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Protein-Energy Malnutrition Still Exists in Kenya in the Twenty-First Century

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Abstract: Malnutrition among preschool children is an indicator of underdevelopment and is high in many developing communities. Malnutrition affects performance of children in the later adulthood life. Though determinants of malnutrition vary from region to region, the underlying cause for malnutrition is poverty. A cross-sectional study was conducted to identify prevalence and determinants of nutrition status of preschool children in the Rift Valley in Kenya. Mothers of these children were respondents who provided information on selected variables. Nutrition status was measured by weight-for-age, height-for-age and weight-for-height. General prevalence of malnutrition was still high in this population, with more males than females having poor nutrition status as measured by weight-for-age, height-for-age and weight-for-height. Risk factors for malnutrition in this population were age, sex, education level of the head of household, time taken by women on other household chores (especially collecting fuel wood), number of pregnancies a mother has had, income of the head of household and income from cash crop farming. Education level of household heads could improve nutrition through appreciating the role of good nutrition for child development and availing resources at the household level for adequate nutrition and health. The major determinants of malnutrition included time spent on household chores (30%), income (12%) and gender (10%).

Key words: Malnutrition, education, time use, income, gender, Kenya

INTRODUCTION

Protein-energy malnutrition among preschool children is high in many developing countries. This may lead to retardations in both physical growth and intellectual development in the later years affecting the future national labour force and individuals' work capacity. This decade has witnessed governmental declaration to eradicate hunger and malnutrition (DeClerck *et al*., 2011). The nutrition landscape requires more concerted efforts, especially in the face of heightened global conflicts and displacements. There could be a synergistic relationship between malnutrition, poverty and armed conflict that need to be determined.

More than 1 billion people are chronically underfed (FAO, 2009). Malnutrition remains a significant contributor to reduced economic productivity, poor health, reduced work capacity, poor school performance and attendance amongst others (Grosse and Roy, 2008). Child malnutrition has been associated with various socio-economic determinants including education, income, health, food and agricultural productivity and generally poverty (World Bank, 2006). Malnutrition complicates the efforts to achieve the Millennium Development Goals (Walingo and Musamali, 2008). Many development programs have been set up to address issues of low development after understanding that Malnutrition is a big contributor to the disease burden in many developing countries (Monique, 2012). Malnutrition in children causes an increase in morbidity including higher incidence and severity of diseases that affect normal growth of a preschool child. This in turn has an adverse effect on intellectual ability, with psychological consequences and long term effect of decreased productivity in adulthood. Prevalence of preschool child malnutrition is an indicator of under-development. Extreme weather events associated global climate change is also a significant contributor to malnutrition through low food productivity, harvest, distribution and high food prices (Udani, 1992).

Malnutrition is also the consequence of a combination of inadequate intake of macronutrients, micronutrients and frequent infections (Upadhyaya *et al*., 1992) and is associated with both structural and functional pathology of the brain. Malnutrition results in tissue damage, growth retardation, disorderly differentiation, reduction in synapses and synaptic neurotransmitters, delayed myelination and reduced overall development of dendritic arborization of the developing brain (Upadhyaya *et al*., 1992; Leenstra *et al*., 2005; Levitsky and Strupp, 1995; Bhoomika *et al*., 2008). There are deviations in the temporal sequences of brain maturation, which in turn disturb the formation of neuronal circuits (Upadhyaya *et al*., 1992). Long term alterations in brain function have been reported which could be related to long lasting cognitive impairments associated with malnutrition (Anoop *et al*., 2004).

Risk factors to childhood malnutrition have been variable in different studies, may be due to differences in socioeconomic, cultural and environmental factors in the societies studied (Henry *et al*., 1993; Rikimaru *et al*.,

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1998; Bloss *et al*., 2004). Determinants of malnutrition vary from region to region due to ecological diversity, climatic variation and tribal or ethical differences. Poverty, maternal small height, female gender and absence of hygienic latrines at home were reported as underlying factors in malnutrition of children under the age of 6 years (Sharghi *et al*., 2011). Poor nutrition status of children is associated with increased mortality risk (Horton and Steckel, 2011). Interventions in children below three years of age resulted in increases in height at about 16% (Hoddinott *et al*., 2008). In South East Nigeria, prevalence of malnutrition among pre-school children reportedly for severe acute malnutrition is 4.4% compared to the global prevalence of 9.7% (Manyike *et al*., 2014).

In Khartoum State, Sudan, wasting in children 5-15 years in severe and moderate chronic (stunting) malnutrition was 5 and 15%, respectively. When chronic malnutrition was disaggregated by sex the prevalence was 6.2 and 17.4% in males and 3 and 13% for females. For acute malnutrition (wasting) prevalence was 7% for severe malnutrition and 20% moderate acute malnutrition. However, when this was disaggregated by sex the prevalence was 7 and 20% for severe acute and moderate acute chronic malnutrition in males and 7 and 19% for females, respectively (Musa *et al*., 2013). Information on both nutrition and health both disaggregated by area is crucial in establishment of appropriate interventions. Malnutrition still exists in this century, amidst all the efforts made to eradicating hunger and malnutrition. Pertinently is the determination of the prevalence of malnutrition and the causal factors in different societies for establishment of specific interventions that address the rout causes.

MATERIALS AND METHODS

Study design: The study adopted a cross-sectional survey design to assess the prevalence and the determinants of malnutrition among pre-school children living in the rural areas in Baringo County Kenya.

Study population: A total of 310 preschool children aged between 6 months to 5 years were included in the study. Orphaned preschool children and twins were excluded from the study. The child caretakers were the respondents who provided information child characteristics. These caretakers also provided information on household characteristics. Most of the child caretakers were the mothers of the children.

Household and child characteristics: Data was collected through physical examination and gathering of health history for each index child. A detailed interview schedule was used to gather information on household socio-economic status, morbidity, maternal time use, agro-economic, bio-demographic and environmental factors. The child caretakers provided detailed information on the household characteristics and the health history of the child.

Anthropometric assessment: The age of the child was confirmed from both the birth certificates and baptismal cards of the child. Height was measured using a length board for children below 2 years and the height meter for children above 2 years to the nearest 0.1 cm. Salter scale was used to measure the weight of children below 2 years and the bathroom scale for children above 2 years to the nearest 0.1 kg.

Diagnostic methods: Malnutrition was assessed by weight-for-age (under-nutrition), height-for-age (stunting) and weight-for-height (wasting) by anthropometric indices with reference to the National Centre of Health Statistics (NCHS) standards of growth and development (Musa *et al*., 2013). Stunting as well as stunting and wasting were taken as indices of moderate to severe malnutrition. Height-for-age and weight-for-height measures of each participant were compared to age and grade appropriate norms with reference to the NCHS standards of growth and development. Height-for-age and weight-for-height scores of less than 2 standard deviation [-2 SD] from the median was considered as indicative of moderate to severe malnutrition. The z-scores were used for classification of the pre-school children to the different categories of malnutrition.

Data analysis: Data analysis was done using the Statistical Package for Social Sciences (SPSS) version 19 (Chicago IL). Correlation of household data with anthropometric information and multiple regressions of factors that correlated with nutritional status were carried out. Multiple regressions was done to identify possible determinant of nutritional status.

A p-value of <0.5 was regarded as significant.

RESULTS

Demographic characteristics of households and pre-school children: The demographic characteristics of households are detailed in Table 1. The study population was 1653 people in index households with sex ratio of 1:1 male: female. Average number of children per household was four. A total of 310 pre-school children were the subjects of the study with a sex ratio of 48% male and 52% females. In the age range of 15-44 year olds, sex ratio was 1:2 male: female. Dependency ratio was 1:2 with an average household size of 6 people.

From the subjects, 17% were less than 12 months, 43% were in the age range of 12-23 months and 40% were above 23 months old. These children were from married families with few from widowed (0.2%) households.

About 31% of the children had been ill two weeks prior to the study period. Prevalence of illness was highest in preschool children aged 6-12 months.

Morbidity among the pre-school children: Most of the children had been ill in the previous two weeks prior to the survey. The common symptoms exhibited by the children were diarrhea (8%), fever (20%), vomiting (7%) and difficult breathing (4%).

Agricultural characteristics of households: The socio-economic characteristics of households are detailed in Table 1. About 9.7% of the households did not own any land while only 7.1% owned more than 4 hectares of land. Majority of the households (40%) owned between 0.8-<2 hectares of land, 23% owned between 2-4 hectares and 20% had less than 0.8 hectares. While 10% households did not cultivate their land, 80% cultivated upto 2 hectares while 8.6% cultivated more than 2 hectares.

About 79% of the households grew beans, 7% grew maize, 16% grew millets/sorghum for household consumption. Only about 15% of the households grew cash crops (coffee 14% and pyrethrum 1%). About 45% and 21% of the households purchased maize and beans, respectively due to low stock volume. The average amounts harvested were 641 kgs maize, 108 kgs beans and 36kgs millet. The households kept livestock that included cows 68%, goats/sheep 41% and chicken 60%.

Socio-economic characteristics of households: Socio-economic characteristics of households are detailed in Table 1. Education level of the parents was on average basic with most 14.2% males and 16.3% females illiterate. Basic primary education level was at 59.3% for males and 68.9% for females. More males (23.5%) had secondary education than females (13.7%), with no male attaining post-secondary education compared to 1.1% females.

Most of the females (84.8%) compared to 32.1% males worked on family farms. More males (18.7%) than females (1.5%) were casual labourers, 8.2% males and 2.7% females were self-employed. However, 41% males than females 11% were regularly employed. Most of these families lived in mud houses.

Income level of this group was very low with 52.8% having no real income compared with 87% females. While only 4.1% males and 1.1% females earned more than 24 US dollars a month, 42% males and 8.7% females earned between 6-24 dollars a month.

Availability of water in household during the wet and dry seasons: The sources of water for this community included piped water, river/well/pond, rain water and purchase from vendors. A comparison was made to establish the type of the source of water and the distance traveled to the water source during both the dry and wet seasons.

The most common source of water was river-well during both the wet season (90.6%) and the dry season (91.4%). About 90% of the mothers traveled less than 2km to the water source during the wet season compared to 74% during the dry season. Only 3% of the households relied on rain water catchment in the wet

Table 1: Socio-demographic and agro-economic characteristics of households

Number of pregnancies (%)		
<2	27	
Between 2 and 4	26	
Between 5 and Six	26	
>6	21	
Number of live children		
>2	28	
Between 2-4	29	
Between 5-6	25	
>6	18	
Morbidity (%)		
Diarrhea	8	
Fever	20	
Vomiting	7	
Difficult breathing	4	
Land ownership (%)		Amount of land cultivated
No land	9.7	10.7
<0.8 Ha.	20.2	42.7
0.8-<2 Ha.	39.7	37.8
2-4 Ha.	23.2	7.1
>4 Ha	7.1	1.5
Crop production (%)		Amounts harvested (kg)
Coffee	14	
Pyrethrum	1	
Millet/sorghum	16	36
Maize	7	641
Beans	79	107.9
Livestock ownership (%)		
Cows	68	
Goats/sheep	41	
Chicken	60	
Household income (US Dollar)	Head of Household	Mothers
No income	52.8	87
<7 per month	1.9	3
Between 6-12 per month	17.2	2.3
Between 12-24 per month	24	7.6
>24	4.1	1.1
Education levels (%)		
No formal education	14.2	16.3
Primary	59.3	68.9
Secondary	23.5	13.7
Post secondary	0	1.1
Occupation (%)		
Farmers	32.1	84.8
Casual worker	18.7	1.5
Regularly employed	41	11
Self employed	8.2	2.7
Type of shelter (%)		
Grass thatched	55	
Mud floors	77	
Kitchen	78	

Table 2: Nutritional status of preschool children

		Measure of nutritional status								
Personal characteristics		Weight-for-age			Height-for-age			Weight-for-Height		
Sex	Number	<-2sd	-2sd to +2sd	>+2sd	<-2sd	-2sd to +2sd	>+2sd	<-2sd	-2sd to +2sd	>+2sd
Male	150	24.7	74.7	0.6	30	61.3	8.7	18.7	76.0	5.3
Female	160	12.5	86.9	0.6	26.2	68.8	5.0	8.0	84.0	8.0
Age (months)										
5 to 12	52	9.6	88.5	1.9	28.8	69.2	2.0	9.6	63.5	26.9
12 to 24	132	17.4	81.8	0.8	34.8	56.1	9.1	12.8	81.1	6.1
24-40	126	23.0	77.0	0.0	20.6	73.0	6.4	14.3	85.7	0.0

season compare with only 0.4% in the dry season. A further 0.4 of the households purchased water in both seasons.

Most caretakers traveled for less than 2kms to water source in the wet season (89.9%) and in the dry season (73.8%). About 7% of the caretakers traveled between 2-4kms wet season compared to 12% caretakers in the dry season. However 2.9% and 14.2% of the caretakers traveled more than 4kms in the wet season and dry season, respectively to the source of water.

Time use by caretakers on selected household activities: Time use by caretakers was measured for selected on selected household activities that included water collection both in the wet and dry seasons, farm work, food preparation and gathering of fuel wood.

Average time spent on collecting water was 3 h/day during the dry season and one hour per day in the wet season. Mothers spent on average two hours and one hour per day respectively to collect fuel wood and to prepare meals for the family. Concept of time was different in this community as an activity that took less than an hour to perform was difficult to measure.

The most strenuous activity took more than 120 min and involved: water collection in the wet season (19.9% households), dry season (3.6%), farm work (82%), food preparation (4.8%) and gathering of fuelwood (22.5%). The least time spent on any activity was less than one hour: collecting water in the wet (46.8%) and dry (64.4%) seasons, farm work 4.9%, food preparation 66% and gathering fuel wood 33.3%. Households spent 60-120 minutes as follows 33.3% in wet and 31.9% in dry season, 13.1% on farm work, 29.2% on food preparation and 44.2% gathering fuel wood.

Food intake of preschool children: Preschool children were fed on family meals at least three times a day. One hundred percent households served breakfast, 96.6% served lunch and supper to the pre-school children. While 66% served them a midmorning meal only 54% served an afternoon snack. The most common food served to children for breakfast was milk (66%), porridge (25%) and eggs (11%). Vegetables were commonly served for lunch (100%) and supper (86%) with *ugali* (45% lunch and 86% supper). Meat was served for supper in 86% households. The most common snacks were milk (54%), porridge (19%), eggs (13%) and tea (8%).

Nutritional status of preschool children: Prevalence of malnutrition as measured by weight-for-age, height-for-age and weight-for-height by age is presented in Table 2. The general prevalence of malnutrition among of the preschool children revealed 18.4% under-nourishment, 28.2% stunting and 12.9% wasting. Children with Z-scores less than -2 standard deviation of the NCHS standard were considered malnourished. Under-nutrition was measured by weight-for-age and was more prevalent (23%) among preschool children aged 24-40 months and less among the 5-12 months old preschool children (9.6%). More males (24.7%) than females (12.2%) were under-nourished.

Stunting was measured by height-for-age with more males (30%) than females (26%) stunted. Stunting was more prevalent in the 5-12 months old (34.8%) and less among the 24-40 months old children (20.6%). Further, more males (18.7%) than females (8%) were wasted. Wasting was highest among the 24-40 months old (14.3%). Males suffered poor nutrition status by all indices for malnutrition. The prevalence for malnutrition of 18.4% was lower than the national prevalence of 25% and was lower than that reported in the ASAL project area (21-29%). However, levels of stunting and wasting were higher than the national average.

Determinants of nutrition status: Most factors were associated with weight-for-age of a child. A positive significant association was found between low weight-for-age and income, income of head of household, income from sale of cash crops, land size, occupation of head of household, morbidity (vomiting and diarrhoea), sex and age of a child ($p<0.05$). The morbidity prevalence was higher in children less than a year old than in those over one year of age. The education level of the head of the household was significantly associated with weight-for-age at $p<0.001$. Other variables included the distance traveled to the water source during the dry season, time taken to gather fuel wood and total time spent on all selected household chores. A negative association was found between time

taken to get water during the dry season and height-for-age ($p<0.05$). There was a significant association ($p<0.001$) between the number of pregnancies a mother had with weight-for-age of preschool children.

The factors that were associated with malnutrition were fitted in the multiple regression models to identify the most probable determinants of malnutrition in this population. These factors included the following: income of the head of the household, number of live children, land size, sex, occupation of the head of household, income from sale of cash crops, total household income, morbidity (diarrhoea and vomiting), distance to source of water and time spent on household activities. The most probable causes of malnutrition were household income, time spent by the mother on chores and sex of child. Time spent on household chores contributed about 30%, income 12% and sex 10% to preschool child malnutrition.

DISCUSSION

There was a significant and negative association between weight-for-age and age of a preschool child ($p<0.05$). Prevalence of wasting and stunting in all age groups was above the national average. Prevalence of malnutrition increased with age and was highest among preschool children in the age range 12-40 months. The general prevalence of malnutrition was 18.4% under-nutrition, 28.2% stunting and 12.9% wasting and was highest in males than females. There were no cases of severe malnutrition in this population as seen in Nigeria (4.4%) and a global prevalence of 9.7% (Manyike *et al*., 2014). High prevalence of all forms of malnutrition among males was also reported in Sudan's Khartoum province (Musa *et al*., 2013). Malnutrition was more prevalent amongst males than females and was high among 12-40 months age category. Age and sex of a preschool child still remain major determinants of malnutrition. Gender has been reported as one of the underlying factors in malnutrition of children under the age of 6 years (Sharghi *et al*., 2011).

Poor hygiene (Sharghi *et al*., 2011) in food preparation precipitates diarrhoea and other infections that increase nutritional needs. However, determinants of malnutrition vary from region to region due to ecological, climatic and ethnic diversity. Poor nutrition status of children is associated with increased mortality (Horton and Steckel, 2011) morbidity risk. Interventions in children below three years of age resulted in increases in height at about 16% (Hoddinott *et al*., 2008). In South East Nigeria, prevalence of malnutrition among pre-school children reportedly for severe acute malnutrition was 4.4% compared to the global prevalence of 9.7% (Manyike *et al*., 2014).

The times taken to draw water during the dry season and to collect fuel wood were important determinants of nutritional status. Over half of the households spent more than one hour to get water especially during the dry season.

The time spent on collecting fuel wood was significantly associated with malnutrition. Fuel wood has become very scarce yet it is the most common source of cooking fuel in Kenyan rural communities. The cumulative effect of time spent on various household chores was negatively associated with nutritional status. Mothers had less time for childcare and for performing food related activities within a household, affecting the nutritional status of its children.

Income of the head of household was a very significant factor in the aetiology of malnutrition. This remained true even when total income of household was considered. However, maternal income was not related to nutritional status. It is possible that even where a mother has her own income, the head of the household retains control over it making her still dependent on the man. Households with higher income tended to have better the nutritional status of its children. Income from cash crops was positively associated ($p<0.05$) with nutritional status. Though occupations of both parents did not relate to nutritional status, occupation of the head of the household was associated with malnutrition. Poverty remains one of the major underlying factors for malnutrition (Sharghi *et al*., 2011). While more than 1 billion people were chronically underfed (FAO, 2009), the situation will worsen with escalations in international terrorism coupled with community displacements that in turn affect all economic and agricultural activities. Serious interventions will be required especially with extreme weather events associated with global climate change that affect food productivity, harvest, distribution and high food prices (Udani, 1992).

Malnutrition is a big contributor to the disease burden in many developing countries (Monique, 2012), with increased in morbidity including higher incidence and severity of diseases that affect normal growth of a preschool child. This in turn has an adverse effect on intellectual ability, with psychological consequences and long term effect of decreased productivity in adulthood. Prevalence of preschool child malnutrition is an indicator of under-development. Malnutrition remain a significant contributor to reduced economic productivity, poor health, reduced work capacity, poor school performance and attendance amongst others (FAO, 2009) and has been associated with various socio-economic determinants including education, income, health and poverty (World Bank, 2006). Malnutrition rate partially reflects the failed synergy between inadequate dietary intake and unhealthy environments.

Conclusion: The determinants of nutritional status in this population were age and sex of a child, household income, father's level of education, income of head of household and maternal time availability as measured

by time taken to get firewood which is the main source of fuel. Other factors which are of importance are distance to the source of water during the dry season and morbidity experience of an individual child. Targeted interventions are necessary to reduce the effects of poverty and illiteracy in households to encourage productivity that restore human dignity.

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