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Protein-Energy Malnutrition among Women of Child Bearing Age in Semi Arid Areas of Keiyo District, Kenya

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Abstract
Background: Women of child bearing age are vulnerable to food shortage in arid areas and this ultimately affects their nutritional status. Research on these women remains largely unexploited in many parts of the developing countries such as Kenya. The study sought to establish the prevalence of malnutrition and associated factors among women of child bearing age in the Semi arid areas of Keiyo District. .**Methods:** This was a cross-sectional survey of 335 randomly selected women from three semi arid divisions. Anthropometric measurements of height, weight and mid upper arm circumference (MUAC) were taken. Nutrient intake data was collected using a 24 hour recall questionnaire. A structured questionnaire was used to collect data on socio-demographic information. Data was analysed using SPSS V.16.0. T-test, chi-square and logistic regression were employed in the analysis. P-value of less than 0.05 was considered significant. **Results:** The mean (SD) age of mothers was 29.9±6.3 years. The prevalence of CED was 44.9%. Compared to RDA, protein, energy, vitamin A, Iron and Zinc intake were significantly low ($p<0.05$). Vitamin C and Folate intake were significantly higher than RDA. Based on BMI, 39 (12.2%) were underweight, 54 (16%) overweight while 49 (15.9%) were obese. Only 120 (35.8%) of the households ate a diversified diet. Age, marital status, education level, occupation and income level were significantly associated with under-nutrition ($p<0.05$)
Conclusion: Enhancing diversified diets should be encouraged. Awareness on proper nutrition should be done through education to the community.

INTRODUCTION

Malnutrition worldwide includes a spectrum of nutrient–related disorders, deficiencies, and conditions such as intrauterine growth retardation, protein-energy malnutrition, iodine deficiency disorders, vitamin A deficiency, iron-deficiency anaemia, and overweight/obesity and other diet-related non-communicable diseases (Ratzan *et al.,* 2000). While under-nutrition (underweight and stunting) is still prevalent in most of the developing countries, the rates of overweight and obesity are steadily increasing, especially among adults. Hence, the countries in transition face today new public health problems, while they are yet to eradicate completely the nutritional deficiencies.

For normal growth and development, human beings require energy, proteins and other nutrients in adequate amounts. Food may be available in a particular region, but a household for various reasons may not have access to it. The severity of malnutrition was highlighted by United Nations Development Program (UNDP, 2003), which indicated that everyday 800 million people in developing countries- about 18% of the world's population go hungry; many who are women without access to adequate food.

On the other hand, the Chronic Energy Deficiency (CED) is associated with impaired physical capacity, decreased economic productivity (Durnin *et al,* 1990), increased mortality (National Institute of Nutrition, 1991) and poor reproductive outcomes (World Health Organization, 1995). Evidence in developing countries indicate that malnourished women having a Body Mass Index (BMI) below 18.5 kg/m2 show a progressive increase in mortality rates as well as increased chances of illness (Rotimi *et al*., 1999).

For social and biological reasons, women of the reproductive age are among the most vulnerable to malnutrition (UNACC/SCN, 1992). Several reviews have also emphasized the vulnerability of women throughout their life cycle (Tinker, 1995; Merchant *et al,* 1993*).*

The nutritional issues of women of childbearing have rarely been investigated. Since the female is responsible for ensuring that a full-term healthy, viable infant is born and adequately nursed, maternal nutrition should be properly focused at all phases of reproductive life, to break the cycle of poor health and nutrition that passes on from generation to generation. The limited available data and a few experiences with programs that exist come mostly from small scale efforts to improve nutrition during pregnancy. This lack of emphasis on women's nutrition has led to lopsided policies given the importance of proper nutrition on women's health, pregnancy outcome and survival of the child (Butterworth 1993)..

With decrease in crop production, malnutrition among the women is expected to rise which has implications on health of women of child bearing age in keiyo District. This is because women who bear children are caregivers, household managers and often times work outside the home (WHO, 2000). Achieving and sustaining good nutritional status are important to ensuring good overall health and therefore good nutrition and healthy eating are important goals for women especially throughout the childbearing years (Tinker, 1998; Tinker & Ransom, 2002).

Objectives

1. To determine the prevalence of malnutrition among women of child bearing age in semi-arid areas of Keiyo District
2. To determine dietary diversity and Nutrient intake of women of child bearing age in semi-arid areas of Keiyo District using 24-hour recall questionnaires.
3. To establish factors associated with protein-energy malnutrition among the women in Keiyo District

METHODS

Study area and participants

This was a cross-sectional study conducted in semi-arid parts of Keiyo District. The study population was women aged 15 to 49 years estimated to be 21,000 based on the Keiyo District Agricultural Development Report (2007) and national census registers from the Department of Immigration.

Sample size and sampling

The sample size was determined as recommended by Fisher *et al* (1991). Using the PEM levels of 32.1% for all women in Keiyo District (GoK, 1995), the sample size was determined as follows;
The formula used was $N = z^2 (pq)/d^2$, Whereby; z= the standard normal deviation (1.96),
d= the acceptable range of error (0.05), p= the proportion of mothers who suffered from PEM . on substitution the sample size was 335.
Multistage sampling technique was employed in the selection of the study participants

Inclusion/Exclusion criteria

The women of child bearing age from 15 to 49 years living in Keiyo district participated in the study. Those who were chronically ill or ill in bed or expectant were excluded from the study.

Data collection procedures

The research was approved by the Institutional Research and Ethics Committee (IREC) of Moi University for approval. Informed consent was sought from all the study participants. Preceding the main study, a pilot study was carried. Data was collected between November and December 2009. Two methods were employed; questionnaires and anthropometrical measurements. The respondents were required to recall their exact food intake during the previous 24-hour period or preceding day. The names and estimated quantities (using standardised measuring cups) were recorded on the questionnaire by the interviewer.
The actual nutrient intake was calculated using the nutrient calculator. The dietary diversity was assessed using food diversity questionnaire and recall questionnaires (Appendix 4). The groups assessed were energy, protein, Folate, Iron, calcium , vitamin C and vitamin A intakes. Anthropometric measurements taken included; height, body weight and mid-upper arm circumference of the respondents.

Statistical Analysis

After data collection, the questionnaires were coded, entered and analyzed using SPSS V.16.0. The nutritional status of the mothers was determined using the International Reference Population defined by the United State National Centre for Health Statistics -NCHS standard as recommended by the World Health Organization and the Centre for Disease Control -CDC and Prevention based on the cut off points (<18.5) considered as underweight. The nutrient calculator was used to estimate the mean daily nutrient intake. The house hold Dietary diversity determined by the number of different food groups consumed by the household based on the on the previous 24 hours as the reference period. Frequency tables were generated for categorical variables while mean and standard deviation for continuous variables. Chi-square test of association was used to check for relationship between categorical variables while t-test was used to compare means between two groups. ANOVA was used to assess variation in mean age by nutritional status. Significance was assessed at 95% confidence level.

RESULTS

4.1: Socio demographic characteristics

Table 1: Social Demographic Characteristics

characteristic	N	(%)
Marital status		
Married	216	65.5
Single	94	28.5
Separated	20	6.0
Education level		
None	5	1.5
Primary	235	71.2
Secondary	60	18.2
College	30	9.1
Occupation		
Formal employment	5	1.5
Informal employment	50	15.5
Unemployed	265	81.5
Others	5	1.5
Average monthly income (Kshs)		
0-1999		
2000-3999	84	26.7
400-5999	126	40
6000-7999	60	19
8000-9999	15	4.8
≥10,000	15	4.8
	15	4.8
Amount spend on food monthly(Kshs)		
500-1000	94	29.4
1001-1500	59	18.4
1501-2000	74	23.1
2001-2500	23	7.2
2501-3000	30	9.4
>3000	40	12.5

4.2 Adequacy of nutrient intake

Mean protein, energy, vitamin A, Iron and Zinc intakes of the study population were found to be significantly lower than RDA ($p \geq 0.05$). Vitamin C and Folate intake were found to be significantly higher than RDA as indicated in table 4.2.

Table 2: Nutrient Mean Daily Intake compared to RDA

Nutrient	Mean daily intake	RDA	t	P-value
Protein (gm)				
14-18	63.0±19.7	38	4.93	0.053
19-30	63.9±30.2	38	10.59	<0.001
31-50	65.5±26.0	38	13.44	<0.001
Vitamin C(µg)				
14-18	18.4±16.8	56	8.66	
19-30	26.9±25.3	60	16.18	<0.001
31-50	25.5±23.8	60	18.41	
Energy (Kcal)				
14-18	3070.3±1739.5	2110	2.14	0.05
19-30	3564.4±2032.9	1940	9.88	<0.001
31-50	3344.8±1925.9	1940	9.28	<0.001
Vitamin A(µg)				
14-18	598.8±1143.2	485	0.386	0.706
19-30	1107±1440	500	5.21	<0.001
31-50	767.4±1201	500	2.83	0.005
Iron				
14-18	32.4±12.5	7.9	7.59	
19-30	33.13±16.0	8.1	19.37	<0.001
31-50	35.62±19.1	8.1	18.37	
Folate				
14-18	41.4±42.2	320	25.60	
19-30	39.6±37.6	320	92.19	<0.001
31-50	42.4±41.3	320	85.52	
Zinc				
14-18	8.2±4.6	7.3	0.758	0.461
19-30	7.9±5.7	6.8	2.47	0.015
31-50	8.2±4.7	6.8	3.87	<0.001

As indicated in figure 3, 39(12.2%) women were underweight, 54(16%) normal while 49(15.9%) were overweight.

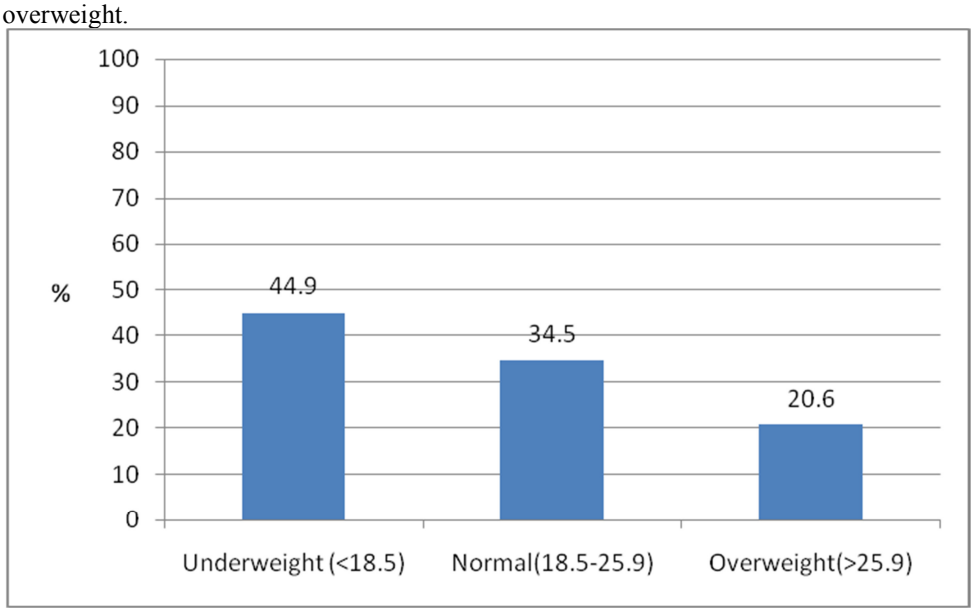

Fig.3: PEM Among the women of child bearing age in Keiyo households (WHO cut offs <18.5)

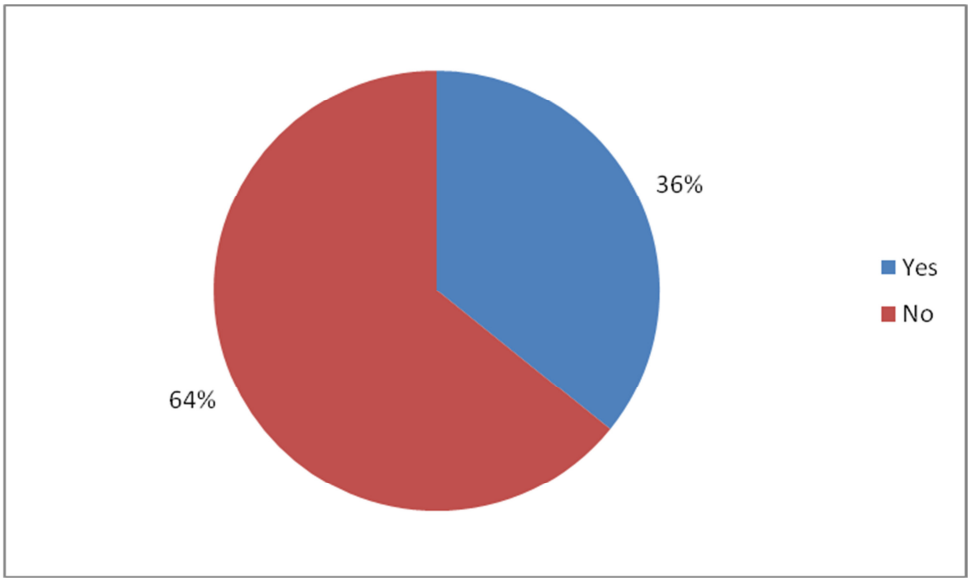

Fig4 : Dietary diversity

As indicated in figure 4, among the 335 women studied, only 120(35.8%) had their households classified as diet diverse.

Table 3: Factors Associated with Protein Intake

	Protein		
Factor	**Adequate**	**Inadequate**	**p-value**
Age	29.9±6.4	29.4±5.5	0.576
Marital status			
Married	191	25	0.546
Single	82	12	
separated	16	4	
Education level			
None	5	0	0.764
Primary	207	28	
Secondary	51	9	
College	26	4	
Occupation			
Formal employment	5	0	0.673
Informal employment	43	7	
Unemployed	231	34	
Others	5	0	
Food diversity			
No	191	24	0.487
Yes	103	17	

Similarly as indicated in table 4, no factor was found to be significantly associated with energy intake (all $p>0.05$).

Table 4: Factors Associated with Energy Intake

Factor	Energy		p-value
	Adequate	Inadequate	
Mean Age	30.12±6.3	29.2±6.3	0.25
Mean h/hold size	5.7±2.3	5.6±.3	0.557
Marital status Married Single separated	 153 78 13	 58 16 7	0.084
Education level None Primary Secondary College	 3 173 46 22	 2 57 14 8	0.864
Occupation Formal employment Informal employment Unemployed Others	 3 39 195 4	 2 11 68 1	0.26
Food diversity **No** **Yes**	 157 92	 54 27	0.596

The chi-square test of association indicated that age, marital status, education level, occupation and income level were significantly associated with nutritional status(all $p<0.05$) as shown in table 4

Table 4.5: Factors Associated with Nutritional Status based on BMI

Factor	Nutritional status				p-value
	Underweight	Normal	Overweight	Obese	
Age	32.1±2.2	28.0±6.6	31.5±6.4	33.9±4.2	<0.001
Marital status Married Single separated	 29 10 0	 109 59 10	 25 15 10	 43 5 0	<0.001
Education level None Primary Secondary College	 0 24 15 0	 5 128 25 20	 0 35 10 5	 0 38 10 0	0.004
Occupation Formal employment Informal employment Unemployed Others	 0 0 39 0	 5 15 148 5	 0 20 30 0	 0 15 33 0	<0.001
Income 0-1999 2000-3999 4000-5999 6000-7999 8000-9999 >10000	 15 19 0 0 0 5	 44 64 25 15 10 10	 15 15 15 0 5 0	 10 18 20 0 0 0	<0.001
Food diversity No Yes	 28 11	 118 70	 37 13	 31 22	0.266

Table 6: Logistic regression of the factors associated with underweight

Variable	B	S.E.	Wald	Sig.	OR(95% CI)
Age	0.07	0.032	4.754	0.029	1.072(1.007-1.142)
Level of education =>secondary	-0.797	0.390	4.171	0.041	0.451(0.210-0.968)
Income	-0.427	0.552	0.599	0.439	0.653(0.221-1.924)

As indicated in table 6, controlling for income, age and level of education were significant predictors of underweight ($p<0.05$). A unit increase in age increases the chances of being underweight (OR: 95%CI, 1.072:1.007-1.142). Higher level of education was associated with lower chances of being underweight (OR: 95%CI, 0.451:0.210-0.968).

DISCUSSION

Prevalence of protein Energy Malnutrition

The prevalence of protein and energy malnutrition (PEM) reported as 44.9% in the study is higher compared to national of PEM which was estimated to be 27% for women (Ngare, *et al*., 1999). In Kenya, a vast part of the country is not endowed with agricultural potentials because of the climate and the fertility of land including large parts of Keiyo District. Statistics show that the vast majority of the population live in poverty without resources required to meet human needs, has a low life expectancy and a heavy burden of diseases (Taylor, 1998), making many mothers prone to malnutrition

The results revealed that energy, proteins, iron and vitamin A were inadequately taken during the survey. This confirms findings from a study by (Arimond *et al.,* 2010) that there is an association between dietary diversity and micronutrient adequacy of diets of women of reproductive age as assessed in five developing countries. The divisions being in an arid and semi-arid area are not agriculturally endowed with only 28% of the land being arable (GoK, 2002). This implies that the foods produced from the farms cannot sustain the households for long. As a result families are forced to economically use what is available.

The findings indicated that the women of child bearing age who had inadequate intakes of the nutrients were from households that were diet diverse in the survey. These results agree with Ssewanyana (2003)

In this study, it was found that the proportion of households that consumed a diversified diet was low (36%). This is consistent with a study done by Kennedy and Meyers, (2005) which indicated that those in resource-poor environments across the globe, low quality monotonous diets are the norm and that those most likely to suffer from deficiencies include infants, young children, adolescent girls and women of reproductive age

The study also found that majority of the respondents had inadequate intake of nutrients.

The estimated protein, energy, Vitamin A, Iron and Zinc were significantly higher than RDA. They were similar to those found in other populations (Suitor et al. 1989; Rose & Tschirley 2003) probably because of the consumption of animal protein by this population that was acquired from their farms.

As Folate deficiency may generate anaemia (Green & Miller 1999) or even foetal neural tube defects (Bower & Stanley 1989), the low consumptions of folate could expose this population to a high risk during pregnancy. This deficiency could be more severe if iron bioavailability is taken into account. Even worse in this case where the consumption of vitamin C, an enhancer of non-hemic iron absorption (Hallberg *et al*. 1989) was insufficient in this population.

Several studies done in Korea have already reported that a considerable proportion of women of childbearing age were marginally folate-deficient (Ahn *et al.*, 2002; Hyun *et al.*, 1999; Lim *et al.*, 2000).

An association was seen between nutrition status and age, marital status, education level and income level. This was in accord with a study done by De Onosis *et al*., (2000) where it was reported that nutrition had a significant effect on the nutritional status of many parents. Furthermore De Onosis *et al* (2000) in his report argued that educated spouse were more likely to have an increased knowledge on nutrition and therefore there is a reduced risk in underfeeding the family. The study further suggested that educated women would tend to utilise their income on a variety of food thus ensuring proper combination of food. The women's education level had a significant impact on dietary intake especially protein in this study. There was a positive effect on diet quality when women attended school. The same observations have been described in pregnant Finnish women by (Erkkola *et al*. 1998), Indian women by (Panwar & Punia 1998).

CONCLUSION AND RECOMMENDATIONS

While the focus of attention in the field of nutrition continues to be on the substantial proportion of women with a chronic energy deficiency, the problem of protein-energy malnutrition in the women of child bearing age cannot be ignored. This study has shown protein-energy malnutrition is present in the region, with important public health implications for the burden of diseases associated with the status. Energy, proteins, zinc, iron and

vitamin A were inadequately taken. Although the factors associated with protein-energy malnutrition are very similar, the challenges and solutions required to, tackle the extremes of underweight are not. Hence, information and health education programs for women are needed to help them to understand the components of a healthy diet and to ensure adequate access to health services. Proportion of households that consumed a diversified diet was low.

An association was seen between nutrition status and age, marital status, education level and income level. Overcoming the barriers in order to achieve improved nutrition, in this group requires multidisciplinary collaborations of health care providers, academics, professional organisations, policy makers, and industry and service users. Based on the finding from this study it is recommended that:

There is need for more focus on nutrition of women of reproductive age in semi-arid areas and therefore more emphasis should be placed on this. Nutrition should be a societal responsibility and requires a multi-sectoral, collaborative approach. There is need to encourage and train the community on the importance of girl education.

More needs to be done at a policy level, both with regards to enabling these women access to optimal nutrition and in modifying the nutrition message that they receive. Interventions that aim at encouraging changes in lifestyle should incorporate measures to improve the socio-economic circumstances of their families for instance by promoting irrigation systems and providing drought resistant crops to the community. Only once this is achieved can nutrition among these women be significantly and sustainably optimised.

Finally further research studies on socio-cultural practices and dietary practices that influence women of reproductive age nutritional status should be carried out .

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