

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.

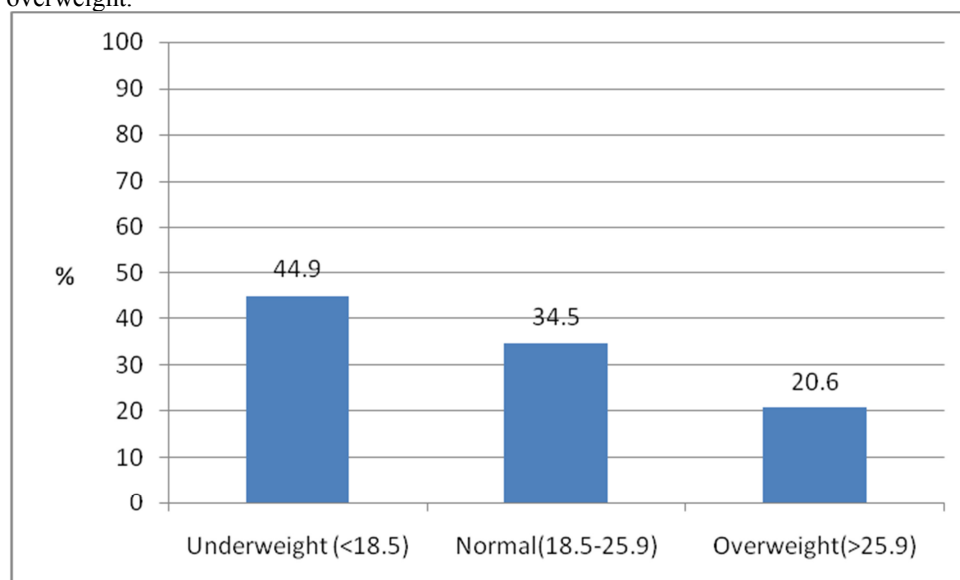


Fig.3: PEM Among the women of child bearing age in Keiyo households (WHO cut offs <18.5)

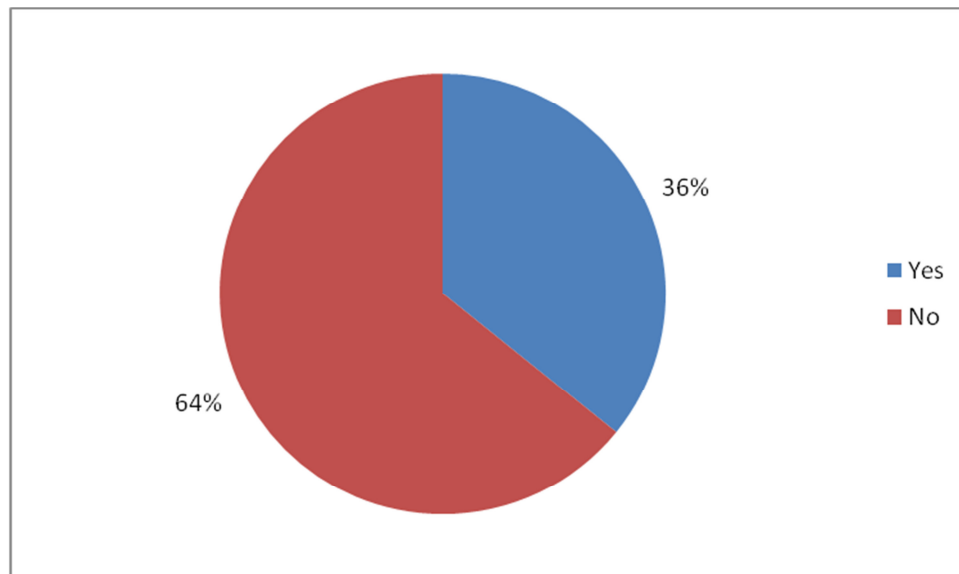


Fig4 : Dietary diversity

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

Factor	Protein		p-value
	Adequate	Inadequate	
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	153	58	0.084
Single	78	16	
separated	13	7	
Education level			
None	3	2	0.864
Primary	173	57	
Secondary	46	14	
College	22	8	
Occupation			
Formal employment	3	2	0.26
Informal employment	39	11	
Unemployed	195	68	
Others	4	1	
Food diversity			
No	157	54	0.596
Yes	92	27	

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	29	109	25	43	<0.001
Single	10	59	15	5	
separated	0	10	10	0	
Education level					
None	0	5	0	0	0.004
Primary	24	128	35	38	
Secondary	15	25	10	10	
College	0	20	5	0	
Occupation					
Formal employment	0	5	0	0	<0.001
Informal employment	0	15	20	15	
Unemployed	39	148	30	33	
Others	0	5	0	0	
Income					
0-1999	15	44	15	10	<0.001
2000-3999	19	64	15	18	
4000-5999	0	25	15	20	
6000-7999	0	15	0	0	
8000-9999	0	10	5	0	
>10000	5	10	0	0	
Food diversity					
No	28	118	37	31	0.266
Yes	11	70	13	22	

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 .

References

- Abdullah, M., Wheeler, E. F. (1985). *Seasonal variations in a Bangladesh village*. American Journal of clinical Nutrition 41: 1305-1313.
- Abrahamson, J. H. (1990). *Survey methods in community medicine. Epidemiological studies programme evaluation clinical trials, 4th edition*, Churchill Livingstone.
- ACC/SCN (2000), *4th Report on the world Nutritional Situation-Nutrition Throughout Life Cycle*. Geneva
- Ahn, H.S., Jeong E.Y., Kim S.Y. (2002). *Studies on plasma homocysteine concentration and nutritional status of vitamin B6, B12 and folate in college women*. Korean Journal of Nutrition. 35:37-44.
- Allen, L.H., Black, A.K., Backstrand, J.R., Pelto, G.H., Ely, R.D., Molina, E. & Chavez, A. (1991) *An analytical approach for exploring the importance of dietary quality versus quantity in the growth of mexican children*. Food Nutr. Bull. 13: 95-104.
- Arimond, M., Wiesmann, D., Becquey E., Carriquiry, A., Daniels, M., Deitchler, M., Fanou-Fogny, N., Joseph, M., Kennedy, G., Martin-Prevel, Y. & Torheim, L.E. (2010) *Simple food group diversity indicators predict micronutrient adequacy of women's diets in 5 diverse, resource-poor settings*. Journal of Nutrition 140:11;2059S-2069S.
- Braun, J.K., Henningham, H. and Grantham-McGregor, S. (1992). *Nutrition and child development*. Nottingham, UK: Nottingham Publishers.
- Burgess, J.L., King, F.S., Durmin, L. and Foster, G. (2002). *Community nutrition for Eastern Africa*. African Medical and Research Foundation, Wilson Airport, Nairobi, Kenya.
- Butterworth, C.E. (1993). *Folate status, women's health, pregnancy outcome, and cancer*. Journal of American College of Nutrition 12 :438-41.
- Bower, C., Stanley, F.J.(1986). *Dietary folate as a risk factor for neuraltube defects: evidence from a case-control study in Western Australia*. Med J 1989;150:613-619.
- CBS. (1977). *Urban food purchasing survey*, Nairobi: Central Bureau of Statistics. Published by the Government of Kenya, Nairobi.
- CBS. (1981). *Kenya population census, Nairobi*, Ministry of Planning and National Development. Published by the Government of Kenya, Nairobi. volumes 1
- CBS. (1982). *Third Rural Child Nutrition Survey*, Central Bureau of statistics, Nairobi, Kenya. Government printers, Nairobi.
- CBS. (1995). *Economic Survey*. Central Bureau of statistics, Ministry of Planning and National Development, Nairobi. Government printers, Nairobi.
- CBS. (1997). *Kenya Demographic and Health Survey*. Calverton, Maryland: CBS, MOH, and ORC Macro.
- Chalmer, J. and Lutz, W. (1989). *Presenting survey information*. A guide for health workers, published by International Epidemiological Association.
- Chamber, R., Longhurst, R., Pacey, A. (1981) *Seasonal dimensions to rural poverty*, London Frances Pinter.
- Collins, K. (1996). *Might efforts to increase birthweight in undernourished women do more harm than good?* Lancet. 340: 1021-3.
- Crevioto, J., Delicardie, E. R., (1990). *Mental performance in school, finding after recovery from early severe*

- malnutrition*. American Journal of Diseases of women of child bearing age.
- De Onosis, K.L. (2000). *Improving adolescent and maternal nutrition: an overview of benefits and options*. UNICEF Staff Working Papers. Nutrition Series Number 97-002. New York: UNICEF
- De Onosis, M., Frongillo E.A. and Blossner, M. (2000). “*Is malnutrition declining? An analysis of changes in levels of child malnutrition since 1980*”. Bulletin of the World Health Organization, 78(10): 1222-33.
- Diop, F. (2006). *Supporting Kenya’s vulnerable women of child bearing age*. World volunteer web. Mht. UNV Kenya.
- Durnin, L. and Rahaman, M. (2008). *A time to act: Women’s nutrition and its consequences for child survival and reproductive health in Africa*. Washington, D.C: Academy for Educational Development.
- Durnin, J. V. G. A, Drummond, S. Satyanaranga, K. (1990). *A collaborative EEC study on seasonality and marginal nutrition; the Glasgow- Hyderabad (S. India) Study*. European Journal on Clinical Nutrition 44 (suppl 1): 19-29.
- Encyclopædia Britannica(2010). *Propædia: Outline of Knowledge and Guide to the Britannica, 15th edition.*,
- Erkkola, M., Karppinen, M., Jarvinen, A., Knip, M. & Virtanen, S.M. (1998). *Folate, vitamin D, and iron intakes are low among pregnant Finnish women*. Eur J Clin Nutr 52: 742–748.
- FAO. (1992). *Food and Nutrition: Creating a well-fed world* Published by FAO.
- FAO. (1995). *Food, nutritional and agricultural*, Published by FAO
- Ferro-Luzzi, A., Scaccini, C., Taffases, J., Abera, B., Demeke, T., (1990). *Seasonal energy deficiency in Ethiopia rural women*. Eur J Clinical Nutrition 44 (suppl 1), 7-18.
- Fisher, A. A, Laing, J. E., and Towns, J.W. (1991). *Handbook for family planning operations research and design. Operations Research Population Council*. USA. West publishing company.
- Foeken, S.D. and Hartog, H.K. (1990). *Seminars in paediatric infectious diseases. Department of paediatrics, wake forest university school of medicine, Winston-Salem, NC and the university of Zimbabwe, Harare*.
- Foeken, D. W. J, den Hartog, A P. (1990). *Season, food supply and nutrition in Africa, African Studies Centre, Leiden*. Research Report no. 43
- FAO. (1992). *Food and Nutrition: Creating a well-fed world* Published by FAO.
- Foote, J. A., S. P. Murphy, L. R. Wilkens, P. P. Basiotis, and A. Carlson.(2004) “*Dietary Variety Increases the Probability of Nutrient Adequacy Among Adults.*” Journal of Nutrition 13: 1779-85.
- Foster, G. (2002). *Supporting community efforts to assist orphans in Africa. North England Journal of Medicine. 346: 1907–1910.*
- Garrow, J. S., James, W. P. T., Ralhp, A. (2002), *Human nutrition and dietetics*, Harcourt publishers Ltd. 10th edition.
- Gibson, R. S. (1990). *Principles of nutritional assessment*, Oxford University press. Inc.
- Gibson, R. S. (2007). *Dietary assessment*. In Mann, J and Truswell, A.S. (2nd ed) *Essentials of human nutrition*. Oxford University Press, New York.
- Gibson, R.S. (1990). *Principles of Nutritional Assessment*. New York: Oxford University Press GFHR.
- Gilborn, L. (2002). *The effects of HIV infection and AIDS on women of child bearing age in Africa*. Western Journal of Medicine. 176: 12–14.
- GOK and United Nations women of child bearing age’s Fund (UNICEF). (1997). *Women of child bearing age and women in Kenya – A situation analysis*. Published by GoK and UNICEF Kenya country office, Nairobi.
- GOK. (2002). *Keiyo District Development Plan (BDDP)-2002-2008*, Government printers, Nairobi.
- GOK. (1997). *Keiyo District Development Plan (KDDP)- 1997 –2001*, Government Printers Nairobi.
- GOK. (2003). *Keiyo District Development Plan (2003), Ministry of planning and national development*. Government printer, Nairobi. Times New Roman
- Green, R., Miller, J.(1999). *Folate deficiency beyond megaloblastic anemia: Hyperhomocysteinemia and other manifestations of dysfunctional folate status*. Semin Hematol ;36:47-64.
- Guthrie, H.A and Picciano, M.F. (1995). *Human nutrition*. Von Hoftmann press, USA.
- Hansen, J.D.L and Bac, M. (1999). *Infant nutrition and related issues*’. Oxford University Press, Cape town, South Africa.
- Hoorweg, J., Niemeijer, R., Van Steenberg, W. (1983). *Nutrition survey in Murunga District Kenya. Relationship between ecology, economic and social condition and nutrition state of women of child bearing age*. Leiden; Africa studies centre., Nutrition Intervention Research project, Report no.9.
- Hyun, T.S., Han, Y.H., Lim, E.Y.(1999). *Blood folate level determined by a microplate reader and folate intake measured by a weighed food record*. Korean Journal of Community Nutrition. 1999;4:512–520.
- Jackson, A. (2003). Protein. In Mann, J and Truswell, A.S. (2nd ed) *Essentials of human nutrition*. Oxford University Press, New York: 55-77.
- James, P., Norum, K. R., Smitasiri, S., Swaminathan, M. S., Tagwireyi, J., Uauy, R. & ul Haq, M. (2000)

- ACC/SCN. *Ending Malnutrition by 2020: an agenda for change in the millennium*. Food Nutr. Bull. 21(Suppl.):1-88.
- Johns, T. (2003): Plant biodiversity and malnutrition: Simple solutions to complex problems. *Afr. J Food Agr. Nutr. Dev.* 3, 45-52.
- Kaikitahi, T. J. and Kalule, T. (2000): *Disrict Plan of Action for Kabale: A Technical paper for FAO*. Published by FAO.
- Kennedy, E., and Meyers L. (2005): *Dietary Reference Intakes: Development and Uses for Assessment of Micronutrient Status of Women—A Global Perspective.* American Journal of Clinical Nutrition 81 : 1194S-97S.
- King, N.B. and Burgess, K.V. (2007): *Delivering essential micronutriments*. A review. Journal of Nutrition. 133: 254-259.
- Kigutha, G.N., Karanja, H., Monda, J.L., Oyombe, K.H. (1992). *Food deficiency during maternal nutrition in Kenya. Journal of Dietetics.* 176: 122-129.
- Kigutha, H.N. (1992). *Effect of season on food consumption and nutritional status of smallholder rural households in Nakuru District*, Report No. 42, Ministry of Planning and National Development, Nairobi 9-40.
- Kigutha, H. N., Waiyaki, L. N., Karani, E. K. and Nassiuma, D. K. (1989). *Breast milk and infant nutrition in relation to early infant growth in Njoro Kenya*. East African Medical Journal 66 (11): 707-714.
- King, F.S. and Burgess, A. (1992). *Nutrition for developing countries* 2nd Ed. Oxford University Press U.K.
- Kliest, T. (1985), *Regional and seasonal food problem in Kenya*. Nairobi/Leiden: Ministry of Planning and National Development/Africa studies centre, Food and nutrition studies Programme, Report No, 10.
- Koul, L. (1992). *Methodology in educational research*. New Delhi: Vikas Press.
- Kramer, M.S, McLean F.H, Eason, E.L, Usher, R.H.(1992). *Maternal nutrition and spontaneous preterm birth. Am J Epidemiol*;136:574-83
- Kumar, S. K. (1988). *Effect of season on food shortage on agricultural production in Zambia*. World Development report 16 (9), 1051-1063.
- Lagua, T. and Claudio, S. (1999). *Nutrition and diet therapy dictionary (3rd ed)*. Chapman and Hall, New York.
- Leslie, J. (1991). *Women's nutrition: the key to improving family health in developing countries?* Health Pol Plan ; 6(11):1-19
- Lim, H.S, Jin, H.O, Lee, J.A.(2000). *Dietary intakes and status of folate in Korean women of childbearing potential. Korean Journal of Nutrition.* ;33:296–303.
- Mann, J. and Truswell, A.S., (2002) *Essentials of Human Nutrition* 2nd Edition. Oxford University Press National Bureau of Statistics /U.S Agency for International Development /ORC
- Marek, (1992). *Relationships between malnutrition and poverty. Journal of clinical medicine.* 122: 199-208.
- Martolle, R. (1996), *The role of Nutrition in Economic Development*. Nutrition Reviews 54; S66-S71.
- Maxwell S. (1996). *“Food security: A post-modern perspective”*. Food policy, 41(2): 385-99.
- Maxwell, S. and Smith M. (1992). *“Household food security: A conceptual review”*.. A technical review. Jointly sponsored by UNICEF and IFAD.
- Mbithi, P. and Barnes, C. (1975) *The spontaneous settlement problem in Kenya*. East Africa Literature Bureau, Nairobi, Kenya.
- Mc Neil, G., Payne T., Rivers S. J. P. W, Enos, A. M. T. de Britto, J. J. Mukarji, D. S. (1988). *Socio-economic and seasonal patterns of adult energy nutrition in a South Indian village*. Ecology Food Nutrition 22: 85-95.
- Meilink, H. A. (1987). *Food consumption and prices in Kenya*. A review. Nairobi /Leiden; Ministry of Planning and National Development/ Africa studies centre, food and Nutrition studies Programme. Report no. 21
- National Council for Population and Development (2003) *Central Bureau of Statistics. Kenya demographic and health survey*. Maryland. Macro international, Inc.
- Ngare, D. K. and Muttunga, J. N. (1999), *Prevalence of Malnutrition in Kenya, East African Medical Journal,* 76, 376-380.
- Niemeijer, R, Klaver, W. (1990). *Climate seasonality and growth: longitudinal research in Coast province Kenya*. In Foeken, Supply and nutrition in Africa. Leiden: Africa studies centre, Research report no, 43.
- Niemeijer, R. Geuns, M. Kliest, T. Ogonda, V, Hoorweg, J. (1985). *Nutritional aspect of rice cultivation in Nyanza province Kenya*. Nairobi/Leiden: Ministry of planning and National Development/ Africa studies centre, Food and Nutrition Studies Programme Report no. 14
- Onchere, M. (1987). *Kenya HIV/AIDS Service provision Assessment Survey 2004*. Nairobi, Kenya: National co-ordinating Agency for population and Development, Ministry Of Health statistics, and ORC Macro.
- Onchere, S. R. (1987). *Agricultural and economic characteristics*. In Van Ginnerker J K, Muller A S, Eds, *maternal and child health in rural Kenya; An epidemiological study*, London. Croom Helm; 13-30.

- Onchere, S. R. Slooff, R. (1981). *Nutrition and disease in Machakos district Kenya*. In; chamber R, Longhurst R, pacey A, Eds, seasonal dimensions to rural poverty. London; Frances Pinter.
- Ondiek, M and Ong'ondo, O (2005) *Analysis of integrated approaches used in alleviating socio-economic hardships of orphans and women of child bearing age made vulnerable by HIV/AIDS*. In 2nd book of abstracts.
- Panwar, B. and D. Punia, 1998. *Food intake of rural pregnant women of haryana state, Northern India: Relationship with education and income*. *Int. J. Food Sci. Nutr.*, 49: 243-247.
- Pelletier, D.L , Frongillo, E. A, Schroeder, D. G. and .Habicht, J. P. (1994), *A methodology for estimating the contribution of malnutrition to child mortality in developing countries*. *Journal of Nutrition* 124 (10 suppl.):2106s-2122s.
- Popkin, B.M. & Bisgrove, E.Z. (1988). *Urbanization and nutrition in low-income countries*. *Food Nutr. Bull.* 10: 3–23.
- ROK, (1981). *Sessional paper number 4 on National Food Policy*, Government printers, Nairobi.
- ROK. (1984). *Development plan 1984-1988*, Government printers, Nairobi, Kenya.
- ROK. (1989). *Proceeding on the second national workshop in population and development*, Nairobi: Ministry of Home Affairs, Nairobi, Kenya. Government printers.
- ROK. (1996). *Development plan 1994-1996*, Government printerS, Nairobi.
- Rosegrant W.M. and Cline A.S (2003). *Global food security: Challenges and policies* Science vol. 302
- Rotimi CN, Cooper RS, Ataman SL,(1995) *Distribution of anthropometric variables and the prevalence of obesity in populations of West African origin*. *Obes Res*,3(suppl 2).95S-105S.
- Schofields, J. S. (1974), *Seasonal factors affecting nutritional in different age groups and especially pre- school women of child bearing age*. *Journal on Development. Studies* 2 (1), 22-40.
- Schultink, W. J. Klaver, W. Van Wijk, H. Van Raaij, J. M. A, Hautvast, J. G. A. J. (1990). *Body weight changes and basal metabolic rates of rural Beninese women during seasons with different energy intakes*. *European Journal on Clinical Nutrition* 44 (Suppl 1) 31-40.
- Sehmi, J.K.(1993) *National Food Composition Tables and the Planning of Satisfactory Diets in Kenya*. Nairobi: Ministry of Health.
- .Shah, M. M. Frohberg, H. (1980), *Food consumption pattern in Keiyo Kenya*. Laxenburg: International Institute for Applied Systems Analysis, working paper 8-13.
- Shetty, K.L., Maricht, M., Donaldson, B.T. and Richmond, S.K. (2003). *Assessment of the impact of intervention strategies in populations*. *Journal of Population studies*. 122: 111-119.
- Smart, M.N. (2003). *Child health*. African Medical and Research Foundation, Wilson Airport, Nairobi.
- Sswanyana, N. S, (2003). *Food security and child nutrition status among poor households in Uganda: Implications for poverty alleviation*. AERC Research paper 130, African Economic Research Consortium, Nairobi.
- Taylor, A. (1998), *A Review of the Causes and Discussion of Programming Implications, Save The Women of child bearing age* Fund (UK), (8-9, 53,67 and 86-89).
- Taylor, K.L. (1998). *Infant feeding*. In Mann, J and Truswell, A.S. (2nd ed) *Essentials of human nutrition*. Oxford University Press, New York.
- Tinker, A., Hoop-Bender, P. S., Bustreo, F., Bell, R.(2005). *A Continuum of Care to Save Newborn Lives*. *Lancet*. ;365(9462):822. –52.
- Tinker, A. Ransom, E. (2002): *Healthy Mothers and Healthy Newborns: The Vital Link*. Washington DC: Population Reference Bureau.
- Tomkins, A. (1981), *Seasonal health problems in the Zaria region*. In chambers R, Longhurst R, paley A, Eds. Seasonal dimensions to rural poverty. London; France Pinter 177-181.
- Torun Bchew, F. (1994). *Protein – energy malnutrition*. In Shils M.E. Olson J.A. Shike M. eds. *Trans R. Soc – Tropical Med Hyg.* 1994 Truswell, S. (2003) '*Protein- energy malnutrition*'. In Mann, J. and Truswell, A.S. (2nd ed) *Essentials of human nutrition*. Oxford University Press, New York.
- Tucker, K.L. (2001): *Eat a variety of healthful foods: old advice with new support*. *Nutr. Rev.* 59, 156-158.
- Tuttle, C. and Truswell, S. (2003) '*Childhood and adolescence*'. In Mann, J. and Truswell, A.S. (2nd ed) *Essentials of human nutrition*. Oxford University Press, New York.
- Underwood, B.A. (1998) *From research to global reality: the micronutrient story*. *J. Nutr.* 128: 145–151.
- Uganda Bureau of Statistics,/US Agency for International Development/ORC Macro, Uganda, (2000-2001). *Nutrition of Young Women of child bearing age and Mothers*, African nutrition Chartbooks, 4, 10-14, 22, 36, 40, 46-56, 58-67.
- UNICEF (1990). *A UNICEF policy Review: Strategy for Improved Nutrition of Women of child bearing age and Women in developing Countries*. New York: United Nations Women of child bearing age's Fund Whitney.
- UNICEF (1998). *The state of the world's women of child bearing age*, UNICEF, Oxford University Press.

- UNICEF (2003). *The state of the world's women of child bearing age*, UNICEF Oxford University Press.
- UNICEF. (1999). *Breastfeeding: foundation for a healthy future*. New York: UNICEF. (2000). *State of the world's women of child bearing age*; New York.
- UNICEF (1995). *The Situation Analysis of Children and Women inIndonesia*. Jakarta: UNICEF Perwakilan Indonesia dan BAPPENAS.
- United Nations (UN), (1989). *ACC/SCN updates on nutrition Situation Recent Trends in Thirty-three countries*, Geneva WHO.
- UNDP, (2003), *Human development report; Millennium development goals; A compact among nations to end Human Poverty*. Published by Oxford University Press.
- Van Ginneken J.K, Muller A.S (2000), *Maternal and child health in rural Kenya; an epidemiological study*. London; Croom Helm; 31-42
- Van-Steenbergen, E.N. and Rolfes, S.F. (1984). *Understanding Nutrition*. Wadsworth group. Thomson learning inc: New York.
- Von Braun J, Bouis H, Kumar S, Pandya-Lorch R. (1992). *Improving food security of the poor; concepts, policy and Programs, IFPRI*, Washington D.C USA: 6-35.
- Von Braun, Joachim T. and Leonardo, P. (1990). *Food in Sub-Saharan Africa trends and policy challenges for the 1990*, Food Policy 15 (6): 505 – 517.
- Wandel, M. (1989). *Household food consumption and seasonal variations in food availability in Sri Lanka*. Ecology Foods Nutrition 22: 169-182.
- Wandel, P.J. (1989). *Increased birthweight after prenatal dietary supplementation of rural African women*. *Am J Clin Nutr.* 46: 912–25.
- Waterlow, J.C. and Anold, E. (1992). *Protein-Energy malnutrition 5TH Edition, child health in the tropics London*.
- WHO/FAO. (1996) *Preparation and use of Food-based Dietary Guidelines*. Nutrition Programme Geneva: WHO.
- WHO. (1986). *Use and interpretation of anthropometric indicators of nutritional status*: Bull World Health Organisation 64, 926-941.
- WHO. (1999). *Report of the WHO informal consultation on the use of chemotherapy for the control of morbidity due to soil-transmitted nematodes in human*.
- WHO. (2000). *Global Database on child growth and malnutrition*. WHO/Department of Nutrition for health and development CH-1211.
- WHO.(2003). *Guiding Principles for Complementary Feeding of the Breastfed Child*. Washington, DC: PAHO.
- WHO. (2002) *Complementary feeding- family foods for breastfed women of child bearing age*.
- WHO and UNICEF, (2000).*Report of Technical Consultation on Infant and Young Women of child bearing age Feeding, Themes, Discussion and Recommendations*, WHO, 1, 4, 6, 8-10 1990.120; 404-410.
- WHO. (2000). *The management of nutrition in major emergencies*. WHO publication, Geneva. 35-40.
- WHO. (2000). *Nutrition for Health and Development: A Global Agenda for Combating Malnutrition - Progress Report*. Geneva: World Health Organization.

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