DIETARY ASSESSMENT OF VITAMIN A AND IRON AMONG PREGNANT WOMEN AT NDHIWA SUB-DISTRICT HOSPITAL-KENYA

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DECLARATION

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

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To my dear husband Wickliffe Ngala, dear son Philomon Ngala, parents: Johnson and Jedida Othoo, Philemon and Mary Mangla for their support and foresight in providing for valuable education.

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ABSTRACT

The study was a descriptive case study done at Ndhiwa Sub District Hospital, Homa-Bay District. The main purpose of the study was to establish vitamin A and iron consumption levels of pregnant women as well as the relationship between vitamin A consumption levels and iron consumption levels during pregnancy. Studies on iron and vitamin A have in the past focused on children while maternal vitamin A and iron has not been exhaustively documented. Moreover few studies in Kenya have focused on the relationship between vitamin A and iron during pregnancy. The findings will be useful to policy makers and NGOs in designing and implementing programs suitable to improve vitamin A and iron among pregnant women. Data on vitamin A and iron were assessed using 24-hour recall of three days and food frequency questionnaire recommended by HellenKeller International (1999). Demographic and general health data were collected through structured interview questionnaires. Data analysis was done using Sight and Life vitamin A calculator for vitamin A consumption and Nutrisurvey for iron consumption. SPSS was used to analyse consumption frequencies of vitamin A and iron rich foods as well as demography and other qualitative data. Nutrition status was determined as BMI which was analysed using BMI calculator. Majority (80 %) had severe vitamin A inadequacy, 12% had mild inadequacy while 8% had adequate vitamin A. On the other hand, 65 % had severe iron inadequacy, 27% had mild inadequacy while 8% had adequate iron. Prevalence of dietary vitamin A and iron inadequacies at Ndhiwa Sub District Hospital was at 90%. Vitamin A and iron rich foods were irregularly consumed by most respondents. There was a positive significant relationship between vitamin A and iron consumption of pregnant women at Ndhiwa Sub District Hospital. Food cost and number of meals consumed per day are some of the factors that influenced vitamin A and iron consumption of pregnant women at Ndhiwa Sub District Hospital. Almost half of respondents (49 %) had normal nutrition status that is attributed to good nutrition status prior pregnancy. Number of meals consumed per day influenced nutrition status (BMI) of pregnant women at Ndhiwa sub District Hospital. Number of meals consumed per day contributed to nutrition status more than vitamin A and iron consumption.

ABBREVIATIONS

VAD	-Vitamin A Deficiency
PEM	-Protein Energy Malnutrition
WHO	-World Health Organisation
UNICEF	-United Nations Children's Fund
MOH	- Ministry of Health
MCH	- Maternal Child Healthcare
RDA	- Recommended Daily Allowance
NGO	-Non Governmental Organisation
WFP	-World Food Programme
HH	-House Hold
HKI	-Hellen Keller International
FAO	-Food and Agriculture Organisation
ADA	-American Dietetics Association
CBS	- Central Bureau of Statistics
DSO	- District Statistics Office
NSDH	-Ndhiwa Sub District Hospital
DVO	- Divisional Vertenary Officer
DNO	- Divisional Nutrition Officer
PSI	- Population Services International
MI	- Micronutrient Initiative
MUAC	- Mid upper Arm circumference
NUO	- Norwich Union of Obstetrics
INACG	- International Nutritional Anaemia Consultative Group

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CHAPTER ONE

1.0 INTRODUCTION

This chapter presents background information, statement of the problem, objectives, hypothesis, assumptions, rationale and significance of the study.

1.1 GENERAL INFORMATION ON VITAMIN A AND IRON

Vitamin A and iron are the most common nutritional deficiencies in most developing countries probably second to protein energy malnutrition (WHO, 2001). Infants, children, pregnant and lactating women are especially at high risk of both deficiencies due to various physiological changes involved (Cellic, 1999). It is estimated that 80 % pregnant women in developing countries suffer from iron deficiency anaemia and ¼ of these women have Vitamin A deficiency resulting in clinical and sub clinical signs (WHO, 2001). Iron and Vitamin A deficiencies were recognized to be public health problems in many developing countries as early as 1946 (WHO, 1997). It is estimated that 40 % of pregnant women in the United States of America are iron deficient and this is attributed to influence of fad foods thus, poor dietary practices (Hunt and Gref, 1999). It is reported that 70 % of pregnant women in Asia are iron deficient (Yipp, 2001). Micronutrient survey indicated that 68% of pregnant women in Africa are iron deficient (Micronutrient Initiative, 2001). In Kenya 83% of pregnant women are iron deficient, where as 65% pregnant women in Nyanza province are iron deficient (Central Bureau of Statistics, 2003: UNICEF, 2003).

Vitamin A deficiency on the other hand is at high levels affecting 50 - 70% of pregnant women in the developing countries (WHO, 2000). Prevalence of vitamin A deficiency in the developing countries is associated with increased maternal morbidity and mortality (Ngare and Marlyen, 2000). Vitamin A deficiency is said to be a public health problem among pregnant women in some 60-73 developing countries (Basil and Singupta, 2003). In Kenya a report by Omni micronutrients survey indicated that 50% pregnant women are vitamin A deficient (MOH, 2003). National micronutrient survey of 1999 and National Food Consumption report of 2003 indicated that 30% pregnant women in Nyanza province are vitamin A deficient (UNICEF, 2003). Low serum retinal levels have been reported among diverse groups of pregnant women in Kenya (Newman, 2002). Pregnant women especially in the developing countries tend to consume less than half of the RDA for iron and Vitamin A thereby increasing the prevalence of these deficiencies during pregnancy (Ngare and Marlyen, 2000).

1.2 STATEMENT OF THE PROBLEM

Vitamin A and iron deficiencies are prevalent among pregnant women in the developing countries (Keith, 2002). Concern regarding vitamin A and iron has in the past focused on infants' survival while little has been done on pregnant women (Fauzi and Msemango, 2002). In Kenya the findings of National micronutrient surveys of 1994 and 1999 focused on children especially under fives while maternal vitamin A and iron have not been exhaustively documented (Ngare and Marlyen 2000). More over few studies in Kenya have focused on the relationship between vitamin A and iron during pregnancy (MOH, 1999). It is in this view that this study focused on dietary assessment of vitamin A and iron as well as the relationship between vitamin A and iron consumption levels of pregnant women at Ndhiwa Sub District Hospital.

1.3 PURPOSE OF THE STUDY

The purpose of this study was to assess vitamin A and iron consumption level as well as the relationship between vitamin A consumption level and iron consumption level of pregnant women at Ndhiwa Sub District Hospital.

1.4 OBJECTIVES

The objectives of this study were to:

1.4 Establish Vitamin A and iron consumption levels of pregnant women at Ndhiwa Sub District Hospital.

1.4 Determine consumption frequencies of vitamin A and iron rich foods of pregnant women at Ndhiwa Sub District Hospital.

1.4 Determine factors that influence vitamin A and iron consumption of pregnant women at Ndhiwa Sub District Hospital.

1.4 Determine nutrition status of pregnant women at Ndhiwa Sub District Hospital

1.4 Determine the relationship between vitamin A consumption level and iron consumption level of pregnant women at Ndhiwa Sub District Hospital.

1.5 HYPOTHESES

1.5 Pregnant women at Ndhiwa Sub District Hospital have inadequate vitamin A and iron levels.

1.5 There is no significant relationship between vitamin A and iron consumption levels and nutrition status of pregnant women at Ndhiwa Sub District Hospital.

1.6 ASSUMPTION OF THE STUDY

The study assumed the correction of altitude and iron absorption. This was due to the fact that respondents were affected equally by altitude since they were drawn form same locality (Ndhiwa). The results on iron were therefore assumed to have same effects of altitude interference.

1.7 RATIONALE OF THE STUDY

Vitamin A and iron deficiencies have continued to be prevalent among pregnant women especially in the rural areas even with supplementation and food fortification strategies in place. This has necessitated studies on vitamin A and iron of pregnant women so as to determine factors affecting vitamin A and iron consumption during pregnancy.

1.8 SIGNIFICANCE OF THE STUDY

Findings from this study are necessary for use to develop appropriate intervention programs suitable for improving vitamin A and iron of pregnant women. The Government could use these findings to set up policies that are geared towards minimizing prevalence of nutritional deficiencies.

1.9 OPERATIONAL DEFINITIONS OF TERMS

Dietary assessment of vitamin A and iron: Consumption analysis of vitamin A and iron based on 24-hour recall replicate and food frequency.

Vitamin A and iron consumption levels: Amounts of vitamin A and iron consumed by the pregnant women as compared to WHO norms for RDA during pregnancy.

Vitamin A Inadequacy: Condition of consuming less than 1000ug/day.

Iron inadequacy: Condition of consuming less than 30mg/day.

Nutrition status: An individual's nutritional condition as indicated by BMI.

Under weight: Having BMI of less than 19.0

Normal weight: Having BMI between 19.0-25.0

Over weight: Having BMI between 26.0-29.0

Obese: Having BMI of more than 29.0

Regular consumption of vitamin A and iron rich foods: Consumption of vitamin A and iron rich foods for more than four times a week.

Irregular consumption of vitamin A and iron rich foods: Consumption of vitamin A and iron rich foods for less than four times a week.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

Literature review captured the following sub headings: background, assessments of vitamin A and iron in pregnancy, recommended daily allowance of vitamin A and iron in pregnancy, factors influencing vitamin A and iron consumption of pregnant women, interaction between vitamin A and iron in pregnancy, prevention of vitamin A and iron deficiencies in pregnancy and summary of literature review.

2.1 GENERAL INFORMATION ON VITAMIN A AND IRON

Vitamin A and iron deficiencies are the most common nutritional deficiencies in most developing countries (Curriec, 1999 and Fraud, 2000). These deficiencies are probable seconding PEM among infants, children, lactating and pregnant women (WHO, 2001). Basta (2000) reported that Vitamin A deficiencies (VAD) contribute to increased childhood morbidity and mortality. Studies on vitamin A and iron have in the past focused on children where as studies on maternal vitamin A and iron have shown no improvement in deficiencies even in areas where supplementation has been carried out for a longer period of time (Polit, 2000 and Anderson, 1999). A more sustainable preventive measure to both deficiencies is still a dilemma to various health and nutrition professionals (Kenanny and West, 2002). Anaemia and xerophthalmia as well as night blindness are manifestation of nutrition deficiencies or consequences of poor dietary practices (WHO, 1998). The detrimental effect of VAD and iron deficiencies on quality of life and survival, including negative economic consequences is reasonably recognized in the developing countries (Ryan, 1997). Various global and regional meetings on micronutrient surveys have expressed the need for more surveys in light of the vulnerable groups of individuals to such deficiencies (Micronutrient Initiative, 2001). It is in light of this that the situation analysis of vitamin A and iron is assessed in terms of infants, children, lactating and pregnant women because these group of people are most vulnerable to the deficiencies (Mwaniki et al., 1999).

Vitamin A is a generic term for the biologically active compounds (Jack & Roger, 1989). It is a nutrient, which originates from both animals and plants in form of retinoid, provitamin A and carotenoids (Longer, 1986). Its deficiency is almost automatically indicated by xerophthalmia and night blindness (Jack and Roger, 1989). The significance of vitamin A and the global effort to address its deficiency are widely documented (Ministry of Health, 1999 and MI, 2001). Estimate based on series of prevalence of VAD suggests that there are 87% cases of VAD in the whole world (Laren, 2000). Nearly 70% children in developing countries present public health problems associated with VAD, while 54% pregnant women in some 60-73 developing countries present vitamin A deficiencies (Base et al., 2003). Low serum levels have been reported during pregnancy among diverse groups of south Asian pregnant women (Katz et al., 1999). Newman (2002) commented that pregnant women in developing countries consume vitamin A of less than half of the RDA. They have an average serum concentration level of 70% less than that of pregnant women in the developed countries (Katz et al., 1999). VAD has therefore continued to present problems of public health concerns even in areas where supplementation strategies have been put in place, the occurrence is attributed to controversies of vitamin A supplementation and foetal defects, inadequate supply of supplements as well as poor compliance with supplementation. (Katz et al., 1999). Maternal mortality and morbidity have therefore continued to reflect the magnitude of VAD in the developing countries (Katz et al., 1999).

Ahmed (1990), Jones (1986) and Lirid (1989) say that the normal physiologic changes in pregnancy result from a greater relative increase in plasma volume over red cell mass. The hemodilation of red cell is greater in pregnancy, thus, haemoglobin values fall particularly during the second trimester (Pauge, 1988). This creates iron deficiency anaemia, which is a common problem to pregnant women worldwide. Pauge (1988), WHO (1997), Adiels (2001) and Muroki, (2003) state that iron deficiency anaemia was recognized to be a public health problem in many developing countries as early as 1946. In the USA 40% of pregnant women are said to be iron deficient (Hunt and Lirof, 1999). This kind of deficiency comes as a result of poor dietary intake, which is mostly influenced by fad foods in developed countries. Hunt et al (1999), Atmaka (1999) and Yipp (2001) reported that 70% of pregnant women in Asia are anaemic even with supplementation programs that have been put in place since 1974. This is attributed to low compliance with iron supplementation as well as nutrient interactions during pregnancy (Yipp, 2001). WHO (2000), Herberg (2002), Fleming (2001) and Dsoko (2000) stated that pregnant women in developing countries have continued to be anaemic due to inadequate dietary intake and poor distribution of tablets especially in the rural areas. Among pregnant women in Kenya, the prevalence of moderate and severe anaemia increases with gestation period (Mwaniki et al., 1999). Thus, during the first trimester, 37.8% of pregnant women become anaemic while 42.6% become anaemic during the second trimester and 23.7% become anaemic during third trimester (Mwaniki et al., 1999).

Inadequate consumption of vitamin A and iron rich foods have contributed to increased prevalence of these deficiencies among pregnant women in the rural areas (Suprapto et al., 2002). Consumption of soil during pregnancy introduces worms to the human system that deprives adequate nutrients (including vitamin A and iron) in the body. Long term cooking of vegetables ensures loss of volatile micronutrients thereby decreasing nutritive values of vegetables that are good sources of vitamin A and iron (MOH, 1999 and UNICEF, 2003).

2.2 VITAMIN A AND IRON ASSESSMENTS IN PREGNANCY

A broad base of information about the women's general body composition, nutritional status, food habits, and living conditions, personal and family goals is essential for assessing initial nutrition and health needs of pregnant women (Loyd, 2001). The basic methods used in vitamin A and iron assessment in pregnancy include clinical assessment, dietary assessment, biological or laboratory assessment and anthropometric assessments (Thomson, 1987).

In clinical assessment the observer physically assesses the visible signs of any deficiency as can be reflected in skin, eyes, hair and nails (Tamura, Arakawa, Evele and Grace, 1999). Clinical examination sometimes is difficult to interpret in relation to a specific deficiency during pregnancy (Tamura et al., 1999). For example, gingival hypertrophy and oedema in pregnancy may not respectively imply vitamin and protein deficiencies (Tamura et al., 1999: Loyd, 2001). Nonetheless, general examination of the skin, eyes and mucous membranes are checked for paleness, which provide clues for the presence of iron deficiency during pregnancy (Wickizer, 1999). Vitamin A on the other hand is clinically assessed through eye examination that provides clues to its deficiency (Loyd, 2001). These signs must be evaluated in relation to other assessment results such as results from laboratory procedures and dietary history in order to ascertain their degrees of reliability (Wong and Epid, 1998).

Biochemical or laboratory assessments though expensive provide precise information on nutritional condition of a specific nutrient in pregnancy (Borch and Bryant, 1998). Assessment of iron can be curried out using hematocrit levels, where by less than 32% in pregnancy indicates iron deficiency (Borch et al., 1998). Serum transferitin as well reflects the amount of bound iron that is supposed to circulate in the body. If serum transferitin levels are less than 5mg/dl of blood then it indicates that there are less iron stores in the body and this encourages blood transfusion during pregnancy (Ninch and Triip, 1999). Total iron binding capacity values indicate how much iron is available in the body so that if binding capacity is less than 20% then this is an indication of iron deficiency (Wardlow, 1999). Vitamin A on the other hand is assessed through serum retinol levels whereby low serum levels (<1000ug) indicate vitamin A inadequacy (Almooth, 2001).

Dietary assessment is another way of assessing nutritional condition of an individual, which basically looks at food consumption patterns through a combination of two or more food consumption indicators (Loyd, 2001). Food consumption indicators include 24-hour recall, food diaries, food frequencies and food weighing methods (Semba et al., 2001). The most WHO recommended indicators for dietary assessments are 24-hour recall and food frequency. Questionnaires are constructed in such a way that the nutrients consumed can be reflected (Chawla and Puri, 2001). Estimation of specific nutrient consumption can be achieved through average of 24-hour recall replicates and food frequency checklist (HKI, 1999 and Gibson, 1990). Reports indicate that 24-hour recalls and food frequencies are commonly used in dietary assessments compared to food diaries and food weighing methods as they are more detailed and do not require expatriates in conducting the processes of weighing food and rigorous updating of food diaries (HKI, 1999). Studies done on vitamin A and iron assessments have in the past focused on biochemical analysis (WHO, 1995). The method has been considered most accurate though expensive compared to other methods of micronutrient analysis. However various researches have reported reliability of dietary analysis through an average of 24-hour recall and food frequency checklist as means of individual nutrient analysis (Gibson, 1990).

Anthropometric measurements commonly used in nutrition status assessments during pregnancy include BMI and MUAC (American Dietetics Association, 1998). The two components of nutrition status assessment have faced controversies with regard to pregnant women. The controversy of BMI concerns stature of pregnant women that is affected by physiological changes where by they are unable to stand straight especially during the third trimester (Norwich Union of Obstetrics, 2004). Another controversy of BMI concerns the additional foetal, amniotic fluid and placental weights. To address these controversies of BMI, the (NUO, 2004) developed a theory that uses Knee height measurements to estimate heights of pregnant women in their third trimesters. Heights of pregnant women in their first and second trimesters are however taken using height sticks since their stature is not significantly affected by the physiological change (NUO, 2004). To take care of additional foetal, placental and amniotic fluid weights, the NUO, suggests that 3kg be subtracted form the obtained weights for pregnant women in their first trimesters and that 1kg be subtracted for pregnant women in their second and third trimesters (NUO, 2004). The controversy of MUAC concerns the fluctuations in body fluids (especially oedema) caused by physiological changes. A scientific theory that can take care of this controversy is not yet accomplished (NUO, 2004).

2.3 RECOMMENDED DAILY ALLOWANCE OF VITAMIN A AND IRON IN PREGNANCY

Vitamin A and iron needs during pregnancy increases due to the increased demands of nutrients by the developing foetus as well as the increased body mass of the mother (Gross, 1997). In normal situations women are advised to have a daily iron consumption of 10-20mg per day but in pregnancy, a total day's consumption of <20mg/day is considered severe inadequacy. Consumption of between 20-30 mg/ day is classified as mild inadequacy where as consumption of between 30-60mg/day is classified as adequate during pregnancy (WHO, 2003). This amount of iron can be met through adequate dietary intakes or a combination of elemental iron supplements (Chenny and Frankle, 1997).

During normal situation, vitamin A's daily intake is between 700-800mg/day where as in pregnancy a total day's consumption of vitamin A is increased by 400mg/day so that a total day's intake of 1000-1200ug/day is considered sufficient to meet the increased demands of this vitamin during pregnancy (Davis, 2000). The WHO defines consumption of <800ug/day as severe vitamin A inadequacy during pregnancy. Consumption of 800-1000ug/day is considered as mild inadequacy where as consumption of between 1000-1200ug per day is considered adequate during pregnancy (WHO, 2003).

2.4 FACTORS INFLUENCING VITAMIN A AND IRON CONSUMPTION OF PREGNANT WOMEN

Sommer (1997), Huseine (2000) and Muhilal (1999) noted that problems of nutrient deficiencies (including vitamin A and iron) in developing countries are associated with poor socio-economic status. Poverty has lessened the purchasing powers of most families so that adequate food consumption is compromised (Bieri and Katigani, 1999). In most developing countries the employment trend has been biased against women such that formal employment that promotes economy tend to favour men than women, women are therefore unable to provide quality diets to their families (Bieri and katigani, 1999).

Cultural practices especially food taboos have contributed to nutritional deficiencies (including vitamin A and iron) in most developing countries (Berg and Joosten, 1997). In Kenya, communities such as Mijikenda pregnant women are prohibited from eating meat, meat cuts, eggs and groundnuts for the fear of caesarean deliveries (Ocholla, 2003). Among the Samburu of Kenya, pregnant women are supposed to have one meal a day that is composed of cereals, wild vegetables and row fat. The practice is meant to nature the developing foetus to the hardship especially food insecurity (Ocholla, 2003). Cultural practices have deprived pregnant women of vitamin A and iron rich foods that could help raise their serum levels (Ocholla 2003).

Poor dietary intakes during pregnancy have contributed to nutritional deficiencies especially micronutrients (vitamin A and iron included). Poor or low dietary intake of nutrients is attributed to malabsoption and poor appetite caused by hormonal changes that take place in pregnancy (Power, 1998). Poor dietary intakes are as well associated with inadequate nutrition information and education regarding quality versus quantity food consumption, food preparation methods (e.g. overcooking of vegetables) and dietary diversification that increases bioavailability of nutrients (FAO, 2003). Inadequate nutrition information leads to poor dietary habits (e.g. consumption of soil induced by pregnancy cravings) which expose pregnant women to worm infestations that deplete their nutrient stores (FAO, 2003). Poor dietary intakes are attributed to insensitivity of food policies to vulnerable groups such as children, lactating, pregnant women and the elderly. This factor has increased food insecurity due to poor national and household food distribution which limits availability and accessibility of food (FAO, 2003).

Infectious diseases such as malaria, typhoid, and pregnancy induced diabetes and hypertension affect the availability of vitamin A and iron as these diseases promote PEM and general under-nutrition (Power, 1998). Infections such as malaria and typhoid are directly attributed to increased iron deficiencies among pregnant women as they involve parasites that directly attack plasma cells (Population Service International, 2005). Pregnancy induced conditions such as dilutational anaemia caused by increased body fluid increases prevalence of iron deficiencies during pregnancy (ADA, 1998). Vitamin A deficiency on the other hand is increased by reproductive tract infections, urinary tract infections, dysentery and measles which basically affect immune system thereby exposing individuals to increased morbidity (WHO, 2003). Vitamin A deficiency and infections during pregnancy occur in a viscous cycle in that VAD leads to increased infection due to weak immune system, while increased infection caused by VAD that weakens immune system among other factors increases infections, thus increased morbidity (WHO, 2003).

Low compliance to iron and vitamin A supplementation during pregnancy have been associated with high prevalence of both deficiencies (WHO, 2002). This has been attributed to poor and inadequate tablet distribution especially in the rural areas (Chewla and Puri, 2001). Besides inadequate supplement distribution, low compliance to supplementation has been attributed to poor attitude towards medicine (Chewla and Puri, 2001). Attitude just like appetite and emotional status is affected by hormonal fluctuations during pregnancy (Chewla and Puri, 2001).

Poor antenatal turnovers in the developing countries has been associated with the nutrition deficiencies including vitamin A and iron (WHO, 2002), thus, expectant mothers do not receive adequate health and nutrition guidance because of the expenses involved and long distance walk to the antenatal clinics which hinder them from attending nutrition counselling session (Surhano et al., 2001). Antenatal visits have not been perceived as a vital aspect that promotes healthy pregnancies characterized by adequate nutrition and good health (NUO, 2004).

Food insecurity, which is a challenge, to most households in the developing countries as well contributes to the micronutrient deficiencies (Sommer, 1997). Food insecure household tend to consume unbalanced diets whereby the food most consumed come from carbohydrate source so that rich sources of vitamin A and iron are least consumed or even not consumed at all (Ocholla, 2003). Other factors that arise from Physiological change during pregnancy affects nutrient status especially iron. It is widely recognized that dilutational anaemia occurs in pregnancy due to additional body fluid (MI, 2001). It is well recognized that iron deficiency is more common to pregnant women during first and second trimester as the body gradually adjusts to the increased physiological changes (INACG, 2002).

2.5 INTERACTION BETWEEN VITAMIN A AND IRON DURING PREGNANCY

Hunt et al., (1999) stated that iron is another mineral in addition to zinc that is related to vitamin A. Vitamin A deficiency is associated with iron deficiency anaemia thus, vitamin A deficiency causes a decreased mobilization of iron from the liver thereby making its supply to the whole body insufficient (Kaafa et al., 1997). Studies that were curried out in central Java Indonesia among pregnant women showed that Vitamin A supplementation among pregnant women elevated their serum iron concentrations (Suprapto et al., 2002).

Vitamin A is known to play a role in haematopoiesis but the biological mechanism by which this happens has not been well understood (Semba et al., 2001). Controlled trial in Guatemala, Indonesia and Balize demonstrated that vitamin A supplementation increased haemoglobin levels in pre- school children (Surhano et al., 2002). Smith (1992) and Muhilal (1999) reported that improvement of vitamin A condition using vitamin A fortified monosodium glutamate ensured an increase in haemoglobin levels of pre- school children.

Among pregnant women a combination of vitamin A and iron supplements improved serum iron concentrations more than iron supplementation alone. A combination of iron, folate, and zinc supplementation showed a great improvement of anaemia and vitamin A among pregnant women more than the two combinations involving iron with folate or zinc supplementation alone (Surhano et al., 2001: Chelwa and Puri, 2001). In Kenya pregnant women are issued with doses of iron and vitamin A tablets so as to minimize deficiencies of both nutrients (Mwaniki et al., 1999).

2.6 PREVENTION OF VITAMIN A AND IRON DEFICIENCIES IN PREGNANCY

Vitamin A and iron deficiencies have been declared public health problems, which can be controlled and prevented (West, 2002). Available evidence show that vitamin A and iron supplementation during pregnancy will lead to a significant reduction of maternal morbidity and moralities (Berger et al., 1995). WHO and UNICEF (2000) have recommended that vitamin A and iron supplementation be integrated in various maternal and child programs so as to target pregnant women during tablet distribution (Binka and Dollimore, 1997). Vitamin A and iron supplementation should be part of other interventions at health clinics particularly diarrheal disease control and supplementary food distribution (Court et al., 1998). Community based distribution may offer the best strategy for supplementation in pregnancy where pregnant woman are issued with vitamin A and iron tablets so as to reduce prevalence of vitamin A and iron deficiencies (Walt, 2000).

Vitamin A and iron deficiencies can be prevented through food fortification (Solon, 1997). The appropriate food vehicles for fortification are being identified in most developing countries (Ngare, 2003). In East African countries, maize meal flour, cooking fats and margarine have been identified as appropriate foods for fortification with vitamin A since these are food commodities that are widely consumed in these countries (Ngare, 2003). Optimum nutrition rigorously supported is an integral part of sound maternity care (Hales and Rehal, 1982). Pregnant women have always been advised to ensure adequate dietary intakes of vitamin A and iron rich foods (Fauzi, 2002). Pregnant women experience anorexia and vomiting especially during the initial stages of pregnancy, which affects their food intakes and utilization (Fauzi, 2002: Korkil, 1996). Optimum nutrition ensures good nutrition status and healthy pregnancies (MOH 2003).

Consumption of locally available dark green leafy vegetables, orange and yellow fruits, eggs and red meats should be encouraged to ensure adequate dietary intake especially micronutrients that improve immunity of vulnerable groups of individuals (Herman, 2002). Good dietary practices during pregnancy are mostly encouraged and are considered applicable and practical practice toward prevention of most nutritional deficiencies (Fauzi, 2002). Pregnant women have tendencies of eating soil, which predispose them to warm infestations. Deworrming during pregnancy is therefore one way of getting rid of such parasites (Kobar and Mackic, 1995). Pregnant women should be counselled against soil consumption during their antenatal visits (Kobar and Mackic 1995). Malaria is a disease that is crucial during pregnancy as it deplete iron stores. Pregnant women are therefore advised to use mosquito nets and other available mosquito repellents so as to prevent malarial attacks (PSI, 2004). Typhoid is a common infection during pregnancy which is preventable through proper sanitation and use of safe drinking water (MOH/WHO 2005). Nutrition and health education should be ensured prior to conception so that pregnant women get to know the implications of good nutrition and health during pregnancy (WHO/UNICEF/MOH, 1999). Nutrition and health education should form part of antenatal services in various MCH units (UNICEF/MOH, 2003). Preconception health and education helps to correct any deficit and prevent nutrition deficiencies before they occur (Davidon, 2000).

Micronutrient deficiencies especially vitamin A and iron among pregnant women is a concern to the MOH in Kenya (MOH/WHO, 2003). Various strategies that have been put in place to prevent prevalence include food fortification with vitamin A and iron as well as vitamin A and iron supplementation that has not been positively achieved especially in the rural areas (WHO, 2003). Food fortification is an effective method of reducing micronutrient deficiencies as it does not rely on compliance as the case with supplementation. Appropriate food vehicles for fortification are widely consumed in Kenya (Unilever/MOH, 2006). Fortified foods should be retailed at subsidized costs to target low income households and vulnerable groups in Kenya (Unilever, 2006). Supplementations though faced with challenges improve micronutrient deficiencies. The ministry of health is encouraging the use of public MCH by subsidizing on the cost of services and free distribution of supplements through mobile clinics that target pregnant women in the rural areas (MOH, 2002).

2.7 SUMMARY

Iron and vitamin A deficiencies were declared public health problems affecting infants, children, lactating and pregnant women in most developing countries. Vitamin A and iron deficiencies have been attributed to poor dietary intakes. 24-hour recall and food frequencies have been used in the assessment of vitamin A and iron consumption. The detrimental effects of vitamin A and iron deficiencies on quality of life are reasonably recognized in the developing countries. The cause of vitamin A and iron deficiencies during pregnancy range from poor dietary intake to low compliance with supplementation whereby the RDA is not met. Vitamin A and iron are micronutrients whose interactions are dependent on one another. Various studies have shown that a combination of vitamin A and iron supplementation improves iron deficiency significantly. The deficiencies are preventable through adequate dietary intakes, supplementation and food fortification among others. Related literature has indicated that there is poor supplementation in the rural areas which is a challenge to meeting the RDA during pregnancy. This has significantly captured efforts of many MOH in developing countries hence provision of vitamin A and iron supplement to pregnant women. Poverty on the other hand remains a challenge to preventive measures since majority of pregnant women face the economic constraints that interfere with efforts to achieving quality diet and health care. The financial challenge therefore limits consumption of a variety of foods that ultimately compromise nutrient supplies especially micronutrients.

CHAPTER THREE

METHODOLOGY

3.0 INTRODUCTION

This section gives a description of study design, study area, target population, sample selection and sample size, data collection instruments, data collection procedures and data analysis.

3.1 STUDY DESIGN

Descriptive case study was used to undertake a study between October and December 2005 to establish vitamin A and iron consumption levels of pregnant women at Ndhiwa Sub District Hospital. This design was more appropriate for the study because the study was done in-depth at one station and involved collection of non-experimental quantitative and qualitative data. Combining both types of data increased the research reliability that met the objectives of the study (Antony and Michael, 1993).

3.1.1 STUDY AREA

This study was carried out at Ndhiwa Sub District Hospital where subjects were accessed for further interviews. Ndhiwa Sub District Hospital was chosen as it is the sole public health facility that serves a large population of cosmopolitan community within Homa-Bay Sub District (District Statistics Office, Homa-Bay, 2004).

3.1.2 TARGET POPULATION

The target and accessible population were pregnant women in their first and second trimester attending Ndhiwa Sub District Hospital. The study purposively targeted pregnant women in their first and second trimesters because their heights could be obtained without limitations of stature and physiological change (NUO, 2004). Owing to the study design it was appropriate to access respondents from a health center hence the reason for targeting pregnant women who attended Ndhiwa Sub District Hospital.

3.1.3 SAMPLE SELECTION AND SAMPLE SIZE

The respondents were accessed through convenient sampling method (Orodho, 2004). Convenient sampling is a non-probability technique where population elements are selected based on ease of access, (Orodho, 2004: Fisher et al., 1998). A sample frame of 336 pregnant women was expected to attend the clinic within the two months of data collection (Ndhiwa Sub District Hospital, 2005). Thus on average 42 pregnant women attended the clinic in a week (Ndhiwa Sub District Hospital, 2005). By taking 30% as a representation of pregnant women, the sample size was therefore 100 pregnant women (Gerald, 1988). Owing to convenient sampling method, the first 100 pregnant women in their first and second trimesters, who attended the health facility and consented participation during data collection weeks were included in the respondents list for interviewing (Orodho, 2004).

3.2 DATA COLLECTION INSTRUMENTS

Data were collected using a semi-structured questionnaire focusing on demography, dietary and general health data. 24-h recall whose contents included food/drinks, cooking method, duration of cooking vegetables and ingredients as well as food frequency checklist for vitamin A and iron rich foods were used to collect dietary data for average assessment of vitamin A and iron consumption. Quantities of foods consumed were estimated using household utensils and food models. The average weight of each type of food was estimated to the nearest grams after incorporating FAO's mini food list for Kenya (FAO, 2002). Bathroom scales and graduated height stick were used to measure weight and height to the nearest 100g and 0.5 cm respectively to determine BMI.

3.3 DATA COLLECTION PROCEDURE

Research clearance (Appendix VIII) was obtained from the research committee at the Ministry of Education, Science and Technology through Graduate school, Kenyatta University. Two research assistants were trained on how to collect data. The training was done to ensure that key data were collected. They were trained on the purpose and objective of the study, the meaning and expectation of each question and how to use the measuring equipments. Consent was sought from respondents before administration of interviews and participation was purely voluntary. Familiarization with respondents was undertaken at the health facility prior to face to face interview with questionnaire by research assistants. Anthropometrics (weight and height) measurements were administered by clinics in charge and readings recorded accordingly by research assistants at the clinic.

The research assistants and the researcher administered 24-h recall and food frequencies questionnaire together with other questionnaire focussing on demography on home visit. Data was edited and coded immediately.

3.4 DATA ANALYSIS

Data analysis was carried out using computer package; Statistic Package for Social Science (SPSS) to determine factors that influence vitamin A and iron consumption of pregnant women at Ndhiwa Sub District Hospital. The quantitative data were summarized using descriptive statistics namely frequencies and percentages. Anthropometrics data (weight and height) were transformed to BMI values by BMI Calculator (2004) computer software developed by NUO. BMI values were used to determine nutrition status of pregnant women in terms of underweight, normal, overweight and obese. BMI Calculator was used because it has an in-built component specific to pregnancy. Data on 24-hour recall was analyzed using Nutri-Survey and vitamin A Calculator software to establish the total amount of vitamin A and iron in the meals consumed per day. Vitamin A Calculator is a software that gives collective amounts of vitamin A derived from provitamin A, carotenoids and retinoid. Nutri-Survey just like vitamin A calculator is a software that has WHO food tables that have bioavailability component built in them. The amount of food consumed per day was compared with RDA to establish whether there was adequate vitamin A and iron. Data on food frequency check list was analyzed using SPSS to determine consumption frequency of vitamin A and iron rich foods. Consumption of these foods for more than four times a week was considered regular while consumption of these foods for less than four times a week was considered irregular. Pearson Product Moment correlation was used to determine strength and direction of relationships between vitamin A and iron consumption of pregnant women for non-categorical variables. Spearman's Rho was used to establish the relationships between vitamin A consumption, iron consumption and nutrition status and some categorical variables derived from demographic, dietary and health related factors. Multiple regression was used to determine whether vitamin A consumption, iron consumption and number of meals per day predict nutrition status. Quantitative data were presented using tables, graphs and charts. Qualitative data were reported in narrative form.

3.5 VARIABLES

3.5.1 Dependent variables

3.5.1.2 Vitamin A consumption

Vitamin A consumption was determined as inadequate depending on amount consumed in relation to RDA. Vitamin A was classified as severe inadequacy, mild inadequacy and adequate based on WHO cut-off points for RDA during pregnancy. Cut-off points were<800ug for severe inadequacy, 800-1000ug for mild inadequacy and 1000-1200ug for adequate vitamin A consumption during pregnancy (WHO, 2003).

3.5.1.3 Iron consumption

Iron consumption was determined as inadequate depending on food consumption that was compared to RDA during pregnancy. Iron consumption was classified as severe inadequacy, mild inadequacy and adequate based on WHO cut- off points for RDA. Cut-off points were <20mg for severe inadequacy, 20-30mg for mild inadequacy and 30-60mg for adequate iron consumption during pregnancy (WHO, 2003).

3.5.1.4 Nutrition status

Nutrition status was determined as BMI. This was interpreted as under weight, normal, over weight and obese depending on BMI cut-off values by American Dietetics Association for pregnancy. The cut-off points were <19.0 for under weight, 19.0-25.0 for normal weight, 26.0-29.0 for over weight and >29.0 for obese.

3.5.2 Independent variables

3.5.2.1 Demographic variables:

These were variables that described respondents in terms of age, weight, height, ethnicity, marital status, education level and occupation. Age was considered due to vulnerability implications on vitamin A and iron consumption. Weight and height determined BMI hence nutrition status. Ethnicity was considered for its implications on dietary norms where as marital status was considered due to its social implications on food consumption. Education levels and occupation as well have social and economic implications on food consumption.

3.5.2.2 Dietary variables:

Refers to food consumption pattern as reflected by 24-hour recall and food frequencies. The variables that were used in the study included number of meals consumed per day (24-

hour recall), frequency of consumption of vitamin A and iron rich foods (food frequency checklist described as either regular or irregular consumption) and factors considered in food choice.

3.5.2.3 Health related variables:

These variables described health conditions related to vitamin A and iron during pregnancy. They included common illnesses during pregnancy, complications suffered during pregnancy, vitamin A and iron supplementation, antenatal visits, and number of pregnancies.

CHAPTER FOUR

RESULTS AND DISCUSSIONION

4.0 INTRODUCTION

This chapter provides detailed presentation of results and discussion of research findings organized into: Demographic characteristics of respondents, vitamin A and iron consumption of the pregnant women, consumption frequencies of vitamin A and iron rich foods, factors that influence vitamin A and iron consumption of pregnant women, nutrition status of pregnant women and relationship between vitamin A and iron consumption of pregnant women at Ndhiwa Sub District Hospital.

4.1 Demographic characteristics of pregnant women at Ndhiwa Sub District Hospital

The demographic characteristics of respondents were crucial in obtaining personal backgrounds that have various impacts on general health and nutrition backgrounds of individuals. The demographic characteristics considered included age, ethnicity, marital status, education level, occupation and household size. These are presented in Table 4.1

Table 4.1. Demographic characteristics of the pregnant women at Ndhiwa Sub-District Hospital

Variables	Categories	n	%
Age	14-20	9	10.3
	21-25	38	40.8
	26-30	25	23.2
	31-35	21	20. 3
	36-40	3	3.1
	41-45	4	3.3
Ethnicity	Luo	88	87.0
	Suba	6	8.8
	Kisii	3	2.1
	Bukusu	3	2.1
Marital status	Married	75	65.2
	Single	12	20.8
	Separated	8	9.8
	Widow	3	2.1
	Divorced	2	2.1
Education level	< std 8	49	48.7
	KCPE	22	20.8
	KCSE	20	19.8
	College level	9	10.3
Occupation	Not employed	47	44.5
	Casual	20	19.7
	Self employed	24	22.8
	Civil servant	5	8.8
	NGO	4	3.3
Household size	1-3	31	34.7
	4-6	52	48.5
	7-10	10	11.4
	11-13	7	5.1

4.1.1 Age

Age was crucial in determining vitamin A and iron consumption irrespective of pregnancy status. As presented in Table 4.1, about 41% were aged between 21 – 25 years, the ages associated with minimal incidences of low birth weight and pregnancy complications. The study as well realized 10% respondents who were aged between 14-20 years and 3% aged 41-45. Studies have shown that risks of iron deficiency are high among pregnant adolescent aged between 13-15 years (Roberts, 1998). Pregnant women aged below 15 and above 35 years are the groups associated with complications of pregnancy including iron deficiency while those aged between 25-30 experience the best pregnancy outcome (Roberts, 1998 and MI, 2001). Vitamin A just like other nutrients is considered crucial during pregnancy to boost immune system so as to reduce maternal morbidity. Pregnant women aged 35 and above are at risk of increased morbidity (MI, 2001). However optimum nutrition is crucial during pregnancy in ensuring adequate nutrient stores (vitamin A and iron included).

4.1.2 Ethnicity

Ethnic background plays central role in food habits adopted by people including food preference, taboos, preparations and inter-household distribution (MOH/UNICEF, 2001).

Table 4.1 shows that 87% were Luos, followed by 9% who were Suba while 2% belonged to Kisii and Bukusu tribes. Luos formed majority of respondents because the study area was their geographic territory. Other tribes were residents either by marriage or visitation. Certain ethnic practices contribute to nutritional problems e.g. restriction of eggs among Luos (Ocholla, 2003). Food taboos practiced by diverse cultures within developing countries are unfavourable to women especially pregnant and lactating women. Cooking methods and food consumption varies with respect to cultural practices in Kenya. Thus, vegetables that are good sources of vitamin A and iron such as spider herb, corchrus, nightshade are popular among Bukusu, Luos and Kisii (Ocholla, 2003).

4.1.3 Marital status

Marital status on the other hand contributes to inter-household food distribution disparity and ultimately has an impact on nutrition status of pregnant women. Results presented in Table 4.1 shows that 65% of pregnant women were married, 21% were single, 10% had separated, 2% were widows and 2% were divorced. Married women were the majority. Single respondents were teenagers. According to Ndhiwa Sub District Hospital report, teenage pregnancies are encouraged by school dropouts due to poverty and customary norms (NSDH, 2005).

4.1.4 Education level

Education level is a crucial determinant of job opportunities and income level as well as decision making on food purchase and consumption (FAO, 2003). Education level of respondents was categorized to reflect various levels of formal education certification such as Kenya Certificate of Primary Education (KCPE), Kenya Certificate of Secondary Education (KCSE) as indicated in Table 4.1. Almost half of the respondents (49%) did not study up to standard 8, according to Ndhiwa Sub District Hospital report, this is a reflection of semi literacy associated with unemployment and low income levels that affect food purchasing and consumption (NSDH, 2005). Another 21% and 20% attained KCPE and KCSE respectively. Those respondents who attained college education (10%) had increased employment opportunities and increased decision making on food purchase and consumption that promote optimum nutrition (NSDH, 2005).

4.1.5 Occupation

Occupation determines the kind of employment or business that determines income level that in turn affects food consumption patterns. According to Table 4.1, almost half (45%) of respondents were not employed, 20% were casual labourers, 23% were self employed while 9% and 3% worked as civil servants and NGO employees. According to Ndhiwa Sub District Hospital report, the unemployed, casual labourers and self employed were at risks of nutrient inadequacy due to low income levels mostly associated with informal employment and sugarcane farming that interfere with food production (NSDH, 2005). Those respondents who were formerly employed had increased purchasing powers and decision in food purchasing that is associated with improved health and nutrition status (NSDH, 2005).

4.1.6 Household Size

Household size plays a crucial role in determining food consumption pattern and inter household distribution (FAO, 2003). Half of the respondents (49%) had 4-6 household members, 35% had 1-3 members, 11% had 7-10 members where as 5% had between 11-13 members (Table 4.1). Pregnant women with large households may be exposed to increased discrepancies in inter-house food distribution which ultimately affect their nutrient consumption (vitamin A and iron included). Those with smaller households may have minimum discrepancies in inter-household food distribution which minimize nutrition deficiencies, vitamin A and iron included (FAO, 2003).

4.2 Vitamin A and iron consumption of pregnant women at Ndhiwa Sub District Hospital

The study sought to establish vitamin A and iron consumption of pregnant women at Ndhiwa Sub District Hospital. This was done through dietary assessment (replicate of 24-hour recall) and analyzed using sight and life vitamin A calculator and Nutri-Survey. Ndhiwa is an area within Nyanza province that has pockets of vitamin A and iron deficiencies even with supplementation program in place (DSO-Homabay, 2004). This sub topic presents and discuses the following captions. Vitamin A consumption of the pregnant women, vitamin A consumption and RDA during pregnancy, iron consumption of the pregnant women, iron consumption and RDA during pregnancy and prevalence of vitamin A and iron inadequacies at Ndhiwa Sub District Hospital.

4.2.1 Vitamin A consumption of pregnant women at Ndhiwa Sub District Hospital

The study established vitamin A consumption of pregnant women at Ndhiwa Sub District Hospital. Vitamin A consumption in this study is established as the average vitamin A consumed by pregnant women as reflected in 24-hour recall and analyzed by Sight and Life vitamin A calculator (HKI, 1999). The disease burden associated with VAD during pregnancy is widely recognized. It is recognized that pregnant women are at risk of sub-clinical VAD, they show none of the ocular signs or symptoms, but have markedly increased risk of morbidity and mortality particularly from malaria and diarrhoea (WHO, 2003). Table 4.2 presents established vitamin A consumption of the pregnant women alongside WHO norms for RDA during pregnancy.

Table 4.2. Vitamin A consumption and RDA of pregnant women at Ndhiwa Sub District Hospital

Vitamin A levels (ug)	n	%	RDA(ug)	%
< 200	17	16.3	severe inadequacy(<800)	80
201 – 400	45	43.4		
401 – 600	21	20.3		
601 – 800	5	8.8	Mild inadequacy (800-1000)	12.1
801 – 1000	4	3.3		
1001 – 1200	3	2.1	Adequate(1000-1200)	2.1
1201 – 1400	2	2.1	>1200	
1401 – 1600	1	1.6	>1200	5.8
1601 – 1800	2	2.1	>1200	

Nearly half of the respondents (43%) had vitamin A consumption between 201ug and 400ug followed by 20% whose vitamin A consumption was between 401ug to 600ug, while 16% had vitamin A consumption below 200ug (Table 4.2). Another 9% and 4% had vitamin A consumption of 601-800 and 801-1000, where as 2% had vitamin A consumption of 1001-1200.

4.2.2 Vitamin A consumption and RDA of pregnant women at Ndhiwa Sub District Hospital

The study compared the established vitamin A consumption of pregnant women at Ndhiwa Sub District Hospital against WHO norms for RDA during pregnancy as shown in Table 4.2. Most respondents (80%) did not compare positively to the RDA indicating severe inadequacy. A small percentage (12 %) had mild inadequacy, while 8% had adequate consumption levels. Most pregnant women at Ndhiwa Sub District Hospital had inadequate vitamin A consumption that predisposed them to risks of vitamin A deficiency during pregnancy. The increased vitamin A inadequacy could be attributed to inadequate supplementation, unsuccessful food fortification strategies and more so inadequate consumption of foods rich in vitamin A. The study findings compares with the 50% national prevalence for vitamin A deficiency among pregnant women (Mwaniki et al., 1999: C.B.S, 2003: MOH, 2003). The findings as well compares with 30% prevalence of vitamin A deficiency among pregnant women in Nyanza Province (UNICEF, 2003). This study is in agreement with Ettyang (2003) that reported increased vitamin A deficiency among lactating women in Nandi District where supplementation with vitamin A is practised.

4.2.3 Iron consumption of pregnant women at Ndhiwa Sub District Hospital

Iron consumption of pregnant women at Ndhiwa Sub District Hospital was established. Maternal iron deficiency has continued to present nutritional anaemia with supplementation strategy in place (MOH-Homabay, 2004). Iron consumption in this study is established as the average amount of iron consumed by pregnant women as reflected in 24-hour recall and analyzed using Nutri-Survey. The established iron consumption level is presented in Table 4.3 alongside WHO norms for iron consumption during pregnancy.

Table .4.3. Iron consumption of pregnant women at Ndhiwa Sub District Hospital

Iron consumption (mg)	n	%	RDA(mg)	%
< 20	73	64.8	Severe inadequacy(<20)	64.8
21 – 30	19	26.6	Mild inadequacy(20-30)	26.6
31 – 40	4	3.3	Adequate((30-60)	3.3
41 – 50	1	1.6	Adequate((30-60)	1.6
51 – 60	2	2.1	Adequate((30-60)	2.1

Table 4.3 indicates that 65% pregnant women had iron consumption of less than 20mg, about 27% had consumption between 21-30mg, and a total of 8% had iron consumption of 31-60. Inadequate supply of iron if prolonged during pregnancy encourages blood transfusion that increases the risks of unhealthy pregnancies (Jack, 2000).

4.2.4 Iron consumption and RDA of pregnant women at Ndhiwa Sub District Hospital

Iron consumption of pregnant women was established and compared to RDA during pregnancy. Table 4.3 shows that 65% of pregnant women had severe inadequacy that could predispose them to increased risk of low birth weights and pregnancy complications. Those who had mild inadequate consumption (27%) may be at risk of severe iron inadequacy. The other 8% had adequate iron consumption. Pregnant women who had adequate iron consumption likely had minimal risks of pregnancy complications and reduced risks of low birth weights. Increased iron deficiency during pregnancy is attributed to parasitic infections such as malaria and to a greater extent inadequate consumption of iron rich foods during pregnancy (WHO, 2003). This study compares closely with 83% prevalence of iron deficiency in Kenya (Mwaniki et, al., 1999). It as well compares closely with 65% prevalence of iron deficiency in Nyanza Province (Mwaniki et, al., 1999: UNICEF, 2003). It is reported that pregnant women in the developing countries consume less than half of their vitamin A and iron requirement (INACG, 2002).

4.2.5 Prevalence of dietary inadequacy of vitamin A and iron among pregnant women at Ndhiwa Sub District Hospital.

Prevalence in this study refers to general existence of both vitamin A and iron inadequacy as influenced by food consumption. The prevalence was achieved after proportional dietary analysis of respondents who presented inadequate consumption of vitamin A and iron. Table 4.4 presents prevalence of vitamin A and iron inadequacies among pregnant women at Ndhiwa Sub District Hospital.

Table 4.4. Prevalence of dietary vitamin A and iron inadequacies at Ndhiwa Sub district Hospital

Vitamin A levels (ug)	n	Iron levels (mg)	n	Dietary vitamin A and iron inadequacy (%)
Inadequate	92	Inadequate	91	90.1
Adequate	8	Adequate	9	9.9
Total	100	Total	100	100

Most respondents (90%) presented inadequacies in both vitamin A and iron while 10% presented adequacy in both nutrients. This study therefore presents prevalence of dietary inadequacy of vitamin A and iron at Ndhiwa Sub District Hospital as 90%. Pregnant women at Ndhiwa Sub District Hospital have inadequate vitamin A and iron consumption that predisposes them to increased risks of deficiencies in both nutrients. The study therefore accepts the hypothesis that stated that pregnant women at Ndhiwa Sub District Hospital have inadequate consumption of vitamin A and iron. The increased dietary inadequacy is attributed to inadequate consumption of vitamin A and iron rich foods. This study is in agreement with WHO (2004) that reported increased prevalence of both vitamin A and iron deficiencies among pregnant women in East and Central Africa due to inadequate dietary consumption of vitamin A and iron rich foods as well as unsuccessful food fortification and dietary diversification strategies. It is reported that highest prevalence of micronutrient deficiencies (vitamin A and iron included) is in Africa. The full magnitude of these deficiencies often remain hidden (WHO, 2004). Inadequate documentation of maternal vitamin A and iron in Kenya has contributed to increased prevalence of these deficiencies (Ngare, 2003 and Mwaniki et al., 1999).

4.3 Consumption frequency of vitamin A and iron rich foods by pregnant women at Ndhiwas Sub-District Hospital

The study established consumption frequency of vitamin A and iron rich foods by pregnant women at Ndhiwa Sub District Hospital. This was achieved through 24-hour recall and food frequency checklist that consisted of foods rich in vitamin A and iron adopted from Micronutrient Surveys in Developing countries (1997). In establishing food frequencies, meal pattern was assessed as it determines nutritional condition (vitamin A and iron included) of individuals (FAO, 2004). Meal pattern is presented in Table 4.5. A detailed meal pattern is however presented in appendix VII.

Table 4.5. Meal pattern of pregnant women at Ndhiwa Sub District Hospital

Meal/foods commonly taken	n	%
Breakfast	78	78.0
Poridge	69	63.8
Tea(black)	9	14.2
Lunch	93	93.3
Ugali and kales	25	26.3
Ugali and small fish (*omena*)	68	66.2
Supper	100	100
Ugali and kales	29	29
Ugali and *omena*	71	71
Other meals (snacks) e.g bananas/orange	4	4.6

Table 4.5. gives a summary of meal pattern that reflect the general trend of food consumption among pregnant women at Ndhhiwa Sub District Hospital. Most respondents (78%) reported consumption of breakfast that consisted of either porridge or tea. According to Ndhiwa Sub District Nutrition report, breakfast is considered as a light meal popularly consumed as tea or porridge (NSDH, 2005). Porridge was consumed by 64% of those respondents who consumed breakfast where as tea was consumed by 14% as shown in Table 4.5. Lunch was consumed by 93% of respondents who consumed either *ugali* with kales or *ugali* with small fish (*omena*). Ugali was popularly consumed as it is a staple food within the region, kales and *omena* on the other hand were readily obtainable (NSDH, 2005). *Ugali* and kales was consumed by 26% of those who consumed lunch while *ugali*

and small fish was popularly consumed by 66%. All the respondents (100%) reported having taken supper. Meals for supper consisted of foods consumed for lunch. Meals for lunch and supper were counted once for respondents who consumed similar food for lunch and supper. Other meals (snacks) were consumed by 5% of total respondents. Pregnant women did not popularly consume vegetables that are good sources of vitamin A and iron. Their meal pattern was monotonous and this was attributed to limited funds that could not allow a variety of food purchases. Besides meal consumption pattern, section 4.3 addresses consumption frequencies of vitamin A and iron rich food under different sub heading such as: Consumption frequencies of vitamin A rich foods and consumption frequencies of iron rich foods

4.3.1 Consumption frequency of vitamin A rich foods

Consumption frequency of vitamin A rich foods was established through analysis of food frequency checklist specific to vitamin A as adopted from Micronutrient Surveys in developing countries 1997 shown in Appendix II. Each food item was treated as different variable during the analysis such that its consumption remained specific to response rate. Two terms of reference were used, regular versus irregular consumption. A consumption frequency of less than four times a week was considered irregular consumption of this nutrient while consumption frequency of four times and above was considered regular consumption of vitamin A (Ryan, 1997). Table 4.6 presents consumption frequency of vitamin A

Table 4.6. Regular consumption of vitamin A rich foods by pregnant women at Ndhiwa Sub District Hospital

Food Items	Response	n	%
Maize meal (ugali)	100	96	96.7
Cassava	86	32	27.5
Millet	100	67	71.8
Red paper	63	11	10.0
Night shade (osuga)	100	41	38.4
Spider herb (dek)	100	47	41.1
Cow peas	100	88	80.3
Amaranthus (ododo)	100	24	21.7
Olitorous tiliacene (apoth)	86	55	36.0
Carrots	11	2	1.4
Tomatoes	100	71	77.3
Yellow sweet potato	100	39	24.0
Yellow/orange pumpkin	86	32	28.0
Ground nut	77	51	66.2
Fish	94	72	64.2
Chicken	86	2	1.4
Meat	100	37	23.3
Liver	71	7	4.5
Egg with yolk	87	29	16.8
Ripe paw paw	61	14	7.0
Ripe mango	94	2	1.4
Foods fortified with vitamin A	9	2	1.4

Respondents verified whether or not they consumed listed food items as indicated in column one of Table 4.6. Column two and three of Table 4.6 respectively indicate frequency for regular consumption of these food items and the percentage. Some staple food items such as maize meal and millet as well as dark green leafy vegetables such as nightshade, cowpeas, spider herb, and amaranths were consumed by all respondents (100). Consumption of tomatoes, yellow sweet potatoes and meat were as well reported by all pregnant women (100). Other foods were not consumed by all the pregnant women for various reasons that included allergy and dislikes induced by hormonal fluctuations caused by pregnancy. Foods that were consumed by all the pregnant women were basically staple foods and locally grown vegetables. Foods rich in vitamin A had irregular consumption by majority of pregnant women. Apart from staple maize meal and millet that had regular consumption, cow peas, tomatoes, fish and groundnuts as well had regular consumption by majority (80%, 77%, 64% and 66% respectively) as indicated in Table 4.6. Other foods rich in vitamin A such as carrots, yellow/orange pumpkin, ripe mango and ripe paw paw were not consumed regularly by most respondents. Thus most respondents recorded irregular consumption eg carrots had 1% regular consumption while pumpkin, pawpaw, yellow sweet potato and mango had regular consumption by minority (28%, 7%, 24% and 2% respectively) as shown in Table 4.6. Vitamin A rich foods were not regularly consumed by the pregnant women at Ndhiwa Sub District Hospital. Most of the traditional leafy vegetables included in Table 4.6 that are good sources of vitamin A recorded minimal regular consumption by most respondents. Foods fortified with vitamin A as well were not consumed regularly by those who received food consignment (relief food) from locally based NGO.

4.3.2 Consumption frequency of iron rich foods

Consumption frequency of iron rich foods was established through food frequency checklist that consisted of iron rich foods adopted from Micronutrient Surveys in developing countries 1997 (Appendix III) and presented in Table 4.7.

Table 4.7. Regular consumption of iron rich foods by pregnant women at Ndhiwa Sub District Hospital

Food Items	Response	n	%
Maize meal (*ugali*)	100	96	96.7
Cassava	86	32	27.5
Millet	100	67	71.8
Lemon	73	14	21.3
Night shade (*osuga*)	100	41	38.4
Spider herb (*dek*)	100	47	41.1
Kidney beans	91	72	68.2
Amaranthus (*ododo*)	100	24	21.7
Olitorous tiliacene (*apoth*)	86	55	36.0
Spinach	3	0	0
Chwa	19	1	1.0
Sesame (*simsim*)	88	2	1.4
Kidney	86	32	27.5
Ground nut	77	51	66.2
Fish	94	72	64.2
Chicken	86	2	1.4
Meat	100	37	23.3
Liver	71	7	4.5
Eggs	87	29	16.8
Milk	97	69	50.0
Cream	61	14	6.6
Foods fortified with iron	9	2	1.4

Citrus fruits rich in vitamin C were included in food checklist due to its ability to facilitate iron absorption (MI, 2001). Dark green leafy vegetables included in the food list are good sources of minerals including iron. Kidney beans were regularly consumed since most respondents (68%) reported its consumption for more than four times a week. Meat, chicken and eggs were not consumed regularly by most respondents as they were not affordable and eggs and chicken were traded for money to meet other household needs (NSDH, 2005). Iron rich foods were therefore consumed irregularly by most respondents. Dietary consumption of vitamin A and iron is the most effective way of managing these deficiencies among vulnerable groups of individuals (Donald, 1996). Irregular consumption of fruits and vegetables compromise micronutrient conditions of individuals (Catherine, 2003).

Cooking duration of vegetables was of concern. Kale, cabbage and other vegetables that are not bitter were boiled first for 10-15 minutes, enriched with cooking fat and seasoned with salt for taste. Traditional vegetables that are bitter were however boiled for 50-70 minutes to get rid of bitter taste. These vegetables were enriched with milk and ghee for a period of 5 days before consumption to make them palatable by children and as a way of exercising cooking traditions of traditional vegetables (DNO, 2005). Long term cooking of vegetables however leads to loss of volatile vitamins and minerals (UNICEF, 2003).

4.4 Relationship between vitamin A consumption and iron consumption of pregnant women at Ndhiwa Sub District Hospital

Relationship between vitamin A consumption and iron consumption was established through Pearson's product moment correlation. This was used after the study reasonably assumed that both variables are normally distributed (Rees, 1992). Relationship is indicated in Table 4.8.

Table 4.8. Correlations between vitamin A and iron consumption of pregnant women at Ndhiwa Sub District Hospital

	Vitamin A (ug)	Iron (gm)
Vitamin A (ug)		
Pearson correlation	1.000	0.265
Sig. (2-tailed)	0	0.025
Iron (gm)		
Pearson correlation	0.265	1.000
Sig. (2-tailed)	0.025	0

As shown in Table 4.8, there existed a weak positive but significant correlations between vitamin A consumption and iron consumption of the pregnant women ($r<1, P<0.05$). It therefore means that the better vitamin A consumption the better iron consumption. This study is in agreement with Etyang (2003) that found a significant correlation between vitamin A and iron among lactating women in Nandi District Kenya.

4.5 Factors that influence vitamin A and iron consumption of pregnant women at Ndhiwa Sub District Hospital.

Micronutrient deficiencies can take varieties of forms that contribute to deficiencies of each other, such as iodine, iron and vitamin A deficiencies. At its most basic level, micronutrient deficiencies are consequences of diseases and inadequate dietary intake, but many more elements are involved (UNICEF, 2005). Some of these elements crucial during pregnancy are addressed under two main categories: Dietary factors and health-related factors. Factors that influence vitamin A and iron consumption of the pregnant women was established through Pearson product moment correlation and Spearman's Rho for variables with normal distribution and without normal distributions respectively.

4.5.1 Dietary factors

Dietary factors that were considered in this study included number of meals taken per day and food choice believed to affect nutrient consumption.

4.5.1.1 Number of meals consumed per day by pregnant women at Ndhiwa Sub District Hospital

Number of meals taken per day is crucial in determining nutrient intakes and meal pattern of individuals. Respondents stated the number of meals they consumed in a day. This is presented in Figure 4. 1

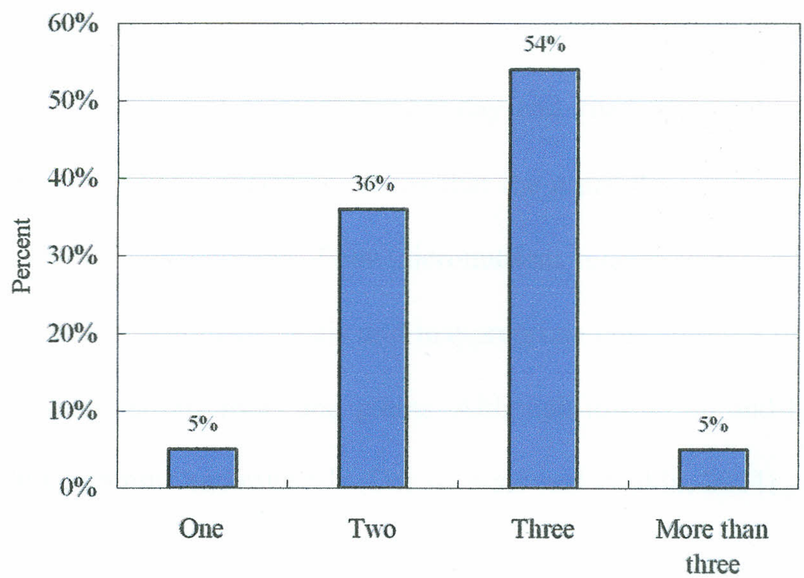

Figure 4. 1 Number of meals in a day

Most respondents (54%) had three meals in a day, which reflect routine meal pattern within the region. The maximum number of meals was consumed by 5% and the minimum number of meals was consumed by 5%. The number of meals consumed per day was correlated with vitamin A and iron consumption as presented in Table 4.9.

Table 4.9. Correlation between number of meals consumed per day and vitamin A and iron consumption of pregnant women at Ndhiwa Sub District Hospital

	Vitamin A (ug)	Iron (mg)	Number of meals/day
Number of meals/day			
Pearson correlation	0.232	0.125	1.000
Sig.(2-tailed)	0.045	0.048	0
Vitamin A (ug)			
Pearson correlation	1.000	0.265	0.232
Sig.(2-tailed)	0.	0.025	0.045
Iron (mg)			
Pearson correlation	0.265	1.000	0.125
Sig.(2-tailed)	0.025	0	0.048

According to Table 4.9, there were weak positive relationships that were significant ($r<1$, $p>0.05$) between number of meals taken per day and vitamin A and iron consumption of the pregnant women. This therefore means that the more the number of meals the better vitamin A and iron consumption. Poor micronutrient intakes in the developing countries have been attributed to limited meals and inappropriate consumption of foods that consist of little more than starchy roots and grains. Although low in fat and high in fibre, these foods offer low vitamins and minerals (Drewnowski and Popkin, 2004).

4.5.1.2 Food choice of pregnant women at Ndhiwa Sub District Hospital

Food choice and meal planning are determinants of individual's nutrition condition (UNICEF, 2005). The respondents stated factors they considered in planning and choosing the foods they consumed as presented in Table 4.10.

Table 4. 10. Factors that influenced food choice of pregnant women at Ndhiwa Sub District Hospital

Factors	N	%
Availability of food	86	86.0
Personal preference	95	95.0
Children's preference	43	43.0
Food taboos	5	5.0
Advice from clinic	1	1.0
Mother's preference	12	12.0
Food cost	93	93.0
Nature of work	9	9.0
Duty schedule	21	21.0
Quantities of food in market	95	95.0
Availability of firewood	43	43.0
Time foods take to cook	21	21.0
Husband's preference	41	41.0

Most respondents (86%, 95%, 93% and 95%) considered availability of food, personal preference, food cost and quantities of food as sold in the market as factors that influenced their food choice most. Other factors that were considered included availability of firewood, children's preference and husband's preference at response rates of 43% and 41% as indicated in Table 4.10. Variables that recorded high frequencies (availability of food, personal preference, food cost and quantity of food as sold in the market) were correlated with vitamin A and iron consumption of the pregnant women. Table 4.11 present correlations between selected variables (availability of food, personal preference, food cost and quantities of food as sold in the market) and vitamin A and iron consumption of the pregnant women.

Table 4.11 Correlation between selected dietary variables and vitamin A and iron consumption of pregnant women at Ndhiwa Sub District Hospital

Variables	Vitamin A (ug)	Iron (mg)
Availability of food		
Spearman's (r)	0.045	0.094
Sig. (2-tailed)	0.085	0.096
Personal preference		
Spearman's (r)	0.174	0.156
Sig. (2-tailed)	0.099	0.078
Quantities of food		
Spearman's (r)	0.192	0.163
Sig. (2-tailed)	0.073	0.065
Food cost		
Spearman's (r)	0.187	0.163
Sig. (2-tailed)	0.046	0.048

There were weak positive correlations that were not significant between availability of food, personal preference and quantity of food as sold in the market and vitamin A and iron consumption ($r<1, p>0.05$). However there were weak positive correlations that were significant between food cost and vitamin A and iron consumption of the pregnant women ($r<$, $p<0.05$). It therefore means that food cost influenced vitamin A and iron consumption of the pregnant women. The lower the prices of food the higher the chances of consuming foods rich in vitamin A and iron. This study is in agreement with other population studies that looked into food cost versus food consumption. Power (1998) says that inappropriate food choice is a factor that contributes to nutritional deficiencies in the developing countries. Consumption of adequate nutrients is mandatory during pregnancy for the mother and developing foetus (Power, 1998). Quantitative consumption of indigenous foods in most developing countries have improved prevalence of vitamin A and iron deficiencies (Vuong, 1998). This is especially evident among populations consuming most of their dietary vitamin A from provitamin carotene sources and non-haemoglobin inhibitors that compromise availability of these nutrients to the body (FAO/WHO, 1998). Consumption of foods rich in vitamin A and iron is the basic means of improving prevalence of vitamin A and iron deficiencies among pregnant women in both developed and developing countries (FAO/WHO, 1998).

4.5.2 Health Variables

The nutrition status of pregnant women is greatly affected by various interrelated health factors and, past and current obstetric factors (WHO, 2001). The influence of such factors as common illness, pregnancy induced complications, vitamin A and iron supplementation, antenatal visits, and number of pregnancies were investigated in this study.

4.5.2.1 Common illnesses suffered by pregnant women at Ndhiwa Sub District Hospital

Common illnesses suffered by the pregnant women were established. Respondents stated various illnesses they frequently suffered during pregnancy, responses were verified with hospital's records for those who were treated at the hospital. Response rate on common illnesses of the pregnant women is presented in Figure 4.2.

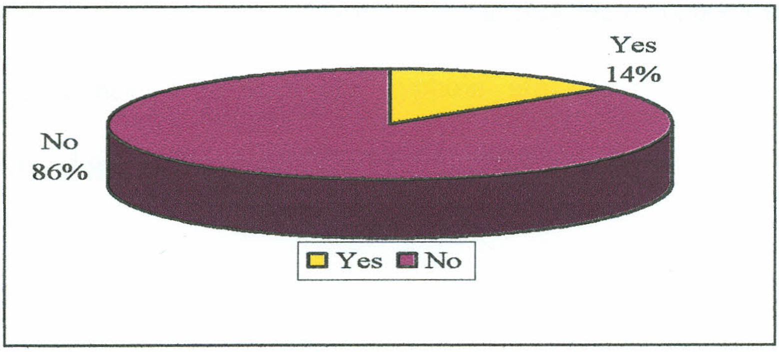

Figure 4. 2. Response rate of common illnesses suffered by pregnant women at Ndhiwa Sub District Hospital

Most respondents (86%) did not experience common illnesses during pregnancy while 14% experienced these common illnesses during pregnancy. Table 4.12 presents common illnesses suffered by the pregnant women. Frequent sicknesses burden the body thereby depleting nutrient stores (WHO, 2001).

Table 4.12 Common illnesses suffered by pregnant women at Ndhiwa Sub District Hospital

Common illness	n	%
Malaria	8	8.0
Apathy and general weakness	3	3.0
Typhoid	2	2.0
Diarrhoea	1	1.0
Not suffered	86	86.0

Malaria was frequently suffered by 8 % of respondents. Apathy and general weakness was suffered by 3 % of respondents who were mostly taking two meals per day, typhoid and diarrhoea was suffered by 2% and 1 % of respondents respectively. These illnesses were not correlated to vitamin A and iron consumption because sample response for specific illnesses were less than 10% which does not allow for substantial comparison of variables (Rees, 1992). Malaria in pregnancy compromise the nutrient stores of the pregnant women that eventually affect nutrient supply to developing foetus hence the need of mosquito nets during pregnancy. Diarrhoea and typhoid are however preventable through proper sanitation and general hygiene (PSI/MOH, 2005).

4.5.2.2 Complications suffered by pregnant women at Ndhiwa Sub District Hospital

Response rates for complications suffered during pregnancy are presented in figure 4. 3

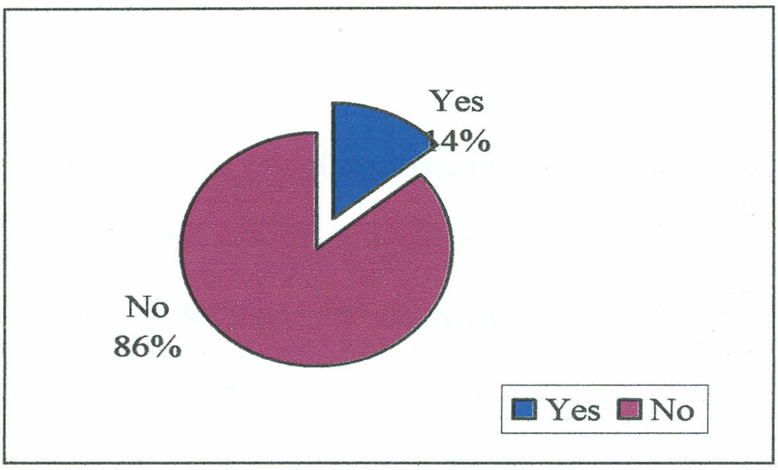

Figure 4.3 response rates of complications suffered by pregnant women at Ndhiwa Sub District Hospital during pregnancy

Most respondents (86%) did not experience complications during pregnancy while 14% suffered complications during pregnancy. The complications included sicknesses and symptoms that have implications on availability of vitamin A and iron to the body (WHO, 2002). These complications are presented in Table 4. 13.

Table 4.13. Frequencies of complications suffered by pregnant women at Ndhiwa Sub District Hospital

Complications	n	%
Fainting	1	1.0
Reproductive tract infection	1	1.0
Urinary tract infection	1	1.0
Poor vision	1	1.0
Dysentery	1	1.0
Anaemia	9	9.0
Not suffered	86	86.0

Anaemia was suffered by 9% of respondents who at the same time had irregular consumption of iron rich foods. The rest of the complications were suffered at a rate of 1 %. These complications were however not related with vitamin A and iron consumption because the percentage sample that suffered specific complications is small for comparison thus, the sample responses are less than 10% (Rees, 1999).

4.5.2.3 Vitamin A supplementation of pregnant women at Ndhiwa Sub District hospital

Vitamin A supplementation was established through oral interviews and hospital records. Vitamin A supplements were administered to pregnant women who faced severe vitamin A inadequacy accompanied by frequent illnesses (Ndhiwa Sub District Hospital, 2005). Responses upon vitamin A supplementation is presented in figure 4.4.

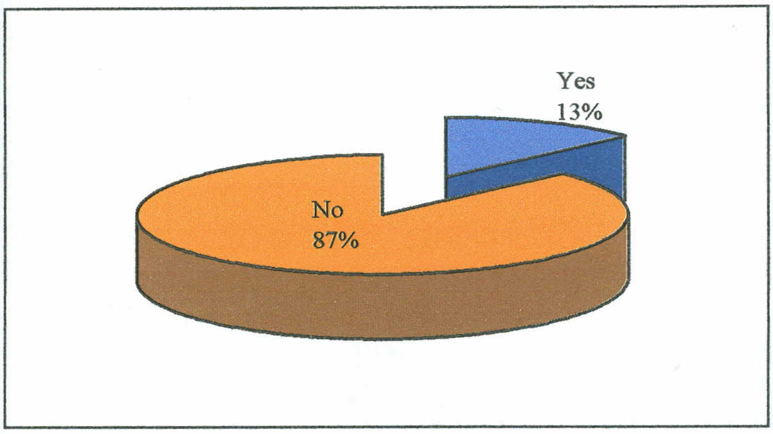

Figure 4.4. Vitamin A supplementation of pregnant women at Ndhiwa Sub District hospital

Most respondents (87%) were not on vitamin A supplements while 13% were on vitamin A supplements. Vitamin A supplementation is not encouraged during pregnancy however its administration is considered in severe deficiencies accompanied with increased morbidity and where the deficiency is pandemic. Supplementation in such cases is administered at low doses ≤50,000 IU (UNICEF, 1999). The provision of vitamin A supplements to pregnant women not only protects against blindness but also has a dramatic multiple impact on maternal health, reducing the risk of morbidity by about 33% in the developing countries (UNICEF, 2003).

4.5.2.4 Iron supplementation of pregnant women at Ndhiwa Sub District hospital

Respondents stated whether they received iron supplements or not and responses presented in Figure 4.5. Responses were verified with hospital records.

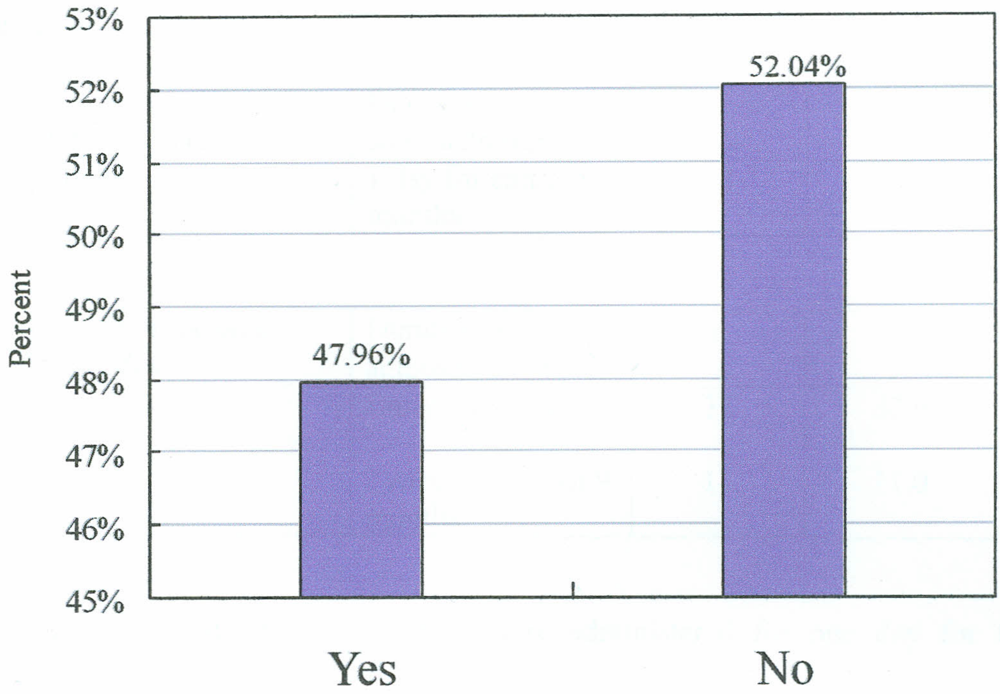

Figure 4.5. Responses on iron supplementation of pregnant women at Ndhiwa Sub District hospital

Majority (52%) were not on iron supplements while 48% were on iron supplements. Not all pregnant women could be put on iron supplements because supplements were received in limited distribution from Homa-Bay District Hospital. Iron supplements were therefore given to teenagers and young mothers (14-20years) and those who were having their first pregnancy as they were considered most vulnerable (NSDH, 2005). Vitamin A and iron supplements were administered differently to pregnant women as shown in Table 4. 14.

Table 4.14. Dosage levels of Vitamin A and iron of pregnant women at Ndhiwa Sub District Hospital

Vitamin A dose level/day (IU)	Duration of administration	n	%
50,000	1 day for entire 9 months	13	13.0
Iron (mg) dosage level/day	Duration of administration	n	%
15	Daily for 9 months	37	37.0
15	Twice a week for 9 months	11	11.0

Vitamin A supplements of 50,000IU were administered for one day for the entire pregnancy period. This was given to those who had frequent illness. It was administered in moderation to avoid fetal defects associated with vitamin A supplements (NSDH, 2005). Iron supplement of 15mg was administered daily for the entire pregnancy period for the 37% pregnant women while 11 % were given 15 mg twice a week for the entire pregnancy period.

4.5.2.5 Antenatal visits of pregnant women at Ndhiwa Sub District hospital

Antenatal visit was established through hospital records and presented in Table 4.15

Table 4.15. Antenatal visits of pregnant women at Ndhiwa Sub District Hospital

Number of Visits/month	n	%
Once	90	90.0
Twice	6	6.0
More than twice	2	2.0
Visit while sick	2	2.0
TOTAL	100	100.0

Most respondents (90%) visited antenatal clinic once a month, 6% visited twice a month while 2% visited more than thrice and the other 2% visited clinic only when they fell sick. Antenatal visit was mostly done once for weight monitoring. Those who visited more than once a month did so at the demand by the health facility as they needed close monitoring due to unhealthy pregnancies (NSDH, 2005). Antenatal visits to MCH increases nutrition and health awareness to various mothers thereby promoting healthy pregnancies (Dalmire and Benoist, 2001). Nutrition counselling is one of the services encouraged at various MCH countrywide (MOH, 2005).

4.5.2.6. Number of pregnancies

Number of pregnancy affects general health and nutrition status of the women especially those who have close interval pregnancies (WHO, 2001). Respondents stated number of pregnancies they had had (both successful and miscarried pregnancies). This is presented in Table 4.16.

Table 4.16. Number of pregnancies of pregnant women at Ndhiwa sub District Hospital

Number of pregnancies	n	%
1-3	31	31.0
4-6	48	48.0
7-9	11	11.0
10-12	8	8.0
13-15	2	2.0
TOTAL	100	100.0

Almost half (48%) of the respondents had had between 4-6 pregnancies, followed by 31% who had had between 1-3 pregnancies, 11% had had between 7-9% 2% and 8% had had between 10-12 and 13-15 pregnancies respectively.

4.5.2.7 Relationships between health related factors and vitamin A and iron consumption of pregnant women at Ndhiwa Sub District Hospital

The health related factors (vitamin A and iron supplementation, antenatal visit and number of pregnancies) were correlated with vitamin A and iron consumption levels of the pregnant women. The correlation coefficient and the significance level (p-value) for these variables are presented in Table 4. 18.

Table 4.17. Correlation coefficient and significance level of health variables and vitamin A and iron consumption levels of pregnant women at Ndhiwa Sub District Hospital

Health variables	Vitamin A levels (ug) r	P	Iron levels (mg) r	P
Vitamin A supplementation	0.065	0.043	0.065	0.042
Iron supplementation	0.185	0.082	0.185	0.041
Antenatal visit	0.187	0.561	0.186	0.053
Number of pregnancies	0.174	0.99	0.176	0.057

There were weak positive relationships that were significant between vitamin A supplementation and vitamin A and iron consumption. The relationship between iron supplementation and iron consumption was as well significant at 0.05 confidence level. There was however no significant relationship between iron supplementation and vitamin A consumption. This implies that supplementation with vitamin A improved both vitamin A and iron consumption levels, however iron supplementation did not improve vitamin A consumption levels of the pregnant women. There were weak positive relationships that were not significant between antenatal visit and number of pregnancies and vitamin A and iron consumption levels of the pregnant women. These findings are similar to findings by Vuong (1998) that reported improved vitamin A deficiency with supplementation among pre-school children in Kitui District Kenya.

4.6 Nutrition status of pregnant women at Ndhiwa Sub District Hospital.

Nutrition status of pregnant women at Ndhiwa Sub District Hospital was established. Micronutrient status (vitamin A and iron included) during pregnancy is dependent on nutrition status of individuals prior to and during pregnancy (ADA, 1998). This was achieved through analysis of BMI whose cut off points for pregnancy is defined by ADA (1998) as follows

- Underweight (<19.0)
- Normal weight (19.0-25.0)
- Overweight (26.0-29.0)
- Obese (>29.0)

BMI was used because it is an indicator of nutritional status based on two common measurements (height and weight) thereby reflecting body composition such as body fat and lean body mass (ADA, 1998). BMI cutoff points were therefore used as references to describe nutrition status of pregnant women at Ndhiwa Sub District Hospital. Nutrition status of the pregnant women is presented in Table 4.19.

Table 4.18. Nutrition status of pregnant women at Ndhiwa Sub District Hospital

Nutrition Status	n	%
Under weight(<19)	27	27.0
Normal (19 – 25)	49	49.0
Overweight (26 – 29)	19	19.0
Obese (> 29)	5	5.0
Total	100	100

Almost half of respondents (49%) had normal weights (19.0-25.0). These women probably had normal weights (18.0 – 25.0) before pregnancy. Other 27% were under weight (<19.0) indicating poor nutrition status before pregnancy which continued in pregnancy. Another 19% were overweight (26.0-29.0) indicating tremendous weight gain during pregnancy. However 5% were obese (>29.0) implying overweight prior pregnancy. Nutrition status prior pregnancy determines general nutrition status of individuals during pregnancy. Weight monitoring during pregnancy is vital in achieving desirable pregnancy weight that is an indicator of healthy pregnancy and normal birth weights (ADA, 1998).

4.6.1 Relationship between vitamin A and iron consumption and BMI of pregnant women at Ndhiwa Sub District Hospital.

Relationship between vitamin A and iron consumption and BMI of pregnant women was established through Spearman's Correlation Coefficient applicable to variables without reasonable normal distribution (Rees, 1992).

Table 4.19. Correlations between vitamin A and iron consumption levels and BMI of pregnant women at Ndhiwa Sub District Hospital

	Vitamin A levels (ug)	Iron levels (mg)	BMI
BMI			
Spearman's correlation	0.092	0.005	1.000
Sig. (2-tailed)	0.062	0.962	0
Vitamin A (ug)			
Spearman's correlation	1.000	0.265	0.092
Sig. (2-tailed)	0	0.025	0.062
Iron (mg)			
Spearman's correlation	0.062	1.000	0.005
Sig. (2-tailed)	0.025	0	0.962

There were weak positive correlations that were not significant between BMI and vitamin A and iron consumption of the pregnant women ($r < 1$, $p > 0.05$). This means that BMI does not influence consumption of vitamin A and iron of the pregnant women. Based on reported correlation, this study therefore accepts the null hypothesis that stated that there is no significant relationship between vitamin A and iron consumption and BMI of pregnant women at Ndhiwa Sub District Hospital. This study differs with Bloem (1990) that found association between vitamin A and iron consumption and weights of children aged 5-12 years in Ethiopia. However, this study is in agreement with Shelty (2000) that indicated no significant relationship between BMI and vitamin A consumption among women of reproductive age in Thailand.

4.6.2 Relationship between BMI and vitamin A and iron consumption and number of meals consumed per day

Relationship between BMI and vitamin A and iron consumption and number of meals consumed per day was established. Meal consumption is a determinant of individual's nutrition status. Table 4.20 present the relationships.

Table 4.20. Relationship between Number of meals/day and BMI and vitamin A and iron consumption among pregnant women at Ndhiwa Sub District Hospital

	BMI	Number of meals/day	Vitamin A levels (ug)	Iron level (mg)
BMI				
Correlation coefficient	1.000	0.021	0.092	0.005
Sig (2-tailed)	0	0.046	0.062	0.962
Number of meals/day				
Correlation coefficient	0.021	1.000	0.232	0.125
Sig (2-tailed)	0.046	0	0.045	0.048
Vitamin A levels (ug)				
Correlation coefficient	0.092	0.232	1.000	0.265
Sig (2-tailed)	0.062	0.045	0	0.025
Iron levels (mg)				
Correlation coefficient	0.005	0.125	0.265	1.000
Sig (2-tailed)	0.962	0.048	0.025	0

There were weak positive relationships that were significant between number of meals consumed per day and BMI as well as vitamin A and iron consumption at 0.05 confidence level. This means that the more the number of meals consumed per day the better nutrition status as well as vitamin A and iron consumption of the pregnant women. These findings are similar to reports by FAO (2002) that with at least three meals a day there is less likelihood of under weight. This can be attributed to the fact that the more the number of meals consumed the more the likelihood of adequate supply of nutrients. Inadequate food intake when prolonged gives rise to PEM and micronutrient deficiencies (FAO, 2002).

4.6.2 Contribution of Vitamin A, iron consumption and number of meals consumed per day to nutrition status of the pregnant women.

Contribution of Vitamin A, iron consumption and number of meals consumed per day to nutrition status of the pregnant women was established through regression analysis presented in Table 4.21.

Table 4.21. Contribution of Vitamin A, iron consumption and number of meals consumed per day to nutrition status of pregnant women at Ndhiwa Sub District Hospital

	Nutrition status	R2	% contribution
Vitamin A consumption	BMI	0.047	4.7
Iron consumption	BMI	0.008	8.8
Number of meals per day	BMI	0.097	9.7

Results show that only 4.7% of nutrition status can be explained by vitamin A consumption. Iron contributes to 8.8% of nutrition status while number of meals consumed per day contributes to 9.7% of nutrition status. From the study it can be reported that, number of meals taken per day, vitamin A and iron consumption contribute to a small percentage (23.2%) of the nutrition status. Thus, the rest of the variation in nutrition status could be contributed by other factors especially those related to pregnancy.

Chapter 4 presented and discussed the study findings. Chapter 5 presents the summary conclusion and recommendations arising from the study.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATION

5.1 Summary

This study aimed to establish vitamin A and iron consumption levels of pregnant women at Ndhiwa Sub District Hospital through dietary assessments. The existing literature reveals that vitamin A and iron deficiencies are major nutrition deficiencies affecting pregnant women due to inappropriate dietary intake among other factors. Improvements on vitamin A and iron inadequacy in pregnancy can be ensured through consumption of adequate foods rich in vitamin A and iron. A descriptive case study was used to carry out the study at Ndhiwa Sub District Hospital. Data were collected using a questionnaire from respondents sampled through convenient sampling method that achieved 100-sample size. Data were analyzed using Nutri-Survey, Sight and life vitamin A calculator, BMI calculator and Statistic Package for Social Science (SPSS).

5.1.1 Demographic characteristics

Most respondents (87%) were Luos. Others were Suba, Kisii, and Bukusu, at a response rate of 9%, 2% and 2% respectively. The youngest respondent was 14 years and the oldest was 46 years. Most respondents (65%) were married. Majority (49%) did not achieve any formal educational certification while 10% achieved college level of education. Most respondents (45%) were not employed while 12% had formal employment with NGOs and civil servants.

5.1.2 Vitamin A and iron consumption of pregnant women at Ndhiwa Sub District Hospital

Majority (80%) had severe vitamin A inadequacy (<800ug/day). About 12% had mild inadequacy (800-1000ug/day) while 8% had adequate vitamin A consumption (1000-1200ug/day). Severe iron inadequacy (<20mg/day) was realized among 65% pregnant women. Mild iron inadequacy was suffered by 27% (21-30mg/day), whereas adequate iron consumption was realized among 8% of the pregnant women. Prevalence of both vitamin A and iron inadequacies at Ndhiwa Sub District Hospital was at 90%.

5.1.3 Vitamin A and iron consumption frequencies

Most respondents (97%) had regular consumption of maize meal. Cowpeas, groundnut, kidney beans, tomatoes and fish had regular consumption by majority (80%, 66%, 68%, 77% and 64% respectively). The rest of foods rich in vitamin A and iron however had irregular consumption by most pregnant women. This contributed to high prevalence of vitamin A and iron inadequacies among the pregnant women.

5.1.4 Relationship between vitamin A and iron consumption of the pregnant women

There was a positive significant correlation between vitamin A and iron consumption ($p<0.05$). This means that the better vitamin A consumption the better iron consumption. However, there was no significant relationship between vitamin A and iron consumption and BMI of the pregnant women at 0.05 confidence level.

5.1.5 Factors that influence vitamin A and iron consumption of the pregnant women

Among dietary variables, number of meals/day and food cost had significant correlations with vitamin A and iron consumption. Among health variables vitamin A supplementation had significant relationship with vitamin A and iron consumption of the pregnant women. Iron supplementation had significant relationship with iron consumption and not with vitamin A consumption.

5.1.6 Nutrition status

Nutrition status was assessed through analysis of BMI using cut off points of <19.0, 19.0-25.0, 26.0-29.0, >29 as defined by ADA for pregnant women. Most respondents (49%) had normal weights (19.0-25.0) while 27% were underweight (<19.0) 5% were obese (>29.0). There was no relationship between vitamin A and iron consumption and BMI. However there existed a significant relationship between number of meals/day, BMI and vitamin A and iron consumption. Vitamin A and iron consumption together with number of meals/day contributed to 23.2% of nutrition status (BMI).

5.2 Conclusion

Pregnant women at Ndhiwa Sub District Hospital have inadequate vitamin A and iron consumption levels as depicted by high prevalence (90%). This was mainly due to inadequate consumption of vitamin A and iron rich foods as well as pregnancy-related conditions. Consumption of vitamin A and iron rich foods depended mainly on availability of foods, personal preference and food cost. Food cost influenced vitamin A and iron consumption more than availability of food and personal preference. Consumption of vitamin A and iron rich foods did not compare adequately with RDA during pregnancy leading to increased prevalence of vitamin A and iron inadequacies among pregnant women.

Relationship noted between vitamin A and iron consumption influenced iron consumption levels most.

Nutrition status of pregnant women at Ndhiwa Sub District Hospital was good since almost half of respondents (49 %) had normal nutrition status (19.0-25.0). This could be attributed to normal nutrition status before pregnancy.

Number of meals consumed per day contributed to nutrition status of pregnant women more than vitamin A and iron consumption.

5.3 Recommendations

The following recommendations for practices and policy are necessary toward improving vitamin A and iron consumption among pregnant women.

- There is need for Government and NGOs to emphasize nutrition education through media (vernacular radio broadcast) that target pregnant women in the rural set up which ultimately promote adequate nutrient consumption that minimizes risks of nutrient deficiencies.
- There is need for NGOs and Government to develop strategies that would enhance adequate distribution of supplements as well as dietary diversifications especially in the rural areas to ensure increased vitamin A and iron consumptions.
- Fortified maize meal and wheat flour should be sold at subsidized cost to encourage their consumption that ultimately reduces risks of vitamin A and iron deficiencies.

5.4 Suggestions for further studies

1. A comparative study involving dietary intakes and vitamin A and iron supplementation is needed to verify the roles played by each in reducing the risks of vitamin A and iron deficiencies among pregnant women in similar areas as Ndhiwa.
2. A study involving biochemical and dietary analyses to validate the reliability of 24-hour recall in establishing micronutrient conditions of various groups of individuals.
3. A research on the interaction between vitamin A, folic acid and zinc in improvement of iron deficiency during pregnancy.

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APPENDIX I

INTERVIEW SCHEDULE

DIETARY ASSESSMENT OF VITAMIN A AND IRON AMONG PREGNANT WOMEN AT NDHIWA SUB DISTRICT HOSPITAL

Interviews were administered through questionnaire that provided the researcher with information that assisted in establishing vitamin A and iron consumption of pregnant women at Ndhiwa Sub District Hospital.

DEMOGRAPHIC INFORMATION

Respondents number____________

Division_____________ Location______________ Ethnicity_____________

Date of interview_____________ Trimester______________

Marital status______________Age___________Body weight___________Height_________

1.1 What is your education level? (Check your answer with a tick in the brackest provided.)

1. College level------------------- (   )
2. K.C.S.E holder---------------- (   )
3. K.C.P.E. holder---------------- (   )
4. Below STD 8 ------------------ (   )

1.2. What is your occupation?

(i) Civil servant (   )

(ii) Non- governmental organization (   )

(iii) Self employment (   )

(iv) None (   )

(v) Others (state) ___________________________________

1.3. What is your household size (state in the space provided below)

____

2.0 GENERAL HEALTH DETAILS

2.1 Do you frequently fall sick during pregnancy?

(i) Yes ( )

(ii) No ( )

2.2 If yes what common illness do you suffer from most?

(i) Malaria ( )

(ii) Typhoid ( )

(iii) Diarrhea ( )

(iv) Vomiting ( )

(v) Apathy & general weakness ( )

(vi) Other states ____________________________

2.3 Have you suffered from complication during pregnancy?

(i) Yes ( )

(ii) No ( )

2.4 If yes what were these complications

(i) Fainting ( )

(ii) Poor vision ( )

(iii) Reproductive tract infections ( )

(iv) Urinary infections ( )

(v) Measles ( )

(vi) Dysentery ( )

(vii) Others (state)________________________

2.5 How many pregnancies have you had? (state both successful and miscarried pregnancies in the space provided) ________________________________

2.6 Are you on iron supplements?

(i) Yes ( )

(ii) No ( )

2.7 If yes what is the dosage level and duration of administration?

2.8 Are you on Vitamin A supplements

(i) Yes ( )

(ii) No ( )

2.9 If yes what is the dosage level and duration of administration?

2.10 How often do you visit antenatal clinics?

(i) Once a month ( )

(ii) Twice a month ( )

(iii) Others specify____

3.0. DIETARY ASSESSMENT

3.1 How many meals do you have in a day?

(iii) One ( )

(iv) Two ( )

(v) Three ( )

(vi) More than three ( )

(vii) None ( )

3.2 a 24 – HOUR RECALL

List the foods and drinks you consumed in the last 24 hours in the table provided indicating cooking methods quantities of ingredients and recipe. Specify duration taken in cooking vegetables.

Meals Day 1	Food /drinks	Amounts hh measures	Cooking method	Ingredients	Amount hh measures	Recipe	metric conversion of hh measurers (g)
B/Fast							
Lunch							
Supper							
Others							

3.2 b List the foods and drinks you consumed in the last 24 hours in the table provided indicating cooking methods quantities of ingredients and recipe. Specify duration of cooking vegetables.

Meals Day 2	Food /drinks	Amounts hh measures	Cooking method	Ingredients	Amount hh measures	Recipe	metric conversion of hh measurers (g)
B/Fast							
Lunch							
Supper							
Others							

3.2 c List the foods and drinks you consumed in the last 24 hours in the table provided indicating cooking methods quantities of ingredients and recipe. Specify duration of cooking vegetables.

Meals Day 3	Food /drinks	Amounts hh measures	Cooking method	Ingredients	Amount hh measures	Recipe	metric conversion of hh measurers (g)
B/Fast							
Lunch							
Supper							
Others							

APPENDIX II

FOOD FREQUENCY CHECKLIST FOR VITAMIN A RICH FOODS

1.0 Do you consume all food items listed in the table?

Yes (   )

No (   )

1.1 If No indicate with a star (*) against foods you don't consume

2.0 Indicate the number of times you consume the food items listed in the table.

Food items	Frequency (Number of days /week)
Staple food Maize meal (ugali)	
Millet	
Cassava	
Spices (red paper)	
Night shade (osuga)	
Spider herb (dek)	
Cow-pease	
Amaranthus (ododo)	
Olitorus (apoth)	
Tomatoes	
Liver	
Meat	
Fish	
Carrots	
Ripe Mango	
Yellow / Orange Pumpkin	
Ripe papaya	
Eggs with yolk	
Ground nut	
Yellow / orange sweet potato	
Food fortified with vitamin A	
Chicken	

APPENDIX III

FOOD FREQUENCY CHECKLIST FOR IRON RICH FOODS

1.0 Do you consume all food items listed in the table?

Yes ( )   No (   )

1.1 If No indicate with a star (*) against foods you don't consume

2.2. Indicate the number of times you consume the listed food items below

Food items	Frequency (Number of days /week)
Staple foods maize meal (ugali)	
Casava	
Millet	
Night shade (osuga)	
Spider herb (dek)	
Speenach	
Olitorus (apoth)	
Sesame (simsim)	
Amaranthus (ododo)	
Lemon	
Milk	
Kidney beans	
Eggs	
Liver	
Fish	
Kidney	
Dried fruit (chwa)	
Cream	
Ground nut	
Chicken	
Meat / Mutton	
Food fortified with iron	

2.3. What influences your food choice?

1. Advice from the clinic (   )
2. Personal preference (   )
3. Preference of other household (children) (   )
4. Availability of food (   )
5. Food taboos (   )
6. Others specify ________________________________

APPENDIX IV

BMI CUT OFF POINTS DURING PREGNANCY

BMI cut-off points and recommended weight gain during pregnancy

BMI category
Under weight (<19.0) or 90% wt/ht
Normal weight (19.0 to 25.0) or 90 to 120% wt/ht
Over weight (26.0 to 290) or 120 to 135% wt/ht
Obese (>29.0) or 135% wt/ht

APPENDIX V
FOOD CALIBRATION TABLE

Food /drinks	Description	gm	1tsp	1 Tsp	1ssp	1 cstk	1 plate 320ml	calabash 360ml	kasuku 500ml	bowl 540ml	tin 250m
Maize flour	Level						225	253	500	495	140
C.fat	Level		15	20	70	80					
S.potato	Whole	320									
Rice							220			500	225
Chapatti	whole	60									
Beans					40		80				
Omena					30	50					
Nyoyo		260									
Sukuma				25	30	35					
Cabbage				25	30	35					
Osuga				20	25	30					
Dek				20	25	30					
Fish	medium	155									
Meat	1/2	500									
Chicken	1 piece	60									
Sugar			5	10	15	20					
Milk											
Dengu							225			180	
G nut											
Eggs	Whole	50									
Orange	Medium	150									
Papaw	1/4	15									
Carrots	Small	70									
Cassava	Slice	90									
Banana	Medium	150									
Maize	Medium	150									
Uji flour							210	110	155	120	90
Onions	Small	40									
Tomatoes	Small	60									
Ododo				15		20	25				

APPENDIX VI

VOLUMES OF COMMONLY USED HOUSE HOLD EQUIPMENT IN NDHIWA

Equipment	Volume (ml)
1 serving spoon	30
1 tea spoon	5
1 table spoon	10
1 calabash	260
1 cooking stick	40
1 plate	300
1 kg kasuku	1550
½ kg kasuku	775
1 tin (gorogoro)	3100
1 metallic bowl	540
1 small jug	1500
1 plastic cup	220
1 glass	230
½ kg blue band tin	

APPENDIX VII

MEAL PATTERN OF PREGNANT WOMEN AT NDHIWA SUB DISTRICT HOSPITAL

Meals	n	%
BREAKFAST	78	78.2
Tea with milk	9	7.02
Tea without milk	62	48.36
Poride (maize meal)	54	42.12
Poridge (millet/cassava)	25	19.05
Poridge(Finger millet/cassava)	73	56.94
Poridge (sorghum/cassava)	14	10.92
Bread	12	9.36
Mandazi	19	14.82
Sweet potato	32	24.96
Socotus (nyoyo)	47	36.66
Pumpkin	9	7.02
Ground nut	41	31.98
Left over ugali	8	6.24
Cooked banana	4	3.12
Ripe bananas	6	4.68
LUNCH	93	93.32
Ugali (maize meal)	100	100.0
Ugali (millet)	23	21.39
Ugali (millet/maize)	67	61.82
Ugali (millt/cassava)	6	5.52
Rice	2	1.83
Nyoyo	43	39.67
Sweet potato	18	16.92
Arrow root	13	11.74
Cassava	7	6.61
Kale(sukuma)	78	72.31
Olitorus(apoth)	17	15.96
Pumpkin leaves	5	4.63
Amaranthus	9	8.42
Night shade	2	1.82
Spider herb	8	7.42
Small fish (omena)	71	65.82
Fish	58	53.62
Meat	14	12.81
Chicken	1	0.93
Eggs	6	5.52
Milk	8	7.42
Beans	44	41.23
Green grams	23	21.85
Ground nut source (magira)	31	29.19
Awayo	4	3.72
Offals (matumbo)	3	2.73

APPENDIX VII continued

MEAL PATTERN OF PREGNANT WOMEN AT NDHIWA SUB DISTRICT HOSPITAL

Meals/Foods	n	%
SUPPER	100	100.00
Ugali (maize meal)	96	96.00
Ugali (millet)	30	30.00
Ugali (millet/maize)	70	70.00
Ugali (millt/cassava)	4	4.00
Nyoyo	63	63.00
Sweet potato	28	28.00
Arrow root	11	11.00
Cassava	14	14.00
Kale(sukuma)	83	83.00
Olitorus(apoth)	3	3.00
Pumpkin leaves	2	2.00
Amaranthus	24	24.00
Night shade	16	16.00
Spider herb	11	11.00
Small fish (omena)	71	71.00
Fish	78	78.00
Meat	4	4.00
Eggs	2	2.00
Milk	15	15.00
Beans	74	74.00
Green grams	18	18.00
Ground nut source (magira)	35	35.00
Awayo	2	0.01
Offals (matumbo)	8	8.00
OTHER/SNACKS	5	5.23
Tea with milk	3	0.15
Tea without milk	1	0.05
Poridge	4	0.2
Ripe bananas	4	0.2
Cakes	2	0.1
Pawpaw	4	0.2
Lemon	1	0.05
Orange	3	0.15
Mango	2	0.01
Sugar cane	3	0.15
Guavas	4	0.2

APPENDIX VIII RESEARCH CLEARENCE

KENYATTA UNIVERSITY
GRADUATE SCHOOL
P.O. Box 43844,
NAIROBI
Tel. No. 810901/9 Ext. 57530
E-mail: kubps@yahoo.com

Our Ref: H60/5416/03 **Date:** 30th June, 2005
Your Ref:

The Permanent Secretary,
Ministry of Education, Science & Technology,
P.O. Box 30040,
NAIROBI.

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION:

I write to introduce Ms. Dorothy Apondi Othoo who is a Postgraduate Student of this University. She is registered for M.Sc. degree programme in the Department of Foods, Nutrition & Dietetics.

Ms. Othoo intends to conduct research for a project entitled, "Vitamin A and Iron Status of Pregnant Women at Ndhiwa Sub-District Hospital."

Any assistance given to her will be highly appreciated.

Yours faithfully,

P. K. MUCHEMI
FOR AG. DEAN, GRADUATE SCHOOL

C.C. Registrar (Academic)
Dean, GS - to see on file
Dean, School of Environmental Studies & Human Sciences
Chairman, Department of Foods, Nutrition & Dietetics

PKM: eww

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REPUBLIC OF KENYA

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P. O. Box 30040
NAIROBI
KENYA

MOEST 13/001/35C 471/2

7th September, 2005

Dorothy Apondi Otho
Kenyatta University
P.O. BOX 43844
NAIROBI

DISTRICT MEDICAL OFFICER OF HEALTH HOMA-BAY DISTRICT RECEIVED DATE 3/10/05 P.O. BOX HOMA-BAY

Dear Madam

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "Vitamin A and Iron Status of pregnant Women at Ndhiwa Health Centre". I am pleased to inform you that you have been authorized to carry out research in Homa Bay District for a period ending 30th September, 2005.

You are advised to report to the District Commissioner, the District Education Officer, the Medical Officer of Health Homa Bay District and the Medical Officer In-Charge Ndhiwa Health Centre before embarking on your research project.

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

Yours faithfully

B. O. ADEWA
FOR: PERMANENT SECRETARY

The RCO i/c
Ndhiwa Sub-Dist Hosp.

"Ms Dorothy Apondi Otho has been granted permission by this office to carry out research on Vit. A. and Iron status of pregnant women at your facility.
Please accord her every possible assistan in carrying out the exercise.

DISTRICT HEALTH ADMINISTRATIVE OFFICER HOMA-BAY DISTRICT

for MEDICAL OFFICER OF HEALTH HOMA BAY DISTRICT.

4/10/05