7

Food Intake and Iron Status of Lactating and Nonlactating Mothers in Kenya

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INTRODUCTION

Iron is required in the tissues of the body for basic cellular functions, and is critically important in muscle, brain and red blood cells. Anaemia is simple to measure and has been used as a hallmark of iron deficiency severe enough to affect tissue functions. However, iron deficiency is not the sole cause of anaemia in most populations. Even in an individual, anaemia may be caused by multiple factors. Iron deficiency is one of the most prevalent nutrient deficiencies in the world, affecting an estimated two billion people (Kafwembe 2001).

The World Health Organization (World Health Organization 1995) has produced the estimates of the global burden of deaths attributable to anaemia (all forms) in women of reproductive age. The total estimate is a minimum of 16,800 and a maximum of 28,000 annually with a greater risk of anaemia present in younger women (Brabin et al. 2001). Globally, around 600,000 women die every year from pregnancy related causes. Many of these women are short, thin, and anaemic and have a variety of micronutrient deficiencies, which could be prevented with attainable resources and skills (Tomkins 2001). Maternal anaemia is 50-100 times greater in women of developing countries than women of developed world, rates are high as 700 per 100,000 live births in many parts of Africa and in some countries in South Asia (Brabin et al. 2001, Haider et al. 1999, Tatala 2000). A pregnant woman is considered to be anaemic when haemoglobin in her blood stream is below 11g/dl and non-pregnant when it is below 12g/dl. The highest rates of anaemia are found in

Asia followed by Oceania and Africa (Lassey et al. 1999). Studies from different parts of the world in the last two decades have shown that nutritional anaemia, usually due to iron deficiency, affects 40-90% of the population, particularly pregnant women, young children and adolescents (Agarwal 2001, Agyei et al. 2001, Kilbride et al. 1999, Tatala et al. 2000). A study done in the three East African countries, Kenya, Uganda and Tanzania reported an overall prevalence of anaemia for women to be 61% (Waudo et al. 2005).

Hospital data indicate that factors such as pregnancy haemodilution, concurrent infection, and haemorrhage prior to treatment or poor maternal nutritional status, and malaria can rapidly lead to death (Brabin et al. 2001). Successive pregnancies, use of breastfeeding as a contraceptive, lactation and food insecurity have cumulative effects on specific nutrients leading to maternal depletion syndrome, iron being one of the nutrients (Kilbride et al. 2000).

The aetiology is commonly multifactorial and includes inadequate intake of iron, vitamin B12, vitamin A, zinc and folic acid, increased demands from many and frequent pregnancies, increased losses from hookworm infestation, low socio-economic status, increased destruction and dyserythropoiesis from malaria and the haemoglobinopathies. Furthermore dependence on cereal and legume based diets that often lack animal proteins as well as fruits and vegetables that enhance absorption of non-heme iron aggravate the condition (Lassey et al. 1999, Mulira et al. 1999, Tatala et al. 2002). IDA arises from impaired absorption and/or utilization, inhibitors, excessive losses, or a combination of these factors, economic, cultural and religious constraints (Gibson and Hotz 2001). Poor bioavailability of iron (2.6-3.6%) in cereal-based diets is a responsible factor (Nair 2001). Iron deficiency in a community studied in Zambia had its roots in the social economic cycle of poverty (Kafwembe et al. 2001). Many causes of IDA have been identified nevertheless, nutritional deficiency due to lack of bio-available dietary iron accounts for over 50% of the cases and dependency on a single crop, resulting in shortage of minerals and vitamins, which affects the nutritional status of the Ethiopian community (Haider 1999). As people shift from rural to urban areas, the type of food consumed changes. Although urban poverty is a growing problem due to rapid urbanization, up to 80% of extreme poverty is still in rural areas.

Iron as a micronutrient, is required for regulation of brain transmitters by altering the pathway enzymatic system and severe iron deficiency results in anaemia that can lead to reduced work performance, therefore realise low income (Agarwal 2001, Agyei et al. 2001, Kafwembe 2001, Kilbride et al. 2000, Tatala et al. 2002). Severe anaemia lowers resistance to diseases and may cause death directly. For example, anaemic women have cardiopulmonary complications and do not tolerate blood loss as well as healthy women and are therefore more likely to die if they start to haemorrhage. Sub clinical iron deficient status also influences several physiological functions that govern cellular prolification and metabolism. In latent iron deficiency (without anaemia), brain iron content, neuro-transmitters and the related receptors are affected irreversibly during brain development (Agarwal 2001).

STUDY AREA

The study was carried out at Uzima Medicare Centre a peri-urban clinic in Thika Municipality. The study targeted mothers attending the health unit. Thika is a cosmopolitan town with people of different ethnic origin, who mainly work in factories, pineapple plantations, coffee and flower farms, while some have small self-help businesses. Majority are of low income. Apart from the natural population growth, there has been an influx of people into the area due to rural poverty seeking for jobs. The main tribes are Kikuyu and Kamba and the others tribes are a minority.

Clearance to carry out research was obtained from the Kenyatta University Board of postgraduate. Ethical approval was obtained from the Ministry of Education headquarters in Nairobi and at District and Municipality level, office of the President and the management of Uzima Medicare Centre. Participants were informed about the aim of the study and its procedures and oral consent was obtained. Participants were given their test results and women with some form of anaemia were referred to the physician in charge for further advice and treatment.

Thika District was purposively selected as the study district. Cluster sampling was used to select one private Health Clinic out of 50 clinics in Thika District. In selecting the study respondents, a purposive search for the lactating and non-lactating mothers was employed. The technique involved selecting cases or units of observation as they became available and the ones with the required information with respect to the objectives of the study (Mugenda and Mugenda 2003). The study was confined to the clinic. The researcher carried out the interviews using an interview schedule. The blood from the subjects for the analysis was either drawn by the doctor or the laboratory technician. The laboratory technician did the analysis of the haemoglobin levels.

METHOD

The Haemoglobin tests and data collection were integrated into the usual services of the clinic. The main instruments for gathering data was the interview schedule.The 24-hour dietary recall and food frequency was used to determine the dietary iron intake. Calibrated household measures like plates, cups, and spoons were used to estimate the food intakes. Household visits were made to ascertain the household measures were correct. The household measurements were later converted into metric measures.

In order to pre-test the interview schedule on the length, content, question wording, language and sensitivity, three respondents were interviewed. Pre-testing was to facilitate modifications by correcting mistakes and eliminating ambiguous questions to ensure clarity and hence elicited the required information for better validity.

The instrument was administered to the lactating and non-lactating mothers regarding demographics, household food security, food preparation and consumption methods, their health and sanitation data, and breastfeeding among others.The interview was administered when the mothers gave consent to be included in the study. Before the interviews commenced, the researcher formed a rapport with the subjects by clearly explaining the purpose of the study.

Blood sample was drawn with a sterile disposable needle and syringe or a deep prick with a lancet and pipetted from the respondents after disinfections with methylated spirit swap and drying of skin. Venous blood was collected for (n=20) mothers asceptically from antecubital veins of the arm and was alliquotted into tubes with an anti-coagulant(sequestrene). This was done to mothers who could not be able to come back for a finger prick in the evening when usual procedures of analysis were undertaken by the lab technician. Serum

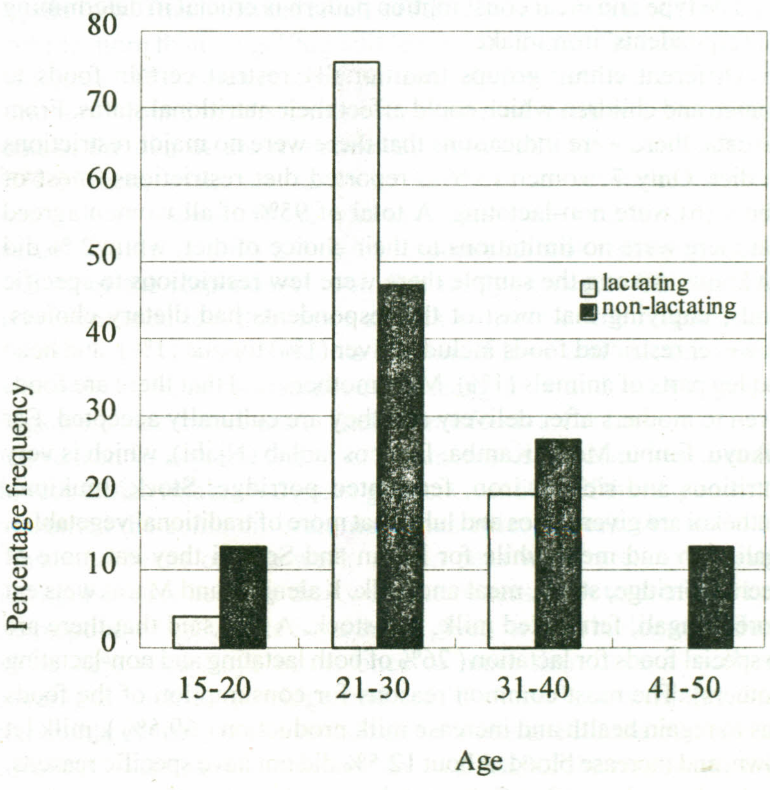
Hb measurements was performed using the Sahli hemometer (took 8 minutes to determine) and values were recorded for each subject. The mothers were categorized as having iron deficiency anaemia when found with Haemoglobin <12g/dl.

RESULT

Age

The age of a woman is crucial in determining the iron status irrespective of non-pregnancy status (Figure 1). Lactating mothers consisted of those in age bracket 15-20 years (4%), 21-30 years (76%) and 31-40 years (20%). Within the non-lactating mothers, the age

Figure 1
Distribution by Age of Lactating nd Non-lactating Mothers



group 21-30 had the highest respondents (47%), followed by the 31-40 years age cohort (27%). The oldest women (41-50) years and teenagers (15-20) years were the least respondents in the study among non-lactating mothers. In total, 123 young women in the range of (21-30) years consisted most of the respondents in the sample (61.5%), with those in the eldest bracket (41-50 years) being the least (6.5%). This compares well with the KDHS (2003) survey whereby the majority of the respondents were of age 21-30 years and on the age specific fertility rates.

From figure 1 majority of the respondents for both categories were in the age group 20-30 years associated with high fertility rates (KDHS 2003).

Theme 1: Food Intake and Dietary Iron Intake

The type and meal consumption pattern is crucial in determining the respondents' iron intake.

Different ethnic groups traditionally restrict certain foods to women and children which could affect their nutritional status. From the data, there were indications that there were no major restrictions on diet. Only 7 women (3.5%) reported diet restrictions, most of whom (6) were non-lactating. A total of 95% of all women agreed that there were no limitations to their choice of diet, while 2 % did not know. Among the sample there were few restrictions to specific foods, implying that most of the respondents had dietary choices. However restricted foods included liver (1%) tongue (1%), and head and leg parts of animals (1%). Most mothers said that there are foods given to mothers after delivery and they are culturally accepted. For Kikuyu, Embu, Meru, Kamba, Dolicos lablab (Njahi), which is very nutritious and rich in iron, fermented porridge, Stock, mukimo/muthokoi are given. Luos and luhya eat more of traditional vegetables, ugali, fish and meat while for Boran and Somali they eat more of ajeera, porridge, stock, meat and milk. Kalenjins and Marakwets eat more of ugali, fermented milk, and stock. A few said that there are no special foods for lactation (26% of both lactating and non-lactating mothers). The most common reasons for consumption of the foods was to regain health and increase milk production (69.5%), milk let down, and increase blood. About 12.5% did not have specific reasons. Studies have shown that Culture, taboos and food preferences were a common thing in some community that influenced food consumption whereby women were not supposed to eat certain foodstuffs especially those of animal protein origin. This study did not show that trend, probably because most urban dwellers have abandoned most of the traditions.

Theme 2: Food Frequency and Dietary Iron Intake

Iron can be obtained from both animal and plant sources. Iron from plants (non-heme) is less bio available than iron from animal foods (heme a constituent of haemoglobin and myoglobin), such as meat, fish and poultry. Heme iron is highly bio available (15-35% is absorbed) whereas non-heme iron is absorbed much less (only 2-20% is absorbed). Non-heme iron from plants is affected by phytates, which are present in cereals and legumes the main staples of the populations. This indicates levels of IDA.The iron rich foods selected provide more than 1mg/100g edible portion except for milk and the inhibitors. The consumption pattern of selected iron rich foods commonly found in Makongeni are explained. Milk was a common food in the diet of the respondents, taken daily in tea or fresh, by 95% of them. Meat was taken by 41.5% of the respondents more than 3 times a week. Those who took meat once or 2 times a week were (77) 38.5 %. Only 2% of the respondents took fish daily. Up to 70.5 % of the respondents took fish rarely or never. Chicken and liver were used less than once a week by most of the respondents. Up to 85 % of the respondents consumed liver and chicken rarely with only 0.5% of the respondents using liver and chicken daily. Eggs were moderately used. These heme foods are enhancers of non-haeme iron absorption.The most commonly used pulses were beans, dolicos lablab (njahi) and green grams. Over 60% of the respondents consumed the common bean more than twice a week. About 30 % consumed beans once a week. Green peas were rarely consumed during the study because they were out of season. A total of 59 % of the respondents never ate Soya beans given its high biological value, while 22% used Soya beans once or more than once a week in beverages such as porridge and tea. Dolicos lablab (njahi) was commonly consumed by over half of the mothers. Fruits as iron uptake enhancers were rarely consumed by over half of the respondents. It is only 36.5% of the respondents who consumed them twice or more than twice a week. About 15.5% of the respondents ate Oranges once a week, while 32.5% ate pawpaw twice or more than twice a week and 15.5% once a week. A total of 35.5% of the respondents consumed pineapple twice or more than twice a week and 21 % once a week. Vitamin C from fruits and vegetables promotes iron absorption. For vegetables, the most commonly consumed was tomato by 96% of the respondents daily in all forms of cookery. Followed by kales (sukuma wiki) by 22% of the respondents' daily. The most common vegetables were spinach, kales and cabbages(brassica sp). Managu (solanum nigrum) , capsicum, mitoo(Crotalaria ochroleuca), mrenda (Corchorus olitorius) and garlic were rarely used. Over 60% of the respondents never ate mrenda (Corchorus olitorius), mitoo (Crotalaria ochroleuca),and managu (solanum nigrum). Overcooking of these vegetables was cited by a number of mothers. Tea as a beverage was common, and predominately taken at breakfast by 95% of the respondents, while coffee was rarely used by 86% of the respondents. These beverages are known to contain tannins and caffeine respectively that inhibit iron uptake in the gut but were rarely consumed with main meals. There was high consumption of wheat and its products, maize and its products and rice. These foods are known to have high amounts of phytates which is an inhibitor of iron absorption. These findings are in agreement with other researches, which have shown low consumption of animal products and increased consumption of plant foods in developing countries.

Theme 3 : Food Accessibility

Food consumption patterns are greatly influenced by the ease at which the consumer accesses it. There is lack of adequate and nutritious foods dúe to urban poverty leading to an increasing number of people suffering from diseases that were previously not common like ulcers, diabetes, hypertension and cardiovascular.

The main sources of food for lactating mothers were purchase (90%), farm (6%), donations and purchase (4%). The non-lactating mothers relied mainly on purchases (80%), farms and purchase (17%) donations and purchase (3%). Most mothers said that they could afford the basic foodstuffs (92%), mainly plant foods. A few said that they couldn't afford some of the foodstuffs, as they would wish due to their high costs. Proteins were ranked as the foodstuffs that some mothers felt they would like to eat more often but cannot afford. In urban areas the main source of food is purchase. Income is a key determinant of quality and quantity access of food. The adequate access to quality foods in turn affects the nutritional status of the individual.

Theme 4 : Food Intake in Lactation

Food intake requirements are higher for the mothers immediately after delivery due to blood lost during delivery and also the demand for breast milk from the baby. Energy requirements for example increases by 500kcal over and above the recommended requirements for a non-lactating mother.

The lactating mothers who breast fed their children for over 1 year, were 30%, while 18% breast fed for 10-12 months. Others were 6-9 months (16%), 4-6 months (17%), and 1-3 months (19%). Most mothers breast-fed their babies on demand since majority were housewives. The results reveals that a big number of mothers (98%) breast fed their babies which compares with 96% (KDHS 2003). According to Waudo et al. (2005) in East Africa 96.1% of the mothers in their study gave their children breast milk at the time of introduction of complimentary foods. Exclusive breastfeeding was not common and babies were given complimentary feeds before 2 months inform of water, fruit juices and other milk. Most mothers did not have any breast-feeding problems (99%). It is only 1% of lactating mothers who experienced the problem of cracked nipples and little or no milk production. This could have been associated to hormonal imbalances. Most women agreed that there were special foods for lactation (86.5%). Only 13% did not agree, while 1% did not know.

Theme 5 : Haemoglobin Levels of Lactating and Non-lactating Mothers

The lactating mothers had a haemoglobin level ranging from 7-14 g/dl, while the non-lactating mothers had 9-15 g/dl. On average, lactating mothers had a lower mean (12.1g/dl) than non-lactating mothers (12.4 g/dl) with a mean difference of 0.3g/dl (Table 1).

Table 1
Comparison of Haemoglobin Mean by Age among Lactating and Non-lactating Mothers

Age (years)	Mean	Std. Deviation	n
15-20	11.9	1.2	17
21-30	12.3	1.1	123
31-40	12.2	1.2	47
41-50	12.5	1.3	13
Total	12.3	1.1	200

P=0.428, R=0.118, R2=0.014

Classification of Respondents' Haemoglobin Cut-off

Iron deficiency is the end stage of a relatively long process of deteioration of Hb levels, based on the World Health Organisation recommendations. A cut-off of <7g/dl as severe anaemia, 7-10.9g/dl moderate anaemia, 10.8-11.9g/dl as mild anaemia and 12-16g/dl as normal was used to analyse the haemoglobin levels. WHO identifies Hb levels below 12g/dl for non-pregnant mothers as being anaemic (Brabin et al. 2001).

In general most of the lactating mothers (66%) had normal haemoglobin levels (12-16g/dl) as compared to (25%) who had mild anaemia (10.9-11.9g/dl) and (9%) who had moderate anaemia (7-10.8g/dl). In comparison 73% of the non-lactating mothers had normal haemoglobin levels, 19% had mild anaemia and 8% had moderate anaemia. Nevertheless, since IDA is the final stage of Hb levels deterioration, many persons are sufffering from iron deficiency, with its adverse effects on health and physical stamina, than are frankly anemic. In a rural area in Northern Natal a prevalence of anaemia in females 6-74 years was found to be 52% by Ahmed et al. (2001). While in Bangladesh Ahmed et al. (1997) found a prevalence of 44% among adolescent female garment factory workers with rural roots having Hb <12g/dl.

Mild anaemia (33%), moderate anaemia (17%), and severe anaemia (1%) was prevalent in the lactating mothers, as compared to 29% mild anaemia and 15% moderate anaemia in non-lactating mothers after altitude adjustment at a calculated factor 0.5 for Thika altitude (1700m asl). Altitude adjustments were based on an increase of 0.25g/dl per 1000 m rise asl. This factor was suggested by Gies et al. (2005). Iron deficiency in this population may be masked by altitude induced polycythaemia as increased prevalence of anaemia after altitude adjustment suggests.

Theme 6: Nutrient intake of lactating and non-lactating mothers

There is evidence from studies that nutrients interact and do not influence nutritional status singly. There is general consensus that in poor countries diets tend to be deficient in multiple micro-nutrients and not only iron and folate.Deficiency in vitamin B12, vitamin A as well as zinc also contribute to anaemia

The energy mean intakes for the lactating mothers (1485 Kcal) and non-lactating mothers (1290Kcal) were significantly below the RDA for an adult African woman 15-50 years of 2250kcal.These results are in agreement with Waudo et al 2005 that Kenyan women have low RDA for calorie intake as compared to Uganda and Tanzania.The mean intakes for other macronutrients were normal. These findings are in agreement with Waudo et al that women in East Africa have better protein intake while the nutrients already associated with anaemia like iron, folic acid, vitamin B and C mean intakes were significantly lower than the RDAs.

There were significant differences in energy with lactating mothers showing higher mean intake levels. This difference in energy intakes could have been attributed to the fact that lactating mothers culturally are given better nutritional attention more than any other time of reproductive cycle.

The copper intakes were higher in lactating mothers than their non-lactating counterparts ($p>0.05$). As regards vitamins, there were significantly higher readings for retinol, for lactating mothers as compared to non-lactating mothers. There was a statistical significance of Haemoglobin and protein, iron, zinc, selenium carotene and vitamin C at ($p<0.05$).

Correlation between Haemoglobins and Other Nutrients

Consumption of other nutrients was factored in because they equally affect the mobilization of depot iron and dietary iron into the tissues.

Table 2
Correlations between Haemoglobin(Hb) and Vitamin Intake among Lactating and Non-lactating Mothers in Makongeni

	Hb	iron	Retinol	Caroten	Vitb12	Folate	Vit. C
Hb	1.000						
Iron	-0.068	1.000					
Retinol	-0.008	0.275**	1.000				
Carot	0.054	0.164*	0.037	1.000			
Vitb12	0.017	0.432**	0.485**	0.006	1.000		
Folate	-0.018	0.515**	0.177*	0.195**	0.294**	1.000	
Vit. C	-0.115	0.304**	0.040	0.309**	0.069	0.448**	1,000

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 3
Correlations between Haemoglobin and Mineral Intake among Lactating and Non-lactating Mothers in Makongeni

	Haemoglobin	Iron	Calcium	Copper	Zinc	Selenium
Haemoglobin	1.000					
Iron	-0.068	1.000				
Calcium	-0.051	0.341**	1.000			
Copper	0.022	0.057	0.059	1.000		
Zinc	-0.039	0.785**	0.412**	0.067	1.000	
Selenium	0.004	0.503*	0.254**	0.109	0.492**	1.000

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Iron was significantly related to all vitamins, with a strong correlation with folate(r=0.515, p<0.01). The weakest correlation for iron was carotene (r= 0.164, p<0.05). Hb correlated negatively with retinol (r = –0.008, P<0.05), Folate(r = –0.018, P<0.05) and Vitamin C (r = –0.115, P> 0.05) (Table 2).

Iron indicated a positive significant correlation with most minerals, including calcium (r=0.341, p<0.01), zinc (r= 0.785, p<0.01), and selenium (r=0.503, P<0.05). Calcium was also significantly related to zinc (r=0.412, p<0.01) and selenium (r= 0.254, p<0.01). Copper relationships were not significant. Hb correlated negatively with iron (r = –0.06, P>0.05), Zinc (r = –0.039, P<0.05) (Table 3). These nutrients were included in the study since they were considered important for the health of the woman and are very strong indicators of nutrition security. Iron consumption and the related nutrients affect the Haemoglobinb levels. Calcium affects the absorption of iron while the rest enhances iron uptake. Vitamin C helps in the absorption of iron in the gut by helping to change it into a soluble compound absorbable through the gut wall. The parameters that were significantly independently related to haemoglobin included protein, fat, folate, while carotene indicated a negative regression on haemoglobin, though it was not significant.

There were significant positive correlations between haemoglobin and Carbohydrates (r=0.14, p>0.05).Haemoglobin correlated negtively with protein (r= –0.074, p>0.05). Protein and energy also correlated significantly at (r= 0.158, p>0.05). Fat levels were also significantly related to energy (r=0.584, p>0.01), protein (r=0.203, p>0.05).

By multiple regression analysis, intake of energy, Carbohydrate and zinc were found to have a significant independent relationship with haemoglobin levels. The overall t- ratio was significant for CHO, energy and zinc at p<0.05 (Table 3). Studies done by Ahmed et al. 2001 showed that vitamin A and other nutrients plays an important role in the haematological response to iron .

Bivariate Linear Association for Nutrient Intake Behaviour

Nutrients that influence the uptake of iron showed a positive linear relationship. The nutrients include copper, zinc, selenium, Vitamin C & B12, folate and retinol.

A positive linear relationship between iron and Hb levels varied together in the same direction such that a increase in iron intake did not affect the Hb. It can be concluded that the increase in Hb levels was not influenced by dietary iron intake alone other factors may have influenced. The direction also could be attributed to the fact that dietary information given was for one day.

There were significant positive correlations between haemoglobin and income at $P<0.05$. The level of income will determine the types and amounts of foods an individual buys. The findings supported the hypothesis that there is no significant difference in the haemoglobin levels of the lactating and non-lactating mothers at $p>0.05$

Correlation between Haemoglobin Levels and Selected Nutrients

There were significant positive correlations between haemoglobin and various nutrients Iron $p<0.05$, Carotene $p<0.05$, Vit.C $p<0.05$, Zinc $p<0.05$, Selenium $p<0.05$, Protein $p<0.05$ .The mothers in Makongeni had below RDA of various nutrient intakes, which may have influenced the haemoglobin levels. The results rejected the hypothesis that there is no significant relationships between dietary iron intake and the haemoglobin levels at $P<0.05$,and therefore concluded that there was a signicant relationship in dietary iron intake and the haemoglobin levels. The findings are in agreement with a study done by Waudo et al. (2005) that Kenyan women have lower nutrient intakes as compared to Uganda and Tanzania.

CONCLUSION

Iron deficiency anaemia is a serious health problem in the world affecting over 80% of women in many countries Kenya included. Studies have shown that even non-pregnant women are vulnerable to iron deficiency anaemia equally as the highly studied preschool children and pregnant mothers. Minimal information exists on the iron status of lactating and non-lactating mothers. The major objective of the study was to investigate the iron status of lactating and non-lactating mothers. A cross-sectional study was conducted at Uzima Medical Care Centre in Makongeni Thika, Kenya. A sample size of 100 lactating and 100 non-lactating mothers were purposively selected. Their demographic, socio-economic, health and haemoglobin levels data were taken. The 24-hour recall and food frequency were used to determine the food consumption patterns.

The majority of the women both lactating and non-lactating attending the Uzima Medical Care Centre are from a low economic classes residing in rented single rooms. They were either in low income earning groups or totally dependent to their spouses/guardians or parents for their entire daily needs including food. Low economic status that was associated with IDA is a common characteristic in among the lactating and non-lactating mothers. Despite the high nutrient requirement in reproductive age women, the women in this study had below the RDAs diets mainly due to financial constraints since their diets comprised mainly of the monotonous cereal and plant foods .The women in this study irrespective of age, marital status, ethnicity and education status consumed similar diets high in plant foods but less in fruits and animal foods. Food was mainly taken in three meals per day.

Mild anaemia was prevalent in 33% of the lactating mothers, while 17 % had moderate anaemia and 1% severe anaemia (total 51%) compared to 29% mild anaemia and 15% moderate anaemia (total 44%) in non-lactating mothers after altitude adjustment. Haemoglobin levels were not significantly different among the lactating and non-lactating mothers with lactating mothers recording lower levels $P>0.05$ ($p=0.393$).The findings are in agreement with findings from Tanzania where 49% of non-pregnant women (80% lactating) were anemic and nearly 2% severely anemic (Tatala et al. 2000).

Lactating and non-lactating in low socio-economic classes irrespective of ethnicity, age, education levels, marital status have a common food consumption pattern characterised by monotonous diets high in plant based foods. High income levels increases consumption of animal based food and fruit, ultimately improving the quality and quantity of nutrient content, particularly proteins of high biological value. Poor economic status as reflected by low profile occupations and low-income levels is associated with inadequate iron consumption both in quality and quantity. The lactating mothers had higher incidences of anaemia including severe anaemia than the non-lactating mothers. The results emphasize the need to intervene and prevent/ control anaemia in women.

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