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PRELIMINARY PROGRESS REPORT

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EVALUATING THE NUTRITIONAL STATUS OF YOUNG CHILDREN IN KABAROLE DISTRICT, WESTERN UGANDA

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INTRODUCTION:

Childhood undernutrition is a global problem. Food insecurity, poverty, and illiteracy are often cited as the underlying causes of malnutrition (*1-3*). Uganda is one of the countries with high rates of poverty and illiteracy in rural areas and high rates of childhood malnutrition (*4*). More research is needed to characterize the causes, types, and prevalence of malnutrition in different regions of the country in order to develop targeted interventions to combat malnutrition.

Generally, weight-for-age, height-for-age, and mid-upper arm circumference (MUAC) are useful measures in identifying children that are undernourished or at risk for morbidity and mortality. However, these measures have limitations when used to assess the effectiveness of programs if the variable of interest is improvement in nutrition status. To adequately evaluate the effectiveness of a nutrition intervention, additional assessments are often recommended (*5*). Such assessments include clinical examinations, biochemical analysis of blood or other biological specimens, and measures of dietary intake. Environmental and socio-economic factors are also often assessed to control for variables that might confound the outcomes of the program.

The purpose of this study was to assess the nutritional status of young children of low income, less literate caregiver in order to characterize the types of nutritional deficiencies that are prevalent in rural areas and to determine caregiver factors that are likely to predispose young children to malnutrition. Data generated from this survey will be used to evaluate the effectiveness of a nutrition education intervention that is being implemented - and will also help us in developing more targeted nutritional messages in the future. A combination of assessment techniques were employed in order to ascertain the nutritional status of young

children (6-48 months); assess the adequacy of children's diets, and to uncover the socioeconomic factors that might explain the risk for malnutrition in the target population.

RESEARCH METHODS

Two rural sub-counties were selected from Kabarole district, western Uganda. Pairs of female primary child-caregivers (mostly mothers) and their young children (6 - 48 months) were recruited through the local councils. Participants that met the selection criteria (and consented to participate) were invited to attend health fairs which were held at local primary schools. The caregivers were interviewed and children's health status was assessed at the fair by trained enumerators. The study protocol was reviewed and approved by the University of Georgia Institutional Review Board and the Uganda National Council for Science and Technology.

DATA COLLECTION PROCEDURES:

A field survey was conducted by the principal investigator and community workers to select study sites. The two survey sites (Kiguma and Gweri) were selected because they seemed to be similar in socio-economic status (judging from housing structures) and cropping patterns. All assessments were conducted at local primary schools. Six classrooms were set up and color coded to serve as assessment stations and participants went through the stations in the order of precedence presented in Table 1 below. For quality control purposes, each child was given a number tag which had to be worn by the child throughout the assessment exercise.

Table 1: Organization of the Assessment Stations

Station	Activity	Enumerators
A. Registration	Verified participants' eligibility and obtained the caregiver' consent to participate in the study	-School health education teacher - Two trained volunteers
B. Anthropometrical	Assessed children's heights or lengths, weights, and mid-upper arm circumferences	- 2 Nurses - 2 university students (master's) - 2 Volunteers
C. Clinical	Physical examinations (children only)	- 2 nurses - 1 university student - 1 volunteer
D. Dietary	Interviewed caregivers	-1 nurse -1 nutritionist - 1 university student

-2 volunteers

E. Biochemical	Drew blood from children to assess hemoglobin and prepare blood spots for retinol and C-reactive protein analysis only	-1 phlebotomist/lab technician - 1 university student - 2 volunteers
F. Socioeconomic	Interviewed caregivers	- 1 university student
	Disbursed incentives	- 3 volunteers - Local village council member

Characteristics of the study participants:

This study targeted low income, less literate female primary child-caregivers. About a quarter of the caregivers recruited for the study had not received any formal education, 67.5% had received primary education, and only 6.4% received post-primary education. The majority of caregivers (96.8%) described themselves as homemakers and/or subsistence farmers. Only 3.2% engaged in money generating activities such as making and/or selling quick breads, local beers, and crafts. The majority of caregivers (70.7%) were also married and in monogamous relationships (72.3%). Only 16% of the caregivers indicated that they were the heads of their households. The spouses were the primary income earners and heads of the households. A large number of the caregivers' spouses or the heads of their households were also subsistence farmers (41.3%) while 39.1% were employed (full-time) outside the home. More information about the characteristics of the children and caregivers is provided in Table 2.

Anthropometrical Assessments:

Heights, weights, and mid-upper arm circumferences were assessed from a total of 204 children by trained enumerators (nurses and university students) with the help of volunteers (high school students and teachers at the primary schools). Weights were taken from all children using a Salter hanging scale and recorded to the nearest 10 gm. Heights were taken from children 24 months and older with a standiometer while children under 24 months of age were measured recumbent with a Seca 210 measuring mat. Both length and heights were recorded to the nearest 0.1 cm. Measuring tapes (*6*) were used to measure mid-upper arm circumference (MUAC) and data was also recorded to the nearest 0.1 cm. EpiInfo Version 3.2.2 (CDC, USA) was used to compute height-for-age (HAZ), weight-for-age (WAZ), weight-for-height (WHZ), MUAC-for-age (MUAZ), and MUAC-for-height (MUHZ) z-scores using the median of the NCHS/WHO reference population. ANOVA was computed to assess differences in the means of the two survey sites. Since there were no

significant differences on most parameters included in the analysis (WAZ, HAZ, MUAZ, and MUHZ), anthropometric assessment results are reported by age groups only.

The results are presented in Table 3. The rate of chronic undernutrition as indicated by stunting (low height-for-age) was lower than the national rate (*4*). Six percent of the children were severely stunted while 18.4% were classified as stunted. However, the prevalence of stunting was high among children under 24 months of age (31.6% versus 18.4%). Underweight (low weight-for-age was observed in 9.9% of the children, 19.7% had low MUAC-for-age, while 21.4% had low MUAC-for-height. There were no children that were classified as wasted (weight-for-height below -2 SD); 3.5% had WHZ >2SD of the NCHS/WHO reference population.

The risk for stunting (an indicator of chronic undernutrition) was reduced among children of caregivers with higher monthly incomes (r_s = .215, p = .010), children that live in households that spent a large amount of their income on food (r_s = .199, p = .017), and among children that were provided diets comprising a wide variety of foods (r_s = .194, p = .022). The relationship between the caregiver's income and risk for stunting was determined to be independent of the caregiver's education level, occupation, and total household income. Household's that spent more of their incomes on food were also less likely to have children with MUAC-for-age and MUAC-for-height below -2 SD of the median of the NCHS/WHO reference population (r_s = .174, p = .042 and r_s = .211, p = .013 respectively). MUAC-for-age was also positively correlated with the caregiver's age.

Clinical examinations:

A total of 205 children were examined. Three cases were discarded because their body temperature was above 37 ^{o} Centigrade. Almost half of the children (45.5%) were not observed to have any physical signs of malnutrition or poor health (see Table 4). Conditions that were most prevalent are dry hair (25.5%), dry skin (21.8%), discolored hair (18.8%), hepatomegaly (12.4%), and tooth carries (10.4%). With the exception of tooth carries, all these conditions are often clinical signs of protein deficiency (*7*). The strong positive correlations between the physical abnormalities in hair and skin and low anthropometric dimensions indicate a prevalence of nutrient deficiencies, particularly protein deficiency. Further analyses revealed that children with dry or discolored hair were likely to consume milk (the most frequently consumed animal source protein – see Figure 1) less frequently. This further suggests that physical abnormalities in hair and skin are diagnostic of malnutrition. The lack of association between hepatomegaly and anthropometric measures

and indices of dietary intake suggest that the condition could be a result of non-nutritional causes.

The incidence of tooth carries among these young children (6-48 months) was very surprising. This calls for immediate intervention. From this survey it cannot be determined whether the tooth caries are a result of poor hygiene, high consumption of simple sugars, or limited intake of nutrients that are essential for the mineralization of teeth. This problem needs more investigation to pinpoint the cause of tooth carries among children this young. In the meantime, simple interventions such as fluoridation of the community water supplies (protected wells) can reduce the problem. Caregiver need also to informed about appropriate and inexpensive oral hygiene practices.

Dietary Assessment:

The purpose of this assessment was to determine the adequacy of children's diets. A qualitative 24-hour recall questionnaire was used to collect data on meal patterns and meal quality while a food frequency questionnaire was used to collect data on food selection patterns (food frequency and food variety).

Variety: Diets that include a variety of foods from all food groups tend to be adequate (*8-10*). Ninety one (91) locally available indigenous food items were included in the food frequency questionnaire. Caregivers were asked to indicate which foods they consume in their households. Each food consumed was assigned a score of 1 point and those not consumed were assigned a zero. Foods were then grouped into sub-groups (Bananas, Tubers & Starchy vegetables, Grains, Fats, oils & sweets, Legumes, Nuts, Meats, Milk, Fruits, and Vegetables) and a score for each subgroup was computed by dividing the number of foods consumed in each subcategory with the total number of foods in that group. A mean score was computed for each subcategory and then these subcategories were further grouped into the 3 food groups (Energy-yielding, Body-building, and Protective foods) which were then used to compute the total variety score.

The total variety scores indicate that about half of the foods that are locally available are being consumed (see Table 5). This finding raises concern since research shows that diets which have a variety of foods tend to be adequate in most nutrients (*11*). Further analyses indicated weak but significant correlations between consumption of diets limited in variety and risk for stunting.($r_s = 0.187$, $p = 028$). The risk for stunting was negatively associated with consumption of a variety of tubers and starchy vegetables, grains, meats, fruits, and vegetables. This suggests that children that are provided a variety of foods have a reduced

risk for becoming stunted. However, partial correlations among the food variety scores and stunting controlling for household income indices (caregivers income, income spent on food, and total household income) revealed no relationship between stunting and food variety.
Food frequency: **T**he adequacy of the diets depends on how frequently different food items are included in the diet. In this study, caregivers were asked to indicate how often (in a day, week, month, or year) they used each of the foods included in the food frequency questionnaire explained above. The results of this survey indicate that most households do not regularly consume a variety of foods. Green bananas, dried beans, avocado, tomatoes, and tea were the most frequently consumed food items (see Figure 1). On average, bananas were consumed daily and were the most frequently consumed staple while sweet potatoes ranked second (mean frequency = 1-3 times per week). The mean frequency of consumption of other staples such as grains and dried tubers and starchy vegetables was 1-3 times per month. This finding raises concern since green bananas are nutrient dilute when compared to grains and dried indigenous staples. Dried beans (mean frequency = daily) were the most frequently consumed food from the body building food group. Milk was the second protein-rich food, however, the frequency scores for milk should be interpreted with caution since the 24-hour recall data show that milk is often mixed in tea. The high frequency score of milk consumption is likely to overrate the diets of most households. The food frequency scores were only related to the amount of income spent on food ($r_s = 0.307$, $p = 0.013$).
Adequacy of children's diets: A qualitative 24-hour dietary intake recall was used to determine the adequacy of children's diets. Caregivers were asked to recall all the foods and drinks their children consumed during the 24 hours preceding the interview. Participants were not required to quantify their children's dietary intake because our previous investigation revealed that mothers in the target population do not habitually keep track of the amounts of food eaten by their children. Data obtained through the 24-hour dietary recalls was coded using the scoring method (*12*). Each time a food item was consumed, regardless of the amount, a score of 1 point was assigned to the sub-group in which that food belongs. A few foods such as porridge and milk in tea were assigned half a point. The validity of this scoring method was assessed in our previous study and the scores obtained using this method were found to be effective in predicting caloric intake, protein, total fat, calcium, iron, and zinc intake (*13*).

Overall the diets that were recalled were limited in variety and seem to be inadequate in foods from all groups (see Table 5). The diets were low in energy-yielding foods (mean score = 2.84, optimal score = 6), body-building foods (mean score = 2.32, optimal score = 4),

and very low in protective foods (mean score = .40, optimal score = 5). An ANOVA conducted to assess differences in the mean total adequacy scores of the four age groups was significant, $F(3, 126) = 4.78$, $p = .003$. Children in the 24-35 age group were provided a larger number of foods from the energy yielding food group while children in the 12-23 age group had slightly higher servings of the body-building food group (milk). This difference could be related to the quality of weaning foods. Spearman's correlations computed to determine the relationship between the diet adequacy scores and children's nutritional status revealed no significant relationships between the diet adequacy scores and the nutritional status indicators (anthropometric measures, physical signs, or hemoglobin levels). This can partly be explained by the fact that the diets reported by the caregivers were not representative of the usual diets. Almost half of the caregivers (47%) had indicated that the 24-hour recall did not reflect their typical meal patterns. Thus, these findings cannot be generalized, especially since this was just a one day recall. Observational methods need to be employed in order to fully characterized the quality of children's diets.

Meal and snacking patterns of young children: Caregivers were asked to indicate how many times they provided meals and snacks to young children. About two thirds (62.8%) of the caregivers indicated that they prepared three meals each day, 30.3% provided two meals, and 6.9% provided one meal per day. However, the results of the 24-hour recall indicate that the majority of the participants (82.6%) provide their young children three meals each day, 16.1% provide two meals, whereas 1.3% provide one meal. It is not clear whether this discrepancy was due to lack of a clear definition of what constitutes a meal. Caregivers had a tendency of not counting breakfast as a meal especially when they provided food leftover from the previous night's meal. There was also a discrepancy in the number of snacks reported by caregivers. Although 61.3% of the caregivers had indicated that they regularly provide snacks to their young children, only 1/3 of the children were provided snacks in the 24-hour period preceding the survey. The limited number of meals and snacks is likely to increase the risk for malnutrition since young children need to be fed frequently in order to meet their daily nutrient needs (*14*).

Biochemical Assessments:

Nutrients tend to interact in a synergetic manner and thus people with nutritional deficiencies tend to be deficient in multiple micronutrients. Improvement in status of one nutrient resulting from improvement in dietary intake or supplementation often leads to

improved levels of other nutrients (*15-17*). In this study, whole blood retinol and hemoglobin were assessed to serve as proxies of micronutrient nutriture. Capillary blood (finger prick) was collected by finger prick from children to assess hemoglobin concentration and prepare blood spots for retinol and C-reactive protein analysis. The blood spots have not yet been analyzed; results will be reported in a separate paper. The concentration of hemoglobin was measured with the Hemocue b-hemoglobin photometer (Lake Forest, California). The results indicate that only 36% of the 166 children that were assessed had normal hemoglobin levels (hemoglobin concentration of $\geq$11.0 g/dl). About 5% of the children were classified as severely anemic (<7.0 g/dl), 34.8% were moderately anemic, while 24.4% were mildly anemic. More research is needed to determine the cause of anemia in this population, however, a close examination of the quality of children's diets indicate that children may be at risk for deficiency of hematopoetic nutrients such as iron.

Assessment of Socioeconomic Status:

This assessment only focused on identifying factors that may determine food availability and access. Much of the data on socioeconomic status was collected during the recruitment phase. During the assessment exercise, caregivers were mainly interviewed about the social structure of their households and food production and consumption patterns. The results of this assessment are included in Table 1. Caregivers were also asked to indicate whether they 'always have enough food' to feed their families, never have enough food', or 'sometimes have problems obtaining food'. The results indicate that more than half of the caregivers (58.3%) never have enough food or have problems obtaining food (see Table 2). This suggests that a large proportion of the households are likely to experience food insecurity. This finding is disturbing given the fact that the survey participants engage in farming as the primary activity. An analysis of the participants food acquisition patterns indicate that the majority of households buy food on a daily or weekly basis to supplement what they produce. However, judging from the amount of income that is spent on food, the survey participants mainly consume what they produce. Only a half of the caregivers indicated that they buy special foods for young children. There is need to improve household's food purchasing power since the results of this study show that children that live in households that do buy food are at a high risk for stunting.

IMPLICATIONS FOR RESEARCH AND POLICY:

There is no precise measure of nutritional status. However, the volume of literature on nutritional assessments (*7, 18, 19*)indicate that employment of a combination of assessment parameters provides a good measure of nutritional status. In this survey, we looked at anthropometric dimensions (heights, weights, and MUAC), physical signs of poor health or nutritional deficiencies, dietary intake, and incidence of anemia in effort to characterize the nutritional status of young children. The results of the survey indicate a high incidence of malnutrition among young children in the survey areas (Kabarole district, western Uganda). The high prevalence of stunting coupled with no incidence of wasting suggests that children in the survey sites are at risk for chronic forms of malnutrition. The assessment of food selection patterns and the adequacy of meals indicate that the diets provided to young children are inadequate in calories, protein, and other nutrients essential for achieving optimal growth. This calls for measures to improve the dietary intake of young children.

To develop effective interventions, one needs to fully understand the causes of inadequate dietary intake. Cultural beliefs, limited food availability, limited education, and other social and environmental factors may determine what foods are chosen in a society. Resources such as land for growing food and raising animals for home consumption, income to purchase food, and time allocated to child care also affect children's dietary intake and nutritional status (*20*). These factors need to be explored in order to determine what kind of nutrition intervention can work for the targeted population (*21*). For groups that engage in farming like the survey participants, interventions such as diversification of food crop production can help improve food variety. However, improvement in food production alone may not lead to improvement in nutritional status because some families may sell off their produce, especially if farming is the primary income generating activity. According to a report by Smith & Haddad (2000)[*22*]improving the care of children and status of women is likely to lead to greater reductions in childhood undernutrition than improvement in food availability (an indicator of improvements in dietary intake).

In this survey nutritional risk was strongly correlated to income spent on food and the caregiver's income (and independent of food production). Thus, to improve nutritional status in this population, interventions need to focus on improving household food purchasing power. Improving economic growth in rural areas can generate more income, especially for caregivers, and lead to improvements in health and nutrition status of young children. Any policies that can lead to reduction in food prices or an increase in households' disposable incomes is likely to improve the food purchasing power. However, in order for us to see such changes, caregivers and household heads need to be encouraged to buy food for their

families. Otherwise, the extra income is likely to be spent on non-food items. Nutrition education or communication programs need to target the food selection (purchasing) habits of rural families. Special emphasis need to be put on increasing consumption of animal source proteins, fruits, vegetables, and whole grains.

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Table 2: Characteristics of Study Participants

Parameter of Interest	†Survey Site		†Total
	Gweri	Kiguma	
Mean age of children (months)	23.6 ± 11.6	23.7 ± 10.8	23.6 ± 11.2
*Total number of children	100	104	204
Percentage of children by age group:			
6-11 months	20.0	18.3	19.1
12-23 months	31.0	27.9	29.4
24-35 months	31.0	36.5	33.8
36-48 months	18.0	17.3	17.6
Mean age of caregivers (years)	30.6 ±12.6	27.9 ± 7.7	29.4 ± 10.8
Mean years of formal education	3.9 ± 3.0	4.0 ± 2.9	3.9 ± 2.9
Distribution by years of formal education			
0-2 years	40.0	33.0	36.5
3-5 years	24.0	35.0	29.6
6-8 years	31.0	25.2	28.1
9-11 years	5.0	6.8	5.9
Education level attain by caregiver			
No formal education	22.0	27.2	24.6
Kindergarten	3.0	0.0	1.5
Primary	69.0	66.0	67.5
Senior	6.0	6.8	6.4
Head of Caregiver's Household			
Self	19.1	12.8	15.8
Husband	63.2	65.4	64.4
Caregiver's parents	13.2	15.4	14.4
Grandparents	2.9	1.3	2.1
Sister or brother	0.0	3.8	2.1
Other	1.5	1.3	1.4
Caregiver's occupation			
Homemaker	26.5	23.7	25.2
Subsistence farmer	61.1	49.4	55.8
Homemaker/subsistence farmer	5.3	23.7	13.6
Small scale producer	0.9	0	0.5
Small scale trader	5.3	3.2	4.4
Other	0.9	0	0.5
Caregiver's spouse or household head's occupation			
Subsistence farmer	43.3	38.7	41.3
Small scale producer	1.8	0.0	1.0
Small scale trader	5.3	4.3	4.9
Large scale trader	1.8	1.1	1.5
Other	37.2	41.9	39.3
Do not have spouse or cannot tell	12.1	14.0	12.1

Caregiver's Monthly Income			
No cash earnings	60.9	58.2	59.5
<Shs.15,000	24.6	20.3	22.3
Shs.15,001 - 30,000	5.8	15.2	10.8
Shs.30,001 - 50,000	2.9	5.1	4.1
Shs.50,001-100,000	4.3	1.3	2.7
>Shs.100,000	1.4	0.0	0.7
Total household's monthly income			
No cash earnings	1.4	0.0	0.7
<Shs.15,000	42.0	45.6	43.9
Shs.15,001 – 30,000	24.6	26.6	25.7
Shs.30,001 – 50,000	20.3	8.9	14.2
Shs.50,001-100,000	5.8	13.9	10.1
>Shs.100,000	5.8	5.1	5.4
Total household's income spent on food			
None	4.3	5.1	4.7
<Shs.5000	58.0	51.9	54.7
Shs.5,000 - 10,000	27.5	24.1	25.7
Shs.10,001 - 15,000	5.8	8.9	7.4
>Shs.15,000	4.3	10.1	7.4
Caregiver's perception of food availability			
No response	1.5	1.3	1.4
Never have enough	20.6	35.9	28.8
Sometimes have problems obtaining food	29.4	29.5	29.5
Always have enough food	48.5	33.3	40.4
How often food is bought			
Daily	11.8	11.5	11.6
Weekly	41.2	56.4	49.3
Once a month	32.4	23.1	27.4
Less than once a month or occasionally	11.8	5.1	8.2
Never	2.9	3.8	3.4
Buy any special foods for children			
No	41.2	56.4	49.3
Yes	58.8	43.6	50.7
Housing arrangement			
Owns house	80.4	84.9	82.5
Rents	13.4	4.3	9.2
Lives with parents	6.3	9.7	7.8
Other	0.0	1.1	0.5
Housing structure: Floor			
Tiles, hardwood, asphalt, or brick	1.0	0.0	0.5
Concrete	16.7	6.8	15.0
Bare/mud	82.4	93.2	84.5
Housing structure: Roofing			
Iron Sheets	94.7	83.9	89.9
Grass thatched	5.3	16.1	10.2

[†]Numbers in these columns are percentages unless indicated otherwise.
*247 children participated in the assessments. This number excludes 43 children whose ages could not be verified.

Table 3: Results of Anthropometrical Assessments

Age Group (Months)	Height-for-Age			Weight-for-Age			MUAC-for-Age			MUAC-for-Height		
	Percentage of children		Mean z-score	Percentage of children		Mean z-score	Percentage of children		Mean z-score	Percentage of children		Mean z-score
	<-3.0 SD	<-2.0 SD		<-3.0 SD	<-2.0 SD		<-3.0 SD)	<-2.0 SD		<-3.0 SD)	<-2.0 SD	
6-11	5.1	25.6	-.85 ± 1.64	2.6	7.7	-0.45 ± 1.22	3.4	10.3	-0.96 ± 1.00	3.4	17.2	-1.06 ± 1.03
12-23	3.5	28.1	-1.25 ± 1.59	0.0	6.9	-0.62 ± 1.26	3.4	15.3	-1.16 ± 1.04	3.5	14.0	-1.07 ± 1.06
24-35	8.7	11.6	-0.88 ± 1.54	1.4	11.6	-0.76 ± 1.03	0.0	24.6	-1.36 ± 0.87	2.9	23.2	-1.37 ± 0.92
36-47	5.6	8.3	-1.02 ± 1.16	0.0	8.3	-0.92 ± 0.82	0.0	16.7	-1.34 ± 0.65	0.0	19.4	-1.38 ± 0.75
Total	6.0	18.4	-1.01 ± 1.52	1.0	8.9	-0.69 ±1.11	1.6	18.1	-1.23 ±0.87	2.6	18.8	-1.23 ± 0.96

Table 4: Results of clinical examinations

Examination	Parameter of Interest	† Condition Diagnosed		
		YES	NO	Doubtful
HAIR:	a. Dry, staring	25.2	74.8	
	b. Discoloured	18.8	81.2	
	c. Easily pluckable	9.9	90.1	
	d. Abnormal texture/ straight	8.9	91.1	
EYES:	a. Conjuctival infection	4.0	93.6	2.5
	b. Bitot's spots	1.0	96.5	2.5
	c. Xeropthalamia	0.0	99.5	0.5
TEETH:	a. Visible carries	10.4	88.6	1.0
	b. Debris/Calculus	5.9	94.1	
	c. Fluorosis	3.5	95.5	1.0
FINGER NAILS:	a. Clubbed	1.5	98.5	
	b. Spooned	0.5	99.0	0.5
	c. Ridged	4.5	95.5	0
	d. Combinations	1.5	98.5	0.5
SKIN:	a. Follicular hyperkeratosis, arms	8.4	91.6	
	b. Follicular hyperkeratosis, back	7.4	92.1	0.5
	c. Dry or scaling (Xerosis)	21.8	78.2	
	d. Hyperpigmentation (Face & hands)	5.0	94.1	1.0
	e. Thickened pressure points (not elbow or knees)	3.5	95.5	1.0
	f. Purpura	1.0	98.0	1.0
	g. Cracked skin (mosaic)	2.5	97.5	
	h. Loss of elasticity	5.0	95.0	
	i. Pellagrous dermatitis	0	0	0
ABDOMEN:	Hepatomegaly	12.4	87.6	

† Percentage of total children examined

Table 5: Variety in Household Diets

Food Group	Proportion of Foods Consumed in Each Food Group Mean ± Std		
	Gweri (n = 65)	Kiguma (n = 106)	Total (N=171)
Energy- yielding foods	.51 ± .13	.53 ± .14	.53 ± .14
Bananas	.50 ± .22	.52 ± .16	.51 ±.18
Tubers & starchy vegetables	.68 ± .19	.71 ± .22	.70 ± .21
Grains	.46 ± .21	.47 ± .22	.46 ± .22
Fats, oils, & sweets	.42 ± .16	.44 ± .19	.43 ± .18
Body-building foods	.49 ± .12	.50 ± .16	.49 ± .15
Legumes	.27 ± .16	.31 ± .18	.29 ± .17
Nuts	.46 ± .13	.48 ± .20	.48 ± .17
Meats	.33 ± .19	.37 ± .23	.36 ± .22
Milk†	-	-	-
Protective	.42 ± .15	.46 ± .17	.45 ± .16
Fruits	.45 ± .16	.47 ± .18	.46 ± .18
Vegetables	.40 ± .17*	.46 ± .17*	.44 ± .18

*Differences between groups are significant at P = .05 significance level
†Milk was not presented in various forms in the food frequency questionnaire

Table 6: Adequacy of Meals Provided to Young Children

Food group	Mean Adequacy Scores by Age Group					Optimal Score
	6-11 months (n = 19)	12-23 months (n = 40)	24-35 months (n = 49)	36-47 months (n = 23)	Total (n = 131)	
Energy- yielding foods	**2.58 - .77***	**2.61 - .91***	**3.22 - .68***	**2.78 - .60***	**2.87 - .80**	**6**
Bananas	1.32 - .88	1.47 .88	2.04 - .93	1.96 - .93	1.75 - .95	
Tubers & starchy vegetables	.68 .58	.57 - .59	.43 - .54	. 35 - .65	.50 - .59	
Porridge	.21 - .42	.10 - .30	.14 - .41	0	.11 - . 34	
Grains	.37 - .68	.45 - .55	.61 - .86	.43 - .59	.50 - .71	
Fats, oils, & sweets	.10 - .31	.17 - .38	.22 – 51	.04 - .21	.16 - .41	
Body-building foods	**2.47 - .79***	**2.05 - .78***	**2.29 - .81***	**2.76 - .79***	**2.33 - .82**	**4**
Legumes	1.53 – 1.12	1.27 - .85	1.69 - .92	2.04 - .77	1.60 - .93	
Nuts	.32 - .58	.45 - .64	.22 - .49	.26 - .45	.31 - .54	
Meats	.10 - .31	.15 - .36	.18 - .44	.13 - .34	. 15 - .38	
Milk	.53 – 98	.15 - .36	. 19 - .44	. 33 - .51	.25 - .55	
Protective	**.21 - .41**	**.36 - .63**	**.41 - .61**	**.35 - .65**	**.35 - .59**	**5**
Fruits	.16 - .37	.15 – 43	.12 – 39	.17 - .49	.15 - .41	
Vegetables	.05 - .23	.25 - .54	.29 - .50	.17 - .49	.22 - .48	
Total score	**5.26 – 1.08**	**5.02 – 1.49**	**5.93 - .98**	**5.89 – 1.36**	**5.55 – 1.29**	**15**

*Mean differences in adequacy scores are significant at P < .05.

Figure 1: Frequency of Food Consumption by Food Group