# EFFECT OF HIV AND NUTRITIONAL STATUS ON PREGNANCY OUTCOMES OF WOMEN ATTENDING PREVENTION OF MOTHER-TO-CHILD TRANSMISSION (PMTCT) OF HIV PROGRAM AT NYANZA PROVINCIAL GENERAL HOSPITAL, KENYA

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## DECLARATION AND RECOMMENDATION

**Declaration by the candidate**

This Thesis is my original work and has not been previously submitted for award of a degree in any other university

**Signature:** ..... **Date:** 05-02-09.....

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**Recommendation by the supervisors**

This thesis has been submitted for examination with our approval as the student's supervisors

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X 2013/97158 X

## DEDICATION

This work is dedicated to my beloved wife **Joan**, daughters **Angel** and late Dad **Mala**

## ACKNOWLEDGEMENTS

I wish to express my deep and lasting appreciation to those who in one way or another assisted me during this study. Althouth it is not possible to mention all of them by name, I am gratefull for their worthwhile assistance.

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## ABSTRACT

This study assessed the effect of HIV and nutritional status on pregnancy outcomes of women attending the *Prevention of Mother-To-Child Transmission* (PMTCT) of HIV program at Nyanza Provincial General Hospital, Kenya. Descriptive cross-sectional survey research design was used. Purposive sampling procedure was employed to select pregnant women (n=107) who had been tested into the study. Data were collected through an interview schedule, anthropometry and dietary indices, from HIV-positive (n=48) and HIV-negative (n=59) pregnant women. Maternal dietary intakes and anthropometric measurements were assessed. Dietary intakes were investigated using 24-Hour Diet Recalls and Food Frequency Questionnaires (FFQ). Maternal Mid-Upper Arm Circumference was measured by the use of non-stretchable tape. Infants' birth weights, gestational age, birth complications and still births were recorded immediately after birth. The Statistical Package for Social Sciences (SPSS version 11.0) was used to analyze data for descriptive statistics, regression and ANOVA while NutriSurvey computer program, analyzed dietary data. The results of the study showed that HIV-positive women gave birth to infants of low birth weight (2.70 ± 0.3799 kg) compared with their HIV-negative counterparts (3.16 ± 0.5307 kg). Gestational age of infants born to HIV-positive mothers was shorter (34.6 ± 3.24 weeks) compared with that of infants born to HIV-negative mothers (39.4 ± 2.21 weeks). Maternal MUAC was a significant predictor of infants' birth weight in HIV-positive mothers ($P < 0.05$) than in their HIV-negative counterparts. Magnesium, iron and folate had a significant influence ($P < 0.05$) on infants gestational age in both HIV-positive and HIV-negative mothers. It was concluded that both HIV and nutritional status have effects on pregnancy outcomes. Designing and implementation of appropriate and relevant training materials on nutrition education can go along way in improving maternal health during HIV infection to ensure favorable pregnancy outcomes.

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## LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| AIDS | Acquired immune deficiency syndrome |
| ARV | Antiretroviral therapy |
| CDC | Center for disease control |
| FANTA | Food and Nutrition Technical Assistance Project |
| FAO | Food and agriculture organization |
| HIV | Human immunodeficiency virus |
| KDHS | Kenya demographic and health Survey |
| MCH | Maternal and child health |
| MOEST | Ministry of education science and technology |
| MTCT | Mother-to-child transmission of HIV |
| MUAC | Mid-upper arm circumference |
| NACC | National AIDS control council |
| NAIDS | Nutritionally Acquired Immune Deficiency Syndrome |
| NPGH | Nyanza provincial general hospital |
| PLWHA | People living with HIV/AIDS |
| PSC | Patient Support Centre |
| RCQHC | Regional center for quality of healthcare |
| RDA | Recommended daily allowance |
| UNAIDS | Joint united nations program on HIV/AIDS |
| UNICEF | United nations children's fund |
| WFP | World food program |
| VCT | Voluntary counseling and testing |

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background to the study

Africa remains by far the continent most affected by Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS). Of the 40 million people living with HIV/AIDS globally, 28.5 million are in sub-Saharan Africa (SSA), which is home to only 11 percent of the world's population. Of the 19 million deaths globally resulting from AIDS so far, 83 percent (16 million) have occurred in SSA. In sub-Saharan Africa, more than 50 percent of adults infected with HIV are women (UNAIDS, 2005). For women who are HIV infected the effect of malnutrition and HIV, increase poor clinical and pregnancy outcomes (FANTA, 2001).

In Africa where the seroprevalence of HIV infection in pregnant women exceeds 20 percent in many areas, perinatal HIV transmission rates have been reported to be 20-42 percent. In Kenyan urban sentinel sites, HIV prevalence among antenatal women ranges between 4-10 percent in low seroprevalence sites to 20-35 percent in high seroprevalence sites (National AIDS Control Council (NACC), 2000). Results from the 2003 Kenya Demographic and Health Survey (Owuor & Mburu, 2003) indicate that 6.7% of Kenyan adults are infected with HIV. In women aged 15-49 years, HIV prevalence is 8.7% while for men 15-49 years; it is 4.6% (NACC, 2005).

A study in Kisumu, revealed that HIV prevalence among sexually active 15-49 year-olds was six times greater among women than among men and that among 24-year-olds, prevalence was three times higher among women than among men (Glynn *et al.,* 2001). The gender difference is most pronounced among young people; in the 15-24 year-age range, where female prevalence is nearly five times higher than male prevalence (NACC, 2005).

Malnutrition and HIV work in tandem, with malnutrition weakening the immune system, increasing vulnerability to infection and may hasten the progression of HIV to AIDS. On the other hand, HIV compromises the nutritional status of infected people and increases their susceptibility to other infections (Piwoz & Preble, 2000). It is also

possible that poor status of specific nutrients may hasten the transmission of HIV (Helestein & Kotler, 1998).

The physiological changes that occur during pregnancy require extra nutrients and energy to meet the demand of an expanding blood volume, the growth of maternal tissue, the developing fetus, loss of maternal tissue at birth, and preparation for lactation (Hoffman, 2001). The endemic problem of malnutrition makes many women enter pregnancy already malnourished and consequently the nutritional status of an HIV infected woman before, during and after pregnancy may influence her own health as well as the risk of transmitting HIV to her infant (Bijlsma, 2001).

Good maternal nutrition during both pregnancy and lactation is vital for the survival and well being of the developing infant (Queen & Hess, 1998). However, these reproductive years are periods of nutritional stress for many African women. Pregnancy-related health and nutrition problems have an effect on the quality of their lives and of their newborn infants well beyond delivery (Semba, 2000). Well-nourished mothers have healthier babies and a lower risk of maternal mortality and morbidity. In contrast, malnourished women have higher reproductive risks and subsequently poorer pregnancy outcomes (Institute of Medicine, 1990).

## 1.2 Statement of the problem

The HIV prevalence in pregnant women in Kenya varies from one sentinel surveillance site to another with a range of 1% to 30% (NACC, 2005). Nyanza Provincial General Hospital (NPGH) being one of the sentinel surveillance sites had a high HIV prevalence (22.7%) among pregnant women attending its PMTCT program. HIV compromises the nutritional status of infected people resulting into poor pregnancy outcomes (Piwoz & Preble, 2000). Wasting is a cause of stillbirth, preterm delivery, and intrauterine growth retardation (IUGR), yet it is virtually unknown whether maternal anthropometry especially the mid-upper arm circumference (MUAC) plays a role in the pathogenesis of these adverse outcomes among HIV-infected women (Ayisi *et al.,* 2003). The study sought to establish the extent to which HIV and nutritional status affect pregnancy outcomes of the women attending the PMTCT program at Nyanza Provincial General Hospital.

## 1.3 Overall objective of the study

The overall objective of the study was to determine the effect of HIV and nutritional status on pregnancy outcomes of women attending Prevention of Mother-to-Child Transmission (PMTCT) of HIV program at NPGH, Kenya.

## 1.4 Specific objectives of the study

The specific objectives of the study were: -

1. To determine the Mid-Upper Arm Circumference (MUAC) measurements of HIV-infected and uninfected women attending the PMTCT program at NPGH.
2. To determine the dietary intakes of HIV-infected and uninfected women attending the PMTCT program at NPGH.
3. To assess pregnancy outcomes of HIV-infected and uninfected women attending the PMTCT program at NPGH.
4. To establish if there is a relationship between maternal HIV status, MUAC and nutrient intakes on the infants birth weight, gestational age, type of birth and mode of delivery.

## 1.5 Hypotheses of the study

To achieve the objectives of this study, the following null hypotheses were tested: -

$H_{01}$ No difference in MUAC and pregnancy outcomes between the HIV-infected and uninfected women.

$H_{02}$ No difference in dietary intakes between HIV-infected and uninfected women.

$H_{03}$ No difference in pregnancy outcomes between HIV-infected and uninfected women.

$H_{04}$ No relationship between HIV status, MUAC, nutrient intakes and infants' birth weight, gestational age, type of birth and mode of delivery.

## 1.6 Significance of the study

Information gathered from this study will be used by the government and various partners to educate the pregnant women on nutrition and HIV in pregnancy. This will help prevent malnutrition and improve the health and nutritional status of the women,

thereby slowing the progression HIV, ensure adequate gestational weight gain and decrease the risk of premature delivery and low birth weights. The women can then remain productive and prolong the quality of their lives; which will help achieve some of the millennium development goals especially on maternal and child health.

### 1.7 Assumption of the study.

The study was carried out on the assumption that the HIV-positive and HIV-negative pregnant women would be available and willing to participate in the study.

### 1.8 Scope of the study.

The study focused only on the pregnant women attending PMTCT program at Nyanza Provincial General Hospital.

### 1.9 Limitation of the study.

1. The birth weights of the babies were taken by nurses and to ensure accuracy the nurses were trained and the paediatric weighing scales standardized to reduce error.
2. Maternal pre-pregnancy weights were not available hence weight gain in pregnancy could not be captured.
3. Monitoring of weight gain in pregnancy was not possible since majority of the women attend antenatal clinic for the first time in their $2^{nd}$ and $3^{rd}$ trimesters.
4. Outcome of the study was influenced by immuno-suppression (staging of HIV disease) among the HIV-infected women.

### 1.10 Exclusion Criteria.

The pregnant women enrolled at the patient support centre (PSC) for HIV care were excluded from the study as a measure to reduce bias that would arise due to nutritional interventions given to them.

### 1.11 Operational definitions of terms

The following were operational definitions of terms pertinent to this study.

**Anthropometry:** -The measurement of maternal Mid-Upper Arm Circumference (MUAC) and infant birth weights.

**Food Frequency Questionnaire:** - A method of dietary assessment in which the women were asked to give how often they consume food items listed in the questionnaire.

**Mid-Upper Arm Circumference:** - Circumference halfway between the acromnion process of the scapula and the tip of the elbow. It is a measure of stored skeletal protein and hence maternal nutritional status.

**Nutritional status:** - Measurement of the extent to which the womens` physiological needs for nutrients were being met as shown by adequate maternal dietary intake and MUAC.

**Nutritional assessment:** - Refers to the analysing of maternal dietary intake and MUAC.

**Pregnancy outcomes:** -Refers to the infant birth weight, gestational age, mode of delivery and type of birth.

**24-Hour dietary recall:** -Refers to asking the women to remember everything they consumed during the 24 hours preceding the study.

**HIV Status:** - Refers to whether the women were HIV-infected or not.

**Mode of delivery:** - Refers to whether the baby born normally or by caesarean section

**Type of birth:** - Refers to whether birth was normal or by episiotomy.

**State of birth:** - Refers to whether the baby was born alive or dead either as an abortion (delivery before 28 weeks of gestation) or stillbirth (delivery at or after 28 weeks).

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

This chapter focuses on the link between nutrition, HIV/AIDS and women. Other issues reviewed include nutritional implications for pregnant HIV-infected woman, mother-to-child transmission of HIV in pregnancy, effects of HIV on pregnancy outcomes, effects of malnutrition on pregnancy outcomes and nutrient requirements of HIV-infected pregnant woman. A review of the conceptual framework used to guide this study concludes this chapter.

## 2.2 Link between nutrition, HIV/AIDS and women

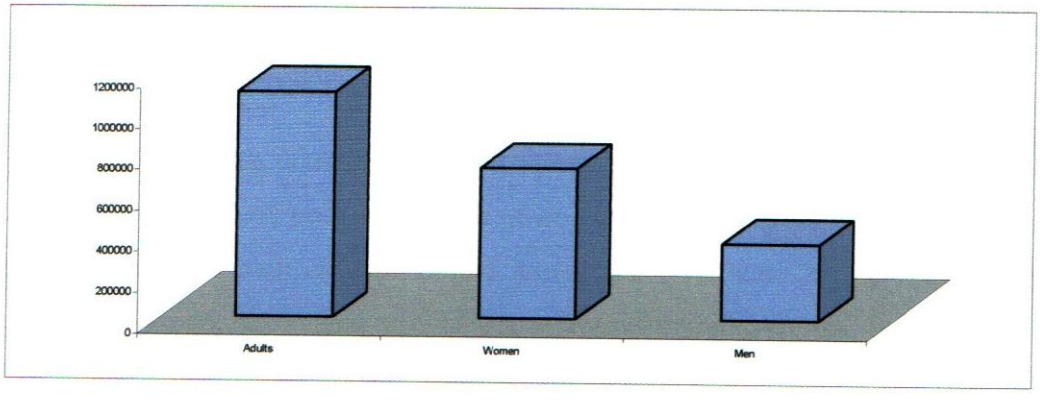
It has long been recognized that HIV infection can have impact on nutritional status. Human immunodeficiency virus (HIV) infection is characterized by progressive destruction of the immune system, leading to recurrent opportunistic infections and malignancies, progressive debilitation, and death (Seumo-Fosso & Cogill, 2003). Malnutrition is one of the major complications of HIV infection and a significant factor in advanced disease. The shock of initial HIV infection is sometimes characterized by hyper metabolism and catabolism. The host's food intake has to increase in order to compensate the catabolism due to the rapid multiplication of the virus (FANTA, 2001).

During the seroconversion phase, the body is producing antibodies to fight the virus, and all these syntheses require additional energy and proteins and the body uses its fat store. The infected host muscle is the principal source of energy and host protein is used to repair the cellular and tissue damage. If the nutrition needs are fulfilled at this stage, the people living with HIV and AIDS (PLWHA) may recuperate from the opportunistic infections, hence stopping the vicious cycle leading to malnutrition and contribute to delaying the progression of the disease (Piwoz & Preble, 2000).

According to WHO/UNAIDS figures, 12-13 women are infected for every 10 men in Sub-Saharan Africa (UNAIDS, 2002) (Fig. 2.0). The ratios are even lop-sided between the sexes, for the females in the 15-24 age group accounting for 76 percent of all

the infected (UNAIDS, 2004). Women are physically more susceptible to HIV infection than men, with the male-to-female transmission risk being twice as high as that of female-to-male. Other socio-economic factors like poverty, drive many young women and girls to engage in transactional sex in exchange for goods, services, money or basic necessities, often with older men. Young girls tend to have their first sexual encounter with men having a sexual history going back 10 years. These factors have weighed in to bring the wide gender disparity hence HIV in sub-Saharan Africa (SSA) is said to have the face of a woman (Alban & Guinness, 2000).

HIV/AIDS is fast acquiring a feminine face in African countries like Kenya, as biological vulnerability, poverty and sexual violence join to raise infection rates for young women and girls (UNAIDS, 2004). Although men basically drive the epidemic, women and girls now make up to 60 percent of those infected with HIV in African countries. The Kenya Demographic and Health Survey (Owuor & Mburu, 2003) revealed that 6.7% of adults tested are infected with HIV. Reconciliation of KDHS and sentinel surveillance data gives an adjusted prevalence of 7% (range 6.1-7.5%) implying a total of 1.1 million adult Kenyans infected with HIV of whom about two thirds are women (NACC, 2005) (Fig. 2.0). Nutritional status may affect the progression of HIV disease in adults and the survival of HIV-infected people (Piwoz & Preble, 2000). Good maternal nutrition is important for the health and reproductive performance of women as well as the survival and development of their children (Queen & Hess, 1998).




Source: NACC, 2005

Fig 2.0: Estimated number of men and women 15-49 years of age living with HIV/AIDS in Kenya, end of 2004

## 2.3 Nutritional implications for HIV-infected pregnant woman

In all women, malnutrition during pregnancy increases maternal morbidity and mortality and affects pregnancy outcomes. For the HIV-infected woman the infection causes nutrient losses that increase nutritional requirements and the risk of malnutrition, both of which increases the risk of mother-to-child transmission (MTCT) of HIV (Lwanga, 2001). Zinc and Vitamin A deficiency increase the risk of reproductive tract infections during pregnancy (Patrick, 2000). Low calcium intake increases the risk of pre-eclampsia and high blood pressure. Iron deficiency reduces the resistance to disease, causes fatigue and reduces productivity (Dreyfuss & Fawzi, 2002).

Randomised placebo controlled studies have been carried out in Africa by Coutsoudis and Pillay (1999) and Fawzi (2001) on the impact of Vitamin A supplementation and other vitamin supplements on vertical HIV transmission. These studies have found marked decreases in prenatal mortality and an increase in birth weight that was associated with Vitamin A supplementation in pregnancy. However caution must be exercised with Vitamin A supplementation during pregnancy because of its teratogenic effect on the fetus at high dosage (Semba, 1994).

Providing multivitamin supplementation to HIV-infected women during pregnancy has shown decreased adverse pregnancy outcomes and increased T-cell counts. In yet another study giving multivitamin supplements daily during pregnancy to HIV-infected women improved weight gain among these women (Fawzi, 2000). These studies suggest that providing a daily multivitamin to HIV-infected woman, as part of their care is beneficial.

In developing countries, anaemia is common in pregnant women and may be due to poor dietary intake, poor absorption of iron and other vitamins such as folate and $B_{12}$ and co-infections such as malaria and hookworm (Gorduek, 2001). For HIV infected pregnant woman, prolonged use of some antiretroviral (ARVs), such as zidovudine (AZT) can cause megaloblastic anaemia (Semba, 2001). Anaemia is common during HIV-infection and increases risk of prolonged labour and death from haemorrhage (Levine, 2001).

In HIV-infected mother, anaemia increases the risk of mortality, pre-term delivery and low birth weight; both of these conditions increase the risk of MTCT of HIV (Clark

& Semba, 2001). A study of multivitamins plus iron and folic acid given during pregnancy to HIV-infected mothers (Fawzi *et al.*, 2000) in Tanzania, resulted in increased weight gain during pregnancy, lowered risk of low birth weight and pre-term delivery and other positive outcomes. These studies focused more on supplements and therefore there is need to do research on the role of dietary and anthropometric effects on pregnancy outcomes.

## 2.4 Mother-to-child transmission (MTCT) of HIV in pregnancy.

There is a 5-10 percent risk of transmission of HIV during pregnancy. A child is considered to have been infected in utero, if the HIV-I genome is detected within 48 hours of delivery by a polymerase chain reaction test (DNA-PCR) or viral culture. Transmission during pregnancy occurs when placental protection of the fetus is compromised allowing for viral transmission. The following factors are associated with increased transmission during pregnancy: a viral, bacterial or parasitic placental infection in the mother; HIV infection of the mother; severe immune deficiency associated with advanced AIDS in the mother and malnutrition (WHO/UNAIDS/UNICEF, 1998).

There is a 10-20 percent risk of transmission of HIV during labour and delivery. Transmission is considered to have occurred intrapaturm if the results of the diagnostic test were negative during the first 48 hours after delivery but became positive in subsequent samples taken within 7-90 days of delivery. During labour and delivery transmission most often occurs when babies suck, imbibe or aspirate maternal blood or cervical secretions containing HIV. High risk of HIV transmission during labour and delivery are associated with long duration of membrane rapture, acute chorioamnionitis resulting from untreated sexually transmitted infections (STIs) or other infections and invasive delivery techniques that increase the baby's contact with the mothers blood (WHO, 1999). In Kenya there is an estimated overall mother-to-child transmission rate of 40% (Table 2.0).

Table 2.0: Estimated magnitude of MTCT in Kenya

| | |
|---|---|
| Population: | 28.7 million |
| Births per annum: | 1.2 million |
| Seropositive prevalence in mothers | 20% |
| Total number of births to seropositive mothers annually (children exposed to MTCT assuming no multiple pregnancy) | 240,000 |
| Number of HIV positive infants per annum in Kenya assuming 40% transmission: | 96,000 |

Source: NACC, 2000

## 2.5 Effect of HIV on pregnancy outcomes

The expanding epidemic of HIV infection contributes to substantial increases in the risk of adverse pregnancy outcomes. Data have accumulated that HIV, especially when more advanced may result into increases in certain pregnancy complications (Miller & Gorbach, 1999). Furthermore concerns have been raised that antiretroviral treatment itself may increase some adverse outcomes in pregnancy. Both HIV and pregnancy may affect the natural history, presentation, treatment and significance of certain infections and these in turn may be associated with pregnancy complications or perinatal infections (Institute of Medicine, 1990).

More severe reduction in birth weight is observed in HIV infected mothers. Worldwide, 24 million children are born weighing less than 2500 g each year. Low birth weight affects between 7 percent of pregnant women in developed countries and 33 percent in developing countries while premature births range from 7.1 percent to 22.3 percent respectively (Naeye, 1979). Compared with uninfected women, HIV infected pregnant women are at a higher risk of adverse pregnancy outcomes, including intrauterine growth retardation, low birth weights, and prematurity (Table 2.1).

Analysis of more than 30 published studies show that HIV-infected women were twice as likely to deliver low birth weight babies and twice as likely to have pre-term

deliveries (Fawzi, 2000). A study in South Africa of 497 HIV-infected pregnant women enrolled in a perinatal clinical trial found that the risk factors for adverse pregnancy outcomes (pre-term birth, low-birth weight, and inter-uterine growth retardation) in ARV treated women are similar to those reported for uninfected women (Piwoz & Preble, 2000). A study in the USA showed HIV-positive new-borns to be weighing 0.28 kg less and measuring 1.64 cm less than HIV-negative children born to HIV-negative mothers (Naeye, 1979). A study in Kigali Rwanda found that infants born to HIV-positive mothers weighed less by 2.947 kg compared to those born to HIV-negative mothers, who weighed 3.104 kg (Anderson, 2001).

However, these studies did not come to any conclusive evidence hence further research is needed in these areas. In Kenya, there are a number of published studies focusing on lactating women particularly on safe feeding options for HIV-infected infants, but no studies have been done on HIV-infected women and their pregnancy outcomes.

Table 2.1: Adverse pregnancy outcomes and relationship to HIV infection

| **Adverse Pregnancy Outcome** | **Relationship to HIV** |
|---|---|
| Spontaneous abortion | Limited data but evidence of possible increased risk |
| Stillbirths | No association noted in developed countries. Evidence of increased risk in developing countries. |
| Low birth weight (< 2500 g) | Evidence of possible increased risk |
| Pre-term delivery | Evidence of possible increased risk with more advanced disease. |

**Source:** Anderson, 2001

## 2.6 Effect of malnutrition on pregnancy outcomes

It is well established that the nutritional wellbeing of a healthy mother is critical for uncomplicated pregnancy and positive outcome (Hoffman, 2001). Many women in Africa maintain pregnancy and lactation on dietary intakes lower than recommended and

this is reflected in their lower weights. Nutritional status has even greater implications for the HIV-infected woman, who is at a higher risk of delivering pre-mature or low-birth weight infants and being malnourished than the uninfected woman (De Onis & Hubitch, 1996).

For all women, improving nutritional status before and during pregnancy can help ensure adequate gestational weight gain and decrease the risk of premature delivery and low birth-weight. For HIV-infected woman in particular, improving nutrition can help strengthen the immune system, prevent weight loss, prevent maternal malnutrition and delay disease progression, allowing the woman to remain productive and prolong her quality of life (Anderson, 2001).

. Surveys show that micronutrient inadequacies in pregnant and lactating women are often seen to occur for iron, Vitamin A, folic acid, riboflavin and iodine (Miller & Gorbach, 1999). Malnutrition leads to intra-uterine growth retardation and low birth weights. It also leads to decreased nutrient stores for later development and increases neonatal mortality and morbidity (Gordon & Paul, 1996). In HIV-infected pregnant women, Vitamin A deficiency is associated with increased viral load in blood, genital secretions and breast milk (Semba, 1994). A study among HIV-infected pregnant women in Tanzania showed that there is also low haemoglobin associated with increased risk of pre-term delivery and low birth weight; both are risk factors for MTCT of HIV (Fawzi, 2001). Similar studies have not been carried out in Kenya among HIV-infected pregnant women, moreover there is need to combine dietary and anthropometric nutritional assessment methods to assess pregnancy outcomes of women.

## 2.7 Nutrient requirements of HIV-infected pregnant woman

During pregnancy the requirement for energy, protein, and various micronutrients increase to meet the demands for adequate gestational weight gain, growth and development of the foetus and milk production (Seumo-Fosso & Cogill, 2003). The recommended increase in energy and protein requirements for healthy women is 285 kcal/day and 6 g/day respectively above non-pregnant levels (FAO/WHO, 1985). Human immunodeficiency virus causes excess nutrient loss and malabsorption, further increasing the nutritional requirement of HIV-infected pregnant woman. The requirements may be

higher if the HIV-infected pregnant or lactating woman is suffering from secondary infections (Table 2.2).

Table 2.2: Comparison of nutritional risks of HIV-infected and uninfected pregnant women.

| HIV-infected | Uninfected |
|---|---|
| - Increased need for energy, protein and other nutrients secondary to the demands of pregnancy or lactation<br>- Increased need for energy, protein, and other nutrient secondary to HIV-infection<br>- Increased risk of opportunistic infection and malnutrition<br>- Increased risk of weight loss and delivery of low-birth weight baby as a result of HIV-infection<br>- Increased risk of inadequate dietary intake and hence malnutrition as a result of depression, isolation or stigmatisation<br>- Increased risk of MTCT with poor nutritional status | - Increased need for energy, protein, and other nutrients secondary to the demands of pregnancy or lactation |

**Source:** Piwoz *et al.*, 2000

The current recommended increase in energy intake for HIV-infected pregnant and lactating women is 10 percent during the asymptomatic phase and 20-30% during the symptomatic phase. The additional energy (10 percent) is added to the basic energy requirement for a non-pregnant, woman of the same age and physical activity level (Seumo-Fosso and Cogill, 2003). Iron and folate supplementation is an established standard prenatal care practice in many developing countries. Current WHO recommendations include daily iron-folate supplements (60 mg iron and 400 μg folate) for a period of six months where prevalence of anaemia is less than 40 percent (WHO,

1999). There has not been evidence to question this recommendation in the context of HIV infection. Data on other micronutrient intake for HIV-infected pregnant women are limited.

A few observational studies have related micronutrient status to the risk of pregnancy outcomes among HIV-positive women and these studies have tended to focus on Vitamin A. Fawzi (2000) in a study among HIV-infected pregnant women in Tanzania showed that multivitamin supplements, not Vitamin A decreased the risk of fetal mortality and concluded that multivitamin supplementation is a low-cost way to reduce adverse pregnancy outcomes in HIV-infected women. In a study from Malawi, low prenatal plasma vitamin A concentrations were associated with low birth weights and a higher risk of MTCT of HIV. Three trials have been published among HIV-positive pregnant women in Malawi and South Africa to ascertain the efficacy of micronutrient supplementation on pregnancy outcomes and mother-to-child transmission.

In Blantyre Malawi, women were randomised to Vitamin A versus placebo during the antenatal period. Individuals in the Vitamin A arm had significantly lower number of low-birth-weight babies compared with those who were on placebo. The supplements had no effect on the risk of fetal death, MTCT of HIV-1, or infant mortality. In Durban, South Africa, the women were randomly assigned to receive daily supplements of preformed Vitamin A and beta-carotene or placebo. The supplements had no effect on the risk of low birth weight, small-for-gestational age, or fetal death, but were associated with significant reduction in pre-term delivery of less than 37 weeks of gestation (Fawzi, 2001). Currently there are no published findings of similar studies done in Kenya.

## 2.8 Anthropometry and pregnancy outcomes

Among presumably HIV-uninfected populations, maternal anthropometry is one of the strongest predictors of the outcome of pregnancy (WHO, 1995). Short maternal stature, low pre-pregnant weight, and low weight gain during pregnancy are independently related to increased risks of intrauterine growth retardation (IUGR), preterm delivery, and possibly fetal death (Stephansson *et al.*, 2001).

Wasting is a cause of stillbirth, preterm delivery, and IUGR (Ayisi *et al.,* 2003), yet it is virtually unknown whether maternal anthropometry plays a role in the pathogenesis of these adverse outcomes among HIV-infected women. Weight loss during pregnancy is likely to occur at the expense of maternal rather than fetal tissues, and may therefore constitute an indicator of maternal wasting in the course of HIV disease (Villamor *et al.,* 2002).

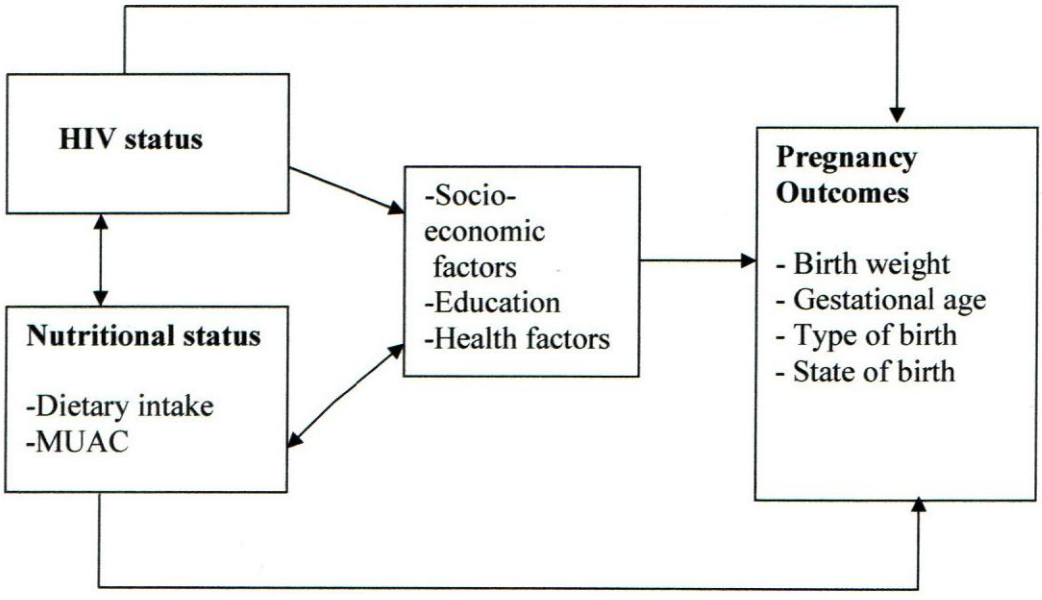
Mid Upper Arm Circumference (MUAC) is the most useful measurement for identifying pregnant women with increased risk of Low Birth Weight (LBW), Intra Uterine Growth Retardation (IUGR) or fetal/infant mortality compared to all other anthropometric indicators investigated (weight-for-gestational-age, weight gain, absolute weight, pre- or early pregnancy weight, BMI, pre- or early pregnancy BMI) (Paton, 1997).

MUAC is relatively stable throughout pregnancy and independent of gestational age and can therefore be used in all stages of pregnancy. One disadvantage of MUAC is that weight increase, (accumulation of fat) is not directly reflected in an increased MUAC. MUAC is therefore not suitable for monitoring the nutritional status of the individual pregnant women during intervention or for evaluating the impact of the nutritional intervention (Jansen *et al.,* 1984). The most suitable indicator for monitoring nutritional status of pregnant women is weight gain during pregnancy (Moller *et al.,* 1989). This however requires an efficient antenatal care system. Other indicators like weight-for-gestational age, weight gain and BMI are also valid for identifying pregnant women at risk, but these indicators have no particular advantages above MUAC. Moreover, several of these measurements are not easily made in emergencies measurement (Naeye, 1979).

## 2.9 Conceptual framework

According to the theory of malnutrition and infection by UNAIDS/WHO (2002), malnutrition increases vulnerability to and severity of infections, and infections aggravate malnutrition. Human immunodeficiency virus (HIV) infection has long been recognised to have a possible negative impact on the nutritional status of PLWHA and lead to

malnutrition. For women, HIV and nutritional status interact with socio-demographic and health factors to affect pregnancy outcomes (Fig. 2.1).




**Source:** Adapted from Piwoz & Preble, 2000

Fig. 2.1: Dynamic interaction between HIV status, nutritional status and socio-economic factors, education and health factors and how they affect pregnancy outcome.

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.1 Introduction

This study was set to determine the effect of HIV and nutritional status on pregnancy outcomes of women attending PMTCT program at Nyanza Provincial General Hospital (NPGH). This chapter discusses the research design adopted, the location of the study, the population and sample, instrumentation, data collection procedures and data analysis.

## 3.2 Research design

Descriptive cross-sectional survey research design was used. The study was an ex post factor as it dealt with an already existing situation where the researcher has no control of variables (Kerlinger, 1973).

### 3.2.1 Variables

For this study maternal HIV status and nutritional status were the independent variables. The dependent variable was maternal pregnancy outcomes. Extraneous variables were maternal socio-economic and health factors (Annex 1).

## 3.3 Research locale

The research was carried out at Nyanza Provincial General Hospital in Kisumu City (Latitude: 0° -35' 0 N, Longitude: 34° 28' 0 E) near the shore of Lake Victoria in the western part of Kenya (Annex 2).

## 3.4 Population of the study

The target population consisted of all pregnant women attending antenatal clinics in Nyanza Province. The accessible population of this study comprised both HIV-infected and uninfected pregnant women attending PMTCT program at Nyanza Provincial General Hospital.

### 3.5 Samples and sampling procedure

Purposive sampling procedure was used to recruit the pregnant women into the study. According to Borg and Gall (1989) purposive sampling enables the researcher to select cases that are likely to be information rich with respect to the purpose of the study. Only those that had been tested and known their HIV status at the PMTCT program were involved in the study. Informed consent to participate in the study was obtained from the women by asking them to sign consent forms (Annex 3). Confidentiality was maintained by use of hospital identity numbers on stickers put on their antenatal cards (Annex 3). The sample size was apportioned according to the HIV prevalence of 23% among antenatal women attending PMTCT program at NPGH. Nassiuma (2000) provided the following formula for use in determining the sample size.

$$n = n`N / N-1+n`$$

Where;

n = sample size

N= accessible population

n`= sample size for simple random sampling with replacement

But, $n` = Z\alpha_{/2} / d^2 \times p\ (1-p)$

$Z\alpha_{/2}$ = degree of confidence taken as 1.96 at 95%

d = level of statistical significance taken as 0.05

p = proportion of the target population estimated to have the characteristic being measured (taken as 0.23 at 23%)

Therefore:

$n` = (1.96/ 0.05 \times 0.05) \times (0.23\ (1-0.23)) = 138.8464$

$n = (138.8464 \times 1654) / (1654 -1 + 138.8464) = 129$

Add 13 (10%) as respondents dropout = 142

Although the actual sample size recruited was 142, only 107 completed the study indicating a drop-out rate of 24.6%.

### 3.6 Instrumentation

This study used a triangulation of methods for data collection, which involved using two or more instruments to collect data. This is because no single method of

obtaining data is perfect (Okuni & Temble, 1997). Research data for this study was collected by means of questionnaires developed by the researcher (Annex 1). The questionnaires included items on maternal socio-economic, health, dietary and anthropometric data. The questionnaires, were standardised, pre-tested and adopted for this study as outlined in Mugenda & Mugenda (1999). The questionnaire on anthropometry captured data on maternal Mid-upper-Arm Circumference (MUAC) and pregnancy outcome in terms of baby's birth weight, gestational age, type and state of birth.

To determine the content validity of the instrument, a panel of experts from Egerton University Foods, Nutrition & Dietetics Department examined the instrument and corrections were made according to their recommendations. The instrument was then piloted at Kisumu District Hospital, which had similar sample characteristics. To ensure the reliability of the instrument, the internal consistency technique was used, in which a score obtained from one item was correlated with scores obtained from other items in the instrument. Cronbachs Coefficient alpha ($\alpha$) was then computed to determine how items correlated among themselves (Mugenda & Mugenda, 1999). The result obtained from the pilot study was $\alpha = 0.76$, indicating that the items in all the instruments were highly correlated hence the instruments were adopted for the study.

### 3.7 Data collection procedure

Data was collected from 48 HIV-infected and 59 uninfected pregnant women attending PMTCT program at Nyanza Provincial Hospital, Kisumu. Permission was sought from the hospital and a research permit (Annex 4) obtained from the Ministry of Education Science and Technology before commencement of the study.

#### 3.7.1 Maternal socio-economic data

Maternal socio-economic data was collected by the researcher through interview administered to the mothers. The questionnaire captured aspects of age, education level, household size and income. Others included marital status, housing and occupation. Age was obtained from their antenatal cards.

### 3.7.2 Maternal health factors questionnaire

Data on maternal HIV status was collected from mothers' antenatal cards (Annex 5) to show whether they were HIV-infected or uninfected. Others included haemoglobin concentration, any pregnancy related conditions and whether they had abortion or stillbirth cases before the current pregnancy.

### 3.7.3 Maternal MUAC measurements

Maternal Mid-upper Arm Circumference (MUAC) was measured to the nearest 0.1 cm halfway between the acromnion process of the scapula and the tip of the elbow by use of MUAC tapes for older sub-saharan Africans from UNICEF, Kenya Country Office as per the specifications of Help Age International London, United Kingdom, (De Onis & Hubitch, 1996).

### 3.7.4 Maternal dietary intake

Maternal dietary intakes data was collected by use of 24-hour dietary recalls and food frequency questionnaires (FFQ) based on the one used by the Kenya Demographic and Health Survey (Owuor & Mburu, 2003). In the 24-hour dietary recalls, the women were asked to remember everything they consumed in the previous 24 hours preceding the interviews. They were asked to describe the utensils they used for serving the foods to help in the estimation and standardization of portions (Waudo *et al.*, 2005). A calibrated list obtained from UNICEF was used in estimating the quantity of food consumed. Volumes of solid food items were estimated by asking the respondents to depict the actual amount of food consumed household measures. These volumes were then converted to volumes using water and measuring cylinders.

In the food frequency questionnaire the women were asked how often they consumed certain foods from a given list of foods. This method is used to determine consumption of different foods over different periods to establish the types of foods consumed (Kigutha, 1994). During the assessment, consumption of food items at least once a day was considered high, once a week was considered medium, once a month was considered low and never was considered very low (Kikafunda *et al.*, 2004).

### 3.7.5 Maternal pregnancy outcomes

The existing health staff collected data on maternal pregnancy outcomes after they were appropriately trained by the researcher. Maternal pregnancy outcomes included infants' birth weight, gestational age, mode of delivery, type and state of birth. Birth weights were taken immediately after birth to the nearest 0.1 g by use of a paediatric pan scale. Gestational age was determined by the health staff by calculating the difference between the date of the last menstrual period at recruitment and the actual date of delivery. Mode of delivery was described as either normal or by caesarean section, while type of birth could either be normal or by episiotomy. Whether the baby was born alive or dead constituted the state of birth.

## 3.8 Data analysis

Data analysis was done by use of Statistical Package for Social Sciences (SPSS for Windows Version 11.0) and NutriSurvey computer programs. Both descriptive and inferential statistics were used. Descriptive statistics involved the use of frequencies, percentages, means, and distribution tables. Inferential statistics involved the use of multivariate regression analysis and independent sample t-test to test hypotheses as outlined in the summary of methods of data analysis in Table 3.0.

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Table 3.0: Summary methods of data analysis

| **Hypotheses** | **Independent Variable** | **Dependent Variable** | **Test Statistic** |
|---|---|---|---|
| $H_{01}$ No difference in MUAC and pregnancy outcomes between HIV-positive and HIV-negative women. | MUAC | Pregnancy outcomes | Regression t-test |
| $H_{02}$ No difference in dietary intakes between HIV-positive and HIV-negative women | Dietary intakes. | Pregnancy outcomes | Regression t-test |
| $H_{03}$ No difference in pregnancy outcomes between HIV-positive and HIV-negative women. | HIV status | Pregnancy outcomes. | Regression t-test |
| $H_{04}$ No relationship between HIV status, MUAC, nutrient intakes and infants' birth weight, gestational age, type of birth and mode of delivery. | HIV status, MUAC, nutrient intakes | Pregnancy outcomes | Regression t-test |

# CHAPTER FOUR

# RESULTS & DISCUSSION

## 4.1 Introduction

This chapter presents results and discussions of the findings of the study. The results are reported and discussed under the following sub headings: maternal socio-demography, health factors, dietary and anthropometry.

## 4.2 Age characteristics

Results of the maternal age characteristics of the women under study are summarized in Table 4.0. Mean age for the HIV-positive women was 22.2 ± 4.15 years, with the youngest and oldest being 16 and 36 years respectively while their HIV-negative counterparts had a mean age of 23 ± 5.62 years, with the youngest and the oldest being 15 and 38 years respectively. But t-test did not show any statistically significant difference ($\propto = 0.05$) in age between the two groups ($p = 0.20$).

Table 4.0: Mean age of the women under study

| | N | Minimum | Maximum | Mean |
|---|---|---|---|---|
| HIV Positive | 48 | 16.00 | 36.00 | 22.2 ± 4.15 |
| HIV Negative | 59 | 15.00 | 38.00 | 23.0 ± 5.62 |

## 4.3 Marital status

Marital status was distributed by HIV status and it is worth noting that all the women who were divorced were HIV-positive (100%). HIV prevalence was also reportedly high in women who were single (49.1%), separated (50%) and widowed (57.1%). The results reveal that there is a low HIV prevalence (C.I = 95%) among the

married women compared to other marital groups. However t-test did not establish any significant difference ($\propto = 0.05$) in marital status between the two groups ($p = 0.092$).

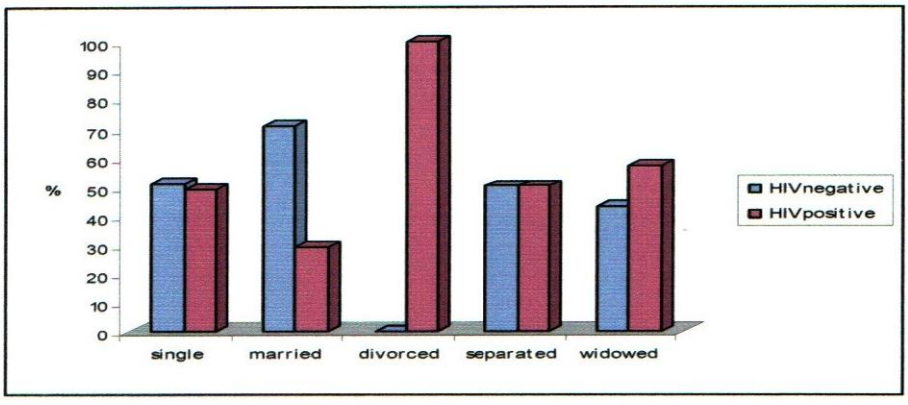



Fig 4.0: Maternal marital status by HIV status

### 4.4 Household size

Results of the proportions of households having different household sizes among the women in the study are summarized in Table 4.1. On average the HIV-positive women had households consisting of 4 individuals while, their HIV-negative counterparts had households consisting of 5 individuals. The results did not show any statistically significant difference ($\propto = 0.05$) in household size between the two groups ($p = 0.82$).

Table 4.1: Maternal household size

| | N | Minimum | Maximum | Mean |
|---|---|---|---|---|
| HIV-Positive | 48 | 2 | 9 | 4.42 ± 1.98 |
| HIV-Negative | 59 | 2 | 12 | 5.39 ± 2.50 |

### 4.5 Household income level

Table 4.2 presents the results of the monthly household income levels among the women under study. On average, the monthly income of the HIV-positive women was Kshs 3810.42 ± 2958.52 while that of their HIV-negative counterparts was Kshs. 5,247. ±

3789.61. However, t-test did not establish any statistically significant difference ($\propto$ = 0.05) in household monthly income between the two groups ($p$ = 0.45).

Table 4.2: Mean maternal household monthly income

| | N | Minimum | Maximum | Mean |
|---|---|---|---|---|
| HIV Positive | 48 | 1000.00 | 18000.00 | 3810.42 ± 2958.52 |
| HIV Negative | 59 | 1000.00 | 20000.00 | 5,247.46 ± 3789.61 |

### 4.6 Sources of livelihood

The respondents were asked about their sources of livelihoods and the results as presented in Table 4.3 show that majority had no source of livelihood (33.3% HIV-positive, 40.7% HIV-negative) however majority were housewives who considered themselves to be dependants on their spouses or other sources. Farming was represented by a few respondents (6.3% HIV-positive, 10.2% HIV-negative) as was business (12.5 % HIV-negative, 11.9% HIV-positive) and casual work (10.4% HIV-positive, 10.2% HIV-negative). Respondents in salaried employment were notably few (6.3% HIV-positive, 11.9% HIV-negative). T-test showed there was a statistically significant difference ($\propto$ = 0.05) in terms of the sources of livelihood between the two groups of women in the study ($p$ = 0.00).

Table 4.3: Maternal sources of livelihood

| Occupation | HIV-negative | | HIV-positive | |
|---|---|---|---|---|
| | frequency | percent | frequency | percent |
| None | 24 | 40.7 | 16 | 33.3 |
| Casual worker | 6 | 10.2 | 5 | 10.4 |
| Domestic servant | 3 | 5.1 | 5 | 10.4 |
| Farmer | 6 | 10.2 | 3 | 6.3 |
| Businesswoman | 7 | 11.9 | 6 | 12.5 |
| Salaried employment | 7 | 11.9 | 3 | 6.3 |

## 4.7 Education level

Table 4.4 summarises the education levels as reported by the respondents under study. There were more HIV-negative (18.6%) women with no education as compared to the HIV-positive group (6.3%). The majority of the respondents had attained primary education (62.5 % HIV-positive, 42.4% HIV-negative), followed by secondary education (29.2% HIV-positive, 28.8% HIV-negative). Only a few (2.1%) of the HIV-positive women had attained tertiary education as compared to their HIV-negative counterparts (10.2%). The results showed statistically significant difference ($\propto = 0.05$) in education level between the two groups ($p = 0.004$).

Table 4.4: Maternal level of education

| Education level | HIV-negative | | HIV-positive | |
|---|---|---|---|---|
| | frequency | percent | frequency | percent |
| None | 11 | 18.6 | 3 | 6.3 |
| Primary education | 25 | 42.4 | 30 | 62.5 |
| Secondary education | 17 | 28.8 | 14 | 29.2 |
| Tertiary education | 6 | 10.2 | 1 | 2.1 |
| Total | 59 | 100 | 48 | 100 |

## 4.8 House types

The respondents were asked to describe the types of houses where they lived as an indicator of their socio-economic status (Table 4.5). Majority of the women under study lived in semi-permanent houses (81.2% HIV-positive, 74.6% HIV-negative) with only a few reportedly living in permanent houses (18.8% HIV-positive, 25.4% HIV-negative). This scenario demonstrates the low socio-economic status in the study groups however independent sample t-test did not show any statistically significant difference ($\propto=0.05$) in the type of housing between the two groups ($p = 0.692$).

Table 4.5: Maternal house types

| House Types | HIV-negative | | HIV-positive | |
|---|---|---|---|---|
| | frequency | percent | frequency | percent |
| Permanent | 15 | 25.4 | 9 | 18.8 |
| Semi-permanent | 44 | 74.6 | 39 | 81.2 |
| Total | 59 | 100 | 48 | 100 |

## 4.9 Health factors

### 4.9.1 Haemoglobin concentrations

Haemoglobin concentrations was investigated as one of the variable indicators of maternal health factors. The subjects were routinely taken blood samples by the health staff for haemoglobin concentration check. HIV-infected and uninfected women had a mean haemoglobin concentration of 9.52 ± 1.88 g/dl and 10.05 ± 1.54 g/dl respectively, however t-test did not establish any statistically significant difference ($\propto = 0.05$) in haemoglobin concentration between the two groups ($p = 0.410$).

The results show that generally the women under study had lower haemoglobin concentrations than the WHO recommended standard of 12 g/dl in pregnancy (WHO, 1995). Anaemia exists even though women who attend antenatal clinic are given iron/folate supplements. It is possible that because of late start in attendance of clinic and consequently delay in beginning iron/folate supplementation, may have contributed to anaemia among the women.

A study of maternal haemoglobin status of Indian women during pregnancy found that normal concentration of haemoglobin in all the 3 trimesters had a significant influence on birth weight (Fatemeh *et al.*, 2006). Another study among HIV-infected pregnant women in Tanzania showed that there is also low haemoglobin associated with increased risk of pre-term delivery and low birth weight; both are risk factors for MTCT of HIV (Fawzi, 2001). This scenario can be attributed to the high parasitaemia of malarial parasites, low altitude and low dietary intake of iron rich foods (Clark & Semba, 2001).

Another study by Tuitoek & Waweru (2005) attributes the high incidence of anaemia in pregnancy to delay in clinic attendance and consequently delay the initiation

iron/folate supplementation, anti-malarial prophylaxis and routine deworming on the 16th week and as recommended by the Ministry of Health (MoH). This is also supported in a study by Gorduek (2001), who found that in developing countries, anaemia in pregnant women is due to poor dietary intake, poor absorption of iron and other vitamins such as folate and $B_{12}$ and co-infections such as malaria and hookworm.

### 4.9.2 Other health characteristics

Table 4.6 presents other health characteristics of the women under study. Malaria incidences were more in the HIV-positive-group (68.8%) possibly due to lower immune status than their HIV-negative counterparts (59.3%). Gestational diabetes (16.9%), hypertension (8.3%) and pre-eclampsia (23.7%) cases were reportedly higher in the women who were HIV-negative. This scenario could be attributed to a better nutritional status among the HIV-negative group compared to their HIV-positive counterparts (Seumo-Fosso and Cogill, 2003). However other infectious disease conditions like respiratory (14.6%), skin (29.2%) and gastrointestinal (14.6%) diseases were higher in HIV-positive women possibly due to suppressed immune system within the group.

Table 4.6: Maternal health characteristics

| Health factors | HIV-negative (n = 48) | | HIV-positive (n = 59) | |
|---|---|---|---|---|
| | frequency | percent | frequency | percent |
| Gestational diabetes | 10 | 16.9 | 4 | 8.3 |
| Hypertension | 4 | 6.8 | 2 | 4.2 |
| Pre-eclampsia | 14 | 23.7 | 7 | 14.6 |
| Respiratory disease | 5 | 8.5 | 7 | 14.6 |
| Skin disease | 3 | 5.1 | 14 | 29.2 |
| GIT infections | 8 | 13.6 | 7 | 14.6 |
| Malaria | 35 | 59.3 | 33 | 68.8 |

### 4.10 Maternal mid-upper arm circumference

One of the objectives of the study was to determine the effect of maternal MUAC measurements on pregnancy outcomes (baby's birth weight, gestation, mode of delivery and type of birth). The hypothesis was that maternal MUAC measurements had no association with the pregnancy outcomes. Table 4.8 shows the average MUAC measurements of the HIV-infected (23.71 ± 3.32 cm) and uninfected women (24.57 ± 3.23 cm) however t-test did not establish any statistically significant difference in MUAC between the two groups (P=0.380). Using the WHO MUAC cut-off value of 24 cm to define wasting it can be noted that the HIV-positive women (52.3%) were generally more malnourished (MUAC<24 cm) than their HIV-negative (32.5%) counterparts (MUAC >24 cm).

Table 4.7: Maternal mean mid-upper arm circumference

| Maternal HIV Status | Maternal MUAC (cm) |
|---|---|
| HIV positive | 23.71 ± 3.32 |
| HIV negative | 24.57 ± 3.23 |

The lower MUAC measurement in the HIV-positive group could be attributed to the physiological changes that occur in HIV infection that lead to progressive degradation of stored skeletal protein in the muscle against reduced intake from dietary and other sources. The muscle is the principal skeletal protein storage site and hence the main source of energy in HIV infection. During the seroconversion phase, the body is producing antibodies to fight the virus, and all these syntheses require additional energy and proteins and the body uses its fat store. The infected host muscle is the principal source of energy and host protein is used to repair the cellular and tissue damage (Piwoz & Preble, 2000).

Table 4.8 shows the results of a simple regression of maternal MUAC on birth weight by serology. Multivariate stepwise simple regression analyses showed that MUAC, had a statistically significant ($\propto = 0.05$) relation to the infant's birth weight in HIV-infected (P=0.001) and uninfected women ($p = 0.757$). The results are conformed by other studies carried out in the region like in Tanzania where amongst 2529 singleton live-

born infants birth weight was inversely associated with maternal HIV (AOR, 1.45, $p$ = 0.02) and maternal mid-upper arm circumference (AOR=0.93, p<0.001). Other studies in South Africa found that large decreases in MUAC were associated with fetal death and lower mean birth weight (Moller *et al.,* 1989) and that maternal nutritional status as indicated by mid-upper arm circumference (MUAC) was independently and significantly associated with the risk of having a low birth weight infant ($p < 0.001$) (Nigel *et al.,* 2004). In Malawi preterm delivery was associated with low MUAC (OR=2.08, 95% C.I. 1.50, 2.89). IUGR was associated with low height (OR=1.67, 95% C.I. 1.14, 2.45) and low MUAC (OR=1.46, 95% C.I. 1.04, 2.04) (Kalanda, 1996).

Table 4.8: Simple regression analyses of maternal MUAC on birth weight by serology

| Serology | F value | P value |
|---|---|---|
| HIV positive | 44.379 | 0.001 |
| HIV negative | 0.097 | 0.757 |

## 4.11 Dietary data

### 4.11.1 Nutrient intakes from 24-hour dietary recall

Another objective of the study was to determine maternal dietary intakes. The hypothesis was that there was no statistically significant difference in maternal dietary intakes. The study assessed the womens' nutrient intake for calories, fat, protein, retinol, folate, vitamin $B_6$, vitamin $B_{12}$, and minerals iron, zinc, and magnesium. Table 4.9 presents summaries of distribution of mean intakes of these nutrients from twenty four hour dietary recall as reported by the women under study. These nutrients were included in the study since they are considered important for the health of the women and are very strong indicators of the immune function (antioxidant vitamins and minerals).

Table 4.9: Maternal 24-hour nutrient intakes

| Nutrients | HIV-Positive | HIV-Negative | F-value | P-value |
|---|---|---|---|---|
| Energy (kcal) | 1511.57 ± 421.47 | 1677.65 ± 504.77 | 4.701 | 0.032 |
| Fat (g) | 50.99 ± 27.81 | 52.91 ± 28.67 | 1.023 | 0.314 |
| Protein (g) | 76.11 ± 26.98 | 68.49 ± 29.36 | 0.283 | 0.596 |
| Vitamin A (μg) | 1389.93 ± 965.08 | 925.89 ± 939.58 | 0.464 | 0.497 |
| Folate (mg) | 302.13 ± 88.84 | 311.71 ± 98.21 | 0.013 | 0.908 |
| Vitamin $B_6$ (mg) | 1.84 ± 0.47 | 1.89 ± 1.07 | 2.371 | 0.127 |
| Vitamin $B_{12}$ (mg) | 85.10 ± 38.26 | 73.45 ± 42.50 | 1.012 | 0.317 |
| Iron (mg) | 16.39 ± 5.38 | 17.81 ± 5.74 | 1.526 | 0.219 |
| Zinc (mg) | 12.92 ± 4.83 | 14.84 ± 5.61 | 2.435 | 0.122 |
| Magnesium (mg) | 393.82 ± 184.18 | 397.69 ± 129.00 | 0.010 | 0.970 |

From the results (Table 4.9) it can be seen that HIV-positive women recorded a lower intake of calorie (1511.57 kcal), fat (50.99g), folate (302.13 mg), Vitamin $B_6$ (1.84 mg) and iron (16.39 mg). Other nutrients that recorded lower intakes among the HIV-positive group include zinc (12.92 mg) and magnesium (393.82 mg). However intake of retinol (1389.93μg) and Vitamin $B_{12}$ (85.10 mg) was higher among the HIV-positive group. Only calorie intake was found to have a statistically significant difference ($\propto$ = 0.05) between the two groups ($p$ = 0.032).

To test the hypotheses that there was no statistically significant effect on pregnancy outcomes, multivariate stepwise regression of each nutrient on the specific pregnancy outcomes (birth weight, gestational age, type and state of birth) was done to establish any significance. The results (Table 4.10) show no statistically significant effect ($\propto$ = 0.05) of any of the nutrients on infant's birth weight among the HIV positive and negative women.

Table 4.10: Multivariate stepwise regression of nutrient intake on birth weight

| | HIV positive | HIV negative |
|---|---|---|
| 24-Hour Nutrient Intakes | *p* value | *p* value |
| Energy intake | 0.830 | 0.409 |
| Fat intake | 0.744 | 0.421 |
| Protein intake | 0.757 | 0.837 |
| Vitamin A intake | 0.716 | 0.560 |
| Folate intake | 0.936 | 0.704 |
| Vitamin $B_6$ intake | 0.716 | 0.947 |
| Vitamin $B_{12}$ intake | 0.181 | 0.709 |
| Iron intake | 0.666 | 0.974 |
| Zinc intake | 0.595 | 0.879 |
| Magnesium | 0.743 | 0.820 |

Table 4.11 summarizes the stepwise regression analyses of the various nutrients on the infants' gestational age. Protein ($p = 0.025$) and vitamin $B_{12}$ ($p = 0.021$) intakes were found to have significant effect ($\propto = 0.05$) on infants' gestational age among the HIV-infected women as opposed to the HIV-negative women whose infants' gestational ages were positively influenced by their calorie ($p = 0.042$), vitamin $B_6$ (($p = 0.048$) and vitamin $B_{12}$ ($p = 0.015$) intakes.

The lower energy intakes from the HIV-infected group could be attributed to lower household income. A study in the US on the effect of prenatal dietary protein intake on birth weight found that mean protein intake of ≥85 g/day was associated with a 71 g decrement in birth weight ($n = 2163$, $p = 0.009$) compared to intermediate (50–84.9 g/day) average protein intake (Sloan *et al.*, 2000).

Table 4.11: Regression analyses of selected nutrients on gestational age

| | HIV positive | HIV negative |
|---|---|---|
| 24-Hour Nutrient Intakes | *p* value | *p* value |
| Energy intake | 0.889 | 0.042 |
| Fat intake | 0.381 | 0.391 |
| Protein intake | 0.025 | 0.680 |
| Vitamin A intake | 0.408 | 0.128 |
| Folate intake | 0.503 | 0.779 |
| Vitamin $B_6$ intake | 0.234 | 0.048 |
| Vitamin $B_{12}$ intake | 0.021 | 0.015 |
| Iron intake | 0.061 | 0.641 |
| Zinc intake | 0.055 | 0.928 |
| Magnesium | 0.207 | 0.076 |

A study in South Africa and Malawi by Coutsoudis & Pillay, (1999) and Semba (1994) respectively, showed that vitamin A supplementation reduces pre-term delivery and improved birth weight, neonatal growth, and reduced anaemia. In another study in Tanzania by Fawzi (2000), multivitamin supplements increased weight gain in pregnancy and reduced risk of fetal death, low birth weight, and pre-term delivery less than 34 weeks (Tanzania).

The respondents under study were asked if they considered their 24-hour nutrient intakes representative of a normal day. Those who responded in the affirmative were (68.8% HIV-positive and 71.2% HIV-negative). The study also revealed that more HIV-positive women (95.8%) received Iron/folate supplements compared to HIV-negative women (86.4%). Apparently majority of the HIV-positive (83.3%) women received multivitamin supplements compared to their HIV-negative women counterparts (11.9%), because it is a government policy to issue multivitamin supplements to HIV-positive mothers in pregnancy. Supplementation was factored in the analyses of the 24-hour dietary recalls, which is why there was an apparent higher intake among the HIV-negative group.

### 4.11.2 Food frequency

The results have been represented as food consumption frequency by serology cross tabulation as in Table 4.12.

Table 4.12: Maternal food frequency

| Food | Never (0) | | Monthly once (1) | | Weekly once (2) | | Daily once (3) | |
|---|---|---|---|---|---|---|---|---|
| | % HIV+ | % HIV- | % HIV+ | % HIV- | % HIV+ | % HIV- | % HIV+ | % HIV- |
| Rice | 22.9 | 18.5 | 4.2 | 8.5 | 47.9 | 45.8 | 25.0 | 35.6 |
| Maize meal | 14.6 | 6.8 | - | 5.1 | 37.5 | 45.8 | 47.9 | 42.5 |
| Cassava | 20.8 | 25.4 | 60.4 | 52.5 | 18.8 | 22.0 | - | - |
| Mixed foods | 25.0 | 18.6 | 56.3 | 44.1 | 18.8 | 37.3 | - | - |
| Red meat | 31.3 | 18.6 | 35.4 | 50.8 | 33.3 | 30.5 | - | - |
| White meat | 33.3 | 22.0 | 33.3 | 40.7 | 33.3 | 37.3 | - | - |
| Fish | - | - | 97.9 | 100 | - | - | 2.1 | - |
| Eggs | 14.6 | 15.3 | 39.6 | 47.5 | 45.5 | 37.3 | - | - |
| Dairy | 33.3 | 16.9 | 33.3 | 45.8 | 33.3 | 37.3 | - | - |
| Legumes | 20.8 | 13.6 | 22.9 | 20.3 | 27.1 | 33.9 | 29.2 | 28.8 |
| Plant oils | 52.1 | 59.3 | 31.3 | 18.6 | 4.2 | 10.2 | 2.1 | 6.8 |
| Animal fats | 10.4 | 3.4 | 2.1 | 1.7 | 33.3 | 20.3 | 54.2 | 74.6 |
| Sugars | 12.5 | 13.6 | 23.2 | - | 22.9 | 6.8 | 79.7 | 64.2 |
| Green vegetables | 14.6 | 15.3 | - | - | 33.3 | 23.7 | 52.1 | 6.1 |
| Fruits | 4.2 | 11.9 | 6.3 | 6.8 | 66.7 | 39.0 | 22.9 | 39.0 |
| Other foods | 14.6 | 6.8 | 39.6 | 54.2 | 45.8 | 27.1 | - | 11.9 |

Food consumption patterns are a very important parameter in determining the main sources of nutrients for a given population and the rate at which they use the food (Kikafunda, 2005). Cereals like rice, maize and cassava are important sources of calories and thus the main source of energy for human body. Animal products and legumes are the main sources of protein which is very important in growth and development of human

body. Results show that consumption of foods rich in carbohydrates such as maize, rice and cassava were fairly high.

These results agree with findings by Nyambose *et al.,* (2002) who reported similar findings in Malawi. However the cereal that was most consumed on a daily basis by the women was maize meal (42.7% HIV-positive, 42.5% HIV-negative) followed by rice (25.0% HIV-positive, 35.6% HIV-negative). Kinabo *et al.,* (1997) reported similar findings in Tanzania. Sugar consumption on a daily basis was reportedly high (79.7% HIV-positive, 64.2% HIV-negative) as was animal fat (54.2% HIV-positive, 74.6% HIV-negative). Other foods mostly consumed on a daily basis by the women were legumes (29.2% HIV-positive, 28.8% HIV-negative).

Even though Kisumu is at the show of Lake Victoria, interestingly daily consumption frequency for fish was very low among the study subjects (2.1% HIV-positive) possibly due to its high price and the low economic status among the subjects. Other foods that also recorded low daily consumption frequency include plant oils (2.1% HIV-positive, 6.8% HIV-negative), fruits (22.9% HIV-positive and 39.0% HIV-negative). The foods that did not record any daily consumption frequency include dairy products, eggs red meat, white meat and mixed foods. This scenario could also be attributed to the fact that these products being animal protein sources are relatively more expensive compared to the plant sources.

The food items consumed most frequently on a weekly basis by the subjects were rice (47.9% HIV-positive, 45.8% HIV-negative), fruits (66.7% HIV-positive, 39.0% HIV-negative) and eggs (47.5% HIV-positive, 45.5% HIV-negative). Consumption of white and red meat improved considerably (33.3% HIV-positive, 30.5% HIV-negative) as was white meat (33.3% HIV-positive, 37.1% HIV-negative). Legumes were also being eaten more on a weekly basis at 27.1% for HIV-positive and 33.9% HIV-negative respectively.

On a monthly basis the foods mostly eaten were fish (97.9% HIV-positive, 100% HIV-negative), cassava (60.4% HIV-positive, 62.5% HIV-negative) and mixed foods (56.3% HIV-positive, 44.1% HIV-negative). However it is still important to note that fish consumption was generally low across the board due to its price. The foods that recorded a low monthly consumption frequency include rice (4.2% HIV-positive, 10.2% HIV-

negative) and animal fat (2.1% HIV-positive, 1.7% HIV-negative). The food was mostly never eaten by the subjects were plant oils (52.1% HIV-positive, 59.3% HIV-negative), dairy (33.3% HIV-positive, 16.9% HIV-negative) and red meat (31.3% HIV-positive, 18.6% HIV-negative). High consumption of red meat is discouraged in HIV-infection due to its effect on the antioxidant vitamins and minerals. This could be the reason why most HIV-positive subjects reportedly avoid it.

## 4.12 Maternal HIV status and pregnancy outcomes

Another objective of the study was set to assess the pregnancy outcomes of HIV-positive and HIV-negative mothers. It was hypothesized that there was no statistically significant difference in pregnancy outcomes between the HIV-positive and HIV negative mothers. Figure 4.1 summarizes the distribution of the women under study according to their HIV status. Fifty nine percent (59) of the women were HIV negative while 45% (48) were HIV positive.

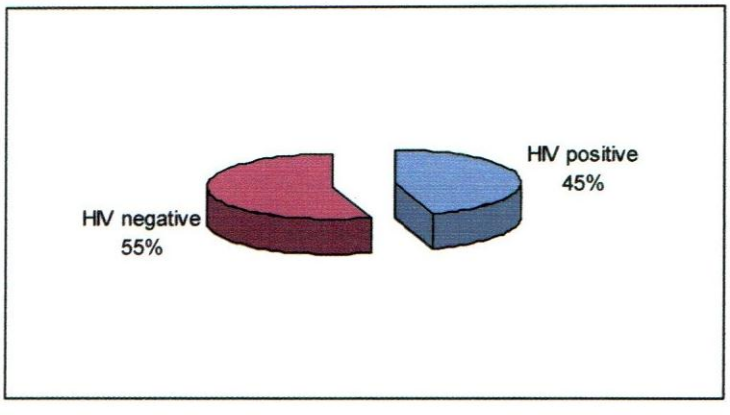



Fig. 4.1: Maternal HIV status

Table 4.13 summarizes the multivariate regression analyses of maternal HIV status on infant's birth weight, gestational age, mode of delivery and state of birth.

Table 4.13: Stepwise regression analyses of maternal HIV status on infant's birth weight, gestational age, mode of delivery and state of birth.

| Pregnancy Outcomes | F value | *p* value |
|---|---|---|
| Birth weight | 2.327 | 0.130 |
| Gestational age | 20.567 | 0.000 |
| Mode of delivery | 2.317 | 0.131 |
| Type of birth | 0.285 | 0.595 |
| State of birth | 1.743 | 0.190 |

From the results it can be seen that that the infant's gestational age was the only outcome that was most significantly predicted ($\propto = 0.005$) by the mother's HIV status ($p = 0.000$).

### 4.12.1 Birth weight

Table 4.14 shows the mean birth weights of babies born to HIV-positive and HIV-negative mothers under the study. The findings reveal that the overall mean birth weight of babies born of the women under study to be 3.29 ± 3.54 Kg, with the HIV-positive women giving birth to babies with a mean birth weight of 2.71± 0.61 Kg while babies born to HIV-negative women had a mean birth weight of 3.15 ± 4.70 Kg. However t-test established a statistically significant difference ($\propto = 0.05$) in birth weight between the two groups ($p = 0.035$).

Table 4.14: Mean birth weight of babies born to HIV-positive and HIV-negative mothers

| Maternal HIV Status | Babies Birth Weight (kg) |
|---|---|
| HIV positive | 2.71 ± 0.61 |
| HIV negative | 3.15 ± 4.70 |

From the findings in can be seen that babies born of HIV-positive mothers have lower mean birth weights (2.71± 0.61 Kg) compared with those born to their HIV

negative counterparts (3.15 ± 4.70 Kg). This is confirmed by a study in Nakuru district where HIV-positive women gave birth to infants weighing 3.03 Kg as opposed to their HIV-negative counterparts who had gave birth to infants weighing 3.12 Kg (Mbuthia, 2006).

Another study in Kigali, Rwanda, reported a mean birth weight of 2,947 g in infants of HIV-positive women compared with 3,104 g in those born to HIV-negative mothers (Fawzi, 2000). Another study in the United States (Move *et al.*, 1996) showed HIV-positive newborns weighing 0.28 Kg less than HIV-negative children born to HIV-positive mothers. Analysis of more than 30 published studies show that infected women were twice as likely to deliver low birth weight babies and twice as likely to have pre-term deliveries. This scenario can be attributed to the fact that infants born to HIV-positive women had a shorter gestational age of 37.02 ± 3.28 weeks compared with 39.41 ± 2.13 weeks in those born to HIV-negative mothers. However, independent sample t-test did not establish any significant difference ($\propto = 0.05$) between the HIV-positive and HIV-negative women in terms of birth weight ($p = 0.235$).

### 4.12.2 Gestational age

Table 4.15 represents the mean gestational ages of babies born to HIV-positive and HIV-negative women under study. The results reveal that HIV-positive women gave birth earlier at 37.02 ± 3.28 weeks compared with their HIV-negative counterparts who gave birth at 39.41 ± 2.13 weeks. Independent sample t-test showed a statistically significant difference ($\propto = 0.05$) in gestational ages between the two groups ($p = 0.002$).

Table 4.15: Mean gestational ages of babies born to HIV-positive and HIV-negative women

| Maternal HIV Status | Babies Gestational Age (weeks) |
|---|---|
| HIV Positive | 37.02 ± 3.28 |
| HIV Negative | 39.41 ± 2.13 |

According to Move *et al.*, (1996) and Berhane *et al.*, (1997) the shorter gestational age and consequently low birth weight babies in HIV-positive women is

attributed to intrauterine growth retardation (IGR), viral load (severity of HIV disease). Intrauterine growth retardation in these infants, results from lower maternal energy intake compared to increased needs from HIV and lower vitamin A (multivitamin) status.

### 4.12.3 Mode of delivery, state and type of birth

Table 4.16 summarizes the mode of delivery, state and type of birth of the babies born under the study. Results show that majority of the babies were born normally (77.1% HIV-positive, 88.1% HIV-negative) with only a few being born through caesarean section (22.9% HIV-positive, 11.9% HIV-negative). It is important to note that a considerable number (22.9%) of the HIV positive mothers delivered by caesarean section, which is recommended to reduce MTCT of HIV. All the babies under study were born alive. Those born through episiotomy were fewer (20.8% HIV-positive, 11.9% HIV-negative) compared to those born through the normal procedure.

Table 4.16: Type of birth and mode of delivery of babies born to HIV-positive and HIV-negative mothers.

| | % HIV-positive | % HIV- negative |
|---|---|---|
| **Mode of delivery** | | |
| Normal | 77.1 | 88.1 |
| Caesarean | 22.9 | 11.9 |
| **Type of Birth** | | |
| Normal | 79.2 | 78.0 |
| Episiotomy | 20.8 | 11.9 |
| **State of birth** | | |
| Born alive | 100 | 100 |
| Dead | 0 | 0 |

Independent sample t-test (Table 4.17) showed a statistically significant difference ($\propto = 0.05$) in mode of delivery ($p = 0.003$) and state of birth ($p = 0.008$) between the two groups, however there was no statistically significant difference ($\propto = 0.05$) in type of birth ($p = 0.139$).

Table 4.17: Independent sample t-test of birth weight, gestation, mode of delivery and type of birth

| Outcome | F value | *p* value |
|---|---|---|
| Birth weight | 1.430 | 0.235 |
| Baby's gestation | 10.537 | 0.002 |
| Mode of delivery | 9.505 | 0.003 |
| Type of birth | 2.222 | 0.139 |
| State of birth | 7.235 | 0.008 |

## 4.13 Maternal MUAC, dietary intakes, HIV status and pregnancy outcomes

The overall objective of the study was set to determine the effect of maternal MUAC, dietary intakes and HIV status on pregnancy outcomes. The hypothesis was that maternal MUAC, dietary intakes and HIV status had no statistically significant effect on pregnancy outcomes. To test the hypothesis multivariate regression analyses was done to show the combined effect of all the independent variables on each dependent variable in turn. Table 4.18 summarizes the results of multivariate regression analyses of maternal MUAC, HIV status and various nutrients on infant's birth weight, gestational age, mode of delivery and state of birth.

Table 4.18: Multivariate regression analyses of maternal MUAC, HIV status and various nutrients on infant's birth weight, gestational age, mode of delivery and state of birth.

| Outcome | F value | P value |
|---|---|---|
| Birth weight | 0.634 | 0.808 |
| Baby's gestation | 2.450 | 0.008 |
| Mode of delivery | 0.262 | 0.262 |
| Type of birth | 0.984 | 0.470 |
| State of birth | 2.028 | 0.030 |

Results from Table 4.18 show that there exists a statistically significant ($\propto = 0.05$) association of maternal MUAC, HIV status and various nutrients on infant's gestational

age ($p$ = 0.008). However there was no statistically significant effect ($\propto$ = 0.05) of maternal MUAC, HIV status and various nutrients on infant's birth weight ($p$ = 0.808).

Multivariate regression also did not show any statistically significant association ($\propto$ = 0.05) between maternal MUAC, HIV status and various nutrients to infant's mode of delivery ($p$ = 0.262), type of birth ($p$ = 0.470) and state of birth ($p$ = 0.030).

# CHAPTER FIVE

# CONCLUSIONS & RECOMMENDATIONS

## 5.1 Introduction

This chapter presents conclusions and recommendations based on the objectives and findings of the study.

## 5.2 Conclusions

Based on the findings of the study the following conclusions can be made;

1. Infants born to HIV-positive women have a lower birth weight (2.71± 0.61 kg) compared with in those born to HIV negative mothers (3.15 ± 4.70 kg).

2. The infants born to HIV-positive women have a shorter mean gestational age (37.02 ± 3.28 weeks) compared with 39.41 ± 2.13 weeks in those born HIV-negative mothers.

3. There is a positive correlation between maternal mid-upper arm circumference (MUAC) and birth weight in infants born to HIV-positive mothers. Hence MUAC as a tool can be used to predict infant's birth weight in HIV-positive pregnant women and consequently to screen patients for referrals for nutritional intervention.

4. The results show a statistically significant difference in level of education and sources of livelihood between HIV-positive and HIV-negative pregnant women.

5. Maternal intakes of magnesium, folate and iron were correlated with infant's gestational age.

## 5.3 Recommendations

Based on the above conclusions, the following are recommended:

1. The antenatal women at Nyanza Provincial General Hospital need to interventions to improve socio-economic status. The government and private sector could empower them in this vein by providing small and micro-enterprise (SME) opportunities.

2. Training in form of sensitization workshops, seminars need to be organized for health workers to bridge knowledge and skills gaps on issues of HIV and nutrition.

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**Annex 1**

**EFFECT OF HIV AND NUTRITIONAL STATUS ON PREGNANCY OUTCOMES OF WOMEN ATTENDING PMTCT PROGRAM AT NYANZA PROVINCIAL GENERAL HOSPITAL, KENYA**

MATERNAL QUESTIONNAIRE

**Section 1: Maternal identification**

Q001 Serial Number_____

Q002 PMTCT Number _____

Q003 Estimated Date of Delivery ___/___/___

Q004 Date ___/___/___

Q005 Time Interview started _____

Q006 Time Interview ended _____

**Section 2: Socio-demographic data**

| | | |
|---|---|---|
| Q201 | How old are you? | Age completed years<br>__ __ |
| Q202 | What is your marital status? | Married……..1<br>Single……2<br>Divorced……....3<br>Separated……...4<br>Widowed……6 |

| | | |
|---|---|---|
| Q203 | What is the highest level of education | None……..0<br>Upper primary (5-8)…1<br>Secondary education…2<br>Tertiary education……..3 |
| Q204 | What is your main source of livelihood? | No occupation……0<br>On daily wages……...1<br>Domestic servant……..2<br>Farmer……3<br>Saleswoman……...4<br>Salaried……...5<br>Other specify……...6<br>No answer……..7 |
| Q205 | How much is your household estimated monthly income? | Kshs…… |
| Q206 | How many persons live in your household? (2-30) | |
| Q207 | In what type of house does your family live? | Permanent……..1<br>Semi-permanent……..2<br>Other……4 |

**Section 3: Health data**

| | | |
|---|---|---|
| Q301 | Gestational age of pregnancy (e.g. 20 weeks) | ..... |
| Q302 | Serostatus of the mother | Non-reactive.....0<br>Reactive.....1 |
| Q303 | Haemoglobin concentration of the mother (g/dl) | |
| Q304 | Have you been diagnosed with any of the following conditions in this pregnancy? | Gestational diabetes.....1<br>Hypertension.....2<br>Pre-eclampsia.....3<br>None.....0 |
| Q305 | In which trimester did you first attend MCH clinic? | First trimester.....1<br>Second trimester.....2<br>Third trimester.....3 |
| Q306 | How many children have you had previously | |
| Q307 | Have you had any abortion/stillbirth cases before | No.....0<br>Yes.....1 |
| Q308 | Have you fallen ill in the past 6 months to conditions related to the following? | No.....0<br>Respiratory.....1<br>Skin.....2<br>Gastrointestinal.....3<br>Malaria.....4<br>Other (specify).....77<br>No answer.....99 |

**Section 4: Dietary data**

Now I would like to ask you some questions related to your dietary practices

| NO. | Questions and Filters | Coding categories |
|---|---|---|
| Q401 | Are there foods you avoid in this pregnancy and which ones are they? | Starches& Breads.....1<br>Fruits.....2<br>Vegetable.....3<br>Meats.....4<br>Legumes.....5<br>Sugars.....6<br>Fats.....7<br>Other (specify).....77 |
| Q402 | Are there foods you crave for this pregnancy, and which ones are they? | Starches& Breads.....1<br>Fruits.....2<br>Vegetable.....3<br>Meats.....4<br>Legumes.....5<br>Sugars.....6<br>Fats.....7<br>Other (specify).....77 |
| Q403 | Have you experienced any of the conditions below? | Heartburn.....1<br>Nausea.....2<br>Vomiting.....3<br>Constipation.....4<br>Other.....77 |

Q404 Please tell me everything you ate yesterday from the time you woke up until you went to sleep.

**24-hr recall form**

| Time | Food | Quantity | Ingredients | Preparation Method |
|---|---|---|---|---|
| | | | | |

Q405. Did the foods you mention in the 24-hour recall, representative of a normal day?

0) No 1] Yes

Q406 Are you currently taking iron/folate supplements?

0) No 1] Yes

Q407 Are you currently taking multivitamins? 0) No 1] Yes

**Food frequency questionnaire**

Q408 I would like to ask you questions related how often you eat certain foods.

| NO. | Food | Frequency Score |
|---|---|---|
| Q408a | Rice | |
| Q408b | Maize meal | |
| Q408c | Cassava | |
| Q408d | Mixed or processed foods | |

| | | |
|---|---|---|
| Q408e | Meat (large livestock, e.g. cow pig, sheep) | |
| Q408f | Meat (small livestock, e.g. poultry rabbit) | |
| Q408g | Fish, seafood | |
| Q408h | Egg, egg products | |
| Q408i | Milk, milk products | |
| Q408j | Legumes (beans, peas, soy) | |
| Q408k | Plant Oils | |
| Q408l | Animal fats | |
| Q408m | Sugars | |
| Q408n | Fresh green leafy vegetables | |
| Q408o | Fruits | |
| Q408p | Other fresh vegetables | |

**Anthropometry**

502. Average mid-upper-arm circumference of the mother (0.1 cm)?.....

502. Date of birth of the baby (day, month, year, e.g. 3-4-1995).....

504. What is the gestational age of the baby?.....

505. Weight of the baby (0.1 kg).....

506. Mode of delivery by the mother.....1] Normal 2] Caesarean

507. Type of birth by the mother.....

1] Normal 2] Episiotomy 3] Instrumental

509. State of the birth.....

1] Born alive 2] Still birth 3] Spontaneous abortion

**Annex 2: Consent form**

**Serial No.....** **PMTCT No.....**

**Date.....**

Dear respondent,

**RE: CONSENT TO PARTICIPATE IN RESEARCH STUDY**

I am a student pursuing a Master of Science degree in Nutritional Science at Egerton University. As part of the degree requirements, I'm currently conducting a research study to determine the effect HIV and nutritional status on pregnancy outcomes of women attending PMTCT program at Nyanza Provincial General. Any information you share will be completely confidential and you are under no obligation to participate. No compensation will be made and your name will not be shared with anyone or attached to the information you give. If you agree to participate I will ask you to append your signature hereunder.

Thank you

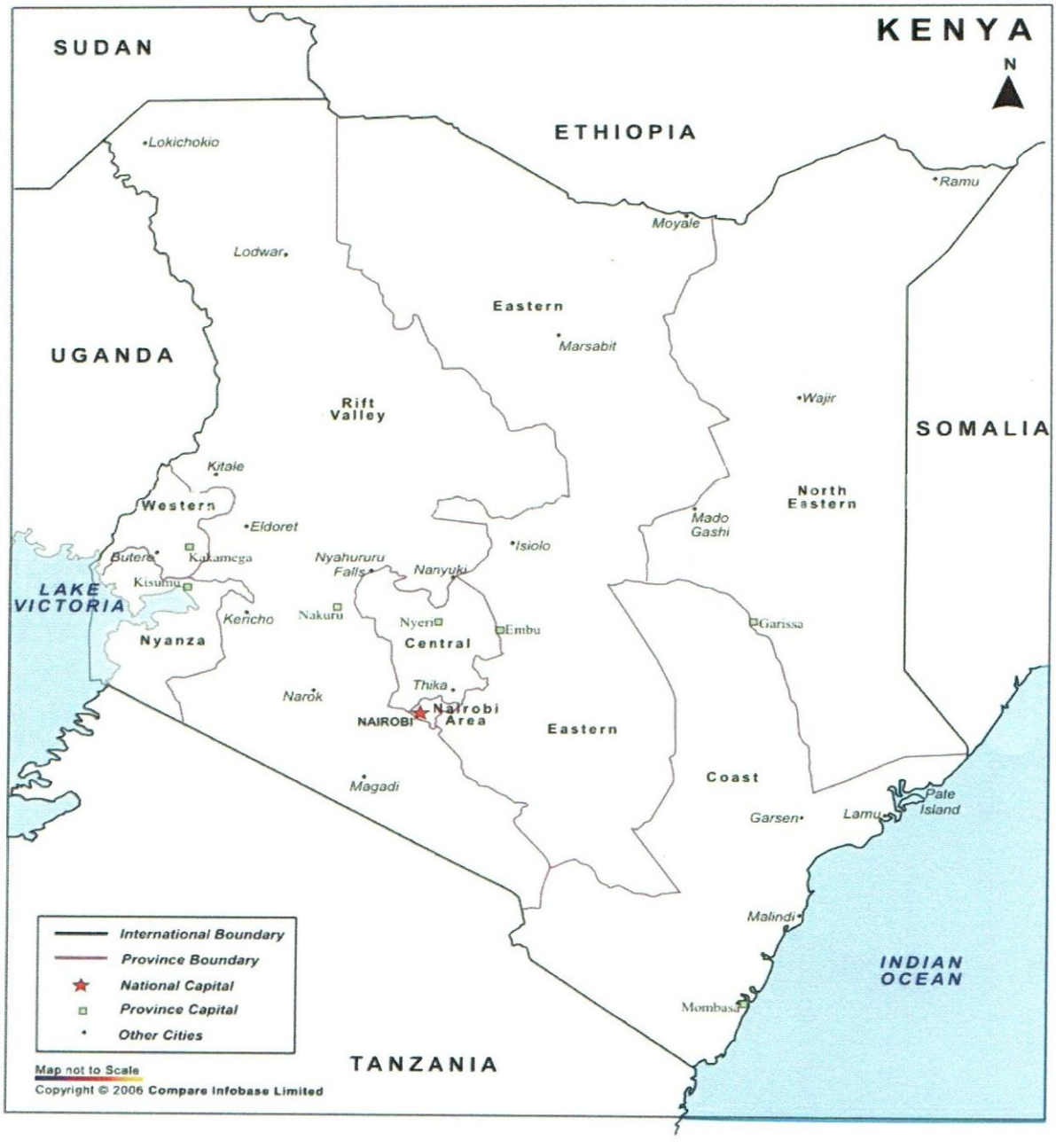
Jared O. Mala

**For the respondent/ Guardian**

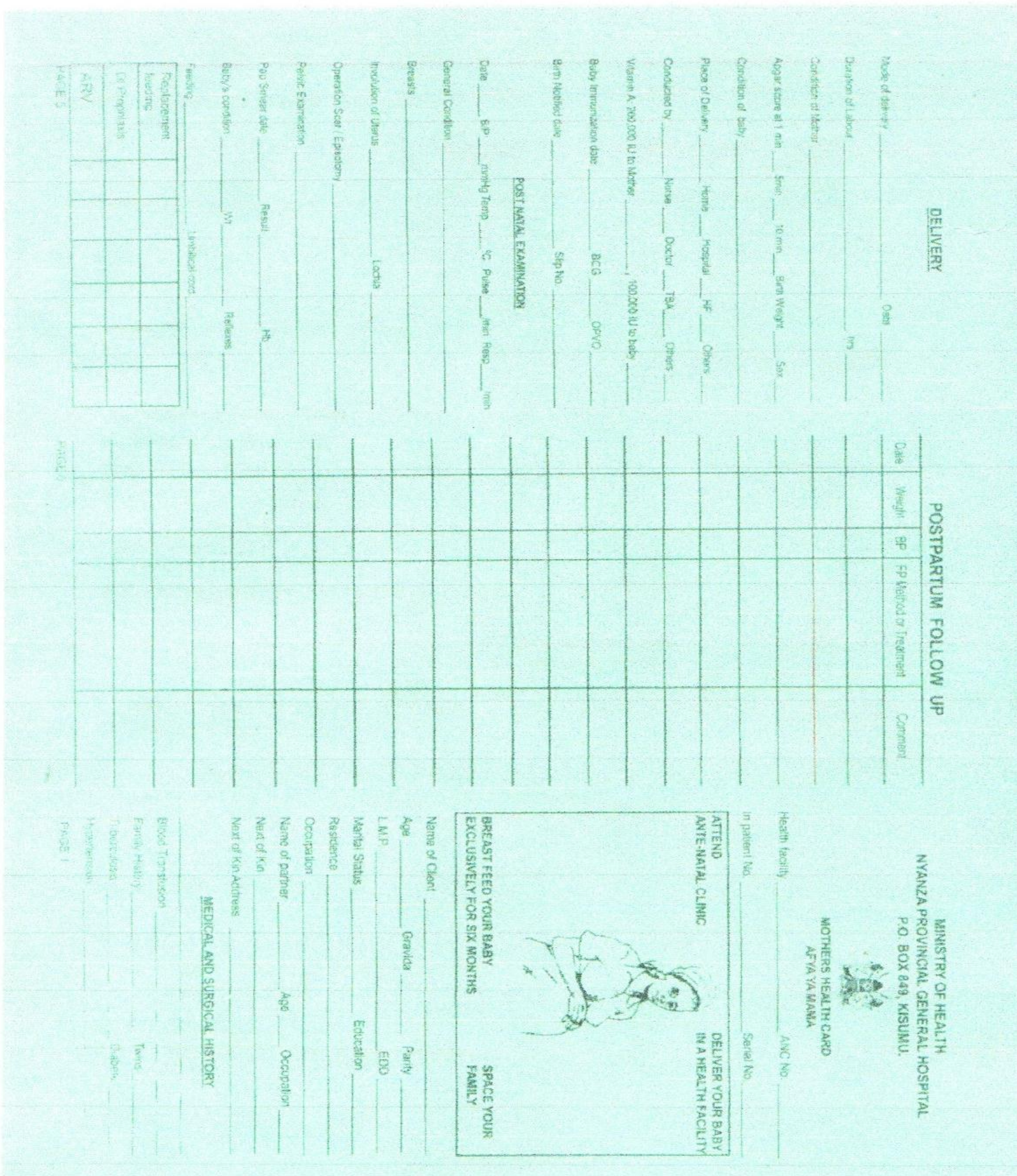
**Consent granted .....**

Signature

**Annex 3:** **Map of Kenya**



## Annex 4: Antenatal card



MINISTRY OF HEALTH
NYANZA PROVINCIAL GENERAL HOSPITAL
P.O. BOX 849, KISUMU.
MOTHERS HEALTH CARD
AFYA YA MAMA

Health facility ____ ANC No. ____
In patient No. ____ Serial No. ____

ATTEND ANTE-NATAL CLINIC
DELIVER YOUR BABY IN A HEALTH FACILITY
BREAST FEED YOUR BABY EXCLUSIVELY FOR SIX MONTHS
SPACE YOUR FAMILY

Name of Client ____
Age ____ Gravida ____ Parity ____
L.M.P ____ EDD ____
Marital Status ____ Education ____
Residence ____
Occupation ____
Name of partner ____ Age ____ Occupation ____
Next of Kin ____
Next of Kin Address ____

MEDICAL AND SURGICAL HISTORY

Blood Transfusion ____
Family History ____ Twins ____
Tuberculosis ____ Diabetes ____
Hypertension ____

PAGE 1

POSTPARTUM FOLLOW UP

| Date | Weight | BP | FP Method or Treatment | Comment |
|---|---|---|---|---|
| | | | | |

DELIVERY

Mode of delivery ____ Date ____
Duration of Labour ____ hrs ____
Condition of Mother ____
Apgar score at 1 min ____ 5 min ____ 10 min ____ Birth Weight ____ Sex ____
Condition of baby ____
Place of Delivery ____ Home ____ Hospital ____ HF ____ Others ____
Conducted by ____ Nurse ____ Doctor ____ TBA ____ Others ____
Vitamin A 200,000 IU to Mother ____ 100,000 IU to baby ____
Baby Immunization date ____ BCG ____ OPV0 ____
Birth Notified date ____ Sfp No. ____

POST NATAL EXAMINATION

Date ____ B/P ____ mmHg Temp ____ °C Pulse ____ /min Resp ____ /min
General Condition ____
Breasts ____
Involution of Uterus ____ Lochia ____
Operation Scar / Episiotomy ____
Pelvic Examination ____
Pap Smear date ____ Result ____ Hb ____
Baby's condition ____ Wt ____ Reflexes ____
Feeding ____ Umbilical cord ____
Replacement feeding
ARV

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**Annex 5: Research permit**

**MINISTRY OF EDUCATION, SCIENCE & TECHNOLOGY**

Telegrams: EDUCATION", Nairobi

Fax No.
Telephone: 318581
When replying please quote

REPUBLIC OF KENYA

JOGOO HOUSE
HARAMBEE AVENUE
P. O. Box 30040
NAIROBI
KENYA

**MOEST 13/001/35C 249/2**

**2nd June, 2005**

**Jared Ochieng Mala**
**Egerton University**
**P.O. BOX 536**
**NJORO**

Dear Sir

**RE: RESEARCH AUTHORIZATION**

Please refer to your application for authority to conduct research on "Effect of HIV and Nutritional Status on pregnancy outcomes of Women attending PMTCT programme at Nyanza Provincial General Hospital". I am pleased to inform you that you have been authorized to conduct research in Nyanza Provincial General Hospital for a period ending 30th November, 2005.

You are advised to report to the Provincial Commissioner, the Provincial Director of Education and the Provincial Medical Officer of Health Nyanza Province before embarking on your research.

Upon completion of your research project, you are expected to submit two copies of your research findings to this Office.

Yours faithfully

For PERMANENT SECRETARY
MINISTRY OF EDUCATION
SCIENCE AND TECHNOLOGY

**M. O. ONDIEKI**
**FOR: PERMANENT SECRETARY**

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