Referral Hospital. Anthropometric data (mid upper arm circumference) and haemoglobin levels were used to assess the women nutritional status. Data from the 24 hour dietary recall was analyzed using Nutri-survey software to determine the amount of each nutrient consumed. Dietary diversity score (DDS) was used to assess diversity of the diet consumed by each respondent. Census and Survey Processing system software (CSPPro) was used to enter and verify data while Statistical Package for Social Sciences version 20.0 software was used to analyse the data for both descriptive and inferential statistics. Regression analyses were carried out to determine the contribution of dietary diversity to nutrient intake and nutritional status. A p-value of <0.05 was considered significant in all the analyses. The mean age of the women was 26.81 ± 5.64 years with most being between the ages of 20-24 years. Majority (54.3%) of the respondents were in the second trimester and with a mean gestational age of 27 ± 6.99 weeks at the time of examination. Out of the possible 14 food groups the mean DDS was 6.84 ± 1.46 , with cereals being the most (99.2%) commonly consumed food group. The mean intake of all selected nutrient was inadequate except for vitamin A and C. The mean energy intake (1890.59 ± 898.18) was also below the recommended nutrient intake of 2300 kilocalories. Morbidity burden was high with 57.5% of the respondents being ill two weeks prior to the date of interviews. In respect to nutritional status, 19.3% of the respondents were undernourished based on MUAC while 16.9% were found to be anaemic based on haemoglobin levels. Chi-square test showed that DDS was significantly associated with socioeconomic factors (education level ($P<0.001$), occupation ($P=0.002$), monthly income ($P<0.001$) and household assets ownership ($P=0.009$). Chi-square test further showed significant relationship between DDS and morbidity incidence ($P=0.01$) and nutritional status of the respondents (MUAC; $P<0.001$, Hb; $P=0.033$). Additionally, regression analysis revealed that DDS was a significant predictor of both MUAC ($P<0.001$) and Hb levels ($P= 0.016$). Dietary diversity is therefore crucial in improving nutrient intake and ensuring adequate nutritional status. The researcher recommends that policy makers should enact and support policies on investments geared towards improving the living standard of every household particularly among the poor population. Further, the ministry of health should initiate, support and monitor existing community based programmes promoting dietary diversity especially among vulnerable groups such as pregnant women.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Good nutrition is considered as a paramount component of health and development (Vakili et al., 2013). Moreover, the growth and prosperity of a nation is highly dependent on the nutritional status of women of the reproductive age since they influence growth of the remaining population (Choudhary et al., 2010). In that view, pregnancy has over time been considered as a critical period during which good maternal nutrition is a key determinant of the health of both child and mother (Popa et al., 2013; Sajjad & Khan, 2012). According to World Health Organization (2012), good nutrition during pregnancy is related to proper infant growth, maternal and child health, healthier pregnancy and delivery and lower risk of chronic diseases.

Cheng et al. (2009) have argued that maternal nutrition has a critical role in foetal development and therefore adequate nutrient intake during pregnancy is needed to ensure satisfactory birth outcomes. Maternal diets during pregnancy therefore needs to provide energy and nutrients not only for the mother but also for the growing foetus. The essential importance of diet quality during pregnancy is progressively becoming implicit (Torjusen et al., 2012). According to Zainal-Badari et al. (2012), adequate nutrient intake necessary for good nutrition has often been associated with food variety and diet quality of individuals. Consumption of a wide variety of foods, an integral component of diet quality is thus needed to ensure adequate intake of essential nutrients particularly during pregnancy.

Dietary diversity refers to the number of different foods or food groups consumed over a given reference period (Swindale & Bilinsky, 2006). The value of a diverse diet has long been recognized and is considered as a key element of high quality diet (Arimond & Ruel, 2004; Jayawardena et al., 2013). Kennedy et al. (2009) argues that a sufficiently diverse diet reflects nutrient adequacy since no single food contains all the required nutrients for optimal health. In this regard, Labadarios et al. (2011) noted that the more food groups included in a person's daily diet the greater the likelihood of meeting their nutrient requirements. A variety of foods in the diet is therefore considered imperative in ensuring an adequate intake of essential nutrients (Drimie et al., 2013).

In most developing countries micronutrients malnutrition is still a major problem of public health attention due to intake of monotonous, cereal-based diets that lack diversity (Kennedy et al., 2007; Ruel, 2003). Most diets in developing countries lack vegetables, fruits and animal source foods (Daniels, 2009). According to Arimond et al. (2010) women of reproductive age are the most vulnerable to suffer from these deficiencies particularly those from resource poor settings. Pregnant women specially are at a higher risk due to their increased nutrient needs (Lee et al., 2013).

As observed by Black et al. (2008) deficiencies in micronutrients such as folate , zinc, iron, vitamin A, B6, B12, C, E and riboflavin are highly prevalent and may occur concurrently among pregnant women. While these deficiencies can have a number of causes not necessarily related to nutrition, a high proportion results from nutritional inadequacies (Kennedy et al., 2010). Notably, iron deficiency anaemia during pregnancy

has been reported to be a major problem throughout the world, particularly the developing countries (Alene & Dohe, 2014; Rodriguez-Bernal et al., 2012; Vivek et al., 2012). Similarly, more than 7.2 million pregnant women have been reported to be suffering from vitamin A deficiency (Abebe et al., 2014). In Kenya, according to the 1999 National Micronutrient Survey Report, 55.1 percent of pregnant women are anaemic due to iron deficiency (GOK, 1999; WHO, 2016). To overcome nutritional problems resulting from inadequate intake of micronutrients, food based strategies such as dietary diversification have been recommended (Kennedy, 2009). In Kenya, just as in most developing countries information about dietary diversity is scanty. This study therefore sought to investigate dietary diversity, nutrient intake and nutritional status of pregnant women in Laikipia County. The study also focused on the factors influencing dietary diversity and nutrient intake among the pregnant women.

1.2 Problem Statement

Adequate nutrient intakes among women of reproductive age are important determinants of maternal and child health outcomes (Nguyen et al., 2013). According to Black et al. (2008), deficiencies in micronutrients such as folate, zinc, iron, vitamin A, B6, B12, C, E and riboflavin are highly prevalent and may occur concurrently among pregnant women. Further, micronutrient deficiencies are said to be widely spread among women and children in developing countries (Allen, 2014). This may be due to poor dietary habits.

Dietary diversity is associated with a good nutritional status. In Kenya, 12.3% of women of reproductive age are said to have a Body Mass Index (BMI) of less than 18.5kg/m².

During pregnancy, this under nutrition has resulted to one in ten new born in Kenya being a low birth weight (<2500g) infant (Kenya National Bureau of Statistics (KNBS) and ICF Macro, 2010). Despite the importance of dietary diversity being well acknowledged, there is paucity of scientific data in Kenya on dietary diversity, nutrient intake and nutritional status of pregnant women in arid and semi-arid land (ASAL) areas and more so in Laikipia County. Laikipia County is an ASAL in Kenya, with frequent drought which increases vulnerability of the resident pregnant women.

Furthermore, as rightly noted by Rashid et al. (2011), most studies have been focusing on dietary quantity at the expense of dietary quality. Dietary diversity, a component of dietary quality has received little attention and therefore merits further research especially in developing countries where dietary diversity is rarely reported. To address this gap, this study aimed at determining dietary diversity, nutrient intake and nutritional status among pregnant women in Laikipia County.

1.3 Purpose of the Study

The purpose of this study was to assess dietary diversity, nutrient intake and nutritional status among pregnant women in Laikipia County.

1.4 Objectives of the Study

The specific objectives of this study were to;

1. Determine demographic and socio-economic characteristics among pregnant women in Laikipia County.

2. Assess dietary diversity and nutrient intake among pregnant women in Laikipia County.
3. Assess the morbidity patterns among pregnant women in Laikipia County.
4. Assess the nutritional status among pregnant women in Laikipia County.
5. Establish the relationship between dietary diversity and maternal demographic factors, socioeconomic characteristics, nutrient intake and nutritional status among pregnant women in Laikipia County.

1.5 Hypotheses of the Study

This study tested the following hypotheses;

H₀₁: There is no significant relationship between maternal demographic factors, socio-economic status and dietary diversity of the pregnant women.

H₀₂: There is no significant relationship between dietary diversity and nutrient intake of the pregnant women.

H₀₃: There is no significant relationship between dietary diversity and maternal morbidity patterns of the pregnant women.

H₀₄: There is no significant relationship between dietary diversity and the nutritional status of the pregnant women.

1.6 Significance of the Study

The findings of this study are useful to the Ministry of Health (MOH) and other stakeholders by providing important information needed in designing appropriate interventions to improve maternal nutrition. This study also makes an important empirical contribution to the growing body of literature on dietary diversity, nutrient intake and their associated factors among pregnant women and its influence to their nutritional status.

1.7 Delimitation of the Study

Since the study was conducted in one county, generalization to other counties, country or region should be made with utmost caution due to demographic and ecological variations.

1.8 Limitations of the Study

The data was collected from a cross-sectional study and therefore may not reveal whether the reported Dietary Diversity Score (DDS) values varies over time (Gibson, 2005). To minimise this limitation, Focus Group Discussions (FGDs) were used to solicit information on dietary consumptions at different times of the year.

1.9 Conceptual Framework

This study's conceptual framework was adopted and modified from the UNICEF's conceptual framework on maternal and new born health (UNICEF, 2009) (Figure 1.1).

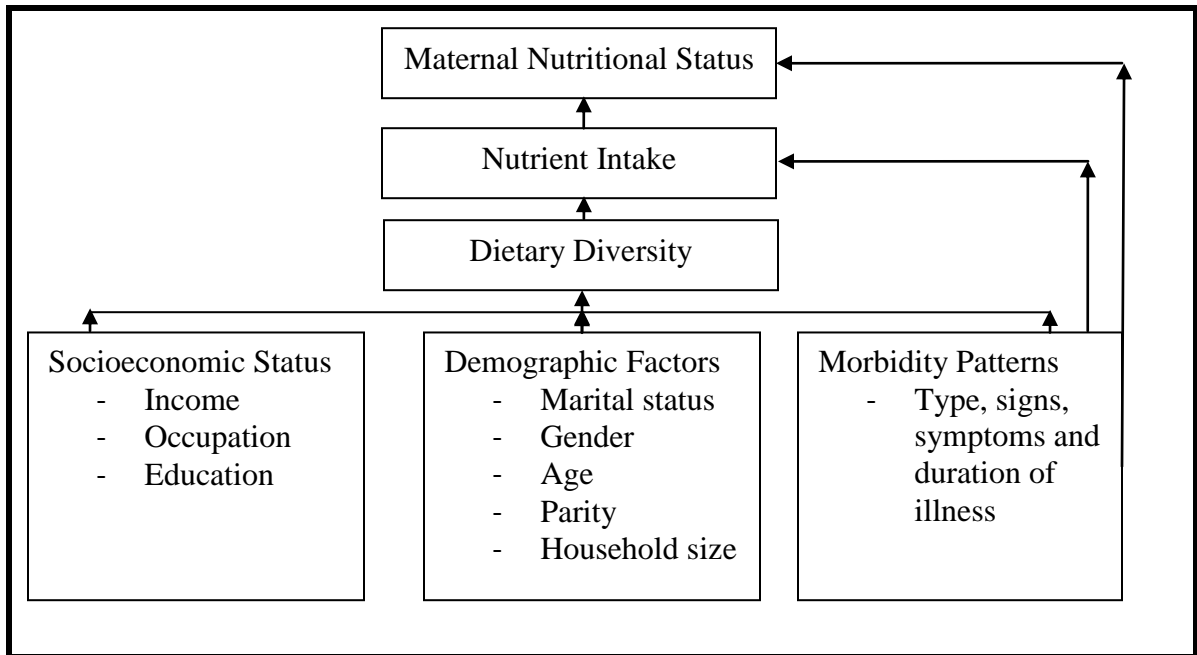


Figure 1.1: Conceptual framework of factors influencing maternal dietary diversity, nutrient intake and nutritional status.

Source: Adapted and modified from UNICEF (2009).

Figure 1.1 illustrates the various factors that influence maternal nutrient intake and nutritional status. Nutrient intake is an important factor that determines the nutritional status of a person. During pregnancy, a good nutritional status is strongly associated with healthy birth outcomes. Dietary diversity affects nutrient intake (Figure 1.1) since a diversified diet is positively correlated with nutrient adequacy. However, nutritional status, dietary diversity and nutrient intake may be directly affected by individual health factors such as morbidity patterns. Illness affects food intake, absorption and utilization of nutrients. Similarly, dietary diversity is also influenced by demographic factors such as maternal age, gender, household size and parity. Socio-economic factors such as income, occupation and education are also known to influence dietary diversity as shown in figure 1.1.

CHAPTER TWO: LITERATURE REVIEW

2.1 Nutrient Needs during Pregnancy

Adequate nutrient intake is needed to ensure healthy birth outcomes (Saaka, 2013). Compelling evidence suggest that nutrient intake during pregnancy has a critical role in foetal development and therefore maternal diets needs to provide nutrients for both the mother and the foetus (Cheng et al., 2009). Macro and micronutrients such as carbohydrates, protein, fat, zinc, iron, folate, calcium, vitamin C and A are some of the nutrient which are stated to be of specific concern during pregnancy (Black et al., 2008).

Pregnant women are vulnerable to nutritional inadequacies due to their elevated nutrient needs (Lee et al., 2013). According to Arimond et al. (2010), the high nutrient demand during pregnancy has put women in developing countries at a high risk since poor dietary intakes have been reported. Poor nutrient intake during pregnancy have been associated with adverse birth outcomes such as permanent damage to the foetus, pre-term delivery, poor infant survival and increased risk of chronic diseases in later life (Ahmed & Tseng, 2013; Blumfield et al., 2012; Imdad & Bhutta, 2011; Sullivan et al., 2009). Additionally, some micronutrient deficiencies in pregnancy, such as iron and calcium deficiencies have been cited to cause substantial maternal deaths (Black et al., 2013).

According to Lartey (2008) maternal malnutrition has been shown to be a major predisposing factor for maternal morbidity and mortality. This according to Ajani (2013) is caused by inadequate food intake, poor diet quality and infections. Ojofeitimi et al. (2008) have demonstrated that maternal malnutrition is known to worsen the other causes

of maternal morbidity and mortality such as anaemia, obstructed labour, postpartum haemorrhage and infections among others. Also, limited availability of high quality food and poor dietary habits in developing and developed countries respectively have been associated with these problems (Radlowski & Johnson, 2013). Despite the evidence on the relationship between maternal nutrient intake and birth outcomes, there is limited data on nutrient intake among pregnant women in Kenya and more so in ASAL areas. This study therefore sought to establish the nutrient intake among pregnant women in Laikipia County.

2.2 Dietary Diversity and Pregnancy

Dietary diversity is defined as the number of different food groups or foods that are consumed over a specific reference period (Ruel, 2002). The value of a diverse diet has over time been recognized (Kadiyala & Rawat, 2013; Rathnayak et al., 2012), since it can provide a wide range of nutrients which enhances the nutritional quality of the diet (Fujita et al., 2012). All people therefore need a variety of foods to meet requirements for essential nutrients (Drimie et al., 2013; Hoddinott & Yohannes, 2002).

High dietary diversity is highly recommended since it is positively associated with nutrient adequacy (Jayawardena et al., 2013). Several studies have demonstrated this positive association between dietary diversity and nutrient adequacy of the diet (Kennedy et al., 2009; Mirmiran et al., 2006). In 2003, five out of seven studies reviewed by Ruel revealed a positive association between DDS and nutrient adequacy (Ruel, 2003). Similarly, a positive relationship between intake from a diversified diet and nutrient

adequacy was observed in a research on women of reproductive age living in Mali, Mozambique, Bangladesh, Burkina Faso, and the Philippines (Arimond et al., 2010). In their study, Acham et al. (2012) also noted a strong relationship between dietary diversity and micronutrient intake among women in an informal settlement of South Africa. Based on the above arguments, a diverse diet is therefore paramount in meeting the nutrient requirements of a person and more so to those considered vulnerable to nutrient deficiencies such as the pregnant women. Ruel (2003) noted that in developing countries lack of dietary diversity is a major problem since the diet is predominantly cereal based. The diets are considered monotonous and are comprised of little or no animal products, fruits and vegetables (Kennedy et al., 2007; Leyna et al., 2010).

Voster et al., (2011) have argued that the dependency on available and affordable staple foods and energy dense but poor nutrient foods, snacks and beverages have aided to the increased vulnerability to the nutrition transition in Africa. Notably, changing from a monotonous diet to a diet with varied range of food has been shown to increase energy and micronutrient intakes in developing countries (Kennedy et al., 2007). Based on this, consuming a diversified diet has been recommended by virtually all national and global food-based dietary guidelines (Clausen et al., 2005; Kennedy, 2009; Rathnayake et al., 2012; WHO, 1998). In Kenya information on dietary diversity among pregnant women is minimal and thus this study sought to assess dietary diversity among pregnant women in Laikipia County.

2.2.1 Measurement of Dietary Diversity

Dietary diversity is measured by summing up the number of foods or food groups consumed over a reference period (Vakili et al., 2013; Ruel, 2002). Dietary diversity score has been defined as the total count of different food groups irrespective of the amounts consumed by individuals over a specific period of time (Jayawardena et al., 2013). According to Taruvunga et al. (2013), a reference period of one to three days is usually used though a period of seven days has often been used (FAO, 2011). In some instances, a period of up to 15 days has also been reported (Drewnowski et al., 1997). Notably, dietary diversity instruments (dietary diversity score or food variety score) have become the most preferred method of assessing dietary adequacy in developing countries (Hooshmand and Udipi, 2013). Moreover, single food or food group count have been the most popular methods for measuring dietary diversity (Pellegrini & Tasciotti, 2014). This is because the measurements are simple to collect and easily adopted in different settings (Daniels et al., 2009).

2.3 Nutrient Intake and Individual Dietary Diversity during Pregnancy

Adequate nutrient intake prior and during pregnancy has been recognized as a major contributor to healthy birth outcomes. Adequate food intake and dietary diversity has been found to be positively associated (Msaki & Hendriks, 2013). Studies have similarly revealed a positive correlation between dietary diversity and nutrient intakes (Acham et al., 2012; Torheim et al., 2004). According to Krishna et al. (2012), increased dietary diversity is therefore important in ensuring adequate intake of essential foods and nutrients. Notably, micronutrient deficiencies in pregnancy is cited to cause substantial

maternal deaths (Black et al., 2013). Adequate nutrient intake among pregnant women is therefore important for maternal and child health (Lee et al., 2013). This study sought to establish the relationship between dietary diversity and nutrient intake among pregnant women in Kenya.

2.4 Factors Influencing Dietary Diversity and Nutrient intake

2.4.1 Socio-economic Factors

A number of studies have shown that dietary diversity is associated with socio-economic status (SES) (Savy et al., 2005; Torheim et al., 2004). Rashid et al. (2011) and Thorne-Lyman et al. (2010) found that dietary diversity is strongly associated with SES of a household. Similarly, Brinkman et al. (2010) in their study discussed that families with more income and resources had a more diversified diet. A study in Burkina Faso on women also found that those who were wealthier and with higher education had a higher DDS (Savy et al., 2008). Literature furthermore suggests that individuals with lower incomes and less education have been reported to be more likely to have poorer diets than those individuals with more income and education (Silk et al., 2008). This could be because a healthy diet which consist of a diversified diet is said to be more expensive than a less healthy diet (Morris et al., 2014).

Food insecurity which is an outcome measure of dietary diversity has been associated with low purchasing power leading to inadequate dietary intake (Ihab et al., 2012). Expensive food groups such as the high quality animal source foods, fruits and vegetables are also reported to have a decreased intake (Dachner et al., 2010). In Kenya, Kimiywe et

al. (2007) revealed that consumption of varied vegetables was influenced by occupation and income levels. According to Ihab et al. (2012), availability and access to food is prohibited by high food prices and scarce resources resulting in inadequate quantity and poor quality diets in the household. Nonetheless, there is paucity of data on the relationship between socio-economic factors and dietary diversity among pregnant women living in ASAL.

2.4.2 Demographic Factors

Factors such as age, parity, household size, marital status, gender among others have been found to influence dietary diversity. A study in Botswana showed that older adults consume a diet low in variety with inadequate animal products, fruits and vegetables (Clausen et al., 2005). Age therefore is a determining factor of nutrient intake. According to Taruvunga et al. (2013), female-headed households have a higher probability of achieving a high dietary diversity than the male-headed households. This is in agreement with a study in 1996 by Rogers which noted that female headed households spent more on higher quality foods. In 2003, Thiele and Weiss in Germany also reported that age, sex, household size, employment status and level of education were the strongest determinants of dietary diversity. The association between dietary diversity and demographic characteristics is still less documented.

2.4.3 Morbidity Patterns

Illness affects dietary diversity and nutrient intake since they cause decreased food intake as a result of loss of appetite associated with the condition (Scrimshaw, 2003). UNICEF

(1998) described morbidity as being one of the immediate causes of malnutrition in individuals. It affects food intake, absorption and utilization of nutrients resulting in poor nutritional status. According to Pieters et al. (2013), an individual's health affects their ability to absorb nutrients. Antenatal care (ANC) has been cited as one of the best strategies in early detection of complications that might affect pregnancy. Antenatal care is said to serve as a key entry point for implementing nutrition and health interventions that would improve maternal and child nutrition (Perumal et al., 2013). This study sought to establish the relationship between morbidity pattern and nutritional status of pregnant women in Laikipia County.

2.5 Maternal Nutritional Status during Pregnancy

Nutritional status can be termed as an outcome of the process of acquiring, consuming and utilizing food (Rajapaksa et al., 2011). In their study, Ey et al. (2012) indicate that a diversified diet is associated with a good nutritional status. Compelling evidence of the relationship between maternal nutritional status during pregnancy and the future health of the child is now substantial. The evidence suggests that the nutritional status of the mother pre and during pregnancy has a crucial role in the growth and development of the foetus (Imdad & Bhutta, 2011). Yakoob et al. (2009), Han et al. (2011) and Hambidge et al. (2014) in their studies have argued that poor nutritional status during pregnancy has been reported to cause delivery of low birth weight babies and is a significant contributor to maternal morbidity.

According to Bhutta et al. (2013) maternal under-nutrition contributes to 800,000 neonatal deaths globally annually through small for gestational age births. This maternal under-nutrition has also been stated to increase disease risk in the offspring even in later life (Ferreira et al., 2009; Ahmed & Tseng, 2013). Literature furthermore indicates that the effects of pre-pregnancy Body Mass Index (BMI) on pregnancy outcome have continued to gain widespread attention (Yu et al., 2013). In Kenya, there is paucity of scientific information on the relationship between dietary diversity and the nutritional status of pregnant women and more so among those living in ASAL.

In assessing pregnant women nutritional status, methods such as the use of anthropometrics, biochemical methods, clinical methods and dietary intake assessments has been used (Gibson, 2005). According to De et al (2009) anthropometric measurements are the most frequently used methods. The methods are considered effective and most appropriate in the promotion of women's health. In developing countries the use of BMI in assessing nutritional status among pregnant women has been restrained since most women attend their antenatal clinic late and thus their pre-pregnancy BMI may remain unknown (Kruger, 2005). In this study, mid upper arm circumference (MUAC) and haemoglobin levels (Hb) were used.

2.6 Summary of Literature Review

Diverse literature reveals that dietary diversity is indeed strongly associated with nutrient adequacy. Discussed literature further reveals that micronutrient deficiencies among pregnant women remain a major public health concern in developing countries. Despite

the relationship between dietary diversity and nutrient adequacy being clearly documented there exist limited information on dietary diversity, nutrient intake and their association with nutritional status among pregnant women. This study therefore sought to determine dietary diversity, nutrient intake and the nutritional status among pregnant women in Laikipia County.

CHAPTER THREE: METHODOLOGY

3.1 Research Design

The study adopted a cross-sectional analytical design. The design is effective in collecting both qualitative and quantitative data (Mugenda & Mugenda, 2003). The design was also appropriate as it enabled gathering of information at one point in time and identification of associations between the various variables.

3.2 Research Variables

3.2.1 Independent Variables

Socio-economic status, demographic factors, morbidity patterns and dietary diversity were the independent variables for this study.

3.2.2 Dependent Variables

The dependent variables for this study were nutrient intake and maternal nutritional status (MUAC and Hb).

3.3 Study Area

The study was undertaken in Laikipia-East Sub County, Laikipia County; Kenya. The County is an ASAL which is experiencing a worsening food security situation (GOK, 2014). This situation makes pregnant women in the area very vulnerable due to their increased nutrient needs. Laikipia County is one of the 47 counties in the Republic of Kenya which covers an area of 9,462 km². According to the 2009 Kenya Population and

Housing Census, the population for the county stood at 399,227 people. The approximate population of Laikipia-East Sub County is 116,562 people.

3.4. Target Population

The study target population comprised of all pregnant women in Laikipia County.

3.4.1 Accessible Population

The accessible population included all the pregnant women attending the antenatal clinic at Nanyuki Teaching and Referral Hospital at the time of data collection.

3.4.2 Inclusion Criteria

All pregnant women who consented to participate in the study and who had been residents of Laikipia County for at least one year prior to the period of the study were included. One year was appropriate as it covered the whole food security cycle.

3.4.3 Exclusion Criteria

Pregnant women with chronic diseases such as cancer and diabetes were excluded from the study. This was because these conditions are known to impact on the nutritional status of an individual. This health information was obtained from the respondents, clinical notes in the mother child booklet and from the hospital records.

3.5 Sampling Technique

Nanyuki Teaching and Referral Hospital had been purposively selected since it is the referral and main hospital in the area. Comprehensive sampling was used to select the respondents as they arrived in the hospital for their antenatal clinic (Figure 3.1).

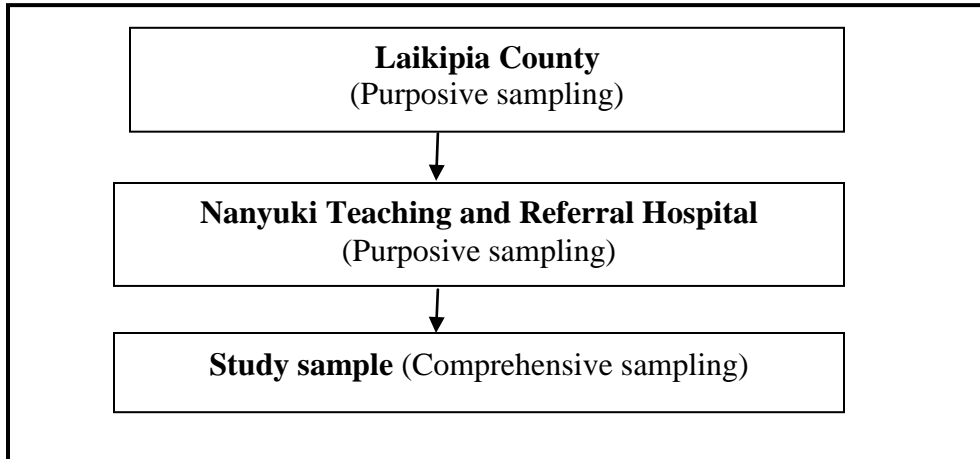


Figure 3.1: Flow chart on the sampling procedure

3.6 Sample Size Determination

Nanyuki Teaching and Referral Hospital records indicated that antenatal clinic attendance was by an average of 237 pregnant women per month. Based on this, a comprehensive sample (100%) in a period of one month was used. A comprehensive sample is used when the number of units are small (Ary et al., 2013). One month was appropriate since ANC attendance in the hospital was on monthly basis.

3.7 Research Instruments

A researcher administered questionnaire (Appendix B) was used to collect data on socio-economic and demographic characteristics, nutrient intake, dietary diversity, morbidity

patterns and nutritional status. Key informant interviews schedules (Appendix C) and Focused group discussion guides (Appendix D) were used to solicit qualitative data on maternal nutrition perceptions. The socio-economic and demographic data collected was; age, marital status, level of education, occupation, income level, parity, trimester, household head, household sex and household size. Dietary diversity data was collected using a modified individual dietary diversity questionnaire as recommended by FAO 2008.

3.8 Pretesting of Data Collection Tools

The tools were pre-tested before the study on 24 respondents (10% of the expected sample size) to establish whether the tools could generate the information needed and with precision. This was done to check the length, content, wording and language of the tools. The pre-test was conducted at Nanyuki Teaching and Referral Hospital. The respondents who were used in the pretesting were not sampled for the actual data collection. After the pre-test, adjustments were done accordingly to enhance reliability and validity of the tools.

3.8.1 Validity of the Tools

The tools were tested and validated by a panel of nutrition experts including the university supervisors to ensure that the questions solicited the information intended.

3.8.2 Reliability of the Tools

The test-retest method was used to test the consistency of the data collection tools within a span of one week between the interviews. The test retest was done on 24 respondents which was 10% of the expected sample size. Correlation coefficient was determined between the two sets of results and a correlation coefficient of 0.92 was obtained. According to Cronbach and Shavelson (2004) a coefficient correlation of above 0.70 is considered as an acceptable threshold. Respondents were also allowed to make comments and give suggestions concerning the tools.

3.9 Training of Research Assistants

Five research assistants with a minimum of a diploma in nutrition were recruited and trained as research assistants for four days. They were extensively trained on ethical issues, purpose and objective of the study. In addition, they were trained on how to use the data collection research tools, taking anthropometric measurements, interviewing skills and expectations from each question.

3.10 Data Collection Procedures

Respondents were recruited at the hospital (Nanyuki Teaching and Referral Hospital) and followed to their households for the face to face interviews. The respondents were recruited after they had received their usual ANC services.

3.10.1 Demographic, Socio-Economic and Morbidity Data

A semi-structured questionnaire (Appendix B) was used for collecting data on demographic and socio-economic characteristics of the study subjects. A two week recall period was used to gather information on morbidity pattern and experience among the study respondents.

3.10.2 Dietary Diversity and Nutrient Intake

Nutrient intake information was generated using 24 hour recall dietary assessment. The 24-hour dietary recall was done to capture detailed and comprehensive information about all foods and beverages the respondent consumed. Food models, pictures, household utensils and other visual aids were used to help respondents judge and report on portion sizes. The time of food consumption was also recorded. A reference period of 24 hour was used in this study as it minimized the recall bias thus improving on accuracy.

The 24 hour dietary recall involved asking the respondents to enumerate all the foods and beverages consumed in previous day from the time they woke up in the morning, throughout the day to the time they went to sleep at night indicating clearly the time the food was consumed. Thorough probing was done to ensure that no food consumed was forgotten. The 24-hour dietary recall was considered to be useful in determining the average intake of energy and nutrients for the respondents.

Using the information collected from the 24-hour recall the DDS for the respondents was derived using the 2008 FAO guideline for measuring household and individual dietary

diversity (FAO, 2008). In assessing dietary diversity, a scale of sixteen food groups; cereals, vitamin A rich vegetables and tubers, dark green leafy vegetables, other vegetables, white roots and tubers, vitamin A rich fruits, other fruits, flesh meat, organ meat, eggs, fish, pulses/legumes, nuts and seeds, milk and milk products, oils and fats, sweets and sugar and condiments and spices was used.

3.10.3 Nutritional Status of the Respondents.

Anthropometric measurements mid upper arm circumference (MUAC) were taken to assess the subject nutritional status. A standard adult MUAC tape was used and the measurements were taken on the less active arm with no clothing. Measurements were taken and recorded to the nearest 0.1 cm. For accuracy purposes, the measurements were taken twice and the average calculated. Additionally, respondent's nutritional status was also assessed using haemoglobin (Hb) values. Haemoglobin tests were done following standard operating procedures by a qualified laboratory technologist on the same days of the interviews.

The process of Hb test involved drawing blood into the microcuvette thorough a finger prick. The microcuvette was then placed into the HemoCue photometer for Hb analysis. The Hb value reading was recorded immediately in the questionnaire and the cuvette was hygienically disposed. Notably, in this study BMI for pregnancy was not used since it is documented that pregnant women in developing countries start to attend their antenatal clinic late in pregnancy and thus their pre-pregnancy BMI may be unknown (Kruger, 2005).

3.10.4 Qualitative Data

Key informant interviews were conducted using the interview schedule (Appendix C). The respondents included doctors, nurses and nutritionists. Information on maternal knowledge and attitude during pregnancy, nutritional problems faced in pregnancy and possible solutions was solicited. Focus group discussions (FGDs) (Appendix D) were also administered to elicit information on maternal nutrition perceptions. Four focused group discussions were conducted and each FGD comprised of 8-12 respondents who were randomly selected.

3.11 Data Analyses

Data on dietary intake from the 24 hour recall was entered and analysed using the Nutri-survey software. The nutrient intakes among the respondents were compared to the Recommended Nutrient Intakes (RNIs) to establish the percentage meeting the RNIs. To determine the DDS of the respondents, a point was awarded to each food group consumed over the reference period and a sum of all points was computed as recommended by FAO (2008). A scale of sixteen food groups (Cereals, vitamin A rich vegetables and tubers, dark green leafy vegetables, other vegetables, white roots and tubers, vitamin A rich fruits, other fruits, flesh meat, organ meat, eggs, fish, pulses/legumes, nuts and seeds, milk and milk products, oils and fats, sweets and sugar and condiments and spices was used.

Since the food groups considered in the Individual Dietary Diversity Score (IDDS) put more emphasis on micronutrients, a scale of fourteen food groups (excluding the last two:

sweets and sugar and condiments and spices) was used for analysis purposes (FAO, 2008). According to FAO (2008), those two food groups may be used for additional analysis and considerations of bioavailability of micronutrients but not part of the IDDS. The dietary diversity was assessed based on the number of food groups consumed over the immediate past 24 hours.

Using the fourteen food groups, dietary diversity terciles were established namely; low diversity tercile (≤ 3 food groups); medium diversity tercile (4 to 5 food groups) and high diversity tercile (≥ 6 food groups) (FAO, 2006; 2011). The respondent DDS was then assessed based on their position on the scale. Nutritional status was assessed using MUAC and Hb values. A MUAC value of less than 23cm was considered as under nutrition while that above 23 cm was considered normal for pregnant women (UNICEF, 2009; Ververs et al., 2013). Similarly pregnant women with Hb values of below 11.0 g/dl were considered anemic (UNICEF, 2001) while those above it were considered as having adequate nutritional status.

Data was entered and verified using Census and Survey Processing system (CSPRO) software version 6.1 and later exported to Statistical Package for Social Sciences (SPSS) version 20.0 software for analyses. Descriptive statistics such as means, frequencies, percentages, standard deviations and ranges were computed to describe the study population. Pearson's product moment was used to determine the relationship and the strength between DDS and nutritional status. Chi-square tests were used to test for

association between dietary diversity, demographic and socio-economic status of the respondents.

Moreover, T-test and Analysis of Variance (ANOVA) were used to test for significant differences in the mean DDS on different groups based on demographic and socioeconomic characteristics. Regression analyses were further carried out to determine the contribution of dietary diversity to nutrient intake and nutritional status. Qualitative data from key informant interviews and FGDs were transcribed and coded to show the emerging themes. Conclusions were drawn which were then triangulated with data from the questionnaire. A p-value of <0.05 was considered significant in all the analyses.

3.12 Logistical and Ethical Considerations

Approval to conduct the research was sought from Kenyatta University graduate school. Ethical clearance was obtained from Ethical Review Committee of Kenyatta University while permit to conduct the research was obtained from the National Council for Science, Technology and Innovation (NACOSTI) (Appendix E). Permission was similarly sought from the area of study local administration and the hospital medical superintendent. Further, after being briefed and offered an opportunity to ask questions about the study, a signed consent was sought from the respondents before administering the questionnaire. To ensure confidentiality, names and other means of identity were not used in this study. Confidentiality and privacy of the data collected was also assured and maintained during and after the study.

CHAPTER FOUR: RESULTS

4.0 Introduction

This chapter presents the study findings. Data on a comprehensive sample of 254 respondents was collected and reported. The results are organized as per the specific objectives of the study namely; demographic and socio-economic characteristics of the respondents, dietary diversity and nutrient intake among the respondents, morbidity patterns and nutritional status of the respondents. The results on the association between dietary diversity and demographic factors, socio-economic status, nutrient intake and nutritional status among the study respondents are also presented.

4.1 Description of the Study Population

4.1.1 Demographic Characteristics.

4.1.1.1 Age Distribution of the Respondents

Table 4.1 displays the demographic characteristics of the study respondents. The mean age of the pregnant women was 26.81 ± 5.64 years with the youngest and the oldest mothers being 16 and 49 years respectively. Most of the women (33.9%) were between the ages of 20-24 years while the age bracket of 45-49 years had the least number of respondents (0.8%).

4.1.1.2 Marital Status of the Respondents

The study revealed that majority (88.6%) of the population were married whilst the rest were either single (10.6 %) or widowed (0.8%).

Table 4.1: Demographic characteristics of the respondents

| Category (n=254) | n | % |
|--------------------------------------|----------|----------|
| Age group(Years) | | |
| 16-19 | 14 | 5.5 |
| 20-24 | 86 | 33.9* |
| 25-29 | 78 | 30.7 |
| 30-34 | 48 | 18.9 |
| 35-39 | 23 | 9.1 |
| 40-44 | 3 | 1.2 |
| 45-49 | 2 | 0.8 |
| Mean age 26.81 ± 5.64 | | |
| Marital status | | |
| Married | 225 | 88.6* |
| Widowed | 2 | 0.8 |
| Single | 27 | 10.6 |
| Parity of the respondents | | |
| 1 | 84 | 33.1 |
| 2 | 89 | 35.0* |
| 3 | 51 | 20.1 |
| >3 | 30 | 11.8 |
| Mean parity 2 ± 2 | | |
| Trimester of the respondents | | |
| First | 13 | 5.1 |
| Second | 138 | 54.3* |
| Third | 103 | 40.6 |
| Household characteristic | | |
| Sex of the household head | | |
| Male | 225 | 88.6* |
| Female | 29 | 11.4 |
| Household head | | |
| Respondent | 19 | 7.5 |
| Husband | 219 | 86.2* |
| Relative | 12 | 4.7 |
| Others (Not related) | 4 | 1.6 |
| Household size | | |
| 1 | 13 | 5.1 |
| 2 | 86 | 33.9* |
| 3 | 81 | 31.9 |
| >3 | 74 | 29.1 |
| Mean size of household | | |
| 3.02 ± 1.27 | | |
| *:Majority of the respondents | | |

4.1.1.3 Parity of the Respondents

The mean parity of the study population was 2 ± 2 . Most mothers were primiparous (35%) followed closely by 33.1%, being primigravida. The rest of the study participants were multiparous (Table 4.1).

4.1.1.4 Gestation of the Women in Weeks

The mean gestational age at the time of examination was 27 ± 6.99 weeks. The gestation age ranged from 8 to 39 weeks. Slightly more than half of the respondents (54.3%) representing the majority were in their second trimester. Notably, only around 5.1% of the participants reported being in their first trimester.

4.1.1.5 Household Characteristics

Information on key aspects of the composition of households, such as the sex of the household head and the size of the household, is presented in Table 4.1. This information is crucial since it is associated with the welfare of the household. The average size of the household was 3.02 ± 1.27 . The smallest household had one member while the largest household had 10 members. Most of the household (33.9%) had 2 members. Household with 7, 8, and 10 members were least reported at 0.4% each.

Majority (86.2%) of the respondents reported their husbands as being the household heads. Around, 7.5% of the participants indicated to be the heads of their households while 4.7% reported their relatives as being the household heads. Additionally, majority of the households were male headed (88.6%). For those household whose respondent

were not the household head the mean age of the head was 32.66 ± 6.87 years and ranging from 21 to 65 years.

4.1.2 Socio-economic Characteristics of the Study Population

4.1.2.1 Education Level and Occupation of the Respondent

Education level is a key determinant of the type of employment one gets which in turn is likely to influence the income level of an individual. Moreover, education attainment has a strong effect on the health behaviour and attitude of a person.

Table 4.2: Respondents education and occupation

| Characteristic | N=254 | |
|--|------------|------------|
| | n | % |
| Respondent education | | |
| No formal education | 10 | 3.9 |
| Primary | 62 | 24.4 |
| Secondary | 131 | 51.6* |
| Tertiary | 51 | 20.1 |
| Total | 254 | 100 |
| Occupation of respondents | | |
| Farming | 11 | 4.3 |
| Casual labour | 21 | 8.3 |
| Employed (salaried) | 50 | 19.7 |
| Business | 67 | 26.4 |
| Housewife | 105 | 41.3* |
| Total | 254 | 100 |
| Occupation of household head (excluding those respondents who were household heads)(n=19) | | |
| Unemployed | 4 | 1.7 |
| Farming | 16 | 6.8 |
| Casual labour | 57 | 24.3 |
| Employed(salaried) | 95 | 40.4* |
| Business | 63 | 26.8 |
| Total | 235 | 100 |

*: Majority of the respondents

The study results showed that slightly more than half (51.6%) of the respondents had secondary education whilst about 24.4% followed with primary education. Only 20.1% of the total respondents reported to have had formal education up to the tertiary level.

Occupation is not only the source of income for an individual but also determines the social class that one enjoys in the society. Examinations of the respondent occupation distribution revealed that most (41.3%) of the women were housewives while those in business followed closely at 26.4%. Additionally, Table 4.2 further shows that about 19.7% of the study participants indicated that they were employed (salaried). For the households where the respondents were not the household heads, most (40.4%) of the household head were in formal salaried employment. Notably, 1.7% among this group was also not in any gainful employment.

4.1.2.2 Household Monthly Income

The household wealth index is a background characteristic used as a proxy measure of the standard of living of a household. Household income explains the purchasing power and status of the household. In this study, household income was assessed as a combined income for all the household members. Descriptive analysis revealed that most (28.3%) of the households had a monthly income of between Ksh 10,000 to Ksh 20,000. They were followed by about 21.7% who declared that their household monthly income was between Ksh 8,000 to Ksh 10,000. Worthwhile noting, the findings further revealed that 13.3% of the participants had their household monthly income below Ksh 6,000.

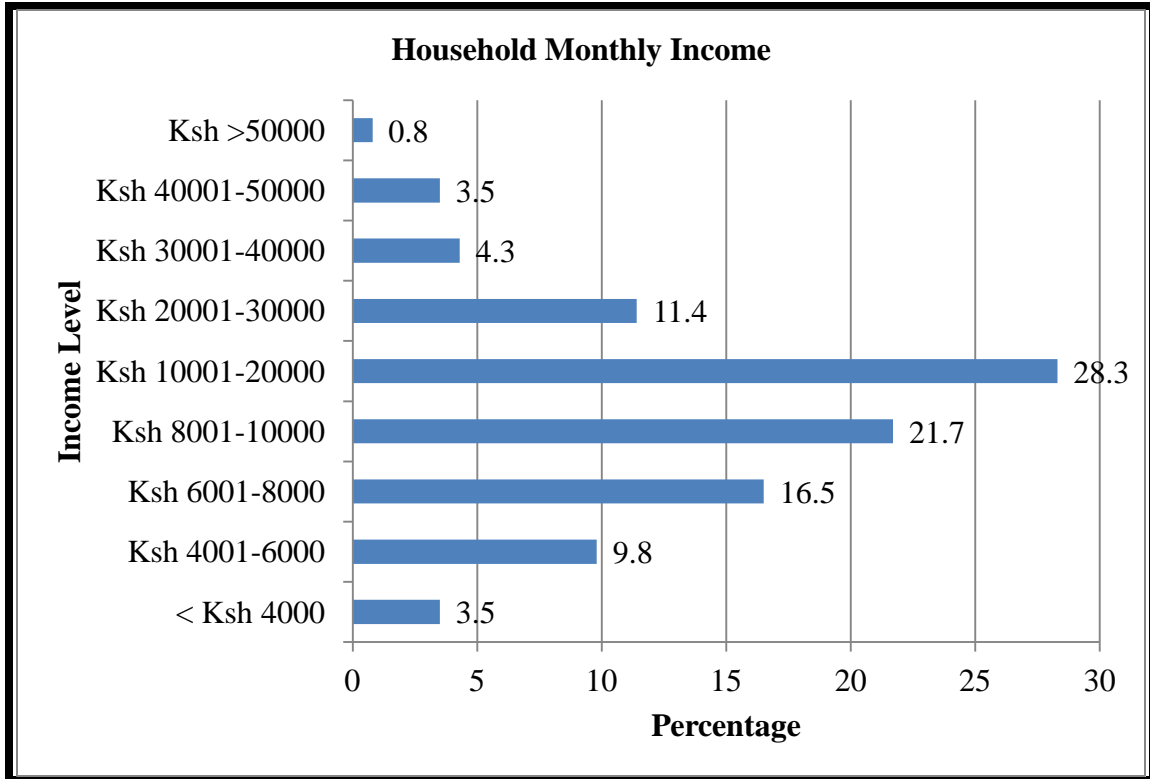


Figure 4.1: Respondents household monthly income

4.1.2.3 Major Sources of Household Income and Decision maker on Income use

Less than half of the participants (44.5%) highlighted formal employment as their major source of income. The results further show that 24.8%, 23.6%, 5.5% and 1.6% cited business, casual labour, agricultural farm produce and donations as their major source of household income respectively (Table 4.3). In regard to who determines how the income will be used, a huge majority (78.0%) indicated their husbands were the major decision makers. Additionally, a notable proportion (16.1%) of the respondents acknowledged that they were in command of how the income will be used as reflected in Table 4.3.

Table 4.3: Major sources of income and decision maker on income use among the respondents households

| Variable | N | % |
|--|------------|------------|
| Major sources of household income | | |
| Agricultural farm produce | 14 | 5.5 |
| Business | 63 | 24.8 |
| Formal employment | 113 | 44.5* |
| Casual labour | 60 | 23.6 |
| Donations | 4 | 1.6 |
| Total | 254 | 100 |
| Income use decision maker | | |
| Respondent | 41 | 16.1 |
| Husband | 198 | 78.0* |
| Relative | 15 | 5.9 |
| Total | 254 | 100 |
| *: Majority of the respondents | | |

4.1.2.4 Household Assets and Livestock Ownership

4.1.2.4.1 Household Assets

The availability of durable consumer goods is a useful indicator of a household's socio-economic status. The respondents were asked to state whether they own any of the following items; vehicle, motorcycle, bicycle, wheelbarrow, tractor, sofa set, computer, landline, mobile phone, radio, television, refrigerator, oven/gas cooker and solar pane. Most of the households did not own valuable items associated with high socio-economic status such as vehicle, computer and refrigerator. Only one household reported to have none of all the asked assets while the highest number of assets owned was 11 out of the possible 13.

The mean asset ownership out of the possible 13 was 5.28 ± 1.86 . From the results most owned asset was mobile phone (96.9%) followed by radio (93.3%) while the least owned

asset was a land line telephone (1.2%). Ownership of certain assets such as radio (93.3%), mobile phone (96.9%) and television (78.3%) could be a sign of improved awareness on various nutrition and health related issues since they are good channels of communication through which nutrition messages can be conveyed.

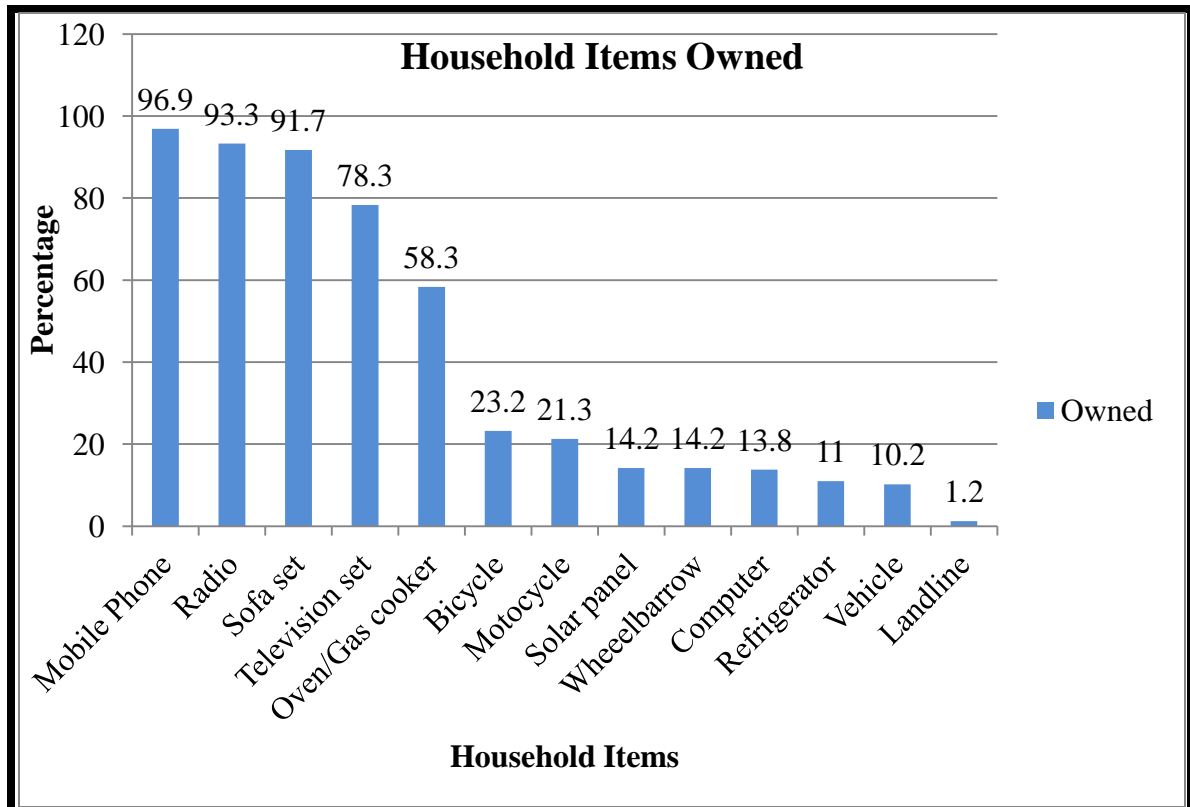


Figure 4.2: Household assets of the respondents

4.1.2.4.2 Household Livestock ownership

Household livestock ownership has the potential to improve the nutritional status of household members either directly as good sources of proteins through milk, meat and eggs or indirectly by boosting household income which can be used for food expenditure. Slightly more than half (51.2%) of the total respondents confirmed owning some

livestock. As shown in Table 4.4 the most commonly owned animals were chicken, which were owned by 44.1% of all the households.

Table 4.4: Respondents household livestock ownership

| Variable (n=254) | <5 animals | 5-10 animals | 10-20 animals | >20 animals |
|--------------------------------|----------------------|---------------------|----------------------|-----------------------|
| Livestock ownership (%) | | | | |
| Yes (51.2) | | | | |
| No (48.8) | percent | Percent | percent | Percent |
| Cattle | | | | |
| Yes (25.2) | 84.4 | 14.1 | 1.6 | 0 |
| Goat | | | | |
| Yes (16.5) | 47.6 | 42.9 | 7.1 | 2.4 |
| Sheep | | | | |
| Yes (13) | 57.6 | 27.3 | 6.1 | 9.1 |
| Donkey | | | | |
| Yes (1.6) | 100 | 0 | 0 | 0 |
| Chicken | | | | |
| Yes (44.1) | 18.8 | 43.8 | 27.7 | 9.8 |
| Pigs | | | | |
| Yes (2) | 100 | 0 | 0 | 0 |
| Ducks | | | | |
| Yes (3.9) | 50 | 50 | 0 | 0 |
| Rabbit | | | | |
| Yes (5.1) | 46.2 | 53.8 | 0 | 0 |

4.1.2.5 Land Size, Ownership Status and Main Source of Family Food.

Strengthening household access to land and productive resources improves food and nutritional security. Access to land increases food production and raises income to improve wellbeing of household's members. More than half (60.6%) of the study respondents reported to own a piece of land. However, the pieces of land were very small with most (31.8%) of the households owning between a half and one acre piece of land. The researcher observed that out of 254 respondents, 100 respondents representing 39.4% of the study population did not own any land (Table 4.5).

Table 4.5: Land size, ownership status and main source of family food of the respondents

| Characteristic | N=254 | |
|-----------------------------------|------------|------------|
| | n | % |
| Land ownership | | |
| Yes | 154 | 60.6* |
| No | 100 | 39.4 |
| Total | 254 | 100 |
| Land size | | |
| < 1/4 acre | 6 | 3.9 |
| 1/4-1/2 acre | 39 | 25.3 |
| >1/2- 1 acres | 49 | 31.8* |
| >1-3 acres | 46 | 29.9 |
| >3-5 acres | 11 | 7.1 |
| >5 acres | 3 | 1.9 |
| Total | 154 | 100 |
| Land ownership status | | |
| Self owned | 146 | 94.8* |
| Hired | 4 | 2.6 |
| Public land | 4 | 2.5 |
| Total | 154 | 100 |
| Main source of family food | | |
| Home production | 46 | 18.1 |
| Purchase | 206 | 81.1* |
| Donation | 2 | 0.8 |
| Total | 254 | 100 |

*: Majority of the respondents

For those who reported owning land, a significant proportion (94.8%) said the land was self owned. A small fraction 2.6% and 2.5% pointed out that their land was either hired or public land respectively. In respect to the main source of family food, the highest percentage (81.1%) of the respondents purchased food as opposed to 18.1% who had

produced their own food. Only a small fraction (0.8%) mentioned donations as their major source of family food.

4.1.2.6 Housing, Lighting, Fuel and Source of Water

Socio-economic profile of a household can also be reflected by the household's type of house, lighting source and cooking fuel used. The present study results revealed that more than half (64.2%) of the participants rented their houses. The rest of the participants (35.8%) reported living in their own houses. In terms of source of household lighting, 78.3% of the respondents indicated to be using electricity. Use of kerosene lamp and solar panel followed at 12.2% and 7.9% respectively.

The study showed variations in the type of cooking fuel used. Most (44.9%) of the households had charcoal as their main source of cooking fuel followed by use of gas at 32.7%. In reference to the source of water, Table 4.6 shows that about 82.3% of the respondents had water piped into their homestead while 6.7% of the respondent got their water for domestic use from rivers. The rest of the participant had rain water (4.7%), communal well (3.1%) or communal tap (3.1%) as their source of water. Access to safe water plays an indispensable role in realizing good health and other human rights such as the right to food and livelihood.

Table 4.6: Housing, lighting, fuel and source of water among the respondents households

| Variable | N=254 | |
|---------------------------|-----------|------------|
| | Frequency | Percentage |
| Type of housing | | |
| Own house | 91 | 35.8 |
| Rented | 163 | 64.2* |
| Source of lighting | | |
| Electricity | 199 | 78.3* |
| Solar panel | 20 | 12.9 |
| Kerosene lamp | 31 | 12.2 |
| Pressure lamp | 4 | 1.6 |
| Type of fuel | | |
| Kerosene | 15 | 5.9 |
| Gas | 83 | 32.7 |
| Firewood | 42 | 16.5 |
| Charcoal | 114 | 44.9* |
| Source of water | | |
| Piped into house | 209 | 82.3* |
| Communal Tap | 8 | 3.1 |
| Communal well | 8 | 3.1 |
| Rain tanks | 12 | 4.7 |
| River | 17 | 6.7 |

*: Majority of the respondents

4.2 Individual Dietary Diversity Score

Out of the possible fourteen food groups, the mean DDS was 6.84 ± 1.46 with scores ranging from 3-10 food groups. The DDS of most respondents was in the high tercile (60.6%) (≥ 6 food groups) and medium tercile (37.0%) (4 to 5 food groups). Only 2.4% of the study subjects were found to be in the lower tercile (≤ 3 food groups).

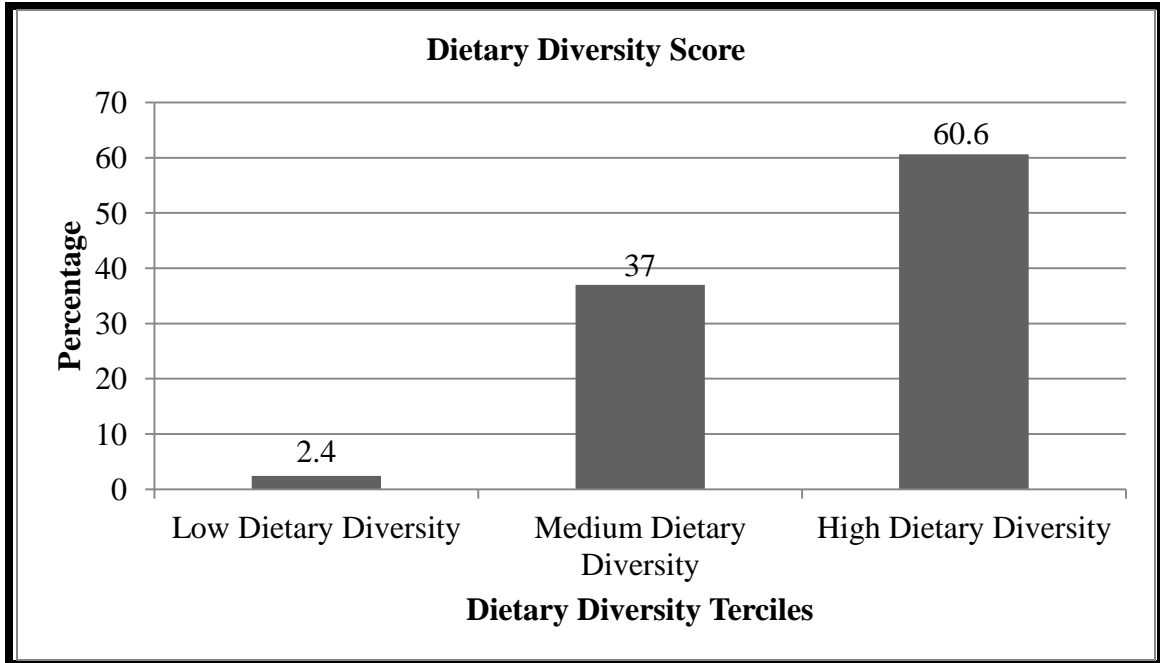


Figure 4.3: Respondents individual dietary diversity score terciles

4.2.1 Consumption of Foods by Respondents Based on Food Groups

In general, the most commonly consumed foods were cereals (99.2%), oils and fats (93.3%), other vegetable (92.9%) and milk and milk products (91.7%). White root and tubers were also highly consumed by the participants (Figure 4.4). Dark green leafy vegetables, legumes and other fruits were consumed in moderation by slightly above half of the respondents at 58.3%, 54.3% and 51.2% respectively. Notably, foods of animal origin were least consumed. Only 1.6% of the total respondents reported to have consumed fish and sea food. Similarly, only about 3.9%, 9.4% and 23.6% of the study participants had consumed organ meat, eggs and flesh meat respectively.

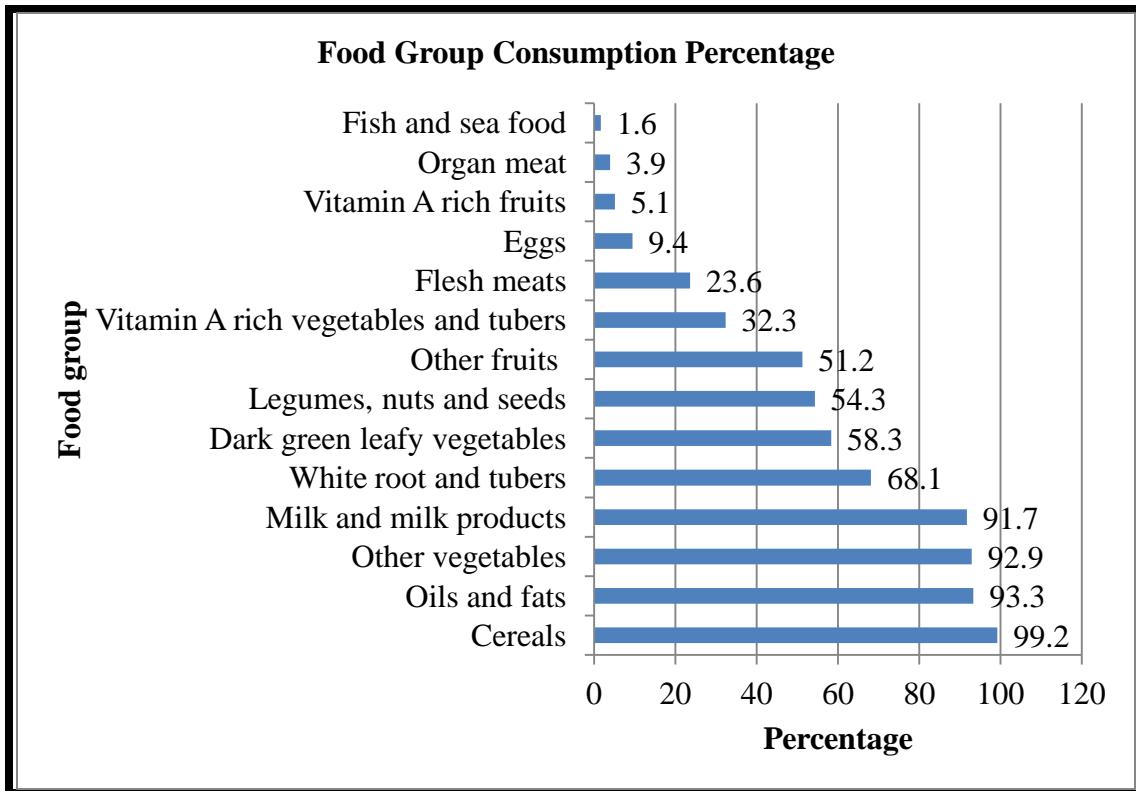


Figure 4.4: Consumption of foods by respondents based on food groups

The study also showed that Vitamin A rich vegetables and tubers were consumed by approximately one third (32.3%) of the participants. In regard to vitamin A rich fruits, the researcher noted that only 5.1% of the respondents had consumed foods from this food group. There was consensus among the women that cereals was the most consumed food group as was underscored by the FGD statement *“In this area most of us feed on Ugali and Githeri as a culture and also since the food is not very expensive”*. In regard to meats one of the women said *“the cost of buying meat is prohibitive and thus we opt for cheaper foods or we buy when we have extra cash or in important occasions”* (FGD, Pregnant Women, 2015).

Table 4.7: Number of respondents who consumed each food group

| Food group | n=254 | Percentage |
|--------------------------------------|--------------|-------------------|
| Cereals | 252 | 99.2 |
| Oils and fats | 237 | 93.3 |
| Other vegetables | 236 | 92.9 |
| Milk and milk products | 233 | 91.7 |
| White root and tubers | 173 | 68.1 |
| Dark green leafy vegetables | 148 | 58.3 |
| Legumes, nuts and seeds | 138 | 54.3 |
| Other fruits | 130 | 51.2 |
| Vitamin A rich vegetables and tubers | 82 | 32.3 |
| Flesh meats | 60 | 23.6 |
| Eggs | 24 | 9.4 |
| Vitamin A rich fruits | 13 | 5.1 |
| Organ meat | 10 | 3.9 |
| Fish and sea food | 4 | 1.6 |

Notably, in respect to food intake frequency, the majority (82.7%) of the study respondents had a meal frequency of 3 times and above per day. Approximately 17.3% of the study subjects were noted to have a meal frequency of below 3 times per day. Both meals and snacks were considered as reported by the respondents.

4.2.2 Maternal Perception towards Dietary Diversity based on Qualitative data from

FGDs

Majority of the mothers had a good understanding of the benefits of consuming a diversified diet. One of the mothers who acknowledged consuming a diversified diet said, *“Consuming different foods is important during pregnancy so that the foetus can get all the nutrients it requires for growth”*. Despite majority of the mothers having a good attitude toward dietary diversity some had a contrary opinion. One of the women said,

“Consuming many foods is not good since it will make the baby big which will lead to birth through caesarean section”. In respect to the question of whether they believe that what they ate influenced on the health of the infant, majority said it had some influence. For instance one of the mothers stated that, *“if you don’t take enough food then you might get a preterm baby or a very small baby”*.

In respect to frequency of consuming the different food groups, there was agreement among all mothers that the most consumed food group was cereals. A mother said, *“Most of us consume Githeri (mixture of boiled maize and beans) almost on daily basis, Githeri is our cultural food. Sometimes Githeri is replaced with Ugali or rice”*. When asked on what dictates what and how much they consume during pregnancy, majority said the household income influences what they eat. Others said that their health status influenced the type and quantity of the food they consumed. One of the mothers who reported eating very little quantities of food said, *“During pregnancy, I lose appetite to foods, other times the increased heartburn makes me avoid food completely”*.

On the question of whether what they eat changes during pregnancy, majority of the mother said their diet does not change. One of the few mothers who acknowledged change of diet during pregnancy said, *“During pregnancy, I have to eat a lot of fruits since I think they are good for the health of my baby”*. In regard to food seasonality, there was consensus among the mothers that food seasonality also affected what they eat. One of the mothers stated, *“In some months during the year, we have plenty of food all over*

which makes them cheaper for us to buy. In other months the food is not readily available and what is available is very expensive”.

4.2.3 Findings of Key Informant Interviews (KII) on Dietary Diversity among Pregnant Women

The health care providers (doctors, nurses and nutritionists) were interviewed on factors affecting dietary intake among pregnant women. There was agreement among the three cadres that morbidity and pregnancy disorders affected dietary intake of most of the pregnant women. The nutritionist in charge said, *“Most of the mothers complain of heartburn, loss of appetite and vomiting”*. When asked about whether they think poor dietary intake is a problem among the pregnant women, all of them considered it a potential problem. One of the nurses said, *“There is an increase in pregnancy anaemia in this area which we highly attribute to poor dietary intake among our pregnant women. In regard to maternal knowledge on dietary diversity, the doctors, nurses and nutritionist all stated that majority of the women knew the importance of a diversified diet. “Many mothers have knowledge on the importance of dietary diversity but that does not necessarily translate to practice”* said one of the doctors attending the maternity wing.

4.3 Dietary Intake of Selected Nutrients among the Pregnant Women

Estimates of nutrient intake are necessary in monitoring the nutritional status of an individual. Table 4.8 presents the nutrient intake of some selected food nutrients in this study. The mean energy intake (1890.59 ± 898.19) of the respondents was below the recommended nutrient intake. When the body does not get enough energy for basal

metabolism and daily activities it responds by depleting the reserves and breaking other substances to meet the deficit resulting to poor nutritional status. Notably, the mean contribution of macronutrients (protein, fat and carbohydrate) in the diet to the total energy intake was found to be adequate except for fats 18.72% against the recommended 20-30%. Further, the study showed that the mean intake of vitamin A and C were adequate. The mean intake of all the other selected nutrients was found to be inadequate (Table 4.8).

Table 4.8: Nutrient intake of selected nutrients among the respondents

| Nutrient | Mean intake (SD) | Reference values | % contribution to total energy intake | % of respondents meeting the RNI's |
|-------------------------|-------------------------|-------------------------|--|---|
| Energy (kcal) | 1890.59 ± 898.19 | 2300 | | 28 |
| Protein (g) | 57.17 ± 29.96 | 74 (10-15%) | 11.15 | 46.5 |
| Fat (g) | 43.54 ± 25.41 | 94(20-30%) | 18.72 | 8.7 |
| Carbohydrate (g) | 415.98 ± 311.67 | 175(55-75%) | 70.17 | 75.6 |
| Vitamin A (µg) | 1595.81 ± 3874.73 | 800 | | 46.5 |
| Vitamin C (mg) | 96.38 ± 68.21 | 55 | | 70.5 |
| Calcium (mg) | 475.52 ± 308.54 | 800 ^a | | 18.1 |
| Folic Acid (µg) | 178.97 ± 103.99 | 600 | | 8.3 |
| Iron (mg) | 28.48 ± 48.33 | 30 ^b | | 16.9 |
| Zinc (mg) | 4.48 ± 2.82 | 20 ^c | | 5.1 |

FAO/WHO 1981; FAO/WHO 2001; WHO/FAO 2004

^a Based on a low animal protein intake. ^b Based on a 10% bioavailability level. ^c Based on a low bioavailability level.

4.4 Maternal Health Profile

4.4.1 Antenatal Clinic Attendance among the Pregnant Women

Antenatal clinic attendance is considered important in ensuring maternal and child health. As presented in Figure 4.5, though at different gestational ages, most (30.3%) women had attended their antenatal clinic thrice. Approximately 23.2% reported to have attended the antenatal clinic twice whereas around 24% were in their first antenatal visit. Furthermore, only 22.4% indicated to have attended the antenatal clinic more than thrice.

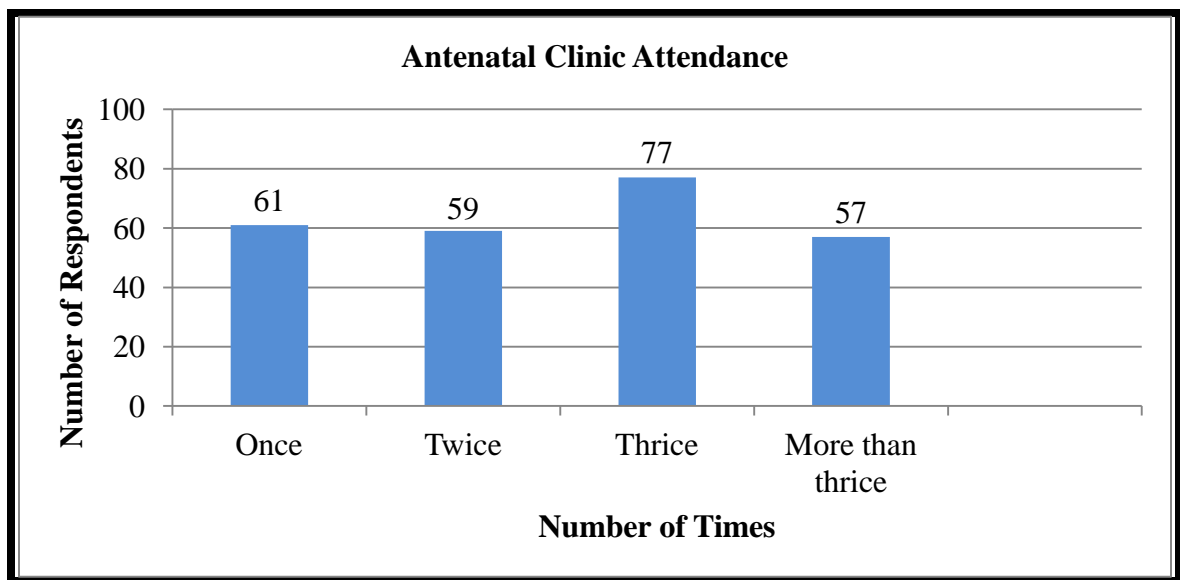


Figure 4.5: Antenatal clinic attendance of the respondents

4.4.2 Micronutrient Supplementation among the Mothers

The Table 4.9 reveals that vast majority (70.1%) of the women were having micronutrient supplementation. Out of the 70.1% who reported having micronutrient supplementation, most (98.9%) women indicated to be using iron and folic acid supplements.

Table 4.9: Micronutrient supplementation intake among the respondents

| Variable | Frequency (n) | % |
|---|----------------------|------------|
| Micronutrient supplementation | | |
| Yes | 178 | 70.1* |
| No | 76 | 29.9 |
| Total | 254 | 100 |
| Type of supplements | | |
| Iron and Folic acid | 176 | 98.9* |
| Multiple micronutrient | 2 | 1.1 |
| Total | 178 | 100 |
| Source of supplement | | |
| Health facility | 168 | 94.4* |
| Bought from shops | 9 | 5.1 |
| Friends | 1 | 0.5 |
| Total | 178 | 100 |
| Reason for lack of supplementation | | |
| First ANC visit | 32 | 42.1* |
| Not available at ANC clinic | 14 | 18.4 |
| Don't see their need | 4 | 5.3 |
| They make me sick | 19 | 25 |
| Ran out | 4 | 5.3 |
| Unaware of them | 3 | 3.9 |
| Total | 76 | 100 |

*: Majority of the respondents

In regard to the source of the supplements, health facility had the highest percentage of 94.4%. For those not having any micronutrient supplementation, 42.1% said it was their first ANC visit and thus had not started taking them as the reason of not taking the supplements. Additionally, 25% said the supplements were making them sick and thus could not take them. In the same line, 18.4% reported that the supplements were not available at the ANC clinic while 5.3% said they did not see the need to take the supplements. The study further revealed that another 5.3% of those not taking the supplements indicated their supplements had run out and had not secured more. About

3.9 % of the respondents not taking the supplements indicated that they were unaware of the supplements.

4.4.3 Maternal Morbidity Pattern

Since illness affects food intake, absorption and utilization of nutrients of an individual, this study determined the morbidity patterns of the study participants. More than half (57.5%) of the women involved in this study reported to be unwell in the immediate two weeks preceding the day of the interviews. The main disorders reported by the women were heartburn (42.9%) and anorexia (15.4%) as shown in the Table 4.10. Out of all those who reported being sick, only 40.4% who sought medical attention. Government hospital was most preferred by those who sought medical treatment (78%) in comparison with 16.9% who sought attention from the private hospitals. About 5.1% of the sick respondents reported that they used traditional medicine to cure their ailments.

Table 4.10: Maternal morbidity of the respondents in the past two weeks

| Type of illness/disorder | N=254 | | |
|-----------------------------|-------|----------------|-------------------------------|
| | n | Prevalence (%) | Highest frequency of duration |
| Heartburn | 109 | 42.9 | >7 days |
| Anorexia | 39 | 15.4 | >7 days |
| Vomiting | 36 | 14.2 | > 7days |
| Constipation | 29 | 11.4 | 2 days |
| Fever | 14 | 5.5 | 7 days |
| Abdominal pains | 10 | 3.9 | 6 days |
| Upper respiratory infection | 6 | 2.4 | 5 days |
| Diarrhoea | 5 | 2 | 1 day |
| Headache | 3 | 1.2 | 5 days |

Sick= 146, Not sick=108, Total=254 Multiple responses

4.5 Nutritional Status of the Respondents

4.5.1 Nutritional Status Based on MUAC

The average MUAC of the respondents was 26.72 cm \pm 3.66 with the measurements ranging from 19.5 cm to 40.2 cm. The study results revealed that 19.3% of the study subjects were undernourished (MUAC <23cm) while about 80.7% of the participants had adequate nutritional status.

Table 4.11: Nutritional status by MUAC of respondents

| MUAC in cm | N=254 | |
|-------------------|-----------|------------|
| | Frequency | Percentage |
| <23.0 cm | 49 | 19.3 |
| 23.0 cm and above | 205 | 80.7 |
| Total | 254 | 100 |

UNICEF, 2009; Ververs et al., 2013; WHO, 1995

Chi-square test showed a significant relationship between mother's age and their respective nutritional status based on MUAC (Likelihood ratio; 20.210, df=6, P=0.003). Moreover, Pearson's correlation coefficient revealed a significant positive relationship ($r=0.217$, $P<0.001$) between the mothers MUAC and age suggesting that MUAC increased with increase in age.

Notably, when MUAC of the women was correlated with their gestational age in weeks, a negative relationship was revealed showing that MUAC readings decreased with increase in gestational age ($r=-0.174$, $P=0.005$). This could be explained by the fact that the foetal nutritional needs increase with gestational age and if the mother is not able to meet the requirements, body stores are depleted resulting in deterioration of the nutritional status

of the expectant woman. Cross tabulation of women age category and their respective nutritional status (MUAC) revealed that most of the women who were under nourished were in the age category of between 20-29 years as reflected in the Table 4.12.

Table 4.12: Nutritional status (MUAC) by age of respondents

| Age category | N=254 MUAC status | | |
|--------------|----------------------------|----------------|---------------|
| | Under Nourished (n) (%) | Normal (n) (%) | Total (n) (%) |
| 16-19 | 9(3.5) | 5(2.0) | 14(5.5) |
| 20-24 | 15(5.9) | 71(28.0) | 86(33.9) |
| 25-29 | 15(5.9) | 63(24.8) | 78(30.7) |
| 30-34 | 7(1.4) | 41(16.1) | 48(18.9) |
| 35-39 | 1(0.4) | 22(8.7) | 23(9.1) |
| 40-44 | 1(0.4) | 2(0.8) | 3(1.2) |
| 45-49 | 1(0.4) | 1(0.4) | 2(0.8) |
| Total | 49(19.3) | 205(80.7) | 254(100) |

4.5.2 Nutrition Status Based on Haemoglobin Values

The respondent's blood was tested for haemoglobin levels. In this study, pregnant women with haemoglobin of less than 11g/dl were considered to be anemic (UNICEF, 2001). The mean haemoglobin level of the respondents was 12.52 g/dl \pm 1.61. About 16.9% of the respondents were found to be anemic.

Table 4.13: Nutritional status by haemoglobin levels of the respondents

| Hb in g/dl | N=254 | |
|---------------------|-----------|------------|
| | Frequency | Percentage |
| <11.0 g/dl | 43 | 16.9 |
| 11.0 g/dl and above | 211 | 83.1 |
| Total | 254 | 100 |

UNICEF, UNU, WHO, 2001

Table 4.14: Nutritional status (Hb) by age of respondents

| Age category | N=254 MUAC status | | |
|--------------|----------------------|----------------|---------------|
| | Anemic (n) (%) | Normal (n) (%) | Total (n) (%) |
| 16-19 | 4(1.6) | 10(3.9) | 14(5.5) |
| 20-24 | 15(5.9) | 71(28.0) | 86(33.9) |
| 25-29 | 17(6.7) | 61(24.0) | 78(30.7) |
| 30-34 | 3(1.2) | 45(17.7) | 48(18.9) |
| 35-39 | 3(1.2) | 20(7.9) | 23(9.1) |
| 40-44 | 1(0.4) | 2(0.9) | 3(1.2) |
| 45-49 | 0(0) | 2(0.9) | 2(0.8) |
| Total | 43(16.9) | 211(83.1) | 254(100) |

Cross-tabulation between women age category and nutritional status based on Hb showed that the age category of 25-29 years had the highest number of women who were anemic. Additionally, since dietary iron is important in formation of blood, Chi-square test was carried out to test for association between iron intake and anemia and the results showed no significant relationship ($\chi^2=0.103$, $df=1$, $p=0.748$).

4.6 Relationship between Study dependent and Independent Variables

The study established the association between the dependent and the independent variables.

4.6.1 Relationship between Dietary Diversity and Maternal Demographic Factors

Table 4.15 shows that there was no statistically significant relationship between dietary diversity and maternal demographic factors (age category, marital status, trimester of the pregnancy, house headship and household size of the respondents) assessed in this study.

Table 4.15: Relationship between dietary diversity and demographic factors of the respondents

| Variables | χ^2/Likelihood ratio | P value |
|--------------------|---|----------------|
| DDS vs. | | |
| Age category | 10.096 | 0.608 |
| Marital status | 1.261 | 0.868 |
| Parity | 6.296 | 0.900 |
| Trimester | 1.299 | 0.862 |
| Household headship | 3.109 | 0.211 |
| Household size | 12.426 | 0.714 |

Likelihood ratio used for cells with less than 5 counts.

4.6.2 Relationship between Dietary Diversity and Maternal Socio-Economic

Characteristics

The study results established that there was significant relationship between dietary diversity and the respondent education levels ($P < 0.001$), occupation of the respondents ($P = 0.002$), monthly income level ($P < 0.001$), land ownership ($P = 0.041$), total number of household assets ($P = 0.009$) and source of household lighting ($P = 0.017$) (Table 4.16).

When post hoc analysis of variance (ANOVA) was done, it was established that as the level of education increased, the level of dietary diversity score also increased. These results suggest that the more educated the respondents were the more they were likely to attain a high dietary diversity. Despite this positive relationship, it was noted that the mean diversity score of the various education levels was not significantly different ($P = 0.10$). Similar trend was observed in respect to household monthly incomes. The

finding suggested that high income is associated with increased probability of having high dietary diversity.

Table 4.16: Association between dietary diversity and socio-economic characteristic of the respondents

| Variables | χ^2/Likelihood ratio | df | P value |
|----------------------------------|---|-----------|----------------|
| DDS vs. | | | |
| Education level | 43.409 | 14 | <0.001* |
| Occupation of the respondents | 31.101 | 12 | 0.002* |
| Occupation of the household head | 11.197 | 10 | 0.342 |
| Source of income | 15.285 | 8 | 0.540 |
| Monthly income | 43.307 | 16 | < 0.001* |
| Income use determiner | 8.180 | 6 | 0.225 |
| Land ownership | 6.382 | 2 | 0.041* |
| Land size | 11.142 | 10 | 0.347 |
| Main source of food | 0.348 | 4 | 0.987 |
| Livestock ownership | 2.196 | 2 | 0.334 |
| Total number of household assets | 40.587 | 22 | 0.009* |
| House ownership | 2.665 | 4 | 0.615 |
| Source of lighting | 18.633 | 8 | 0.017* |
| Type of cooking fuel | 8.805 | 6 | 0.185 |
| Source of water | 6.854 | 8 | 0.552 |

*: significant (P< 0.05) Likelihood ratio used for cells with less than 5 counts.

With regard to the occupation of the respondents, those who reported to be employed (salaried) had the highest mean score of dietary diversity (7.04) while those in casual labour had the lowest mean score (5.90). The differences in dietary diversity mean score amongst the different employment status categories were significantly different (ANOVA; P=0.031).

A paired sample t-test was done to establish any significant differences in the dietary diversity mean score among those who reported owning land against those who did not. A significant difference ($P=0.024$) in the means was revealed with those who reported owning land having a higher mean score (7.01 ± 1.48) than those who did not (6.59 ± 1.39). A significant positive relationship was also established when Pearson's correlation test was done between DDS and the total household assets ($r=0.244$, $P<0.001$). This implies that an increase in household assets is associated with an increase in the DDS. This could be explained by the fact that increased household assets are associated with a better socio-economic status. Since total household assets was found to be a predictor of DDS ($P<0.001$) a prediction equation of dietary diversity based on total household assets was developed.

$$DDS = 5.835(\text{constant}) + 0.191(\text{total household assets})$$

4.6.3 Relationship between Dietary Diversity and Respondents Nutrient Intake

When Pearson's correlations were done between DDS and nutrient intake of selected nutrients, positive correlations were noted in all the nutrients. This means that as dietary diversity increased, the nutrient intake of the respondents also increased. This indicates that increased dietary diversity is needed in ensuring adequate intake of essential nutrients. However, in this study the correlations were only statistically significant to some of the selected nutrients (protein and calcium) (Table 4.17).

Table 4.17: Relationship between dietary diversity and respondents nutrient intake

| Variables | r | P value |
|------------------|----------|----------------|
| DDS vs. | | |
| Energy | 0.041 | 0.518 |
| Protein | 0.134 | 0.031* |
| Fat | 0.074 | 0.238 |
| Carbohydrate | 0.118 | 0.061 |
| Vitamin A | 0.085 | 0.176 |
| Total folic | 0.031 | 0.618 |
| Vitamin C | 0.058 | 0.354 |
| Calcium | 0.143 | 0.023* |
| Iron | 0.021 | 0.740 |
| Zinc | 0.048 | 0.446 |

*: significant (P<0.05)

4.6.4 Relationship between Dietary Diversity and Respondents Morbidity Patterns

Illness affects dietary diversity and nutrient intake since they cause decreased food intake. The decreased food intake is as a result of loss of appetite associated with the illness. A paired t-test showed that there were significant differences (P=0.01) in the mean DDS among those who had reported being sick two weeks prior to the day of the interviews and those who had not fallen ill in the same period. Those who had not reported any illness had a higher mean score (7.19±1.33) than their ill counterparts (6.59±1.50). This study finding confirms that illness can affect dietary diversity. There was however no significant relationship between morbidity pattern and the nutritional status of the respondents based on both MUAC ($\chi^2=0.348$, P=0.555, df=1) values and Hb levels ($\chi^2=0.059$, P=0.808, df=1).

4.6.5 Relationship between Dietary Diversity and Respondents Nutritional Status

4.6.5. 1 Relationship between Dietary Diversity and MUAC of the Respondents

A positive linear relationship between dietary diversity and the pregnant women MUAC was revealed by the study results ($r= 0.362$, $P<0.001$). From a statistical standpoint, DDS stood out as an important predictor of the respondent nutritional status (MUAC) ($P<0.001$). In light of the present study finding, the following regression equation was formulated to enable prediction of MUAC based on DDS;

$$MUAC = 20.504(\text{constant}) + 0.909(DDS)$$

Similarly, when a Chi-square test was done between dietary diversity and the respondent nutritional status, a significant relationship was established ($\chi^2 = 16.003$, $df=2$, $P<0.001$). Furthermore, a paired t-test revealed a significant difference on the mean dietary diversity score, with those with poor nutritional status having a lower mean DDS as compared with those who had a normal nutritional status (Table 4.18). From these findings, it is therefore evident that a diversified diet is associated with a good nutritional status.

Table 4.18: DDS mean difference by nutritional status (MUAC) of the respondents

| | MUAC STATUS | N | Mean DDS | SD | Std. Error Mean | df | Sig. (2 tailed) |
|------------|----------------|-----|----------|------|-----------------|-----|-----------------|
| DDS | Undernourished | 49 | 5.9 | 1.48 | 0.211 | | |
| | Normal | 205 | 7.07 | 1.36 | 0.095 | 252 | <0.001 |

4.6.5. 2 Relationship between Dietary Diversity and Hb of the Respondents

Haemoglobin levels was positively correlated with high dietary diversity and negatively correlated with low dietary diversity ($r= 0.152$, $P=0.016$). Regression equation was also developed to predict haemoglobin levels based on DDS

$$Hb = 11.375(\text{constant}) + 0.167(\text{DDS})$$

Additionally, t-test analysis showed significant differences between the DDS means of those found anemic as compared to those who had normal Hb levels as shown in the Table 4.19

Table 4.19: DDS mean difference by nutritional status (Hb) of respondents

| | | | Mean | | Std. Error | | |
|-----------|--------|-----|------|-------|------------|-----|-----------------|
| Hb levels | | N | DDS | SD | Mean | df | Sig. (2 tailed) |
| DDS | Anemic | 43 | 6.30 | 1.389 | 0.212 | | |
| | Normal | 211 | 6.95 | 1.450 | 0.100 | 252 | 0.007 |

These results infer that increased DDS is positively associated with increased haemoglobin levels.

CHAPTER FIVE: DISCUSSION

5.1 Introduction

The aim of this study was to assess dietary diversity, nutrient intake and nutritional status of pregnant women in Laikipia County. This chapter discusses the study findings in relation to the study objectives as well as how the results compare with other research findings.

5.2 Demographic and Socio-Economic Characteristics of the Respondents

Most of the pregnant women were young (20-24 years). Age consideration in pregnancy is very important because pregnancy complications may occur if the mothers are too young or at advanced age. The majority of the women had some formal education with only 3.9% being reported to have no education. This figure is lower than the national figure which reported that 7.5% of the women had no education (KNBS and ICF Macro, 2010). The mean household size of this study was also slightly lower than the national figure (4.2) reported by the Kenya National Bureau of Statistics (2010). Large household sizes may affect household and individual dietary diversity since economic resources tend to be constrained in large households as compared to households with few members.

Most of the respondent in this study were married. Marital status affects the provision of basic needs and the general well being of the household. Further, According to Dyer (2007) marriage in the African society has been considered an important milestone in one's life and the starting point of getting children who will carry the family name to

posterity. Most of the mothers had only completed secondary education. Education level affects food choices, type of occupation and ultimately the level of income one gets.

5.3 Dietary Diversity of the Mothers

The value of a diverse diet has over time been recognized and is highly recommended since it is strongly and positively associated with nutrient adequacy (Jayawardena et al., 2013; Kadiyala & Rathnayak et al., 2012). Majority of the women in this study had a high dietary diversity with a mean of 6.84 ± 1.46 . The findings of this study compare with those of studies done by Vakili et al. (2013) and Saaka (2012) where a mean DDS of 6.81 and 9.1 were reported respectively. It is important to note that the compared study of Saaka (2012) considered 12 food groups in a reference period of 7 days unlike this study which considered 14 food groups in a reference period of 24 hours.

The high DDS score observed in this study could be explained by the fact that the study was conducted in the season of plenty. The high consumption of food items from the grains and grains product by almost all respondents (99.2%) confirms that diets of the pregnant women were predominantly based on starchy staples. The findings agree with those of other studies that most diet in developing countries are predominantly cereal based (Ekesa et al., 2011; Kennedy et al., 2007; Ruel, 2003). Notably, as stated by Daniels (2009) diets in developing countries have also been reported to be lacking or having little animal source foods which were confirmed by this study since only 27.5% of the total respondent had consumed animal source foods based on the 24 hour dietary recall. With regard to food intake frequency, the majority of the respondents had attained

the minimum meal frequency of 3 meals per day. Frequency of eating during pregnancy is a component of maternal nutrition relevant to pregnancy outcome.

5.4 Nutrient Intake of the Pregnant Women

Saaka (2013) has argued that adequate nutrient intake is needed to ensure satisfactory birth outcomes since the nutrients have a critical role in the foetal development. Lee et al. (2013) have also demonstrated explicitly that pregnant women are vulnerable to nutritional inadequacies due to their increased nutrient needs. Despite the fairly high dietary diversity reported in this study most of the women had inadequate intake of some of the selected nutrients. In the present study, only the mean intake of vitamin A and C were adequate and this would be attributed to the high consumption of green leafy vegetables and other vegetables reported in the study.

This study finding of inadequate nutrient intake during pregnancy are comparable with those of a study conducted by Black et al. (2008) where it was noted that deficiencies in micronutrients such as vitamin A, C, zinc, iron and folate are highly prevalent and may occur concurrently among pregnant women. Similar findings are also documented in a study conducted among pregnant women in Nakuru-Kenya (Kamau-Mbuthia, 2007). Moreover, a study in Deep South of Thailand reported nutrient inadequacies of key macro and micro nutrients among pregnant women (Sukchan et al., 2010). A possible reason for the inadequacies established in this study would be the low quantities of food that the women consumed. This could also be further explained by the fact that majority of the respondents had reported being sick in the two weeks prior to the period of data

collection and literature has clearly shown that sickness affect food intake, absorption and utilization of nutrients.

5.5 Maternal Health Profile

5.5.1 ANC Attendance

The objective of ANC care during pregnancy is to identify and treat maternal health problems such as anaemia and infections (KNBS and ICF Macro, 2010). It is attested as one of the best strategies in early detection of maternal complications that might affect the pregnancy. Furthermore, according to Perumal et al. (2013) antenatal care is said to serve as a key entry point for implementing nutrition and health interventions that would improve maternal and child nutrition. Pregnant women should attend ANC clinic at least four times in the entire period of the pregnancy. Though the women were at different gestational ages, the study revealed that only a small number had attended their antenatal clinic more than thrice by the time of data collection.

In respect to the gestational age, most women sought their first ANC visit in their second trimester. The study results are in agreement with those of Kenya National Bureau of Statistics and ICF Macro (2010) which indicate that most women seek their first ANC attendance either in their second and third trimester. KNBS and ICF Macro (2010) findings reported that only 15% of pregnant women seek antenatal care in their first trimester. ANC visit from the first trimester are very crucial for both the mother and the unborn child. This is because early visits can enable timely detection and treatment of any complication that might otherwise cause maternal and infant mortality

5.5.2 Micronutrient Supplementation among the Women

Iron deficiency anaemia is still very common in developing countries. To overcome this deficiency iron supplements are usually prescribed to pregnant women (Shaw et al., 2011). In this study, majority of the respondents reported to be taking iron folate supplements or multiple micronutrient supplements. Due to the enormous prevalence of micronutrient deficiencies in developing countries which may adversely affect pregnancy, supplementation with iron and folate supplements have been shown to be of potential benefit to both the mother and the foetus. Anemia during pregnancy increases the chances of maternal mortality especially during delivery.

5.5.3 Maternal Morbidity Patterns

Morbidity in an individual affects dietary diversity and ultimately nutrient intake. This is because it affects food intake due to the loss of appetite associated with the illness. According to UNICEF (1998) morbidity affects food intake, absorption and utilization of nutrients resulting in a poor nutritional status. As it emerged in this study a notably high proportion of the respondents reported being unwell two weeks prior to the date of data collection. Findings of this study are consistent with those of a study carried out in India which found that most women had reported being sick during antenatal period (Singh et al., 2013).

The present study results pinpointed gastrointestinal disorders such as heartburn, anorexia constipation, abdominal pains, vomiting and diarrhoea as the most common type of illnesses and disorders among the pregnant women. This finding was further supported

by two of the key informant participants (nursing officer and nutritionist) who said that most of the pregnant women complained of heartburn and lack of appetite. The nutritionist in charge said, “*Most of the mothers complain of heartburn, loss of appetite and vomiting*” (KII, Health Care Provider, 2015). These findings compare well with those of studies done by Patel et al. (2013) and Singh et al. (2013) which reported abdominal pains and gastrointestinal disorders as the most common disorders among pregnant women.

5.6 Nutritional Status of the Mothers

Several studies have documented that poor nutritional status during pregnancy have been reported to cause delivery of low birth weight babies and is also a significant contributor to maternal morbidity (Hambidge et al., 2014; Han et al., 2011; Yakoob et al., 2009). Additionally, available evidence suggests that maternal nutritional status prior and during pregnancy influences the birth outcome (Imdad & Bhutta, 2011). Based on both MUAC (19.3%) and Hb (16.9%) a considerable number of respondents in this study had a poor nutritional status. The poor nutritional status may be due to the inadequate intake of both macro and micronutrients as witnessed in this study.

In comparison with this study findings, a study in South Eastern Nigeria among pregnant women reported 40.4% of the respondents as being anemic (Dim & Onah, 2007). Equally, a study in Nairobi by Nduhiu-Githiji (2013) reported 36.2% of the study participant as being anemic. The results of this study were comparable with a study conducted in Ethiopia which revealed that 21.3% of the participants were anemic (Hailu-

Alemayehu, 2013). The relatively low level of malnutrition detected in this study could be explained by the high dietary diversity reported by the pregnant women. Similarly, despite the inadequate dietary intake of iron revealed in this study the relatively lower cases of anemia in this study may be attributed to the high number of respondents who were taking iron-folate supplements.

5.7 Relationship between Dietary Diversity and Demographic and Socio-Economic Factors among the Pregnant Women

The association between dietary diversity and maternal demographic and economic factors was established. In this study, the selected maternal demographic factors were not significantly associated with dietary diversity. Similar findings were also documented by a study done by Ali et al. (2014) in Pakistan among pregnant women. Contrary to the finding of this study, Taruvinga et al. (2013) reported a significant association between house headship and dietary diversity. The study found that female headed households were more likely to achieve high dietary diversity. Likewise, since age was not a determining factor of dietary diversity in this study, this study finding is therefore in disagreement with another study done in Botswana by Clausen et al. (2005) which reported that older adults consumed a diet low in variety.

In regard to association between dietary diversity and socio-economic status, this study found compelling evidence that dietary diversity is indeed strongly associated with the socioeconomic status of the respondent households. Those women with higher education had a higher DDS. This could be so because women with a higher education might have

acquired essential information on appropriate feeding practices. Additionally, those households with higher income had better DDS. The possible reason is that higher income is associated with increased purchasing power which can help in promoting dietary diversity. In respect to occupation, those who reported being employed and salaried had the highest dietary diversity. This could be so because irregular family income contributes to low DDS as evidenced by this FGD participant statement “*Since I have no consistent monthly income it becomes difficult for me to change my regular diet*” (FGD, Pregnant Women, 2015).

Significant association between dietary diversity and land ownership were shown in this study. Those who reported owning land had a higher DDS than those who did not own land and the difference was significant. This could be explained by the fact that those who had land were able to engage in food production which enhanced their dietary diversity. This was confirmed by the FGD finding where a mother said “*I grow some food in my small piece of land which complements the food I obtain through buying*” (FGD, Young Mother, 2015). Moreover, household assets and source of lighting were also significantly associated with DDS. This would be possible since household assets and source of lighting have been associated and used as a proxy indicator of the socioeconomic status of a household.

Findings of this study are consistent with findings of several studies which have reported that dietary diversity is associated with socio-economic status (Rashid et al., 2011; Savy et al., 2008; Torheim et al., 2004). In unison with this study, a study conducted by

Kimiywe et al. (2007) in Nairobi revealed that dietary diversity was influenced by occupation and income levels. Moreover, in agreement with this study, a study by Vakili et al. (2013) in Ahvaz-Iran showed a significant relationship between DDS and the economic situation of the respective respondents. It is evidently clear that high DDS is accompanied by a greater cost and thus poor families may not access a highly diversified diet. In respect to this revelation that dietary diversity was indeed associated with the socioeconomic status of the respondents, the stated hypothesis that there is no significant relationship between maternal demographic and socio-economic factors is therefore rejected.

5.8 Relationship between Maternal Dietary Diversity and Nutrient Intake

In this study, positive correlations were noted between dietary diversity and some of the selected nutrients. This finding suggests that nutrient intake increases with increase in dietary diversity. In light of this observation, improved dietary diversity therefore enhances the chances of nutrient adequacy in an individual. In comparison with other studies, a positive relationship between consumption of a varied diet and nutrient adequacy was noted in a study done on women in Tehran (Mirmiran et al., 2006). A strong relationship between dietary diversity and micronutrient intake was also found by Acham et al. (2012) among women in an informal settlement in South Africa. Moreover, a study in Brazil by Bezerra and Sichieri in 2011 demonstrated a direct association between dietary diversity and energy intake. A high dietary diversity should therefore be widely recommended and the importance of consuming a diversified diet should be captured in all food based dietary guidelines. Since relationships have been found

between dietary diversity and nutrient intake, the postulated hypothesis that dietary diversity is not associated with nutrient intake of the respondents is therefore rejected.

5.9 Relationship between Maternal Dietary Diversity and Morbidity Pattern

The majority of the study participant reported being sick two weeks prior to the date of the interview. Significant differences were also found in the mean DDS among the sick and those not sick. This finding therefore supports evidence that illness affects dietary diversity of an individual. These observations are supported by a study by George et al (2014) who observed that high diet quality was found to be less associated with illness and side effects of medications. Moreover, a study by Young in 1997 concurs with this study that dietary intake is worsened by illness. Additionally, Morton et al (2014) have argued comprehensively that diseases affect dietary intake of a person. Since these findings reveal a significant relationship between morbidity pattern and dietary diversity, this study hypothesis that stated that there is no significant relationship between maternal morbidity pattern and dietary diversity is thus rejected.

5.10 Relationship between Dietary Diversity and Nutritional Status of the Women

Significant relationship between dietary diversity and the respondent nutritional status based on both MUAC and Hb were observed in this study. These findings add evidence to the existing literature that dietary diversity is indeed associated with nutritional status of an individual. Findings from this study are in agreement with those observed by Ey et al. (2012) in their study who found a significant relationship between dietary diversity and nutritional status of the respondents. Based on the findings of this study, the

hypotheses that there is no significant relationship between dietary diversity and nutritional status of pregnant women in Laikipia County is therefore rejected.

CHAPTER SIX: SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

This chapter provides a summary of the study, conclusions and recommendations.

The study aimed at determining dietary diversity, nutrient intake and nutritional status of pregnant women in Laikipia County.

6.1 Summary of the Findings

Most of the respondents were young and in the age category of 20-24 years. The highest percentages of the respondents were married and were in the third trimester of the pregnancy. The majority of the household were male headed and with a mean household size of 2 members. The results further showed that most of the pregnant women had only completed their secondary education. In regard to their occupation, most of the pregnant women reported being housewives. Overall, most of the households reported their monthly income as being between Ksh 10,000 to 20,000. Additionally, despite majority reporting owning some land, most of the households purchased their food.

Dietary diversity of the respondents was generally good with a mean of 6.84. In respect to food groups, the highest consumed food group was cereals by almost all (99.2%) of the respondents while the least consumed food group was fish and sea food. The majority of the respondents had inadequate intake of both macro and micronutrients except for vitamin A and C. With regard to morbidity, the morbidity incidence was high with majority of the respondents being ill two weeks prior to the day of data collection. Results further revealed that maternal malnutrition was high with 19.3% and 16.9% of

the respondents having poor nutritional status based on both MUAC and Hb levels respectively.

Moreover, the present study revealed statistically significant association between dietary diversity and the socio economic status of the respondent but found no significant association between dietary diversity and demographic factors of the respondents. Dietary diversity was also positively related to some of the selected nutrients. Similarly, morbidity and nutritional status were also found to be significantly associated with dietary diversity.

6.2 Conclusion of the Study

The study has demonstrated that dietary diversity of the pregnant women was generally good. However, the diets of respondents were noted to be predominantly cereal based. Despite the good dietary diversity reported most of the respondent did not meet the recommended nutrient intakes of most of the selected nutrients. The inadequate intake of both macro and micronutrient was attributed to the low quantities of foods that were being consumed by the respondents. Morbidity incidence among the pregnant women was noted to be high.

In regard to nutritional status, the majority of the respondents had a good nutritional status but a significant proportion of the respondents had a poor nutritional status. The discussed results also highlighted the critical role of education, occupation, monthly household income, lighting source, household assets and land ownership in the

attainment of high dietary diversity. Additionally, positive associations between dietary diversity and nutrient intake underscored the importance of dietary diversity in meeting nutrient requirements among pregnant women. Further, this study finding that morbidity negatively influenced dietary diversity strengthens the growing evidence that improved dietary diversity is associated with reduced likelihood of morbidity. In respect to nutritional status, the study confirmed that dietary diversity is indeed associated with nutritional status. This finding suggested that pregnant women with a diversified diet were more likely to have a better nutritional status.

6.3 Recommendations of the Study

This study has the following recommendations;

6.3.1 Recommendation for Policy

Results have demonstrated that factors such as level of education, occupation, monthly income, household assets and land ownership are important determinants of dietary diversity. Based on this finding, policy makers should enact new and support existing policies on investments geared towards improving the living standards of every household. This support would play a significant role in enhancing household dietary diversity and ultimately maternal dietary diversity and nutrient intake for better pregnancy outcomes particularly among the poor population. Further, policies to enhance women education and policies to ensure access and proper utilization of health facilities in the context of women general reproductive health are recommended.

6.3.2 Recommendation for Practice

Since the study has revealed that illness influences dietary diversity and nutrient intake, it is therefore paramount that the government through the ministry of health and other relevant stakeholders launch public health awareness campaigns to make the public and more so the pregnant women aware of the importance of early identification and timely treatment of diseases. Moreover, nutritionists and dieticians have a critical role in educating pregnant women on the importance of diversified diets in improving nutrient intake for a healthy present and future generation. Nutrition education could be disseminated during pregnant women ANC visits. The ministry of agriculture should also scale up training on some practical skills of how they can achieve high dietary diversity through methods such as the use of kitchen gardening and through production of a variety of high yielding nutritious crops. Furthermore, the ministry of health should initiate and monitor existing community based programmes promoting dietary diversity especially among vulnerable groups such as pregnant women.

6.3.3 Recommendation for Further Research

The study was undertaken in one season of the food security cycle. It is therefore recommended that similar studies be done during other seasons so that it can better explain the true dietary diversity of the study population. Moreover, despite high dietary diversity being reported it would be worthwhile studying further the whole array of factors involved in the inadequate food consumption reported by the pregnant women. A longitudinal study on the effect of dietary diversity on pregnancy outcomes is also highly recommended. Along the same lines, since there is minimal information in the country on

dietary intakes during pregnancy further research in other geographical locations is also strongly recommended.

REFERENCES

- Abebe, H., Abebe, Y., Loha, E., & Stoecker, B. (2014). Consumption of vitamin a rich foods and dark adaptation threshold of pregnant women at Damot Sore District, Wolayita, southern Ethiopia. *Ethiopian Journal of Health Sciences*, 24(3), 219. doi:10.4314/ejhs.v24i3.5
- Acham, H., Oldewage-Theron, W., & Egal, A. A. (2012). Dietary diversity, micronutrient intake and their variation among black women in informal settlements in South Africa: a cross-sectional study. *Intern. J. Nutr. Metab*, 4, 24–39.
- Addis Alene, K., & Mohamed Dohe, A. (2014). Prevalence of Anemia and Associated Factors among Pregnant Women in an Urban Area of Eastern Ethiopia. *Anemia*, 2014, e561567. doi:10.1155/2014/561567.
- Ahmed, F., & Tseng, M. (2013). Diet and nutritional status during pregnancy. *Public Health Nutrition*, 16(08), 1337–1339. doi:10.1017/S1368980013001651
- Ajani, S. (2013). An assessment of dietary diversity in six Nigerian States. *African Journal of Biomedical Research*, 13(3), 161–167.
- Ali, F., Thaver, I., & Khan, S. A. (2014). Assessment of dietary diversity and nutritional status of pregnant women in Islamabad, Pakistan. *Journal of Ayub Medical College, Abbottabad: JAMC*, 26(4), 506–509.
- Allen, L. H. (2014). Micronutrient Research, Programs, and Policy: From Meta-analyses to Metabolomics. *Advances in Nutrition: An International Review Journal*, 5(3), 344S–351S. doi:10.3945/an.113.005421
- Arimond, M., & Ruel, M. T. (2004). Dietary diversity is associated with child nutritional status: evidence from 11 demographic and health surveys. *The Journal of Nutrition*, 134(10), 2579–2585.
- Arimond, M., Wiesmann, D., Becquey, E., Carriquiry, A., Daniels, M. C., Deitchler, M., ... Torheim, L. E. (2010). Simple Food Group Diversity Indicators Predict Micronutrient Adequacy of Women's Diets in 5 Diverse, Resource-Poor Settings. *Journal of Nutrition*, 140(11), 2059S–2069S. doi:10.3945/jn.110.123414
- Ary, D., Jacobs, L., Sorensen, C., & Walker, D. (2013). *Introduction to Research in Education*. Cengage Learning.
- Bezerra, I. N., & Sichieri, R. (2011). Household food diversity and nutritional status among adults in Brazil. *The International Journal of Behavioral Nutrition and Physical Activity*, 8, 22. <http://doi.org/10.1186/1479-5868-8-22>

- Bhutta, Z. A., Das, J. K., Rizvi, A., Gaffey, M. F., Walker, N., Horton, S., ... Black, R. E. (2013). Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? *The Lancet*, 382(9890), 452–477.
- Black, R. E., Allen, L. H., Bhutta, Z. A., Caulfield, L. E., De Onis, M., Ezzati, M., ... Rivera, J. (2008). Maternal and child undernutrition: global and regional exposures and health consequences. *The Lancet*, 371(9608), 243–260.
- Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., De Onis, M., ... others. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet*, 382(9890), 427–451.
- Blumfield, M., Hure, A., MacDonald-Wicks, L., Smith, R., Simpson, S., Raubenheimer, D., & Collins, C. (2012). The Association between the Macronutrient Content of Maternal Diet and the Adequacy of Micronutrients during Pregnancy in the Women and Their Children's Health (WATCH) Study. *Nutrients*, 4(12), 1958–1976. <http://doi.org/10.3390/nu4121958>
- Brinkman, H.-J., de Pee, S., Sanogo, I., Subran, L., & Bloem, M. W. (2010). High Food Prices and the Global Financial Crisis Have Reduced Access to Nutritious Food and Worsened Nutritional Status and Health. *Journal of Nutrition*, 140(1), 153S–161S. doi:10.3945/jn.109.110767.
- Cheng, Y., Dibley, M. J., Zhang, X., Zeng, L., & Yan, H. (2009). Assessment of dietary intake among pregnant women in a rural area of western China. *BMC Public Health*, 9(1), 222. doi:10.1186/1471-2458-9-222.
- Choudhary, S., Mishra, C. P., & Shukla, K. P. (2010). Dietary pattern and nutrition related knowledge of rural adolescent girls. Retrieved from <http://medind.nic.in/ibl/t10/i3/iblt10i3p207.pdf>
- Clausen, T., Charlton, K. E., Gobotswang, K. S. M., & Holmboe-Ottesen, G. (2005). Predictors of food variety and dietary diversity among older persons in Botswana. *Nutrition (Burbank, Los Angeles County, Calif.)*, 21(1), 86–95. doi:10.1016/j.nut.2004.09.012
- Cronbach, L. J., & Shavelson, R. J. (2004). My Current Thoughts on Coefficient Alpha and Successor Procedures. *Educational and Psychological Measurement*, 64(3), 391–418.
- Dachner, N., Ricciuto, L., Kirkpatrick, S. I., & Tarasuk, V. (2010). Food purchasing and food insecurity among low-income families in Toronto. *Canadian Journal of Dietetic Practice and Research: A Publication of Dietitians of Canada = Revue Canadienne De La Pratique Et De La Recherche En Diététique: Une Publication Des Diététistes Du Canada*, 71(3), e50–56.
- Daniels, M. C., Adair, L. S., Popkin, B. M., & Truong, Y. K. (2009). Dietary diversity scores can be improved through the use of portion requirements: an analysis in

young Filipino children. *European Journal of Clinical Nutrition*, 63(2), 199–208. doi:10.1038/sj.ejcn.1602927

- Daniels, Melissa C. (2009). Dietary Diversity as a Measure of the Micronutrient Adequacy of Women's Diets: Results from Metropolitan Cebu, Philippines Site. *Washington, DC: Food and Nutrition Technical Assistance II Project, FHI 360.*
- De Carvalho Padilha, P., Accioly, E., Della Libera, B., Chagas, C., & Saunders, C. (2009). assessment of nutritional status in Brazilian pregnant women. *Rev Panam Salud Publica*, 25(2), 171.
- Dim, C. C., & Onah, H. E. (2007). The Prevalence of Anemia Among Pregnant Women at Booking in Enugu, South Eastern Nigeria. *Medscape General Medicine*, 9(3), 11.
- Drewnowski, A., Renderson, S. A., Driscoll, A., & Rolls, B. J. (1997). The Dietary Variety Score: Assessing Diet Quality in Healthy Young and Older Adults. *Journal of the American Dietetic Association*, 97(3), 266–271. doi:10.1016/S0002-8223(97)00070-9
- Drimie, S., Faber, M., Vearey, J., & Nunez, L. (2013). Dietary diversity of formal and informal residents in Johannesburg, South Africa. *BMC Public Health*, 13(1), 911.
- Dyer, S. (2007). The value of children in African countries: Insights from studies on infertility. *Journal of Psychosomatic Obstetrics & Gynaecology* 28 (2): 69 - 77.
- Ekesa, B. N., Blomme, G., & Garming, H. (2011). Dietary diversity and nutritional status of pre-school children from Musa-dependent households in Gitega (Burundi) and Butembo (Democratic Republic of Congo). *African Journal of Food, Agriculture, Nutrition and Development*, 11(4).
- Ey, C. E., Zalilah, M. S., Ys, C. Y., & Norhasmah, S. (2012). Dietary diversity is associated with nutritional status of Orang Asli children in Krau Wildlife Reserve, Pahang. *Malaysian Journal of Nutrition*, 18(1), 1–13.
- Ferreira, H. S., Moura, F. A., Cabral Júnior, C. R., Florêncio, T. M. M. T., Vieira, R. C., & de Assunção, M. L. (2009). Short stature of mothers from an area endemic for undernutrition is associated with obesity, hypertension and stunted children: a population-based study in the semi-arid region of Alagoas, Northeast Brazil. *British Journal of Nutrition*, 101(08), 1239. doi:10.1017/S0007114508059357
- FAO. 2006. Baseline Survey Report Protecting and Improving Household Food Security and Nutrition in HIV/AIDS Affected Areas in Manica and Sofala Province, Maputo, Mozambique. (available at http://www.foodsec.org/tr/nut/baseline_june07)

- FAO/WHO. (1981). Diet and the pregnant and lactating woman: Report of a joint FAO/WHO/UNU expert consultation on energy and protein requirements; Rome, Italy.
- FAO/WHO: Human vitamin and mineral requirements. Food and Nutrition Technical Series. Report of a joint FAO/WHO/UNU Expert Consultation, Rome 2001.
- Food and Agriculture Organization (FAO). (2011). *Guidelines for measuring household and individual dietary diversity*. Food and Agriculture Organization of the United Nations: Rome, Italy.
- Food and Agriculture Organization of the United Nations-FAO. (2008). Guidelines for measuring household and individual dietary diversity. *Version 4, Rome, Italy*.
- Fujita, M., Lo, Y., & Baranski, J. R. (2012). Dietary diversity score is a useful indicator of vitamin A status of adult women in Northern Kenya. *American Journal of Human Biology*, 24(6), 829–834.
- George, S. M., Ballard-Barbash, R., Manson, J. E., Reedy, J., Shikany, J. M., Subar, A. F., ... Neuhauser, M. L. (2014). Comparing indices of diet quality with chronic disease mortality risk in postmenopausal women in the Women's Health Initiative Observational Study: evidence to inform national dietary guidance. *American Journal of Epidemiology*, 180(6), 616–625. <http://doi.org/10.1093/aje/kwu173>
- Gibson, R. S. (2005). *Principles of Nutritional Assessment*. Oxford University Press.
- GOK. (2014). National Drought Management Authority Laikipia County Drought Monitoring and Early Warning Bulletin – July 2014.
- Government of the Republic of Kenya (1999). The National Micronutrient Survey Report. Ministry of Health, Nairobi, Kenya.
- Hailu Jufar, A. (2013). Prevalence of Anemia among Pregnant Women Attending Antenatal Care at Tikur Anbessa Specialized Hospital, Addis Ababa Ethiopia. *Journal of Hematology & Thromboembolic Diseases*, 02(01).
- Hambidge, K. M., Krebs, N. F., Westcott, J. E., Garces, A., Goudar, S. S., Kodkany, B. S., ... others. (2014). Preconception maternal nutrition: a multi-site randomized controlled trial. *BMC Pregnancy and Childbirth*, 14(1), 111.
- Han, Z., Mulla, S., Beyene, J., Liao, G., McDonald, S. D., & Knowledge Synthesis Group. (2011). Maternal underweight and the risk of preterm birth and low birth weight: a systematic review and meta-analyses. *International Journal of Epidemiology*, 40(1), 65–101. doi:10.1093/ije/dyq195

- Hoddinott, J., & Yohannes, Y. (2002). Dietary diversity as a food security indicator. *Food Consumption and Nutrition Division Discussion Paper, 136*, 2002.
- Hooshmand, S. (2013). Dietary Diversity and Nutritional Status of Urban Primary School Children from Iran and India. *Journal of Nutritional Disorders & Therapy, 03*(02). doi:10.4172/2161-0509.S12-001
- Ihab, A. N., Rohana, A. J., Manan, W. W., Suriati, W. W., Zalilah, M. S., & Rusli, A. M. (2012). Food Expenditure and Diet Diversity Score are Predictors of Household Food Insecurity among Low Income Households in Rural District of Kelantan Malaysia. *Pakistan Journal of Nutrition, 11*(10), 869–875.
- Imdad, A., & Bhutta, Z. A. (2011). Effect of balanced protein energy supplementation during pregnancy on birth outcomes. *BMC Public Health, 11*(Suppl 3), S17.
- Jayawardena, R., Byrne, N. M., Soares, M. J., Katulanda, P., Yadav, B., & Hills, A. P. (2013). High dietary diversity is associated with obesity in Sri Lankan adults: an evaluation of three dietary scores. *BMC Public Health, 13*(1), 314.
- Kadiyala, S., & Rawat, R. (2013). Food access and diet quality independently predict nutritional status among people living with HIV in Uganda. *Public Health Nutrition, 16*(01), 164–170. doi:10.1017/S136898001200050X
- Kamau-Mbuthia, E., & Elmadfa, I. (2007). Diet quality of pregnant women attending an antenatal clinic in Nakuru, Kenya. *Annals of Nutrition & Metabolism, 51*(4), 324–330. <http://doi.org/10.1159/000107674>
- Kennedy, G. L., Pedro, M. R., Seghieri, C., Nantel, G., & Brouwer, I. (2007). Dietary diversity score is a useful indicator of micronutrient intake in non-breast-feeding Filipino children. *The Journal of Nutrition, 137*(2), 472–477.
- Kennedy, G. (2009). Evaluation of dietary diversity scores for assessment of micronutrient intake and food security in developing countries. s.n., S.I.
- Kennedy, G., Fanou-Fogny, N., Seghieri, C., Arimond, M., Koreissi, Y., Dossa, R., ... Brouwer, I. D. (2010). Food Groups Associated with a Composite Measure of Probability of Adequate Intake of 11 Micronutrients in the Diets of Women in Urban Mali. *Journal of Nutrition, 140*(11), 2070S–2078S. doi:10.3945/jn.110.123612
- Kennedy, G., Fanou, N., Seghieri, C., and Brouwer, I.D. (2009). Dietary diversity as a measure of the micronutrient adequacy of women's diets: results from Bamako, Mali site. *Food and Nutrition Technical Assistance II Project (FANTA-2)*.
- Kennedy, G. L., Pedro, M. R., Seghieri, C., Nantel, G., & Brouwer, I. (2007). Dietary diversity score is a useful indicator of micronutrient intake in non-breast-feeding Filipino children. *The Journal of Nutrition, 137*(2), 472–477.

- Kenya National Bureau of Statistics (KNBS) and ICF Macro. (2010). *Kenya Demographic and Health Survey 2008-09*. Calverton, Maryland: KNBS and ICF Macro.
- Kimiywe, J., Waudo, J., Mbithe, D., & Maundu, P. (2007). Utilization and medicinal value of indigenous leafy vegetables consumed in urban and peri-urban Nairobi. *Afr. J. Food Agric. Nutr. Dev*, 7(4), 14.
- Krishna, J., Mishra, C. P., & Singh, G. P. (2012). Dietary diversity of urban adolescent girls in Varanasi. *Indian J. Prev. Soc. Med*, 43(3), 340.
- Kruger, H. S. (2005). Maternal anthropometry and pregnancy outcomes: a proposal for the monitoring of pregnancy weight gain in outpatient clinics in South Africa. *Curationis*, 28(4), 40–49.
- Labadarios, D., Steyn, N. P., & Nel, J. (2011). How diverse is the diet of adult South Africans. *Nutrition Journal*, 10(3). Retrieved from <http://www.biomedcentral.com/content/pdf/1475-2891-10-33.pdf>
- Lee, S. E., Talegawkar, S. A., Merialdi, M., & Caulfield, L. E. (2013). Dietary intakes of women during pregnancy in low- and middle-income countries. *Public Health Nutrition*, 16(08), 1340–1353. doi:10.1017/S1368980012004417
- Leyna, G. H., Mmbaga, E. J., Mnyika, K. S., Hussain, A., & Klepp, K.-I. (2010). Food insecurity is associated with food consumption patterns and anthropometric measures but not serum micronutrient levels in adults in rural Tanzania. *Public Health Nutrition*, 13(9), 1438–1444. doi:10.1017/S1368980010000327
- Mirmiran, P., Azadbakht, L., & Azizi, F. (2006). Dietary diversity within food groups: an indicator of specific nutrient adequacy in Tehranian women. *Journal of the American College of Nutrition*, 25(4), 354–361.
- Morris, M. A., Hulme, C., Clarke, G. P., Edwards, K. L., & Cade, J. E. (2014). What is the cost of a healthy diet? Using diet data from the UK Women's Cohort Study. *Journal of Epidemiology & Community Health*, 68(11), 1043–1049. doi:10.1136/jech-2014-204039
- Morton, G. J., Meek, T. H., & Schwartz, M. W. (2014). Neurobiology of food intake in health and disease. *Nature Reviews Neuroscience*, 15(6), 367–378. <http://doi.org/10.1038/nrn3745>
- Msaki, M. M., & Hendriks, S. L. (2013). Do Food Quality and Food Quantity Talk the Same? Lesson From Household Food Security Study in Embo, South Africa. *Journal of the American College of Nutrition*, 32(3), 165–176. doi:10.1080/07315724.2013.797859.
- Mugenda, O.M., & Mugenda, A.G (2003). *Research Methods; Quantitative and Qualitative Approach*. Nairobi.

- Nduhiu-Githinji, C. (2013). *Prevalence of anaemia among pregnant women attending Antenatal clinic at Mbagathi District Hospital* (Thesis). University of Nairobi.
- Nguyen, P. H., Strizich, G., Lowe, A., Nguyen, H., Pham, H., Truong, T. V., ... Ramakrishnan, U. (2013). Food consumption patterns and associated factors among Vietnamese women of reproductive age. *Nutrition Journal*, *12*(1), 126.
- Ojofeitimi, E. O., Ogunjuyigbe, P. O., Sanusi, R. A., Orji, E. O., Akinlo, A., Liasu, S. A., & Owolabi, O. O. (2008). Poor dietary intake of energy and retinol among pregnant women: implications for pregnancy outcome in Southwest Nigeria. *Pakistan Journal of Nutrition*, *7*(3), 480–484.
- Patel, K., Joshi, H., & Patel, V. (2013). A study of morbidity and drug utilization pattern in indoor patients of high risk pregnancy at tertiary care hospital. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*, 372–378. <http://doi.org/10.5455/2320-1770.ijrcog20130922>
- Pellegrini, L., & Tasciotti, L. (2014). Crop diversification, dietary diversity and agricultural income: empirical evidence from eight developing countries. *Canadian Journal of Development Studies/Revue Canadienne D'études Du Développement*, *35*(2), 211–227. doi:10.1080/02255189.2014.898580
- Perumal, N., Cole, D. C., Ouédraogo, H. Z., Sindi, K., Loechl, C., Low, J., ... Oyunga, M. (2013). Health and nutrition knowledge, attitudes and practices of pregnant women attending and not-attending ANC clinics in Western Kenya: a cross-sectional analysis. *BMC Pregnancy and Childbirth*, *13*(1), 146. doi:10.1186/1471-2393-13-146
- Pieters, H., Guariso, A., & Vandeplass, A. (2013). *Conceptual framework for the analysis of the determinants of food and nutrition security*. LEI Wageningen UR. Retrieved_from:http://www3.lei.wur.nl/FoodSecurePublications/13_Pieters_Guariso_Vandeplass_ConceptualFramework.pdf
- Popa, A. D., Ni, O., Graur, L. I., Popescu, R. M., Botnariu, G. E., Mihalache, L., & Graur, M. (2013). Nutritional knowledge as a determinant of vitamin and mineral supplementation during pregnancy. *BMC Public Health*, *13*(1), 1105.
- Radlowski, E. C., & Johnson, R. W. (2013). Perinatal iron deficiency and neurocognitive development. *Frontiers in Human Neuroscience*, *7*. doi:10.3389/fnhum.2013.00585
- Rajapaksa, L.C, Arambepola, C, Gunawardena, N, Rosa, C, & Opatha, S. (2011). Nutritional Status in Sri Lanka, Determinants and Interventions: a Desk Review.Colombo. *UNICEF*.

- Rashid, D. A., Smith, L. C., & Rahman, T. (2011). Determinants of Dietary Quality: Evidence from Bangladesh. *World Development*, 39(12), 2221–2231. doi:10.1016/j.worlddev.2011.05.022
- Rathnayake, K. M., Madushani, P. A. E., & Silva, K. (2012). Use of dietary diversity score as a proxy indicator of nutrient adequacy of rural elderly people in Sri Lanka. *BMC Research Notes*, 5(1), 469.
- R. G. Vivek, A. B. Halappanavar, P. R. Vivek, S. B. Halki, V. S. Maled, & P. S. Deshpande. (2012). Prevalence of Anemia and its epidemiological,” Determinants in Pregnant Women, 5, 216–223.
- Rodriguez-Bernal, C., Rebagliato, & Ballester. (2012). Maternal nutrition and fetal growth: the role of iron status and intake during pregnancy. *Nutrition and Dietary Supplements*, 25. doi:10.2147/NDS.S13093.
- Rogers, B. L. (1996). The implications of female household headship for food consumption and nutritional status in the Dominican Republic. *World Development*, 24(1), 113–128. doi:10.1016/0305-750X(95)00122-S
- Ruel, M. (2002). Is Dietary Diversity an Indicator Of Food Security Or Dietary Quality? A review of measurement issues and research needs. *FCND Discussion Paper No. 140. International Food Policy Research Institute, Washinton, DC.*
- Ruel, M. T. (2003). Operationalizing dietary diversity: a review of measurement issues and research priorities. *The Journal of Nutrition*, 133(11), 3911S–3926S.
- Saaka, M., & Osman, S. M. (2013). Does Household Food Insecurity Affect the Nutritional Status of Preschool Children Aged 6–36 Months? *International Journal of Population Research*, 2013, 1–12. doi:10.1155/2013/304169
- Saaka, M. (2013). Maternal dietary diversity and infant outcome of pregnant women in Northern Ghana. *International Journal of Child Health and Nutrition*, 1(2), 148–156.
- Sajjad, R., & Khan, A. (2012). Nutrient intakes of pregnant women in comparison to the reference intake. *Pakistan Journal of Nutrition*, 11(2), 166–171.
- Savy, M., Martin-Prével, Y., Danel, P., Traissac, P., Dabiré, H., & Delpeuch, F. (2008). Are dietary diversity scores related to the socio-economic and anthropometric status of women living in an urban area in Burkina Faso? *Public Health Nutrition*, 11(02). doi:10.1017/S1368980007000043
- Savy, M., Martin-Prével, Y., Sawadogo, P., Kameli, Y., & Delpeuch, F. (2005). Use of variety/diversity scores for diet quality measurement: relation with nutritional status of women in a rural area in Burkina Faso. *European Journal of Clinical Nutrition*, 59(5), 703–716. doi:10.1038/sj.ejcn.1602135.

- Scrimshaw, N. S. (2003). Historical Concepts of Interactions, Synergism and Antagonism between Nutrition and Infection. *The Journal of Nutrition*, 133(1), 316S–321S.
- Silk, K. J., Sherry, J., Winn, B., Keesecker, N., Horodyski, M. A., & Sayir, A. (2008). Increasing nutrition literacy: testing the effectiveness of print, web site, and game modalities. *Journal of Nutrition Education and Behavior*, 40(1), 3–10. doi:10.1016/j.jneb.2007.08.012.
- Singh, R., Chauhan, R., Nandan, D., Singh, H., Gupta, S. C., & Bhatnagar, M. (2013). Morbidity Profile Of Women During Pregnancy: A Hospital Record Based Study In Western Up. *Indian Journal of Community Health*, 24(4), 342 – 346.
- Sukchan, P., Liabsuetrakul, T., Chongsuvivatwong, V., Songwathana, P., Sornsrivichai, V., & Kuning, M. (2010). Inadequacy of nutrients intake among pregnant women in the Deep South of Thailand. *BMC Public Health*, 10(1), 572. <http://doi.org/10.1186/1471-2458-10-572>
- Sullivan, K. M., Ford, E. S., Azrak, M. F., & Mokdad, A. H. (2009). Multivitamin use in pregnant and nonpregnant women: results from the Behavioral Risk Factor Surveillance System. *Public Health Reports*, 124(3), 384.
- Swindale, A., & Bilinsky, P. (2006). Household dietary diversity score (HDDS) for measurement of household food access: indicator guide. *Washington, DC: Food and Nutrition Technical Assistance Project, Academy for Educational Development*.
- Taruvunga, A., Muchenje, V., & Mushunje, A. (2013). Determinants of rural household dietary diversity: The case of Amatole and Nyandeni districts, South Africa. *Journal of Development and Sustainability*, 2(4), 2233–2247.
- Thiele, S., & Weiss, C. (2003). Consumer demand for food diversity: evidence for Germany. *Food Policy*, 28(2), 99–115. doi:10.1016/S0306-9192(02)00068-4.
- Torheim, L. E., Ouattara, F., Diarra, M. M., Thiam, F. D., Barikmo, I., Hatløy, A., & Oshaug, A. (2004). Nutrient adequacy and dietary diversity in rural Mali: association and determinants. *European Journal of Clinical Nutrition*, 58(4), 594–604. doi:10.1038/sj.ejcn.1601853.
- Torjusen, H., Lieblein, G., Næs, T., Haugen, M., Meltzer, H. M., & Brantsæter, A. L. (2012). Food patterns and dietary quality associated with organic food consumption during pregnancy; data from a large cohort of pregnant women in Norway. *BMC Public Health*, 12(1), 612.
- UNICEF. (2009). Anthropometry Tools and Use Presentation to UNICEF Supply Meeting.

- UNICEF. (1998). *The State of the World's Children 1998*. Oxford University Press.
- UNICEF., Moccia, P., & Anthony, D. (2009). *The state of the world's children 2009: maternal and newborn health*. New York: Unicef.
- UNICEF, UNU, WHO (2001). Iron deficiency anaemia assessment, prevention, and control – a guide for programme managers. (WHONHD/ 01.2). [http: / www.who.int/reproductivehealth/docs/anaemia.pdf](http://www.who.int/reproductivehealth/docs/anaemia.pdf).
- Vakili, M., Abedi, P., Sharifi, M., & Hosseini, M. (2013). Dietary Diversity and Its Related Factors among Adolescents: A Survey in Ahvaz-Iran. *Global Journal of Health Science*, 5(2). doi:10.5539/gjhs.v5n2p181.
- Ververs, M., Antierens, A., Sackl, A., Staderini, N., & Captier, V. (2013). Which Anthropometric Indicators Identify a Pregnant Woman as Acutely Malnourished and Predict Adverse Birth Outcomes in the Humanitarian Context? *PLoS Currents*, 5.
- Vorster, H. H., Kruger, A., & Margetts, B. M. (2011). The Nutrition Transition in Africa: Can It Be Steered into a More Positive Direction? *Nutrients*, 3(12), 429–441. doi:10.3390/nu3040429
- WHO. Maternal anthropometry and pregnancy outcomes. A WHO Collaborative Study. *Bull World Health Organ* 1995b;73 Suppl:1-98. [PMCID: PMC2486648]
- WHO. (2016). Nutrition Landscape Information System: Nutrition Landscape Information System (NLIS) Country Profile. Retrieved June 20, 2016 from <http://apps.who.int/nutrition/landscape/report.aspx?iso=ken>
- WHO, UNICEF, UNFPA, & the WB. (2012). Trends in Maternal Mortality: 1990 to 2010. Retrieved from: http://www.unfpa.org/webdav/site/global/shared/documents/publications/2012/Trends_in_maternal_mortality_A4-1.pdf
- World Health Organization. (1998). *Preparation and use of food-based dietary guidelines: report of a joint FAO/WHO consultation*. WHO technical report series. Geneva. World Health Organization.
- World Health Organization. (2012). 10 facts on nutrition. Retrieved from <http://www.who.int/features/factfiles/nutrition/en/index.html>
- World Health Organization and FAO (Ed.). (2004). *Vitamin and mineral requirements in human nutrition* (2. ed). Geneva.
- Yakoob, M., Menezes, E. V., Soomro, T., Haws, R. A., Darmstadt, G. L., & Bhutta, Z. A. (2009). Reducing stillbirths: behavioural and nutritional interventions before and during

pregnancy. *BMC Pregnancy and Childbirth*, 9(Suppl 1), S3. doi:10.1186/1471-2393-9-S1-S3

- Young, J. S. (1997). HIV and medical nutrition therapy. *Journal of the American Dietetic Association*, 97(10 Suppl 2), S161–166.
- Yu, Z., Han, S., Zhu, J., Sun, X., Ji, C., & Guo, X. (2013). Pre-pregnancy body mass index in relation to infant birth weight and offspring overweight/obesity: a systematic review and meta-analysis. *PLoS One*, 8(4), e61627.
- Zainal Badari, S. A., Arcot, J., Haron, S. A., Paim, L., Sulaiman, N., & Masud, J. (2012). Food Variety and Dietary Diversity Scores to Understand the Food-Intake Pattern among Selected Malaysian Households. *Ecology of Food and Nutrition*, 51(4), 265–299. doi:10.1080/03670244.2012.674445.

APPENDICES

APPENDIX A: LETTER OF INTRODUCTION AND CONSENT

Dear Respondent,

My name is WILLY KAHANYA KIBOI from Kenyatta University pursuing a Master of Science in Foods, Nutrition and Dietetics. I am undertaking a study on dietary diversity, nutrient intake and nutritional status of pregnant women in Laikipia County, Kenya. This study will help inform the government on possible strategies of enhancing maternal nutrition. I will explain to you about the research and you may thereafter decide to participate in the research or decline.

Procedure to be followed

I and my research assistants would like to ask you some questions about yourself and your household. In addition, we will also take your anthropometric measurement mid upper arm circumference (MUAC). Though your views are very important, you have the right to refuse participation in the study. You will get the same care and treatment whether you agree to join the study or not. The questionnaire will take about 1 hour and your cooperation is highly appreciated.

Possible benefits

The benefits from this study may not be directly anticipated but the findings may be useful to the relevant stakeholder in initiating interventions geared toward improving maternal and young child health. You will also benefit from understanding your current dietary and nutritional status and if found to have a problem, advice on appropriate action will be provided.

Possible Risks/Discomfort

There are no foreseen risks associated with the study; however some questions to be asked might make you uncomfortable. If this happens you may refuse to answer the questions and you are at liberty to stop the interview at any time.

Compensation

Your participation to the study is voluntary and thus you are not entitled to any form of payment.

Community consideration

All those respondents with poor nutritional status will be given appropriate advice. Moreover, on completion of the study, the result finding will be disseminated to the relevant community stakeholders for appropriate actions.

Care and protection of the study participants

The research procedure will adequately be explained to the participants. This will assure them that no risk is associated with the study. They will also be informed of their right to withdraw from the study at any time without penalty.

Confidentiality

Whatever information you provide will be treated with utmost confidentiality and will not be used for any other purpose other than the purpose of the study.

If you have any questions you may contact;

Willy Kiboi
P.O BOX 43844
Nairobi, Kenya
Tel: +254 722653111

or

Kenyatta University
P.O BOX 43844
Nairobi, Kenya
Tel: +254 20 8710901

Respondent's statement

The above information regarding my participation in the study is clear to me and I voluntarily agree to participate.

Respondent Signature/ Thumb print-----

Date: -----

Interviewer's statement

I certify that, I the undersigned have explained the purpose and procedure, the potential benefits and possible risks associated with participating in this study to the above individual.

Interviewer Name -----

Signature-----

Date: -----

APPENDIX A: BARUA YA UTANGULIZI NA IDHINI

Mpendwa Mshiriki,

Jina langu ni WILLY KAHANYA KIBOI kutoka Chuo Kikuu cha Kenyatta, idara ya chakula na lishe bora. Mimi nafanya utafiti juu ya malazi tofauti, ulaji madini, na hali ya lishe ya wanawake wajawazito katika kata ya Laikipia. Utafiti huu utasaidia kujulisha serikali kuhusu mikakati ya uwezekano wa kuimarisha lishe ya wajawazito. Nitakuelezea kuhusu utafiti huu na baada ya hapo unaweza kuamua kushiriki katika utafiti au kukataa.

Utaratibu utakao fuatwa

Mimi na wasaidizi wa utafiti wangu tungependa kukuliza baadhi ya maswali kuhusu wewe mwenyewe na kaya yako. Aidha, tutachukua kipimo cha (MUAC) itakayochukuliwa katika mzingo wa katikati juu ya mkononi chini ya kazi. Ingawa maoni yako ni muhimu sana, una haki ya kukataa kushiriki katika utafiti. Wewe utapata huduma na matibabu sawa kama utakubaliana kujiunga na utafiti au la. Dodoso itachukua takribani saa moja, na ushirikiano wako utapewa shukra sana.

Faida zinazoweza kupatikana

Faida kutokana na utafiti huu huwenda si wa moja kwa moja, lakini matokeo inaweza kuwa na manufaa muhimu kwa wadau katika kuanzisha hatua zinazolenga kuboresha uzazi na afya ya mtoto. Wewe pia utafaidika na kuelewa hali yako ya sasa ya malazi na lishe na kama kutapatikana kuwa na tatizo, ushauri juu ya hatua sahihi utatolewa.

Hatari / usumbufu unaowezekana

hakuna hatari linaonekana kuhusishwa na utafiti huu; Hata hivyo baadhi ya maswali ya kuulizwa yanaweza kukupa wasiwasi. Kama hali hii itatokea, unaweza kukataa kujibu maswali hayo na uko na uhuru wa kusimamisha mahojiano wakati wowote.

Fidia

Ushiriki wako kwa utafiti huu ni wa hiari na hivyo hakuna aina yoyote ya malipo.

Masuala ya Jamii

Wale watakaohojiwa na kupatikana na lishe duni watapewa ushauri sahihi. Aidha, utafiti utakapokamilika, matokeo itasambazwa kwa wadau husika katika jamii kwa ajili ya kuchukua hatua zinazofaa

Huduma na ulinzi wa washiriki wa utafiti

Utaratibu wa utafiti utaelezewa vya kutosha kwa washiriki. Hii itawahakikishia kwamba hakuna hatari inayohusishwa na utafiti huu. Pia watajulishwa kuhusu haki yao ya kujiondoa katika utafiti wakati wowote bila adhabu

Usiri

Habari yoyote utakayotoa itabebwa na usiri mkumbwa na haitatumika kwa madhumuni mengine yoyote zaidi ya madhumuni ya utafiti.

Kama una maswali yoyote unaweza kuwasiliana na;

Willy Kiboi
SLP 43844
Nairobi, Kenya
Simu +254 722653111

ama

Chuo Kikuu cha Kenyata
SLP 43844
Nairobi, Kenya
Simu: +254 20 8710901

Taarifa ya Mshiriki

Habari iliyopo hapo juu kuhusu ushiriki wangu katika utafiti ni wazi na mimi kwa hiari yangu nakubali kushiriki.

Saini ama alama ya dole gumba-----

Tarehe -----

Taarifa ya Mhoji

Ninathibitisha kwamba, mimi niliyetia sahihi hapa nilielezea mshiriki madhumuni, utaratibu, faida na uwezekano wa hatari zinazohusiana na kushiriki katika utafiti huu.

Jina La Mhoji -----

Saini -----

Tarehe -----

APPENDIX B: RESEARCHER ADMINISTERED QUESTIONNAIRE

Dietary diversity, nutrient intake and nutritional status of pregnant women in Laikipia County

MODULES

1. MD 1: Demographic and socio-economic characteristics
2. MD 2: Health information
3. MD 3: Dietary diversity and Dietary intake
4. MD 4: Anthropometric measurement

Checked by: -----

Administrative Details

County _____

Location _____

Questionnaire Number |__||__||__||__| Date of Interview |__|__|/|__|__|/|__|__|

MD 1: Demographic and socio-economic status

Interviewer's name _____

Part A: Respondent Details

1.1 Respondent Code _____

1.2 Age of the mother in completed year's (confirm from ANC card) _____

1.3 Parity _____

1.4 Gestation in weeks _____

1.5 Marital status _____

1 = Married 2 = Divorced/Separated 3 = Widow/Widowed 4 = Single

1.6 What is the highest level of education reached? (Respondent) _____

1 = Pre-school 2 = Primary incomplete 3 = Primary complete 4 =
Secondary incomplete 5 = Secondary complete 6= College (certificate) 7
= College (Diploma) 8= University (degree) 9= Adult education 10= none

1.7 What is the Occupation of the respondent?

1= Farming 2=Casual labour 3=Employed (salaried) 4=Business 5=
Housewife 6=Unemployed 7= Others (Specify) _____**Part B: Household composition and characteristics**

1.8 How many people live in your *household? _____

*Household= Members living together and sharing the same pot.

1.9 Who is the household head? 1=respondent 2=Husband 3=Child 4=Others (specify)

1.9.1 Sex of household head (skip if the respondent is the household head)

1=Male 2=Female

1.10 Occupation of household head (skip if the respondent is the household head)

1= Farming 2=Casual labour 3=Employed (salaried) 4=Business 5=Housewife 6=Unemployed 7= Others (Specify) _____

1.11 What is the relationship between the household head and the respondent (skip if the respondent is the household head)

1. Husband 2. Child 3. Relatives 4. house help

1.12 What is the age of the household head? (skip if the respondent is the household head)

1.13 How many children do you have.....

1.14 How many children are below 5 years of age.....

Part C: Household Wealth ranking

1.15 Please indicate the sources of income earned by the household _____

1= Agricultural farm produce 2= Business 3= Formal employment 4= Casual labour 5= Donations (Specify source) _____ 6= any other specify _____

1.16 Please indicate the level of income earned by the household in last one month.

- | | |
|-----------------|-------------------|
| 1. ≤ 2000 | 7. 20001- 30000 |
| 2. 2001- 4000 | 8. 30001- 40000 |
| 3. 4001- 6000 | 9. 40001- 50000 |
| 4. 6001- 8000 | 10. 50001- 100000 |
| 5. 8001- 10000 | 11. >100001 |
| 6. 10001- 20000 | |

1.17 Who determines how family income will be used?

1=Respondent 2=Husband/Partner 3=Relative 4=Friend 5=Other

(Specify) -----

Land status

1.18 Does the household have land? _____ 1. Yes 2. No

1.19 If yes indicate the size of the land _____ acres

1.20 If yes, indicate the ownership status _____

1= Self owned 2. Hired=3. Public=land 4. Any other (specify)

1.21 Where do you mainly get the food that you feed your family on? (One response only) _____

- 1= Home grown
- 2= Purchase
- 3= Farm Livestock
- 4= Donation
- 5= Other sources (specify)

1.212 Have you in the last 1 yr been a beneficiary of any food program? 1=Yes 2= No

If yes, list the food program(s)

- i. -----
- ii. -----
- iii -----

1.22 Are there any groups, association or clubs within your location? 1=yes 2=no

1.23 If yes, list them; tick if any are specifically for women and if the respondent belongs to any (tick)

| | Name | Any for women | Any for respondent |
|----------|-------------|----------------------|---------------------------|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |

Household Livestock, Assets and Communication

1.24 Does the household own any livestock? 1. Yes 2. No

1.25 If yes, what is the number of livestock owned in the household?

0= None 1=<5 2=5-10 3=>10-20 4=>20

| Livestock | Code | Livestock | Code |
|-----------|------|-----------------|------|
| Cattle | | Pigs | |
| Goats | | Ducks | |
| Sheep | | Rabbits | |
| Donkey | | Other (specify) | |
| chicken | | | |

1.26 Does the household own any of the following household items?

| Item | 1=Yes 2=No | Item | 1=Yes 2=No | Item | 1=Yes 2=No |
|--------------|---------------|--------------|---------------|-------------------|---------------|
| Vehicle | | Sofa set | | Television | |
| Motorcycle | | Computer | | Refrigerator | |
| Bicycle | | Landline | | Oven/cooker/mekeo | |
| Wheel barrow | | Mobile phone | | Solar panel | |
| Tractor | | Radio | | Other (specify) | |

1.27

| How many times in a week do you access the following | No of times in a week Code | Item | No of times in a week code |
|--|----------------------------|--------------------------------|----------------------------|
| Mobile phone (call) | | News paper | |
| Mobile phone(text) | | Social worker | |
| Radio | | Barazas(communitiy gatherings) | |
| Television | | Church/Mosque | |
| Internet | | | |

0=None 1=Once 2= twice 3= Thrice 4= more than three times 5=None

1.28 Where do you live?

1=Rented house 2=Own house

1.29 Materials used to make the house

1.30 Please indicate the materials the house is made up of

a) Walls _____

1=Mud 2=Wood 3=Bricks 4=Iron sheets 5=Any other specify ____

b) Roof _____

1=Iron sheets 2=Grass 3=Concrete 4=Tiles 5= Any other specify _____

c) Floor _____

1=Mud 2=Wood 3=Concrete 4=Tiles 5=Any other specify _____

1.31 What is your main source of water? _____

1= Piped into the house 2=Piped to a tap on property outside the house 3= Rain tanks on property 4:=Communal tap 5=Communal well 7= River

1.32 Please indicate your main source of cooking fuel

1=Firewood 2=Charcoal 3=Kerosene 4=Gas 5=Any other (specify)

1.33 Please indicate your main source of lighting

1=Electricity 2= Pressure lamp 3=Kerosene lamp 4= Any other (specify) _____

MD 2: Health Information (Morbidity patterns)

2.1 Have you suffered from any disease for the last two weeks? _____

1 = yes 2 =No

2.2 If yes, state the illness and its duration.

| Type of illness | Duration of illness |
|-----------------------|---------------------|
| 1=Anorexia | |
| 2=Vomiting | |
| 3=Fever | |
| 4=Constipation | |
| 5=Malaria | |
| 6=Diarrhoea | |
| 7=Anaemia | |
| 8=STI | |
| 9=Any other (specify) | |

2.3 Did you seek medical attention?

1= yes 2= no

2.4 If yes where?

1=government hospital 2=private hospital 3= traditional medicine 4=others (specify) -----

2.5 How many times have you attended the antenatal clinic?

0=None 1=once 2=twice 3=thrice 4= more than three times

Micronutrient supplementation

2.6 Are you taking any micronutrient supplements currently? 1=Yes 2=No

2.7 If yes, which ones?

1= Folic acid supplements 2=Multiple micronutrient supplement 3= others (Specify) -----

2.8 If yes, where did you get them from?

1=Health facility 2=Bought from the shops

2.9 If no, why not?

1=don't see their need 2=not available at ANC 3=they make me sick
4=any other (specify) -----

MD3: Dietary Intake/Diversity

3.1 Recording form for 24hr recall of foods and drinks consumed by the respondent

Establish the drink/foods the respondent consumed in the previous day starting from the time she woke up to the time she went to sleep whether at home or outside the home. Establish the meals taken per day, ingredients and the amount in the meals, the volume of the food cooked the volume of the food taken and calculate the amount of ingredients consumed in grams by the respondent?

3.1.1 *Confirm if the day was usual or unusual*

1= usual day

2= unusual

3.2.2 *If unusual, explain why*

1=Celebration 2=Religious activity 3=Little food in household 4=Other (specify)

| | | | | | | | | |
|----------------|--|--|--|--|--|--|--|--|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Snack 2 | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Supper | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Snack 3 | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

3.2 DIETARY DIVERSITY QUESTIONNAIRE

Fill in the food groups based on the 24 hour recall information recorded above. For any food groups not mentioned, ask the respondent if a food item from this group was consumed.

| Question number | Food group | Examples | YES=1 NO=0 |
|------------------|--|--|---------------|
| 1 | CEREALS | corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) + <i>insert local foods e.g. ugali, nshima, porridge or pastes</i> | |
| 2 | WHITE ROOTS AND TUBERS | white potatoes, white yam, white cassava, or other foods made from roots | |
| 3 | VITAMIN A RICH VEGETABLES AND TUBERS | pumpkin, carrot, squash, or sweet potato that are orange inside + <i>other locally available vitamin A rich vegetables (e.g. red sweet nenger)</i> | |
| 4 | DARK GREEN LEAFY VEGETABLES | dark green/leafy vegetables, including wild forms + <i>locally available vitamin A rich leaves such as amaranth, cassava leaves, kale, spinach</i> | |
| 5 | OTHER VEGETABLES | other vegetables (e.g. tomato, onion, eggplant) + <i>other locally available vegetables</i> | |
| 6 | VITAMIN A RICH FRUITS | ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from these + <i>other locally available vitamin A rich fruits</i> | |
| 7 | OTHER FRUITS | other fruits, including wild fruits and 100% fruit juice made from these | |
| 8 | ORGAN MEAT | liver, kidney, heart or other organ meats or blood-based foods | |
| 9 | FLESH MEATS | beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects | |
| 10 | EGGS | eggs from chicken, duck, guinea fowl or any other egg | |
| 11 | FISH AND SEAFOOD | fresh or dried fish or shellfish | |
| 12 | LEGUMES, NUTS AND SEEDS | dried beans, dried peas, lentils, nuts, seeds or foods made from these (e.g. hummus, peanut butter) | |
| 13 | MILK AND MILK PRODUCTS | milk, cheese, yogurt or other milk products | |
| 14 | OILS AND FATS | oil, fats or butter added to food or used for cooking | |
| 15 | SWEETS | sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes | |
| 16 | SPICES, CONDIMENTS, BEVERAGES | spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages | |
| Individual level | Did you eat anything (meal or snack) OUTSIDE the home yesterday? | | |

MD 4: Nutritional status: Anthropometric Measurement

4.1 MUAC of the respondent in centimeters (to the nearest 0.1cm).

| | First reading | Second reading | Average |
|------|----------------------|-----------------------|----------------|
| MUAC | | | |
| | | | |

4.2 Hb of the respondents in g/dl.....

APPENDIX B: DODOSO LINALOSIMAMIWA NA MTAFITI

Malazi tofauti, ulaji madini na hali ya lishe ya wanawake wajawazito katika kata ya Laikipia.

MODULI

1. MD 1: Demografia na hali ya jamii ya kiuchumi
2. MD 2: Habari za afya
3. MD 3: Malazi tofauti na ulaji
4. MD 4: Vipimo

Imeangaliwa na: -----

Maelezo ya Tawala

Kata _____ Eneo _____

Nambari ya dodoso |__||__||__||__| Tarehe ya mahojiano |__|__|/|__|__|/|__|__|

MD 1: Demographia na hali ya kiuchumi ya jamii

Jina la mhoji _____

Sehemu A: Maelezo ya mshiriki

1.1 Nambari ya utambulisho ya mshiriki _____

1.2 Umri wa mama katika miaka iliyokamilika (Thibitisha kutoka kwa kadi ya ANC)

1.2 Idadi ya mimba ya mama _____

1.4 Umri wa Ujauzito (katika kipindi cha wiki) _____

1.5 Hali ya ndoa _____

1 = Oleka 2 = Talikiwa/Tengana 3 = Mjane 4 = Asiyeoleka kamwe

1.6 Je, ni kiwango kipi cha juu cha elimu kufikiwa ? (Mhojiwa) _____

1 = Kabla ya shule ya msingi 2 = Shule ya msingi isiyomaliziwa 3 = Shule ya msingi iliyomaliziwa 4 = Shule ya sekondari isiyomaliziwa 5 = Shule ya sekondari iliyomaliziwa 6= Chuo (cheti) 7 = Chuo (Stashahada) 8= Chuo kikuu (shahada) 9= Elimu ya watu wazima 10= Hakuna elimu yoyote

1.7 Kazi ya mhojiwa?

1= Kilimo 2=Kazi ya kawaida 3=Ajira (mshahara) 4=Biashara 5= Mama wa nyumba 6=Mkosa ajira 7= Nyingine yeyote (Taja) _____

Sehemu B: Utungaji na sifa za kaya

1.8 Watu wangapi wanaishi katika * kaya yako? _____

*Kaya = Wanaoishi pamoja na kushirikiana sufuria moja ya chakula

1.9 Jinsia ya mkuu wa kaya (ruka kama mhojiwa ni mkuu wa kaya)

1 = Kiume 2 = Kike

1.10 Kazi ya mkuu wa kaya (ruka kama mhojiwa ni mkuu wa kaya)

1= Kilimo 2=Kazi ya kawaida 3=Ajira (mshahara) 4=Biashara 5= Mama wa nyumba 6=mkosa ajira 7= Nyingine yeyote (Taja) _____

1.11 uhusiano kati ya kaya kichwa na mhojiwa (ruka kama mhojiwa ni mkuu wa kaya)

1. Mume 2. Mtoto 3. Jamaa 4. msaadisi wa nyumba

1.12 Umri wa mkuu wa kaya? (ruka kama mhojiwa ni mkuu wa kaya)

1.13 una watoto wangapi?

1.14 Una watoto wangapi walio chini ya miaka tano?.....

Sehemu C: Mali ya kaya

1.15 Tafadhali onyesha vyanzo vya mapato ya kaya _____

1= Uzalishaji wa shamba 2= Biashara 3= Ajira rasmi 4= Kazi ya kawaida
5=Michango (Taja Chanzo) _____ 6= Nyingine yoyote (Taja)

1.16 Tafadhali onyesha kiwango cha mapato ya kaya katika mwisho wa mwezi mmoja uliopita.

- | | |
|------------------|-------------------|
| 7. <2000 | 7. 20001- 30000 |
| 8. 2001- 4000 | 8. 30001- 40000 |
| 9. 4001- 6000 | 9. 40001- 50000 |
| 10. 6001- 8000 | 10. 50001- 100000 |
| 11. 8001- 10000 | 11. >100001 |
| 12. 10001- 20000 | |

1.17 Nani huamua jinsi mapato ya familia zitatumika?

1=Mhojiwa 2=Mume 3=Jamaa 4=Rafiki 5=Nyingine (Taja) -----

Hali ya shamba

1.18 Je, kaya inamiliki shamba? _____ 1. Ndiyo 2. La

1.19 Kama ndiyo onyesha ukubwa _____(katika ekari)

1.20 Kama ndiyo, onyesha hali ya umiliki _____

1= inayomilikiwa kibinafsi 2. Iliyokodiwa =3. Inayomilikiwa na umma 4.
Nyingine yeyote (Taja) _____

1.21 Wapi hasa unapopata chakula cha kulisha familia yako? (Jibu moja pekee)

- _____
1= Kukuza nyumbani
2= Ununuzi
3= Mifugo wa shamba
4= Mchango
5= Nyingine yeyote (Taja)

1.212 Je, kwa wakati wa mwaka moja uliopita umelengwa na mpango wowote wa chakula? 1=Ndiyo 2= Hapana

Kama ndiyo, orodhesha

- i. -----
- ii. -----
- iii -----

1.22 Je, kuna makundi, chama au klabu ndani ya eneo lako?? 1=Ndiyo 2=Hakuna

1.23 Kama ndiyo, orodha yao; onyesha kama yoyote mahsusi ni kwa ajili ya wanawake na kama mhojiwa ako kwa yoyote?

| | Name | Any for women | Any for respondent |
|----------|-------------|----------------------|---------------------------|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |

Mifugo, mali na mawasiliano ya kaya

1.24 Je, kaya inamiliki mifugo yoyoye ? 1. Ndiyo 2. Hakuna

1.25 Kama ndiyo, ni nini idadi ya mifugo inayomilikiwa katika kaya?

1=<5 2=5-10 3=>10-20 4=>20

| Livestock | Code | Livestock | Code |
|------------------|-------------|--------------------|-------------|
| Ngombe | | Nguruwe | |
| Mbuzi | | Mbata | |
| Kondoo | | Sungura | |
| Punda | | Nyingine (Taja) | |
| Kuku | | | |

1.26 Kaya inamiliki vitu vifuatazo?

| Bidhaa | 1=Ndiyo 2=Hapana | Bidhaa | 1=Ndiyo 2=Hapana | Bidhaa | 1=Ndiyo 2=Hapana |
|---------------|-----------------------------|----------------|-----------------------------|---------------------|-----------------------------|
| Gari | | Kiti cha sofa | | Televisheni | |
| Motorcycle | | Kompyuta | | Jokovu | |
| Baiskeli | | Simu ya mezani | | Tanuri/Jiko/gesi | |
| Toroli | | Simu ya rukono | | Jopo nishati ya jua | |
| Trekta | | Radio | | Nyingine(Taja) | |

1.27

| Ni mara ngapi kwa wiki wewe hutumia | Mara katika wiki (code) | bidhaa | Mara katika wiki |
|--|--------------------------------|-------------------------------|-------------------------|
| Simu ya mkononi (wito) | | Gazeti | |
| Mobile phone(Ujumbe wa mandishi) | | Mfanyi kazi wa kijamii | |
| Radio | | Mabaraza(mkusanyiko wa jamii) | |
| Televisheni | | Kanisa/Msikiti | |
| Mtandao | | | |

1=Mara moja 2= Mara mbili 3= Mara tatu 4= Zaidi ya mara tatu 5=Hakuna

1.28 Je unaishi wapi?

1=Nyumba ya kukodiwa 2=Nyumba ya kibinafsi

1.29 Vifaa vilivyotumika kujenga nyumba

1.30 Tafadhali onyesha vifaa vilivyotumika kujenga nyumba

a) Ukuta _____

1=Matope 2=Mbao 3=Matofali 4=Mabati 6=Nyingine yoyote (taja) ____

b) Paa _____

1=Mabati 2=Nyasi 3=Saruji 4=Tiles 5= Nyingine yoyote (taja)_____

c) Sakafu _____

1=Matope 2=Mbao 3=Saruji 4=Tiles 5=Nyingine yoyote (taja) _____

1.31 Nini nyenzo yako kuu ya maji? _____

1= Mboba ndani ya nyumba 2=mboba nje ya nyumba 3= Mizinga ya mvua
4:=mboba ya jumuiya 5=Kisima cha jumuiya 7= Mto

1.32 Tafadhali onyesha nyenzo kuu ya nishati ya upishi

1=Kuni 2=Makaa 3=Mafuta ya taa 4=Gesi 5=Nyingine yoyote (Taja)

1.33 Tafadhali onyesha nyenzo yako kuu ya mwangaza?

1=Umeme 2= Taa la shinikizo 3=Taa ya mafuta 4=Nyingine yoyote (Taja)

MD 2: Habari za afya (Chati cha maradhi)

2.1 Je, umepata ugojwa wowote kwa wiki mbili zilizopita? _____

1 = Ndiyo 2 =Hapana

2.2 Kama ndiyo, taja ugojwa na muda uliochukua.

| Aina ya ugojwa | Muda wa ugojwa |
|--------------------------|----------------|
| 1=Kukosa hamu | |
| 2=Kutapika | |
| 3=Homa | |
| 4=Kuvimbiwa | |
| 5=Malaria | |
| 6=Kuhara | |
| 7=Anemia | |
| 8=Magojwa ya zinaa | |
| 9=Nyingine yoyote (taja) | |

2.3 Je, ulitafuta matibabu? 1= Ndiyo 2= La

2.4 Kama ndiyo, wapi?

1=hospitali ya serikali 2=hospitali binafsi 3= dawa za jadi 4=Nyingine yoyote (Taja) -----

2.5 Ni mara ngapi umehudhuria kliniki ya wajawazito?

1=mara moja 2=mara mbili 3=mara tatu 4= zaidi ya mara tatu

Matone ya kuongeza lishe

2.6 Je, wewe unachukua virutubisho lishe yoyote kwa sasa? 1=Ndiyo 2=La

2.7 Kama ndiyo, gani,?

1= Virutubisho vya folic 2=Virutubisho nyingi za matone 3= Nyingine yoyote (Taja) -----

2.8 Kama ndiyo, ulizipata kutoka wapi?

1=Kituo cha afya 2=Kununuliwa kutoka kwa maduka

2.9 Kama hakuna, Kwa nini?

1=Sioni haja yazo 2=Haipatikani katika ANC 3=zinanifanya mgojwa
4=Nyingine yoyote (Taja) -----

MD3: Malazi tofauti na ulaji

3.1 Fomu ya kurekodi vyakula na vinywanji vilivyotumiwa masaa 24 iliyopita na mhojiwa.

Uliza vyakula na vinywanji mhojiwa alizotumia siku iliyopita kuanzia alipoamka asubuhi hadi alipolala usiku kwa nyumba yake au nje ya nyumba yake. Uliza chakula iliyotumiwa kwa siku, viungo na kiasi katika milo, kiasi cha chakula kupikwa, kiasi cha chakula kilicholiwa na uhesabu kiasi cha viungo zilizotumiwa katika gramu na mhojiwa?

3.1.1 *Thibitisha kama siku ilikuwa ya kawaida au siyo ya kawaida*

1= siku ya kawaida

2= siku isiyo ya kawaida

3.1.2 *Kama si ya kawaida, elezea kwa nini?*

1=Sherehe 2=Shughuli ya kidini 3=Chakula kidogo katika kaya 4=Nyingine (Taja)

| | | | | | | | | |
|--------------------|--|--|--|--|--|--|--|--|
| mchana | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Kitafunio 2 | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Karamu | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Kitafunio 3 | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

3.2 DODOSO LA MALAZI TOFAUTI

Jaza makundi ya chakula kulingana na taarifa ya malazi kumbuka iliyoandikwa hapo juu. Kwa makundi yoyote ya chakula yenye haikutajwa, uliza mhojiwa kama kuna bidhaa ya chakula kutoka kundi hilo alikula.

| Nambari ya swali | Kundi la chakula | Mifano | Ndiyo=1 La=0 |
|------------------|--|--|-----------------|
| 1 | NAFAKA | mkate, tambi (supagetti), biskuti, mandazi, samosa au vyakula vingine vyovyote vilivyotengenezwa kutoka kwa mtama, wimbi, mahindi, mchele au ngano, kwa mfano: ugali, uji n.k. | |
| 2 | VIAZI VYEUPE NA VYAKULA VYA MIZIZI | viazi vya mboga, viazi vitamu vyeupe, nduma, mhogo au vyakula vilivyo tengenezwa kutokana na mizizi | |
| 3 | MBOGA NA VIAZI VILIVYO NAWINGI WA VITAMINI A | matango, karoti, viazi tamu vya manjano + vyakula vingine vipatikanvyo vyenye wingi wa vitamini A | |
| 4 | MBOGA ZA MAJANI ZENYE WINGI WA RANGI YA KIJANI KIBICHI | Sukuma wiki, mchicha, mnavu, mkunde, kigwada, bwere, mchunga, mchicha, mzungi, majani ya matango + mboga zingine zozote za majani yenye wingi wa rangi ya kijani kibichi | |
| 5 | MBOGA ZINGINE | nyanya, kitunguu maji, hoho, biringanya, kabichi, tunguja, pilipili, mamumunye, n.k. | |
| 6 | MATUNDA YENYE WINGI WA VITAMINI A | maembe yaliyoiva, paipai n.k. | |
| 7 | MATUNDA MENGINE | machungwa, ndimu, ndizi, mapera, nanasi, matikiti, passion, kunazi, pepeta, vitoria, mkwaju, chenza, madafu, matunda ya damu (tree tomato), zabibu, avocado (parachichi) n.k. | |
| 8 | NYAMA YA VIUNGO | ini, figo, moyo au nyama ya chombo nyingine au vyakula damu | |

| | | | | |
|--------------------|--|------------|--|--|
| 9 | NYAMA | | nyama ya ng'ombe, nguruwe, kondoo, mbuzi, sungura, nyama ya mwituni, nyama ya kuku au bata au ndege wengine, nyama ya wadudu kama kumbikumbi, panzi, nyama ya mamba n.k. | |
| 10 | MAYAI | | Mayai ya kuku, bata, ndege n.k. | |
| 11 | SAMAKI DAGAA | NA | samaki asiyekaushwa au aliyekaushwa, omena, papa, simu, kamba, ngege, mbuta, kweza, kaa n.k. | |
| 12 | BOROHOA, NJUGU KOROSHO MBEGU | AU NA | maharagwe, ufuta, mbaazi, kunde, ndengu, pojo, soya, njugu mawe, minji, njahi, au vyakula vingine vitokanavyo na hivi vilivyotajwa | |
| 13 | MAZIWA VYAKULA VYOTE VINAVYOTOKA KWA MAZIWA | NA | maziwa, maziwa lala, cheese, yogurt n.k. | |
| 14 | MAFUTA | | mafuta ya kupikia, mafuta ya samaki, mafuta ya nguruwe, siagi, mafuta ya nasi n.k. | |
| 15 | VYAKULA SUKARI | VYA | sukari, asali, soda yenye sukari, sukari nguru, kaimati, miwa, chokoleti, peremende, icecream, barafu (ice) | |
| 16 | VIUNGO, AU KAHAWA VILEO | CHAI NA | viungo kama vile tangawizi, mdalasini, binzari, dhania, kitunguu saumu, karafuu, iliki n.k.; kahawa, chai; vileo kama chang'aa, mnazi, matingasi/busaa, mukoma n.k. | |
| Ngazi ya kibinafsi | Je, ulikula kitu chochote (mlo au vitafunio) nje ya nyumba jana? | | | |

MD 4: Hali ya lishe: Vipimo

4.1 MUAC ya mhojiwa katika sentimita (kwa karibu zaidi ya 0.1sentimita).

| | Kwanza kusoma | Pili kusoma | Wastani |
|------|----------------------|--------------------|----------------|
| MUAC | | | |
| | | | |

4.2 Kipimo cha Himoglobini g/dl.....

APPENDIX C: KEY INFORMANT INTERVIEW SCHEDULE

Dietary diversity, nutrient intake and nutritional status of pregnant women in

Laikipia County

Information obtained from the participant(s) will be treated with utmost confidentiality and will only be used for the purpose of this study.

Doctor/Nurse/Nutritionist

Respondent Code _____ Position _____

Date of Interview _____

1. Do you believe that poor diet is a problem among pregnant women in this area?
Yes () No ()
2. What nutritional services are available to the pregnant women in this area?
3. a) What are the most common types of complications among pregnant women in this area?
b) Do these complications among pregnant women affect their dietary intake?
4. What do you think are the best solution to solve malnutrition among pregnant women?
5. a) Would it be possible for policy makers in this area to help address the problem of pregnancy malnutrition in this area?
b) If yes, how do you think they could help?

Thank you for taking the time to participate in this interview

APPENDIX D: FOCUS GROUP DISCUSSION GUIDE**Dietary diversity, nutrient intake and nutritional status of pregnant women in****Laikipia County**

Date of discussion _____

1. What foods are mostly consumed in this area?
2. Does what you eat change when you are pregnant? Yes/No
 - If yes, how?
3. What are some of the nutrition messages you get during pregnancy?
 - State the sources of the information
4. Do you believe that what you eat have an influence on the health of the infant? Yes/No
 - If yes how?
5. What foods should be avoided during pregnancy? Give reasons
6. Are there specific foods that must be taken during pregnancy? If yes, state them
7. What determines your choice of food during pregnancy?
8. Do we have food seasonality in this area? If yes describe the seasons and state if they affect your food consumption patterns?
9. Suggest ways that can be adopted to promote dietary diversity among pregnant women in this area?

Thank you for taking the time to participate in this discussion.

APPENDIX D: MWONGOZO WA MAJANDILIANO (FGD)

Malazi tofauti, ulaji madini na hali ya lishe ya wanawake wajawazito katika kata ya

Laikipia.

Tarehe ya majandiliano _____

1. Ni aina gani ya vyakula zinazotumiwa zaidi katika eneo hili?
2. Je, kunamabadiliko ya unacho kula unapokuwa majamzito? Ndiyo/La
 - Kama ndiyo, ni jinsi gani?
3. Je, ni baadhi ya unjumbe mgani wa lishe wewe hupata wakati waujauzito
 - Taja chenzo cha habari hizo?
4. Unaamini kwamba unachokula kina ushawishi zidi ya afya ya mtoto mchanga? Ndiyo/La
 - Kama ndiyo, jinsi gani?
5. Ni aina gani ya vyakula vinafaa kuepukwa wakati wa ujauzito? Toa sababu
6. Je, kuna vyakula maalum ambazo lazima zichukuliwe wakati wa ujauzito? Kama ndiyo, taja ni gani
7. Nini huamua uchaguzi wako wa chakula wakati wa ujauzito?
8. Je, kuna majira ya chakula katika eneo hili? Kama ndiyo elezea majira hayo na taja kama yanaathiri uchaguzi wako wa chakula?
9. Pendekeza njia zinazoweza kuchukuliwa kukuza ulaji wa malazi tofauti kati ya wanawake wajawazito katika eneo hili?

Asante kwa kuchukua muda wa kushiriki katika mjadala huu.

APPENDIX E: MAP OF LAIKIPIA COUNTY, KENYA



Source: Map data (2015) by Google

APPENDIX F: RESEARCH PERMIT AND AUTHORIZATION



KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA

Website: www.ku.ac.ke

Tel. 810901 Ext. 57530

Internal Memo

FROM: Dean, Graduate School

DATE: 19th June, 2015

TO: Mr. Kiboi Willy Kahanya
C/o Foods, Nutrition & Dietetics Dept.
Kenyatta University

REF: H60/27145/13

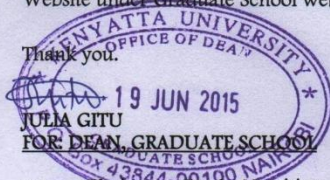
SUBJECT: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that Graduate School Board at its meeting of 17th June, 2015 approved your Research Proposal for the M.Sc. Degree, entitled "Dietary Diversity, Nutrient Intake and Nutritional Status among Pregnant Women in Laikipia County, Kenya".

You may now proceed with your Data collection, subject to clearance with the Permanent Secretary, Ministry of Higher Education, Science and Technology.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed supervision Tracking Forms per semester. The form has been developed to replace the progress Report Forms. The Supervision Tracking Forms are available at the University's Website under Graduate School webpage downloads.

Thank you.



c.c. Chairman, Foods, Nutrition & Dietetics Dept.
Supervisors:

1. Prof. Judith Kimywe
C/o Foods, Nutrition & Dietetics Dept.
KENYATTA UNIVERSITY
2. Dr. Peter M. Chege
C/o Foods, Nutrition & Dietetics Dept.
KENYATTA UNIVERSITY

JG/nm

Committed to Creativity, Excellence & Self-Reliance



KENYATTA UNIVERSITY
ETHICS REVIEW COMMITTEE

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Our Ref: KU/R/COMM/51/505

Date: 21st July, 2015

Kiboi Willy Kahanya
Kenyatta University,
P.O Box 43844,
Nairobi

Dear Kahanya,

RE APPLICATION NUMBER PKU/376/1348- "DIETARY DIVERSITY, NUTRIENT INTAKE AND NUTRITIONAL STATUS AMONG PREGNANT WOMEN IN LAIKIPIA COUNTY, KENYA"

1. IDENTIFICATION OF PROTOCOL

The application before the committee is with a research topic "Dietary diversity, nutrient intake and nutritional status among pregnant women in Laikipia County, Kenya" received on 24th June, 2015.

2. APPLICANT

Kiboi Willy Kahanya, Department of Food Nutrition & Dietetics

3. STUDY SITE

Laikipia East Sub-County, Nanyuki General Hospital, Kenya.

4. DECISION

The committee has considered the research protocol in accordance with the Kenyatta University Research Policy (section 7.2.1.3) and the Kenyatta University Ethics Review Committee Guidelines AND APPROVED that the research may proceed for a period of ONE year from 21st July, 2015.

5. ADVICE/CONDITIONS

- i. Progress reports are submitted to the KU-ERC every six months and a full report is submitted at the end of the study.
- ii. Serious and unexpected adverse events related to the conduct of the study are reported to this board immediately they occur.
- iii. Notify the Kenyatta University Ethics Committee of any amendments to the protocol.
- iv. Submit an electronic copy of the protocol to KUERC.

If you accept the decision reached and advice and conditions given please sign in the space provided below and return to KU-ERC a copy of the letter.

PROF. NICHOLAS K. GIKONYO
CHAIRMAN ETHICS REVIEW COMMITTEE



I Willy K. Kiboi accept the advice given and will fulfill the conditions therein.

Signature Willy K. Kiboi Dated this day of 14/08 2015.
cc. Vice-Chancellor



**NATIONAL COMMISSION FOR SCIENCE,
TECHNOLOGY AND INNOVATION**

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Fax: +254-20-318245, 318249
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9th Floor, Utalii House
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P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No.

Date:

25th September, 2015

NACOSTI/P/15/9607/7659


Willy Kahanya Kiboi
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "*Dietary diversity, nutrient intake and nutritional status among pregnant women in Laikipia County, Kenya,*" I am pleased to inform you that you have been authorized to undertake research in **Laikipia County** for a period ending **23rd September, 2016.**

You are advised to report to **the County Commissioner and the County Director of Education, Laikipia County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.


DR. S. K. LANGAT, OGW
FOR: DIRECTOR GENERAL/CEO

Copy to:

The County Commissioner
Laikipia County.

The County Director of Education
Laikipia County.