Dietary diversity, nutrition status and morbidity of pre-school children in Matungu division, Western Kenya

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Abstract: This cross-sectional survey was to determine dietary diversity, nutrient intake, nutrition status and prevalence of childhood illnesses among pre-school children in Matungu division, Western Kenya. A total of 144 households were arrived at using multistage sampling, structured questionnaires with food frequency tables and 24-hour recalls were administered and anthropometric measurements taken. Linear regression tested statistical associations between variables. Epi Info was used to compute nutrition indices later assessed relative to National Centre for Health Statistics and World Health Organization. Only 3% of pre-school children had consumed highly diversified diets and consumption. Stunting was the most prevalent form of malnutrition and malaria was the most prevalent childhood infection. About 7%, 3.6% and 8.1% of changes in underweight, stunting and wasting, respectively, could be attributed to changes in dietary diversity. An r^2 of 0.284 was obtained between nutrition status and morbidity. To enhance children's nutrition and health status, efforts should be on strategies that increase dietary diversity.

Keywords: dietary diversity; nutrition status; childhood illnesses; pre-school children; Western Kenya.

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1 Introduction

A diversity of food items mutually reinforces each other's nutrition benefits by enhancing the body's ability to absorb essential nutrients, and enhancing health and nutrition status (Emile, 2004). Most developing countries are facing economic and environmental changes. This has led to increased simplification of diets by a large number of people to a limited number of high-energy foods, which present a precedence obstacle to health. Diversifying local diets helps in providing essential macronutrients and micronutrients, such as vitamin A, vitamin C, iron, zinc and calcium that help nourish children. These micronutrients also strengthen the immune system that fights diseases and infections like diarrhoea, acute respiratory infections, malaria and tuberculosis that are the major causes of child mortality in developing countries (ACC/SCN, 2004). This was a cross-sectional survey that incorporated both quantitative and qualitative analysis. The study was carried out in Matungu division, Butere/Mumias district, Western Kenya. In Butere/Mumias district, sugarcane occupies 68% of arable land and the district has been facing a rising trend in food insecurity. Of the people, 60% are food insecure and the major reason given is overreliance on one cash crop (sugarcane). The division is faced with several health problems such as malnutrition, malaria, acute respiratory infections, skin diseases and diarrhoeal diseases with under five mortality rate of 156 deaths per 1,000 live births (Government of Kenya, 2002). Although the divisional and district data on levels of malnutrition is scanty, Matungu division is in Western Kenya where prevalences of stunting, wasting and underweight have been recorded as 30.3%, 4.2% and 18.6%, respectively. Since dietary diversity is essential for health (Pillay, 2003), giving children enough nutrients and from a variety of sources, would reduce the incidence and severity of these illnesses.

2 Methodologies

The study involved households with pre-school children between 2–5 years. Butere/Mumias district had a total population of 476%, 928% and 12.2% (58,185) of them were pre-school (Government of Kenya, 2002). Fisher's formula was used to come up with a sample of 144 households. Multistage sampling was used in selection of locations and villages to be included in the survey. Households with pre-school children in the sampled villages were listed and systematic random sampling was used to select the specific 144 households. Food frequency questionnaires were used to obtain information on dietary diversity of meals consumed by the pre-school children. A 24-hour diet recall was administered to a subsample of 41 households with pre-school children to acquire information on nutrient intake. The respondents included mothers of the children and in some cases, caregivers (grandmother or any other responsible adult). Anthropometric measurements: height and weight were taken using standard procedures. Dietary diversity was measured in terms of different/unique foods consumed within a reference period of seven days preceding the study. Consumption of more than 23 food varieties was considered as high dietary diversity, consumption of between 18 and 22 was moderate dietary diversity, 13–17 was low dietary diversity, while <13 was very low dietary diversity (FANTA, 2004). Nutrient intake was measured after conversion of data on 24-hour diet recall into nutrients using Kenyan food composition tables developed by Harvey (1951) and Sehmi (1993). Morbidity level of pre-school children was measured by finding out the number of episodes of childhood infections: diarrhoea, malaria and acute respiratory illnesses (ARI) in the last two months preceding the survey. Nutrition status was measured by levels of wasting, stunting and underweight. WHO/NCHS *Z*-score cut-off points were used for classification.

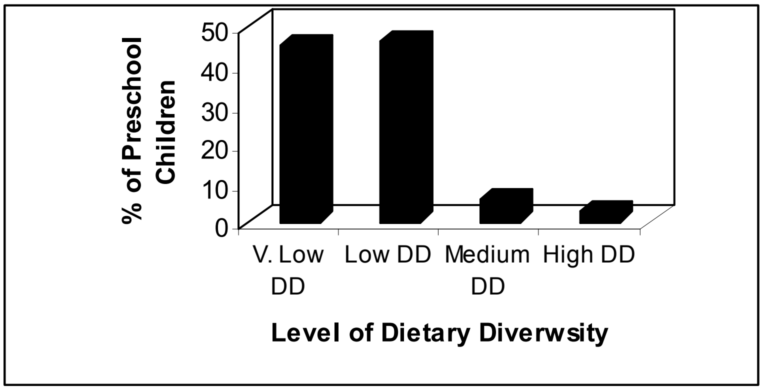
Frequency tables, charts and graphs were used to summarise data on dietary diversity, nutrition status and prevalence of infections. Food composition tables were used to convert the quantities of food taken into nutrients. Tests of proportion were used to show how many pre-school children consume meals that are well diversified. Epi Info software program was used to get the *Z*-scores. Using the Statistical Package for the Social Sciences (SPSS), linear regression was used to show the effect of dietary diversity on nutrition status and morbidity.

3 Results and discussion

3.1 Dietary diversity

Although dietary diversity is widely recognised as a key element of high-quality diets (Jamalludin, 2004; Were, 1989), only 3% of the pre-school children had consumed highly diversified diets and 45% of the pre-school children had very low-dietary diversity (Figure 1).

Figure 1 Dietary diversity of pre-school children based on food items consumed in one week, $N = 144$



Since studies have shown that dietary diversity is significantly associated with nutritional status indicators among children below five years (Onyango et al., 1998; Ruel, 2002) and that an increase in dietary diversity is associated with socioeconomic status and household food security (household energy availability) (Hoddinott and Yisehac, 2002). The low dietary diversity observed in this survey indicates that majority of the children come from poor food insecure households that are not able to meet the nutrient needs of households members leave alone the vulnerable groups like children below five years.

3.2 *Diversity of food variety in each group*

Eight food groups were considered in the study, these were breads and cereals, roots and tubers, pulses and nuts, vegetables, fruits, meat and meat products (including fish), milk and milk products, and fats and oils. Table 1 shows the percentage of pre-school children in relation to consumption of foods from the eight food groups.

The breads and cereals that could be obtained by the community were maize, sorghum, millet, rice and wheat. All the pre-school children had consumed at least one food item from this group and 3.5% of them had consumed more than five varieties. It is, therefore, evident that the diets of pre-school children are predominantly based on starchy cereals (Were, 1989). Roots and tubers are good sources of carbohydrates, some of them like the yellow-flesh sweet potatoes are good sources of vitamin A (FAO, 2004). Studies have also shown that several roots and tubers grow within this region; they include cassava, sweet potatoes and yams (Ekesa et al., 2008). However, the consumption of roots and tubers was low, 9% of the children had not consumed any roots or tubers in the last week preceding the study (Table 1). This could be due to changing food habits where sources of carbohydrates are now limited to three main crops: maize, wheat and rice.

Table 1 Consumption of foods from the eight food groups among pre-school children, *N* = 144

Food variety	*Percentage food variety consumption among pre-school children in one week*							
	Breads and cereals	*Roots and tubers*	*Pulses and nuts*	*Vegetables*	*Fruits*	*Meat and meat products*	*Milk and milk products*	*Fats and oils*
≥ 5	3.5	0	0	0.7	0	0	0	0
4	12.5	0.7	0	11.1	1.4	0	0	0
3	33.3	5.6	8.3	48.6	25.0	6.9	0	0
2	45.1	38.9	25.0	33.3	44.4	43.1	6.3	4.2
1	5.6	45.8	45.1	6.3	27.8	38.2	63.3	89.6
0	0	9.0	21.5	0	1.4	11.8	30.6	6.3

Consumption of animal sources of proteins: fish, meat and meat products was low; of the total population, 11.8% had not consumed any food item from this group during the one week preceding the study and none of the children had consumed more than three types of food items from this group. Milk and milk products are also very good protein sources but their consumption was also low. Although fresh milk, fermented milk and ghee have been found to be accessible to communities in Matungu division (Ekesa et al., 2008), not all households could manage to provide these food items to their pre-school children. Only 63.2% of the children had taken tea with milk, 9% percent of them had taken both fresh and fermented milk while 30.6% of the pre-school children had not consumed any food from this group.

The observed poor consumption of animal proteins could be complemented by consumption of plant sources of proteins which are cheaper and more available despite their lower bioavailability. This was not the case in Matungu division. The consumption of legumes and pulses was also low. About 2.1% of the pre-school children had not consumed any food item from this group for the seven-day period, 45% had consumed only one variety and none of the children had consumed more than three varieties.

The consumption of vegetables was relatively good; all the pre-school children had consumed at least one type of vegetable for the seven-day period, with 11.8% of them having consumed more than three varieties. This is because in the 'Luhya' community, a variety of vegetables are cooked together (e.g. cowpea leaves, jute mallow and spider plant). Boiling was the common method of preparing these vegetables. It is, therefore, probable that most of the water soluble vitamins such as vitamin C and the B complex are lost during the cooking process and the retained fat-soluble vitamins are not absorbed and utilised by the body due to lack of fat/oil during cooking process. These vegetables are supposed to be cooked in as little water as possible and for brief periods with some fat/oil, served immediately or kept covered for a short time (Williams, 1994).

The consumption of fruits was relatively good. The households could access guava, mangoes, pawpaw, avocado, oranges and many wild fruits. Almost all the pre-school children (89.6%) had consumed at least a fruit in the seven-day period. The most popular fruit was guavas and this could be because guava trees are common in the region and they grow naturally in most homesteads.

For the seven-day period, nine children had neither consumed fat-rich foods nor foods cooked with fat or oil. This is because refined oils and animal foods that are sources of fat are expensive (World Resources, 1998). The low consumption of dietary fat hinders bile release, thus negatively affecting the absorption of fat-soluble vitamins like A, D, E and K in the body resulting (Williams, 1994).

3.3 Nutrient intake

Using a 24-hour diet recall, the intake of both macronutrients (proteins, fats and total energy) and micronutrients among pre-school children in Matungu division was estimated. The micronutrients considered were vitamin A, vitamin C, iron, calcium and zinc; this is because of their major role in boosting the immune system. The results were compared to the Recommended Dietary Allowances (RDAs).

The findings showed that the pre-school children were not meeting their energy requirements. A total of 74% had only met between 50–99% and 5% had not even met 50% of their daily energy requirements. In addition, the consumption of macronutrients like fats was low. No child had met the RDA of fat. The low consumption of fats is also reflected in Table 1. This could be explained by the fact that refined oils and animal fats are expensive (World Resources, 1998). During the 24-hr diet recall, most of the foods given to children had been boiled, implying that the bioavailability of fat-soluble vitamins, A, D, E and K was reduced since dietary fat stimulates bile release for effective absorption of these vitamins (Williams, 1994). Therefore, the low consumption of dietary fat observed is a possible hindrance to the absorption of essential micronutrients resulting to malnutrition and impaired immune system (Williams, 1994).

Proteins are the major components of muscle but 31% of the children had not met their protein RDAs. Protein collagen is responsible for the high tensile strength of skin and bone. The control of growth and of cell differentiation is also a function of proteins. In the immune system, highly specific proteins – antibodies – recognise and combat foreign cells including bacteria and viruses. Proteins also serve as a secondary source of energy when amounts of carbohydrates and fat in the diet are inadequate to provide sufficient energy (Sehmi, 1993).

Many studies throughout the world have demonstrated that vitamin A can reduce child mortality and that child death due to infections like respiratory infections and diarrhoea can be reduced by up to 23% by supplying these children with adequate vitamin A intake (Corinna and Ruel, 2004). Despite this, the consumption of vitamin A was poor. Only 23% of the pre-school children had met their RDAs. This could be explained by consumption of vegetables and fruits that are not rich sources of the vitamin.

Research has shown that a large number of children in developing countries are exposed to zinc deficiency because they consume cereal-based staple diets that have low zinc content (Corinna and Ruel, 2004). The findings of this study were not different, only 14% of the pre-school had met their RDAs for zinc. Since zinc is also known to play a vital role in normal growth, boost immunity and increase antibody production (Corinna and Ruel, 2004), its deficiency in these children has great negative impact on their health status. The low zinc consumption could be explained by the low consumption of animal proteins and milk products observed and shown in Table 2. With the high intake of cereals-based starch, the fibre in these cereals could have created a zinc imbalance. We have also noted that the consumption of iron was not a problem, 97% of the children met their RDAs. This could lead to iron/zinc ratios greater than 3 : 1 and thus inhibit zinc absorption (Williams, 1994).

Table 2 Percentage nutrient consumption in relation to recommended dietary allowances' among the pre-school children, *N* = 41

Nutrient	*Percentage of pre-school children meeting their RDAs (%)*	*Percentage of pre-school children not meeting their RDAs (%)*
Energy (kcal)	21	79
Proteins (g)	69	31
Fats (g)	0	100
Vitamin A (mg)	23	77
Vitamin C (mg)	79	21
Iron (mg)	97	3
Calcium (mg)	44	56
Zinc (mg)	14	86

The findings show that, although there was low consumption of nutrients like fats, vitamin A, calcium and zinc, the consumption of vitamin C and iron was adequate. Due to the nutrient–nutrient interaction, there is need for ensuring that foods with different nutrients are combined appropriately and consumed in their right amounts (Williams, 1994). This can only be achieved by diversifying the diets of the pre-school children.

3.4 Nutrition status

Nutrition status refers to the nutritional status of the body as expressed according to scientifically tested parameters, such as weight, height, age or a combination of these (FAO, 2002). Nutrition status assessment of the pre-school children was carried out and the indicators used were stunting, underweight and wasting.

3.4.1 Stunting

Stunting is the outcome of failure to receive adequate nutrition over an extended period and is also affected by recurrent or chronic illness (ACC/SCN, 2004). Of the children, 35% fell below the –2 SD cut-off point, meaning they were stunted and 12% of them were severely stunted (Table 3). The level of stunting observed in this study is higher than the national level of 31% recorded by Kenya Demographic Health Survey (KDHS) of 2003 and even higher than that of Western Province, which was 30.3%, with 11.6% severely stunted (Government of Kenya, 2004).

Table 3 Prevalence of stunting among pre-school children by age and sex, *N* = 144

Classification by age (months)	*Stunting (height-for-age Z-scores)*					
	Male	*%*	*Female*	*%*	*Total*	*%*
24–36 months						
>1.00 SD	4	2.8	2	1.4	6	4.2
0.99 to –0.99	11	7.6	10	6.9	21	14.6
–1.00 to −1.99	8	5.6	14	9.7	22	15.3
<–2.00	13	9.0	6	4.2	19	13.2
Total	36	25.0	32	22.2	68	47.2

Table 3 Prevalence of stunting among pre-school children by age and sex, $N = 144$ (continued)

Classification by Age (Months)	*Stunting (height-for-age Z-scores)*					
	Male	*%*	*Female*	*%*	*Total*	*%*
37–48 months						
>1.00 SD	0	0.0	1	0.7	1	0.7
0.99 to –0.99	6	4.2	4	2.8	10	6.9
–1.00 to –1.99	5	3.5	7	4.9	12	8.3
<-2.00	4	2.8	8	5.6	12	8.3
Total	15	10.4	20	13.9	35	24.3
49–60 months						
>1.00 SD	1	0.7	1	0.7	2	1.4
0.99 to –0.99	5	4.2	3	2.1	8	5.6
−1.00 to −1.99	5	4.2	7	4.7	12	8.3
<–2.00	13	9.0	6	4.2	19	13.2
Total	24	16.7	17	11.8	41	28.5

Although a document by FAO (2002) states that there is little statistical difference in stunting recorded between girls and boys, the results of this study are different. More males (40%) were stunted compared to females (29%). The same trend was observed in the KDHS of 2003, where the stunting levels among the male children in Kenya were higher when compared to the female children (Government of Kenya, 2004). The most affected age category was that of children aged 49–60 months, where 54% of them were stunted and 46% severely stunted. This was the oldest group of the pre-school children. These results differ with those of a study done in Marsabit, where there was no significant difference in stunting levels of the pre-school children aged 49–60 months and other children. Stepwise linear regression was carried out to determine the major contributing factors to stunting. According to the findings, there was a positive but weak relationship between stunting and dietary diversity ($r^2 = 0.036$). This is because the stunting is associated with nutrient inadequacy over a prolonged period of time mostly beginning in the uterus while this study collected information on one-week dietary intake. Morbidity level had a negligible relationship with stunting.

3.4.2 Underweight

One official Millennium Development Goal indicator of progress towards the poverty and hunger goal is the rate of low weight-for-age (underweight) of children 0–5 years (Government of Kenya, 2004). The underweight measure conflates indicators of chronic malnutrition (low height-for-age or stunting) and acute malnutrition (low weight-for-height or wasting) (ACC/SCN, 2004). Of the 144 children, 21.5% fell below the –2 SD cut-off point, and 5.6% were severely underweight (Table 4).

These levels of underweight are almost similar to the national levels of 20%, although slightly higher than the provincial levels of 18.6% observed (Government of Kenya, 2004). The most affected age category was that of children 24–36 months, where 28% of them were severely underweight. This could be because at this age, most of these children have just stopped breastfeeding and are fully dependent on complementary foods. There is, therefore, a high possibility that the complementary foods are not meeting their daily nutrient needs. In addition, children at this age are prone to illnesses; therefore, the other cause of malnutrition could be nutrient leakage due to morbidity.

Table 4 Prevalence of underweight among pre-school children by age and sex, $N = 144$

Classification by Age (Months)	*Underweight (weight-for-age Z-scores)*					
	Male	*%*	*Female*	*%*	*Total*	*%*
24–36 months						
>1.00 SD	0	0	4	2.8	4	2.8
0.99 to –0.99	17	11.8	15	10.4	32	22.2
–1.00 to –1.99	7	4.9	6	4.2	13	9.0
<–2.00	10	6.9	9	6.3	19	13.2
Total	34	23.6	34	23.6	68	47.2
37–48 months						
>1.00 SD	0	0	0	0	0	0
0.99 to –0.99	9	6.3	8	5.6	17	11.8
–1.00 to –1.99	3	2.1	9	6.3	12	8.3
<–2.00	3	2.1	3	2.1	6	4.2
Total	15	10.4	2.0	13.9	35	24.3
49–60 months						
>1.00 SD	0	0	0	0	0	0
0.99 to –0.99	10	6.9	11	7.6	21	14.6
–1.00 to –1.99	11	7.6	3	2.1	14	9.7
<–2.00	4	2.8	2	1.4	6	4.2
Total	25	17.4	16	11.1	41	28.5

Following stepwise linear regression, it was found that both morbidity and dietary diversity influence 11.6 and 7.0% of underweight, respectively.

3.4.3 Wasting

Wasting indicates failure to receive adequate nutrition in the period immediately before the survey and typically is the result of recent illness episode, especially diarrhoea or rapid deterioration of food supply (Government of Kenya, 2004). The findings of this study showed that the overall prevalence of severe wasting among the pre-school children was 8.3% (Table 5). This prevalence is far much higher than the statistically expected prevalence of between 2 and 3% and a little lower than the overall global prevalence of 9.4% (ACC/SCN, 2000). The prevalence observed was also higher than the national average of 6% (Government of Kenya, 2004). Just like in the case of underweight, the most affected age group was those 24–36 months.

About 13.4% of the changes in wasting could be attributed to changes in morbidity level, while 8.1 % could be attributed to changes in dietary diversity. Since the study was carried out in the month of March, April and May, a period considered lean in terms of food production and availability, this could explain the high level of wasting. Most households had depleted their food stores and were planting and weeding in preparation for the first season of 2005.

Table 5 Prevalence of wasting among pre-school children by age and sex, $N = 144$

Classification by Age (Months)	*Wasting (weight-for-height Z-scores)*					
	Male	*%*	*Female*	*%*	*Total*	*%*
24–36 months						
>1.00 SD	5	3.5	7	4.9	12	8.3
0.99 to –0.99	19	13.23	20	13.9	39	27.1
–1.00 to –1.99	4	2.8	5	3.5	9	6.3
<–2.00 to –2.99	7	4.9	1	0.7	8	5.6
Total	35	24.3	33	22.9	68	47.2
37–48 months						
>1.00 SD	1	0.7	3	2.1	4	2.8
0.99 to –0.99	11	7.6	15	10.4	26	18.1
–1.00 to –1.99	1	0.7	1	0.7	2	1.4
<–2.00	2	14	1	0.7	3	2.1
Total	15	10.4	20	13.9	35	24.3
49–60 months						
>1.00 SD	3	2.1	3	2.1	6	4.2
0.99 to –0.99	19	13.2	11	7.6	30	20.8
–1.00 to –1.99	3	2.1	1	0.7	30	20.8
<–2.00	0	0.0	1	0.7	1	0.7
Total	25	17.4	16	11.1	41	28.5

3.4.4 General nutrition status of the pre-school children

Stunting was the most prevalent form of malnutrition with 35% of the pre-school children having it, this was followed by underweight (20.5%) and lastly wasting (10%) (Table 6). The levels of stunting and underweight observed are more than 30 and 20%, respectively. This confirms that these forms of malnutrition are of high public health significance in the region. The levels of wasting observed are also above the acceptable cut-off point of 3% (ACC/SCN, 2000). The KDHS report of 2003 showed a similar trend where stunting was the most prevalent (31%), followed by underweight (20%) and finally wasting (6%) (Government of Kenya, 2004) The major determinant of general nutrition status was morbidity level ($r^2 = 0.269$). The strong association between morbidity level and nutrition status is because common childhood infections, such as those of the upper respiratory tract, gastrointestinal infections causing diarrhoea and malaria, interfere with feeding habits, lead to the loss of electrolytes and other nutrients, and also increase metabolic rate, thus rise in nutrient needs requirements. Therefore, when the prevalence of these infections is high, there is a high possibility of the child becoming malnourished. A study by Onyango et al. (1998) showed that dietary diversity measured was significantly associated with five nutrition status indices (height-for-age *Z*-scores (HAZ), weight-for-age *Z*-scores (WAZ), weight-for-height *Z*-scores (WHZ), triceps skin folds and mid-upper arm circumference) among 12–36-month-old children.

Table 6 General prevalence of malnutrition among pre-school children, *N* = 144

Classification	*Stunting (height-for-age Z-scores)*		*Underweight (weight-for-age Z-scores)*		*Wasting (weight-for-height Z-scores)*	
	Frequency	*%*	*Frequency*	*%*	*Frequency*	*%*
>1.00 SD	7	4.9	6	4.2	22	15.3
0.99 to –0.99 SD	39	27.1	68	47.2	95	66.0
–1.00 to –1.99 SD	48	33.3	39	27.1	15	10.4
<–2.00	50	34.8	31	21.5	12	8.3
Total	144	100	144	100	144	10

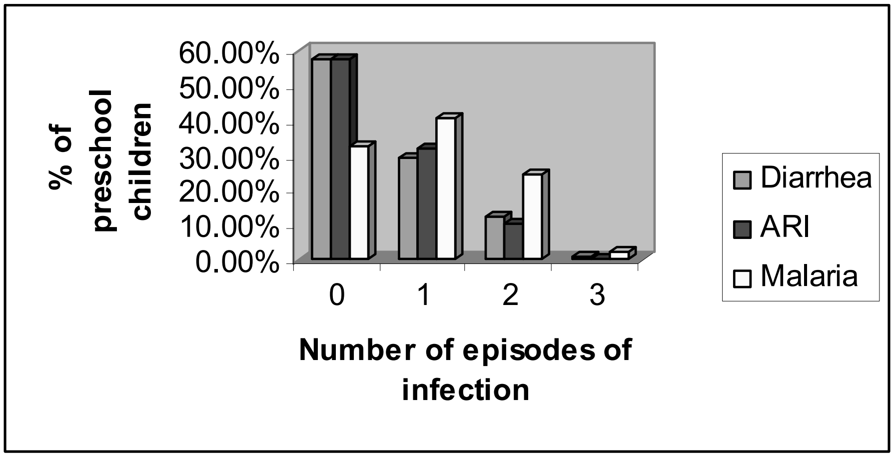
Important gender differences in nutrition do exist in some populations, however in many, rates of malnutrition are very similar for children and sometimes males are worse off. The findings of this study showed that boys were more malnourished than girls. A similar trend was observed in a study done in Vihiga district within Western Kenya 'unpublished data'. According to a document by FAO (1998), illness rates of boys younger than six years were significantly higher than those of girls and the difference was even higher in rural areas, this could explain the higher level of malnutrition among male pre-school children. The gender disparities in nutrition status indicate that males are equally susceptible to malnutrition, contrary to the commonly held view that girls are most vulnerable.

3.5 Prevalence of childhood infections

Under five mortality rate in Matungu division is so high that in 156 deaths per 1000 live births, the major causes of these deaths are ARI, malaria and dehydration caused by severe diarrhoea with undernutrition as an underlying cause (Government of Kenya, 2002; Government of Kenya, 2004). In the two months preceding the study, 57.6% of the children had no diarrhoea while only 0.7% had three episodes of diarrhoea. Of the 144 children in the study, 57.6% had no episode of ARI, 31.9% had one episode and 15% had two episodes, while no child had three or more episodes of ARI. More than half of the children (67.4%) had malaria, although most of them (41.0%) had only one episode (Figure 2).

Considering all the three infections, malaria was the most prevalent (67.4%), diarrhoea and ARI had similar prevalence of 42.4%. Similar results were also observed by Keino in the ACC/SCN report (2004) where malaria accounted for about one-third of outpatient clinic attendance. The high prevalence of malaria could also be the reason why it is one of the diseases constituting the main focus of the 6th millennium development goal (ACC/SCN, 2004).

Figure 2 Prevalence of diarrhoea, acute respiratory illness and malaria among pre-school children in Matungu division, $N = 144$



Although mother's education level was not a major variable in this study, it was the major determinant of morbidity among the pre-school children with an r^2 of 0.346, this was closely followed by nutrition status (r^2 of 0.284). This indicates that 35% of changes in morbidity of pre-school children could be attributed to changes in mother's education, while 28.4% could be attributed to changes in nutrition status of the child. The association observed between morbidity, mothers' education and nutrition status could be because more education is associated with greater awareness of children's needs and better child-care practices (Rafiqul, 1990).

4 Conclusions

The diversity of meals given to pre-school children in this region is low, on average; the pre-school children consume 13 different food items in a week instead of the recommended 24 food items. The consumption of animal sources of proteins, fats and oils is low among pre-school children in Matungu division, Western Kenya. The pre-school children are not meeting their daily RDA of energy, fat, zinc, vitamin A and calcium. Although stunting is the most prevalent form of malnutrition in Western Kenya, general undernutrition is still a major public health problem in the region with male pre-school children being the most affected. Malaria was the most prevalent childhood infection among pre-school children in Matungu division, Western Kenya. Nutrition status of pre-school children is mainly determined by prevalence of infections than the dietary diversity. Major determinants of childhood infections are mother's education level followed by nutrition status of the child.

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