

**EFFICACY OF PSYCHO-EDUCATIONAL NUTRITION INITIATIVE ON
ENERGY AND MICRONUTRIENT INTAKE, PHYSICAL ACTIVITY AND
PREGNANCY OUTCOMES IN MIGORI COUNTY, KENYA**

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H87/25989/2013

**A RESEARCH THESIS SUBMITTED IN FULFILMENT OF THE
REQUIREMENT FOR THE AWARD OF THE DEGREE OF DOCTOR OF
PHILOSOPHY IN FOOD, NUTRITION AND DIETETICS, KENYATTA
UNIVERSITY, SCHOOL OF PUBLIC HEALTH AND APPLIED HUMAN
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MARCH 2019

DECLARATION

This research thesis is my original work and has not been presented for a Degree in any other University.

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DEDICATION

To Myrtle Amana, Rei Salma and Reaiah Azel; the onus of showing you the way.

To the Oyeho Family; your great love has inspired me this far. God bless you.

ACKNOWLEDGEMENT

The development and production of this work has taken the inputs of many great men and women through their commitment and diligence to the course of this work .I am greatly indebted to the following:

I am forever grateful to my supervisors Prof. Judith Kimiywe and Prof. Judith Waudu, you have journeyed with me through the length of this work by your inspiration, wisdom, scholarly advice, encouragement, bright insights, patience and tireless effort to ensure the perfection and completion of this work. Your mentorship has not been in vain. God richly bless you. Iam grateful to the entire department of Food, Nutrition and Dietetics for the support they gave me through the entire study period. I will forever be indebted to Hellen. God graciously reward you.

Sub- County Hospitals Rongo, Migori and Uriri for providing centres for this study and all the staff for their support and the nurses who participated in the psycho-educational initiative. All the Research Assistants Catherine, Joy, Rose, Myrtle, and the mother mentors and lab technician Michael for your resilience and determination during data collection.

The study participants; their time and energy to provide information and their acceptance to take instruction, read and utilize the educational materials and bear the burden of being followed up through pregnancy and delivery is an immense contribution to the success of this work.

My wonderful husband Oddy and children Amana, Rei and Reaiah whose patience, understanding, encouragement and support have been immense.

Kenneth Oomo my gifted and diligent transcriber, editor and advisor who laboured to type set this work.

And finally, the Object, Subject and Purpose of my life, the only one we should worship, the Omnipotent Father and the Lord Jesus Christ for your grace and faithfulness during the course of this work. Glory and honour be unto your name.

This study was done with financial support of National Research Fund and Rongo University. This effort has been appreciated.

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OPERATIONAL DEFINITION OF TERMS

Birth Weight	The first weight of a newborn obtained after birth
Effect	Short medium range less than 5 years change in behaviour promoted by programme
Food Diversity	A diet containing a wide range of different types of foodstuffs, used as a measure of household food access.
Health Condition	means the health status of a patient described in terms of "critical", "poor", "fair", "good", "excellent", or terms denoting similar conditions.
HEPA active	Vigorous-intensity activity on at least 3 days and accumulating at least 1500 MET-minutes/week or 7 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 3000 MET-minutes/week.
Hidden Hunger	Occurs when a population may be consuming enough calories but not receiving enough micronutrients (vitamins and minerals), negatively impacting the health, cognitive development and economic development of over 2 billion people worldwide.
Intrauterine Growth Retardation	Birth weight below a given low percentile limit for gestational age (e.g. birth weight less than 10 th percentile for gestational age); typically reflects inadequate supply of nutrients and oxygen to the foetus.

Low Birth Weight	Weight at birth less than 2,500 grams upto and including 2499 g irrespective of gestation age.
Miscarriage	Loss of a pregnancy that occurs before 20 weeks of pregnancy.
Nutrients	Nourishing substances supplied through food such as vitamins, proteins, carbohydrates and minerals.
Outcome	Changes observed at the population level among members of the target population as a result of the programme intervention.
Output	Results achieved at the programme level or simply programme products.
Physical Activity	Energy expended in Activity beyond basal processes for survival and for the attainment of physical, intellectual and social well being
Pregnancy Outcomes	Includes gestational weight gain, birth weight, and gestational age as used in this study.
Preterm	Born before 37 weeks of pregnancy.
Reproductive Health	The ability of healthy women to bear healthy children thus enabling their children to develop into healthy adults
Window of Opportunity	Period from before conception through to the first 2 years after birth.
Women of Reproductive age	Women of age 15 to 49 years

LIST OF ABBREVIATIONS/ACRONYMS

ACCN/SCN	Administrative Committee on Coordination (of the United Nations) Sub-Committee on Nutrition
ANC	Ante-Natal Care
BMI	Body Mass Index measured as weight (in Kg) divided by height (in m) squared.
CBC	Communications for Behavioural Change
CHW	Community Health Worker
CF	Conceptual Framework
DPT	Diphtheria-polio-tetanus immunization
EU	European Union
FAO	Food and Agricultural Organization of the United Nations
Fe	Iron
FNB	Food and Nutrition Board
FSNP	Food and Nutrition Security Policy
FSNS	Food and Nutrition Security Strategy
GA	Gestation age
GNP	Gross National Product
Hb	Haemoglobin
HH	Household
ICRW	International Centre for Research on Women
IDA	Iron Deficiency Anaemia
IEC	Information Education Communication
IFPRI	International Food Policy Research Institute
INCAP	Institute de Nutricion de Centro America y Panama
IPAQ	International Physical Activity Questionnaire
IQ	Intelligence Quotient
IOM	Institute of Medicine

IU	International Units
IUGR	Intrauterine Growth Retardation
KDHS	Kenya Demographic Health Survey
KES	Kenya Shillings
LBW	Low Birth Weight
MCH	Mother and Child Health
MOH	Ministry of Health
NAS	National Academy of Sciences (USA)
NCI	Nutrition Counselling Initiative
NGOs	Non-Governmental Organizations
PA	Physical Activity
SD	Standard Deviation
SGA	Small for Gestational Age
TB	Tuberculosis
TBA	Traditional Birth Attendant
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organizations
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VAD	Vitamin A Deficiency
WASH	Water, Sanitation and Hygiene
WFP	World Food Programme
WHO	World Health Organization
WRA	Women of Reproductive age

ABSTRACT

A large number of pregnant women in many parts of the world enter pregnancy at sub-optimal weight and height. A third of Kenyan population suffer from food insecurity that is further complicated by factors such as adverse weather conditions and increases in food prices. The result is malnutrition which primarily affects pregnant women and children under five years and significantly contributes to their morbidity and mortality. Maternal nutrition is critical for both mother and child as it lays fundamental foundation for the successful outcome of pregnancy. Kenya's high rate of undernutrition among women of reproductive age are due to sub-optimal feeding practices, heavy workload, inadequate micronutrient intake and insufficient awareness and knowledge on nutritionally adequate diets among pregnant women leading to preterm births, low birth weight, high mortality and morbidity, impaired growth, and increased risks during childbirth for both mother and child. This study sought to investigate socio-demographic characteristics, determine nutrition knowledge and health conditions and effect of nutrition education on nutrition knowledge and dietary practices, assess energy and micronutrient intake, determine physical activity levels, and determine pregnancy outcomes and associations between psycho-educational nutrition initiative and nutrient intake, physical activity and pregnancy outcomes among pregnant women in Migori County. A prospective cohort study design was used and simple random sampling was used to obtain a sample of 150 pregnant women from three sub-county hospitals purposively selected for study. Pregnant women of GA \leq 26 weeks were recruited and enrolled into psycho-educational nutrition intervention study. Data was collected by 24 hour recall, International Physical Activity Questionnaire, biochemical analysis, anthropometric measurements and secondary data. Data was collected at baseline and after intervention for each woman and analyzed by Nutri-Survey computer package, IPAQ scoring protocol and SPSS. Data was summarized by descriptives and relationships between variables was tested by Chi square, regression model and Pearson's product moment correlation. ANOVA and t-tests were used to test for differences between means. Findings showed that the pregnant women were of low economic status. Nutrition education had positive significant associations with nutrition knowledge and practices. Most women had good health with no conditions interfering with their food consumption. Generally, there was improved dietary intake of all nutrients after the intervention although some did not meet the RDA even after intervention. There was a slight reduction in physical activity factors and increased time for rest was observed after intervention although there was no significant reduction in activity levels ($p \leq 0.05$). Weight gain (5.98 kg) was lower than recommended, mean gestation age was normal (37.74 weeks) but lower for preterm births category and mean BW (3039 ± 489.5 g) was normal although 7% of newborns had LBW. The study found significant effects of nutrition knowledge from the psycho-educational initiative on nutrient intake and pregnancy outcomes but found no effect on physical activity. The study concludes that nutrition education can be used to enhance pregnancy outcomes and nutrient intake among pregnant women. The finding is important to central and county governments, civil society, intergovernmental agencies, research groups, business enterprises and community under study.

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Seven hundred and ninety three million people in the world suffer from chronic hunger not getting enough food to live an active life. Most hungry people (98%) live in developing countries, where almost 15% of the population is undernourished. Malnutrition is the leading cause of disease in the world (FAO, 2014). Women make up a little over half of the world's population but they account for over 60% of the world's hungry (Merkel, 2016). In many parts of developing countries women are responsible for performing a large portion of unpaid domestic work much of which is difficult physical labour. In sub-Saharan Africa women contribute 60-80% of agricultural labour (Ransom & Elder, 2013). This makes them engage in high levels of activity throughout pregnancy. This energy expenditure increases the amount of energy needed from their diet.

Maternal nutrition is critical for both mother and child as it lays fundamental foundation for the successful outcome of pregnancy (Republic of Kenya, Ministry of Health, 2013). Several factors determine the choices that low income groups have regarding their food consumption and diets. Most vulnerable of all include pregnant women. Malnutrition in women including pregnant women is not conspicuous and remains to a large extent unaccounted for and unreported, thus insufficient attention has been given to its extent, causes and consequences (Black & Victoria, 2013).

As a result inadequate resources and efforts have been allocated to improving women's nutrition compared with other nutritional and public health actions. Because of women's child bearing roles, their pre and post natal health and nutritional status is

an important determinant of the survival and development of her foetus and newborn child. The biological processes that affect the foetus in the womb are related to the mother's physiology, her nutrition, socioeconomic factors and physical activity. In developing countries low birth weight babies account for 14 % of all births (Schultink, Eggers & Chalderjee, 2018). According to WHO, 15 million babies worldwide are born preterm. One million die yearly due to complications of being born before term. Many survivors face a lifetime disability including learning disabilities and visual and hearing problems (Merkel, 2016). More than 7 million newborn deaths worldwide are associated with maternal health and nutrition related problems resulting from poorly managed pregnancies among others (Stevens, 2013). Much evidence is supporting the foetal-origin hypothesis that in utero, conditions have profound and long lasting effects on the foetus and the subsequent health of the offspring (Kinley, Francis & Woodside, 2017).

Nutrient related deficiency diseases and micronutrient deficiencies which can result to intrauterine growth retardation are manifested worldwide (Rao, 2014). Hidden hunger or micronutrient deficiency affects more than one in three of the world's population in both developed and developing countries. In Kenya, malnutrition primarily affects pregnant and lactating women and children under five years of age, and significantly contributes to their morbidity and mortality (MoPHS & SCUK, 2011). Kenya is among 15 Countries with a high number of preterm births; over 180,000 babies are born premature and 15,000 die each year. Poor maternal nutrition, strenuous activities and anaemia, among others increase the likelihood of a premature birth (Ojina, 2019). Half of Kenyan mothers are deficient in at least one micronutrient and many mothers have multiple micronutrient deficiencies. Although poor nutrition contributes directly and indirectly to the large mortality and morbidity rates, the

extent of its contribution has not been measured because the main reported causes of maternal mortality greatly overshadow the role of nutrition itself (Essendi, Mills & Fotso, 2011).

Nutrition International (2017) states that maternal, infant and child nutrition indicators are still sub-optimal. In addition, the High Impact Nutrition Interventions recommended by Lancet have been adopted by MOH Kenya (Unicef, 2014) yet according to the Nutrition Division (GOK) (2012) the coverage of these interventions remains very low due to inadequate resources and low prioritization of nutrition as reflected by low investment. In Kenya good quality maternal health services are not accessible to many expectant women according to Kisika, (2013). Nationally 59 % of pregnant women visit ANC at least four times, 43% deliver at a health facility, 74% receive ARV treatment (AFIDEP, UNFPA & Norad, 2017), 51 % are still anaemic, 41 % do not receive 2 tetanus toxoid vaccines, only 22 % consume iron and folic acid supplements for ≥ 90 days, 14 % are undernourished (SUN, 2016) and only 53 % receive iron folate supplementation (MOH, 2013).

In Migori County 45 % of births are delivered in a health facility, 50 % of pregnant women receive the 4 recommended ANC care (AFIDEP, UNFPA & Norad, 2017; MOH 2015). Iron supplementation programmes for pregnant women have had little success in decreasing the high rates of iron deficiency anaemia. Several interventions are provided at the ANC as recommended by WHO (KNBS, 2013). Nutrition Education and counselling has not been brought out strongly in this healthcare package for pregnant women (Unicef, 2014) and its impact cannot be quantified. The Status of monitoring and evaluation for Nutrition in Kenya indicates that there is limited impact from nutrition interventions (Republic of Kenya MOH, 2013).

Creating awareness among pregnant mothers is important. Nutrition education and counselling during pregnancy can reduce the risk of anaemia, increase gestational weight gain and improve birth weight (Giward & Olude, 2012). Positive behaviour adjustments by participants in nutrition education and counselling interventions have been reported by several authors. Nutrition education intervention is therefore an essential consideration to optimise maternal nutrition and pregnancy outcomes.

Scaling up maternal and child nutrition is important. The economic implication of this may be high in certain countries, but every dollar spent on this package generates around \$18 in economic benefits. By the standards of economics, these are impressively high benefit:cost ratios (Hoddinot, Alderman, Behrman, Haddad, & Horton, 2013). According to Quinn (2013) the window of opportunity is small (first 1000 days). Interventions must focus on this window of opportunity; any investments after this critical period are much less likely to improve nutrition.

It is important to give women support for optimal nutrition before and after they become pregnant, in order to promote good nutrition. According to Schultink (2013) to improve local and global health and development, there is need to scale up nutrition. Moreover given the close links between maternal and child nutrition, efforts to improve the nutritional status of women are critical to attaining global nutrition targets of the Sustainable Development Goals (Aguayo & Menon, 2016).

1.2 Statement of the Problem

Approximately 200 million women become pregnant each year in developing countries and many of these women suffer from ongoing nutritional deficiencies (Ruel; 2013, Merkel, 2016). According to FAO (2012) and Merkel (2016) a large number of women in many parts of the world enter pregnancy at sub-optimal weight

and/or height. Many others suffer micronutrient deficiencies. The most (48%) affected groups on anaemia prevalence worldwide are pregnant women, 56% in developing countries. In Kenya, just over half (55%) of pregnant women experience iron deficiency anaemia, 52% experience zinc deficiency and 40% experience vitamin A deficiency ranging from severe (10%) to marginal (51%) (Republic of Kenya, 2011; MoPHS and SCUK, 2011).

There is evidence to suggest that other maternal characteristics may also affect pregnancy outcomes. Among these, the effect of strenuous maternal work on pregnancy outcomes constitutes a priority for investigation especially in developing countries where high proportion of women bear heavy physical work either inside or outside the home (Odiwuor, Kimiywe, Rombo & Kenneth, 2013). Low income women from developing countries must often continue a strenuous work pattern until shortly before delivery. Strenuous work may precipitate an early delivery and gestational age is recognized as a major determinant of birth weight (Nutrition Division (GOK), 2012). Increased maternal requirements for physical activity combined with low micronutrient and energy intake may also reduce the supply of nutrients to the foetus.

The definitive negative outcome of poor nutrition, strenuous work as well as inadequate care and practices during pregnancy is reflected in the high prevalence of maternal and infant mortality and poor pregnancy outcomes in developing countries. Globally 20 million babies delivered every year have low birth weight and one in every ten newborns are born preterm (Merkel, 2016). Studies in sub-Saharan Africa have observed high preterm delivery rates up to 20%. In Kenya low birth weight and maternal underweight stand at 11% and 12% respectively, yet this has not been considered high enough to be a significant public health concern (FAO, 2012).

Migori County is one of 5 counties with highest preterm births, with a rate of 13 % (Ojina, 2019) and a low birth weight Prevalence of 4.4%. However this may not be representative, only 57.1% of newborns were weighed at birth in Migori County (KNBS, 2013). According to Ojina (2019) Migori County has high burdens of poor pregnancy outcomes especially high incidences of preterm delivery. Kenya's high rates of under nutrition among WRA are particularly due to sub-optimal feeding practices, heavy physical work and low energy and micronutrient intake (Shrimpton & Sadahha, 2011, Division of Nutrition (GOK), 2012) coupled with insufficient awareness and knowledge on nutritionally adequate diets (Unicef, 2014).

Kenya's Health indicators continue to lag behind the rest of the world including Sub-Saharan Africa despite the favourable policy and legal frameworks intended to promote reproductive, maternal and child health. Kenya missed the 2015 Millenium Development Goal (MDG) targets, therefore much is still to be done to improve maternal and child's health. Migori County is one of 15 Counties that account for over 60 % of maternal deaths in Kenya. The high maternal and infant mortality rates are linked to limited access to maternal and child health interventions according to AFIDEP, UNFPA and Norad (2017). UNICEF (2016) states that interventions aimed at preventing foetal growth retardation are urgently needed in many countries.

Universal Health Coverage (UHC) targets reduction of neonatal deaths; achieving substantial improvements in nutrition is key. Such Interventions are closely linked to those that protect maternal nutrition and health (Oketch & Lelegure, 2015). There is urgent need for interventions to improve pregnancy outcomes in Migori County (AFDEP, UNFPA & Norad, 2017). An investment in preventing foetal under nutrition is a highly effective investment because it not only improves maternal and infant nutritional status but may also slow down or prevent the onset of chronic

disease in later life. According to Black and Victoria, (2013) malnutrition is one of the most persistent barriers to growth and human development. To be able to achieve all the Sustainable Development Goals, nutrition must be up scaled because it is the driver for a healthy and active life (FAO, 2017) that can propel communities to work towards attaining these goals.

According to Kenya Reproductive, Maternal, Newborn, Child and Adolescent Health Framework (GOK, 2016) and AFIDEP, UNFPA & Norad (2017) nutrition education is inconspicuous in the healthcare package and in intervention programmes both nationally and in Migori County for pregnant women. In light of the poor maternal nutrition indicators and poor coverage of evidence based interventions, this study aimed at implementation of a psycho-educational nutrition initiative to fill the missing gap and encourage the adoption of optimal nutrition practices by promoting behavioural changes that would improve maternal nutrient intake and pregnancy outcomes in Migori County.

1.3 Purpose of the Study

The purpose of this study was to determine the effect of psycho-educational nutrition initiative designed to upscale adoption and utilization of nutrition knowledge and nutrition related behaviours for optimal feeding practices to enhance dietary intake and pregnancy outcomes among pregnant women in Migori County.

1.4: Objectives of the Study

The objectives of this study were to:

1. Investigate socio-economic and demographic factors of pregnant women in Migori County.

2. Determine nutrition knowledge and health conditions, and the effect of nutrition education on nutrition knowledge and dietary practices among pregnant women in Migori County.
3. Assess intakes of energy and selected micronutrients before and after psycho-educational nutrition initiative among pregnant women in Migori County.
4. Determine physical activity levels before and after psycho-educational nutrition initiative among pregnant women in Migori County.
5. Determine pregnancy outcomes (gestational weight gain, gestational age and birth weight) in Migori County.
6. Determine the associations between psycho-educational nutrition initiative and nutrient intake, physical activity and pregnancy outcomes in Migori County.

1.5 Research Hypotheses

HO1: There is no significant effect of Psycho-educational nutrition initiative on intake of energy and micronutrients among pregnant women in Migori County.

HO2: There is no significant effect of Psycho-educational nutrition initiative on physical activity among pregnant women in Migori County.

HO3: There is no significant effect of Psycho-educational nutrition initiative on pregnancy outcomes in Migori County.

1.6 Significance of the Study

This study is significant to national and county governments, civil society organizations, intergovernmental agencies, research groups and business enterprises.

The National and County governments of Kenya may benefit from the study in their effort to yield lasting nutritional benefits for women, in the formulation/review of policies to benefit women and children, and at improving child and maternal health. The study may be of benefit to Commission for Vision 2030 in its efforts to bring equal opportunity for all. International Agencies, NGOs and civil society concerned with maternal and child health may use the findings from this study to design new/improve existing programmes to improve maternal and child health.

For political leaders this study may translate into healthy citizens and improved economic development indicators. The study may point out gaps for business, community and researchers that need to be filled through new innovations for profit making. For the community under study, the study may be an initiative towards better health for the pregnant women and children and thus benefit the whole community. The study has contributed to knowledge in the field of maternal health.

1.7 Scope of the Study

Pregnant women attending ante-natal clinics were recruited for the study. Although ante-natal care is provided by private clinics, faith based health facilities and government health facilities, the pregnant women involved were those attending public health facilities.

1.8 Limitations and delimitations of the Study

Many pregnant women do not attend ANC facilities early in their pregnancies. This explains the few participants recruited during their first trimester of pregnancy. The challenge to all interventions is that Health Systems are usually unable to reach women early in their pregnancies. Only 53% of pregnant women in Migori County

deliver in health facilities, (KNBS, 2015) despite the new free maternity programme by the government which has seen improvement in numbers of hospital deliveries. Some participants in this study did not deliver in the health facilities therefore obtaining pregnancy outcomes from the entire sample was not possible because such participants could not be traced.

Another notable limitation was that although the recruitment met the initial objective, there was a substantial attrition and a number of subjects did not complete the intervention. The period of study was marked by episodes of industrial action by health workers. Some women therefore stopped attending the ANC and could not be traced during follow up. This reduced the number of the subjects who were included in the data analysis by less than 10 %. In addition there were high non-response rates requiring much data cleaning during data handling. A major strength of this study is the prospective cohort design which enabled the subjects to be counselled and reminded to use the educational resources issued to them.

1.9 Assumptions of the Study

The study assumed a natural attrition of not more than 10% and also that pregnant women would comply with the requirements of the psycho-educational nutrition initiative by reading and practising information given in the education resources.

1.10 The Conceptual Framework

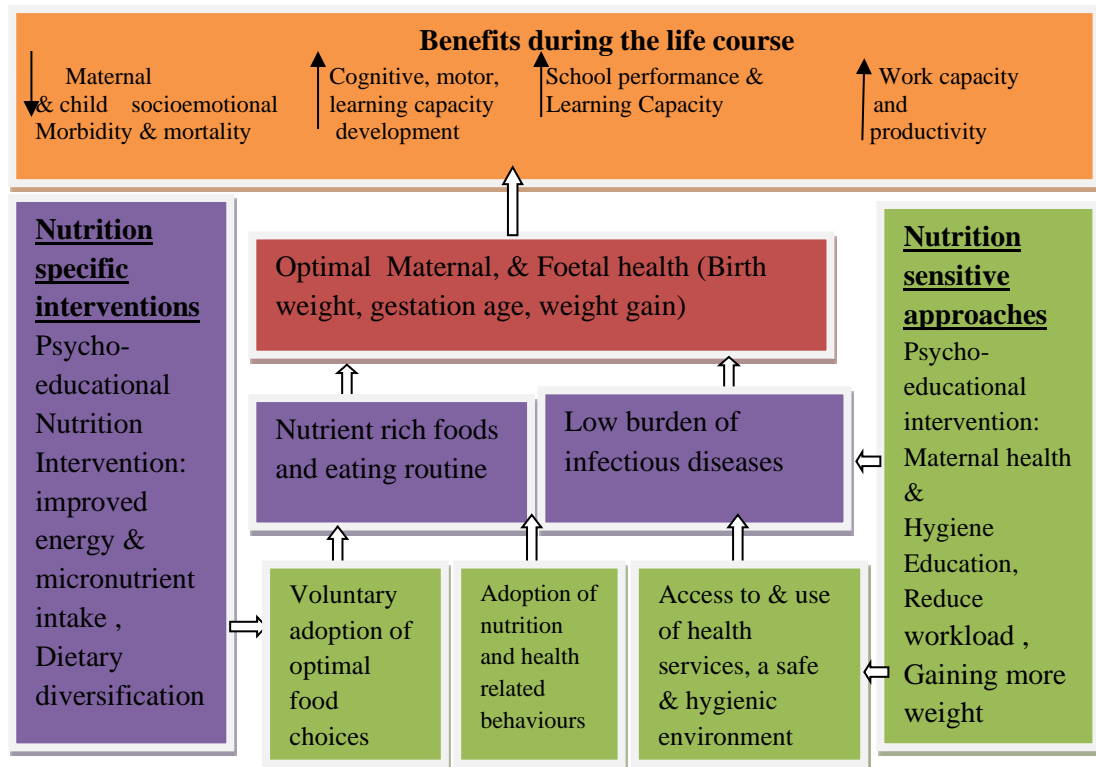


Fig 1.1 Conceptual Framework for actions to achieve optimum maternal and foetal nutrition

Source: Modified from; Quinn V. (2013). *The Road to Good Nutrition: A Global Perspective*

This conceptual framework has two types of nutrition actions namely, nutrition-specific interventions and nutrition-sensitive interventions in efforts to improve maternal and foetal nutrition. Nutrition-specific interventions offered through the psycho-educational nutrition initiative are educating women to increase energy and micronutrient intakes and to diversify their diets. This education addresses immediate determinants of maternal and foetal development. Nutrition-sensitive interventions offered through the psycho-educational nutrition initiative are educating women on hygiene practices, reducing work load and gaining more weight. These address the underlying determinants of maternal and foetal nutrition and development and function as delivery platforms for the nutrition specific interventions by increasing their effectiveness.

This nutrition support can be delivered in the form of nutrition education e.g. use of educational nutrition resources and health worker to mother to encourage the adoption of optimal nutrition practices. Behaviour change communication is an important element and was built into the delivery of such nutrition support so that it reached the right person at the right time in the right way.

Hence this study was an initiative intended to provide nutrition support in the form of psycho-educational nutrition initiative to bring about behaviour change to encourage the adoption of optimal nutrition practices that would improve the nutritional health of the pregnant mother. The initiative was delivered through educational resources by health worker and researcher involving interpersonal communication to participants for behaviour change. However information on a range of non-health determinants which can have a profound effect on nutritional status such as economic, and environmental factors were not addressed by this study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Maternal Dietary Intake

Many women in developing countries maintain pregnancy on dietary intake lower than those recommended by international agencies (Shrimpton & Sadahha, 2011). Studies carried out in Kenya much earlier found that pregnant women consumed an average of 1442 kilo calories per day while those conducted more recently in the region of study found women to consume an average of 1450 kilocalories per day (Odiwuor, et al, 2013). Recent studies show that deficiencies of several micronutrients are common among pregnant women in Africa particularly iron, vitamin A, zinc, folic acid, riboflavin and iodine.

The high prevalence of multiple deficiencies can be accounted for by low dietary intake and poor bio availability of micronutrients and minimal consumption of animal products and fortified foods (Schultink, 2013). A study by Fowler, Evers and Campbell (2012) on inadequate dietary intakes among pregnant women found only a total of 3.5% of women to have consumed the recommended number of servings for all four food groups; 15.3% did not consume the minimum number of servings of foods for any of the four food groups. Women with a first pregnancy were less likely to consume the recommended number of servings from all four foods. The study concluded that very few pregnant women consumed food group servings consistent with RDA and recommended that strategies to improve dietary behaviours must focus on the establishment of healthy eating behaviours among women of reproductive age.

A study by Hartini (2004) on food habits, dietary intake and nutritional status during economic crisis among pregnant women found that before the crisis, more than 80% of pregnant women had inadequate energy and 40% had inadequate protein and

vitamin A intake. All women had inadequate calcium and iron intake. The food intake consisted of rice, nuts, pulses and vegetables, indicating that it was mainly plant-based food. Rural poor women with access to rice fields increased their rice intake and decreased their intake of non-rice staple foods. Intake of nuts, pulses and vegetables increased for most groups. Nuts and pulses were an important supplier of calcium and iron, and vegetables were an important source of vitamin A.

The study concluded that before the crisis, energy and nutrient intake of pregnant women were inadequate. The food pattern of the women was predominately plant based. Rural poor women with access to rice fields had a higher rice intake than other groups throughout the crisis. Urban poor and rural poor, landless women experienced a decreased intake of most nutrients in the transition period but an increased intake during the crisis, reflecting government intervention and support from relatives and neighbours. The latter, however, is not sustainable. Thus, vulnerable groups are at risk of developing nutritional deficiencies without food support programmes.

2.2 Physical Activity Levels in Pregnancy

Women in Africa carry out physically demanding activities requiring high levels of energy. In Buchi, more than 80% of pregnant women continued to do heavy work even in the last trimester and in Cross River almost half of pregnant women continued with heavy workload (Nigeria Information & Planning Systems (NIPS), 2013).

Strenuous work especially when involving long hours of standing and walking seems to increase the risk of preterm delivery. A study by Marilia, Ismail, Askworth & Morris (2013) on influence of agricultural work on birth weight in Brazil found mean birth weight of infants born to women who worked in agriculture during 9 months of pregnancy to be 190 grams lower than that of the non exposed group. They

concluded that working throughout pregnancy significantly reduces birth weight in low income populations.

Another study by Snijder, et al (2012) found no consistent significant associations between physically demanding work nor working hours in relation to small for gestational age, low birth weight, or preterm delivery. Women exposed to long periods of standing had lower growth rates and lower foetal head circumference (HC). Compared with women working less than 25 hours a week, women working 25 to 39 hours a week and more than 40 hours a week had lower growth rates for both foetal weight and HC, resulting in a difference of 148 – 198 grams in birth weight. They concluded that long standing and long working hours per week during pregnancy seemed to negatively influence intrauterine growth.

For a study done in Homabay and Migori Districts, participants observed that in practice, most women continue to work in the fields, carry water, collect firewood, etc. throughout their pregnancies, and many only stop performing these tasks when labour begins (FCI, 2013). Occupational Med (2006) states that from the examination of studies dealing with exposures of women to occupational risks, it appears that at present the evidence is sufficient to warrant the maximum protection of pregnant women to several well documented occupational risks such as heavy physical work and irregular work. In general heavy work duties should be avoided and enough rest periods assured especially in late pregnancy.

2.3 Health Factors of Pregnant Women in Developing Countries

Infections put on additional burden on the dietary needs of women. Many infections decrease appetite, gastrointestinal infections reduce nutrient absorption and the metabolic stress of illness increase energy and nutrient needs. According to reports

from several authors, the major infections affecting maternal nutrition in Africa are hookworm, Malaria and HIV. Pregnant women living in places where malaria is prevalent are four times more likely than other adults to get malaria and twice as likely to die of the disease (FCI, 2013).

Once infected, pregnant women risk anaemia, premature delivery and stillbirth. Their babies are likely to be of low birth weight, which makes them unlikely to survive their first year of life. For this reason, steps are taken to protect pregnant women by distributing insecticide-treated mosquito nets and intermittent preventive treatment. In a Nyanza Indicator Cluster Survey, nearly 70% of mothers who delivered a child during the two year period preceding the survey received medicine to prevent malaria during pregnancy (KNBS, 2013). The prevention and treatment of malaria and other infections, management of anaemia and other nutrient deficiencies during pregnancy can significantly improve foetal outcomes and improve maternal health.

2.4 Implications of Pregnancy on the Woman

In most developing countries, women spend a large proportion of their reproductive years pregnant, lactating or pregnant and lactating. Women in Africa are pregnant or lactating on an average of 30 to 48 percent of the time between the ages 15 and 45 years. If a woman does not consume enough food to meet energy requirements during pregnancy, her body makes up the deficit by depleting energy stores (Black & Victoria, 2013). Frequent births and short interval between births may not provide a woman with sufficient time to replenish lost energy stores before she begins another reproductive cycle. If energy intake is not adequate after delivery her body uses fat stores to support lactation. Short recuperative intervals after pregnancy and lactation

can result in reduced fat stores for women of marginal nutritional status and deplete micronutrient stores (Black & Victoria, 2013).

Short birth intervals may also be associated with high rates of anaemia. Large amounts of iron are lost during pregnancy due to tissue synthesis in the mother, placenta and fetus and at delivery due to maternal blood loss, which totals 600 mg in addition to basal iron loss. Extending birth intervals between births allows a woman more time to replenish her iron stores. Birth intervals of 36 months or more help to ensure child survival and allow mothers time to replenish their nutritional stores (Linkage, 2001). The actual length of birth intervals in many African countries is often much shorter as shown in an analysis of Demographic Health Survey data where over half the birth intervals were less than 36 months and approximately a quarter were under 24 months (Linkage, 2001).

2.5 Consequences of Maternal Malnutrition

Human eating behaviour depends on both biological and cultural factors. Both perceptions and food taboos often influence food intake during pregnancy. According to several authors, a well-nourished woman, gaining 12.5 kg and giving birth to an infant weighing 3.5 kg, is estimated to require 80 000 kcal in addition to her non pregnancy energy balance. Hence, the mother requires extra energy and extra intake of nutrients. For some women, a reduction in physical activity covers part of this extra cost of pregnancy, but for many women this is not the case. Consequently, an increased intake of 300 kcal/day during the second and third trimesters is recommended for pregnant women. Deficiencies in calcium, iron, zinc, folate, thiamine, riboflavin, vitamins A, D, B6 and B12 are very frequent and increase the

predisposal to adverse pregnancy outcomes (Becquecy, Martin & Perel, 2010). The consequences of maternal malnutrition are summarized in Table 2.1.

Table 2.1: Consequences of Maternal Malnutrition

For Maternal Health	For Infant Health
<ul style="list-style-type: none"> • Increased risk of maternal mortality • Increased infections • Anaemia • Compromised immune functions • Lethargy • Lower productivity 	<ul style="list-style-type: none"> • Increased risk of foetal and neonatal death • Intrauterine growth retardation, low birth weight, preterm birth. • Compromised immune functions • Birth defects • Cretinism and reduced IQ

Source: Linkage (2001)

2.6 Pregnancy Outcomes

In well nourished women, optimal weight gain and outcomes of pregnancy can be attained over a wide range of nutrient intakes. Many women sustain a pregnancy with a successful outcome on less than the recommended energy intake. This reflects different adaptive strategies that may be used to meet the additional energy demands of pregnancy e.g. increased nutrient intakes, efficient use of nutrients and reductions in BMR, diet induced thermogenesis, physical activity and growth in new tissues/fat deposition in maternal stores (MoH, Wellington, 2008).

However there is a limit to the physiological capacity of the body to adjust nutrient metabolism and foetal growth development may be compromised. In undernourished women, nutrients are preferably partitioned to the mother effectively protecting nutrient stores from foetal demand, so that foetal growth is compromised to a greater extent than maternal growth (MoH, Wellington, 2008). Malnourished women (short or underweight or anaemic) do not gain sufficient weight during pregnancy, are more likely to have miscarriages or stillbirths or to deliver babies with intrauterine growth retardation (IUGR) or low birth weight which in turn are linked to increased risk of

perinatal and infant mortality (Xiao, et al, 2017). Birth weight is a good indicator of mother's health and nutritional status.

In Developing Countries low birth weight is majorly from mothers with poor health and nutrition. Challenges of measuring low birth exist in Developing Countries because more than half of infants are not weighed. Due to this, data for low birth weight may be a biased sample of all births (KNBS, 2013). In Kenya 25 % of neonatal deaths (within the first 28 days) are due to prematurity (Ojina, 2019). In Migori County preterm births are among the highest in Kenya. Prematurity is a major contributor to neonatal mortality. In a study in Homabay and Migori districts, participants perceived obstetric complications as an increasing problem in their communities. They reported that rates of miscarriages and stillborn births were “increasing,” and that maternal deaths had “almost doubled” judging by the more “frequent deaths and burials” occurring in the community.

Haemorrhage was mentioned more frequently than others and identified as the leading cause of maternal morbidity and mortality. Obstructed labour and ruptured uterus, retained placenta, and abortion (miscarriage) were also mentioned, as were medical problems aggravated by pregnancy, such as anaemia or malaria. Further, participants cited a range of socio-economic and gender issues that contributed to poor overall health, and linked these to maternal complications (FCI, 2013). Adverse outcomes such as low birth weight and prematurity can be reduced through a combination of interventions to improve women's nutritional status and prevent infections during pregnancy (KNBS, 2013).

2.7 Strategies to improve Maternal Nutrition and Health

2.7.1 Adequate Food Intake during Pregnancy

Maintaining energy and nutrient balance has important implications for the nutrition and health status of women throughout their life cycle but especially so during pregnancy and lactation, when nutritional demands are increased (linkage 2001). Nutrition programmes can encourage pregnant women to increase food intake to meet their additional needs. Counselling on appropriate diet and the need to adopt appropriate nutritional behaviours and practices is essential. Some of the actions are illustrated in table 2.2.

2.7.2 Actions to ensure Adequate Food Intake during Pregnancy

Table 2.2: Health Sector and Maternal Actions to ensure adequate Food Intake

Essential Health Sector Actions	Maternal Actions
Encourage increased food intake during pregnancy	Eat at least one extra serving of staple food per day during pregnancy
Monitor weight gain in pregnancy	Gain at least one kilogram per month during the 2 nd and 3 rd trimester of pregnancy
Counsel about reducing Energy Expenditure	Rest more during pregnancy

Source: Linkage (2001)

2.7.3 Educational Messages: Communication for Behaviour and Social Change

Communication for behaviour and social change based on formative research on the barriers to the facilitators of good nutrition can promote behaviour change in communities, raise awareness about nutrition services and stimulate shifts in social norms in order to improve the enabling environment for good nutrition in

communities (Schultink, 2013). The Nutrition Communication Project has addressed maternal nutrition in several country programmes.

In Burkina Faso the project developed a counselling handout and flip chart for health workers. Women who reported exposure to the flip charts and health worker counselling showed higher levels of knowledge on the dietary needs of pregnant women. However, behaviour was unchanged because the message did not address women's underlying fears of obstructed labour (NCP, 1995). The Bangladesh integrated nutrition project included a community based nutrition component to bring about sustainable changes in feeding and eating behaviours of pregnant and lactating women.

An evaluation found that 84% of mothers in the project areas compared with 52% in the control areas were aware of the additional needs for food during pregnancy. More women (56%) in the project areas reported eating additional food during pregnancy than in the control areas (22%). The mean weight of women during pregnancy was higher in the project areas than in the control areas 8.4 kg versus 7.8 kg. Pregnant women were also encouraged to rest, 64% of women in the project areas compared with 35% in the control areas reported resting more during pregnancy (NCP, 1995). A programme among women in Thailand found that a message to measure weight gain in pregnancy was useful in encouraging women to eat more (Roesel, Schaffer, Durongdej & Tokmoh, 1990).

2.7.4 Actions for adequate Micronutrient Intake during Pregnancy

Actions for diet diversification and micronutrient supplementation can be introduced. Iron and other micronutrients can be supplied through multiple micronutrient supplements provided by UNICEF/WHO (2004). To counsel on diet diversification,

women should be counselled on ways to increase consumption of fruits, vegetables, animal products and fortified foods. Increased daily consumption of green leafy and yellow/orange fruits and vegetables will improve the status of many micronutrients such as vitamin A, C, folic acid, zinc and Iron.

Diets in most poor settings are not diversified. An Indonesian study on dietary intake among pregnant women found that energy, vitamin A, calcium or iron intakes were lower than the Indonesian recommended allowances (Hartini, 2004). Overall, more than 40% of the pregnant women had inadequate protein, vitamin A, or calcium intakes and all women had inadequate iron intakes. With regard to socioeconomic groups, there was a tendency towards a higher intake of carbohydrates, vitamin A, calcium and iron among urban women as compared to rural pregnant women; this was significant.

Before crisis, a positive significant correlation ($p < 0.05$) between the intake of rice and pulses plus vegetables was found, that is, the more rice a woman consumed the more pulses she also consumed. A different pattern was found regarding rice and animal foods. In this case, the correlation was negative: the more rice the less animal foods (Hartini, 2004). The food intake of the women was predominately plant-based in all three periods. Concurrently, the women tended to decrease their already low consumption of animal foods.

2.7.5 Supplementation Programmes

Several Research projects and small-scale programmes for pregnant women have shown positive outcomes from supplementation. Iron supplementation during pregnancy improved iron status and reduced anaemia in pregnancy in various studies. Zinc supplementation during pregnancy increased infant length at birth in a study in

Kenya, and improved maternal and neonatal development of infants in Peru. Calcium supplementation during pregnancy (of women with low baseline calcium intakes) reduced risks of high blood pressure and pre-eclampsia in randomized control studies (Evenson, et al, 2014). Vitamin A/beta carotene supplementation lowered maternal mortality by nearly half (Taddese & Ayele, 2013; West et al, 1999) and decreased illness rates in late pregnancy (>28 weeks gestation) in a randomized control study in Nepal (Christian et al, 2000).

2.7.6 Monitor Weight Gain and Counselling on reduced Energy Expenditure

Adequate weight gain is required for optimal pregnancy outcome and it is one of the best predictors of birth weight. There are some groups of women who may require extra support and advice about weight gain and energy intake in pregnancy such as women who are under weight before pregnancy and those with a current or previous history of an eating disorder or restrained eating (MoH, Wellington, 2008). Counselling women to add weight can be a useful tool if appropriate messages and counselling techniques are used as well as improving women's nutritional status to increase birth weight. Reduction in physical work can help meet energy needs (Evenson, et al, 2014). Women should be advised to rest more as soon as pregnancy is detected and the message passed to other members of the family. According to MoH, Wellington (2008), pregnant women should do regular moderate intensity physical activity for a total of 30 minutes on most if not all days of the week. This should be supported with an appropriate energy intake to help achieve the recommended weight gain. Several authors suggest that work adjustments in pregnancy may be effective in reducing the risk of later adverse pregnancy outcomes.

According to Lindbolm (2013) elimination of physically loading work conditions such as long hours in difficult posture, whole body vibration and cumulative index

composed of nine work conditions was found to reduce risk of adverse pregnancy outcomes. Work adjustments may also present a means to reduce sickness presence among pregnant women. He continues to state that higher rates of sickness have been observed in work entailing long working days, night or shift work and physically demanding tasks.

2.7.7 Psycho-Educational Nutrition Interventions in Improving Maternal Outcomes

Psycho-educational interventions encompass a broad range of activities that combine education and other activities such as counselling and supportive interventions. Nutrition education on the other hand is a collection of instructive methodologies accompanied by environmental supports designed to facilitate voluntary adoption of food choices and other food and nutrition related behaviours conducive to health and wellbeing. It may be delivered individually or tailored to groups (Aguayo & Menon, 2016). Women who are short, thin, anaemic or gain inadequate weight during pregnancy are more likely to suffer adverse birth outcomes including low birth weight and preterm delivery (Christian, et al, 2013).

The centrality of maternal and neonatal health among others is critical to achieving Universal Health Coverage (UHC) (Schultink, et al, 2018). One approach towards achieving UHC must be promotive and preventive based interventions. Schultink, et al (2018) recommends improving nutrition of women who become pregnant among other actions to achieve UHC. Nutrition education (NE) programmes have been effective in positive behaviour modification measured in terms of eating patterns and health quality. NE programmes are important as they endeavour to alter participants' intakes by remodelling behavioural factors, food choices, cooking skills, inspiration

and reinforce the change effects (Dunnam & Jeevon, 2015; Bhargava & Hays, 2015).

There is need to expose women to health topics and encourage them to participate in health promotion programmes so as to promote healthy eating habits therefore achieve optimal nutrition. Positive behaviour adjustments by participants in nutrition education and counselling interventions have been reported by several authors. Dean, Lassi, Imam and Bhutta (2014) discussed that preconception nutrition specific interventions increased folic acid and multivitamin supplementation. A preconception counselling resulted into more women being initiated into folic acid supplementation prior to pregnancy (Elsinga, et al, 2008). Rao (2014) demonstrated an improvement in Hb level through a nutrition awareness programme.

An educational intervention programme in Belgium found that nutritional counselling during pregnancy could improve dietary intake in terms of decreased saturated fat intake, increased protein, calcium and vegetable intake (Guelinckx, Derlieger, Millie & Vansat, 2010). A study on the effect of behavioural counselling on patients' consumption of fruits and vegetables in adults from a low income setting found that at post intervention, fruit and vegetable intake increased by 1.5 and 0.9 portions per day in the behavioural and nutrition groups. An increase in the number of participants eating 5 or more portions a day was reported in both groups (42 % and 27 %). Other intervention studies also reported an increase in the intake of fruits and vegetables after a nutrition education program among women of reproductive age (Steptoe, et al, 2003).

A prospective cohort study reported that women who became pregnant during the first 3 months of the study period for those who intended a pregnancy were to some extent

more inclined to follow recommendations as compared to those not planning a pregnancy. Approximately the same numbers of women from both groups were found to take fruits, vegetables and folic acid as recommended (Blossner & De Onis, 2005). A study by Lui, et al (2009) demonstrated the positive influence of change in nutrition and health knowledge as well as enhancement of dietary behaviours in general.

Another study by Lui, et al (2009) found women in the intervention group to exhibit significantly higher improvements in overall dietary behaviours e.g. consumption of fruits, vegetables, soya bean and its products as well as nutrition and health knowledge than the control group. Significantly more women in the intervention group gave up the traditional taboos; health and nutrition education intervention enabled women take away some of the unhealthy traditional postpartum practices and decrease the prevalence of postpartum health problems. They concluded that the intervention has potential for adaptation and development to large scale implementation.

A nutrition education conducted at community level hospitals and area health centres contributed to positive health behaviour modifications (Dunneram & Jeevon, 2015). The nutrition focused maternal nutrition counselling program in Bangladesh significantly increased the proportion of pregnant women who received information on eating five food groups during pregnancy but not the proportion who received information on consuming additional amounts of food during pregnancy. Women in the intervention group consumed 1.6 more food groups, had higher increases in the proportion consuming high nutritional value foods such as pulses and consumed greater quantities of food than women in the comparison group (Nguyen, et al, 2017).

Mbithe, Kimiywe, Waudu and Orodho (2008) found that nutrition education resulted in a significant improvement in nutrition knowledge and practices in rural and urban schools and that lack of nutrition education should be addressed in tackling malnutrition. Nutrition education intervention is therefore an essential consideration to optimise maternal nutrition and pregnancy outcomes. Results of a review of 33 studies found nutrition counselling to be associated with significantly greater gestation weight gain and significantly reduced risk of anaemia in late pregnancy. Subgroup analyses by settings showed that significantly greater weight gain was associated with high income countries and that nutrition education and counselling was associated with a greater mean birth weight and had greater effect combined with nutrition support.

Nutrition education and counselling significantly improved mean birth weight and significantly reduced risk of preterm birth. The study concluded that nutrition education and counselling during pregnancy could reduce the risk of anaemia, increase gestational weight gain and improve birth weight (Giward & Olude, 2012). Kafatos, Vlachon and Codrington (1989) demonstrated that nutrition counselling was associated with improvements in dietary intake and maternal weight ($p \leq 0.05$), mean birth weight was significantly higher in the intervention group as well as incidence of low birth weight (4.5 % and 3.9 %). Prematurity rate was marginally lower in the intervention group ($p \leq 0.04$).

2.8 Situation of improving Maternal Nutrition in Kenya

Kenya continues to demonstrate a high level of leadership in improving nutrition for its most vulnerable groups including pregnant women. Several policy and legal frameworks promote reproductive, maternal and child health. These include Kenya

Constitution (2010), Kenya Health Policy (2014 – 2030), Kenya RMNCAH Investment Framework (2016), National Reproductive Health Policy (2007), Adolescent Sexual and Reproductive Health Policy (2015) e.t.c. However much more action and financing are needed particularly for women and girls. The objectives of Kenya Nutrition Action Plan 2012 – 2017 includes improving the nutrition status of women of reproductive age which entails nutrition education on consumption of healthy foods and strengthening iron and folate supplementation during pregnancy (Kimani, 2014).

Lancet/WHO/UNICEF has described high impact cost effective interventions for maternal and child health and these have been aligned to Kenya Essential Package for Health which defines interventions to be provided to achieve Universal Health Coverage (UHC) (GOK, 2016). Interventions for maternal nutrition include supplements of iron, folate, multiple micronutrients, calcium and balanced energy and protein. These can improve maternal and birth outcomes but few have been assessed at sufficient scale according to Unicef (2014). Many of these interventions are provided at the ANC whose WHO's intervention content include anti-tetanus prevention and treatment of malaria, management of anaemia, treatment of sexually transmitted infections, entry point for HIV prevention and care and encouragement to deliver in a health facility under the care of a skilled midwife (KNBS, 2013). Nutrition Education and counselling has not been brought out strongly in this healthcare package for pregnant women.

In spite of much government action in terms of improving maternal and child health, coverage of health interventions is sub-optimal. The greatest challenge is that it is usually not easy to reach women early in their pregnancies. About a third of women in developing countries do not have access to good quality health services during

pregnancy and child birth, especially poor and uneducated women who live in the rural areas. A review of several of these programmes revealed that the causes of poor programme performance were low accessibility and utilization of ante natal care, insufficient supply and distribution of supplements, inadequate training and motivation of health workers, insufficient and inappropriate counselling of mothers, lack of motivation of mothers and failure of effective screening and referral procedures (Kimani, 2014).

Although Kenya has made considerable progress towards achieving the World Health Assembly Nutrition Targets by 2025, there is need to put more effort to curtail the heavy burden of malnutrition which is still high according to Kimani (2014). Moreover a range of barriers acting at the individual (maternal education, knowledge, decision making authority) household (wealth, family support to women) and health service delivery levels (quality of counselling and supply of supplements) affects intervention coverage during pregnancy (Dunneram et al, 2015). Maternal and child nutrition interventions need to be up scaled and obstacles removed to ensure success of intervention programmes.

Addressing the nutritional needs of pregnant women is now entrenched within the Sustainable Development Goals (SDG), by scaling up efforts to achieve this target; progress will also be accelerated on the targets on maternal and child mortality and health according to Kimani (2014). In improving maternal and newborn nutrition, the government of Kenya's policy is to promote actions to ensure knowledge on adequate and nutritious diet and recommends integration of nutrition education programs for mothers into other maternal initiatives such as safe motherhood, baby friendly initiative, beyond zero initiative e.t.c., promote workload reduction technologies and increase income generating activities (MOH, 2013).

Improving nutrition will require enhancing knowledge, awareness and practices of pregnant women. Presently the education systems do not transfer adequate nutrition knowledge aimed at influencing long life dietary practices, therefore nutrition education and awareness need to be strengthened (GOK, 2011). Improving knowledge, attitudes and practices on optimal nutrition is good but continued commitment by government, development partners and civil society is critical to the outlined national nutrition action plan (Kimani, 2014).

There are suggestions that for these issues to be addressed to bring success there is need for increased awareness of all stakeholders, provide quality service and a quality product and ensure availability of supplies. In this intervention study, effort will be made to ensure quality service in delivering a quality product to the subjects and ensuring improved patient-provider relationship to enhance success of the psycho-educational nutrition intervention.

2.9 Summary

Several women in developing countries enter pregnancy at sub-optimal nutrient levels and also engage in strenuous physical activity. Multiple deficiencies are due to low dietary intake and poor bioavailability of micronutrients as well as minimal consumption of animal products. Studies have shown that very few women in developing countries consume food group servings and nutrients consistent with RDA and most continue with heavy physical activity throughout their pregnancies which further increases their energy requirements.

Infections also put on additional burden on the dietary needs of women by decreasing appetite and reducing nutrient absorption and their metabolic stress increase energy and nutrient needs. Thus, vulnerable groups are at risk of developing nutritional

deficiencies without food support programmes. Malnourished women do not gain sufficient weight during pregnancy, are more likely to have miscarriages or stillbirths, give birth to preterm babies or deliver babies with low birth weight, have increased risk of maternal mortality, increased infections, anaemia, compromised immune functions, lethargy, lower productivity, increased risk of foetal and neonatal death, birth defects, cretinism and reduced IQ.

There is need for adequate food consumption and improving dietary diversity for pregnant women by producing nutrient dense foods, increasing the nutritional content of foods through bio fortification and post harvest fortification, improving storage and preservation of foods to cover 'lean' seasons, and educating women about nutrition and diet. In several settings these types of interventions have been shown to improve dietary patterns and intake of specific micronutrients either directly or by increasing household income.

Available evidence is sufficient to warrant the maximum protection of pregnant women to strenuous physical activity. In general heavy work duties should be avoided and enough rest periods assured especially in late pregnancy. The prevention and treatment of malaria and other infections, management of anaemia and other nutrient deficiencies during pregnancy can significantly improve foetal outcomes and improve maternal health. Adverse outcomes such as low birth weight can be reduced through a combination of interventions to improve women's nutritional status and prevent infections during pregnancy.

Although Kenya has put in much effort in addressing maternal and child health, nutrition indicators are still sub-optimal. A range of barriers acting at the individual, household and health service delivery levels continues to affect intervention coverage. Much more work is needed in order to upscale maternal and child nutrition

interventions. Although not well spelt out in the maternal healthcare package, nutrition education is important as it endeavours to alter participants' dietary intakes by remodelling behavioural factors. Positive behaviour adjustments by participants in nutrition education and counselling interventions have been reported by several authors. Nutrition education intervention is therefore an essential consideration to optimise maternal nutrition and pregnancy outcomes.

CHAPTER THREE: METHODOLOGY

3.1 Research Design

The study adopted a prospective cohort study design. A prospective study is a design that studies future happenings, events and findings or follows a condition/concern into the future or overtime. It was adopted because information gathered is complete and accurate and data quality is high due to data not being a onetime exposure (Wayne & Morte, 2013). The study followed groups of similar individuals (cohorts) exposed to nutrition education over time, and determined its efficacy on certain outcomes. After baseline information was collected, cohorts were followed longitudinally, to determine whether their exposure status changed outcomes.

3.2 Study Variables

Data that was collected and analyzed included; independent variables, namely socio-economic and demographic information, health conditions and nutrition knowledge and practices. Dependent variables were energy and selected micronutrient intake, physical activity levels, birth weight, gestational age, and weight gain during pregnancy.

3.2.1 Primary Outcome Measures

The primary outcome measures were overall improvement of intake of nutritious foods and reduction in physical activity levels as quantified by a written nutrition and activity questionnaire.

3.2.2 Secondary Outcome Measures

Secondary outcome measures were pregnancy outcome variables namely, total weight gained during pregnancy compared to current Institute of Medicine's (IOM) guidelines, birth weight and gestational age.

3.3 Study Area

The study area was Migori County. The County is located in Western Kenya bordering Homabay County on the North, Kisii County on the North East, Narok County on the East and South East, Tanzania on the South and South West and Lake Victoria to the West. The County is made up of an area of 2,597 Km² with a total population of 1,098,343, a population of women of reproductive age of 263,602 and an estimated 47,558 pregnant women in the year 2015 (Migori County Government, 2016). There are eight Sub-County hospitals that provide ANC services to pregnant women among others.

Economic activities in Migori County are mainly Agriculture, mining, fishing and manufacturing. The area is extensively involved in sugar cane and tobacco production and subsistence agriculture producing crops such as maize, millet, sorghum, sweet potatoes, beans, kale (sukuma wiki) and bananas. The area has two rainy seasons, the long rainy season between March and July and the short rainy season between September and December. Agricultural tasks are mostly performed manually including harvesting. Women bear the brunt of subsistence farming, sugar cane weeding and planting. However due to use of poor agricultural methods and unpredictable rains, agriculture does not ensure food security for populations in this region.

The area was selected for study because a preliminary study carried out in a section of this area produced results and gave recommendations that this study was designed to handle. It therefore provided a good opportunity to investigate variables under this study because women in this region consume diets that are energy deficient (Waudu, Tuitoek & Kikafunda, 2004; Odiwuor, et al, 2013) and are engaged in high levels of physical activity which have influenced their weight gain negatively (Odiwuor, et al, 2013).

3.4 Target Population

The study population were pregnant women who visited selected health care facilities to receive antenatal care.

3.4.1 Inclusion Criteria

The study included all pregnant women of reproductive age (15 to 49 years) up to 26 weeks gestation selected based on the timing of at least four ANC visits as a criteria for data analysis, women with a documented medical history or who reported a history of disordered eating, but the diagnosis not listed in the exclusion criteria, those who resided in the county for at least 6 months and those who gave consent to participate in the study.

3.4.2 Exclusion Criteria

The study excluded women pregnant with multiple births, and women with diabetes or hypertension prior to pregnancy and women who were bedridden.

3.5 Sampling Technique

Sub- County Hospitals within each sub-County were used as centres for recruiting the pregnant women for the study. Purposive sampling was used to select sub-County hospitals in Migori County for study. A proportion of .38 was used as a suitable statistical power to meet test requirements according to FANTA Sampling Guide (Magnani, 1999) to select 3 sub-county hospitals. Migori County had a population projection of 47,558 pregnant women in 2015 (Migori County Government, 2016). One quarter of the year's population projection rounded to the nearest ten thousand was used as the study population because sample selection took about three to four months.

The three sub-County hospitals attend to about 1250 pregnant women in a year (MOH, 2014, Migori County Government, 2016) therefore about 400 pregnant women in three months attend each of the health facilities. Each health facility was to provide an equivalent proportion of the sample of pregnant women. Simple random sampling was used to obtain the required sample size (50) of pregnant women in each of the selected health facilities. Women were randomly sampled daily as they arrived at the health facilities by the assistance of health care providers for three to four months until the required sample size was obtained. Those who gave informed consent were recruited into the study. Baseline data was collected from each subject who was then enrolled into the psycho-educational nutrition initiative study and followed up until delivery.

3.6 Sample Size

The sample size was determined by use of Fisher's formula (Fisher, 1991) for original sample and Yamane's 1967 Formula (Singh & Masuku, 2014) for final sample size. Yamane 1967 formula states that for finite populations when original sample selected is more than 5 % of the population size the sample needs to be corrected. Correction for proportion is necessary because when the population is small the sample size is reduced slightly because a given sample size can provide proportionately more information for a small population than for a large one. For handling and collection point of view even if the original sample is less than 5%, the researcher has to make a decision to collect even a smaller number in order to ease handling as long as the sample is representative.

FANTA III Sampling Guide (Magnani, 1999) states that when choosing a value for P it is best to lean towards a value of .50 because the variance for indicators that are measured as proportion reach their maximum value as they approach .50. This will however result in a sample that is larger than needed in the event that the actual value of P is very different from .50. For programmes, insufficient power may lead to a false conclusion that there were no significant changes in indicators over time when in fact there were real changes that were not detectable due to the insufficient sample size used. FANTA Sampling Guide indicates that to ensure sufficient power a minimum value for P of .80 should be used and .90 is more where resources permit. This study used .80 as the preferred power. The original sample was calculated using Fisher's formula:

$$n_o = Z^2pq/e^2$$

Where n is the sample size

Z is the value that equals the desired confidence level = 1.96

e is the desired level of precision = 0.065

p is the estimated proportion/ statistical power = 0.8

q is $1 - p$

$$\text{Therefore: } n = 1.96^2 \times 0.8 \times (1 - 0.8) / 0.065^2$$

$$n = 145$$

After the original sample was obtained a decision to adjust the sample size was made to ease handling given the research design that was adopted. FANTA Sampling Guide indicates that where the number of indicators to be measured is large this would be cumbersome and recommends the use of a sample size that is required for an indicator that is most demanding (Magnani, 1999). This study therefore adjusted the sample size based on this recommendation by FANTA Sampling Guide. The selected sample was followed over a length of time and massive data was obtained from each participant over time. The population size was thus adjusted using the Yamane's 1967 formula:

$$n = n_0 / 1 + (n_0 - 1) / N$$

Where n is the sample size,

N is the population size,

n_0 is the calculated sample size for infinite population.

$$\text{Therefore } n = 145 / (145 - 1) / 10000$$

$$= 136.9$$

A proportion of 10 % was added to the sample size to compensate for non-response and possible attrition.

$$10 \% = 14$$

Total sample size was therefore: $136.9 + 14 = 150.9$

Rounded to = 150

3.7 Data Collection Instruments and Procedures

3.7.1 Data Collection Instruments and Tools

The following data collection instruments and tools were used to collect data from the subjects.

- a) A standard pre-coded socio-economic and demographic questionnaire was used to collect socio-economic information and nutrition knowledge and practices.
- b) A 24 hour dietary recall questionnaire was used to obtain dietary intake information.
- c) A 7 Day International Physical Activity Questionnaire (IPAQ) was used to collect physical activity data.
- d) Secondary data comprising of medical records of pregnant women was used to obtain data on gestation age and gestation weight that was previously measured on a weighing scale.
- e) Hemoglobin Determination was carried out by HemoCue Analyzer of serum to obtain the Hb level of the subjects.

- f) Anthropometric measurements obtained using a weighing scale and a portable baby scale were used to determine gestation weight and birth weight.

3.7.2 Data Collection Procedures

3.7.2.1 Training of Research Assistants

Six research assistants who also included qualified registered nurses in the hospitals were trained on data collection techniques. The Health workers underwent a second training session on the content of the nutrition flip chart and on how to deliver the content to the pregnant women during ANC visits. The objectives of the training were to harmonize questionnaire content, to review effective adult teaching techniques, how to carry out the 24 hour recall interview, and to familiarize enumerators with training materials and equipment.

3.7.2.2 Recruitment of Study Participants

After the training, the researcher and assistants proceeded to the various health facilities for sample selection and recruitment. The pregnant women were selected by simple random sampling as they received ANC services. The study was verbally explained to each woman and then informed consent form was issued to each woman who was also requested to read the same information. The content of the form was read to those who could not read, after which upon consent to participate in the study, each woman had to sign the consent form then recruited into the pre-test–post test psycho-educational nutrition intervention study.

Upon recruitment, baseline data was collected after which the educational resources were issued to each subject with instructions on how to undertake the process of instruction. Data collection was hospital based. A total of 150 pregnant women were selected for study. Each participant was given a code and their names recorded

against the codes to ease follow up. After the study the names were discarded and only the codes were used for data entry and analysis.

3.7.2.3 Actual Data Collection

A standardized socio-economic and demographic questionnaire was administered by interview at the hospital at the first contact to investigate socio-economic factors and nutrition knowledge. Nutrition knowledge that was rated on a scale of 1-10 and nutrition practices and attitudes were investigated again after the intervention. Information that was collected included education level, employment status, income levels, housing characteristics, income, expenditure on food, household size, availability of domestic help, health status and parity, nutrition knowledge, nutrition knowledge score, and practices. After the socio-demographic questionnaire, a 24 hour dietary recall was administered through a face to face interview schedule.

On the first day of recruitment and on the ANC visit just before delivery, subjects were asked to recall all foods and beverages that they had consumed the previous day from the time they woke up in the morning to the time of going to bed in the night and these were recorded on 24 hour recall forms for each participant for each day. The subjects were required to recall all the foods consumed, the time the food was eaten, a description of the food item, method of preparation, ingredients used in food preparation and how much of the food was eaten. The 24 hour recall interview was repeated for a separate day of the same week.

Bowls, cups, spoons and specifically designed food models and other standard cooking measures were carried by the research assistants to the health facilities on each day of data collection. These were presented to participants during the interviews to assist them in providing information on the quantities of each food

consumed. Thorough and in-depth probing of participants and the use of these equipment enabled research assistants to verify the quantities of food that were consumed. After all foods and beverages were recorded, follow up questions on snacks and any other foods were asked to make sure nothing was forgotten. A food frequency questionnaire was also used to get other foods that women consumed but might have forgotten. The subjects were asked to state if what was recorded from the 24 hour recall interview was their usual portions and if not what may have contributed to the particular portion size consumed. It was administered during the first contact and at the end of the intervention in the hospitals' ANC sections.

Anthropometric measurements of the women were taken during the ANC visit before the expected date of delivery. The subjects were weighed on a calibrated weighing scale to the nearest 0.1 kg while they wore only light clothing and with their shoes removed. The weight measurements were recorded on their medical records and then later on copied on to their anthropometric forms. The subjects' hospital records were used to obtain information on Secondary data. Hospital records were used to obtain the first measured and recorded gestational weight, health condition and gestational age. This was done during the study and at the end of the intervention. Information such as gestation age at recruitment, weight prior to delivery was obtained by interview but verified by the hospital records.

International Physical Activity Questionnaire (IPAQ) was used to investigate physical activity which consisted of timing, duration of work, number of hours worked daily, time taken walking daily, time spent sitting on weekdays and on weekends, vigorous activities, and moderate intensity activities. A review of physical activity studies found that questionnaires were the most widely used instruments reinforcing them as the most feasible option for measuring physical activity in epidemiological studies

(Schlussel, Souza, Reichenheim & Kac, 2008). After secondary data was obtained the subjects were issued with IPAQ forms which they were to carry home and record information on physical activity done every day between waking up and going to bed for 7 days.

Those unable to fill in were instructed to use a member of the family who was able to read and write. The subjects were instructed to return the filled IPAQ forms during their next ANC visit. Physical activity data was collected at baseline and at the end of the intervention. During the ANC visit before the last appointment, subjects were issued with IPAQ forms again which they were instructed to fill in as they did during baseline for 7 days and were asked to return them during the last regular appointment at ANC. The physical activity data was categorized into three domains namely vigorous intensity, moderate intensity and walking.

Hemoglobin Determination by HemoCue Analyzer was done according to Cheesbrough (2006) to obtain Hb level. Due to inadequate laboratory equipment and lack of adequate qualified personnel to undertake laboratory analysis for all the participants, as well as the low number of pregnant women that gave consent to this procedure, tests were done for only 15 % (16) of the subjects. Given the small number of participants tested for Hb level, the result cannot be generalized to the entire sample. After the subjects were issued with IPAQ forms the last stage of the baseline data collection in the health facility was laboratory analysis. The subjects who volunteered were sent to the laboratory for the Hb test.

At the laboratory blood sample was collected from the middle finger. The finger was cleaned using alcohol-soaked gauze at the site for blood collection then punctured with a lancet device which was discarded after the first use in an approved sharps

container. A little pressure was applied to the punctured finger, the first and second large drops of blood were wiped off and the third drop was filled into a microcuvette which was removed from a vial. The blood collected in the cuvette was visually inspected for air bubbles in the centre of the cuvette eye. Any cuvette eye that had bubbles was discarded and a fresh blood sample obtained.

The filled microcuvette was loaded by placing into the cuvette holder and gently slid into the measuring position of the HemoCue Hemoglobin Photometer which was turned on earlier. The Hemoglobin value was displayed in grams/dl after 30 – 50 seconds. The results were recorded after removing the microcuvette from the instrument. The microcuvette was immediately disposed into the biohazard container. The results were recorded for each subject whose blood sample was collected and submitted to the research assistants. The laboratory analysis was done in only one of the health facilities.

Ninety two respondents were able to be followed up to delivery and birth weights were obtained. New bornes were weighed with no clothing within 24 hours after birth using a portable baby scale with a capacity of 5 kg and a precision of 10 g. The weighing scale was calibrated before each weighing and results were recorded to the nearest gram on an anthropometric form coded for each participant.

Table 3.1: Summary of data collection instruments and analysis

Research instrument	Procedure and Data obtained	Time of data collection	Method of Analysis/test
A standard pre-coded socio-economic and demographic questionnaire with nutrition knowledge and practices	Face to face, socio-economic and nutrition knowledge and practices data obtained	At recruitment part of it obtained after intervention	Descriptives, ANOVA and Chi square
24 hour dietary Recall questionnaire	A face to face interview schedule for two separate days of the week.	First contact and after intervention	Nutri-survey computer package, descriptive statistics, paired t tests, regression analysis
7 day short form IPAQ	Total activity level, vigorous activities, moderate activities, time spent walking and resting, daily hours spent on activity	For 7 days at home. At baseline level and end of intervention.	IPAQ scoring protocol, descriptive statistics, paired t-tests, regression analysis
Anthropometry	Maternal weight, New born weight obtained in the hospital.	During ANC visits, Within 24 hours after delivery.	Descriptive statistics, Pearson's product moment correlation coefficient, paired t-test, regression analysis
Hospital Records	First maternal weight, health condition, gestational age	During study and at the end of the intervention.	Descriptive statistics Pearson's product moment correlation coefficient, paired t-test
Biochemical Analysis	Samples of blood to test Hb level. This was done in one health facility.	First contact	Descriptive statistics

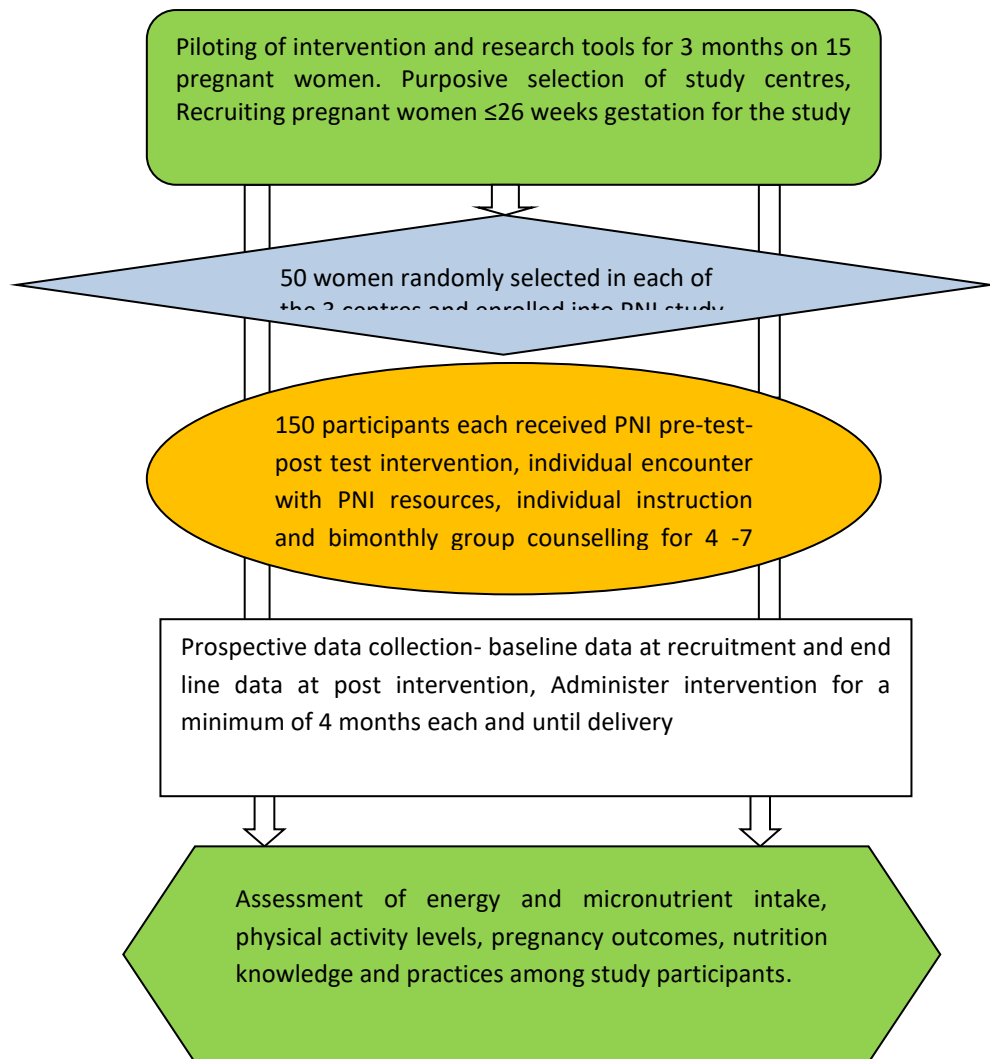


Figure 3.1: Schematic flow diagram of the study design

3.8 Description of the Intervention

The intervention involved the implementation of psycho-educational nutrition initiative (PNI) which utilized educational resources issued to the women after baseline information was collected. The study group underwent the current standard optimal care by the Ministry of Health which included iron and folic acid supplementation, weight and height measurements, anti-tetanus treatment, prevention and treatment of malaria, HIV prevention and care (information derived from participants' medical records). Nutrition education was not in this package of care for

the pregnant women. Overall, the intervention was a psycho-education of subjects on adequate diet, reduction of physical activity, the need to gain more weight, hygiene and other best practices during pregnancy meant to change their attitudes to enable positive behaviour change.

The educational resources that were used were a recipe booklet titled “Recipes for Good Nutrition; Nutrient Dense Local Dishes for Health. Easy to Prepare Mouth Watering Dishes” that contained easy to make recipes using locally available foods, a brochure with a title of “Sound Nutrition Benefits You and Your Baby” that contained information about best nutrition practices, encouraging weight gain and reduction in physical activity and general care in pregnancy, a handout titled “Nutrition During Pregnancy and Breastfeeding that contained guidelines on proper feeding during pregnancy and an educational chart that contained information on the suitable foods and best practices during all the months of pregnancy.

The recipe booklet, the brochure and the chart were prepared by the researcher while the handout was adapted from materials developed by WHO for use in Tanzania and produced by GOK, UNICEF, WHO and USAID. The psycho-education nutrition initiative involved once monthly interaction with health worker for group counselling sessions using flip chart during monthly ANC visits, and individual interaction with a recipe’ booklet based on nutritious local dishes, a brochure on optimal feeding practices and behaviours and a handout encouraging weight gain and reduction in physical activity.

There was an initial educational forum with each of the participants which included instruction on the content of the educational resources and how to apply the knowledge contained in the resources. The participants were then issued with the

brochure, handout and recipe' booklet to carry home and instructed to read and apply the knowledge obtained and use the recipe' booklet to prepare nutritious dishes. The information in the brochure, handout and booklet were translated to the local dialect at the initial educational forum for those who didn't understand English. Those who were completely unable to read were instructed to use a family member who was to read and pass the information to them. During each visit to the ANC the women had group counselling sessions with the health workers who used content from the educational chart. During the bimonthly ANC visits the women were reminded to read the brochure, recipe booklet and hand out and apply the knowledge provided in those materials as well as information given during the group counselling sessions.

Through contact with the educational resources, women were expected to have acquired knowledge and practised optimal feeding habits, and behaviours that would improve dietary intake which would lead to improved pregnancy outcomes. Duration of intervention was determined by the gestation age at recruitment and this ranged from four to seven months depending on the gestation age of every subject at recruitment. Data of pregnant women who underwent the exposure with educational resources for a minimum of four months qualified for analysis.

Table 3.2: Summary of PNI Intervention process

Educational Resources	Content	Place and Period of Interaction	Person Involved
Brochure Titled “Sound Nutrition Benefits You and Your Baby” By researcher	Increasing food intake, appropriate diet and behaviours, encouraging weight gain and reduction in workloads.	A minimum of four months at home	Pregnant woman interacting directly with brochure. Those unable to read using the help of a literate family member
Recipe’ booklet titled “Recipes for Good Nutrition; Nutrient Dense Local Dishes for Health. Easy to Prepare Mouth Watering Dishes” by researcher	Based on nutritious local dishes,	A minimum of four months at home	Pregnant woman interacting directly with the recipe’ booklet. Those unable to read using the help of a literate family member
Hand out titled “Nutrition During Pregnancy and Breastfeeding by GOK/UNICEF/WHO/USAID	Guidelines on proper feeding during pregnancy	A minimum of four months at home	Pregnant woman interacting directly with hand out. Those unable to read using the help of a literate family member
Educational chart by researcher	Contained information on the suitable foods and best practices during all the months of pregnancy	Once a month in the hospital during ANC visit for a minimum of four months	group counselling sessions by trained health worker

3.9 Piloting the Intervention and Pre-Testing of Research Instruments

A pilot run was done to test the methodology for three months prior to the actual research. The intervention process similar to the one used during the study was carried out on 10 % of the sample similar to the actual sample that was used in the study of but who were not included in the study. The instruments were then pre-tested on the same sample. Procedures to be used in pre-testing were identical to those that were used during the actual data collection. This brought out meaningful observations such as unclear direction, clustered and wrong phrasing of questions.

3.10 Validity and Reliability

During the pre-test, a test-retest method was used to estimate the degree to which the same results would be obtained with a repeated measure of accuracy in order to determine the reliability of the instruments. Content validity was carried out to establish whether the instruments were going to measure what they were supposed to measure. Relevance of the content used in the tools was assessed. Research tools were then revised and standardized as per the pre-test results. The validity of the survey instrument was identified by taking the square-root of the reliability coefficient. All the measures had Cronbach's Alpha values (Wayne & Morte, 2013) greater than 0.7 with an overall average of 0.7438 hence the instrument was reliable.

3.11 Data Analysis

Data from all the instruments was cleaned and entered into excel spreadsheet. After data entry and cleaning, data for 136 pregnant women qualified for analysis at baseline level and 115 after the intervention. Ninety two participants were able to be followed until delivery. Other pregnant women dropped out due to various factors

such as moving away from the locality, delivering at home and for others delivering in different health facilities other than where they received ANC care while others could not be traced. Participants who attained the 4 ANC WHO's recommended visits qualified for analysis for pregnancy outcomes. Weights of foods consumed by the subjects from 24 hour recall were converted from household measures into grams and then into intake values for energy, protein, fat, iron, zinc, and vitamin A by Nutri-survey Computer Package. Local measuring utensils were identified and their weights and volumes determined. A calibrated list was then used on a variety of foods and beverages for the analysis.

Physical Activity data were analysed according to IPAQ Scoring Protocol. The volume of activity was obtained by computing each type of activity, classified as vigorous intensity, moderate intensity, walking and sitting by its energy requirements referred to as METS (multiples of the resting metabolic rate) to produce a score expressed as MET-minutes per week: Met level x minutes of activity x events per week. MET levels are expressed as;

- Vigorous = 8.0 METs
- Moderate = 4.0 METs
- Walking = 3.3 METs

The total physical activity MET-minutes/week was computed as the sum of vigorous, moderate and walking MET-minutes/week scores i.e. Total MET-min/week = (Walk METs*min*days) + (Mod METs*min*days) + (Vig METs*min*days). The IPAQ protocol proposed three levels of physical activity which were used to categorize the subjects, Inactive, Minimally active and HEPA- active (IPAQ Research Committee, 2004). The physical activity data scored for each subject was entered into excel

spreadsheet. The data was then transferred to the Statistical Package for Social Sciences (SPSS) which was used for analysis.

Frequencies and descriptive statistics were used as appropriate. Paired t-tests and independent t-tests were used to test for relationships of dietary intakes, physical activity levels, and pregnancy outcomes by gestation age. Analysis of variance (ANOVA) and Chi square test for associations were used to test for relationships while Pearson's Product Moment Correlation was used to test for associations between various pregnancy outcomes. Regression model was used to determine effect of intervention on dietary intake, physical activity levels and pregnancy outcomes. Statistical significance was taken at $P < 0.05$.

3.12 Logistical and Ethical Considerations

Approval to carry out research was granted by Kenyatta University Ethical Review Committee and Graduate School. A research permit was obtained from National Commission for Science, Technology and Innovation (NACOSTI). Permission to carry out research was sought from the Migori County Commissioner, County Director of Health and County Director of Education. Project administration was sought from the Medical Officers in Charge at all the selected health facilities. Participation in the study was purely voluntary and written informed consent was obtained from the pregnant women who were then recruited into the PNI study. Data confidentiality was also maintained. Standards and Operational Guidance for Ethics Review of Health –Related Research with Human Participants by WHO (2011) (Appendix E) were followed.

CHAPTER FOUR: RESULTS

4.1 Introduction

This chapter presents data and statistical analysis that were selected to answer the research objectives. This study sought to determine socio-economic and demographic factors, health conditions, nutrition knowledge and practices and effect of psycho-educational nutrition initiative on nutrition knowledge and dietary practices, assess energy, vitamin A, vitamin C, folic acid, iron and zinc intakes, Hb levels and physical activity levels, determine gestational weight gain, gestational age and birth weight and determine the associations among pregnancy outcomes and effect of the psycho-educational nutrition initiative on nutrient intake, physical activity and pregnancy outcomes among pregnant women in Migori County.

Results have been reported and discussed under the sub headings; socio-demographic characteristics, health and nutrition knowledge and practices, nutrient intakes, physical activity levels, pregnancy outcomes, associations between pregnancy outcomes and effect of psycho-educational nutrition initiative on nutrient intake, physical activity and pregnancy outcomes .

4.2 Socio-economic and demographic Characteristics

The first objective of the study sought to determine socio-economic and demographic factors of pregnant women in Migori County. The socio-economic and demographic factors included level of education, employment status, income levels and amounts of expenditure on food, housing characteristics, source of drinking water, type of toilet, household head and size, person responsible for food distribution in the household, availability of domestic worker and parity of the pregnant women.

4.2.1 Level of Education and Occupation of Respondents

Most (48 %) of the women had only attained a primary education level, 33 % had secondary education and 5 % had no formal education. Those with tertiary education were only 14 %. Most of the women were either self-employed (46 %) or unemployed (45.0 %), a small proportion were employed (5 %). Similarly most spouses (43 %) were self-employed. More spouses compared to the women were employed (31 %) and only a few (7 %) were unemployed (Table 4.1).

Table 4.1: Education level and occupation of women and their spouses

Characteristics		Frequency (n=136)	Percent
Education level of the women	None	6	5
	Primary	65	48
	Secondary	45	33
	Tertiary	19	14
Employment status of the women	Farmer	5	4
	Self employed	63	46
	Unemployed	61	45
	Employed	7	5
Education level of spouses	None	4	2
	Primary	38	27
	Secondary	67	49
	Tertiary	27	18
Employment status of spouses	Deceased	6	4
	Farmer	6	4
	Not applicable	11	8
	Retired	3	3
	Self employed	58	43
	Unemployed	10	7
	Employed	42	31

4.2.2 Household Head, Responsibility for Food, Availability of Domestic worker of Pregnant Women's Household

Most (75.7 %) of the households where the women came from were headed by fathers. Only a few (9.6 %) households were headed by mothers, and very few others still, were headed by other members of the household. Money for food was mostly provided by fathers (55.9 %), followed by mothers (25 %). Other few households were provided for either by aunt, cousin, father in law, mother in law, or uncle.

Mothers (70.6 %) were mostly responsible for food preparation, a few fathers (11.8 %) took responsibility for food preparation and in some few households food preparation was the responsibility of either mother in law (2.2 %), sibling (1.5%) or cousin (4.4 %). In most households (65.4 %) mothers made decisions on what foods to prepare, followed by households where fathers (21.5 %) made the decision and mother in laws (7.7 %). Others in the household such as father in law, cousin, aunt and uncle made food decisions in some few households. Mothers were mostly (72.8 %) responsible for serving food in majority of the households. Almost all the women (87.5 %) did not have domestic workers. Spouses were the main providers for their families as confirmed by the finding of 53 % of the households being provided for by the fathers (Table 4.2).

Table 4.2: Household head, person responsible for food and availability of domestic worker

Characteristics		Frequency (n=136)	Percentage
Household head	Aunt	4	2.9
	Cousin	4	2.9
	Father	103	75.7
	Father in law	1	0.7
	Mother in law	3	2.2
	Mother	13	9.6
	Other	5	3.7
	Uncle	3	2.2
Provider of food money	Aunt	5	3.7
	Cousin	3	2.2
	Father	76	55.9
	Father in law	3	2.2
	Father, mother	2	1.5
	Mother in law	3	2.2
	Mother	34	25.0
	Other	7	5.1
Uncle	3	2.2	
Responsible for food preparation	Aunt	7	5.1
	Cousin	6	4.4
	Father	16	11.8
	Mother in law	3	2.2
	Mother	96	70.6
	Other	6	3.5
	Sibling	2	1.5
Food decision maker	Aunt	5	3.8
	Cousin	3	2.3
	Father	28	21.5
	Father, mother	2	1.5
	Mother	85	65.4
	Mother in law	10	7.7
	Other	4	3.1
	Uncle	3	2.3
Responsible for serving food	mother	99	72.8
	Aunt	9	6.6
	Cousin	8	5.8
	Mother in law	13	9.6
	Other	7	5.1
Available domestic worker	None	119	87.5
	Other	2	1.5
	Yes	15	11.0

4.2.3 Household Income and Food Expenditure of Pregnant Women's Households

In Figure 4.1, most of the women's households had a monthly income of between KES 500 to KES 1000 (20 %) followed by those that had incomes above KES 5000 (15.3 %). Some few households had a monthly income of KES 100 to KES 500 (4.1 %). While 25.3 % of women had no information about total income of their households per month.

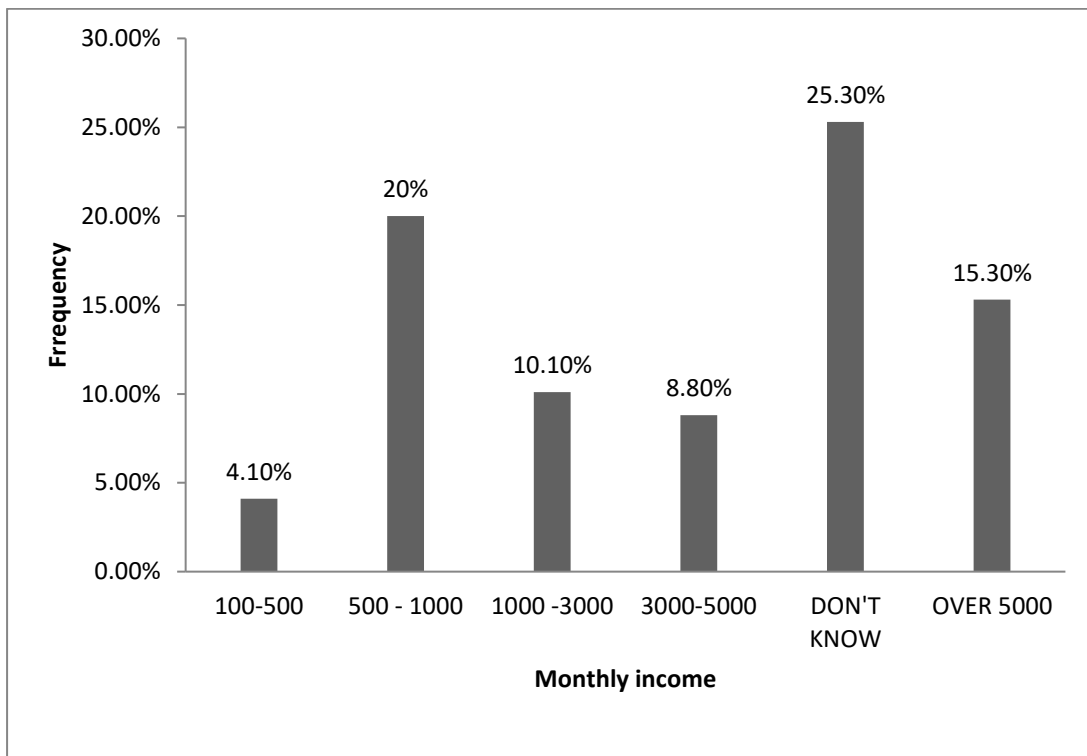


Figure 4.1: Monthly income of pregnant women's households

In Table 4.3 income for most households was brought in by 2 people (53.7 %) followed by households where the income was brought in by one person (39.7 %). For most households (62.4 %) the incomes presented in Figure 4.1 were the usual income per month and had remained so for some households (48.4 %) in the previous six months. For some households (37.6 %) this income seemed to vary monthly and

had also varied for majority (51.6 %) of households in the previous six months prior to the study. Most households (31.6 %) spent KES 150 – 250 per week on food followed by households (28.7 %) that spent KES 100 or less in a week. Some few women (7.3 %) did not know how much was spent by their households on food per week.

Table 4:3: Household income and food expenditure of pregnant women’s households

Characteristic		Frequency (n=136)	Percentage
Number of people contributing to household income	>4	3	2.2
	1	54	39.7
	2	73	53.7
	3 to 4	5	3.7
Usual income	Yes	83	61.1
	No	70	51.4
Same monthly income previous 6 months	≤100	39	28.7
	150 - 250	43	31.6
Money spent on food per week (KES)	300 - 400	36	26.5
	Don't know	10	7.3
	Over 400	18	13.2

4.2.4 Housing Characteristics of the Pregnant Women

Most (60 %) of the women lived in traditional houses, while 35 % lived in brick houses and only a few (3 %) lived in other types of dwelling. Most of the houses had only two rooms (39.5 %) and 28.6 % had three rooms. The highest number of people sleeping in any one room per night was two people (73.2 %). Most of the women’s households were made up of between three and four members (47.7 %) and 34.1 % of households had one or two people. Majority (76.1 %) of the women’s households used wood only as fuel for cooking, 12.7 % used two types of fuel out of a

combination of gas, wood, paraffin, and charcoal. Less than 1 % used electricity only as fuel for cooking. The women's households' toilets were mostly pit latrines (95 %) and some few women's households (1 %) had no toilet at all while about 4 % had other types of toilets.

The women's household possessions were used to work out the women's households' wealth index. Most of the women (41 %) belonged to the lowest quintile; the second lowest and middle quintiles had almost similar proportions (20 % and 21 % respectively). The lowest proportion of women (18 %) was in the second middle quintile and no woman qualified to be in the highest wealth quintile (Table 4.4).

Table 4.4: Housing characteristics of the pregnant women

Characteristics		Frequency (n=136)	Percentage
Type of dwelling	Brick	47	35.0
	Concrete	4	2.0
	Other	4	3.0
	Traditional	81	60.0
Number of people sleeping in house 4 nights /week	1 - 2	46	34.1
	3 - 4	64	47.4
	5 -6	22	16.3
	7 - 8	4	2.2
Number rooms in the House	1	24	17.9
	2	54	39.5
	3	39	28.6
	More than 4	19	14.1
Cooking fuel used by the women	Charcoal	7	5.2
	Electricity, open fire	1	0.7
	Gas	7	5.2
	Gas,wood/paraffi n, charcoal	18	12.7
	Wood	103	76.1
No. of People sleeping per room	5 – 6	13	9.8
	>6	1	1
	0-2	99	73.21
	3 – 4	22	16.2
Type of toilet	Pit Latrines	129	95
	Other types	5	4
	No Toilet	2	1
	Lowest	56	41
Wealth Index quintile	Second lowest	27	20
	Middle	29	21
	Second Middle	24	18
	Highest	0	0

About half of the women's households (50.4 %) obtained drinking water from the river only, 18.5 % from the tap, 13.3 % from the well only, 8.1 % from rain and 2.2 % from spring (Fig 4.2).

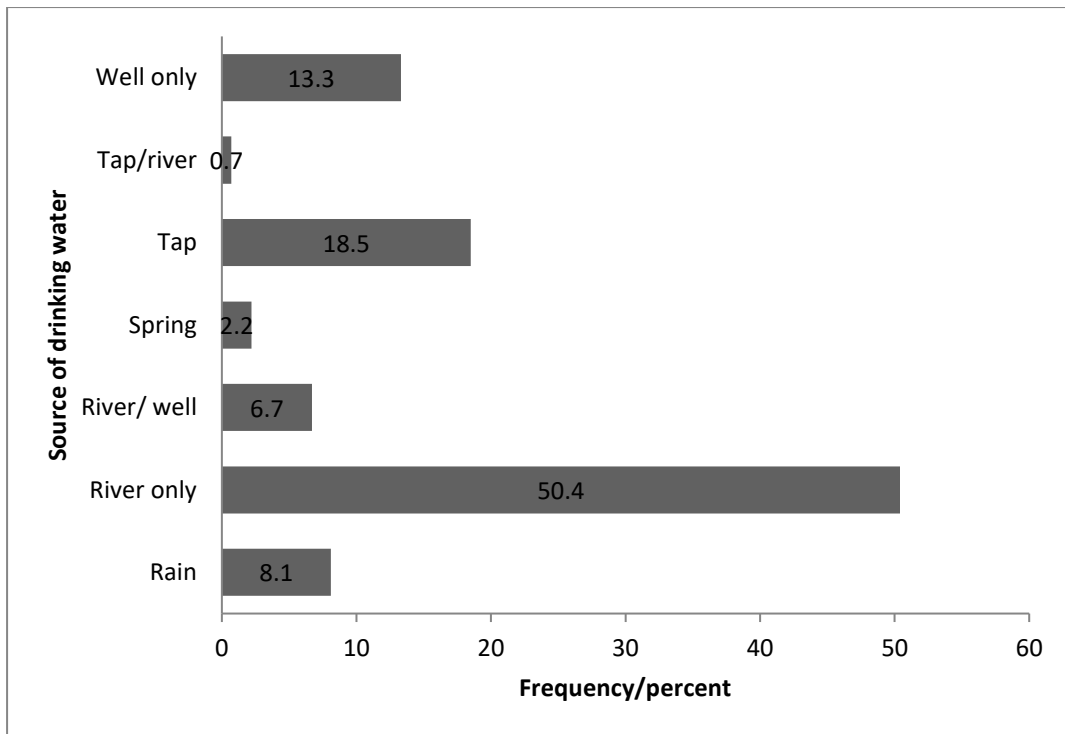


Figure 4.2: Pregnant women's households' source of drinking water

4.2.5 Parity of the Pregnant Women

Most of the women (50 %) were in their second, third or fourth pregnancies, followed by those in their first pregnancy (32 %). Others were in their 4th to 6th (14 %) pregnancies (Table 4.5). The mean number of children per woman was one child.

Table 4.5: Order of pregnancy of the respondents

Characteristic	Birth order	Frequency	Percentage
	0	43	32
	1 - 3	68	50
	4- 6	19	14
	>6	06	4
	Total	136	100.0
	Mean	Frequency	Std
number of children/participant	1.0	136	1.238

4.3 Pregnant Women's Health and Nutrition knowledge and Practices

Under objective two the study utilized nutrition education resource materials to upscale nutrition knowledge and optimal feeding practices among pregnant women and assessed nutrition knowledge and practices and health conditions of the pregnant mothers. Data was collected before and after exposing the participants to the educational intervention and the findings are reported in this section.

4.3.1: Pregnant Women's Health Conditions

The women were asked to state any diseases that they may have heard during the previous one year just before the study. Majority (91.8 %) had not had any disease, very few had suffered the diseases that were listed to them; ulcers (3.1 %), hypertension (2.1 %), and asthma, pneumonia and TB (1 % each) (Figure 4.3). Majority of the women (91.1 %) did not suffer from any other ailment not listed one year prior to the study (Figure 4.3) as well as not having an ailment (73.9 %) requiring treatment during their entire pregnancy (Table 4.7).

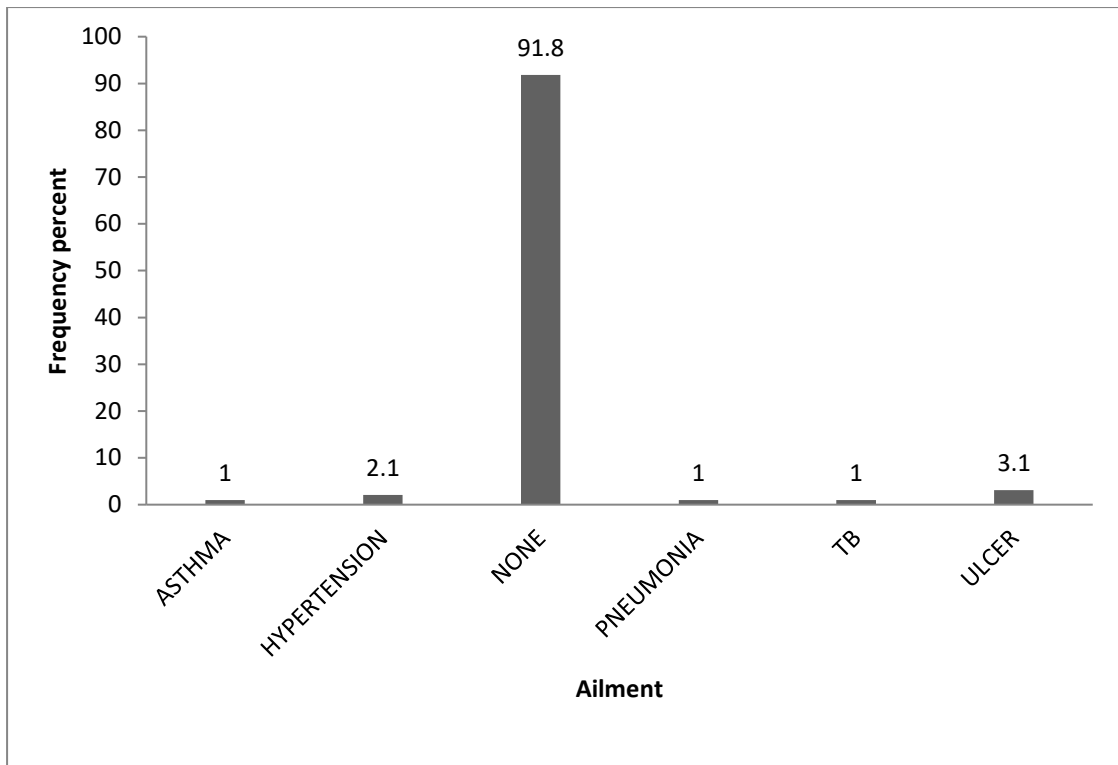


Figure 4.3: Ailments affecting pregnant women within the previous one year prior to the study

Majority of the women (75 %) did not have a medical complication interfering with their food consumption. However, some few had health conditions that dictated their diet pattern such as medical related complications (8.1 %) influencing their food consumption, heartburn (2.9 %), digestion complications (6.6 %) and food allergies (7.4 %). This shows that most of the women had no hindrances to food consumption. As a result most of the women (78 %) were on a normal diet (Table 4.6). During the 24 hour recall interview, the women were asked if what they had consumed the previous day was their usual food intake. Most (71 %) of the women had consumed the usual portion. Those women who consumed unusual portions gave reasons for the unusual intakes as not feeling hungry (18.5 %), stressed (17.5 %) and travelling (18.5 %).

Most of the women (22 %) had no pregnancy related complaint affecting food consumption, for those with such complaints, most suffered from poor appetite (16 %) followed by nausea (14 %), oedema of the legs (7 %) and vomiting (6 %) which may have affected the kinds of foods consumed. Others (35 %) had no conditions related to food intake such as fatigue and backache. The pregnant women were asked to rate themselves on a scale of 1 – 10 indicating high, medium and low level of knowledge before and after the psycho-educational nutrition initiative. Before intervention 47 % of the women had low nutrition knowledge scores, 34 % had medium nutrition knowledge scores and 19 % had high nutrition knowledge scores. At post intervention most women (60.2 %) had acquired high nutrition knowledge, 33.2 % had acquired medium nutrition knowledge and only 6.6 % had low nutrition knowledge (Table 4.6).

Table 4.6: Health and Nutrition Practices

Nutrition and health practices		Frequency (n=136)	Percentage
Prior Day's Food Intake	More than usual	9	5.6
	Less than usual	31	23.4
	Usual	96	71.0
Reasons for less Intake	Travelling	25	18.5
	Not hungry	25	18.5
	Special meal	22	16.2
	Stressed	24	17.5
	Too busy	24	17.5
Health condition influencing diet	Dieting	16	11.8
	Diet related to medical conditions	11	8.1
	Heartburn	4	2.9
	Digestion complications	9	6.6
	Allergy	10	7.4
Special diet pattern	Non Normal diet	102	75.0
	Diet related to health	106	78.0
	Unknown	9	6.6
	Others	06	4.4
	Others	48	35
Pregnancy related complaints affecting food intake	Non	30	22
	Poor appetite	22	16
	Nausea	19	14.0
	Vegetarian	15	11.0
	Oedema	09	07
Nutrition knowledge Score (post intervention)	Vomiting	08	06
	High (7 – 10)	82	60.2
	Medium (4 – 6)	45	33.2
Nutrition knowledge Score (baseline)	Low (1 – 3)	09	6.6
	High (7 – 10)	26	19
	Medium (4 – 6)	46	34
	Low (1 – 3)	64	47

About half of the women (53 %) had a food craving. The foods that were craved for most were vegetables and fruits (37 %), followed by grains and cereals (32 %), meats (17 %) and milk (13 %). Those who craved for non-food items were only 1 % (Figure 4.4).

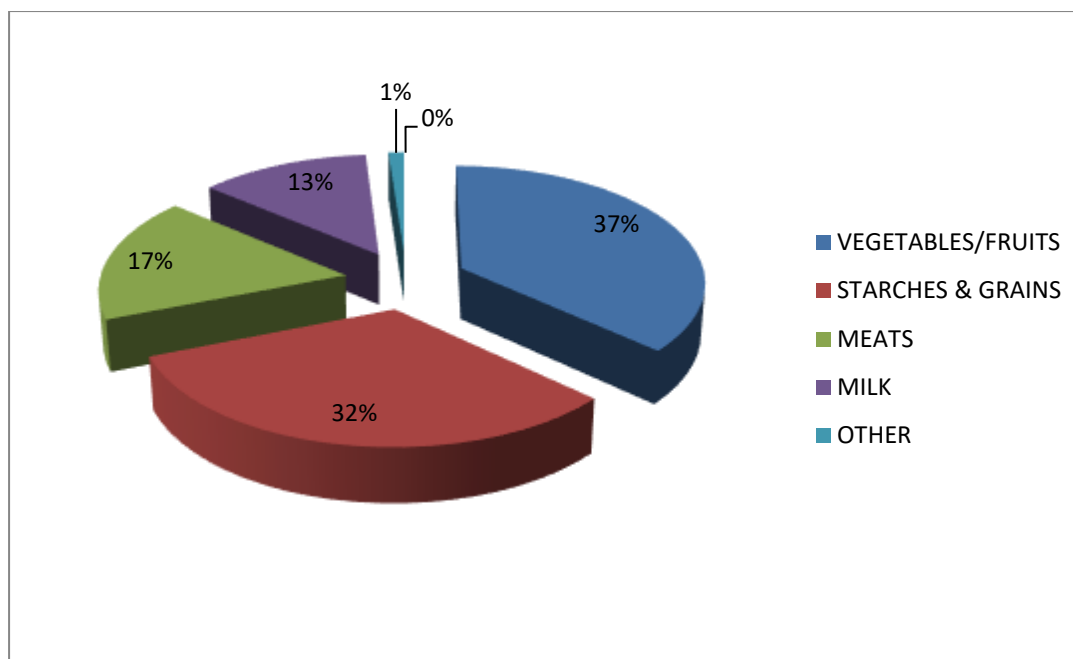


Figure 4.4: Foods and number of times craved for by the pregnant women

4.3.2 Nutrition Knowledge and Practices of Pregnant Women

In determining nutrition knowledge and practices, almost all the women (95.7 %) complied with taking the medication given at the ANC. At the baseline level most (61.4 %) of the women felt that a pregnant woman needed to increase their food intake but 38.6 % felt that a pregnant woman need not increase their food intake. More of the women (58.8 %) felt a pregnant woman also needed to rest more during pregnancy but a considerable proportion although less than half of pregnant women (41.2 %) also felt that a pregnant woman should not decrease their workload during pregnancy.

More women (77.4 %) reported to have increased rest during their pregnancy after the intervention. All the women reported to have applied the knowledge that they had obtained from the psycho-educational nutrition initiative. Almost all the women (96.5 %) observed food hygiene handling practices as well as washing their hands (88 %)

before eating after the intervention. Chi square test for associations found all the factors tested under nutrition knowledge and practices to have significant associations at baseline and after intervention except presence of problem preventing eating, food craving and washing hands that had no significant associations (0.415, 0.902, and 1.83 at $p \leq 0.05$ respectively) (Table 4.7).

Table 4.7: Relationship between nutrition knowledge and practices of pregnant Women at baseline and post intervention

Practices and Attitudes	Baseline (n=136)	Post Intervention (n=115)	P* (χ^2)
Positive attitude on increased Food intake in pregnancy	58(43%)	71(61.4%)	0.014
Increased rest during the pregnancy	71(52%)	89(77.4%)	0.026
Hygiene observed during handling food	82(60%)	110(96.5%)	0.003
Presence of problem preventing eating	82(60%)	68(58.8%)	0.415
Washing hands before eating	103(76%)	101(88%)	0.180
Positive attitude on More rest in pregnancy	46(34%)	68(58.8%)	0.047
Food Craving	67(49%)	61(53%)	0.902
Took all medicine given at ANC**		110(95.7%)	
Incidence of sickness requiring treatment during the pregnancy**		30(26.1%)	
Applied knowledge obtained during the pregnancy**		115(100)	

P* values from chi-square test of association between nutrition knowledge score and dietary attitudes and practices, $p \leq 0.05$

** Test not done.

4.3.3 Number of Meals Consumed by Pregnant Women in a Day

The women were asked to indicate the type of meal they consumed during the 24 hour recall interview schedules. The number of meals consumed was computed and presented in Figure 4.5. At baseline most women consumed three meals a day (42 %) followed by those who consumed four meals a day (27 %) a day, 19 % consumed two

meals a day and 4 % consumed only one meal in a day. After the intervention those who consumed four and five meals in a day increased (43 % and 25 % respectively) while those who consumed three meals in a day reduced (32 %). There were no women who consumed one or two meals in a day after the intervention.

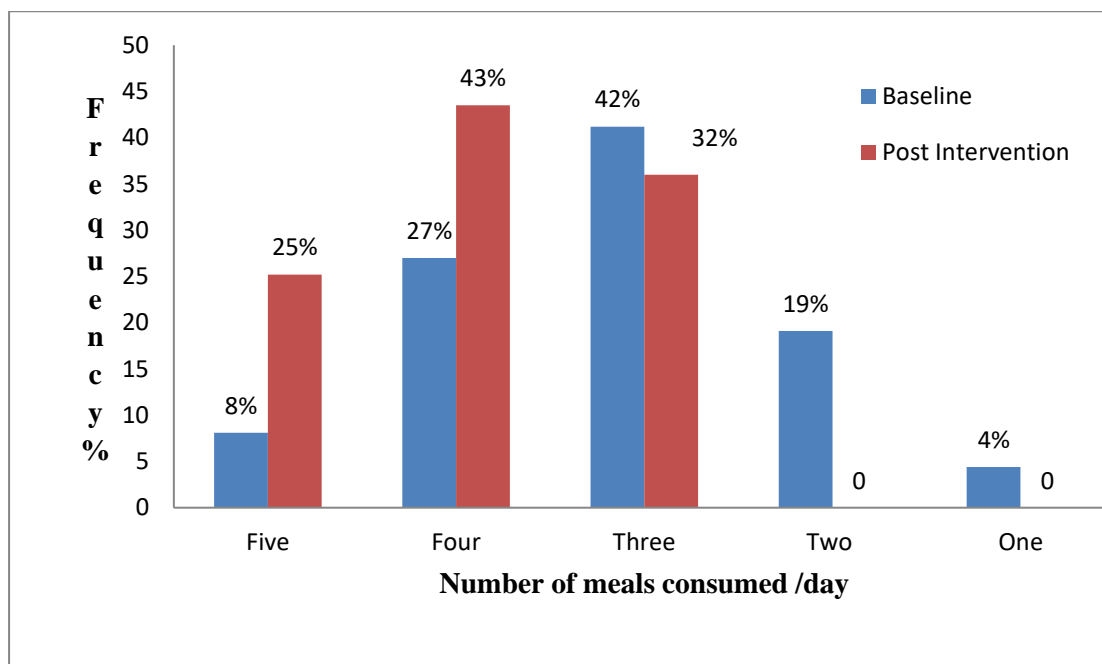


Figure 4.5: Number of meals consumed in a day by the pregnant women

4.3.4: Distribution of Foods Consumed by Pregnant Women according to Food Groups

Dietary intake from 24 hour recall of two days was used to obtain mean food distribution according to food groups (Table 4.8). At baseline vegetables was the most consumed (569) followed by cereals, grains and starches (396), fats and oils and beverages. After the intervention the same food groups were mostly consumed but the frequencies of consumption reduced. Consumption of fish, meat, eggs and dairy products went up after the intervention but consumption of beverages and oils and fats

reduced. Test for relationships between the frequencies of consumption of the food groups at baseline and after intervention found no significant relationships between frequencies of consumption of meats and poultry, fish and fats and oils but found significant relationships between frequencies of consumption of cereal grains and starches (- 0.037), vegetables (- 0.035), fruits (0.050), eggs and dairy products (0.048) and beverages (- 0.044) at $p \leq 0.05$.

Table 4.8: Frequency of consumption of foods in various food groups per week

Food Group	Frequency/Week (Baseline)	Frequency/Week (Post Intervention)	P* (χ^2)
Cereal grains starches	396	340	-0.037
Meats & Poultry	56	68	0.703
Fish	51	92	0.051
Vegetables	569	505	- 0.035
Fruits	65	92	0.050
Eggs & Dairy products	57	95	0.048
Beverages	137	98	- 0.29
Fats & Oils	174	162	- 0.44

P* values from chi-square test of association between frequency of nutrient consumption at baseline and after intervention, $p \leq 0.05$

4.3.5 Iron Status of a Proportion of Pregnant Women

Haemoglobin level was tested on about 10 % of the total sample of pregnant women. The mean Hb level of the participants was 12.25 ± 1.238 g/dl. Majority (93.8 %) of the women had normal or above normal (≥ 10) Hb level while a few (6.3 %) had slightly lower than 10 g/dl (Table 4.9).

Table 4.9: Hb Status of the Women

Frequency	Mean	Std. Deviation
------------------	-------------	-----------------------

Hb level (g/dcl)	16	12.25	1.238
	Status	Frequency	Percentage
Hb status	Normal (> 10)	15	93.8
	Mild Anaemia (< 10)	1	6.2

4.4 Nutrient Intakes of Pregnant Women

In objective three the study sought to assess energy, vitamin A and C, calcium, folic acid, iron and zinc intakes among pregnant women in Migori County. Dietary intake data was collected using 24 hour recall that was done for two separate days of the week for each woman. The average of the two 24 hour recalls for each nutrient was used as the daily intakes. The findings are presented in this section.

4.4.1 Nutrient Intakes of Pregnant Women

24 Hour recall interview was administered to the women to obtain nutrient intakes at baseline and was repeated at the end of the intervention. These interviews were done for two days for each respondent and the mean was computed as the daily nutrient intake. The nutrients that were considered during analysis were energy, proteins, carbohydrates, fats, dietary fibre, vitamin A, vitamin C, calcium, iron and zinc which are considered very essential for pregnant women based on reports from several authors. The mean Macronutrient intakes at baseline were 1613.03±439 Kcal for energy, protein 62.61±23.56 g, carbohydrates 244.93±65.16 g, fat 40.54 ±23.22 g and after the intervention, mean energy intake was 2158.72±309.84 Kcal, protein 85.52±23.83 g, carbohydrates 311.66±58.41 g and fat 60.79±24.64 g. There was a significant improvement in the intakes for all the macronutrients after the

intervention. Kilocalories increased by about 545 Kcal, protein by about 22 g, carbohydrates and fats, by about 66 g and 20 g respectively (Table 4.10).

The mean micronutrient intakes by the women at baseline for vitamin A was 1254.75 ± 2131.48 μg , Folic acid, 196.95 ± 67.22 μg , vitamin C 66.74 ± 42.14 mg, calcium 299.71 ± 142.51 mg, Iron 10.55 ± 2.84 mg and zinc 11.5 ± 3.83 mg. The mean intakes after the intervention were vitamin A 1749.60 ± 3560.43 μg , folic acid 249.37 ± 67.20 μg , vitamin C 89.92 ± 61.11 mg, calcium 441.96 ± 177.93 mg, iron 14.87 ± 3.17 mg and zinc 15.62 ± 3.74 mg. There was a significant increase in intake of all micronutrients after the intervention. Vitamin A intake increased by about 45 μg , folic acid intake went up by about 52.42 μg , vitamin C went up by about 23.18 mg, calcium increased by about 142.25 mg, iron intake increased by about 4.32 mg and zinc intake increased by about 4.12 mg.

Table 4.10: Nutrient Intakes of Pregnant Women

Nutrient	Baseline (n = 136)			Post-Intervention(n= 115)		
	Mean	Std. Dev	% RDA	Mean	Std. Dev	% RDA
Energy (Kcal)	1613.03	439.005	66.90	2158.72	309.837	89.94
Water (g)	941.97	358.227	94.1	1170.93	318.987	117.09
Protein (g)	62.61	23.358	88.18	85.52	23.830	120.45
Carbohydrates (g)	244.93	65.162	139.96	311.66	58.405	178.0
Dietary fiber (g)	31.18	10.055	111.36	39.87	8.017	142.39
Vitamin A (μg)	1254.75	2031.485	162.95	1749.60	3560.428	227.22
Folic Acid (μg)	196.95	67.220	32.82	249.37	67.196	41.56
Vitamin C (mg)	66.74	42.143	78.51	89.92	61.107	105.78
Calcium (mg)	299.71	142.511	29.97	441.96	177.930	44.19
Iron (mg)	10.55	2.846	39.07	14.87	3.172	55.07
Zinc (mg)	11.51	3.829	104.63	14.62	3.741	132.90

RDA obtained from: Food and Nutrition Board, Institute of Medicine, National Academies, 2011. Dietary Reference Intakes (DRIs), Recommended Dietary allowances and Adequate Intakes, DRI table and Application Reports. USDA, United States Department of Agriculture, National Agricultural Library, Food and Nutrition Center. www.nal.usda.gov/fnic/dri-tables.

Table 4.11 gives the proportions of the women who had nutrient intake above or below RDA. For energy, 4.4 % and 20.9 % of the women had intakes above RDA at baseline and after the intervention respectively. For protein, 62.5 % and 84.3 % of the women had intake above RDA at baseline and after intervention respectively. Carbohydrate intake had 93.9 % of the women within or above RDA at baseline while all the women were able to meet the RDA requirement at the end of the intervention. For vitamin A, 61.2 % and 77.4 % of the women were able to meet the RDA requirements at baseline and after the intervention respectively. For folic acid only 13.5 % and iron 13.5 % of the women managed to meet the RDA requirement at baseline but surprisingly after the intervention all the women had intakes below the RDA.

The proportions meeting the RDA requirement for calcium were quite low at baseline (1.4 %) and even after the intervention (1.7 %)). The proportion of women who had met the RDA requirement for zinc intake was less than half (23.8 %) but increased to more than half (52.2 %) after the intervention.

Table 4.11: Proportion of pregnant women with nutrient intakes above/below RDA

Nutrient	≥ RDA				< RDA			
	Baseline		Post intervention		Baseline		Post intervention	
	n	Percent	n	Percent	n	Percent	n	Percent
Energy	6	4.4	24	20.9	130	95.6	91	79.1
Protein	85	62.5	97	84.3	51	37.5	18	15.7
CHO*	128	93.9	115	100	8	6.1	0	0
Vitamin C	33	24.5	53	46.1	103	75.5	62	53.9
Vitamin A	83	61.2	89	77.4	53	38.8	26	22.6
Folic Acid	18	13.5	0	0	118	86.5	115	100
Calcium	2	1.4	2	1.7	134	98.6	113	98.3
Iron	18	13.5	0	0	118	86.5	115	100
Zinc	32	23.8	60	52.2	104	76.2	55	47.8

*CHO – Carbohydrate

RDA obtained from: Food and Nutrition Board, Institute of Medicine, National Academies, 2011.

In Table 4.12 vitamin A (2.714 $P \leq 0.05$), carbohydrate (20.454, $P \leq 0.05$), fiber (3.831, $P \leq 0.05$) and vitamin C (3.378, $P \leq 0.05$) had positive and significant differences between their means and the reference values while energy (-20.630 $P \leq 0.05$), folic acid (-72.698 $P \leq 0.05$), calcium (-59.579, $P \leq 0.05$), zinc (-11.050, $P \leq 0.05$) and iron intakes (-95.644 $P \leq 0.05$) had no significant differences between their means and reference values at post-intervention.

Table 4.12: Test for differences between means of nutrient intakes at post intervention and at baseline with reference Intakes.

Nutrient	Post Intervention				Baseline		
	RDA	t	P value	Mean	t	P value	Mean
Energy (Kcal)	2500	-20.630	.001	2158.72	-6.966	.001	1613.03
Protein (g)	60	1.871	.063	85.52	11.94	.001	62.61
Carbohydrate (g)	175	20.454	.001	311.66	32.44	.001	244.93
Vitamin A (µg)	800	2.714	.007	1749.60	2.86	.005	1254.75
Folic Acid (µg)	600	-72.698	.001	249.37	-55.96	.001	196.95
Vitamin C (mg)	600	3.378	.001	89.92	6.13	.001	66.74
Calcium (mg)	1000	-59.579	.001	441.96	-33.63	.001	299.71
Iron (mg)	27	-95.644	.001	14.87	-61.29	.001	10.55
Zinc (mg)	11	14.62	.001	-3.490	-1.097	.275	11.51

df = 136 (Baseline), 115 (Post intervention), $P \leq 0.05$

RDA obtained from: Food and Nutrition Board, Institute of Medicine, National Academies, 2011, t values from paired t-test.

Protein (11.935, $P \leq 0.05$), carbohydrate (32.437, $P \leq 0.05$) vitamin A (2.860, $P \leq 0.05$), fiber (15.877, $P \leq 0.05$) and vitamin C (6.128, $P \leq 0.05$) had positive and significant differences while energy (-6.966, $P \leq 0.05$), folic acid (-55.958, $P \leq 0.05$), calcium (-33.633, $P \leq 0.05$) and iron (-61.294, $P \leq 0.05$) had no significant differences between their means and the reference values at baseline. Energy intake at baseline and at the end of the intervention had a positive and statistically significant difference between

their means (10.087, $P \leq 0.05$). Protein, fat, carbohydrate, fiber, vitamin C, calcium, iron and zinc had statistically significant differences between their means at baseline and post-intervention (6.366, 6.041, 8.010, 7.1, 5.143, 3.011, 6.470, .399, 5.714 respectively) at $p \leq 0.05$. Only vitamin A intake had no significant difference between their means at baseline and after intervention (Table 4.13).

Table 4.13: Test for differences between means of nutrient intakes at baseline and after intervention

Nutrient	Mean Post intervention (n=115)	Mean Baseline (n=136)	P value	t	Std Error
Energy (Kcal)	2158.72	1613.03	.987	10.087	53.65
Protein (g)	1170.93	941.97	.764	6.366	3.34
Fat (g)	85.52	62.61	.639	6.041	3.13
Carbohydrates (g)	311.66	244.93	.792	8.010	8.77
Dietary fiber (g)	39.87	31.18	.337	7.519	0.000
Vitamin A (μg)	1749.60	1254.75	.689	1.085	426.54
Folic acid (μg)	249.37	196.95	.750	5.143	9.39
Vitamin C (mg)	89.92	66.74	.525	3.011	7.35
Calcium (mg)	441.96	299.71	.275	6.470	21.68
Iron (mg)	14.87	10.55	.526	9.399	0.44
Zinc (mg)	14.62	11.51	.971	5.714	0.52

$P \leq 0.05$, $df = 136$ (Baseline), 115 (Post intervention), $P \leq 0.05$

RDA obtained from: Food and Nutrition Board, Institute of Medicine, National Academies, 2011, t value from paired t-test.

4.5 Physical Activity of Pregnant Women

In objective four, the study sought to assess physical activity levels among pregnant women in Migori County. Physical activity data was collected using a self reported 7 day IPAQ at baseline and after exposing the participants to psycho-educational nutrition intervention. The findings are presented in this section.

4.5.1 Physical Activity Levels of Pregnant Women

Data for physical activity was collected using the 7 day IPAQ questionnaire at baseline and after the intervention. At baseline, the total mean met-minute for the women was 3362.54 ± 351.35 met-minutes/week. Vigorous activities that were done by the women were computed to a mean of 1787.81 ± 315.90 met-minutes/week. The mean met-minutes for moderate activities was 916.89 ± 85.67 . Met-minutes per week for walking was 657.94 ± 140.14 and the mean daily hours spent on activity were 12.21 ± 2.27 (Table 4.14).

After the intervention a repeat of physical activity data collection found the women to have a total mean met-minute per week of 3143.24 ± 462.1 , vigorous intensity activities of 1550.52 ± 835.87 met-minute per week, moderate intensity activities 931.01 ± 63.17 met-minute per week, walking 661.78 ± 616.38 met-minute per week, sitting weekday 129.77 ± 62 minutes, sitting weekend 205.61 ± 76.51 minutes and mean daily hours to be $11.33 \text{ hours} \pm 1.35$. Paired t-test was used to test for the differences in the means of the physical activity factors at baseline and after the intervention and found no significant differences for all the factors at $p \leq 0.05$ (Table 4.14).

Table 4.14: Test for differences between means of Physical activity levels at baseline

and post intervention

PA Category	Baseline (n=136)	Post Intervention (n=115)	t	P value
	Mean	Mean		
Total met-min/week	3362.64	3143.24	-.386	0.001
Vigorous IA (Met-min/week)	1787.81	1550.52	-.379	0.001
Moderate IA (Met-min/week)	916.89	931.01	.119	0.001
Walking (Met-min/week)	657.94	661.78	.103	0.001
Sitting Weekend (min)	187.72	205.61	.227	0.281
Sitting Weekday (min)	110.67	129.77	.202	0.001
Daily Hours	12.21	11.33	-.381	0.003

*IA – Intensity Activities; PA – Physical activity, min – minutes, $p \leq .05$

Under physical activity factors above or below median, for vigorous intensity activities 75 % were below median. For moderate intensity activities, 35.3 % of women were below median. For walking category 70.7 % were below median. For those who spent time sitting on weekends 31 % were below median and on weekdays 44 % were below median (Table 4.15).

Table 4.15: Post intervention and baseline physical activity categories of subjects

above and below median

		Baseline (n=136)			Post Intervention (n=115)		
PA Categories		Frequency	Median)	< Median (%)	Frequency	Median	≥Median (%)
Total	MET-	97	3474	75	39	3095	25.0
min/week							
Vigorous IA	(met-	51	1920	35.3	85	1789	64.7
min/week)							
Moderate IA	(met-	38	960	24.1	98	960	75.9
min/week)							
Walking	(met-	92	660	70.7	44	650	29.3
min/week)							
Sitting	Weekdays	46	180	44	75	130	56.0
(min)							
Sitting	weekend	46	120	31.0	90	300	69.0
(min)							
Daily Hours		59	13	42.2	77	11.30	57.8

*IA – Intensity Activities; PA – Physical activity, min - minutes

Figure 4.5 indicates categorical scores of physical activity levels of pregnant women. At baseline as well as post intervention, most of the women (80.1 % and 66.1 % respectively) were HEPA active while those who were minimally active at post intervention increased. None of the pregnant women were in the inactive category.

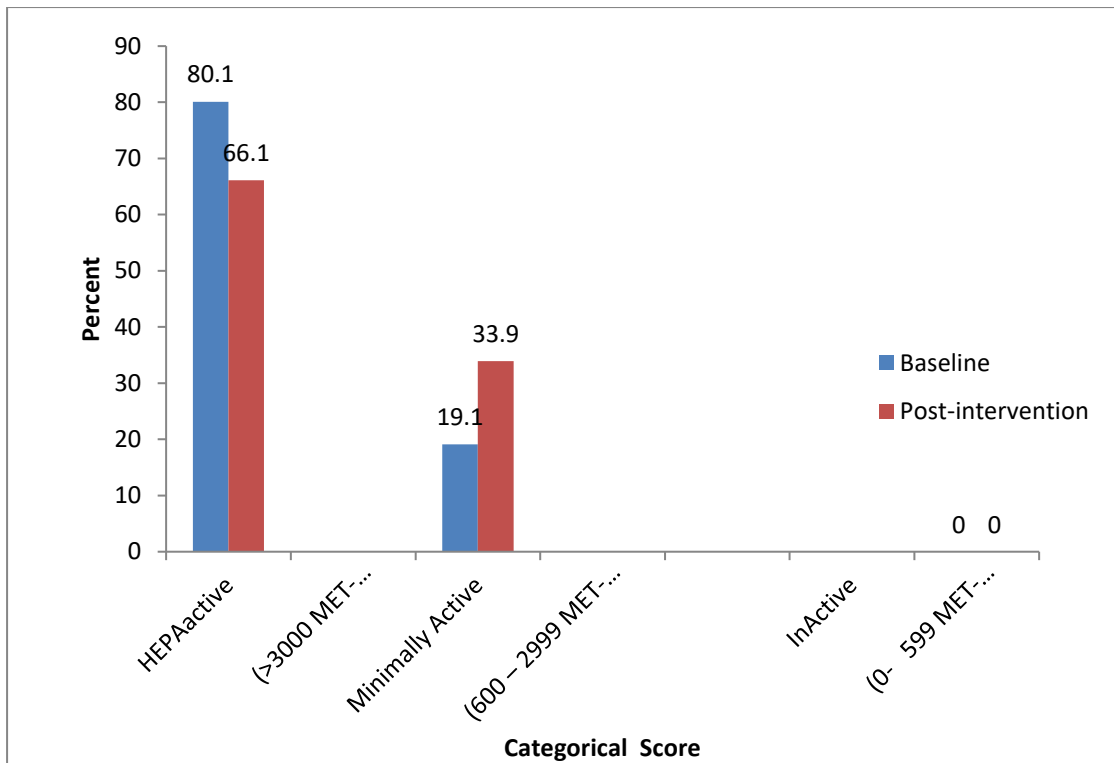


Figure 4.6: Categorical physical activity levels of pregnant women

4.6 Pregnancy Outcomes of Pregnant Women

In objective five, the study sought to determine pregnancy outcomes of pregnant women in Migori County. Pregnancy outcomes that were determined included birth weight of new bornes, gestational weight gain and gestation age.

4.6.1 Weight Gain, Gestation Age and Birth Weight of Respondents

Data for ninety two participants was obtained for birth weight and gestation age at delivery because about 67 % of the women who were recruited for the study delivered in the hospitals hence the possibility of obtaining new born weights. Mean gestation age at recruitment was 21.21 weeks while that for gestation age at delivery was 37.74 weeks. The mean weight gain was 5.98 kg and mean birth weight was 3097.83 g (Table 4.16).

Table 4.16: Pregnancy outcomes of respondents

Pregnancy Outcome	n	Mean	Std. Dev.
Gestation age (weeks) at recruitment	136	21.21	4.27
Gestation age (weeks) at delivery	92	37.74	2.26
Weight gain (kgs)	92	5.98	2.05
Birth weight of newborn (g)	92	3097.83	489.67

The mean weight of respondents at recruitment was 59.5 kg at ≤ 12 weeks gestation (Table 4.17). The cohort of 21 – 24 weeks gestation had the highest weight (67.4 kg) at recruitment. There is a pattern where weight from the first cohort (59.5 kg) increased as expected for the next cohort (65.2 kg) but then went down at 17 – 20 weeks (58.8 kg) rose up again at 21 – 24 weeks (67.4 kg) only to go down again at 25 – 26 weeks gestation (61.7 kg). The mean weight gain of the women was 5.98 kg (Table 4.16). Most women (63.0 %) gained 5.0 – 7.9 kg during their pregnancies and only 9.9 % gained 10 kg and above in their pregnancies (Table 4.17).

Table 4.17: Weight Gain Categories and mean weights of pregnant women at recruitment

Gestation age (weeks)	Mean weight (kg)	Frequency	Percentage
≤ 12	59.5	09	07
13 - 16	65.2	19	14
17 - 20	58.8	46	34
21 – 24	67.4	38	28
25 - 26	61.7	24	18
	Total	136	100

Weight gain Categories (kg)	Frequency	Percentage
Recomendation ≥ 10	09	9.9
Below recommendation		
8.0 – 9.9	13	14.1
5.0 – 7.9	57	63.0
≤ 4.9	25	27.2
Total	92	100

4.6.2: Birth Weight of New Borne and Other Outcomes

The new bornes attained normal (≥ 2500 gm) and above normal birth weight attaining a mean birth weight of 3097.83 ± 489.67 grams (Table 4.18). Majority of the mothers weighed 50 -59 kg at recruitment. Babies born before 37 weeks gestation were 32.6 % while 67.4 % were born at 37 or more weeks gestation.

Table 4.18: Gestation age and New Borne Birth Weight Categories

		Pregnancy Outcome		Frequency	Percentage
Gestation age at recruitment (n = 136)	at	First trimester (0-3 months)		8	5.9
		Second trimester (4-6 months)		128	94.1
Gestation age at delivery (n= 92)		Preterm Births (<37 weeks)		30	32.6
		Term Births (≥ 37 weeks)		62	67.4
Birth weight of New bornes (n = 92)		Low birth weight (< 2.5 kg)		6	7.0
		Normal and above birth weight (≥ 2.5 kg)		86	93.0
Maternal Weight at recruitment (n = 136)	at	40 -49		2	1.4
		50 - 59		54	39.7
		60 - 69		48	35.3
		≥ 70		31	22.8

Table 4.19 describes pregnancy outcomes by maturity of pregnancy i.e. term births and preterm births. For preterm births the mean gestation age at recruitment was 22.83 ± 2.84 weeks while that for term births was 20.11 weeks. Mean gestation age at delivery was 35.40 ± 1.276 weeks for preterm births category and 38.87 weeks for term births category. Weight gain was 5.37 ± 2.07 kg for preterm births and 6.27 kg for the term births category. Birth weight of new bornes was higher for the term births category ($3.13 \pm .444$ kg) and slightly lower for the preterm category ($3.03 \pm .574$ kg).

Table 4.19: Pregnancy outcome categories by gestation age

Pregnancy Outcome	Preterm		Term	
	Mean (n=30)	Std. Dev.	Mean (n=62)	Std. Dev.
Gestation age (weeks) at recruitment	22.83	2.84	20.11	5.035
Gestation age at delivery (weeks)	35.40	1.28	38.87	1.694
Weight gain (kgs)	5.37	2.08	6.27	1.993
Weight of new borne (kg)	3.030	.574	3.1306	.445

Table 4.20 presents new borne weight according to term and preterm births. Babies born at full term with normal and above normal birth weight were the majority (95.2%). For the preterm births babies born with normal and above normal birth weight were more (90.0 %) than those born with low birth weight. Low birth weight was lower than normal and above normal birth weight for both categories although the preterm category had a higher proportion of low birth weight infants compared to term births category.

Table 4.20: New born birth weight by category of preterm and term births

Category	Birth Weight	Frequency	Percent
Preterm (n=30)	Low birth weight(<2500 g)	3	10.0
	≥Normal birth weight (≥2500g)	27	90.0
Term Births (n=62)	Low birth weight	3	4.8
	≥Normal birth weight	59	95.2

In table 4.21, test for relationship of pregnancy outcomes between means of preterm and term birth categories found significant differences between gestation age at recruitment and gestation age at delivery of preterm and term births (2.020, 9.933 p

≤ 0.05 respectively) but found no significant differences between weight gain and new born weights of preterm and term births (0.923, 0.923, $p \leq 0.05$).

Table 4.21: Relationship between pregnancy outcome means of preterm and term births

Pregnancy Outcome	Means		t	p value	Std error
	Preterm	Term			
Gestation age at delivery (weeks)	35.40	38.87	9.933	0.000	.449
Weight gain (kg)	5.37	6.27	2.020	0.046	.349
Weight of newborn (kgs)	3.03	3.13	.923	0.358	.109

df= 90, $p \leq 0.05$

t value from paired t test

Gestation age was disaggregated according to physical activity factors. For preterm births category, the mean met-minutes/week was 3399.07 ± 319.08 and the median was 3474 met-minutes/week. The two measurements were slightly lower for the term births category that is 3267 ± 487.2 met-minutes and 3390 ± 487.20 met-minutes respectively. The preterm category was involved in slightly higher levels of physical activity than the term category. The vigorous intensity activity (1799.09 ± 251 met-minutes/week), moderate intensity activity (928.71 ± 67.70), total met-minutes/week and walking (661.29 ± 138.78 met-minutes/week) for preterm category were not significantly higher than the term categories of 1714.2 ± 432.21 met-minutes/week, 928.4 ± 77.81 met-minutes/week and 625.33 ± 168.44 met-minutes/week for vigorous, moderate activity and walking respectively. The term birth category spent fewer hours (11.63 hours/day) than the preterm category (12.23 hours/day) on activity daily (Table 4.22).

Table 4.22: Physical Activity Categories of Preterm and Term Births

PA Factor	Preterm		Term	
	Mean	Std. Dev.	Mean	Std. Dev.
Total MET-min/week	3399.07	319.08	3267.60	487.207
Vigorous IA (met-min/week)	1799.07	251.00	1714.23	432.210
Moderate IA (met-min/week)	938.71	67.71	928.04	77.812
Walking (met-min/week)	661.29	138.78	625.33	168.442
Sitting Weekdays (min)	191.07	59.09	191.38	57.168
Sitting weekend (min)	110.46	46.21	112.23	57.144
Daily Hours	12.23	2.24	11.61	2.54

IA* Intensity activities, min - minutes

4.7 Associations between Psycho-educational Nutrition knowledge and Nutrient Intake, Physical Activity and Pregnancy Outcomes

Objective six aimed to find the associations between psycho-educational nutrition initiative and nutrient intake, physical activity and pregnancy outcomes. The associations and determination of hypotheses have been presented in this section.

4.7.1 Effect of Psycho-educational Nutrition knowledge on Nutrient Intake, Physical Activity and Pregnancy Outcomes

In testing for the associations between nutrition knowledge obtained from the psycho-educational initiative, the regression model (Table 4.23), R^2 which is a measure of how much of the variability an outcome is accounted for by the predictors registered a value of 0.722 or 72.2% of variation in effect of nutrition intake on pregnancy outcomes, 0.635 variation in effect of nutrition knowledge on nutrient intake, 0.537 variation effect of nutrition knowledge on pregnancy outcomes and 0.698 variability in effect of a combination of nutrient intake, pregnancy outcomes and physical activity after intervention. These variations are close to 1 and therefore indicate

significant associations with nutrition knowledge obtained from the psycho-educational initiative. Physical activity registered a variability of R^2 of 0.006, nutrient intake at baseline $R^2 = 0.001$ and a combination of nutrient intake, physical activity and pregnancy outcomes at baseline $R^2 = 0.115$ which are not significant.

Table 4.23: Test of associations between nutrition knowledge and nutrient intake, physical activity and pregnancy outcomes

Independent Variable	Independent Variables	R	R²	Std Error
Nutrition Intake p*	Pregnancy Outcomes	0.849	0.722	153.99
Nutrient Intake b*	Pregnancy Outcomes	0.038	0.001	133.145
Nutrition Knowledge	Nutrient Intake b*	0.102	0.010	191.413
Nutrition Knowledge	Nutrient Intake p*	0.457	0.635	134.45
Nutrition Knowledge	Physical Activity p*	0.076	0.006	132.579
Nutrition Knowledge	Pregnancy Outcomes	0.467	0.537	179.21
Nutrition Knowledge	Nutrient Intake p*, Physical Activity p*, Pregnancy Outcomes	0.312	0.698	26.355
Nutrition Knowledge	Nutrient Intake b*, Physical Activity b*, Pregnancy Outcomes	0.039	0.115	22.061

p*- Post Intervention, b*- baseline

In quest of ascertaining the variability of relationships between the dependent and independent variables, ANOVA, was used to assess the overall significance of our model which was tested by the hypothesis below;

The researcher was interested in testing the hypotheses:

HO1: There is no significant effect of Psycho-educational nutrition initiative on nutrient intake among pregnant women in Migori County.

HO2: There is no significant effect of Psycho-educational nutrition initiative on physical activity among pregnant women in Migori County.

HO3: There is no significant effect of Psycho-educational initiative on pregnancy outcomes in Migori County.

Versus

H₁: There is a significant effect of Psycho-educational nutrition initiative on nutrient intake among pregnant women in Migori County.

H₂: There is a significant effect of Psycho-educational nutrition initiative on physical activity among pregnant women in Migori County.

H₃: There is a significant effect of Psycho-educational initiative on pregnancy outcomes in Migori County.

Since the p-value in the model for nutrient intake is $p = 0.001$ and for pregnancy outcomes is 0.032 which are less than 0.05, we reject H_0 , and accept H_1 at 5 % level of significance and conclude that indeed there is a significant effect of psycho-educational nutrition initiative on nutrient intake and pregnancy outcomes of women in Migori County. This effect was contributed significantly by nutrient intake followed by pregnancy outcomes when further tested to determine level of effect by each variable by coefficients in Table 4.24.

Since the p-value in the model for physical activity is $p=0.476$ which is greater than 0.05, we accept the H_0 , and reject H_1 at 5% level of significance and conclude that indeed there is no significant effect of psycho-educational nutrition initiative on physical activity of pregnant women in Migori County.

Table 4.24: Determination of the significance of the regression model as measure of association

Variables		ANOVA		Coefficients		
Independent	Dependent	F	P Value	t	P Value	Std Error
Nutrition Intake(p)	Pregnancy Outcomes	28.12	0.001	15.14	0.001	0.107
Nutrient Intake (b)	Pregnancy Outcomes	0.127	0.723	0.356	0.723	0.4.20
Nutrition Knowledge	Nutrient Intake b*	0.931	0.342	0.956	0.342	7.343
Nutrition Knowledge	Nutrient Intake p*	34.88	0.001	5.906	0.001	1.636
Nutrition Knowledge	Nutrient Intake p*	0.913	0.342	0.956	0.342	7.343
Nutrition Knowledge	Physical Activity p*	0.512	0.476	0.716	0.476	0.107
	Nutrient Intake p*			2.152	0.34	0.006
Nutrition Knowledge	Pregnancy Outcomes	3.064	0.032	1.859	.036	1.016
	Physical Activity p*			0.576	0.566	0.370
Nutrition Knowledge	Nutrient Intake b*	3.682	0.158	0.388	0.699	0.851
	Pregnancy Outcomes			-3.298	0.001	0.310
	Physical Activity b*			1.349	0.001	0.005

$P \leq 0.05$, p*- Post Intervention, b*- baseline

4.7.2 Correlations among Pregnancy Outcome Variables

In Table 4.25 Pearson's Product Moment Correlation showed that among the pregnancy outcomes observed, there were significant associations between weight of newborn and weight gain, weight at recruitment and at delivery (.454, .423, .309, $p \leq 0.05$ respectively) and gestation age at recruitment and weight of new born (.046 $p \leq 0.05$). There were also statistically significant associations between gestation age at recruitment and at delivery (-.393 $p \leq 0.05$), weight gain and weight at recruitment (-.311 $p \leq 0.05$), and weight gain and final weight had some significant associations (-.123 $p \leq 0.01$) although the associations were negative. Gestation age at recruitment (.046) had no significant relationships with birth weight.

Table 4.25: Associations among Pregnancy Outcomes Variables

Pregnancy Outcome	GA at recruitment	GA at delivery	Weight gain	First Weight	Final weight
Birth weight (kg)	.046	.128	.454**	.309**	.423**
GA at Delivery (weeks)	-.393**	1	.169	-.165	-.135

** . Correlation is significant at the 0.01 level/ $p \leq 0.01$

GA- Gestation age in weeks

CHAPTER FIVE: DISCUSSION

5.1 Socio-demographic Characteristics

5.1.1 Level of Education and Occupation of Pregnant Women

The finding on education level and occupation of pregnant women indicates that most women have only a basic education and therefore more effort is required to have more women attain higher levels of education. Most of the women were self-employed with most doing small scale businesses, followed closely by those who were unemployed. This indicates that many of the women do not have adequate income to be able to provide for their basic needs like food, implying that majority may be relying on other sources of income for upkeep.

Spouses were the main providers for their families. According to the Kenya Demographic Health Survey 2014 (KNBS, 2015), women with a primary education (25.5 %) is the same proportion as men (25.7 %) in Kenya. However in this study more men (49 %) have a secondary or higher level of education than women (33 %). The national figure of educational level for women with only a primary education (25.5 %) is much lower than that from this study (48 %). More women in Migori County seem to have attained only a primary education compared to the National figures.

At national level more women have no education (7 %) at all compared to the finding from this study of 5 %. This shows that there is greater attempt in Migori County to have women enrol in school although dropout rates may be high since fewer women than the national level attain secondary and tertiary education from this finding. A study on improved pregnancy outcomes in Western Kenya (Ibrahim, et al, 2014)

found 58 % of the pregnant women to have attained only a primary education. This report compares with this study that found slightly less than half of the women (47.5 %) to have attained only a primary education as well. Although the figure in this study is lower than the western Kenya study.

Kenyan women and especially those of this study population need to be supported to attain higher levels of education. The KDHS 2014 shows that level of education and economic status of mothers determines the overall health of pregnant women and their babies before and after delivery (KNBS, 2015; Mureithi, 2017). Mureithi (2017) continues to reiterate that education together with wealth also determine whether a woman visits a health clinic before and after birth. Increased visits to ANC by pregnant mothers significantly reduced infant mortality rate in Kenya (Mureithi, 2017). Similarly a Sri Lankan study (Adikari et al, 2016) found a low educational attainment among the study participants, more than half (52.6 %) of the participants had attained only a basic education.

The studies continue to state that education level is important in acquiring knowledge and skills for proper nutrition during pregnancy and that education improves the household food security and food consumption practices. According to Rutstein and Kierstein (2004) high levels of education allow increased capacity for home care through knowledge gained. As shown above the report from this study is consistent with those from other studies in poor resource settings, that education attainment of women is generally low.

5.1.2 Household Head, Responsibility for Food and availability of Domestic Worker

In most households mothers made decisions on what foods to prepare, followed by households where fathers made the decision then mothers in law. Others in the household such as father in law, cousin, aunt and uncle made food decisions in some few households. From this finding that food decisions are mostly made by the mothers, empowering women in decision making is critical in helping them make informed dietary decisions for themselves and the household. A Bangladeshi study on women's empowerment, household dietary intake and individual dietary intake found that women with more decision making power may improve their own dietary diversity (Sinhavoy, Waid, Youx, Thusted & Girard, 2017). Hence women in this study need to be empowered to be able to participate in household decision making for the purpose of improving their dietary diversity.

Mothers were mostly responsible for serving food in majority of the households. Other female members of the household such as mother in law, aunt, and cousin were also responsible for serving food in some households. In this study population gender roles require the woman to take up roles of feeding the family; this explains why in most households the pregnant women were responsible for serving food. Culturally when a young woman is married to any family among this population she is required to join her husband's family and be under the care of her mother in law. This may explain why a large proportion of women's households had the mother in law as the one concerned with serving food. Some could have been living with other relatives who were responsible for this action.

Almost all the women did not have domestic workers, only a few had domestic workers while very few indicated unspecified, implying that they may have been living with relatives who were offering a helping hand other than a hired domestic worker. Fathers were the household heads in most households. Characteristics of the household head are important to the living conditions of the household members (Rutstein & Kierstein, 2004). Most fathers were self employed and incomes may not have been so high.

5.1.3 Household Income and Food Expenditure

The largest proportion of women had no information about the amount of income received by their households per month. This may be because the women do not have their own incomes and are supported by husbands or other people who may not share such information with them. Rutstein and Kierstein (2004) states that many people do not know their income or only know it in broad range especially in developing countries because many families have self employed earners and/or home production and costs of goods sold or produced are not recorded, no depreciation is calculated and in the case of retail commerce, some of the goods bought wholesale are used for consumption.

Many different members may be earners and do not share all their income with the rest of the household members or an earner may have several sources of income at one time or during a given period of time and also that the reporting of unearned income is problematic. This argument is supported by the findings in this study where the highest proportion of women did not know how much income their households earned monthly. Even though a considerable proportion of households had a monthly income of above KES 5000, this income may be fully under the control of spouses as

shown in Table 4.1 where most of the women are unemployed and more spouses have a source of income than the women. Men's incomes do not necessarily translate into money for food within the household as observed by several authors (Msofi, 2014).

For some households, income seemed to vary monthly and had also varied for majority of households in the previous six months prior to the study. This means that for most households family income is unstable and even for those who reported that these were their usual monthly incomes, for most of the households; these incomes fluctuated monthly for most women during the previous six months. Rutstein and Kierstein (2004) state that in many households and for many earners, income is variable daily, weekly or even seasonally. Fluctuation of incomes can put the household at positions of food insecurity because they may be unable to cope with economic shocks such as inflation. A Kenyan study on food crisis (Mungai, 2017) found that at the median, household income fluctuated 55 % from month to month and that if the income fluctuated downwards the households would cope by borrowing or making cuts.

The report continues to state that if the households reduced their expenditure on a contractual basis of 50 % it would be cutting the food budget by half both in rural and urban areas. The report indicates that the households were supported by remittances from family and friends working in towns but that without such remittances income fluctuations in rural areas were much higher at 64 %. Our study is consistent with this report where there is much fluctuation in income of the households and because households are forced to cope with these variations, the likely coping strategy would be cutting on the food budget (Mungai, 2017). This may continue to jeopardize the nutrition status of the pregnant women. A Bangladeshi Study (Nisbet, Davis, Yosef & Akhtar, 2017) found that economic status is important for proper nutrition and that

extreme poverty was commonly accompanied by reduced food intake, malnutrition and high morbidity. In times of household crisis poor people reported experiences of cutting back on meals, sometimes eating two meals per day instead of three or opting for cheaper foods while avoiding the more nutritious ones seen as expensive to cut on food expenditure. With this trend, pregnant women's food consumption in this study would suffer disproportionately.

In the households where income was brought in by two people, it seemed the income was brought in by both the women and spouses as indicated by Table 4.1 where most of the women were self-employed. However with the pregnant women's low education levels they would only be involved in low paying economic activities which would not make them contribute much to the household income. According to a Kenyan report on food crisis (Mungai, 2017) median expenditure of Kenyans on food is KES 720 per week and this constitutes 48 % of their monthly income. The Kenyan median is more than that obtained in this study where most of the women's households spent KES 150 -250 per week. This variation could be due to under reporting by this study sample or due to the nature of the study area being a rural area, a certain category of food commodities may be obtained from the farm and their value is not reported as part of the expenditure of food.

In households where only one person brought in income, it may seem that spouses were the sole bread winners as shown by Table 4.1 where almost a similar number as self-employed women were unemployed. Most of the spouses had an income, with some self-employed and others in formal employment. Most of the women may not have known how much income came into the household in a month because where the woman is unemployed, decisions regarding financial resources in the home are handled by the men who are heads of most households and who are also the ones

providing money for food in most households, therefore the decision makers regarding how the money must be utilized (Table 4.2).

Msofi (2014) in a study in Blantyre, Malawi found that among the farming households, men were culturally the heads of their households. Men had control over family resources as well as benefits accruing from family resources. Although both men and women had access to family resources, men were the sole decision makers regarding how income and other farm products would be used. Msofi's (2014) finding confirms the argument from this study that men are the household decision makers and also control household resources.

Most household incomes were not high. This may be because both women and husbands were engaged in small scale businesses or odd jobs explaining further why most of the incomes varied during the six months prior to the study. About 30 % of the spouses and 5 % of the women were in formal employment where incomes are likely to be stable. But these proportions are low therefore the women's households may not be considered to have stable incomes that can cushion them from household food insecurity under the current economic instability in Kenya (Mungai, 2017).

Most of the households spent KES 150 – 250 for food in a week. This figure is practically too low for food expenditure in a week and may imply that these households obtain part of their food supplies from the farm and only buy food needed to supplement what is already available. According to ADP (2014) majority of rural poor depend on subsistence farming for survival. It enables the family to be self sufficient in terms of food and nothing needs to be purchased or borrowed from another source. Mungai (2017) states that the precarious situation of poor households is usually not well understood and that from a Financial Sector Deepening Kenya

report (FSD-Kenya) traditional ways of reporting the poverty line like income of KES 200 a day mask the fact that ends are made from a much more underlying complicated pattern.

It may also mean that some food items are purchased in bigger quantities and only a few items are purchased to add to the stock that is already in the home. These findings may also imply that the pregnant women's households were living under a bare minimum of their food requirements. A new study titled Spatial Dimension of Well Being in Kenya by KNBS (Omondi, 2017) reports that nearly half (45.2 %) of Kenyans are poor, wallowing in abject poverty and can barely afford the bare minimum (basic food basket and non-food items). The report indicates that the poverty situation is worse in rural areas and that efforts to contain poverty are not bearing fruit. Data from the Financial Sector Deepening Kenya (FSD-Kenya) report describes how close to the margins most Kenyans live, with dramatic fluctuations month to month (Mungai, 2017). Where the women did not know how much money was spent on food in a week, it could mean that the woman does not play a role on matters of food budgeting because she lives with another woman e. g. mother in law who plays this role as shown in Table 4.2 where mothers in law, aunts and cousins make decisions regarding food consumption within the household.

5.1.4 Housing Characteristics of the Women and Source of Drinking Water

Traditional houses were grass thatched or corrugated iron roofed and mud walled with mud floors. Other types of dwelling were houses made of iron sheet walls with earthen or cemented floors. The proportion of those living in brick houses is high because some may have resided in rented houses. Majority of the women's households were made up of between three and four members. Few households had

five to six members and the least households had seven to eight members. This may both be a disadvantage and an advantage to the pregnant women. It can be an advantage in the sense that if the household members are many, they may provide the required workforce to carry out domestic activities and therefore enable the mother to attain more rest. In most households the highest number of people sleeping in any one room was up to two people.

This is advantageous because having several people sleeping in a room is thought to be related to increased transmission of respiratory illnesses (Rutstein & Kierstein, 2004). This sample of pregnant women is therefore not predisposed to respiratory tract infections in their households according to this argument. According to FAO (2005) household size is one of the important determinants of poverty in Kenya. Therefore a large household may be an indicator of poverty for the women's households contributing to reduced intake of adequate amounts of food by the pregnant women.

Many members in the household can be disadvantageous when the family does not have enough income to provide adequate food to all its members. This may translate into pregnant women not receiving adequate nourishment because the food available must be shared out to all members. Migori County has an average household size of 4.7 while the national household size is 4.4. Both the Migori (4.7) figure and the national figure (4.4) are close to the finding in this study (3 – 4) (Kenya Interagency Rapid Assessment (KIRA), 2015).

Most women used wood as fuel for cooking. The use of wood as a main fuel may increase the women's workload because the wood must usually be gathered from nearby bushes and then carried home. The use of wood fuel by majority of the

women does not also promote good health of the pregnant women. It can put the women and their unborn babies' health at risk. A Kenyan profile and WHO report shows that the highest (84 %) risk factor for preterm birth is solid fuel used for indoor cooking (Omondi, 2017). Another Kenyan report by Ojina (2019) lists the use of unclean fuel as one of the risk factors for preterm birth. The women in this study may be at increased risk of preterm births given this reports. Actions need to be put in place to reduce their use of wood fuel and other solid fuels.

Most women have to ferry their water from the water source to their homes meaning that more physical work must be performed by the women. The KDHS 2014 (KNBS, 2015) found that there was an improvement in the number of Kenyans with access to improved water sources (71 %) compared to other years before the study. Close to 70 % of women's households in this study obtain their drinking water from river, well, spring or a combination of two of these. This may not suggest an improvement especially if the water obtained is not treated. A recent Kenyan study by Muchemi, Echoka and Makokha (2015) found more than half of the pregnant women (52 %) to obtain water from the well unlike in this study where about half of the women (50.4 %) obtained water from the river and only a small proportion (about 19 %) got water from the well.

Almost all women's households owned a toilet. The availability of toilets for almost all the pregnant women's households is an indication of good sanitation and hygiene being practiced; therefore the women's health may not be at risk of illnesses arising from improper hygiene and sanitation practices. According to KDHS 2014 (KNBS, 2015) one out of four or 25 % of households have access to improved and not shared sanitation facilities. Our finding confirms this report but is much higher than the national figure because our data show that over 75 % of women's households own a

latrine. Safe sanitation defined as access to private or shared toilets or ventilated improved pit latrine is important for good health outcomes (Rutstein & Kierstein, 2004).

Most women's households belonged to the lowest wealth quintile. Wealth index is the easiest measure of economic status to collect and produce superior, more believable result and greater distinction in health outcomes. It is useful in assessing the reach of populations to health services (Rutstein & Kierstein, 2004). From the finding in this study, more than half of the women belonged to low socio-economic status. They may not be predisposed to services that improve their wellbeing. Socioeconomic wellbeing of pregnant women is an important determinant of nutrition outcomes.

In Kenya, both median and modal values are below the mean in the distribution of wealth index (Rutstein & Kierstein, 2004). The finding from this study where over half of the women belong to the lowest and second lowest wealth quintiles support this report. The findings in this study also support the argument that rural areas are mostly inhabited by poorer households and that the richest households live mostly in urban areas. Fertility levels and contraceptive use vary substantially by wealth as does, use of health services and knowledge (Rutstein & Kierstein, 2004).

In a Bangladesh's story of change in nutrition, a study (Nisbet et al, 2017) found out that education of women, economic growth, reductions in poverty and increases in household income were the strong drivers of change according to several stakeholders. Specific programmes for awareness around women's rights and empowerment issues were thought to have contributed to positive change in women's status. Bangladesh's falling fertility rate both a driver and an outcome of all the changes to the status of women was mentioned by all the respondents as having one

of the most significant effects on nutritional status. The women in this study therefore need to be empowered economically to place them in a platform for positive nutrition change.

5.1.5 Parity of the Pregnant Women

The finding from this study shows that a substantial number of the women had not had a previous birth. The pregnancy under study was therefore their first pregnancy. Half of the women also had between one to three births. This higher number for none and few births is advantageous to the sample under study because it indicates that there may be little burden on the mother caused by too many or very frequent births if the mother's age falls within the acceptable levels for child bearing. For these women it may have been easy to achieve proper nutrition because the mother was likely to have enough time to recuperate from a previous birth or that the mother's body had not carried a pregnancy before, therefore was at its best to carry a pregnancy with adequate nutrition support.

It is unlikely therefore that parity may have had an effect on pregnancy outcomes. However factors documented to have significant influence on low birth weight in Kenya include birth order, with the first order births having the highest influence and second to fifth order with the smallest influence (Migwi, 2012). This argument may require further research to be able to isolate the effects of parity on birth outcomes. According to The Kenya Demographic Health Survey (2014), nationally Kenyan women give birth to an average of 3.9 children while the women in rural areas give birth to 4.5 children (KNBS, 2015).

The finding from this study is a mean of about one child per woman indicating that fertility rate in this sample is much lower than the national rural mean as well as the

actual mean for the entire country. It may also imply that the women may have just started having children as shown by the higher proportion of women being those with no children at all. In Migori County where the study was carried out, the number of births for each woman is 5.3. This is much higher than the National average (3.9), Nyanza region average (4.3) as well as national rural area averages (4.5) and also much higher than the figure obtained from this study (1.0). The reason for this big difference could be due to the explanation given above for the sample under study. Parity obtained from this study may therefore not be generalized to the entire population.

5.2 Pregnant Women's Health and Nutrition Knowledge and Practices

5.2.1 Pregnant Women's Health Conditions

The pregnant women had been in a good state of health during the year preceding the study; therefore their nutritional status may not have been compromised by infection. The Kenya Government Policy of intermittent preventive treatment (IPT) of pregnant women in malaria endemic areas and the wide spread use of insecticide treated mosquito nets to reduce the risk of malaria may have contributed to the low levels of infection among the pregnant women. Migori County has one of the highest rates of IPT use (51 %) and Nyanza region where the study area falls also has one of the highest proportions of mosquito net use in Kenya ((KNBS, 2015). This may support the reason for low infections among the women.

Migori County is a Malaria endemic region and therefore pregnant women in this study area have an increased risk of malaria during pregnancy. It is impressive that despite this fact almost all the women had no disease incidence during the specific pregnancy and the small proportion with ailments suffered lifestyle diseases (6.2 %)

which may not have had any effect on the growing foetus. Only a very small proportion suffered infectious diseases i.e. pneumonia and TB. A study by Siza (2008) found that illness during pregnancy were significantly associated with low birth weight. In Kenya quality of ANC measured by time of visit and frequency of visits which translates to reduced infection has a significant influence on low birth weight (Beritian, Meseret & Nuru, 2011).

As part of the pregnant women's health care at the ANC the women are closely monitored for any illness and all cases treated as per the guidelines of Kenya Ministry of Health (MOH, 2015). All the women under study had a minimum of 4 ANC visits and this may have contributed to increased contact with health care personnel to necessitate early screening of illness. These actions may have led to the low prevalence of disease in this cohort. According to the Kenya Demographic Health Survey 2014, one of the highest proportions of women receiving at least two doses of SP/Fansidar in Kenya were concentrated in Nyanza (44 %) the region where the study area falls among other regions.

Among the Counties, Migori had 51 % of women receiving at least one dose of SP/Fansidar at least once during their pregnancy (KNBS, 2015). Increased efforts are significantly reducing the malaria burden in many places and the UN has noted that the government of Kenya supported by strong partnerships has continued to scale up interventions against malaria saving the lives of many children and pregnant women (MOH, 2015). This may further explain the reason why most pregnant women enjoyed good health.

A study that was done in Nepal to explore the drivers of maternal and child nutrition success, found that there was a substantial reduction in fertility and longer intervals

between deliveries (Cunningham, 2017). Changes in improved water sources were modest. There were significant associations between nutrition outcome improvement and asset index, parental education (especially maternal) and fertility. Nepal has made significant progress in reducing maternal undernutrition since the 1990s. Their study confirmed that most of the maternal nutrition improvements are due to four main factors; improved access to health services especially during pregnancy, increased coverage, use of toilets, improvements in the levels of education especially for mothers and wealth accumulation. The study did not find any change in dietary diversity (Cunningham, 2017).

In our study, levels of education of mothers is still very low with more than half of the women with only a primary education among whom there are those with no formal education. For any substantial results to be observed in improvement of nutrition outcomes among pregnant women in this study area, other nutrition sensitive initiatives such as education attainment and quality health care need to be improved for this target group. Toilet use in this study was high with only 1 % reporting no availability of a toilet. However, all households need to be encouraged to own a toilet as the use of toilets is related to improvement of nutrition among pregnant women as observed from the Nepal study (Cunningham, 2017).

The sample of pregnant women under study did not have health conditions affecting their food consumption and this may have contributed to the women obtaining proper nourishment. Majority of the women had consumed the usual food portion indicating that the mean nutrient estimates obtained from the study may be assumed to be their normal daily intake during the pregnancy. Even though the pregnant women had nutritional complaints, most of them did not have health conditions related to food consumption. The food intake of these women was therefore not possibly affected by

such conditions and so were in a position to eat normally. However, for the small group that had health and pregnancy related conditions interfering with their eating, measures need to be put in place to ensure optimal feeding by such women to ensure their food intake is not compromised.

A recent Kenyan study by Muchemi et al, (2015) found that although some women (15.8 %) had increased their food intakes as a result of nutritional counselling, the main nutritional complaints were nausea and vomiting (36.7 %), heartburn (27.8 %) and poor appetite (19.3 %) which made a considerable proportion of the women (27.8 %) to avoid food. From the two studies it seems the main complaints by pregnant women is nausea and loss of appetite. If uncontrolled these conditions can interfere with food intake and therefore affect the nutritional status of the pregnant mother and the unborn baby. In this study the pregnant women need to be treated for these two pregnancy related conditions so that their food intake is not interfered with.

About half of the pregnant women had a food craving. Food craving can be a good way to meet adequate intake of certain nutrients if the food craved for is rich in essential nutrients. The women in this study craved mostly for fruits and vegetables followed by grains and cereals. This may have helped the women to obtain higher amounts of micronutrients and higher amounts of calories from the foods craved for respectively. Craving for these particular foods may have also contributed to the women's higher consumption of foods in the vegetable and cereal food groups. Pregnant women therefore should be encouraged to satisfy the craving as long as the item craved for is not a non-food item considering the setting where these women live.

Ward (2014) stated that hormonal shift during pregnancy intensify sense of smell which affect taste. This is powerful enough to affect food choices. According to Ward (2014), foods women tend to crave for are in fact good choices but they should avoid foods considered health risks for pregnant women no matter how strong the craving. A study done in Tanzania found that in different cultures, women crave foods based on what is locally available. Most women craved for meat (23.3%), mangoes (22.7 %), plantain (15.3 %) and soft drinks (13.3 %) which are local foods. In the USA common cravings are for dairy, sweet foods, chocolate, fruits and juices (Manejwala, 2013). This is consistent with the findings in this study since the foods craved for by women are local foods. Medline Plus (2017), however, states that it is fine to have some of the foods craved for as long as the woman is getting all the nutrients needed by the unborn baby.

5.2.2 Pregnant Women's Nutrition Knowledge and Practices

More women reported to have increased rest during their pregnancy implying that those who had earlier felt that a pregnant woman should not rest more may have changed their attitude and behaviour after the encounter with the psycho-educational nutrition initiative. Most of the pregnant women had some dietary knowledge acquired during the intervention as shown by the high proportion of women who applied the nutrition knowledge obtained. From the nutrition knowledge scores more than half of the pregnant women had acquired high nutrition knowledge after the intervention and almost all the women had acquired acceptable nutrition knowledge levels (Table 4.6).

Nutrition knowledge and practices that were tested before and after the intervention (having a positive attitude on increased food intake in pregnancy, positive attitude on

more rest during pregnancy, having increased rest during the pregnancy and having observed hygiene practices during the given pregnancy) showed significant improvements after intervention. Presence of problem preventing eating, hand washing before meals and food craving had no significant associations at baseline and after intervention (Table 4.7). A study on nutrition knowledge of caregivers and dietary practices of children in Kajiado, Kenya found caregivers to have minimal knowledge on nutritional issues with more than half of the caregivers having very low nutritional knowledge scores.

The study found significant relationships between knowledge score and dietary practices (Chege & Kuria, 2017). These findings compare well with that obtained from this study. Proportion of women who wash their hands before eating was however lower than the Migori County figure of 96.9 % (KIRA, 2015). The variation may be due to the nature of the data collection in this study where the women were required to give information on hand washing at all instances of eating even if only a light snack was taken while the Migori figures may have been obtained from questionnaires requiring women to indicate hand washing only during the major meals. An Algerian study (Taleb, Kaibi & Deghboud, 2011) observed that pregnant women's nutrition knowledge was not quite perfect and recommended for nutritional counselling of the pregnant women.

A study conducted in Nepal in 2016 on knowledge on dietary patterns among pregnant women attending ANC checkups in Narayani hospital found that more than half of the women (59.3 %) had moderate knowledge on nutrition and concluded that although all had some sort of knowledge on nutrition, there was lack of sufficient knowledge on dietary patterns and some had wrong perceptions about food intake during pregnancy just like in this study and recommended awareness programs and

health education to develop positive attitudes (Shah et al, 2017). Another study in Dindigul (Usharani & Hepsiba, 2017) on effectiveness of structured teaching programme on diet in terms of knowledge, attitudes and practices observed that there was a significant improvement in knowledge, attitude and practices among mothers after the teaching programme.

A nutrition education conducted at community level hospitals and area health centres contributed to positive health behaviour modifications (Dunneram & Jeevon, 2015). The nutrition focused maternal nutrition counselling program in Bangladesh significantly increased the proportion of pregnant women who received information on eating five food groups during pregnancy (Nguyen, et al, 2017). These observations confirm the important role that nutrition education is able to play in improving the nutritional health of a pregnant woman. The Linkages Project (2001) indicates that improving maternal nutrition partly depends on changing maternal behaviour patterns which can only be achieved through nutritional counselling. Nutrition knowledge and practices improved after the intervention in this study group indicating that nutrition education can be used to successfully improve pregnancy outcomes.

5.2.3 Haemoglobin Level of the Pregnant Women

The finding from laboratory analysis of haemoglobin level suggests that most pregnant women in this cohort had normal Hb levels and only a few could be indicated for mild anaemia. A recent Kenyan study by Muchemi et al, (2015) found a Hb level among pregnant women to be 12.6 ± 1.2 g/dl implying normal Hb levels for the study group. This is very similar to the finding of 12.25 ± 1.2 g/dl indicating similarities in maternal factors in the same country set up. A Sri Lankan study

(Adikari et al, 2016) found mean Haemoglobin level of participants to be within the normal range (>11 g/dl) and 2.5 % had moderate anaemia (7 – 9.9 g/dl).

This study compares well with the present finding of about 6 % of the participants being anaemic and may confirm the prevalence of iron deficiency in developing countries. The high proportions of pregnant women with normal Hb level may be due to regular attendance at ANC and compliance with intake of nutrient supplements given at the clinic such as iron and folic acid supplements as well as antihelminthes that reduce prevalence of parasitic infections among pregnant women. Almost all women reported to have complied with intake of medication given at the ANC (Table 4.7).

In an Algerian study (Taleb et al, 2011) the prevalence of anaemia was much higher (26.67 %) than that from this study (6.3 %). Other studies in developing countries reveal almost similar findings to this study and others reveal much higher figures than the Algerian study (Taleb et al, 2011). The mean Hb level in the Algerian study (Taleb et al, 2011) was 11.84 which again is lower than the Hb mean observed in the present study. This shows that the Hb status of pregnant women in the Algerian study is lower than in this study. It can be implied that the Hb status of pregnant women in Migori County is not alarming although efforts to completely eradicate mild anaemia would be beneficial to the fight against poor pregnancy outcomes. However given the small sample size used for the analysis, this finding may not be generalized to the entire population of pregnant women in Migori County.

5.2.4 Number of Meals Consumed by Pregnant Women in a Day

From the report on number of meals consumed in a day collected during the 24 hour recall, the women had increased the number of meals they ate after the intervention

propelled by the knowledge they had acquired from the psycho-educational nutrition initiative. At baseline the women consumed an average of three meals in a day but after the intervention this increased to four meals a day. Pregnant women are required to increase the number of meals eaten in a day by at least one meal and this seems to have been followed by the women after the intervention. Before the intervention, most women did not increase the number of meals they ate in a day meaning that they ate three meals in a day, suggesting that the women did not have knowledge on pattern of feeding required for an expectant mother.

In a Malawian study majority of pregnant women increased the number of meals they consumed in a day after nutrition education programme (Hjertholm et al, 2017). A study on the effect of behavioural counselling on patients' consumption of fruits and vegetables in adults from a low income setting found that at post intervention fruit and vegetable intake increased by 1.5 and 0.9 portions per day in the behavioural and nutrition groups. An increase in the number of participants eating 5 or more portions a day was reported in both groups (42 % and 27 %) (Steptoe, Perkins, McKay, et al, 2003).

Nutrition focused maternal nutrition counselling programme in Bangladesh significantly increased the proportion of pregnant women who received information on eating five food groups during pregnancy. Women in the intervention group consumed 1.6 more food groups, had higher increases in the proportion consuming high nutritional value foods such as pulses and consumed greater quantities of food than women in the comparison group (Nguyen, et al, 2017). These findings are consistent with the findings from this study where participants increased the number of meals consumed in a day as well as intake of fruits and vegetables.

After being exposed to the psycho-educational nutrition initiative, about half of the participants in this study increased the number of meals they consumed in a day to four and five. The finding at baseline of most women consuming three meals a day is consistent with a Migori County Fact Sheet that reports meals consumed by WRA to be two to three meals a day (KIRA, 2015). This also implies that the pregnant women did not increase their frequency of food consumption much before interaction with the psycho-educational nutrition initiative. However, after the intervention food intake frequency increased to four for most women and even five for others. This suggests that nutrition education can be used to increase frequency of food intake by pregnant women in Migori County.

5.2.5 Distribution of Foods Consumed by Pregnant Women according to Food Groups

At baseline vegetables was the most consumed followed by cereals, grains and starches, after the intervention the same food groups were mostly consumed but the frequencies of consumption reduced. Consumption of fish, meat, eggs and dairy products went up after the intervention but consumption of beverages and oils and fats reduced. Odiwuor et al (2013) in a study on dietary intake in the same study area found that pregnant women consumed mostly carbohydrate rich foods followed by protein rich foods then vegetables. A Migori County Fact Sheet (KIRA, 2015) also reports that grains was the most consumed followed by green vegetables.

This study finding presents a slight variation from the two previous findings (Odiwuor et al, 2013; KIRA, 2015). The pattern seems to have changed slightly as the women consumed mostly vegetables followed by cereal grains and starches at baseline. The reduction in consumption of vegetables and cereal grains and starches after the

intervention may be attributed to increased intake of food from other food groups such as meats, fish, eggs and dairy products. Increased intake of fruits, meats, fish, eggs and dairy may indicate that the women's diet had become more diversified and included all food groups at proper quantities unlike before when intake of only two food groups that is, cereal grains and starches and vegetables was dominant. Intake of fats and oils and beverages reduced after intervention.

The associations between frequency of consumption of meats and poultry, fish and fats and oils and beverages at baseline and post intervention were not significant while frequency of consumption of cereal grains and starches, eggs and dairy products, vegetables and fruits, at baseline and at post intervention were significant. Implying that there were significant variations which were either positive or negative in intakes of cereal grains and starches, eggs and dairy products, vegetables and fruits before and after intervention. Frequency of consumption of meats and poultry, fish, beverages and fats and oils did not vary significantly at baseline and after intervention. According to a FAO fact sheet (2012) the recommendation for pregnant women is a minimum of five food groups that is, grains, fruits, vegetables, protein rich foods and dairy products with less intake of fats and beverages.

The beverages consisted mainly of tea and caffeinated soft drinks which are poor in nutrients. Reduction in consumption of beverages was therefore a sound practice according to FAO (2012) and Pestoa, Meudes, Gomez, Martins and Menendez (2016). The women seem to have gained some nutrition knowledge and skills that enabled them to acquire sound feeding practices. An Indian study which obtained positive pregnancy outcomes observed that pregnant women had reasonable intakes of milk, poultry, meat, fish, eggs and beans (Madan, et al, 2017). This confirms the

necessity of adequate consumption of all nutrients and especially protein rich foods during pregnancy.

5.3 Nutrient Intakes of the Pregnant Women

Out of the nutrients that were analyzed, only zinc, vitamin A, carbohydrate and fiber intakes were above RDA at baseline. After the intervention percentage of RDA went up for all nutrients except that of energy, folic acid, calcium and iron intake which had increased but were still below the RDA. Intake of zinc, vitamin A and carbohydrate were above RDA at both baseline and after the intervention. Percentages of RDA for folic acid, iron and calcium at baseline were less than average and only percentage of RDA for iron managed to rise to slightly above average after intervention (Table 4.10). A few of the women managed to meet the RDA requirement for folic acid and iron at baseline but surprisingly after the intervention all the women had intakes below the RDA.

This finding on iron and folic acid intakes confirms that diets of women in poor settings are usually deficient in iron and folic acid. Becquaey, Martin & Perel (2010) states that the diet of populations in developing countries cannot meet all of the iron requirements of pregnant women especially those who begin pregnancy on low reserves. This may explain why iron intake was below the RDA even after the intervention for many women. However most of the women were not iron deficient, their serum iron levels may have been boosted by the iron and folic acid supplements given at the ANC during each visit.

Intake of nutrients below RDA can be a risk factor for nutritional deficiencies. According to Becquaey, Martin & Perel (2010) deficiencies in iron, vitamin A, calcium and folic acid among others can lead to increased risk of low birth weight and

preterm births as well as foetal deaths. The proportion of preterm births in this study was considerably high and this may have been contributed by the low intake of several micronutrients even after the intervention. Vitamin A, carbohydrate, fiber and vitamin C had positive and significant differences between their means and the reference values at baseline ($P \leq 0.05$). Energy intake, folic acid, calcium, zinc and iron had no significant differences between their means and reference values ($P \leq 0.05$) implying that most nutrient intakes were lower than the reference values at baseline.

Carbohydrate, protein, vitamin A, fiber and vitamin C had positive and significant differences while energy, folic acid, calcium, zinc and iron had no significant differences between their means and the reference values ($P \leq 0.05$) at post-intervention. These findings suggest that intakes of carbohydrate, vitamin A and vitamin C were close to the reference values while intakes of energy, protein, folic acid, calcium, zinc and iron at baseline were significantly lower than reference values.

Intake of carbohydrates, vitamin C, and vitamin A were different and intakes of energy, protein, folic acid, calcium, zinc and iron were close to the reference values at post intervention. Therefore more nutrients had intakes close to RDA after the intervention. The findings from this study on nutrient intakes at baseline are consistent with those obtained by Odiwuor, et al (2013) in the same area of study that found intake of all nutrients except vitamin C and fiber to be below RDA. However intakes after the intervention were above RDA for most nutrients indicating that the situation of nutrient intake in this study area had not changed but that the nutrition education may have improved intake of nutrients among the pregnant women in this study.

These findings support the Kenya Situation Analysis Report that micronutrient deficiencies are common among pregnant women and under-fives and specify that vitamin A, zinc, iron and iodine deficiencies are the most prevalent (GOKMOPHS, 2011). A Malawian study (Hjertholm, et al, 2017) found that the percentage of women who had consumed animal protein foods rich in essential micronutrients was quite low and was reflected in their finding that more than half of all participants were at risk of inadequate intake of most micronutrients. This compares well with the findings from this study with findings of inadequate intake of several essential micronutrients.

A Sri Lankan study (Adikari, et al, 2016) found a mean energy intake of 2472.02 Kcals, protein intake of 74.19 g and vitamin C intake of 71.44 mg. These intakes were above the RDA while iron intake (16.52 mg), calcium intake (844.95 mg), folic acid intake (420.90 µg) and vitamin A intake (525.77 µg) were all below the RDA. Similarly this study found iron, calcium and folic acid to be below RDA both at baseline as well as after intervention. Vitamin A was above RDA for this study at both baseline and after intervention. However, energy, protein and vitamin C intake were below RDA at baseline but protein and vitamin C intake increased to above RDA after the intervention. These findings show that even with nutrition interventions in place, it may still be difficult to attain the recommended intakes for pregnant women in rural areas of developing country set ups.

Previous studies have shown that the effect of consuming different foods on birth outcomes varies according to the stage of pregnancy as tissues and organs go through different timings for rapid development. The effect of nutrient deficiencies on foetal growth will differ depending on the time they occur (Bloem, 2013) e.g. third trimester is the time of most rapid weight gain of the fetus, other foetal outcomes like foetal

length gain peaks before this period. A study on Maternal Dietary Intake during Pregnancy and its Associations to Birth Size in rural Malawi (Hjertholm, et al, 2017) found that more than 50 % of the women had intakes below RDA for most nutrients. This compares with this study where there was inadequacy for some nutrients such as energy, folic acid, iron and calcium.

Energy intake, protein, fat, carbohydrate, fiber, vitamin C, calcium, iron and zinc at baseline and at the end of the intervention had a positive and statistically significant difference between their means at $p \leq 0.05$. Only vitamin A intake had no significant difference between its mean at baseline and after intervention indicating that there were major positive changes in intakes of these nutrients except vitamin A. There is a difference between the two findings however since for the Malawian study (Hjertholm, et al 2007) all the nutrients did not meet RDA while in this study only five out of eleven nutrients failed to meet the RDA after intervention. Mean energy intake (2096 kcal) was slightly lower than energy intake for this study (2158 Kcal). These study findings underscore the important benefit which nutrition policies directed towards food based approaches can produce even in situations where resources are scarce. Although food security may not be ensured, it can still be practical to promote an optimal diet based on local foods to ensure adequate foetal growth.

5.4 Physical Activity Levels of Pregnant Women

There were slight reductions in the means of total met-minutes/week, vigorous intensity activity and daily hours after the intervention. The entire physical activity factors median reduced except for sitting over the week days that increased. However moderate intensity activities increased suggesting that while the women reduced their

vigorous intensity activities, they increased their moderate intensity activities in order to make up for the physical work requirements. Many of them did not have domestic help. According to Puja, Chanda and Morab (2017), many women in rural areas carry out heavy activities in their households, in agricultural activities and in their reproductive roles. All women carry out their household activities alone or with the help of family members.

However, they reduce their farm activities and involve themselves more in household work. They found 48 % of women to have been involved mostly in moderate intensity activities and only 34.7 % to have been involved mostly in vigorous activities. This pattern is consistent with the finding from this study. Walking and sitting on both week day and weekend increased as well. There were no significant differences in the means of the physical activity factors at baseline and after the intervention (Table 4.14). This implies that the physical activity at baseline was similar to that after intervention indicating that women did not have a significant reduction in their workloads during their pregnancies in the study.

A study in Buchi Nigeria found that 80 % of pregnant women continued to do heavy work even in the last trimester and in Cross River about half of the pregnant women continued with their heavy workloads (Nigeria Information & Planning Systems (NIPS), 2013). Dwarkanath, et al (2007) state that physical activity is an important factor during the antenatal period since women have variable physical activities at work outside the home as well as domestic chores in the home. They found that physical activity in the first trimester of pregnancy is an important factor in determining birth weight in Indian babies.

When disaggregated according to term and preterm births, the findings show that the

term birth category spent fewer hours (11.63 Hours/day) than the preterm category (12.23 hours/day) on activity daily, implying that they may have had more rest. This is confirmed by the finding that term birth category spent slightly more hours on rest on both weekdays (112.23 minutes/week) and weekends (191.38 minutes/week) than the preterm category. The median activity factors were also higher for preterm category except for sitting on weekdays and weekends where the median figures were the same. However, the women did not reduce their activity levels much.

A study on influence on maternal physical activity on infant's body composition (Bisson, et al, 2016) found that in women performing ≥ 90 minutes per day of vigorous intensity, physical activity was associated with a significant decrease in birth weight compared with those with no vigorous physical activity. A study on physical Activity and pregnancy outcomes (Ahlborg, 1995) also found that strenuous work had a negative effect on gestation age, birth weight and spontaneous abortion. These findings support the hypothesis that high physical activity can be a risk factor for poor pregnancy outcome.

Most women had lower total met-minutes weekly compared to those who had higher total met-minutes than the median. There were more women who had higher vigorous intensity activity levels as well as moderate intensity activity levels weekly than those who were below the median for each category. The values indicate that more women had high levels of vigorous as well as moderate intensity activities than the median. More women had lower walking levels than median compared to those who were above the median. Ahlborg (1995) states that long hours of walking seem to increase the risk of preterm delivery. It is therefore imperative that pregnant women reduce hours spent on walking. More women walking less in this study group is important for their positive pregnancy outcomes.

For all categories of sitting and the hours spent daily on activity, more of the women had levels above median showing that the amounts were high for most women. In the community where the study took place subsistence farming is the main economic activity and women engage in labour during pregnancy with only small inter-individual variation of physical work as shown in Figure 4.7, where most women are hepa-active (≥ 3000 met-minute/week). This finding is consistent with those obtained by a similar study in the same region on physical activity that found pregnant women to be involved in vigorous activity throughout their pregnancy (Odiwuor, et al, 2013). Most of the women were Hepa active at both baseline and post-intervention with slight reductions in high activity levels and slight increase in sufficient activity at post-intervention.

Minimally active category is more than the minimum level of activity recommended for adults in current public health recommendations. Hepa active category exceeds the minimum public health physical activity recommendations although there is no consensus on the exact amount of activity for maximal benefit (IPAQ Research Committee, 2004). Women attain numerous benefits from physical activity. During pregnancy, however, due to physical changes that occur during pregnancy and also due to inadequate energy intake among women in developing countries special precautions are needed.

WHO guidelines recommend that adults should engage in at least 150 minutes of moderate intensity activity throughout the week or 75 minutes of vigorous intensity activity or equivalent combination of the two (Evenson, 2014). Most Country guidelines support moderate intensity physical activity during pregnancy. Reductions in Vigorous intensity activity and increase in moderate intensity activity may be beneficial to this sample under study although the time they engage in activity in a

day (12.21 and 11.33 hours at baseline and post-intervention respectively) is way above the recommendations.

The women in this study need to reduce their activity levels because this is one way of improving their nutritional status and thereby increasing birth weight and gestation age. Mostly in pregnancy, reducing activity levels can help meet energy needs. Reducing physical activity can be one of the adaptive strategies that can be used by pregnant women to meet the additional demands of pregnancy and therefore sustain the pregnancy under sub optimal nutrition (MoH, Wellington, 2008). A study in Ethiopia showed that pregnant women who engaged in low levels of activity gained more weight and gave birth to infants with higher birth weights than those who engaged in heavy activities even though they all had similar intakes of energy (Linkage, 2001). The findings from this study that found women to reduce vigorous intensity physical activity but increase moderate intensity physical activity in late pregnancy is consistent with a study on influence of maternal physical activity on infant's body composition by Bisson, et al (2017) that found 48.1 % of women to be engaged in vigorous physical activity at 17 weeks gestation and only 17.6 % doing so at 36 weeks gestation.

In this study the women did not reduce their activity levels even after the psycho-educational nutrition initiative. Some women felt that there was no need to reduce activity levels before the education programme (Table 4.7). Factors beyond the women may have compelled them to continue with their heavy physical activity such as unavailability of domestic help, lack of employment as observed by most of the women being unemployed and low income levels that may not have guaranteed the women money to hire domestic help. Other strategies may therefore be required to help the pregnant women reduce their physical activity levels. Evidence is sufficient

to warrant the maximum protection of pregnant women to heavy physical work according to Occupational Med (2006). Ahlborg (1995) also emphasizes that heavy work duties should be avoided and enough rest periods ensured especially in late pregnancy.

National Academy of Sciences and National Research Council of the Academy of Sciences (IMNRCNA), (2009) states that unlike food intake which is usually underreported, physical activity tends to be overestimated and activities of one kind may cause a reduction in activities of another. Therefore there is a chance that findings from this study may have been overestimated and that levels of activity may actually be lower than obtained. It is important to note however that in such poor economic settings the women must usually continue with heavy activity given the lifestyles imposed on them by their socio-economic conditions.

5.5 Pregnancy Outcomes of Pregnant Women

5.5.1 Gestational Weight Gain and Ante-natal Care

Women who were in their first trimester of pregnancy were very few while those who were recruited in their second trimester were the majority (Table 4.17). This confirms the findings that most pregnant women begin attending antenatal clinic during their second trimester of pregnancy hence the huge proportion of women recruited in their second trimester of pregnancy. In this study more than half (67 %) of the women recruited delivered at a health facility. According to Migori County Health Profile, 47.2 % of deliveries take place in a health facility which is higher than the Kenyan figure of 44 % (KIRA, 2015). The figure from this study, is however higher than the Migori proportions as well as the national figures. The Western Kenya study on improved pregnancy outcomes (Ibrahim, et al, 2014) had 83 % of the pregnant

women delivering at a health facility. This is far much higher than the finding from this study.

The weight gain obtained was less than the recommendation according to Institute of Medicine (IOM) (IMNRCNA, 2009) where inadequate weight gain is <12.5 kg in underweight women, <11.5 kg in normal weight women, and <7 kg in overweight women. Very few women (9.9 %) managed to obtain a gestation weight gain of above 10 kg which is close to the recommendation. Most women however obtained a gestation weight gain of 5.0 -7.9 kg which is way below the recommendation by IOM. It is important to note that weight measurement did not begin at the same gestation age for all women and that for most of the women, weighing was done when they were already beyond 20 weeks gestation. This finding may therefore not be reflective of the exact weight gain of the women under study from conception to delivery although weight gain obtained ought to have been higher in situations where weight gain was adequate.

Women in developing countries are usually underweight even before pregnancy; the study used the figure for underweight women as a reference value. IOM (IMNRCNA, 2009) states that women of poor nutrition status, should add weight above that of normal women. This sample of pregnant women can be described as having attained inadequate weight gain during their pregnancy. A Vietnam study on Timing of gestational weight gain on foetal growth and infant size at birth (Young, et al, 2017) found an average gestational weight gain of 10 kg, this is much higher than the finding from this study.

However they found that nearly three quarters of women gained weight below the IOM recommended guidelines. This may compare with the finding in this study

where the average weight gain is actually below the IOM guidelines. A Sri Lankan study on Assessment of Nutritional Status in Rural Areas (Adikari, et al, 2016) found a weight gain of 2.7 kg which was way below the recommended weight gain. This compares with our finding of a mean of 5.9 kg that is below the recommended weight gain as well, although our finding is fairly higher than the Sri Lankan finding.

These findings do not give a normal pattern of weight gain according to recommendations because it would be expected that the subjects' weights would increase as the gestation age increases but this is not the case. Instead it gives a pattern where weight from the first cohort (59.5 kg) increases as expected for the next cohort (65.2 kg) but then goes down at 17 – 20 weeks (58.8 kg), shoots up again at 21 – 24 weeks (67.4 kg) only to go down again at 25 – 26 weeks gestation (61.7 kg) (Table 4.18). The findings point towards a sample that does not have consistent weight gain and also that several women may have entered pregnancy when underweight.

It may, however be important to note that these weight increases are not for similar individuals and that the different cohorts may have started pregnancy with varying dispositions for weight increase. Most of the women had weights of 50 – 59 kg (39.7 %) at recruitment followed by those with 60 – 69 kg (35.3 %) at recruitment. A recent Kenyan study by Muchemi, et al (2015) found that the mean weight of mothers at the start of the pregnancy was 62 kg. This finding compares well with this study where a substantial proportion of the women (35.3 %) had between 60 to 69 kg at recruitment. The women at ≤ 12 weeks may not have gained any substantial weight at the time of recruitment because this group would still be in their first trimester. Weight gain at first trimester is just about 650 grams (IMNRCNA, 2009).

Assuming their weight gain was adequate; their pre-pregnancy weight would then be averagely 58.9 kg. This indicates that the women may have entered pregnancy with low pre-pregnancy weights. Assuming a weight of 59.5 kg at ≤ 12 weeks gestation and a steady increase of 250 g per week according to IOM recommendations, the women ought to have gained 7 kg thereby attaining a weight of about 66.5 kg at 26 weeks. However this is not the case and the cohort of 25 – 26 weeks weighed only 61.7 kg at the time of study. For the 13 -16 weeks (65.2 kg) and 21 – 24 weeks (67.4 kg) cohorts, weight gain at recruitment may seem to have been adequate by the time of the study if at all they entered pregnancy at the assumed weight.

An Indian study on seasonal differences in Birth weight on exposure during pregnancy (Madan, et al, 2017) found pre pregnancy weights to have been 57.38 ± 4.74 kg and weight at delivery to have been 73.31 ± 10.19 kg. This is similar to this study where weight of pregnant women in first trimester was 59.5 kg. If the weight gain in first trimester is subtracted from this weight, then the pre pregnancy weight would be very close to the Indian study finding. The Indian study (Madan, et al, 2017) however had a high weight gain (16 kg) different from that obtained in this study. Their weight gain was adequate while that for this study was inadequate.

5.5.2 Gestation Age and Birth Weight of New Bornes

The mean gestation age at recruitment was 21.21 ± 4.27 weeks and 37.74 ± 2.26 weeks at delivery. This shows that most women in this study sample attained the required gestation age (≥ 37 weeks). The sampling criterion that was used was ≤ 26 weeks gestation. This means that the study was able to recruit many subjects with much lower gestation age. This was strength for the study because it enabled enough time for follow up.

The mean birth weight of new bornes was found to be 3097.83 \pm 489.67 grams. This indicates a normal birth weight. Most of the new bornes (93 %) had a normal and above normal birth weight, only a few (7 %) had below normal birth weight. A WHO/UNICEF report (Muchemi, et al, 2015) indicates that prevalence of low birth weight in Kenya is 11 %, this is lower than the global (15.5 %) and Sub-Saharan (15 %) estimates but higher than that for developing countries (9.2 %). The finding from this study (7 %) is much lower than that of the Global, Developing countries, Sub-Saharan Africa as well as the Kenyan figures. This shows that the situation here is not alarming although action is still needed to eliminate the low birth weights.

Pregnancy outcomes were computed according to maturity of pregnancy. Gestation age at recruitment was lower for the term births compared to the preterm group. This may imply that women who started the intervention at lower gestation age had a longer period of exposure to the intervention that improved their outcomes compared to those who were enrolled into the intervention with higher weeks of gestation. This finding is important for future nutrition interventions because it points to the fact that the earlier the intervention is introduced to pregnant women, the more likely it is to be effective (Magadi, Diamond & Madiso, 2008).

Gestation weight gain was higher for the term category indicating that the duration of pregnancy may be essential for increased and adequate weight gain which is one of the important proxy indicators for birth weight. New born weight was also higher for the term births category. This may imply that higher newborn weights can be attained if the mother is able to carry the pregnancy to term. Therefore, gestation weight gain and gestation age are likely indicators for new born weight. Our findings show that gestation at full term is important for a normal weight infant and that there is a higher likelihood for an infant born preterm to be born underweight. Both mean weight gain

and mean birth weight had significant differences between for preterm and term births. This means that the birth was likely to be preterm or term with a decrease in gestation age at delivery and increased gestation age at recruitment and term with an increased gestation age at delivery and decreased gestation age at recruitment.

A Kenyan study by Magadi (2006) found that preterm delivery was a risk factor for low birth weight. According to Kilonzo (2017) the survival of babies who are born before 37 weeks gestation is dependent on a myriad of factors. In Kenya, a considerable number of babies (193,000) are born alive before 37 weeks gestation (preterm) each year. Of the preterm babies born 8 % weigh less than 2.5 kg and a preterm baby has just a small chance (12 %) of being born alive (Omondi, 2017). Data from the Ministry of Health (2017) indicate that about 13,300 children under five years die annually due to preterm complications (Kilonzo, 2017). This report supports our finding of high preterm births but then continues to elucidate on the implications of preterm births on the health of the new born. A study conducted in South Nyanza (Magadi, 2006) where the study area falls found an unusually high incidence of preterm deliveries with about half of all live births preterm.

Other studies in Sub-Saharan Africa have also reported rather high preterm births up to about 20 % (Osman, Challis, Coho, Norhdal & Beergstrm, 2001). In this study, the preterm deliveries are lower than in Magadi's (2006) study and this may be attributed to several factors such as that Magadi's (2006) study targeted only adolescents while this study included all women of reproductive age who were pregnant. It may also be attributed to the fact that in the recent years after the study by Magadi (2006), several initiatives have been put in place by the Government and other agencies to improve maternal health and reduce maternal mortality such as Nutrition Action Strategy 2012 – 2017, Beyond Zero Campaign, Malaria Strategy 2009 – 2018 and Tunza Mama

Initiative.

A recent Kenyan study by Muchemi, et al (2015) found majority of the pregnant women (82 %) to have had mature deliveries (37 – 42 weeks) and only 7 % had preterm births (< 37 weeks). The mean birth weight was 2928 ± 533 g. The finding of term births are comparable to those from this study where most of the women (67.4 %) had term deliveries but differs where a considerably higher proportion of the women had preterm deliveries (32.6 %) as well as the higher birth weight (3097.82 ± 489 g) identified by this study.

The finding from this study of 32.6 % preterm deliveries is however, higher than the Sub-Saharan estimates and indicates that more effort is still needed in this study population to ensure deliveries occur at full term to reduce risks for low birth weight infants. A study done in a rural area in India on Epidemiology of Stillbirths found that a big proportion (66.1 %) of the stillbirth pregnancies were preterm and 65.5 % of the stillbirths had birth weight < 2.5 kg. Prematurity and low birth weights were associated with stillbirths in this study (Ghumare, Jetendra & Morey, 2016). This indicates that preterm delivery and inadequate weight are risk factors for neonatal mortality and actions are needed to support pregnant women to carry their pregnancies to maturity and ensure adequate new born weight to reduce the likelihood of negative pregnancy outcomes.

The South Nyanza study (Magadi, 2006) found no statistically significant associations between socioeconomic and demographic characteristics with pregnancy outcomes although high incidences of poor pregnancy outcomes among rural residents, those with low educational attainment, first order pregnancy and young age of the mother were observed. This is similar to our findings where no statistically significant

associations were found between pregnancy outcomes and socio-demographic factors of the women except women's employment status that showed a close and positive association with birth weight (Table 4.27, Appendix H).

A study on improved pregnancy outcomes in Western Kenya (Ibrahim, et al, 2014) the same region of this study, found a birth weight of 3202 g which is almost similar although slightly higher than the findings in this study of 3097.8 g. They found that only 5 % of the new bornes had low birth weight which again can be compared to the finding in this study of 7 %. This comparison may confirm the actual trend of pregnancy outcomes in this region. A study in Nyanza Provincial Hospital Kenya (Were, Mukhwana & Musoke, 2002) recorded a low birth weight prevalence of 15 %, and a study in Narok District hospital (Migwi, 2012) recorded a prevalence of 16.4 %. These two Kenyan findings are more than double the finding from this study and may indicate that the Migori Situation is considerably fair and that the Migori County finding from this study cannot be generalized to other regions of the Country.

Another study at Kilimanjaro Christian Medical Centre in Tanzania (Siza, 2008) found a prevalence of low birth weight of 13.6 %. In Ethiopia one study at Gondar University Hospital (Beritian, Meseret & Nuru, 2011) found a low birth weight prevalence of 17.1 % and a study at Jima Zone (Tema, 2006) found a prevalence of 22.5 %. These are much higher than the finding in our study and may be an indication that the situation in other areas of Sub-Saharan Africa may be worse than among this study population as well as in Kenya. However a facility based retrospective study of three MCH facilities (Mmbando, et al, 2008) found a prevalence of low birth weight of 9.1 %. This finding although a little higher, is much close to the finding in this study.

A study on Maternal Dietary Intake during Pregnancy and its associations to birth size in rural Malawi (Hjertholm, et al, 2017) found mean birth weight to be $3.104 \pm .401$ kg and found 6 % of newborns to have LBW. These are consistent with the findings in this study where mean birth weight is $3.098 \pm .826$ kg and low birth weight prevalence is 7 %. This shows that there is a common and similar pattern of LBW in Developing Countries. Several reports support this common trend. According to the Malawian study the small number of infants born with low birth weight could be due to improved quality of the maternal care in the area. This may be similar in this study where the low prevalence of low birth weight may be an outcome of the psycho-educational nutrition initiative as well as better quality health care provided by various agencies and the government.

This study was done during the period of food abundance just after the harvest season. Another study carried out during the lean season may probably elicit a different outcome as indicated by Hjertholm, et al, (2017) that the low prevalence of low birth weight newborns could be due to seasonal differences in birth size and that if their study was done during the food shortage season, the prevalence would probably be higher. Madan, et al (2017) also observed seasonal differences in newborn size according to different seasons of exposure. They found a mean birth weight of 2.64 ± 0.44 kg but this varied according to season. In developed country setting a study carried out in Shanghai, China on associations of maternal pre-pregnancy BMI and gestational weight gain with birth outcomes (Xiao et al, 2017) found mean birth weight to be 3376.9 g and very few were born with low birth weight (1 %) or preterm (1.6 %).

The Shanghai birth weight was higher than the mean birth weight in this study (3097.8 g). Prevalence of low birth weight was much lower than that from this study (7 %)

and prevalence of preterm births (32.6 %) was much lower still. This indicates the situation in developed country set ups and confirms several reports that outcomes in developed countries are much better than those in developing countries. Other studies found varied prevalence of preterm births of 8 % in Guatemala and South Africa, 9 % in Brazil and 15 % in the Phillipines.

These findings are much lower and so do not compare with our finding of 32.6 %. Low prevalence of birth weight also varied for the countries studied and ranged from 9 % in Brazil, 10 % in South Africa, 11 % in Guatemala to 21 % in the Phillipines. Our finding of 7 % compares with Brazil and South Africa but is much lower than those for Guatemala and the Phillipines (Liu, et al, 2017). This comparison suggests that the birth weight for this study sample compares closely with those for other regions but the prevalence of preterm births finding in this study seems a little higher than that from most other studies.

Ghumare, et al, (2016) in their study on Epidemiology of still births found that maternal undernutrition, anaemia, heavy and strenuous work among others during pregnancy contributed to the onset of preterm labour and still birth of premature and low birth weight babies. This may indicate that the high level of physical activity encountered by the pregnant women in this study may be a contributing factor to the preterm births observed. A study in Vietnam on timing of gestational weight gain on foetal growth and infant size at birth found a mean birth weight of new bornes to be 3050 g and found three quarters of women attaining weight gain below the IOM recommended guidelines (Young, et al, 2017).

This finding is similar to the finding from this study of birth weight of 3.097 kg and a fairly low weight gain of about 5.98 kg quite below the IOM recommended

guidelines. This may imply that the subjects in the two studies may have similar characteristics. The Vietnam study also found that maternal weight gain during the first period (below 20 weeks) had the greatest association on all infant outcomes at birth and compared to maternal weight gain in the second window (21 – 29 weeks) had nearly twice the influence on foetal growth. Pregnancy weight gain in the last window (≥ 30 weeks) had no association with foetal growth.

Weight gain during the first window had the highest association followed by the second window that had the second largest association while the last window had the weakest association with weight gain. These findings show that the timing of weight gain is important for adequate birth weight and therefore the women in this study need to be helped to add weight especially at 20 weeks and below when there seems to be some fluctuations in their weight gain. A meta-Analysis showed that dietary counselling interventions aimed at increasing dietary intakes are most successful in increasing birth weight (Dean, et al, 2014).

Young et al (2017) recommends that nutrition education and counselling programs and support to women should be introduced early in pregnancy to optimize infant birth outcomes. In this study there was an effort to reach the women early with the psycho-educational nutrition initiative as shown in Table 4.19 where almost 60 percent of the women were ≤ 20 weeks gestation. This may probably be one reason why birth weight of most new bornes was adequate.

However Young, et al (2017) continues to state that many women do not seek antenatal care until mid pregnancy (≈ 20 weeks), in many resource poor settings alternative strategies for reaching women before and in early pregnancy need to be considered. In view of this observation, this study suggests that given that a high

proportion of women were reached after gestation age of 20 weeks, to be able to improve pregnancy outcomes among this cohort, nutrition education should be administered to pregnant women at the household level to find them early before they come out to seek antenatal care.

5.6 Associations between Psycho-educational Nutrition knowledge and Nutrient Intake, Physical Activity and Pregnancy Outcomes

Tests of association from the regression model showed that there were positive significant effects of nutrition knowledge obtained from the psycho-educational initiative on nutrient intake after the intervention and on pregnancy outcomes. Nutrient intake also had a significant effect on pregnancy outcomes. Nutrition knowledge had no significant effect on physical activity and nutrient intake at baseline. In determining which of the variables were affected most by nutrition knowledge, nutrition intake at post intervention was affected most followed by pregnancy outcomes which showed a lesser effect. This may have been attributed by a smaller sample for the pregnancy outcomes. A bigger sample may probably have elicited a greater effect.

A study on delivery of prenatal health education and pregnancy outcomes in Baatan found that prenatal education in terms of maternal nutrition had a very satisfactory result and findings were a reflection that in caring for pregnant women, the importance of maternal nutrition is emphasized for the promotion of a healthy pregnant mother and a well baby. This is an indication that a healthy pregnancy starts with proper nutrition to bring out positive maternal outcomes (Brugada, 2011). Similarly, this study found nutrient intake to affect maternal outcomes. The findings implied that prenatal health if provided among these women regardless of age or

marital status, will enable them achieve a healthy pregnancy and optimal birth outcomes. On the other hand, pregnant woman's ignorance of prenatal care coupled with poor health services exacerbates maternal deaths.

Therefore a pregnant woman given the age, marital status or parity was not an assurance that pregnancy would bring out a positive birth outcome. Hence providing information through prenatal education given to women promotes wellness and the prevention of illness. The delivery of prenatal nutrition education had an impact on pregnancy outcomes. The study concluded that prenatal education had a significant relationship with pregnancy outcomes and therefore prenatal education must be an essential component in upholding the overall health status for pregnant women (Brugada, 2011). The findings from the Bataan study compare well with that from this study.

In a study to determine level of nutrition awareness through questions related to knowledge of nutrition education, 68 % of women were found to have acceptable level of nutrition awareness. The delivery of awareness was found to be non significant but the author argues that this may have been due to the small sample which if increased, the result would be significant. The study states that it would be desirable to set up an awareness raising program with the aim of increasing the level of education of pregnant women in terms of eating behaviour and nutrition status (Zgeib, Matta & Sacre, 2017). The finding from this study compares with the awareness study which also shows that nutrition education can influence nutrient intake positively.

A study by Zelalem, Endeshaw, Ayenaw, Shiferaw & Yirgu (2017) on effect of nutrition education on pregnancy specific nutrition, found that nutrition education has

significant effect on dietary habits of pregnant women and on maternal birth outcomes. After nutrition education the pregnant women with knowledge on proper nutrition increased from 53.9 % to 97 %, while dietary specific dietary practice increased from 46.8 % to 83.7 %. The study concluded that nutrition education could improve knowledge and practice of women during pregnancy and that attention should be given to promote nutrition education at the ANC for pregnant women.

A Ugandan study on maternal education provided by midwives found that the organization, mode of delivery guidelines, resources and service environment were extremely deficient. The relevance of appropriate weight gain during pregnancy, guidelines for healthy pregnancy, maternal nutrition resources, infrastructure and health systems gaps were identified. The study found that there was an inefficient nutrition education offered to the pregnant women and concluded that as a means of promoting effective nutrition education, appropriate in service training, mentorship and support for midwives are needed as well as infrastructural and resource provision (Nankumbi, Ngabirano & Nalwadda, 2018). Similarly in this study, nutrition education can have positive maternal outcomes and therefore needs to be strengthened in the primary health care system for pregnant women.

A study exploring the outcome of prenatal nutrition counselling in developing countries by Kaur (2010), found that prenatal counselling has a positive outcome in respect to maternal and foetal health. There was adequate maternal weight gain, birth weight and change in dietary habits and other health related habits. The study concluded that there is need for nutrition counselling for pregnant women. A study on experiences with nutrition related information during ANC, concluded that ANC may have considerable potential to promote a healthy diet to pregnant women and found that nutrition communication in antenatal care should be more tailored towards

women's dietary and cultural background (Lisa, Garnweidner & Peterson, 2013). Another study in Nigeria on factors influencing the nutrition practice of pregnant women identified that provision of health information was a key measure for improving nutrition practices of women during pregnancy.

The study concluded that nutrition education and counselling given during each ANC visit should be intensified and supportive care enhanced to positively affect women's nutritional practices (Ogeche & Handalal, 2017). Tini, Syajar, Arsin, Bahar and Yanti (2016) also found nutrition education using a module class modifications to increase nutrient intake of pregnant women. Another study on effects of nutrition education during pregnancy on low birth weight, found that provision of nutrition education and anti-malarial provision had a positive effect on small for gestation age; low birth weight reduced by 96 % and preterm birth by 54 % (Lopes, Ota, Shakya, Dagvadori, Balogun, et al, 2017).

All the studies reviewed here indicate that nutrition education has positive and significant effects on nutrient intake and pregnancy outcomes and supports this study that found significant effects of nutrition knowledge from nutrition education on nutrient intake and pregnancy outcomes. It is essential therefore that the health units recognize nutrition education as a need and priority area for women who are pregnant. Health care providers need to intensify their programmes to increase public awareness of the importance of prenatal dietary and health behaviours by using information and tools across several appropriate channels.

There were positive relationships between weight of newborn and weight gain, weight at recruitment and at delivery, gestation age at delivery and final weight and gestation age at recruitment and weight of new born. There were also statistically significant

relationships between gestation age at recruitment and at delivery, weight gain and weight at recruitment, and weight gain and final weight although the relationships were negative. In this study weight gain, weight at recruitment and at delivery influenced new born weight positively. The higher the weight gain the higher the new born weight, the more the weight at delivery the higher the new born weight. Birth weight seemed to increase with increase in birth order except for those with a birth order of four whose birth weight was lower and zero order whose birth weight was higher than an order of one. Birth weight seemed to begin to reduce again with an order of six and may be if this trend continued, birth weights would have been smaller with increased parity.

A Kenyan 2015 study on factors associated with low birth weight among neonates born at Olkalou District hospital found that factors associated with low birth weight were premature births and a previous low birth weight infant (Muchem, et al, 2015). A WHO Report (2006) found the major influences of birth weight to be religious background of the mother, mother's weight, anaemia and severe physical work. A study in Uttar Pradesh India (Agarwal, Agarwal, Agarwal & Chaudhay, 2012) found 40 % of mothers to have given birth to low birth weight infants. They found that gestation age below 37 weeks, mothers weighing less than 50 kg, Hb less than 12 g/dl, heavy physical work, smoking and history of abortion to be significant determinants of low birth weight. In this study a premature birth had a higher likelihood of producing a low birth weight infant but physical activity had no association with either low birth weight or gestation age.

An Ethiopian study (Tema, 2006) in the Jimma zone found that urban resident mothers, mothers with weight loss and not having additional food during pregnancy had a significant increased risk of delivering low birth weight infants while religion,

ethnicity, engaging in heavy physical work during pregnancy and a history of illness had no association with delivering a low birth weight infant. In this study heavy physical activity also did not have association with birth weight. Another study by Siza (2008) found that lack of an education among mothers was four times more likely to result in a low weight infant. Pregnancy and labour complications and illness during pregnancy such as eclampsia, hypertension, anaemia, TB and Malaria in pregnancy were significantly associated with low birth weight. In this study the women generally enjoyed good health and incidences of such illnesses were majorly absent.

In Kenya factors that have been documented to have a significant influence on low birth weight include premature delivery, quality of ANC visits measured by timing, frequency of visits and tetanus injections, type of birth, birth order, religion and region of residence as well as maternal nutrition (Muchemi et al, 2015). None of the social factors other than religion had an association with low birth weight. This study also found no association between birth weight and socio-economic and demographic factors but similarly found significant associations with nutrient intake and premature delivery (Table 4.27, Appendix H). The Sri Lankan study (Adikari, et al, 2016) found no significant associations between pregnant women's nutritional status and their education level which compares with our finding in this study. First order births had the highest proportions and second order births had the smallest proportion of low birth weight infants.

Bisson, et al (2017) found that high vigorous intensity activity by pregnant women was associated with a significant decrease in birth weight. An analysis of association of physical activity found a subtle association although mean birth weight was not inadequate. This study found no associations between physical activity and

pregnancy outcomes unlike in the mentioned study. However, several other studies have found some specific and occupational activities to be risk factors for low birth weight as well as premature delivery (Schlussel, et al, 2008). A strong correlation has been identified between preterm birth and baby's size at birth. The two are also influenced by different sets of factors which include quality of ANC and delivery care which have been found to be important in preventing adverse pregnancy outcomes such as preterm delivery, low birth weight as well as perinatal and maternal death (Muchemi, et al, 2015).

Another Kenyan study by Magadi, Diamond, Madiso and Smith, (2004) found that whereas baby's size is influenced more by maternal nutrition, preterm delivery is mostly influenced by quality of ANC. The Kenyan Olkalou study found a statistically significant difference in birth weight between mothers who gave birth at below 37 weeks and those who gave birth at 37 or more weeks. This finding is consistent with that from this study. Most of the women (62.5 %) had undergone nutritional counselling just like in this psycho-educational nutrition study where all the women went through the program. Results of a review of 33 studies found nutrition counselling to be associated with significantly greater gestation weight gain and significantly reduced risk of anaemia in late pregnancy. Nutrition education and counselling significantly improved mean birth weight and significantly reduced risk of preterm birth.

The study concluded that nutrition education and counselling during pregnancy could reduce the risk of anaemia, increase gestational weight gain and improve birth weight and when combined with nutrition support, produced a greater effect. (Giward & Olude, 2012). These findings are consistent with this study where nutrition education improved dietary behaviour and nutrient intakes which may have resulted in low

prevalence of low birth weight and improved gestation age at delivery. Although the author states that this evidence was low quality, their findings support the finding from this study that nutrition education can have significant positive effect on pregnancy outcomes.

The contribution of low birth weight (caused by factors such as premature birth, maternal undernutrition and quality of ANC) to neonatal mortality and morbidity in Kenya cannot be overlooked. These babies' survival depends on several factors which may not be easily available in our developing Country set up. Neonatal intensive care is not readily available because of its capital and operational costs and where available hospital capacity is extremely low. Even large rural sub county hospitals are ill equipped to provide essential services to such newborns (Were, et al, 2002). Moreover even for those who access the hospital facilities, their mothers may not have started producing breast milk as the babies were born too soon and the hospital stress tends to make the mothers not to produce enough milk (Kilonzo, 2017) to start off these babies on good feeding for quick weight gain.

Therefore simple cost effective and sustainable interventions and their increased access that include control of quality of infants born are needed to reduce the burden on the health care system (Were, et al, 2002) as well as mitigate other factors created by low birth weight. Nutrition education is one such cost effective interventions that can be implemented and sustainably used to bring about behaviour change for improved nutrition among pregnant women and improved pregnancy outcomes. In Kenya the main objective for many health interventions targeting pregnant women is to reduce maternal and infant mortality and not maternal under-nutrition. This suggests that there is opportunity to design health initiatives that address both mortality and under-nutrition burdens.

Nepal's experience provides important lessons for developing countries that have high undernutrition rates like Kenya. That achieving rapid reductions in under-nutrition requires a multi-sector approach even if the sectors remain uncoordinated. Investments made in health, WASH and education, robust growth in incomes/assets contributed to improvements in nutrition outcomes in Nepal (Cunningham, 2017). Available evidence suggests that nutrition-specific interventions alone are not sufficient to rapidly reduce rates of undernutrition (Hoddinot, et al, 2013).

Government efforts to address undernutrition that has not translated to effective large scale nutrition programs may be due to gaps in implementation, enforcement and monitoring at the local levels as well as the overburdened small workforce in the health sector. As observed during this study there are gaps in maternal dietary counselling or nutrition education for pregnant women in the health care system. Nutrition education programs need to be designed and integrated into the primary health care system for pregnant women and their uptake up scaled.

CHAPTER SIX: SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Summary of Findings

6.1.1 Introduction

This chapter presents the summary of findings that were obtained from the study and gives conclusions derived from the findings, gives recommendations based on the conclusions for practice and policy action and suggests gaps unveiled by this study that require further investigation.

6.1.2 Socio-economic and Demographic Characteristics of the Pregnant Women

This study investigated the socio-economic and demographic factors of pregnant women in Migori County. The socio-economic and demographic factors have been summarized under the sub-headings, level of education, parity and occupation of pregnant women, household head, responsibility for food and availability of domestic worker of the women's households, household income, food expenditure and housing of pregnant women's households.

6.1.3 Level of Education, Parity and Occupation of Pregnant Women

Most (48 %) of the women had only a primary education; those with tertiary education were only 14 %. There were a few with no education at all. Most of the women were self-employed (46 %), and almost a similar proportion was unemployed (45.0 %). A small proportion (5 %) was employed. More spouses compared to the women were employed (31 %) and a smaller proportion were unemployed (7 %) as well as self-employed (43 %) (Table 4.1). Spouses were the main providers for the households (Table 4.2). Most of the women (50 %) were in their second to fourth pregnancy, and 32 % were in their first pregnancy (Table 4.5).

6.1.4 Household Head, Responsibility for Food and Availability of Domestic Worker of Women's Households

Most (75.7 %) of the women's households were headed by the father though a few were either headed by women, father in law or mother in law. Fathers were the sole bread winners in most households (55.9 %), and 25 % were provided for by both the women and the spouses. Food was mostly prepared by the mothers (70.6 %) but fathers, mother in law and a few relatives took this responsibility. Decision making regarding food preparation (65.4 %) and serving (72.8 %) were mainly done by the women. In almost all the households (87.5 %) there were no availability of domestic workers.

6.1.5 Household Income, Food Expenditure and Housing of Pregnant Women's Households

Several of the women's households had a monthly income of KES 500 to 1000 (20 %). The largest proportion (25.3 %) of women had no information about the amount of income received by their households per month. Both spouse and wife contributed to the household income in majority (53.7 %) of the households, followed by households where income was brought in by the spouse only 39.7 %). For some households (37.6 %) this income varied monthly and had also varied for majority (51.6 %) of households in the last six months prior to the study. Most households spent KES 150 – 250 (31.6 %) per week on food (Table 4.3).

Most (60 %) of the women lived in traditional houses. Most of the houses had only two rooms (39.5 %). Majority of the women's households were made up of between three and four members (47.7%). Most (76.1 %) of the women's households used wood as fuel for cooking and majority (50.4 %) obtained their drinking water from

the river. The women's households' toilets were mostly pit latrines (95 %). Some few women's households had no toilet (1 %) at all. When categorized into wealth index, most of the women (41 %) belonged to the lowest quintile; the second lowest and middle quintiles had almost similar proportions (20 % and 21 % respectively). The lowest proportion (18 %) was in the second middle quintile.

6.2 Pregnant Women's Health and Nutrition Knowledge and Practices

Objective two aimed to determine nutrition knowledge and health conditions and utilize nutrition education to improve nutrition knowledge and optimal feeding practices among pregnant women. Educational Materials were given to the pregnant women and were instructed on how to use them and after collecting data, the study came up with the findings summarized under the subtopics; pregnant women's health conditions and nutrition knowledge and practices.

Majority of the pregnant women (91.8 %) had not been sick in the previous one year prior to this study (Figure 4.4). Most of the women did not have an ailment (73.9 %) requiring treatment during pregnancy (Table 4.6). Majority of the women (75 %) did not even have a medical complication interfering with or health complaint (19.1 %) affecting food consumption. This shows that most of the women had no hindrances to food consumption. As a result most of the women (78 %) were on a normal diet (Table 4.6). Most (71 %) of the women had consumed the usual meal portion during the interview. A few women suffered heart burn, vomiting, oedema of the legs, nausea, abdominal pain and constipation which were likely to affect their food consumption.

About half of the women (53 %) had a food craving. The foods that were mostly craved for were vegetables and fruits (37 %) and grains and cereals (32 %), (Figure

4.5). At the baseline level most (61.4 %) of the women felt that a pregnant woman needed to increase their food intake. A considerable proportion of pregnant women (41.2 %) felt that a pregnant woman should not decrease their workload during pregnancy. More women (77.4 %) reported to have increased rest during their pregnancy at the end of the intervention. Almost all the women (96.5 %) observed food hygiene handling practices after the intervention. More than half of the women had high nutrition knowledge score (60.2 %) after intervention and 33.2 % had medium score indicating an increase in proportions compared to nutrition knowledge at baseline. Significant associations were found between nutrition knowledge and practices at baseline and after intervention (Table 4.7).

At baseline, most women consumed three meals a day (42 %) but after the intervention those who consumed four and five meals in a day increased (43 % and 25 %, respectively) while those who consumed three meals in a day reduced (32 %). There were no participants consuming one or two meals in a day after the intervention. At baseline vegetables was the most consumed followed by cereals, grains and starches, fats and oils and, followed by beverages. After the intervention the same food groups were mostly consumed but the frequencies of consumption reduced. Consumption of fish, meat, eggs and dairy products went up after the intervention but consumption of beverages and oils and fats reduced (Table 4.13).

6.3 Nutrient Intakes of the Pregnant Women

The study aimed to assess energy and micronutrient intakes of the pregnant women. The findings that were obtained have been summarized under the sub-topics; nutrient intakes and associations between means of nutrients.

6.3.1 Nutrient Intakes of the Pregnant Women

The mean nutrient intakes at baseline were 1613.03±439 Kcal for energy, protein 62.61±23.56 g, carbohydrates 244.93±65.16 g, fat 40.54±23.22 g and after the intervention, mean intakes for energy, protein, carbohydrates and fat increased markedly (Table 4.9). The mean micronutrient intakes by the women at baseline was vitamin A 1254.75±2131.48 µg, Folic acid 196.95±67.22 µg, vitamin C 66.74±42.14 mg, calcium 299.71±142.51 mg, iron 10.55±2.84 mg and zinc 11.5±3.83 mg. The mean intakes after the intervention had all improved for vitamin A, folic acid, vitamin C, calcium, iron and zinc. Of the nutrients that were analyzed, only zinc, vitamin A, carbohydrate and fiber intakes were above RDA while energy, calcium and iron intakes fell below the RDA at baseline.

After the intervention percentage of RDA went up for all nutrients except that energy, folic acid, calcium and iron intakes had increased but were still below the RDA even after the intervention while intakes of protein and vitamin C shot above the RDA. Intakes of zinc, vitamin A and carbohydrate were above RDA at both baseline and after the intervention. Percentages of RDA for Folic acid and calcium intake at baseline (32.2 % and 29.97 % respectively) and after intervention (41.56 % and 44.9 % respectively) were still less than average. Percentage of iron intake at baseline (39.07 %) was below average but went slightly above average (55.07 %) after the intervention. The mean Hb level of the participants was 12.25 g/dl ±1.238. Majority (93.8 %) of the women had normal or above normal (≥ 11 g/dl) Hb level (Table 4.8).

6.3.2 Test of Associations between Means of Nutrients

Vitamin A (2.714 $P \leq 0.05$), carbohydrate (20.454, $P \leq 0.05$), fiber (3.831, $P \leq 0.05$) and vitamin C (3.378, $P \leq 0.05$) had positive and significant differences between their

means and the reference values at baseline. Energy intake (-20.630 $P \leq 0.05$), folic acid (-72.698 $P \leq 0.05$), calcium (-59.579, $P \leq 0.05$), zinc (-11.050, $P \leq 0.05$) and iron (-95.644 $P \leq 0.05$) had no significant differences between their means and reference values. At post intervention all the nutrients except zinc had statistically significant differences between their means and reference intake values.

Protein (11.935, $P \leq 0.05$), carbohydrate (32.437, $P \leq 0.05$) vitamin A (2.860, $P \leq 0.05$), fiber (15.877, $P \leq 0.05$) and vitamin C (6.128, $P \leq 0.05$) had positive and significant differences while energy (-6.966, $P \leq 0.05$), folic acid (-55.958, $P \leq 0.05$), calcium (-33.633, $P \leq 0.05$) and iron (-61.294, $P \leq 0.05$) had no significant differences between their means and reference values. All nutrient intakes except vitamin A intakes at baseline and at the end of the intervention had a positive and statistically significant difference between their means at $p \leq 0.05$.

6.4 Physical Activity Levels of Pregnant Women

The study determined the physical activity levels of pregnant women at baseline and at the end of the psycho-educational nutrition initiative. At baseline, the mean total met-minutes for the women was 3362.54 ± 351.35 met-minutes/week. Vigorous intensity activity was 1787.81 ± 315.90 met-minutes/week. The mean met-minutes for moderate intensity activity was 916.89 ± 85.67 . Met-minutes/week for walking was 657.94 ± 140.14 . The mean daily hours spent on activity were 12.21 ± 2.27 and median hours were 13 hours/per day.

After the intervention the mean total met-minute per week was 3143.24 ± 462 , vigorous intensity activity, 1550.52 ± 835.87 met-minute per week, moderate intensity activity 931.01 ± 63.17 met-minute per week, walking 661.78 ± 616.38 met-minute per week, sitting weekday 129.77 ± 62 minutes, sitting weekend 205.61 ± 76.51 minutes and

mean daily hours was found to be 11.33 ± 1.35 hours. There were no significant differences observed between the means of the physical activity factors at baseline and after the intervention at $p \leq 0.05$ (Table 4.14).

6.5 Pregnancy Outcomes of Pregnant Women

The study sought to determine the pregnancy outcomes of the women under objective four. Summary of findings of pregnancy outcomes has been presented in this section. Pregnancy outcomes that were determined included birth weight of new bornes, gestational weight gain and gestation age at recruitment and at delivery.

6.5.1 Gestational Weight Gain, Gestation age and Birth Weight

Mean weight gain was 5.98 ± 2.05 kg (Table 4.18). The weight gain obtained was less (5.98 Kg) than the recommendation according to Institute of Medicine (IOM) (IMNRCNA, 2009). Most women (63.0 %) had gestation weight gain of between $5.0 - 7.9$ kg. The mean gestation age at recruitment was 21.21 ± 4.27 weeks and 37.74 ± 2.26 weeks at delivery (Table 4.17). Most of the women had weights of $50 - 59$ kg (39.7 %) at recruitment. New bornes attained normal (≥ 2500 gm) and above normal birth weights with a mean birth weight of 3097.83 ± 489.67 grams (Table 4.18). Only 7 % of new bornes had low birth weight.

Babies born before 37 weeks gestation were 32.6 % while 67.4 % were born at ≥ 37 weeks gestation (Table 4.19). Weight gain was 5.37 ± 2.0 kg for preterm category and 6.27 kg for the term birth category. Mean birth weight of new bornes was higher for the term births category ($3.13 \pm .444$ kg) than the preterm category ($3.03 \pm .574$ kg) (Table 4.20). Gestation age at recruitment was lower for the term births compared to the preterm group. Low birth weight babies were less than normal and above normal

birth weight babies for both categories although the preterm category had a higher proportion of low birth weight infants compared to term births category.

Physical activity was categorized according to gestation age. For preterm births category, the mean total met-minutes/week was 3399.07 ± 31908 . The two measurements were slightly lower for the term births category that is 3267 ± 487.2 met-minutes/week and 3390 ± 487.20 met-minutes/week respectively. The vigorous intensity activity, (1799.09 ± 251 met-minutes/week), moderate intensity activity (928.71 ± 67.70), total met-minutes/week and walking (661.29 ± 138.78 met-minutes/week) for preterm category were slightly higher than the term categories (1714.2 ± 432.2 met-minutes/week, 928.4 ± 77.81 met-minutes/week and 625.33 ± 168.44 met-minutes/week for vigorous, moderate activity and walking respectively). The term birth category spent fewer hours (11.63 hours/day) than the preterm category (12.23 hours/day) on activity daily.

6.6 Associations between Psycho-educational Nutrition knowledge and Nutrient Intake, Physical Activity and Pregnancy Outcomes

6.6.1 Effect of Psycho-educational Nutrition knowledge on Nutrient Intake, Physical Activity and Pregnancy Outcomes

Objective five aimed to find the associations between psycho-educational nutrition initiative with nutrient intake, physical activity and pregnancy outcomes. The variation in effect of nutrition intake on pregnancy outcomes registered a value of 0.722 or 72.2%, 0.635 variation in effect of nutrition knowledge on nutrient intake, 0.537 effect of nutrition knowledge on pregnancy outcomes and 0.698 variability in effect on, nutrient intake, pregnancy outcomes and physical activity after intervention indicating significant associations with nutrition knowledge obtained from the

psycho-educational initiative. Physical activity had a variability of R^2 of 0.006, nutrient intake at baseline ($R^2 = 0.001$) and nutrient intake, physical activity and pregnancy outcomes at baseline ($R^2 = 0.115$) indicating no significant effects.

The study rejects the H01 and H03 and concludes that there is a significant effect of psycho-educational nutrition initiative on nutrient intake and pregnancy outcomes and accepts the H02, and concludes that there is no significant effect of psycho-educational nutrition initiative on physical activity of pregnant women in Migori County at 5 % level of significance.

6.6.2 Associations between Pregnancy Outcomes and other Maternal Variables

Pearson's Product Moment Correlation established that among the pregnancy outcomes observed, there were strong positive relationships between weight of new borne and weight gain of mothers during pregnancy, weight at recruitment and at delivery (.454, .423, .309, $p \leq 0.05$ respectively), and gestation age at recruitment and weight of new borne (.046 $p \leq 0.05$). There were also statistically significant relationships between gestation age at recruitment and at delivery (-.393 $p \leq 0.05$), weight gain and weight at recruitment (-.311 $p \leq 0.05$) and although the relationships were negative.

6.7 Conclusions

The women's educational attainment was low with no formal employment. The women were mostly of low social economic status as given by the wealth quintiles.

The women generally had good health and so health conditions did not interfere with their food consumption. There were significant improvements in the pregnant women's nutrition knowledge and practices and dietary behaviour.

Nutrient intakes increased after intervention although some nutrient intakes were still inadequate. Intakes of protein, carbohydrate, vitamin C and vitamin A were adequate after intervention. Intake of energy, folic acid, calcium and iron were inadequate before and after intervention. More nutrients had intakes higher than RDA after intervention.

There was a slight reduction in women's total activity level per week and vigorous intensity activities but did more moderate intensity activities with increased rest after the intervention. Total daily hours on activity also reduced. However, there were no significant reductions in physical activity levels.

The mean weight gain was less than IOM's recommendations. The mean gestation age at delivery was normal (37.74 weeks). The mean birth weight was adequate. Most babies were born at term (≥ 37) and had normal and above normal birth weights. Weight gain and birth weight were higher for the term birth category. Proportion of preterm birth was higher than those from most studies. Proportions of low birth weight compares well with those of other studies in Kenya and other developing countries. The mean birth weight supports the Developing Countries' trend indicating lower prevalence of low birth weight.

The psycho-educational nutrition initiative had significant effects on nutrient intake and pregnancy outcomes but had no significant effect on physical activity of pregnant women.

6.8 Recommendations for Policy and Practice

From the conclusions obtained from this Psycho-educational Nutrition Initiative Study, the following recommendations are made to the central government, county

government and other agencies concerned with maternal health as outlined below.

- 1) More effort by all stakeholders i.e. Ministry of Health, International Agencies, NGOs and the Community under study is still needed to ensure that most babies are born at term to reduce risks for low birth weight such as strategies addressing risks to premature delivery and LBW that mitigate women's socio-economic constraints such as efforts to ensure more girls complete school and economic empowerment to ensure the women have adequate incomes to access more food.
- 2) The Ministry of Health needs to redesign and strengthen a robust cost effective, sustainable and accessible nutrition education programme within the primary health care system to help pregnant women acquire nutrition knowledge and attitudes that will create optimal feeding practices.
- 3) The study observed that dietary intake of folic acid, iron and calcium could not meet the RDA even after the nutrition education intervention. Other reports also indicate that diets in poor resource settings hardly provide adequate amounts of these micronutrients. The Ministry of Health together with other health agencies need to enhance and evaluate interventions aimed directly at meeting adequate intakes, such as iron and folic acid supplementation and the pregnant women tracked to ensure total compliance. Other long term strategies such as bio-fortification and post-harvest fortification for calcium, folic acid and other essential micronutrients need to be considered by the government.
- 4) This study observed that a high proportion of women were reached after gestation age of 20 weeks, to be able to improve pregnancy outcomes among this population, the Ministry of Health and other Health Agencies should

administer nutrition education as well as other interventions targeting pregnant women and new bornes using other channels of communication to reach them at the household level rather than at health facilities only; to reach them early for greater effectiveness. The government and the private sector need to provide integrated but simple cost effective and sustainable interventions to mitigate other factors created by low birth weight. Nutrition education should therefore be provided together with MCH initiatives such as Beyond Zero Campaign, Tunza mama e.t.c. to address both mortality and under nutrition burdens instead of focusing only on reducing maternal mortality.

- 5) Policy makers need to direct nutrition policies towards a food based approach to promote optimal diversified diets based on local foods targeted at pregnant women. Agri-food policies should also be directed at promoting increased productivity and greater diversity in both production and household food consumption.

6.9 Suggestions for Further Research

1. Nutrition interventions need to be introduced early. Further studies are needed to determine the outcome of interventions to women of reproductive age right before conception. Interventions should therefore be designed to reach women right before conception and throughout the entire pregnancy.
2. This study was carried out during the period beginning in August to the end of February a period of relatively food abundance in this region of study. Studies are needed to cover the lean season to see whether there would be a different outcome among pregnant women.
3. A significant percentage of pregnant women still deliver away from the health facilities. The outcomes of the pregnancies of such women go unreported.

Studies should therefore be designed to follow these women at the household until after delivery to establish the outcome of such pregnancies.

4. Further studies are needed to isolate factors that contribute to LBW among the preterm babies and among the term babies because each category had a proportion of LBW infants.

REFERENCES

- Adikari AMNT, Sivakanesan R, Wijesinghe D. and Liyange C. (2016). Assessment of Nutritional Status of Pregnant Women in a Rural Area in Sri Lanka. *Tropical Agriculture Research* **27** (2): 203 – 211.

- Administration Committee on Coordination-Sub-Committee on Nutrition (ACC/SCN). 2000. Forth Report on the World Nutrition Situation, Geneva: ACC/SCN & Asian Development Bank (ADB).
- African Development Promise (ADP), (2014). What is Subsistence Farming? <http://www.AfricaDevelopmentpromise.org>
- AFIDEP, UNFPA & Norad, (2017). Reproductive, Maternal, Neonatal and Child Health. Migori County Fact Sheet.
- Agarwal K, Agarwal VK, Agarwal P. and Chaudhary V. (2012). Prevalence and Determinants of Low Birth Weight among Institutional Deliveries. *Nigerian Med*; **5**: 48 – 52.
- Aguayo V. M. and Menon P. (2016). Stop Stunting: Improving child feeding, women's nutrition and household sanitation in South Asia. *Maternal and Child Nutrition*, 12 (S1) 3-11. <https://doi.org/10.1111/mcn.12283>.
- Ahlborg G. (1995). Physical Workload and Pregnancy Outcomes. *Journal of Occupation Environment Med* **37**: (8): 94:(94)
- Becquaey E, Martin E. and Perel Y. (2010). Micronutrient adequacy of Women's Diet in Urban Burkina Faso. *Journal of Nutrition* 140: 20795 – 20855 doi:10.3945/jn.110.123356.
- Beritiani MZ, Meseret Z. and Nuru M, (2011). Incidence and Correlates of Low Birth Weight at a Referral Hospital in North West Ethiopia. *Pan African medical Journal*; **12**: 4
- Bhargava A. & Hays J. (2014). Behavioral Variables and education are predictors of dietary change in Women's Health Trial: Feasibility Study in minority Populations. *Prev Med*. 34: 442- 451. doi:10.12648/j.jfn.
- Bisson M, Tremblay F, St-Onge O, Robitaille J, Pronovos E, Simonyan D. and Marc I. (2016). Pediatric Obesity. [Onlinelibrary.wiley.com/doi/10.1111/jpo.12174](http://onlinelibrary.wiley.com/doi/10.1111/jpo.12174).
- Black RE, Victoria CG, and Walker SP. (2013). Maternal and Child Undernutrition and overweight in low income and middle income Countries. *Lancet* **3**, 382:427-451.
- Bloem M. (2013). Preventing Stunting; Why it matters; What it takes: *The Road to Good Nutrition*; A Global Perspective. Krager S. Library of Congress, Germany.
- Blossner M. & De Onis M. (2005). Malnutrition: Quantifying the health Impact at National and Local levels. WHO Environmental of Disease Series No. 2.
- Brugada A. B. (2011). Delivery of Prenatal Health Education and Pregnancy Outcomes in selected Aeta Tribes in Bataan. *Malaysian Journal of Nursing*. **3** (1): 23 – 33.
- Cheesbrough M. (2006). *District Laboratory Practice in Tropical Countries* 2nd Ed Tropical Health Technology, Cambridge University Press.

- Chege P M. and Kuria E N. (2017). Relationship between Nutrition Knowledge of Caregivers and Dietary Practices of Children under Five in Kajiado County, Kenya. *Women's Health Bull; (In Press)*: e43820.
- Christian P, Lee S. E, Donahue A, Adair L.S, Arifeen S. E, Asharon P & Black R. E. (2013) . Risk of Childhood undernutrition related to small for gestational age and preterm birth in low and middle income countries. *International Journal of Epidemiology*: 42 (5). 1340 – 1355. <https://doi.org/10.1093/ije/dyt109>.
- Christian P. West KP. Khattry SK, Katz J, Le Cherg SC. Kimbrough-pradhan E. Dali SM and Shrestha SR. (2000). Vitamin A or beta carotene supplementation reduces symptoms of illness in pregnant and lactating women. *Journal of Nutrition* **130**: 2675-63.
- Cunningham K, (2017). Maternal and Child Nutrition in Nepal: Examining Drivers of progress from mid 1990s to 2010. *Global Food Security* [dx.doi.org/10.1016/j.gfs](https://doi.org/10.1016/j.gfs)
- Dwarkanath P, Muthayya S, Vaz M, Thomas T, Mhaskar A, Thomas A, Bhat S. and Kurpad A, (2007). The Relationship between Maternal Physical Activity during Pregnancy and Birth Weight. *Asia Pac Journal of Clinical Nutrition* **16** (4) 704 – 710.
- Dean SV, Lassi ZS, Imam AM. & Bhutta ZA. (2014). Preconception Care: Nutritional Risks and Interventions. *Reproductive Health* **11**: (S3) [doi:10.1186/1742-4755-11-S3-S3](https://doi.org/10.1186/1742-4755-11-S3-S3).
- Dunneram Y. & Jeevon R. (2015). Nutrition Education Program among Women of Reproductive Age: A Necessity Multilevel Strategies or Community Responsibility. *Health Promotion Perspect.* **5** (2): 116 – 127.
- Elsinga J, Putjer LC, Bruin KM, Cessie S, Assendelft WJ. & Buitendik SE. (2008). The effect of Preconception Counselling on Lifestyle and other Behaviours before and during Pregnancy. *Women's Health Issues.* **18**:117 – 125 [doi:10.1016/j.jwhi](https://doi.org/10.1016/j.jwhi).
- Essendi H, Mills S. and Fotso JC. (2011). Barriers to formal Emergency Obstetric Care Utilization. *Journal of Urban Health* **88** (2) 356 – 369.
- Evenson KR, Barakat R, Brown W, Molina PD, Haruna M et al, (2014). Guidelines for physical Activity during Pregnancy: Comparisons from around the World. *American Journal of Lifestyle Med* **8** (2): 102 – 121.
- Family Care International (FCI), (2013). Care-seeking during Pregnancy, Delivery and the Postpartum Period: A Study in Homabay and Migori Districts Kenya. Final Report.
- FAO, (2005). Kenya Nutrition Profile. Food and Nutrition Division
- FAO, (2014). Better Nutrition Better Lives. Hunger Facts: Second International Conference on Nutrition. Rome, Italy
- FAO, (2017). FAO's Role in Nutrition. FAO of the United Nations. www.fao.org/nutrition

- Fisher A.A, Laing J.E, Stoeckel J.E and Townsend J.W (1991). Handbook for Family Planning Operations Research Design 2nd Ed. P43.Population Council, New York, USA.
- Food and Agricultural Organization (FAO), (2012). Kenya Situation Analysis for Transformed Nutrition: Nutrition Country Profiles- Republic of Kenya. <http://www.fao.org/ag/agn/nutrition/profiles-en.stm>.
- Food and Nutrition Board, Institute of Medicine, National Academies, (2011). Recommended Daily Allowances. National Academy Press, Washington.
- Fowler JK, Evers SE and Campbell MK. (2012). Inadequate dietary intakes among pregnant women. *Canadian Journal of Diet Pract Res*. Summer; **73**(2):72-7.
- Giward A. & Olude O. (2012). Nutrition Education and Counseling provided during Pregnancy: Effects on maternal neonatal and child Health outcomes. *Paediatric and Perinatal Epidemiology* **26** (1): 191 – 204.
- Government of Kenya (GOK), (2016). Kenya Reproductive, maternal, Newborn, Child and Adolescent Health (RMNCAH) Investment Framework. Report.
- Government of Kenya (GOK) (2011). National Food and Nutrition Security Policy. Nairobi, Kenya.
- Guelinckx L, Derlieger R, Millie P. & Vansat G. (2010). Effect of Lifestyle Intervention on Dietary habits, Physical Activity, Gestational Weight Gain in Obese Women: a Randomized Controlled Trial. *American Journal of Clinical Nutrition* : 373 – 380 doi:10.394/.
- Hartini T.N. (2004). Food habits, Dietary intake and nutritional status during economic crisis among pregnant women in Central Java, Indonesia. Umeå University Medical Dissertations. New Series No. **885** ISSN 0346-6612 ISBN 91-7305-590-5.
- Hjertholm KG, Iverson PO, Otteson GH, Mdala H, Munthali A, Maleta K, Shi Z, Ferguson E. and Kamudoni P. (2017). Maternal Dietary intake during Pregnancy and its association to Birth Size in Rural Malawi: A Cross-sectional Study. [Onlinelibrary.wiley.com/doi/10.1111/mcn.12433](http://onlinelibrary.wiley.com/doi/10.1111/mcn.12433).
- Hoddinott J, Alderman H, Behrman JR, Haddad L and Horton S. (2013). The Economic Rationale for investing in Stunting Reduction. *Maternal and Child Nutrition* **9** (Suppl 2) S69- S82.
- Ibrahim O, Daud II, Opinya F, Midem D, Kigani M, Bukusu E, Nganga Z, Sumba PO, Dent A. And Rochford R. (2014). Improved Pregnancy Outcomes in a Prospective Study of Pregnant Women Enrolling in an ante natal Clinic in Western Kenya. *Health* **6**: 2651 – 2656. [Htt://www.scirp.org/journal/health](http://www.scirp.org/journal/health)
- Institute of Medicine and National Research Council of the National Academies (IMNRCNA), (2009). Implementing Guidelines on Weight gain and Pregnancy. National Academy Press, Washington.

- IPAQ Research Committee, (2004). Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire (IPAQ) – Short Form.
- Ghumare C, Jetendra DG, and Morey AP. (2016). Epidemiology of Stillbirth and Tertiary Care Hospital located at a Rural Area of Northern Maharashtra, India. *Indian Journal of Obstetrics and Gynecology Research*; **3** (4): 326 – 329.
- Kafatos AG, Vlachonikolis IG. & Codrington CA. (1989). Nutrition during Pregnancy: The effect of an Educational Intervention Program in Greece. *American Journal of Clinical Nutrition* **50** (5): 970 – 979.
- Kaur S. (2010). Outcomes of Prenatal Nutrition in Developing Countries: A literature Review. Final Project: SNO8S1, Spring.
- Kenya Interagency Rapid Assessment (KIRA), (2015). Migori Secondary Data Review.
- Kenya National Bureau of Statistics, (2015). Kenya Demographic Health Survey; Key Indicators 2014. Final Report.
- Kenya National Bureau of Statistics, (KNBS), (2013). Kenya Nyanza Province; Monitoring the Situation of Children and Women; Multiple Indicator Cluster Survey 2011. Final Report. Nairobi, Kenya.
- Kilonzo E. (2017). Coming soon, a human milk bank run on charity. Daily Nation, Tuesday 27th June. Pp 4-5.
- Kisika S. (2013). Maternal Mortality Rate Still high in Kenya. News 24 Kenya. www.news24.co.ke/myNews24.
- Kinley, M.C Francis J.J and Woodside J. (2017). Pregnancy for the next Generation. Nutrition Guide for Physicians and Related Health Care Professionals: *Nutrition and Health* pp 3 – 12.
- Kimani E. (2014). The Nutrition paradox in Kenya: What are we doing? African Population and Health Research Centre Kenya.
- Lindbohm ML. (2013). Physical Workload – a risk factor for miscarriage. *Scandinavian Journal of Work, Environment and Health*. **39** (4): 321-323.
- Linkage Project, (2001). Essential Health Sector Actions to Improve Maternal Nutrition in Africa. Academy for Educational Development. Washington.
- Lisa M, Garnweidner R. Petterson S. and Mosdol A. (2013). Experiences with nutrition related information during ante natal care of pregnant women of different ethnic backgrounds residing in Oslo, Norway. *Midwifery* **29**: 130 – 137.
- Liu N, Mao L, Sun X, Liu L, Yao P. & Chen B. (2009). The effect of Health and Nutrition Education Interventions on Women's Postpartum Beliefs and Practices: a randomized control trial. *BMC Public Health* **9**: 45 doi:10.1186/1471-2458-9-45.

- Liu X, Behrman JR, Stein AD, Adair LS, Borja JB, et al, (2017). Prenatal Care and Child Growth and Schooling in four Low and Medium Income Countries. *PLOS ONE*; 12(2): eo171299. doi:10.1371/journal.pone.0171299.
- Lopes KS, Ota E, Shakya P, Dagvadori A, Balogun DO, Roses JPP, Regul M, And Mori R. (2017). Effects of Nutrition Education during Pregnancy on Low Birth Weight: An overview of Systematic review.
- Madan E, Has JD, Manon P, Kumar V, Kuma A, Dixit S and Singh S. (2017). Seasonal Differences in Birth Weight and Lengths depends on Exposure during Pregnancy in Rural India. *The FASEB Journal* **31** (1) 639 – 49.
- Magadi M. (2006). Poor Pregnancy Outcomes among Adolescents in South Nyanza Region of Kenya. *African Journal of Reproductive Health*; **10** (1):26-38.
- Magadi M, Diamond I. and Madiso N, 2008. Individual Community Level Factors associated with Premature Births, Size of Baby at Birth and Cesarean Section Deliveries in Kenya. APHRC. Working Papers.
- Magadi M, Diamond I, Madiso N. and Smith P, 2004. Pathways of the Determinants of Unfavourable Birth Outcomes in Kenya. *Journal of Biosocial Science*; **36** (2): 153 – 176.
- Magnani, R. (1999). FANTA III Sampling Guide. Food and Nutrition Technical Assistance Project.
- Malek L, Umberger M, Makrides M. and Hous Z, 2016. Adherence to the Australian Dietary Guidelines during Pregnancy evidence from a National Study. *Public Health Nutrition*; **19** (7) 1155 – 63.
- Manejala O. (2013). Food Cravings in Pregnancy. What really causes pregnancy cravings? www.psychologytoday.com.
- Marilia L, Ismail A, Askworth S and Morris S. (2013). Influence of heavy Agricultural work during Pregnancy on Birth Weight in North East Brazil. *International Journal of Epidemiology*. **8**:469- 474
- Medline Plus, (2017). Eating Right during Pregnancy. Us National Library of Medicine. Medical Encyclopaedia.
- Merkel K. (2016). Women and Hunger Facts: World Hunger Education Services. www.worldhunger.org/women-and-hunger-facts.
- Migori County Government, (2016). County Health Profile. Department of Health.
- Migwi P. M. (2012). Prevalence of Low Birth Weight Deliveries and associated Factors in Narok District Hospital Kenya. University of Nairobi Repository.
- Ministry of Health (MOH), (2015). Migori County at a Glance. Report

- Ministry of Health (MOH), (2014). Rongo Sub-County Health Facility Population Projection. Report
- Ministry of Health, Wellington (2008). Food and Nutrition Guidelines for Healthy Pregnant and Breastfeeding Women. A background paper Pg 9- 10.
- Ministry of Public Health Services (Kenya) & Save the Children UK MoPHS &SCUK), (2011). Nutrition Situation in Kenya. Report.
- Mbithe D, Kimiywe J, Waudo J. And Orodho JA. (2008). Promotion of Nutrition Education in rural and Urban Primary Schools in Machakos District, Kenya. <http://ir.library.ku.ac.ke/handle/123456789/5575>.
- Mmbando BP, Cole LH, Sembuche S, Kamugisha ML, Theander T, Lusingu JP et al, (2008). Risk factors for Low Birth Weight in areas with varying Malaria transmission in Korogwe, Tanzania. Implications for malaria Control. *Tanzania Journal of Health Research Pubmed*; **10** (3): 137 -43.
- Msofi L. (2014). Impacts of Agricultural Development Projects on Gender Relations in Family Households (A case Study of Blantyre Rural Malawi). Conference paper presented at the Agricultural Investment and Gender Conference in Africa. Cape Town
- Muchemi OM, Echoka E. and Makokha A (2015). Factors associated with Low Birth Weight among Neonates born at Olkalou District Hospital, Central Region, Kenya. *The Pan African Medical Journal*; ISSN 1937 – 8688. Doi:10.11604/paamj.2015.20.108.4831.
- Mungai C. (2017). Greed for Huge Profits is Fuelling Current Food Crisis. *The Standard Saturday* 13th May pp 4 – 5.
- Mureithi R. (2017). Delivery at Clinics reduces Child Deaths. *Daily Nation* April Tuesday 25th.
- Nankumbi J, Ngabirawo TD. and Nalwadda G. (2018). Maternal Nutrition Education provided by Midwives: A Qualitative Study in an Antenatal Clinic Uganda. *Journal of Nutrition and Metabolism*. [Http://doi.org/10.1155/2018/3987396](http://doi.org/10.1155/2018/3987396).
- Nguyen P.H, Kim S. S, Sangri T, MahmudZ, Tran L. M, Shabnam S & Menon P. (2017). Integrating nutrition interventions into existing maternal, neonatal and child health programme increased maternal dietary diversity, micronutrient intake and exclusive breastfeeding practices in Bangladesh. *Journal of Nutrition*. 147 (12) 2326 – 2337. <https://doi.org/10.3945/jn117.257303>.
- Nigeria Information and Planning Systems (NIPS), (2013). Knowledge and attitudes towards Maternal Health. CIET building the community voice into planning.
- Nisbet N, Davis P, Yosef S and Akhtar N. (2017). Bangladesh's Story of change in nutrition: Strong improvements in basic and underlying determinants with unfinished

agenda for direct community level support. Global Food Security.
www.sciencedirect.com

NCP (Nutrition Communication Project), (1995). Niger vitamin A promotion project 1991-1995. Final Report. Washington Academy for Educational Development.

Nutrition Division GOK, 2012. National Nutrition Action Plan 2012 -2017.

Nutrition International, (2017). Nutrition International launches Right Start to provide better nutrition for women, adolescent girls and children in Kenya. Fact Sheet.

Occupational Med, (2006). Occupational risk factors and reproductive health of Women. *Oxford Journal of Medicine and Health; Occupational Medicine* 56: (8) 102 – 107.

Odiwuor FA, Kimiywe J, Kenneth OO. and Rombo G. (2013). Energy Intake, Physical Activity and Gestational Weight gain among Pregnant Women at Rongo sub-District Hospital. *African Journal of Education, Science and Technology* 1 (3) 73- 80.

Ogechi AC. and Handalal OO. (2017). Factors influencing the Nutritional Practice of Pregnant Women living in a Semi-Urban Region of Ogun State, Nigeria. *Saudi Journal of Medicine*. Doi. 1021276/sjm.2017.2.5.1.

Ojina E. (2019). Scientists try to crack puzzle of preterm births in Migori. Daily Nation Tuesday 8th January, Pp 4.

Oketch T. M. & Lelegure S. L. (2015) Analysis of Universal Health Coverage and Equity on Health Care in Kenya. *Global Journal of Science* 2188 (7): 37-42.

Omondi D. (2017). Poverty Levels in Kenya. <http://www.standardmedia.co.ke/business/article/2000/244953/concern-as-study-indicates-nearly-half-of-kenyans-poor>

Osman NB, Challis K, Coho M, Norhdal G. And Beergstrm S. (2001). Perinatal Outcome in an Obstetric Cohort of Mozambican Women. *Journal of Tropical Peadiatric*; 47: 30 – 38.

Pestoa MC, Meudes LL, Gomez CS, Martins PA. And Menendez V. (2016). Food Environment and Fruit and Vegetable Intake in an Urban Population. A Multilevel Analysis. *BMC Public Health* 15 (1): 10 – 12.

Puja L, Chanda K. And Morab A. (2017). Knowledge on Reproductive Health of Rural Farm Women. *International Journal of Home Science* 3 (1): 229 – 233.

Quinn V. (2013). Best Practices in Nutrition: The Road to Good Nutrition; A *Global Perspective*. Krager S. Library of Congress, Germany.

Ransom EI. and Elder LK. (2013). Nutrition of Women and Adolescents. Population ReferencBeareau <http://www.prb.org/publication/Articles/2013/NutritionofWomenandAdolescentGirlsWhyitMatters.aspx>.

- Rao S. (2014). Potential of Community based approach for prevention of Anaemia among Women of Child bearing Age from Rural India. *Journal of Food and Nutritional Sciences*. 2: 270 – 276 doi:10.11648/j.jfns.
- Republic of Kenya Ministry of Health, (2013). National Nutrition Monitoring and Evaluation Framework.
- Republic of Kenya, (2011). Maternal, Infant and Young Child Nutrition: National Operational Guidelines for Health Workers. Ministry of Health.
- Roesel C. Schafter T. Durongdej S. and Tokmoh L. (1990). Effects of improved weight monitoring feedback during pregnancy in a Khmar refugee camp in Thailand. Maternal nutrition and health care program. Research Report Series. Report No. 16. Washington.
- Ruel M. (2013). Food Security and Nutrition Linkage and Complimentaries: *The Road to Good Nutrition; A Global Perspective*. Krager S. Library of Congress, Germany.
- Rutstein S.O & Kierstein J. (2004). The DHS Wealth Index. DHS Comparative Reports No. 6. Calverton, Maryland: ORC Macro.
- Schlüssel M.M, Souza E.B, Reichenheim M.E and Kac G. (2008). Physical Activity During Pregnancy and Maternal-Child Health Ocomes: A Systematic Review. *Cad.Saúde Pública* **24** (4). 1 - 11
- Schultink W. (2013). How to improve Nutrition via Effective Programming: *The Road to Good Nutrition; A Global Perspective*. Krager S. Library of Congress, Germany.
- Schultink W, Eggers R. & Chalteejee (2018). Accelerating Universal Health Coverage in Kenya – How do we get there? A Review.
- SCN (2000). Nutrition throughout the Life Cycle.Fourth Report on the World Nutrition Situation. Geneva, United Nations Administrative Committee on Coordination Sub-Committee on Nutrition (ACC/SCN).
- Singh AS. and Masuku MB. (2014). Sampling Techniques and Determination of Sample Size in Applied Statistics Research: An Overview. *International Journal of Economics, Commerce and Management* 2 (11). <http://ijecm.co.uk/>
- Sinhavoy SS, Waid J, Yout K, Thusted S.and Girard AW. (2017). Women's Empowerment, Household Dietary Intake and Individual Dietary Intake in Urban Bangladesh: Repeated Cross-Sectional Study. *The Faseb Journal* **3** (1) 639.22
- Siza JE. (2008). Risk factors associated with Low Birth Weight of neonates among pregnant Women attending a referral Hospital in Northern Tanzania. *Tanzania Journal of Research* **10** (1): 1 – 8.
- Shah S, Sharma G, Shris L, Kumar S, Sharma M and Sapkota NK. (2017). Knowledge on Dietary Patterns among Pregnant Women attending ANC Check-upnin Narayani

- Hospital, Nepal. *International Journal of Community Medicine and Public Health* 2394.
- Shrimpton R. and Sadanha L. (2011). The Kenya Nutrition Programme Review KNPR. Public Nutrition Solutions Ltd (PNSS).
- Snidjer CA, Brand T, Jaddoe V, Hoffman A, Mackenbath JP, Steegers EA and Burdof A. (2012). Physically Demanding Work, Foetal Growth and the risk of adverse Birth Outcomes. The Generation R Study. *Environment Med* **69** (8):543-50.
- Stephoe A, Perkins P, Mckay L, Pinkl E, Hilto S. & Cappucino FP. (2003)). Behavioral Counseling to increase consumption of Fruits and Vegetables in Low Incme Adults: randomized Trial. *BMJ* 326: 855.doi:101136/bmj.
- Stevens G A. (2013). Global Regional and National Trends in Hemoglobin Concentration and Prevalence of Total and Severe Anaemia in Children and Pregnant Women for 1995 – 2011. Systematic Analysis of Population Representative Data. *The Lancet Global Health Blog* **1**: e16-25.
- SUN Movement (2016). Improving Nutrition and Health for Pregnant and Lactating Women. Brief on Nutrition and Health intergration across Reproductive, maternal, Newbon, Child and Adolescent Health Continuum.
- Taddese AZ. and Ayele HT. (2013). Micronutrient and Pregnancy; Effect of Supplimentation on Pregnancy and Pregnancy Outcomes: A System Review. *Nutrition Journal* **12**, 20, 10.1186/1475-2891-12-20, incense Biomed Central Ltd.
- Taleb S, Kaib M. and Deghboudy N. (2011). Assessment of Nutrition Status of Pregnant Women Attending the City Tabessa PMI Algeria. *National Journal of Physiology, Pharmacy and Pharmacology*; **1** (2) 97 – 105.
- Tema T. (2006). Prevalence and Determinants of Low Birth Weight in Jimma Zone South West Ethiopia. *East African Medical Journal Pubmed*; **8** (3): 366 – 71.
- Tini K, Syafar M, Arsin A, Bahar B. And Yanti F. (2016). The effects of Education using Modification Module towards Nutritional Intake during Pregnancy in Kendari, Indonesia. *Public Health of Indonesia* **2** (2): 84 – 92.
- Unicef (2014). Overall Nutrition Situation in Kenya. Nutrition Sector Bulletin
- Unicef (2016). Child Health, A Fair start in life: State of the World's Children.
- United Nations Childrens Fund (UNICEF) & World Health Organization (WHO), (2004). Low Birth and Country, Regional and Global Estimates. New York: UNICEF.
- United States Department of Agriculture (USDA), (2011). DRI Tables and Application Reports. Nutrition and Agriculture Library, Food and Nutrition Information Centre.www.nal.usda.gov/fnic/dvc-tables.

- Usharani L. and Hepsibha S. (2017). Effectiveness of Structured Teaching Programs on Diet During Lactation in terms of Knowledge, Attitudes and Practice among Primiparous Mothers in Kasturba Memorial Hospital Dindigul. *Journal of Obstetrics and Gynecological Nursing*; **5** (1): 23 – 26.
- Ward E. (2014). Coping with Pregnancy Food Cravings. WebMD, WEDMED ARCHIVE
- Waudu J, Tuiteok P, Msuya J, and Kikafunda J. (2004). Food Consumption Patterns and Nutrient Intakes by Women and Under Five year old Children in the Wetlands of Lake Victoria. A Paper presented at KCan Regional Conference Nairobi.
- Wayne M. and Morte L. (2013). "Prospective and Retrospective Cohort Studies". Boston University College of Public Health. Retrieved Nov 25, 2013.
- Were FN, Mukhwana BO. and Musoke R N. (2002). Neonatal Survival of Infants less than 2000 g born at Kenyatta National Hospital. *East African Medical Journal*; **79** (2): 77 – 79.
- West KP, Katz, Khattry SK, LeCherq SC. Pradhan EK. Shrestha SR. Conner PB. Dali S. Christain P. Pokhrel R and Sommer A. (1999). Double blind cluster randomized trial of low dose supplementation with vitamin A or beta carotene on mortality related to pregnancy in Nepal. *BMJ* **318**: 570-5.
- WHO, (2011). Standards and Operational Guidance for Ethics Review of Health-Related Research with Human Participants. Geneva, Switzerland.
- World Health Organization (WHO), (2006). Promoting Optimal Foetal Development. Report of a Technical Consultation, Geneva, Switzerland.
- Xiao L, Wxinjia MD, Young Z, Lin L. and Zhonghao Z. (2017). Reduced Maternal Calcium intake through Nutrition and Supplementation is associated with adverse conditions for both the Women and their Infants in a Chinese Population. *Medicine* **96** (8): 6609.
- Xiao LL, Ding G, Vinturache A, Xu J, Ding Y, Guo J, Huang L, Yin X, Quiko J, Thureraya I. and Ben X, (2014). Associations of Maternal Pre-Pregnancy Body mass Index and Gestational Weight Gain with Birth Outcomes in Shangai China. *Scientific Reports*: **7** No. 41073.
- Young M, Nguyen PH, Addo Y, Nguyen S, Martorell R. and Usha R, (2017). Timing of Gestational Weight Gain on Foetal Growth and Infant Size at Birth in Vietnam. <http://dx.doi.org/10.1371/Journal.pone.0170192>.
- Zelalem A, Endeshaw M, Ayenew M, Shiferaw S and Yirgu R. (2017). Effect of Nutrition Education on Pregnancy Specific Nutrition Knowledge and Healthy Dietary Practices among Pregnant Women in Addis Ababa. *Clinics Mother Child Health* **14**: 265. Doi: 10.4172/2090 – 7214,1000265.

Zgheib C, Matta J and Sacre Y. (2017). Evaluation of Food behaviour and Nutritional Status of Pregnant Women resident in Kesewan. *Journal of Pregnancy and Health*. 4: 331.doi:10.4172/2376-127x.10000331.

APPENDICES

APPENDIX A: INFORMED CONSENT FORM

PSYCHO-EDUCATIONAL NUTRITION INITIATIVE RESEARCH STUDY (PNI)

INFORMED CONSENT FORM

Name of Principle Investigator: ODIWUOR OYEHO FLORENCE

Name of Organization: KENYATTA UNIVERSITY

Name of Project: PSYCHO-EDUCATIONAL NUTRITION INITIATIVE RESEARCH
STUDY (PNI)

This Informed Consent Form has two parts:

- Information Sheet (to share information about the study with you)
- Certificate of Consent (for signatures if you choose to participate)

You will be given a copy of the full Informed Consent Form

Part I: Information Sheet

Introduction

You are invited to participate in a research study conducted by Odiwuor Florence, who is a doctoral student from Kenyatta University. Mrs. Odiwuor is conducting this study for her doctoral dissertation. Your participation in this study is entirely voluntary. You should read the information below and ask questions about anything you do not understand, before deciding whether or not to participate.

Purpose of the research

We want to know how expectant mothers in this community feed. We want to find out if advising mothers on what to eat and how to take care of themselves can help to improve their local dietary practices and their own nutritional health and that of the new born. We hope to use what we learn from the study to influence actions that will improve maternal and infant health.

Type of Research Intervention

This research will involve your participation in questionnaires that will take about half an hour each, and half an hour interview. This will be repeated about three to four months later.

Participant Selection

You are being invited to take part in this research because we feel that you can contribute much to our understanding and knowledge of local nutrition practices.

Voluntary Participation

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. If you choose not to participate, all the services you receive at this Centre will continue and nothing will change.

Procedures

If you volunteer to participate in this study, we will ask you to do the following:

1. We will ask you to take part in about 4 tasks over the course of a total of about a 4 months length of time.
2. These tasks may include: (1) keeping a diary (to be explained by the researcher), (2) answering questions about what you eat, daily and information about your life (3) keeping a list of your daily activities; and (4) Learning about good nutrition practices and applying the knowledge you have learned in the program.
3. We will ask your permission to obtain a list of illnesses you may be suffering from and medications taken during the program.

We shall ask you to participate in an interview.. During the interview, I or another interviewer will sit down with you in a comfortable place at the Centre. If you do not wish to answer any of the questions during the interview, you may say so and the interviewer will move on to the next question. No one else but the interviewer will be present unless you would like someone else to be there. The information recorded is confidential, and no one else will have access to the information documented during your interview. You will also be given questionnaires to fill. You may answer the questionnaire yourself, or it can be read to you and you can say out loud the answer you want me to write down.

If you do not wish to answer any of the questions included in the questionnaires, you may skip them and move on to the next question. You will be given two questionnaires you will fill one and give it back to the researcher and one you will go with to fill at home and bring it back in your next visit. The information recorded is confidential, your name is not being included on the forms, only a number will identify you, and no one else will have access to the information.

Duration

The research takes place for about four months in total. During that time, you will be asked to read some nutrition counseling materials which we shall give you and receive counseling on nutrition at the hospital every time you come for clinic. We request that you apply the knowledge gained from this materials and sessions. In the fourth month we will repeat the interview and questionnaire exactly as we did it the first time. When you deliver we would like to know the health of your baby.

Risks

We expect that any risks, discomforts, or inconveniences will be minor and we believe that they are not likely to happen. If discomforts become a problem, you may discontinue your participation.

There is a risk that you may share some personal or confidential information by chance, or that you may feel uncomfortable talking about some of the topics. However, we do not wish for this to happen. You do not have to answer any question or take part in the interview/survey if you feel the question(s) are too personal or if talking about them makes you uncomfortable.

Benefits

It is not likely that you will benefit directly from participation in this study, but the research should help us learn how to improve services for expectant mothers and new borns. There will be no direct benefit to you, but your participation is likely to help us find out more about how to prevent and treat malaria in your community.

Reimbursements

You will not be provided with any incentive to take part in the research. You will not receive any payment or other compensation for participation in this study. There is also no cost to you for participation.

Confidentiality

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of a code number to let us know who you are. We will not use your name in any of the information we get from this study or in any of the research reports. When the study is finished, we will destroy the list that shows which code number goes with your name. Information that can identify you individually will not be released to anyone outside the study. Mrs. Odiwuor will, however, use the information collected in her dissertation and other publications.

Sharing the Results

Nothing that you tell us today will be shared with anybody outside the research team, and nothing will be attributed to you by name. We may use any information that we get from this study in any way we think is best for publication or education. Any information we use for publication will not identify you individually.

Right to Refuse or Withdraw

You can choose whether or not to be in this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you do not want to answer. There is no penalty if you withdraw from the study and you will not lose any rights to which you are otherwise entitled. The investigator may withdraw you from this research if your physician tells us that continued participation may injure your health.

Who to Contact

If you have any questions or concerns about the research, please feel free to contact

Mrs. Florence Odiwuor
Principal Investigator
Kenyatta University
P.O. Box 43844
Nairobi
florenceoddy@gmail.com

This proposal has been reviewed and approved by Kenyatta University Ethical Review Committee which is a committee whose task is to make sure that research participants are protected from harm. If you wish to find more about the NCIRSP, contact Judith Kimiywe, P.O. Box 43844, Nairobi, Tel: 0722 915 459

Part II: Certificate of Consent

I have been invited to participate in Nutrition Counseling Initiative Research Study Program. I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study

Print Name of Participant _____

Signature of Participant _____

Date _____

Day/month/year

or

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness _____

Thumb print of participant

Signature of witness _____

Date _____

Day/month/year

Statement by the researcher/person taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:

- 1.
- 2.
- 3.

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this ICF has been provided to the participant.

Print Name of Researcher/person taking the consent _____

Signature of Researcher /person taking the consent _____

Date _____ (Day/month/year)

APPENDIX B: ANTHROPOMETRIC DATA ENTRY FORM

SUBJECT CODE: _____		FINAL WEIGHT
Mother's Weight		
New born weight	1.	
	2.	
	3.	
GESTATIONAL AGE		

APPENDIX C: INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days.

Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** and **moderate** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal.

Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal.

PART 1: JOB-RELATED PHYSICAL ACTIVITY

The first section is about your work. This includes paid jobs, farming, volunteer work, course work, and any other unpaid work that you did outside your home. Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family. These are asked in Part 3.

1. Do you currently have a job or do any unpaid work outside your home?

Yes _____ No _____

No Skip to PART 2: TRANSPORTATION

The next questions are about all the physical activity you did in the **last 7 days** as part of your paid or unpaid work. This does not include traveling to and from work.

2. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, heavy construction, or climbing up stairs **as part of your work**?

Think about only those physical activities that you did for at least 10 minutes at a time.

_____ **days per week**

No vigorous job-related physical activity *Skip to question 4*

3. How much time did you usually spend on one of those days doing **vigorous** physical activities as part of your work?

_____ **hours per day**

_____ **minutes per day**

4. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads **as part of your work**? Please do not include walking.

_____ **days per week**

No moderate job-related physical activity *Skip to question 6*

5. How much time did you usually spend on one of those days doing **moderate** physical activities as part of your work?

_____ **hours per day**

_____ **minutes per day**

6. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **as part of your work**? Please do not count any walking you did to travel to or from

work. _____ **days per week**

No job-related walking *Skip to PART 2: TRANSPORTATION*

7. How much time did you usually spend on one of those days **walking** as part of your work?

_____ **hours per day**

_____ **minutes per day**

PART 2: TRANSPORTATION PHYSICAL ACTIVITY

These questions are about how you traveled from place to place, including to places like work, stores, movies, and so on.

8. During the **last 7 days**, on how many days did you **travel in a motor vehicle** like a train, bus, car, or tram?

_____ **days per week**

No traveling in a motor vehicle *Skip to question 10*

9. How much time did you usually spend on one of those days **traveling** in a train, bus, car, tram, or other kind of motor vehicle?

_____ **hours per day**

_____ **minutes per day**

Now think only about the **bicycling** and **walking** you might have done to travel to and from work, to do errands, or to go from place to place.

10. During the **last 7 days**, on how many days did you **bicycle** for at least 10 minutes at a time to go **from place to place**?

_____ **days per week**

No bicycling from place to place *Skip to question 12*

11. How much time did you usually spend on one of those days to **bicycle** from place to place?

_____ **hours per day**

_____ **minutes per day**

12. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time to go **from place to place**?

_____ **days per week**

No walking from place to place *Skip to PART 3:*

HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY

13. How much time did you usually spend on one of those days **walking** from place to place? _____ **hours per day** _____ **minutes per day**

PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY

This section is about some of the physical activities you might have done in the **last 7 days** in and around your home, like housework, gardening, yard work, general maintenance work, and caring for your family.

14. Think about only those physical activities that you did for at least 10 minutes at a time.

During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, chopping wood, shoveling snow, or digging **in the garden or yard**? _____ **days per week**

No vigorous activity in garden or yard *Skip to question 16*

15. How much time did you usually spend on one of those days doing **vigorous** physical activities in the garden or yard?

_____ **hours per day**

_____ **minutes per day**

16. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** activities like carrying light loads, sweeping, washing windows, and raking **in the garden or yard**?

_____ **days per week**

No moderate activity in garden or yard *Skip to question 18*

17. How much time did you usually spend on one of those days doing **moderate** physical activities in the garden or yard?

_____ **hours per day**

_____ **minutes per day**

18. Once again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** activities like carrying light loads, washing windows, scrubbing floors and sweeping **inside yourhome**? _____ **days per week**

No moderate activity inside home *Skip to PART 4: RECREATION,*

SPORT AND LEISURE-TIME PHYSICAL ACTIVITY

19. How much time did you usually spend on one of those days doing **moderate** physical activities inside your home?

_____ **hours per day**

_____ **minutes per day**

PART 4: RECREATION, SPORT, AND LEISURE-TIME PHYSICAL ACTIVITY

This section is about all the physical activities that you did in the **last 7 days** solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.

20. Not counting any walking you have already mentioned, during the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **in your leisure time**?

to do is the same as our previous interview--all that you have eaten including drinks,
_____ **days per week**

No walking in leisure time *Skip to question 22*

21. How much time did you usually spend on one of those days **walking** in your leisure time?

_____ **hours per day**

_____ **minutes per day**

22. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like aerobics, running, fast bicycling, or fast swimming **in your leisure time**?

_____ **days per week**

No vigorous activity in leisure time *Skip to question 24*

23. How much time did you usually spend on one of those days doing **vigorous** physical activities in your leisure time?

_____ **hours per day**

_____ **minutes per day**

24. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like bicycling at a regular pace, swimming at a regular pace, and doubles tennis **in your leisure time**?

_____ **days per week**

No moderate activity in leisure time *Skip to PART 5: TIME SPENT SITTING*

25. How much time did you usually spend on one of those days doing **moderate** physical activities in your leisure time?

_____ **hours per day**

_____ **minutes per day**

PART 5: TIME SPENT SITTING

The last questions are about the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television. Do not include any time spent sitting in a motor vehicle that you have already told me about.

26. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekday**?

_____ **hours per day**

_____ **minutes per day**

27. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekend**

day?

_____ **hours per day**

_____ **minutes per day**

7. Food break and review:

Now let's see what you ate between occasions and if I have

*Did you have anything to eat or drink between your (Time) (This occasion) and (Time) everything :
occasion?) Column 1A when you had (Next occasion)?*

- a. *What was the first food or drink you had after waking up yesterday? (Time?) (First occasion?)*
- b. *Now at (Time) for (This occasion) you had (Foods), did you have anything else?*
- c. *Did you have anything to eat or drink between your (Time) (This occasion) and (Time) when you had (Next occasion)? Such as snacks, deserts, fruits or drinks?*

Repeat 7b and 7c for each occasion except last occasion.

For last occasion, go to 7d

- d. *Now at (Time) for (Last occasion) you had (Foods) did you have anything else?*
- e. *Did you have anything to eat or drink after your (Time) (Last occasion) but before 6am this morning?*
- f. *Did you have anything to eat or drink between midnight last night and waking up today?*

4. Ask about amounts:

6. Ask about the food source:

How much did you eat (each of them) ?

Where did you obtain the (food)?

Go to the next food item on the Quick List. [Skip this step and go to step 7 when all foods in *Did you eat the following foods?* Food intake yesterday

[If yes, ask for the details; If no, continue on step 8]

- | | | | |
|---|--|---------------|--|
| - | <i>Water or other beverages</i> | <i>Cereal</i> | <i>Milk and milk products</i> |
| | <i>soda, juice, tea, coffee, alcohol, etc.</i> | | <i>chips, nuts, candies, gums, dried fruits, etc.</i> |
| | <i>Snacks</i> | | <i>Fruit and vegetable</i> |
| | <i>Other food</i> | | <i>Pasta, rice, congee, bread, cake, biscuit, etc.</i> |

*I'd like you to try to remember anything else you ate or drank yesterday, that you
~~didn't~~ told me about, including anything you ate or drank while preparing a meal or*
[When respondent says no, or when respondent stops, ask]

[If yes, ask for the details; If no, continue on step 8]

6 am yesterday 12 noon 6 pm Midnight 6 am this morning Midnight

APPENDIX E: SOCIO-DEMOGRAPHIC QUESTIONNAIRE

1. Telephone number-----

2. Trimester-----

3. Number of children -----

Tick one block only for every question:

1 Father 2 Mother 3 Sibling 4 Grandma 5 Grandpa 6 Aunt 7 Uncle 8 Cousin 9 Friend
10 Other

4. Who is mainly responsible for food preparation in the house

1 2 3 4 5 6 7 8 9 10

5. Who decides on what types of food are bought for the household?

1 2 3 4 5 6 7 8 9 10

6. Who is mainly responsible for serving Food?

1 2 3 4 5 6 7 8 9 10

7. Who is the head of this household?

1 2 3 4 5 6 7 8 9 10

8. Who decides how much is spent on food?

1 2 3 4 5 6 7 8 9 10

:

Now decide on the following (considering the household where you live):

9. Type of dwelling: 1 2 3 4 5

You can tick more than one

if necessary

1 Brick,

2 Concrete

3 Traditional

4 Mud

5 Tin Plank,

6 Wood

7 Other

Specify:

10. Number of people sleeping in the house for
at least 4 nights per week?

11. Number of rooms in house (excluding
bathroom, toilet and kitchen, if separate):

12 Number of people per living/sleeping room 1 2 3

(Tick one) 0-2 persons 3-4 persons More than 4

13. Where do you get drinking water most of the time? **(Tick one)**

1 Own Tap Communal

2 Tap

3 River, Dam Borehole,

4 Well

5 Other (Specify)

14. What type of toilet does this household have? 1 2 3 4 5

(Tick one)

1 Flush 2 Pit 3 Bucket, 4 Pot flash 5 Other (Specify)

15. What fuel is used for cooking most of the time? **(You can tick more than one) 1**

Electric 2 Gas 3 Paraffin 4 Wood/Coal 5 Sun 6 Open Fire

Tick one box only:

16. Does your home have a **working:** 1 2 3 4

(i) Refrigerator/Freezer Fridge Freezer Both None

(ii) Stove 1 2 If yes, choose one If yes, choose one

Yes No

Gas Coal Electricity With Oven/Without

Oven

(iii) Primus or Paraffin 1 2

Stove Yes No

(iv) Microwave 1 2

Yes No

(v) Hot Plate 1 2

Yes No

(vi) Radio or Television 1 2 3 4

Radio TV Both None

17 Education level of mother 1 2 3 4 5 6

(Tick one only) 1 None 2 Primary

School

3 Secondary 4 Tertiary Education 5 Don't Know

18. Mother's employment status 1 2 3 4 5 6

(Tick one only)

1 Housewife By choice

2 Unemployed 3 Self Employed 4 Wage-Earner 5 Other Specify 6 Don't Know

19. Do you have a house help? (**Tick one only**) 1 None 2 Yes 3 other specify

20. Husband's employment status (**Can tick more than one**) 1 Unemployed 2 Self-Employed

3 Wage-Earner 4 Retired 5 Other Specify 6 Not Applicable 7 Deceased

21. How many people contribute to the total income? (**Tick one only**)

1 1 person 2 2 persons 3. 3-4 persons 4. 5-6 persons 5. More than 6

22. Household income per month (including wages, rent, sales of vegs, etc. State grants). (**Tick one only**)

1 None 2 Ksh100-500 3 Ksh500- 1000 4. Ksh1000- 3000 5 Ksh3000-5000 6. Over Ksh5000 7. Don't know

23. Is this the usual income of the Household? (**Tick one box only**) Yes No

If NO, what other income is available, specify:

24. Is this more or less the income that you had over the past six months? (**Tick one only**)

Yes No

25. How much money is spent on food weekly? (**Tick one only**) R0-

1. Ksh50 2 Ksh 50- 3 Ksh 100 4 Ksh 150, 5 Ksh 200, 6 Ksh 250, 7 Ksh 300, 8 Ksh 350, 9 Ksh 400, 10 Over Ksh 400, 11 Don't know

26. Write down any other information that you feel is important in making your pregnancy better.

32. Are there some foods that you believe you should not eat while pregnant?

Yes ___ No ___

33. How long do you cook your food?

34. Do you treat your water before drinking?

35. Do you think it is important to rest more during pregnancy?

36. Do you have problems that may be preventing you from eating well?

37. Did the information you received during the last 4 – 7 months improve your nutrition knowledge? Yes _____ No _____

38. Do you wash your hands before handling food? Yes No

39. On a scale of 1 – 10 please score the level of knowledge you obtained from the study;

1 – 3 Low

4 – 6 Medium

7 – 10 High

This is the end of the interview. Thank you!

APPENDIX F: WHO STANDARDS AND OPERATIONAL GUIDANCE FOR HEALTH-RELATED RESEARCH WITH HUMAN PARTICIPANTS (PART)

Standards and Operational Guidance for Ethics Review of Health-Related Research with Human Participants

Standards and operational guidance for ethics review of health-related research with human participants.

1.Research - standards. 2.Ethics, Medical. 3.Ethical review - standards. 4.Ethics committees. 5.Patient selection. 6.Guidelines. I.World Health Organization.

ISBN 978 92 4 150294 8 (print)
ISBN 978 92 4 150295 5 (CD-ROM)

(NLM classification: W 50)

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Printed by the WHO Document Production Services, Geneva, Switzerland.

Preface

This document has been developed for individuals and organizations involved in health-related research with human participants, including biomedical, behavioural, social science, and epidemiological research (throughout this document, the term “research” is meant to include, and refers to, all of these domains). In particular, this document is intended to provide guidance to the research ethics committees (RECs) on which organizations rely to

review and oversee the ethical aspects of research, as well as to the researchers who design and carry out health research studies.

Ethics guidance for research involving human participants has been developed and disseminated by numerous organizations and agencies at international (see Annex 1), regional, and national levels over the past 50 years. Adherence to these guidelines helps to promote the ethical conduct of research and enhances and protects the rights and well-being of research participants and communities. A core component of all contemporary research ethics guidelines is that research should be subject to prior ethical review by a competent REC. Such review is intended to ensure that the ethical principles and practices put forward in the guidelines will be followed in the proposed research.

This document is intended provide guidance on the research ethics review process, not to take a substantive position on how particular ethical dilemmas in health-related research should be resolved. It is designed to complement existing laws, regulations, and practices and to serve as a basis upon which RECs can develop their own specific practices and written procedures. It is not intended to replace the need for national and local guidelines for the ethical review of research involving human participants, nor to supersede national laws and regulations. Indeed, it is hoped that this document will be useful to those charged with drafting national, local, and institutional regulations and policies, and that it will enhance the quality of RECs worldwide.

Standards and guidance for researchers

Standard 10: Researchers' responsibilities

Research is performed only by persons with scientific, clinical, or other relevant qualifications appropriate to the project, who are familiar with the ethical standards applicable to their research, who submit the necessary information to the REC for review (including both the research protocol and disclosures of any conflicting interests), and who carry out the research in compliance with the requirements established by the REC.

The person conducting research fulfils the following criteria in the conduct of ethical research.

1. Submitting an application for review

- a. An application or review of the ethics of proposed health-related research is submitted by a researcher qualified to undertake the particular study, who is directly responsible for the ethical and scientific conduct of the research. In certain jurisdictions, the sponsor of a study is responsible for submitting the research protocol to the REC.
- b. Student applications are submitted under the responsibility of a qualified advisor / faculty member involved in the oversight of the student's work or in the student's name, co-signed by the qualified faculty supervisor.
- c. All information required for a thorough and complete review of the ethics of proposed research is submitted, including disclosures about researchers' conflicting interests, if any.

2. Conduct of research

- a. The research is conducted in compliance with the protocol approved by the REC.
- b. No deviation or changes are made to the approved protocol or in following it, without prior approval of the REC, except where immediate action is necessary to avoid harm to research participants. In such a case, the REC is informed promptly of the changes/deviations made, and the justification for doing so.

- c. The REC is informed of any changes at the research site that significantly affect the conduct of the trial, and/or reduce the protections or decrease the benefits provided or increase the risk to participants (e.g. closing down of a health facility at the research site or other impediments to obtaining access to health care that was originally available).

3. Safety reporting

- a. All serious, unexpected adverse events related to the conduct of the study/study product or unanticipated problems involving risks of harm to the participants or others are promptly reported to the REC and/or other relevant authorities, as required by REC policies and applicable laws.
- b. Any recommendations provided by the REC in response to such reporting are immediately implemented.

4. Ongoing reporting and follow-up

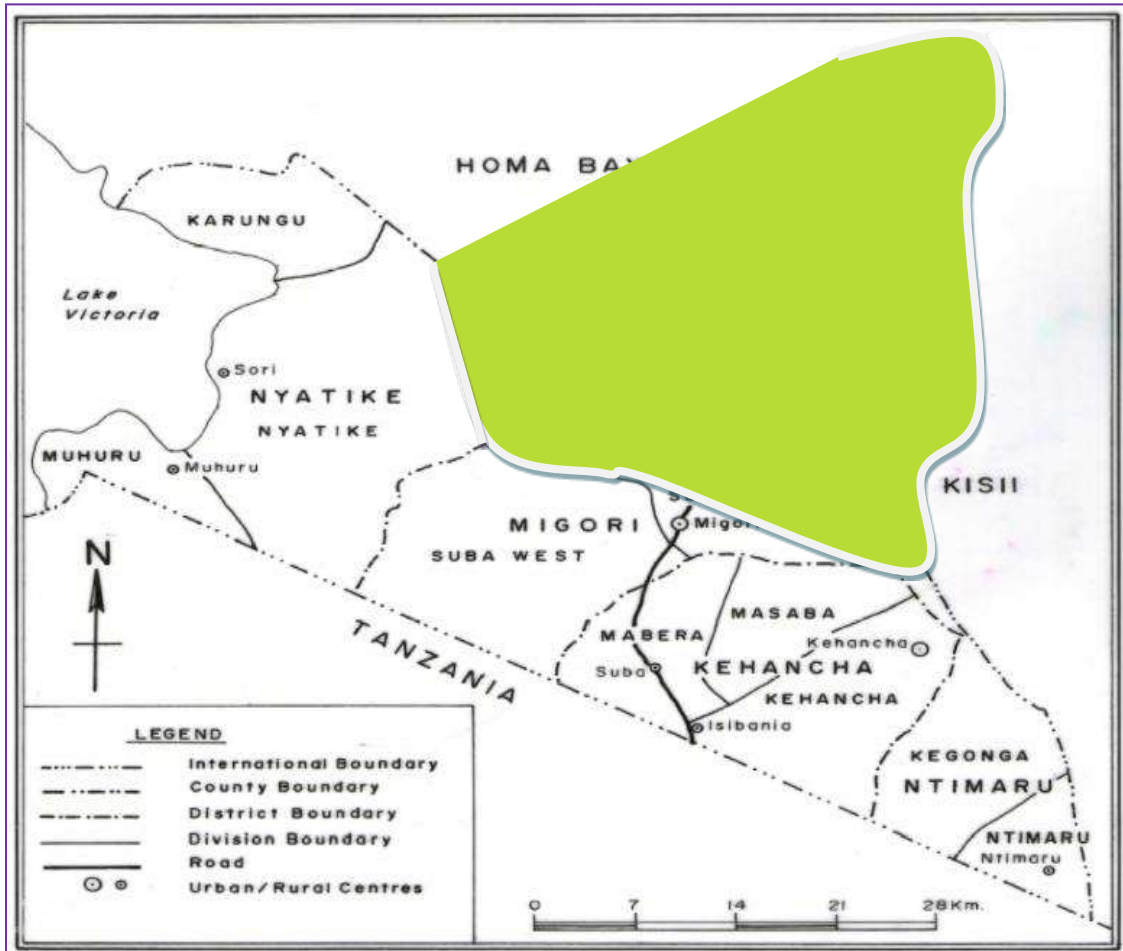
- a. The researcher submits written summaries of the research status to the REC annually, or more frequently, if requested by the REC.
- b. Researchers inform the REC when a study is completed or prematurely suspended/terminated.
- c. In the case of the early suspension/termination by the researcher or sponsor, the researcher notifies the REC of the reasons for suspension/termination; provides a summary of results obtained prior to prematurely suspending or terminating the study; and describes the manner by which enrolled participants will be notified of the suspension or termination and the plans for care and follow-up for the participants.
- d. If the REC terminates or suspends its approval of a study, the researcher informs the institution under whose authority the research is being conducted, the sponsor of the research, and any other applicable organizations.

5. Information to research participants

Researchers have a responsibility to keep the research participants and their communities informed of the progress of research by appropriate means, at suitable time-frames in simple and non-technical language, for example, when:

- a. the research study is terminated or cancelled
- b. any changes occur in the context of the research study that alter the potential benefits or risks
- c. the research project is completed
- d. results of the research are available.

APPENDIX G: MAP OF MIGORI COUNTY



Key: Area of Study

APPENDIX H: ASSOCIATIONS BETWEEN NUTRIENT INTAKES AND SOCIO-DEMOGRAPHIC CHARACTERISTICS

Table 4.26: Test for relationships between socio-demographic factors, birth weight and gestation age

Socio-demographic factor	Nutrient	F	P value
Responsible for Food preparation	Energy (kcal)	.109	.897
	Protein (g)	.222	.802
	Fat (g)	.061	.941
	Carbohydrate (g)	.154	.857
	Dietary fiber (g)	.811	.448
	Vitamin A (µg)	.357	.701
	Folic acid (µg)	.140	.870
	Vitamin C (mg)	.731	.485
	Calcium (mg)	.159	.853
	Iron (mg)	1.902	.156
Food Decision	Energy (kcal)	.703	.498
	Protein (g)	.621	.540
	Fat (g)	3.231	.044
	Carbohydrate (g)	2.598	.080
	Dietary fiber (g)	4.056	.021
	Vitamin A (µg)	.202	.817
	Folic acid (µg)	1.303	.277
	Vitamin C (mg)	.614	.544
	Calcium (mg)	1.796	.172
	Iron (mg)	.256	.775
Household Head	energy (kcal)	.098	.906
	Protein (g)	1.860	.162
	Fat (g)	1.637	.201
	Carbohydrate (g)	1.520	.225
	Dietary fiber (g)	.671	.514
	Vitamin A (µg)	.102	.903
	Folic acid (µg)	.471	.626
	Vitamin C (mg)	.034	.967
	Calcium (mg)	1.118	.332
	Iron (mg)	1.259	.289
Source of Food Money	energy (kcal)	.146	.865
	Protein (g)	.698	.500
	Fat (g)	1.886	.158
	Carbohydrate (g)	3.019	.054
	Dietary fiber (g)	1.142	.324
	Vitamin A (µg)	.147	.863
	Folic acid (µg)	.867	.424
	Vitamin C (mg)	.515	.600
	Calcium (mg)	2.454	.092
	Iron (mg)	.596	.553
Dwelling	energy (kcal)	1.395	.254
	Protein (g)	.573	.566
	Fat (g)	.743	.479
	Carb	.461	.632
	Dieta	2.147	.123
	Vitamin A (µg)	.322	.726
	Folic acid (µg)	3.873	.025
	Vitamin C (mg)	.196	.822
	Calcium (mg)	.345	.709

	Iron (mg)	2.761	.069
No of People in he house	energy (kcal)	1.102	.370
	Protein (g)	.732	.646
	Fat (g)	.502	.831
	Carbohydrate (g)	.552	.792
	Dietary fiber (g)	.879	.527
	Vitamin A (µg)	.563	.784
	Folic acid (µg)	1.439	.202
	Vitamin C (mg)	1.589	.151
	Calcium (mg)	.749	.632
	Iron (mg)	.733	.644
Source of Drinking water	energy (kcal)	1.089	.367
	Protein (g)	.807	.524
	Fat (g)	.646	.632
	Carbohydrate (g)	.882	.479
	Dietary fiber (g)	.081	.988
	Vitamin A (µg)	.370	.829
	Folic acid (µg)	.482	.749
	Vitamin C (mg)	.348	.844
	Calcium (mg)	.166	.955
	Iron (mg)	2.177	.079
Toilet type	energy (kcal)	.591	.556
	Protein (g)	.403	.670
	Fat (g)	1.816	.169
	Carbohydrate (g)	.066	.937
	Dietary fiber (g)	.796	.455
	Vitamin A (µg)	.069	.934
	Folic acid (µg)	1.894	.157
	Vitamin C (mg)	.088	.916
	Calcium (mg)	.478	.622
	Iron (mg)	.424	.656
Fuel	energy (kcal)	1.522	.224
	Protein (g)	2.481	.090
	Fat (g)	1.019	.365
	Carbohydrate (g)	.310	.735
	Dietary fiber (g)	1.180	.312
	Vitamin A (µg)	2.599	.080
	Folic acid (µg)	.366	.695
	Vitamin C (mg)	.172	.842
	Calcium (mg)	.252	.778
	Iron (mg)	1.864	.161
Education Level of mother	energy (kcal)	.109	.897
	Protein (g)	.222	.802
	Fat (g)	.061	.941
	Carbohydrate (g)	.154	.857
	Dietary fiber (g)	.811	.448
	Vitamin A (µg)	.357	.701
	Folic acid (µg)	.140	.870
	Vitamin C (mg)	.731	.485
	Calcium (mg)	.159	.853
	Iron (mg)	1.902	.156
Employment of Mother	en 193	.850	.469
	Pr	.846	.471
	Fa	.231	.874
	Carbohydrate (g)	1.114	.347
	Dietary fiber (g)	.857	.466
	Vitamin A (µg)	.174	.914
	Folic acid (µg)	1.243	.298
	Vitamin C (mg)	.527	.664
	Calcium (mg)	.176	.912
	Iron (mg)	1.110	.348

Employment of husband	energy (kcal)	2.511	.063
	Protein (g)	2.164	.097
	Fat (g)	1.660	.181
	Carbohydrate (g)	1.156	.331
	Dietary fiber (g)	.408	.748
	Vitamin A (μg)	1.151	.333
	Folic acid (μg)	.716	.545
	Vitamin C (mg)	.388	.762
	Calcium (mg)	2.034	.114
	Iron (mg)	.279	.841

P value from analysis of variance, $p \leq 0.05$,
 mean BW – 3097.8 g , mean GA – 21.21 weeks

Table 4.27: Test for relationships between socio-demographic factors, birth weight and gestation age

Socio-demographic factor	Gestation Age		Birth Weight	
	F	P value	F	P value
Education level of mother	.041	.960	.822	.444
Employment status	2.570	.059	.793	.501
Employment status	1.891	.121	1.371	.252
Type of dwelling	.387	.681	.828	.441
No.of people sleeping in house 4 nights /week	.611	.721	.839	.544
No. of rooms/ House	1.421	.192	1.753	.110
Source of Drinking Water	1.980	.090	1.900	.103
Cooking fuel used by the women	1.475	.228	.433	.730
No. of People sleeping per room	1.471	.192	1.755	.110
Food decision maker	.287	.752	.011	.989
Household head	1.226	.299	1.478	.235
Provider of food	.813	.447	.816	.446
Responsible for	1.179	.326	.503	.805
Responsible for	.167	.846	.149	.862

P value from analysis of variance, $p \leq 0.05$,
 mean BW – 3097.8 g , mean GA – 21.21 weeks

APPENDIX I: RESEARCH APPROVAL BY ETHICAL REVIEW COMMITTEE



**KENYATTA UNIVERSITY
ETHICS REVIEW COMMITTEE**

Email: chairman_kuerc@ku.ac.ke
secretary_kuerc@ku.ac.ke
ercku2008@gmail.com
Website: www.ku.ac.ke

P. O. Box 43844 - 00100 Nairobi
Tel: 8710901/12
Fax: 8711242/8711575

Our Ref: KU/R/COMM/51/665

Date: 18th April, 2016

Odiwuor Oyeho Florence
Kenyatta University,
P.O Box 43844,
Nairobi

Dear Oyeho,

APPLICATION NUMBER PKU/463/1 564 – “EFFICACY OF NUTRITION COUNSELLING INITIATIVE ON ENERGY AND MICRONUTRIENTS INTAKE, PHYSICAL ACTIVITY AND PREGNANCY OUTCOMES IN MIGORI COUNTY, KENYA” –VERSION 2.

IDENTIFICATION OF PROTOCOL

The application before the committee is with a research topic, “Efficacy of nutrition counselling initiative on energy and micronutrients intake, physical activity and pregnancy outcomes in Migori County, Kenya”- Version 2

2. APPLICANT

Odiwuor Oyeho Florence, Department of Food, Nutrition & Dietetics

3. SITE

Migori County, 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 18th April, 2016.

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.

When replying, kindly quote the application number above.

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

DR. TITUS KAHIGA
CHAIRMAN ETHICS REVIEW COMMITTEE



Iaccept the advice given and will fulfill the conditions therein.

Signature..... Dated this day of..... 2016.

cc: Vice-Chancellor
DVC-Research Innovation and Outreach

APPENDIX O: COUNTY DIRECTOR OF EDUCATION



MINISTRY OF EDUCATION
State Department of Education

Telephone: (059) 20420
Fax: 05920420
When replying please
quote

COUNTY DIRECTOR OF EDUCATION
MIGORI COUNTY
P.O. Box 466-40400
SUNA – MIGORI

REF: MIG/CDE/ADMN/1/VOL.III/126

DATE: 10th August, 2016


Florence Arony Oyeho Odiwuor
Kenyatta University
P.O. Box 43844 – 00100
NAIROBI

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "*Efficacy of nutrition counseling initiative on energy and micro-nutrient intake, physical activity and pregnancy outcomes in Migori County, Kenya*". I am pleased to inform you that you have been authorized to undertake research in Migori County for a period ending 30th July, 2017.

On completion of the research, you are expected to submit one hard copy and a soft copy of the research report/Thesis to this office.

Thank you.


Asyago B. A. (Mrs.)
County Director of Education
MIGORI COUNTY



MINISTRY OF EDUCATION
State Department of Education

Telephone: (059) 20420
 Fax: 05920420
 When replying please
 quote

COUNTY DIRECTOR OF EDUCATION
 MIGORI COUNTY
 P.O. Box 466-40400
 SUNA – MIGORI

REF: MIG/CDE/ADMN/I/VOL.III/126

DATE: 10th August, 2016


Florence Arony Oyeho Odiwuor
 Kenyatta University
 P.O. Box 43844 - 00100
 NAIROBI

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "*Efficacy of nutrition counseling initiative on energy and micro-nutrient intake, physical activity and pregnancy outcomes in Migori County, Kenya*". I am pleased to inform you that you have been authorized to undertake research in Migori County for a period ending 30th July, 2017.

On completion of the research, you are expected to submit one hard copy and a soft copy of the research report/Thesis to this office.

Thank you.


 Asyago B. A. (Mrs.)
 County Director of Education
MIGORI COUNTY

HIV and nutrition

- ✦ It is important for all women to know their HIV status, especially if they are pregnant or breastfeeding.
- ✦ To know your HIV status you must take a test.
- ✦ If you are HIV-positive, you should consult your health care provider for care and treatment and information on how best to feed your baby.



- ✦ If you are HIV-positive, you need extra food to give you extra energy. HIV puts an additional strain on your body and may reduce your appetite. Eating a variety of nutritious foods is important.
- ✦ Protect yourself and your baby from HIV and other sexually transmitted infections during pregnancy and while breastfeeding by practicing safe sex by using condoms consistently and correctly. Consult a family planning counselor as soon as possible after giving birth.



This brochure was adapted from materials developed originally by WHA for use in Tanzania. Both technical and financial support for the development of this brochure was provided by the Quality Assurance Project (QAP), managed by University Research Co., LLC (URC), under USAID Contract Number GPH-C-00-02-00004-00, May 2007.

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Nutrition

During Pregnancy and Breastfeeding



Protect Your Health

