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Hidden Hunger among Pre-schoolers in Matisi Peri-urban Location, Tran-Nzoia District, Kenya.

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Abstract
Pre-school children require adequate intake of essential nutrients in order to sustain the rapid growth and proper development at this critical period. A child who doesn't eat enough to cover his/her nutritional needs can develop growth failure and may eventually become undernourished. Peri- urban populations are normally characterized by difficult socio- economic situations which are likely to have direct or indirect implications on the nutrient intake and nutritional status of pre- school children. The study aimed at assessing the adequacy of micro-nutrient intake among pre-school children and the associated risk factors in Matisi Peri-urban location. This was a cross sectional survey of 208 randomly selected mother pre-schooler pair. Interviewer administered questionnaires provided socio-demographic data and information on the child's nutrient intake using 24-hour recall. Data was analysed using SPSS V.16.0. Dietary intake data was analyzed using a nutrient calculator. Chi square test and logistic regression and t test were used to find associations between various factors and nutrient intake. Results were considered significant at 5% α-level. More than half of the children 188(90.4%) were female. Their mean age was 38±10.7 months. Percentage inadequate intake of iron, calcium, Folate, vitamins C, A, B1, B2, B3 were (23%), (88%), (99%), (77%), (77%), (82.2%), (43%), (75%) and (71%) respectively. Micronutrient intake was associated with underweight and stunting (p = o.oo1). Based on the findings of this study, there is a problem of inadequate intake of nutrients affecting pre-scholars who are likely to suffer under-nutrition consequences in Matisi Peri-urban location.
Key words: Inadequate, Nutrients, Peri-urban, Pre-schoolers.

1.1 Introduction

Since children's functional development is still taking place, dietary quality remains important as children of this age (24-59 months) have a limited capacity for food intake at each siting. Therefore small meals with nutritious in between-meal snacks are the best means of meeting their nutritional needs (National Dairy Council, 1995). Research has also shown that children have food preferences and they are quite fussy in taking green leafy vegetables and fruits thus compromising their intake of micronutrients from dietary sources (Singh, 2004). The diets of pre-school children from more deprived backgrounds such as peri-urban slums in particular are generally low in minerals and in specific vitamins (particularly vitamins E, C, B_{12} and Niacin and contain higher levels of sugary foods such as non-diet soft drinks and confectioneries which could adversely impact on their health (Gregory et al., 1995). A study done in Malawi showed that micronutrient deficiencies are widespread, as staple diets have minimal variety, and animal-source food intake is low among the pre-schoolers . It has been suggested that the monotonous consumption by humans of cereal crops containing low concentrations (total and bioavailable iron, zinc and vitamin A is a major reason for the widespread deficiencies of these micronutrients in the developing world (Dickinson et al., 2009). It is well known that deficiency of isolated or single nutrient is rare in clinical practice and an individual is likely to have a deficiency of multiple micronutrients (Singh, 2004). A number of studies in developing countries particularly the Sub- Saharan Africa show lack of proper nutrition and intake of micro-nutrients such as vitamin A, B, C, zinc and iron among children aged less than 5 years (UN/ACC/SCN (1997b).
Micronutrients are considered essential nutritional factors, with stimulating and balancing roles in metabolism and thus in the normal body development and functioning which results to good nutritional status. It is widely recognized that nutritional deficiencies prenatal and in early childhood affects growth and development, health status, life expectancy and the quality of a child's life (Ngare and Mutunga, 1999). This study looked at Zinc, vitamin A and C,

iron adequacies and their associations with the prevalence of under-nutrition among the pre-schoolers in peri-urban area.

1.2 Materials and methods

A cross sectional study was carried out in Matisi location, Trans-Nzoia District, Kenya in Kipsongo and Shanti villages between October and December 2008. The participants were 208 randomly selected pre-school child (24-60 months) - mother pairs. Matisi location was chosen purposively due to its peri-urban slum characteristics and Kipsongo and Shanti villages were chosen randomly from other villages.

1.2.1 Inclusion and exclusion criteria

Parent to the child aged 24-60 months who gave a written consent (signing or finger print) and their child and were residents of Kipsongo and Shanti for at least six months prior to the study were enrolled in the study. Children who had malformations or chronic illnesses or their ages could not be ascertained were excluded from the study.

1.2.2 Data collection procedures

Data was collected using interviewer administered questionnaires to determine socio demographic factors. A 24 hour recall was also completed and was used to determine the dietary intake of the child. Anthropometric measurements were taken.

1.2.3 Data analysis Data was cleaned, coded, entered and analyzed using SPSS V. 16.0. Frequency tables, means, and standard deviations were used to summarize the data. Chi-square test of association and logistic regression (binary) were used to determine the significant variables affecting nutritional status of pre-schoolers. A p-value of <0.05 was considered statistically significant. Epi Info V.3.4.0 generated Z scores (SD) for the nutritional status and children below -2 SD was categorized as either underweight, stunted or wasted (Gibson, 1990). One sample T test was used to draw associations between nutrient intakes and under-nutrition. To get a child's average amount of daily nutrient intake from the 24 hour recall, a nutrient calculator; a computer based calculator locally developed using Microsoft Access program based on Kenya Food Composition Tables was used (Sehmi, 1993). Independent samples test was used to compare each nutrient to RDA's for different age groups and dietary adequacy of selected micro nutrients (Iron, Vitamin C, zinc, calcium, Vitamin B1, B2, B3 in mg, Vitamin A in RE and folate in ug,) established. RDA of iron < 10mg, vitamin A < 400RE in 12-47 months and <500RE in 48-72 months, vitamin C < 40mg in 12-47 months and <45mg in 48-72 months, zinc < 10mg, vitamin B1 < 1.2, Vitamin B2 < 1.3, Vitamin B3 < 1.6, calcium < 1000mg was considered inadequate (Mahan and Arlin, 1992). The study was reviewed and approved by Institutional Research and Ethics Committee (IREC) of Moi University before commencing. Written permission was sort from Matisi location chief.

1.3 Results

1.3.1 Selected child characteristics by nutrient intake

The study found an association between vitamin A and the child's age group. There was also an association between vitamin B1 and the frequency of breastfeeding. Disease symptoms were associated with calcium intakes. Vitamin B2, C and zinc intakes were associated with the action that was taken when the child got sick. Vitamin B1 and iron intakes were associated with varied diets. Calcium and folate consumption were associated with the income controller in the family all (p<0.05). No association was found in the length of breastfeeding, age of introduction to complementary feeding, sex of the child, disease symptoms two weeks prior to the study, immunization status and if the child had been dewormed three months prior to the study.

1.3.2 Children's approximate daily nutrient intake

Vitamin A , Iron, folate and Zinc intakes were significantly below the RDA in 49-59 months age-group, all p<0.001. Vitamin A, B2, B3 and C, Calcium, Iron and Zinc intake were significantly below the RDA in 36-48 months age-group, all p<0.001. Vitamin C,B2 B3,Calcium, folate and Zinc intake were significantly below the RDA in 24-35 months age-group all p<0.001 as shown in Table 1

Table 1 Approximate mean daily nutrient intake

Nutrient	Age group n=208	RDA*/ day	Mean daily intake ±SD	% RDA intake	t	p
Folate in micrograms	24-35	400	49.75±*56.63*	12.44	-62.160	**0.000**
	36-48	400	41.5±*42.4*	10.38	-67.636	**0.000**
	49-59	400	82.75±*82.85*	20.69	-24.518	**0.000**
Vitamin B1 in milligrams	24-35	1.2	1.37±*0.82*	114.2	2.081	**0.040**
	36-48	1.2	1.52±*1.07*	126.7	2.436	**0.018**
	49-59	1.2	1.49±*0.9*	124.2	2.086	**0.043**
Vitamin A in RE	24-35	400	320.61±659.35	80.15	-1.210	**0.229**
	36-48	400	175.15±173.14	43.79	-10.470	**<0.001**
	49-59	500	258.91±247.57	51.78	-6.401	**<0.001**
Vitamin C in milligrams	24-35	40	27.20±18.1	68	-7.106	**<0.001**
	36-48	40	27.66±20.83	69.15	-4.777	**<0.001**
	49-59	45	36.17±28.47	80.38	-2.011	**0.051**
Iron in milligrams	24-35	10	10.42±4.07	104.2	1.046	**0.298**
	36-48	10	8.71±4.25	89.1	-2.450	**0.017**
	49-59	10	8.32±4.21	83.2	-2.581	**0.014**
Zinc in milligrams	24-35	10	6.37±3.14	63.7	-11.607	**<0.001**
	36-48	10	6.95±4.31	69.5	-5.708	**<0.001**
	49-59	10	6.87±3.47	68.7	-5.839	**<0.001**
Vit B2 in milligram	24-35	1.3	0.93±*0.50*	71.5	-7.324	**0.000**
	36-48	1.3	0.99±*0.61*	76.2	-4.014	**0.000**
	49-59	1.3	1.00±*0.52*	76.9	-3.596	**0.001**
Vitamin B3 in milligrams	24-35	16	13.31±*8.94*	83.2	-3.019	**0.003**
	36-48	16	11.68±*7.37*	73	-4.721	**0.000**
	49-59	16	14.02±*7.28*	87.63	-1.761	**0.86**
Calcium in milligrams	24-35	1000	554.40±*518.02*	55.44	-8.645	**0.000**
	36-48	1000	470.37±*33.53*	47.04	-12.819	**0.000**
	49-59	1000	698.2±*616.47*	69.82	-3.135	**0.003**

Source:* Recommended Daily allowances Mahan and Arlin, 1992; Sehmi, 1993

1.3.3 Under-nutrition and nutrient intake

From the 24 hour recall, the results of the study found an association between the level of wasting and vitamin A and vitamin C (p= <0.001, 0.005 and 0.046 respectively). Implying that children that had inadequate daily intake of these nutrients were likely to be wasted. No association was found between the other nutrients and level of under-nutrition as shown in Table 2. Iron intake was significantly associated with stunting p=0.009.

Table 2 Nutrient intake and the prevalence of under-nutrition

	Folate	Calcium	Zinc	Vit A	Vit C	Vit B1	Vit B2	Vit B3	Iron
Stunting									
Yes	53.69±62.34	594±*562.3*	6.9±4.6	313.5±886.5	28.4±21.3	1.57±*1.4*	1.02±*0.63*	11.11±*8.04*	10.8±4.8
No	53.78±*60.32*	*545.1±473.3*	6.6±3.2	246±251.9	29.4±21.7	*1.4±0.84*	*0.95±0.51*	*12.58±8.20*	9±4
t	0.008	-0.613	-0.616	-0.526	0.27	-1.167	-0.787	-1.156	-2.648
P value	**0.993**	**0.541**	**0.539**	**0.601**	**0.787**	**0.245**	**0.432**	**0.249**	**0.009**
Underweight									
Yes	55.56±*72.41*	527.62±*542.55*	7±4.7	214.5±282	25.6±19.1	1.54±*1.12*	0.99±*0.63*	13.55±*8.4*	9.5±4.4
No	*53.3±57.3*	*564.87±482.69*	6.6±3.3	276±527.1	30.1±22.2	*1.41±0.85*	*0.96±0.52*	*12.8±8.12*	9.5±4.2
t	-0.22	0.442	-0.689	0.753	0.215	-.0806	-0.275	-.0.558	0.975
P value	**0.824**	**0.659**	**0.492**	**0.453**	**0.215**	**0.421**	**0.783**	**0.578**	**0.975**
Wasting									
Yes	57.63±*73.08*	450.33±*326.69*	6.9±2.5	99.7±117.7	17.3±11.5	1.54±*0.69*	0.89±*0.38*	11.44±*7.24*	8.5±3.1
No	53.54±*60.1*	562.93±*502.66*	6.6±3.7	271.8±495.9	29.8±21.8	*1.43±0.93*	*0.97±0.55*	*13.03±8.22*	9.5±4.3
t	-0.217	0.733	-0.197	3.437	3.306	-0.366	0.445	0.627	0.737
P value	**0.828**	**0.464**	**0.844**	**0.001**	**0.005**	**0.715**	**0.657**	**0.531**	**0.0462**

1.3.4 Selected maternal factors and nutrient intake

The mother's occupation was significantly associated with Vitamin B2 and Vitamin A intakes p=0.000 and 0.004 respectively. Household headship was associated with vitamin B3, calcium and folate intakes ($p < 0.05$). No association was found in marital status, parity, caregiver, and mother's educational level.

1.3.5 Environmental health and nutrient intake

Vitamin B1 and B2 were associated with the source of the drinking water and the size of the family house. Iron intake was associated with the size of the family house and vitamin B3 was associated with if family owned and used a latrine. Cleanliness of the house was associated with zinc and vitamin B2 intakes all ($p < 0.05$). No association was found in waste disposal site and cleanliness of the compound.

1.4 Discussion

Studies have found out inappropriate infant and young child feeding practices especially in places where hygiene and sanitation are poor like slums as a major cause of poor nutrient intake and the subsequent malnutrition among the under fives (Faraque et al; 2008, Ergin et al, 2007). This is consistent with this study that vitamin B3, B2, B1 and zinc intakes were associated with sources of drinking water, use of latrines and cleanliness of the house in which the children lived.

Most mothers fed their children 3-5 times a day (71.6%) while (28.4%) feed them less than three times a day. The study found a statistical significance between frequency of breastfeeding and Vitamin B1 intakes (p 0.044).

Most mothers reported to have weaned their children with maize meal porridge, mashed potatoes, mashed bananas, ugali and vegetable soup. Slightly less than a quarter (21.2%) claimed that they did not enrich the children's foods which could have contributed to the high levels of nutrient inadequacies (in vitamin A, C B group and zinc and iron) and the subsequent stunting, wasting and underweight among the 24-35 months age groups. Almost all (97%) of the children were reported to be feeding on the family foods, which probably may not be of the right consistency and

with the right nutrients. Parker, 1996 indicates that the prevalence of Vitamin A deficiency in developing countries begins to increase in young children just after they stop breastfeeding which is consistent with this study.
For young child feeding practices, the (WHO) recommends that infants should be exclusively breastfed for the first 6 months of life to achieve optimal growth, development and health. Thereafter, to meet their evolving nutritional requirements, infants should receive nutritionally-adequate and safe complementary foods while breastfeeding continues for up to 2 years of age and beyond. Promotion of exclusive breastfeeding (EBF) and improved complementary feeding (CF) are ranked first and third, respectively, among the most effective preventive actions for reducing nutrients inadequacies and mortality in children less than 5 years of age in developing countries. The study findings show an association between vitamin B1 and the frequency of breastfeeding which is likely to lower the risk of stunting. The study did not find a statistical significance in length of breastfeeding and nutrient intakes which contradicts findings from the literature (Onyango, 1998)
This study found high levels of inadequacies in vitamin A, 171 (82.2%), vitamin C 161 (77.4%), Vitamin B1 161 (77%) and zincs 170 (81.7%) yet this age group requires high amounts of micro nutrients for stimulating and balancing roles in metabolism. The inadequacies could be due to low consumption of nutrient rich foods and especially from animal sources or the quantity and quality of the food given to the children may have been low. The study found out that wasting was significantly associated with vitamin A and C daily intakes as they were lower than the RDA's which is also consistent with studies by (Silvia *et al*., 2008; Dickinson *et al*., 2009).
According to the World Health Organization, a child is considered fully vaccinated if he or she has received a BCG vaccination against tuberculosis; three doses of DPT vaccine to prevent diphtheria, Pertussis, and tetanus; at least three doses of polio vaccine; and one dose of measles vaccine. These vaccinations should be received during the first year of life (CBS et al., 2003). High vaccination coverage against childhood diseases has been reported to be a safeguard for better nutrition and health. The study revealed that (4.8%) of the children were not immunized. The results of this study show no associations between nutrient intakes and immunizations which is contrary to the findings in the literature, (WHO, 2002)
In Matisi location, more than half of the children were sick a month before the study .The study found out that a month preceding the survey, the most prevalent form of illness reported was fever and headache (43.9%), followed by respiratory tract infections (23.6%), diarrhoea and vomiting (18.3%) and other illnesses that included skin rushes, eye and ear infections, swollen arms and legs and allergies (14%), This may have resulted to the high cases of micronutrient inadequacies due to lack of appetite that results from subsequent illnesses as found by (Vitolo, 2008).
Some selected maternal characteristics that were purported to have an impact on the nutrient intake of the pre-school children were evaluated. The findings of the study found an association between mother's occupation, household headship and vitamin B2, A, B3, calcium and folate intakes. No association was found between marital status and educational level of the mother which is inconsistent with a study on preschools in a low income suburb by (Kikafunda et al., 2006) that single mothers were more likely to have stunted children than married mothers due to inadequate intake of essential nutrients which probably results from inadequate resources. This is inconsistent with Mittal et al., 2007 study on under fives in urban slums that mothers who were illiterate were more likely to have children who do not take the required amount of nutrients.
The feminization of poverty indicates that female-headed households (FHH) constitute a vulnerable socio-economic group generally considered as impoverished compared to male-headed households (MHH). The study revealed an association between household headship and stunting in children and children who came from FHH had lower stunting rates (38%) compared to MHH (62%). This probably was because resources controlled by women are more likely to be spent on increasing family's food intake hence improving the nutritional status of the preschools as revealed by (Mbagaya et al., 2004) in the study on preschools on nutritional status.
A quarter (25%) of the population lack latrines with three quarters using the latrines that were mostly used communally and the study observed that the pit latrines were dirty and full though they were being locked. The study found an association between nutrients (Vitamin B1, B2, B3, Fe, zinc) with sources of drinking water, size of the family house and latrine use which may cause the spread of microorganisms which cause diseases hence reduces the nutrient intakes due to increased nutrient and water losses, reduced food and water intake due to anorexia, diminished absorption and utilization of ingested food and increased metabolic demands. (Goldman, 1997)

1.5 Conclusion
Percentage inadequate intake of iron, calcium, Folate, vitamins C, A, B1, B2, B3 were (23%), (88%), (99%), (77%),

(77%), (82.2%), (43%), (75%) and (71%) respectively. The study reveals that Zinc, iron, vitamin C, B1, B2, B3 and A intake are significant factors associated with under-nutrition among the pre-schoolers. Environmental and maternal factors were associated with nutrient intakes.

1.6 Recommendation

The government and NGO's should assist residents to begin IGA's so that they could become economically empowered to enable them purchase varied foods. Studies to evaluate the impact of the nutritional interventions on the prevalence of in adequacies in Peri- urban slums needs to be done to evaluate their efficiency. Municipal council needs to provide enough treated drinking water. Emphasis for giving a varied diet to preschoolers should be taught through community based seminars and chief barazas. Slum upgrading projects needs to be set by Government and or NGO's. A further study based on biochemical tests needs to be done to test specific micro nutrients in the body and then related to undernutrition indices.

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1.8 Conflict of interest

I have no conflict of interest as this was my MPH thesis.

1.9 References

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