THE NUTRITIONAL STATUS OF SICK CHILDREN SEEKING CARE AT KENYATTA NATIONAL HOSPITAL USING THE NEW WHO STANDARDS.

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A dissertation in partial fulfillment of Master of Medicine in Pediatrics and Child Health, University of Nairobi.

DECLARATION

This dissertation is submitted as my original work and has not been presented for a degree elsewhere.

Sign---------- Date----------

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APPROVAL

This dissertation has been submitted for examination with our approval as university supervisors.

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DEDICATION

This work is dedicated to my husband Chrispine Oduor, daughter Valarie Akinyi and sons Alvin Oduor and Elvis Otieno. Thank you for your support and patience.

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4. All caretakers and children who participated in this study.

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LIST OF ABBREVIATIONS

CBF	–	Continued breastfeeding
EBF	–	Exclusive breastfeeding
EIBF	-	Early initiation of breastfeeding
HFA	-	Height for age
HIV	-	Human Immune Deficiency Virus
ITNs	-	Insecticide Treated Nets
KDHS	-	Kenya Demographic and Health Survey
KNH	-	Kenyatta National Hospital
MAD	-	Minimum acceptable diet
MDD	-	Minimum dietary diversity
MDG	-	Millennium Development Goals
MMF	-	Minimum meal frequency
MUAC	-	Mid Upper Arm Circumference
NCHS	-	National Center for Health Statistics
NHIF	-	National Hospital Insurance Fund
NRI	-	Nutritional Risk Index
ORS	-	Oral Rehydration Solution
ORT	-	Oral Rehydation Therapy
PBF	–	Predominant breastfeeding
PEU	-	Pediatric Emergency Unit
SBF	-	Still breastfeeding
URTI	–	Upper respiratory tract infection
WFA	-	Weight for age
WFH	-	Weight for height
WHO	-	World Health Organization

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OPERATIONAL DEFINITIONS

1. Normal nutrition- children with nutritional indices less than -2z score below the 2006 World Health Organization reference standards**.**

2. Malnutrition- deviation of child growth as detected by nutritional indices in reference to set standards, in this case 2006 WHO growth standards. In this study it is mainly discussed as under-nutrition.

3. Nutritional indices:

a) Weight for height– termed **Wasting** when low**.** It is a measure of acute malnutrition.

b) Height for age– termed **Stunting** when low. It is a measure of chronic malnutrition.

c) Weight for age- termed **Underweight** when low**.** It indicates overall nutritional status and does not differentiate acute from chronic malnutrition.

4. Moderate malnutrition– nutritional index between -3 z scores and -2 z scores below the reference standards.

5. Severe malnutrition- nutritional index more than -3 z scores below the reference standards or visible severe wasting with or without the presence of nutritional edema. In this study it is defined by severe wasting, stunting or underweight as stated above.

6. The Z-score (also called a standard deviation or SD score)-the number of standard deviations by which a child's weight or height is above or below the reference population median value at the same age.

7. Acute illness- Newly diagnosed health condition with symptoms lasting less than 14 days. In this study mainly included upper respiratory tract infections, pneumonia, acute diarrhea, malaria and meningitis. This is adopted from the Integrated Management of Childhood Illnesses guidelines (IMCI). Other acute illnesses not mentioned above were classified as other illnesses.

8. Chronic illness- Known or newly diagnosed long standing health condition-in this study defined as presence of symptoms lasting 14 or more days and or presence of a known chronic illness. These included illnesses such as HIV, Tuberculosis, Chronic

Organ diseases such as Heart, Liver and Kidney Disease, Hematologic illnesses such as Sickle cell, Malignancies and other chronic illnesses.

NUTRITIONAL INDICATORS

Ref: Indicators for assessing infant and young child feeding practices (WHO-2008) [22]

CRITERIA THAT DEFINE SELECTED INFANT FEEDING PRACTICES

1. **Early initiation of breastfeeding (EIBF)** - A child below the age of 24 months put on the breast within 1 hr of birth.
2. **Exclusively breastfeeding (EBF) –** An infant less than 6 months of age receiving breast milk (including expressed and from wet nurse) as the only source of nourishment. It allows infant to receive ORS, drops, syrups (vitamins, minerals, medicines).
3. **Predominantly breastfeeding (PBF)** - An infant aged 6-8 months receiving breast milk (Including expressed and from wet nurse) as predominant source of nourishment. It allows for certain liquids (water and water-based drinks, fruit juice, ORS, drops or syrups) but excludes feeding on non-human milk (including formula milk) and food based fluids.
4. **Continued breastfeeding (CBF) -** A child aged 12-15 months who is still breastfeeding.
5. **Still breastfeeding (SBF) -** A child aged 20-23 months who is still breastfeeding
6. **Minimum dietary diversity (MDD) –** A child aged 6-23 months of age who is receiving diversified diet which is defined as reception of foods from four or more food groups.

   The seven food groups used in tabulation are:

   - grains, roots tubers,
   - legumes and nuts,
   - dairy products (milk, yoghurt, cheeses)
   - flesh foods (meat, fish, poultry, and liver, organ meats),

- eggs,
- vitamin A rich fruits and vegetables,
- other fruits and vegetables

7. **Minimum meal frequency (MMF)** - A child aged 6-23 months who receives feeds the minimum number of times or more based on age.

   Minimum was defined as:

   a. 2 times for breastfed infants 6-8 months of age
   b. 3 times for breastfed children 9-23 months of age
   c. 4 times for non-breastfed children 6-23 months of age

8. **Minimum acceptable diet (MAD) -** A child aged 6-23 months who receives at least both the minimum meal frequency and the minimum dietary diversity.

ABSTRACT

Background: Despite malnutrition being the single most important potentiating factor in childhood morbidities and mortalities, it remains poorly diagnosed and managed. The diagnostic tool used in a facility is important because of differences in sensitivity and specificity. The new World Health Organization (WHO) growth charts rolled out in the year 2006 to be used for routine diagnosis of malnutrition are yet to be adopted at Kenyatta National Hospital (KNH) amongst other hospitals.

Objectives:

Primary objective: To determine the prevalence of malnutrition in children seeking care at KNH using the new WHO growth charts.

Secondary objectives:

1. To determine the prevalence of malnutrition in children presenting with acute versus chronic illnesses.
2. To determine the socio-demographic, feeding and health factors associated with malnutrition in this population.

Methods: A hospital based cross-sectional study done in the Pediatric Emergency Unit (PEU) at KNH. All eligible patients were administered a standardized structured questionnaire aimed at finding the socio-demographic, feeding and medical history. Height and weight were taken and converted to z scores and nutritional status analyzed in reference to the WHO standards.

Results: 585 children were recruited into the study, 570 children were analyzed. The mean z scores for weight for age, weight for height and height for age were less than -1z score even when stratified by age except for the first 6 months. One third of the patients (33.3%) were malnourished (moderate 29.8%, severe 3.5%). None severe malnutrition accounted for 89.5% of the cases of malnutrition. Moderate wasting was slightly higher

than underweight and stunting (27%, 20% and 20% respectively). A third of the children who were acutely ill and a quarter of the chronically ill were moderately malnourished. All the children with severe malnutrition were acutely ill.
The acutely ill children were more likely to be moderately wasted (p=0.001) and so were the children who did not achieve the minimum dietary diversity (p=0.004). None of the other feeding indicators and the socioeconomic factors were significantly associated with malnutrition.

Conclusion: Malnutrition is a major co morbidity in sick children seeking care at KNH PEU. Malnutrition starts within the first 6 months and is independent of age. For every one child diagnosed as severely wasted, 8.05 are moderately wasted. These cases need to be correctly diagnosed and managed.

INTRODUCTION AND LITERATURE REVIEW:

Various tools have been used to assess nutritional status in hospital based populations. The tool routinely utilized in a given hospital greatly affects the magnitude of malnutrition detected, thus affecting the level of care and attention that malnutrition is given at that facility. Kenyatta National Hospital (KNH) currently utilizes the World Health Organization/National Center for Health Statistics (WHO/NCHS) growth references which classify malnutrition based on standard deviation from the median weight for height for sex. These standards were developed in 1977 from United States of American population data, and have been found not to be representative of worldwide child growth [1] .They are also fairly old and not representative of current child growth [1, 2] .The World Health Organization (WHO),in the year 2006,introduced new standards for defining malnutrition. This tool, commonly referred to as the New WHO Growth Standards, has been found to detect early malnutrition [1, 2, 3] a great advantage if utilized in hospital set ups where a great percentage of sick children may present with non-clinically evident malnutrition which often goes undetected. The New WHO growth standards also classify more children as severely malnourished and allow early admission into therapeutic feeding programs, resulting in better and faster recovery rates[2, 3, 4]. Although KNH, being a tertiary Hospital, has embraced the WHO guidelines on diagnosis and management of various childhood diseases, including malnutrition, it is yet to adopt the current WHO growth standards as a tool for routine diagnosis of malnutrition. In addition, no research has been done to find out the magnitude of malnutrition in the facility by these standards. Previous studies were based on either the Welcome Trust Classification or the NCHS growth standards.

NUTRITIONAL STATUS ASSESMENT IN CHILDREN

Nutritional status in individuals or populations is usually assessed from various anthropometric indices, commonly weight for height, height for age, weight for age and mid-upper arm circumference (MUAC).Weight-for-height (WFH) is a measure of wasting. It indicates acute malnutrition and results from short term, often severe, inadequate dietary intake and serious or repeated infections. Height-for-age (HFA) is a measure of stunting. It results from long term inadequate dietary intake, chronic or repeated infection and poor socioeconomic conditions. Weight-for-age (WFA) is a composite measure of under-nutrition. It fails to distinguish between wasting and stunting but is a good indicator of overall nutrition. MUAC is a measure of wasting and is a very good predictor of short term mortality [5, 6].

The WHO currently defines malnutrition as mild (1-z scores of the median WHO growth standards), moderate (-2z scores of the median WHO growth standards) and severe (-3z scores of the median WHO growth standards). Severe malnutrition is further defined as visible severe wasting, or the presence of nutritional edema [1, 2, 5]. Previously, WHO had recommended NCHS growth charts developed from the FELs longitudinal study for the charts from birth to 2 years, and the NCHS longitudinal study for the charts between two years and five years[7, 8, 9]. They were widely used and had been adopted for routine use by over 90 countries worldwide [8, 9]. Malnutrition using these standards is classified as moderate (-2 z scores, or 80% of median) and severe (-3 z scores or 70% of median). However, because of their reference population which was mainly formula fed children from Ohio, their deficiencies included lack of generalisabilty, and made them descriptive rather than prescriptive[1, 2,, 7, 8] . Their use was thus questioned by various authorities. In addition, they had curve dissociation at 24 to 36 months [7, 8, 9].

WHO thus embarked on a study to create growth standards that were more generalizable and that define optimum child growth. Criteria for enrollment included single birth with no health, environmental or economic constraints on growth and a non smoker mother[2]. The mothers had to be willing to exclusively or predominantly breastfeed up to 4 months of age with the addition of complementary foods from 6 months and continued breastfeeding until 12 months. It came up with the conclusion that when maternal nutrition and environment do not limit a child's growth and infants are fed optimally according to WHO guidelines (which recommends that infants should be exclusively breastfed for the first six months of life then they should receive adequate and safe complementary foods while breastfeeding continues up to two years or beyond), infants and children of various racial and ethnic groups grow similarly[1, 2, 3, 4].

It has been shown that there are significant differences in the magnitude of malnutrition as detected by the two above mentioned diagnostic tools, albeit dependent on the profile of the population of study. This difference is especially noticeable for acute severe malnutrition. De Onis et al found the prevalence of severe wasting according to the WHO standards 1.5 times higher for children from birth to 11 months and 1.7 for children aged 12-60 months [2] while Seal et al, in a study in Refugee camps in Algeria, Kenya and Bangladesh found an increase of 2.5 and 4.2 times respectively[10]. These were determined using the weight-for-height Z-scores. Sheila et al in a study in Niger found an 8 times increase in the prevalence of severe malnutrition by WHO standards[11]. These findings indicate that regions adopting the WHO growth standards need to assess the impact the transition to the new standards will have on their nutrition programs.

KENYAN MALNUTRITION STATUS IN CHILDREN BELOW FIVE YEARS

In Kenya 35 percent of children below five years are stunted and 14 percent severely stunted. Stunting peaks in the second year of life at 46 percent. 7 percent of these children are wasted with 2 percent being severely wasted .Wasting peaks at 6-8 months during weaning. Underweight levels are 16 percent with 4 percent being severely underweight [12]. These levels of malnutrition are much higher than the WHO acceptable levels of malnutrition: moderate malnutrition less than 5 percent and severe malnutrition less than 1 percent [13.] Kenya Demographic Health Survey (KDHS- 2008-09) report further indicates that at 6-12 months, for every 1 child severely wasted, about 10 children are moderately wasted, while for every 1 child severely stunted, two are moderately stunted. This being community data, the ratio is expected to be higher in hospital set ups.

Table 1: Trends of malnutrition by age –KDHS 2008-09 [12].

	H/A		W/H		W/A	
Age in months	<-3 SD	<-2SD	<-3 SD	<-2SD	<-3SD	<-2SD
< 6 months	4.4	11.2	5.1	9.7	2.9	7.9
6-8	9.1	22.8	1.3	11.4	1.5	12.6
9-11	14.6	30.5	1.0	10.6	3.4	14.5
12-17	15.0	41.8	2.5	6.3	3.0	17.1
18-23	21.9	45.7	0.6	4.9	1.9	12.2
24-35	20.3	45.4	1.6	6.6	5.5	19.4
36-47	12.6	35.0	1.1	3.8	3.4	15.8
48-59	10.5	31.8	2.2	7.3	4.0	19.4

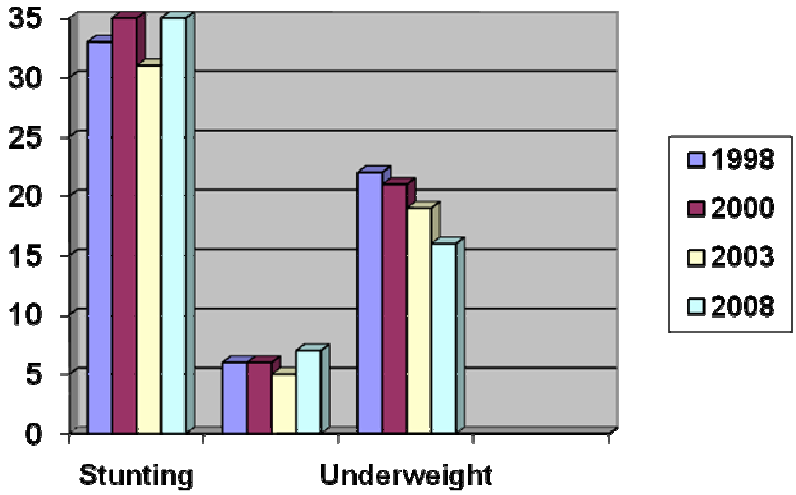
Although KDHS 2008-09 indicates marked reduction in under five mortality rate from 115/1000 (KDHS 2003) to 74/1000 (KDHS 2008-09), there seems to be minimal contribution from reduction of malnutrition attributable mortality.

Table 2: Trends in Infant and under-five mortality rates, Kenya, 1994-2007 (KDHS 2008-09)

Survey Year	Approximate calendar period	Infant mortality	Under-five mortality ($_5q_0$)
1998	1993-1997	74	112
2003	1998 – 2002	77	115
2008-09	2003 -2007	52	74

The reduction in mortality is thought to have resulted from intensive immunization campaigns resulting in improved coverage and increased use of insecticide treated nets (ITNs).Other possible contributions were improved use of Oral Dehydration Therapy (ORT), and improved HIV/AIDS management and Prevention of Mother To Child Transmission (PMTCT) [12].The malnutrition trends, in contrast to mortality trends, show significant stunting in over a decade despite great efforts to deal with the same.

Fig 1: The figure below illustrates malnutrition trend in Kenya over the last decade[12].



It is thought that the rise in the prevalence of stunting and wasting could have resulted from the adoption of the New WHO growth standards in this survey. An in-depth

evaluation is necessary to be able to competently state so since no comparison was done between the two growth standards at point of analysis to rule out a true rise in the prevalence of malnutrition during this period.

With malnutrition contributing to more than half of the 11 million deaths that occur each year among children aged less than 5 years old [14], efforts at reducing child mortality must include malnutrition based interventions. The fourth millennium development goal (MDG-4) stating that signatory countries should reduce their under five mortality rates by two thirds by the year 2015 [15], may remain evasive unless attention is paid to the contribution of malnutrition in childhood mortality. The Kenyan under-five mortality target is 32/1000 by 2015 [15].It is therefore necessary that an appropriate diagnostic tool be utilized in nutrition programs as this would improve the detection rate of both severe and non-severe malnutrition and reduce the prevalence of severe malnutrition

KENYATTA NATIONAL HOSPITAL SITUATION

Studies at Kenyatta National Hospital pediatric wards estimated malnutrition to be as high as 69-75 percent amongst the pediatric inpatients [16, 17]. Severe malnutrition accounts for about 7 % of admissions and 15 % of mortalities [16, 17, 18]. Mortality rates are as high as 30% amongst the severely malnourished compared to less than 10 percent in their well nourished counterparts [16, 17]. More than two thirds of inpatients with pneumonia have malnutrition [17]. In a mortality audit of pediatric patients admitted at the facility with severe malnutrition by Nzioki et al, they found mortality to be at 38% with a half of the mortalities being within 48 hours of admission [19]. Maigua et al (2004), in a cross-sectional study seeking to determine the level of missed diagnosis of malnutrition in children admitted with pneumonia at KNH pediatric wards found that although all the severely malnourished children were correctly diagnosed, the moderately malnourished (61%) were not recognized and thus not managed [17] while

Nyandiko (2004) found that of the 75% malnourished pediatric in patients who had moderate malnutrition at admission, 58% deteriorated during hospital stay as detected by Nutritional Risk Index (NRI) and 34 % had percentage weight loss when weight loss was used [16].

These studies were inpatients based and did not define the overall outpatient pediatric nutritional status and also used either the Welcome Trust Classification of malnutrition or the NCHS growth standards. Since they do not give indicate the magnitude of outpatient levels of malnutrition, they do not give baseline data necessary for planning of outpatient based interventions which would be very useful in management of non-severe malnutrition.

STUDY JUSTIFICATION /STUDY UTILITY

The new WHO growth standards were created with the intention of producing globally applicable growth standards that describe the growth of children as it occurs under optimal nutritional conditions and in the absence of external constraints. They represent childhood growth as it should be. Unlike the previous standards, they are prescriptive [3,4]. They have been shown to detect malnutrition at an early stage enabling early intervention[2,3,4]. With KDHS 2009 indicating that by 6 months of age about 10 percent of infants are wasted, and by one year over 10 % are wasted and over 30 % are stunted[12], this tool is needed in our set up to enable these children to be appropriately diagnosed and managed. Kenyatta National Hospital being the largest primary health facility in Nairobi serves a large population of the poorest population in Kenya. Its catchment area includes the most vulnerable children in the city. This study brought out the magnitude of malnutrition in sick children attended to in the facility. This will sensitize the health workers to look out for especially non-severe malnutrition amongst these children and for the hospital management to plan for adequate equipment, drugs and staff in order

for these children to be prevented from getting severe malnutrition. In addition, the study results will sensitize health workers to adopt the use of these (WHO) growth charts in preference to the currently used WHO/NCHS charts.

STUDY OBJECTIVES

Primary objective

To determine the prevalence of malnutrition in children seeking care at KNH using the new WHO growth charts.

Secondary objectives

1. To determine the prevalence of malnutrition in children presenting with acute illness.

2. To determine prevalence of malnutrition in children with chronic illnesses.

3. To determine the demographic, medical and feeding factors associated with the different severities of malnutrition.

STUDY METHODOLOGY

Study design

This was a hospital based cross-sectional study.

Study site

The study was conducted at the Kenyatta National Hospital, Pediatric Emergency Unit (PEU).

Kenyatta National Hospital is the largest public hospital in Kenya. It is the national referral Hospital and serves as a teaching hospital for Nairobi University School of Medicine, the largest Medical School in the country. Nairobi City has a population of about 3 million people [20]. It has only 5 public hospitals, of which only 3 are serving as general hospitals (Kenyatta, Mbagathi, and Mathare).The other two (Spinal Hospital

and Pumwani) provide services to patients with spinal injury and maternity services respectively. There are a number of private hospitals but these are often financially out of reach to most of the population of Nairobi which has an average poverty level of 44%. Some areas have as high a poverty level as 70-77% [20]. There are also a number of health centers that are able to handle common non-complicated cases and refer patients to Kenyatta when necessary. KNH therefore serves largely as a primary health care facility to this large population besides referrals requiring specialist and sub-specialist care and intensive care management from various parts of the country, and sometimes from neighboring countries.

Kenyatta National Hospital has four pediatric wards which admit children below 12 years of age. The children are first seen at the Pediatric Emergency Unit where a triage is done. Those requiring admissions are then taken to the admitting ward. Nutritional assessment is done by the nurse and the clinician on duty. This routinely involves weight measurement and clinical examination for signs of severe malnutrition. Height, head circumference and mid upper arm circumference are not routinely taken. Children classified as severely malnourished with co-morbidities are admitted in the general pediatric wards while those with less severe forms of malnutrition are managed as outpatient if they do not have another indication of in-patient care.

Study population

Children aged below 60 months seeking care at Kenyatta National Hospital.

Inclusion criteria

1. Children aged below to 60 months.
2. Parent/Guardian consent to take part in the study.

Exclusion criteria

1. Children older than 60 months

2. Failure to obtain consent.

Sample Method

The study was conducted in 2 consecutive months from 24th May to 30th July 2010. Random sampling was used to select the data collection sessions. A 24 hour day was divided into four 6 hour sessions as illustrated below.

Sessions in a 24 hour day:

Session A 24.00-05.59 hrs

Session B 06.00-11.59 hrs

Session C 12.00-17.59 hrs

Session D 18.00-23.59 hrs.

Data collection was done on alternate days. On every data collection day, 2 sessions were randomly picked by computerized random selection method. This was aimed at minimizing subject sampling bias by ensuring that patients seeking care at any hour of the day had an equal chance of being selected. During the session selected, all consecutive cases who meet the inclusion criteria were recruited. The process was repeated until an adequate sample was achieved.

Sample calculation

This was done using the Fisher's formula for determination of sample size in prevalence studies as below [21]:

$$n = \frac{Z^2 \, p\{1-p\}}{d^2}$$

Where;

n = Sample size.

Z=Standardized score at 95% confidence interval; confidence level=1.96

P = 50% (since the proportion of children with malnutrition in outpatient set ups in hospitals is currently unknown P was assumed to be 50%)
d =Precision/ reliability with which to determine p =5%

The sample size calculated using the above formula was **384**.
The sample size achieved was 585.

Enrollment and data collection

The principle investigator trained 3 nurses who were data collection assistants. They were study employees for the study period. The WHO guidelines was the training tool[23] (Appendix 111) .The aim was to standardize data collection and data entry methods and minimize collection and entry errors. During the sessions chosen two members of the study data collection team were stationed at the Pediatric Emergency Unit to recruit subjects. Children aged below 60 months meeting the inclusion criteria were recruited.

Patients' background data including socio-demographic data, immunization and feeding history was sought using a preformed questionnaire (appendix 1). Immunization data was based on mothers recall and confirmed with immunization card if available. Feeding history was obtained as per the WHO 2008 guidelines as stated in the study definitions on indicators for assessing infant and young child feeding practices. A brief clinical history was taken using the preformed questionnaire, and the final diagnosis was based on the diagnosis made by the primary caregiver (either a resident doctor or a pediatric clinical officer). On occasions where the diagnosis was not clear, the principle investigator was informed who then reevaluated and discussed the case with the primary caregiver and then made the final diagnoses. Some of the diagnoses remained unclear and were classified amongst 'other illnesses'.

Anthropometric measurements and indices were taken as per the Standard Operation Procedure adopted from WHO guidelines [22] (Appendix III). In reference to this

protocol, each anthropometric data was taken twice by the same person, both measurements were entered into the questionnaire, their mean was calculated at data entry point and entered into the spread sheet as the final measurement. The equipment used was standardized and calibrated on each data collection day.

N/B Data collection instruments

1. Questionnaire for structure closed interviews.
2. A beam balance scale and basin scale, 100gms increment (Seca Australia).
3. Length board and stadiometer, 1mm increment (Wooden Shorr Board, USA).

DATA MANAGEMENT AND ANALYSIS

Data from the interviews was recorded in questionnaires and then entered into a purpose–designed data base with the participants identified only by a unique study code. At the point of data entry, range and validity checks were incorporated to prevent data entry errors. The software default applied by the WHO was used regarding cut offs for biologically improbable values. Out of range values of z scores were recorded as missing.

Description of the population of study was done in respect to their socio- demographic profiles, immunization, medical and feeding history. Data on feeding history was analyzed as per the WHO 2008 guidelines on indicators for assessing infant and young child feeding practices [23](Appendix IV).

For the primary objective, calculation of nutritional indices and reference to WHO standards was done using STATA v 10 (Stata Corp Ltd, Texas, USA), using a macro provided by WHO. The indices were calculated as z scores. For secondary objectives, Chi square test was used to determine associations between malnutrition and various

socio-demographic, medical and feeding profiles. Odds ratios were used to estimate risk of malnutrition and P values less than 0.05 were considered significant.

ETHICAL CONCIDERATION

Approval to carry out the research was sought from the Kenyatta National Hospital Ethics and Research Committee and from the Department of Pediatrics and Child Health, University of Nairobi. Informed consent was sought from the caretakers of the children before enrollment. To ensure confidentiality every child was allocated a study serial number linking them to their clinical data base which was only be accessible to the investigators.

Care takers of any child found to have malnutrition were informed of the child's nutritional status and also communicated to the attending clinician and documented in the medical charts. The researchers were not involved with the patient management. Information irrelevant to the patient's clinical management was treated with confidentiality.

RESULTS

Five hundred and eighty-five (585) children were recruited into the study. Six of the children had incomplete data and were not analyzed; nine were found to have over-nutrition and were presented and analyzed separately since this study defined malnutrition mainly based on under-nutrition. Socio-demographic characteristics and data on the remaining 570 children are presented in Table 3:

Table 3: Socio-demographic characteristics of the study population

Characteristic	Frequency	Per cent
Distribution by age (in months)		
< 6 months	152	26.7
6-11 months	254	44.6
12-23 months	78	13.7
24-59 months	86	15.1
Distribution by sex		
Male	361	63.3
Female	209	36.7
Distribution by area of residence		
Nairobi slum areas	66	11.6
Non slum areas Nairobi	299	52.5
Nairobi suburbs	205	36.0

The majority (71%) of children recruited into the study were infants with a quarter of the population under 6 months of age**.** Most of the children (85%) were aged less than 2 years, an age where children are most susceptible to malnutrition. There were slightly more males than females with a ratio of 1.7:1. Most of the children (53%) came from non slum areas of 'low' to 'mid' socio-economic class and only 12% came from Nairobi slum areas. These non-slum areas included Kawangware, Kahawa West, Kayole, Eastleigh, Dandora, Huruma amongst others while the slum areas were mainly Kibera, Mathare and Korogocho. The Nairobi suburbs included Thika, Limuru, Kikuyu, Kangundo amongst others. None of the patients came from the 'high' socioeconomic residential areas of Nairobi[20].

Immunization coverage for age as reported by the caregivers was very high at 98.6%, however, immunization status was confirmed by immunization cards in only 68.8% of the children. The agreement rate between the card and the reporting rates was 92.6% as shown below:

Table 4: Agreement rate of caregiver and card information on immunization status of child

	Caregiver	
Card	Yes	No
Yes	361	1
No	30	2

Where Agreement rate= (361+2)/ (361+1+30+2) ×100

CARE-GIVERS BACKGROUND INFORMATION

Majority of the caregivers were aged 20-34 years (85.3%). The youngest mothers were 15 years (4) while the oldest mothers were 38 years (2). Almost all the caregivers were females (93.3%) and were mothers to the children (98.2%). Of the 10 who had other guardians, 2 were under the care of their aunties, 4 under their grandmothers care, 2 with their fathers, 1 abandoned child and 1 from a children's home. A large majority of the caregivers (97.5%) had some level of education, but less than a half (48%) had more than primary education and 89.5% were not employed.

The socio-demographic characteristics of the caregivers of the study population are summarized in table 5 below:

Table 5: Socio-demographic characteristics of the caregivers

Characteristic of caregivers	**Frequency**	**Per cent**
Age (in Years)		
< 20	80	14.0
20-24	296	51.9
25-29	127	22.3
30-34	63	11.1
>34	4	0.7
Mean 23.8 Median 23		
Range 15-38		
Sex		
Female	532	93.3

Mother is caregiver		
Yes	560	98.2
Level of education		
None	14	2.5
Primary	281	49.3
Some secondary & Above	275	48.2
Employment status		
None	510	89.5
Business	12	2.1
Casual laborer	12	2.1
Salaried employment	34	6.0
Other	2	0.4

THE NUTRITIONAL STATUS OF THE STUDY POPULATION

The mean z scores of the study population by the WHO standards for weight for age (W/A), weight for height (W/H) and height for age (H/A) were less than -1z score and are shown in table 6 below:

Table 6: Mean z scores of the study population

Nutritional index	Mean z score for the study population
WH	-1.34
WA	-1.21
HA	-1.10

The z-scores indicate that the nutritional status of this population was generally below optimum. When the means for the nutritional indices were stratified by age they were found to be universally lower than -1z score for all age groups, except at 6 months of age when the mean z-score for height for age was just above -1 (Fig 2 below). There was no catch up growth passed the age of two years.

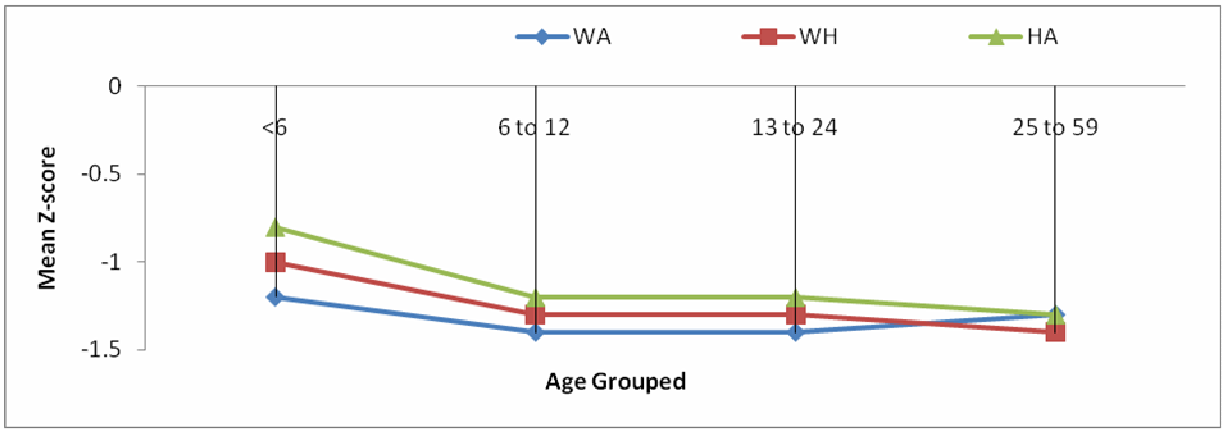


Fig 2: Mean z scores of the study population by age

PREVALENCE OF MALNUTRITION IN THE STUDY POPULATION

Of the 570 children analyzed 191 (33.3%) were malnourished (i.e had nutritional indices more than -2z scores by WHO growth standards). The prevalence of the various severities of malnutrition is shown in Figure3:

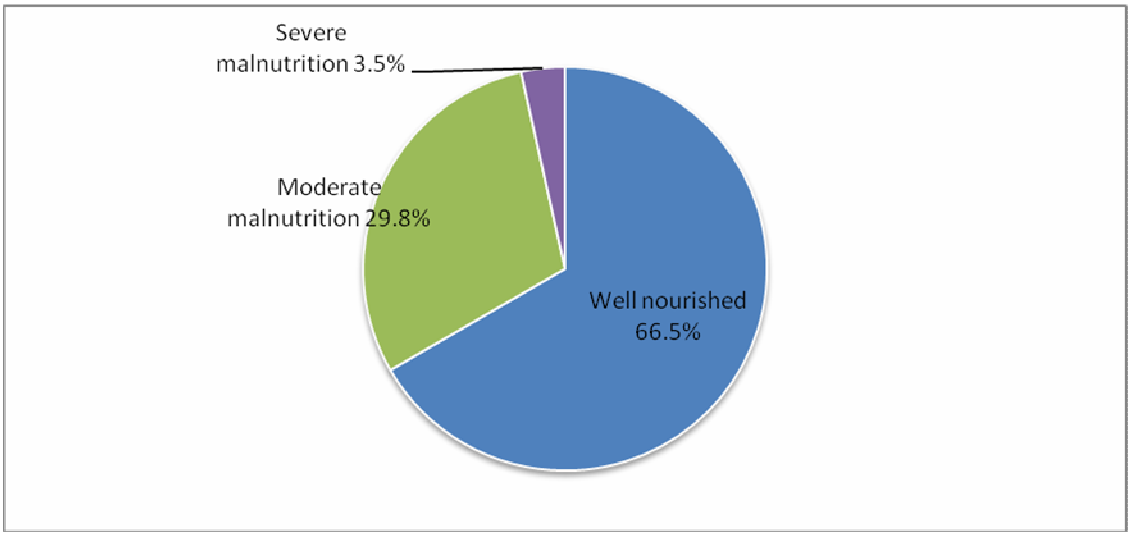


Fig 3: Prevalence of malnutrition: n=570

Majority of the malnourished children (170, 29.8%) had moderate malnutrition and only a small proportion (21, 3.5%) presented with severe malnutrition. Moderate

malnutrition accounted for 89.5% of the malnutrition cases. The ratio of the moderately malnourished to the severely malnourished children was 8.5:1.

PREVALENCE BY TYPE OF MALNUTRITION

The overall prevalence of wasting was 30.3%, stunting 20.5% and underweight 23.7%. The prevalence of moderate wasting was slightly higher than that of underweight and stunting (27%, 20% and 19% respectively). The table below shows the prevalence of the various types of malnutrition by severity:

Table 7: Type of malnutrition by severity N=570

	<-2z score n (%) (Well nourished)	-2z score n (%) (Moderate malnutrition)	-3z score n (%) (Severe malnutrition)
W/H n=570	397(69.7)	153 (26.8)	20 (3.5)
H/A n=570	453(79.5)	109 (19.1)	8 (1.4)
W/A n=570	435 (76.3)	115 (20.2)	20 (3.5)

PREVALENCE OF THE VARIOUS FORMS OF MALNUTRITION BY AGE

Malnutrition was further classified by age and severity. Growth faltering in the study population started within the first 6 months of age with 28.9% moderately wasted and 2.6% severely wasted. There is no peak for wasting as expected in the age group 6-11 months during weaning period when children are most vulnerable to malnutrition.

Table 8: Prevalence of malnutrition in the study population by age and severity:

	Age in Months			
W/H	< 6, n=152	6-11, n=252	12-23, n=78	24-59,n=86
<-2 <-3 ALL	44 (28.9) 4 (2.6) 48 (31.6)	68 (27.0) 11 (4.4) 79 (31.3)	19 (24.4) 3 (3.8) 22 (28.2)	22 (25.6) 2 (2.3) 24 (28.0)
H/A				
<-2 <-3 ALL	28 (18.4) 3 (2.0) 31 (20.4)	50 (19.8) 3 (1.2) 53 (21.0)	16 (20.5) 1 (0.4) 17 (21.8)	15 (17.4) 1 (1.4) 16 (18.6)
W/A				
<-2 <-3 ALL	27 (17.8) 6 (3.9) 33 (21.7)	55 (21.8) 9 (3.6) 64 (25.4)	15 (19.2) 3 (3.8) 18 (23.1)	18 (20.9) 2 (2.3) 20 (23.3)

Prevalence of stunting is also similar through the age groups with no expected peak during the second year of life. There is no catch up growth towards five years.

PREVALENCE OF MANUTRITION IN CHILDREN PRESENTING WITH ACUTE AND CHRONIC ILLNESSES

Acute illnesses accounted for 500 cases (87.7%) while only 28 had chronic conditions. Acute diarrheal illness was the most diagnosed illness (27.1%) followed by pneumonia (25.8%). Malaria diagnosis was made in only 4.6% of the population. The distribution by diagnoses is shown in figure 4 below:

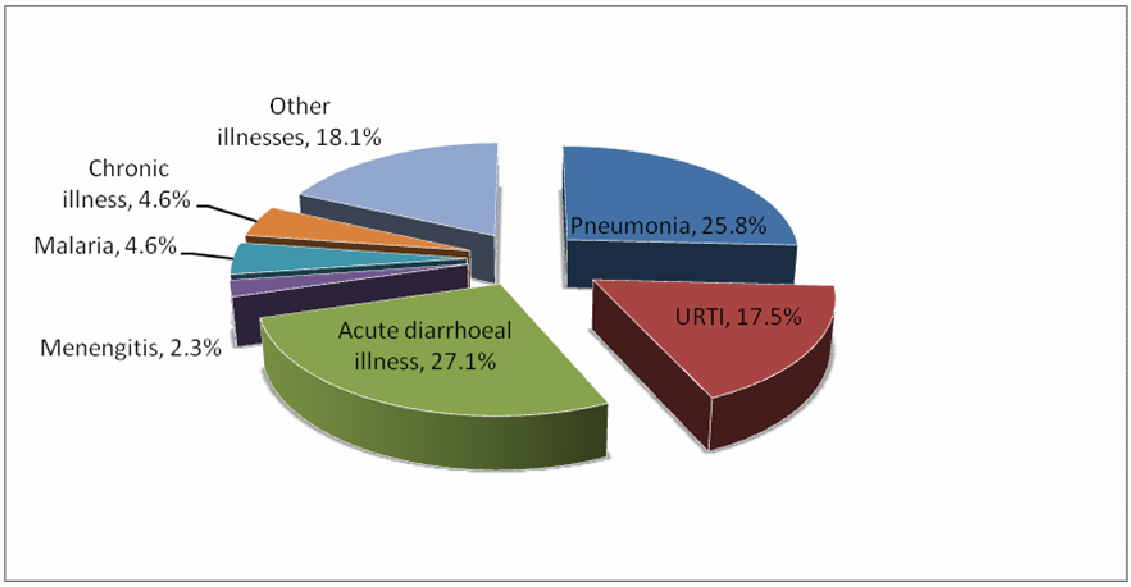


Fig 4: Distribution of the clinical diagnoses at the pediatric emergency unit (n=570)

The diagnoses were grouped by age of the children as illustrated below:

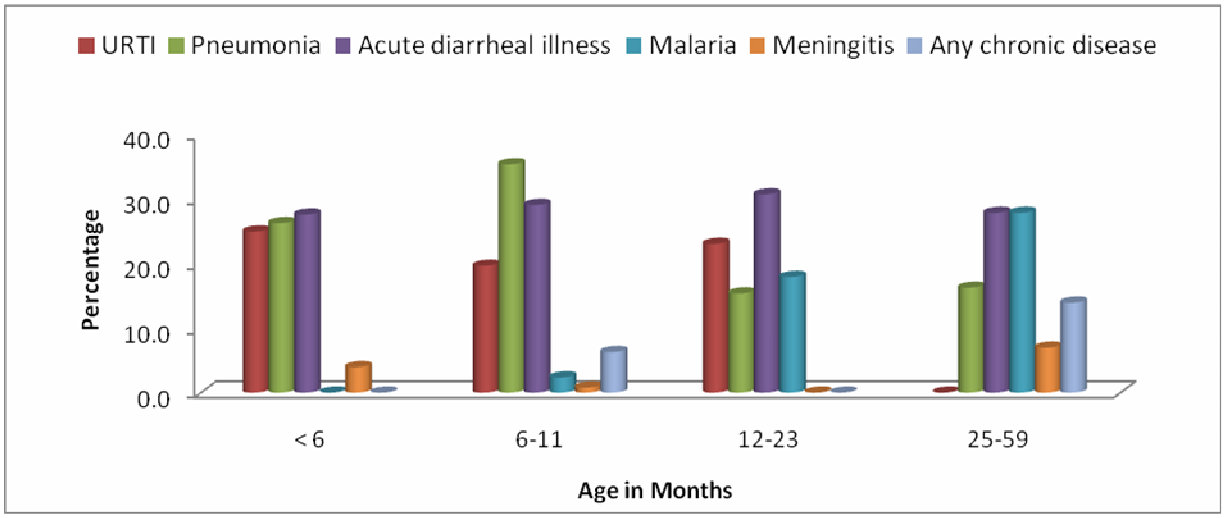


Fig 5: Diagnoses by age

Upper respiratory tract infections accounted for 20-25% of the diagnoses up to the age of 2 years then quickly waned off. The prevalence of pneumonia was high during infancy (27 and 36%), with a peak at 6-11 months (36%). It however remained a significant cause of morbidity in the older children with a prevalence of about 15%. The

prevalence of acute diarrheal illness was high (about 30%) and did not vary with age. Prevalence of malaria progressively increased with age reaching a high level of 30% in the 24-59 months age group. It was almost nonexistent below 6 months and remained low (<5%) between 6 and 11 months of age. Chronic illnesses were mainly diagnosed in children between the ages 6-11 months then 25-59 months with very low rates under 6 months and 12-23 months age groups. Table 8 below presents the distribution of the patients with chronic illnesses.

Table 8: Distribution of chronic illnesses:

Chronic illness	**Number**	**Chronic illness**	**Number**
Cerebral palsy	6	Malignancies	3
Heart disease	4	Down's syndrome	4
Sickle cell disease	5	Renal disease	3
TB/HIV	2	Hemophilia	1

Other illnesses not otherwise classified included symptom based diagnoses whose specific causes were unknown for that point in time such as anemia, edema, heart failure, ascites and pleural effusion.

PREVALENCE OF MALNUTRITION BY THE CLINICAL DIAGNOSIS

Prevalence of malnutrition amongst children presenting with acute illnesses was 36.8 % while 25% of children with chronic illnesses were malnourished. All the children with severe malnutrition were acutely ill. None of the children with chronic illness presented with severe malnutrition. This is illustrated in the table below:

Table 10: Prevalence of malnutrition by diagnosis:

	<-2z score	-2z score	-3z score
Acute illnesses N=500	316 (63.2)	163 (32.6)	21 (4.2)
Chronic illnesses N=28	21 (75.0)	7 (25.0)	0

Chi square statistics was used to test for association between type of illness and malnutrition. The children who were acutely ill were significantly more likely to have moderate wasting as is shown in table 11 below:

Table 11: Association between severity of malnutrition by type of illness

	<-2z score	-2z score	Odds (C.I)	P value
Acute illnesses	316	163	7.3 (2.2to26.2)	<0.001
Chronic illnesses	21	7	1.9 (0.7 to 4.9)	0.163

ASSOCIATION BETWEEN MALNUTRITION AND FEEDING PRACTICES

Of the 570 children studied, 484 were aged less than 24 months. Only 75 (15.4%) of the 484 were put on the breast within 1 hour of birth. Likewise, only 29 (19.1%) out of 152 children aged less than 6 months were exclusively breastfeeding. Breastfeeding practices slightly improved with age**.** Predominant breastfeeding rates were at 36% (37) of 102 children aged 6-8 months). Eleven of 24 (45%) children aged 12-15 months were still breastfeeding while only 6 (30%) of 20 children aged 20-23 months continued to breastfeed (Fig 6). All these rates are way below the WHO recommended rates of 100%.

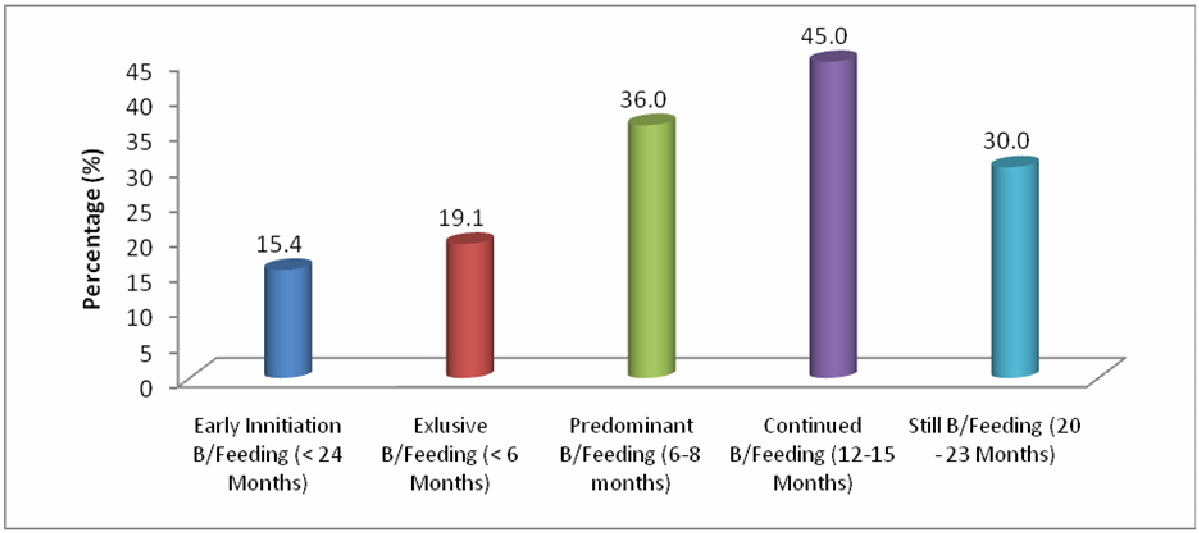


Fig 6: Breast Feeding Practices of the study population

The non-breastfeeding nutritional indicators were also below optimum. These findings are illustrated in the figure 7 below:

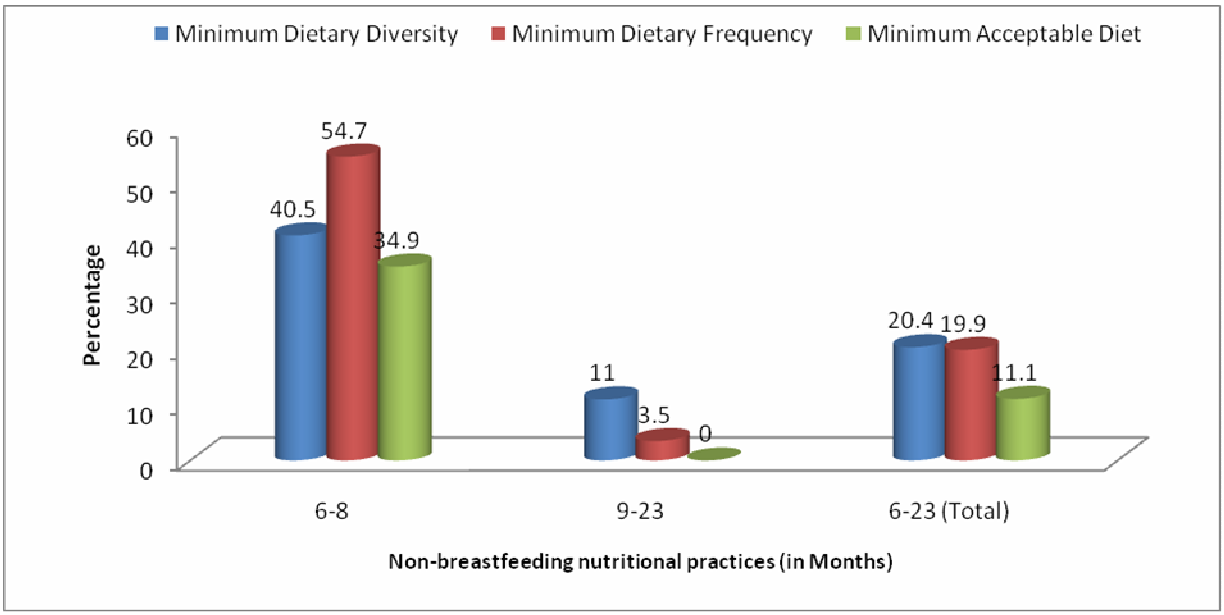


Fig 7: Non-breastfeeding nutritional practices of the study population:

Less than a half (41, 40.5%) of the 102 patients aged 6-8 months achieved the minimum dietary diversity (MDD) and 54.7% achieved the minimum dietary frequency (MDF). The minimum acceptable diet (MAD) was achieved by only 34.9% of children in that age group .These practices worsened with increasing age. Of the 228 children aged 9-23 months, only 11% achieved minimum dietary diversity while only 3.5 % achieved the minimum dietary frequency. None achieved the minimum acceptable diet.

Chi square statistics was used to test for association between malnutrition and feeding practices. The still breastfeeding and continued breastfeeding indicators were not subjected to this test due to the low numbers of children in these age groups.

Table 11: Association between malnutrition and feeding practices:

	Well nourished	Malnourished	Odds (CI)	P value
Early initiation of breastfeeding Yes=75 No-409	49 286	26 123	0.8 (0.5 – 1.4)	0.428
Exclusive breastfeeding Yes=29 No=123	23 81	6 42	2.0 (0.7 – 5.9)	0.161
Predominant breastfeeding Yes 37 No 65	27 44	10 21	1.3 (0.5 – 3.5)	0.577
Minimal Dietary Diversity Yes=67 No=263	37 192	30 71	0.5 (0.3 – 0.8)	0.004
Minimum Meal Frequency Yes=70 No=260	43 186	27 74	0.6 (0.4 – 1.1)	0.103
Minimal Acceptable Diet Yes=37 No=295	29 200	8 93	1.7 (0.7 – 4.2)	0.208

Minimum dietary diversity was the only nutritional indicator associated with malnutrition (p=0.004).

ASSOCIATION BETWEEN MALNUTRITION AND SOCIODEMOGRAPHIC CHARACTERISTICS

Socio-demographic characteristics of the study population were subjected to chi square statistical analysis for association with malnutrition. None of the factors were significantly associated.

Table 12: Association between malnutrition and socio-demographic characteristics

Factor	Malnutrition		OR	p-value
Sex	No (%)	Yes (%)		
female	126	83	Ref.	1
male	233	128	0.8 (0.6-1.2)	0.311
Age				
< 20	44	36	Ref.	-
20-24	192	104	0.7 (0.4-1.1)	0.136
25-29	79	48	0.7 (0.4-1.4)	0.377
30-34	42	21	0.6 (0.3-1.3)	0.214
>34	2	2	1.2 (0.1-12.9)	1.000
Education				
None	9	5	Ref.	-
Primary	171	110	1.2 (0.3-4.1)	0.981
Secondary & Above	179	96	1.0 (0.3-3.6)	1.000
Employment Status				
None	321	189	Ref.	-
Business	5	7	2.4 (0.7-8.8)	0.143
Casual laborer	8	4	0.9 (0.2-3.2)	1.000
Salaried employment	24	10	0.7 (0.3-1.6)	0.476
Other	1	1	1.7 (0.0-62.4)	1.000
Care giver				
Mother	354	206	Ref.	-
Not Mother	5	5	1.7 (0.4-7.0)	0.511

CHILDREN WITH OVERNUTRITION

Nine of the children were found to have weight for height z scores that were higher than 1. Four of these children were aged less than 6 months, 2 of whom were exclusively breastfeeding and four were breastfeeding and also on formula milk. Two children had cerebral palsy and 1 had Down's syndrome; 2 had no identifiable risk factors. None of these children were tall for age. All of them had appropriate height for age except for one child with cerebral palsy who had moderate stunting.

DISCUSSION

The aim of this study was to determine the prevalence of malnutrition and its associated risk factors in children aged 0-59 months seeking care at the Kenyatta National Hospital Pediatric Emergency Unit (PEU).The study was designed to find out the prevalence of both severe and non-severe malnutrition amongst these children. The anthropometric measurements of the children were transformed into z scores based on the New WHO growth standards. Five hundred and seventy children were studied. Male to female ratio was 1.7:1. Majority of the patients (85%) were aged below 2 years and thus falling within the age group most susceptible to malnutrition.

The study population was of low socioeconomic status. Half of the guardians had primary education or less (51.8%) and most were not employed (89.5%) with only 6% having formal employment. About a half of them were residing in the low socioeconomic residence areas of Nairobi[20] and 12% were living in the Nairobi slum areas[20]. None of the children came from the "high" socioeconomic residence areas of Nairobi[20] probably because these children were more likely to seek care at the high cost hospitals. The guardians had a slightly higher level of education than the average Kenyan woman. By KDHS 2008-09, 65.7% of Kenyan women have primary education or less[12]. The low employment status of the guardians was probably due to low education levels in a town which is particularly competitive in terms of job opportunities. In addition, 93.3% of the guardians were females and more likely to be stay home mothers.

In as much as the majority of the caregivers were of low socioeconomic status, very few of them came from the slums. It is possible that this was due to the fact that KNH is a tertiary hospital and has bed charges of ksh.600 and thus relatively expensive for the very poor. Osano, in a study on the cost analysis of children admitted with rotavirus gastroenteritis at KNH, found the average cost of managing a child with rotavirus gastroenteritis upto the point of going home was ksh. 6,505.79, a figure that was about 300 times the average income of the guardians[24].

Immunization coverage in the study population by recall was very high (98.6%) although only 68% were confirmed by card. DPT3 coverage was at 84.5%. This was comparable to the governments reported Nairobi coverage which is 82.2%[12].

The overall mean z scores for age and sex were universally lower than -1z scores indicating that the general nutritional status of these children was below optimum. Malnutrition began during the first 6 months of age and was present throughout to five years. No peaks or troughs were noted in the growth pattern by age. There was no catch up growth towards five years.

The overall prevalence of malnutrition was 33.3%. The prevalence of moderate malnutrition was 29.8% and severe malnutrition was 3.5%. There was limited data on overall prevalence of malnutrition as most of the data is based on prevalence by type of malnutrition and thus no comparisons were made. When classified by type of malnutrition, the overall prevalence of wasting was 30.3%, stunting 20.5% and underweight 23.7%.

Wasting, an indicator of acute malnutrition, and which can be addressed in a hospital set up was 'very high' or 'critical' by WHO guidelines[25]. By these guidelines, this population needs urgent nutritional intervention. However, this being hospital rather than community data, this can be interpreted differently. This hospital cohort is composed of children from different communities who are in urgent need of nutritional intervention. They need to be correctly diagnosed and managed rather than sent back home on medicines without the underlying nutritional problem being handled. The hospital needs to be well equipped to deal with the high levels of wasted children. The high levels of wasting can be explained by the disease status of the children in a population that is already not optimally nourished. By WHO guidelines, stunting level was 'medium'[25] and underweight was 'high'[25].

Marcelle et al in a crossectional study on prevalence of malnutrition in an outpatient clinic in Manaus, Brazil, found the prevalence of wasting to be 4.4%, stunting 17.3% and underweight 14.3%[26]. This study however sampled children aged 0-12 years and this partly explains the lower levels of particularly wasting and underweight as it included children who were past the ages when children are most vulnerable to acute malnutrition. The Brazilian study was based on the NCHS growth charts.

S. Antwi, in a systematic review of children aged 3 months to five years attending outpatient clinics in a Teaching Hospital in Ghana found the prevalence of wasting to be 21.1%[27]. This study was based on the NCHS growth standards, and it did not include infants less than 3 months of age.

Differences are also observed when these results are compared to the KDHS 2008-09 findings on the nutritional status of Kenyan Children. By the KDHS report, the prevalence of wasting is 7 %. The prevalence of wasting is much higher in the study population (30%) possibly because this was a hospital based study. Majority (87.7%) had acute illnesses usually responsible for acute weight loss. By KDHS, the prevalence of moderate stunting is 35 %. Stunting levels were lower for the study population than the KDHS findings probably due to the fact that these children were mainly residing in Nairobi and its suburbs, a province with a relatively lower prevalence of chronic malnutrition in the Kenyan map of distribution of malnutrition This is thought to be due to better socioeconomic status and higher education levels of urban populations.

The wasting prevalence was not age dependent as had been expected. This differs from a study by Pancha et al in Pakistan who demonstrated malnutrition increasing with age from birth to fifteen months of age. In that study, at birth 5.3% of the babies were underweight, 3.2% were stunted and 11.1% were wasted, the percentage of

underweight, stunted and wasted children increased to 37.5%, 29.2% and 16.7%, respectively, by the end of fifteen months [28].

Moderate malnutrition accounted for 89.5% of the cases of malnutrition. Non-severe malnutrition has been shown to contribute to 80% of childhood mortalities, and a child with moderate malnutrition is 4.5 times more likely to die in comparison to their well nourished counterpart[4,29].

Acute illnesses were diagnosed in 87.7% of the children. Children with chronic illnesses were very few (28, 4.6%) likely because the emergency unit is a triage point where minimal history and investigations are done, thus most chronic illnesses are diagnosed in the ward. Some of the illnesses also need time and lack of response to usual management for them to be labeled as chronic. The high prevalence of diarrheal disease seen was unlikely to be due to solely "acute diarrhea of viral origin'' commonly rotavirus. The picture suggests high prevalence of upper bowel colonization and demonstrated at least partly influence of environment to which the children are exposed, particularly in terms of food and water hygiene. Pneumonia was more diagnosed than upper respiratory tract infections, most likely due to the fact that KNH is a tertiary hospital and more likely to receive severely ill children. The sharp decline of diagnosis of respiratory tract infections at the age of 25-59 months could not be entirely explained though there is likelihood that these children have some level of immunity to organisms responsible for simple URTIs, and are less likely to require medical check up from a tertiary hospital for the same. The low levels of diagnosis of malaria is most likely due to the fact that diagnosis of malaria by clinical signs only has declined after clinicians were sensitized on the need for laboratory evidence of malaria. The study did not find out what proportion of these children had a recent history of travel from a malaria endemic zone. Children with acute illnesses were more likely to have moderate wasting in comparison to their chronically ill counterparts ($p=0.001$).

Breastfeeding practices in the population were poor. The children are worst affected during the first 6 months of life with only 15% being breastfed within 1 hour of birth and only 19% being exclusively breastfed. This is a period when breast milk is most useful to the infants. Breastfeeding practices slightly improved with age to 36% predominantly breastfeeding, 45% still breastfeeding and 30% continuing to breastfeed. Breastfeeding practices did not seem to improve with level of education, neither was it affected by employment status. This was contrary to the expectations of the researcher because this was largely a population of children of non-employed women with at least some level of education and the basics of breastfeeding and the availability of time to be with the child was expected to be high.

The children were also poorly fed on other feeds other than breast-milk. Dietary diversity is a proxy for adequate micronutrient-density of foods[22]. Consumption of foods from at least 4 food groups on the previous day suggests that the child had a high likelihood of consuming at least one animal-source food and at least one fruit or vegetable, in addition to a staple food. Meal frequency estimates the amount of nutrient intake[22]. The number of meals that an infant or young child needs in a day depends on how much energy the child needs (and, if the child is breastfed, the amount of energy needs not met by breast milk), the amount that a child can eat at each meal, and the energy density of the food offered. The minimum acceptable diet indicator combines standards of dietary diversity and feeding frequency by breastfeeding status. The indicator thus provides a useful way to assess the quality and quantity dimensions of children's diets[22].

In this population, less than half the children aged 6-8 months achieved minimum food diversity or frequency, and only a third achieved the minimum acceptable diet. This got lower for children aged 9-23 months. No child in this age group achieved the minimum acceptable diet. This too was contrary to the expectations of the researcher as it is

naturally expected that as the children get older and breastfeeding reduces, feeding frequency and diversity should get higher.

When association was sought on nutritional status with feeding practices, the minimum dietary diversity was significantly related. Dietary diversity has been proposed as a candidate indicator of food security[30] and indicates nutritional adequacy [30, 31]. Generally, however, these nutritional indicators have been shown to have low precision and significant correlations have mainly been found with very large sample sizes as were documented in China[32], Mali[33], Kenya[34] and Haiti[35]. This is because nutritional status is affected by many factors and the role of dietary density, amount, and adequacy play a big role. In addition, there are factors that are inversely related and could cancel each other's effects. For instance, it is possible that children having more diverse diet eat less amounts of each component, especially during an acute illness where more diversity may be a result of mothers attempts to get the child to 'eat something' and increased breastfeeding may be associated with reduced intake of other feeds.

STUDY LIMITATIONS

1. The high prevalence of malnutrition could have been due to the fact that it was a hospital based clinic and particularly because KNH is a tertiary hospital and receives very sick children. This may impair generalization to other hospitals.
2. The feeding practices were mainly based on a 24 hour recall which could have been poor due to illness.

CONCLUSION

Malnutrition is major co morbidity in sick children seeking care at Kenyatta National Hospital Pediatric Emergency Unit. Malnutrition starts early with one third of the infants having malnutrition within the first 6 months of life. The prevalence of malnutrition remains stable in all the age groups. For every one child diagnosed as

severely wasted, 8.05 were moderately wasted and at risk of tipping over to overt malnutrition. Among the various nutritional indicators, only lack of minimum dietary diversity was associated with malnutrition. None of the socioeconomic factors were associated with malnutrition.

RECOMMENDATIONS

At initial evaluation, all children seeking care at the KNH PEU should have their nutritional status determined by the WHO growth standards to allow early detection and management of malnutrition.

Further research should be done to look at the adequacy of diagnosis and management of non-severe malnutrition at the Pediatric Emergency Unit. Data should also be sought on the linkage with other nutritional interventions as this may allow the screening in the facility to serve as an entry point into community programs.

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APPENDIX I: QUESTIONNAIRE

Questionnaire serial no: ---------- OP/No.: ---------- Date: ----/----/-----

1. Personal Details

Gender [ ] M [ ]F *Residence in the last 3 months* ----------

Date of birth Day/Month/Year ----/----/---- *Age in months* ----[ ] Don't know

2. Immunization status

BCG /OPV [ ] Yes [ ] No BCG scar present [ ] Yes [ ] No
OPV/ Pentavalent 1 [ ] Yes [ ] No OPV/ Pentavalent 2 [ ]Yes [ ] No
OPV/ Pentavalent 3 [ ] Yes [ ]No Measles (1st dose) [ ]Yes [ ] No
[ ] Don't know

3. Mother/Care givers details

1. Age in years --------- 2. Gender [ ] M [ ] F

3. Years in school --------- Highest grade achieved ----------

4. Employment status [ ] Yes [ ] No If yes state ----------

7. If mother not the caregiver, why? [ ] Mother at work [ ] Mother sick
[ ] Mother passed on [ ] Other (state)…….

4.Birth Weight ----------grams Don't know……..

5. Current Feeding History - *REWRITE AGE OF CHILD……MONTHS*

A) For **all** children **below** the age of **24 months**

From your recall, upon delivering this child within how many hours were able to breastfeed him/her? .....hrs.

B) For children **below** the age of **6 months**

In the last 24 hrs did you give this baby anything else apart from breast milk?

[ ] Yes [ ] No

If yes state …… …… …….

C) For children **6-8 months**

i) In the last 24 hrs, apart from breast milk, what else did you give your child?

Time	Meal contents
……	……..
……	……..
……	……..
……	……..
……	……..
……	……..
……	……..
……	……..

ii) How many times did this child breast feed in the last 24 hrs?.....times.

iii) How many times did this child have a meal apart from breastmilk in the last 24 hours ?.....times.

5. Continuation-Current Feeding History-*REWRITE AGE OF CHILD ……MTHS*

D) For children **between 12-15 months**

Did the child breastfeed in the last 24 hrs? [ ] Yes [ ] No

E) For children **20-23 months**

Is this child still breastfeeding? [ ] Yes [ ] No

F) For children **9-23 months**,

i) What meals did this child have in the last 24 hrs? (Including breastfeeding).

Time Contents of meal

…… ……..

…… ……..

…… ……..

…… ……..

…… ……..

…… ……..

…… ……..

…… ……..

…… ……..

…… ……..

…… ……..

ii) How many times did this child breast feed in the last 24 hrs?.....times.

iii) How many times did this child have a meal apart from breastmilk in the last 24 hours ?.....times.

G) For **all** children **upto 23 months**

From your recall, did your child ever breastfeed? [ ] Yes [ ] No

6. Feeding History for 2 weeks prior to this day- *AGE ……MONTHS*

A). For children **6-8 months**

i) 2 weeks ago, on a typical day (24 hr period) apart from breast milk, what else did you give your child?

Time	Meal contents
……	……...
……	……...
……	……...
……	……...
……	……...
……	……...
……	……...
……	……...

ii) 2 weeks ago, on a typical day (24 hr period), how many times did this child breast feed?.....times.

iii) 2 weeks ago, on a typical day (24 hr period), how many times did this child have a meal apart from breastmilk ?.....times.

G) For children **9-23** months old

i) 2 weeks ago, on a typical day (24 hr period) what meals did this child have?

Time	Contents of meal (Including breastfeeding)
……	……...
……	……...
……	……...
……	……...
……	……...
……	……...
……	……...
……	……...

…… ……..

…… ……..

…… ……..

ii) 2 weeks ago, on a typical day (24 hr period), how many times did this child breast feed?.....times.

iii) 2 weeks ago, on a typical day (24 hr period), how many times did this child have a meal apart from breastmilk ?.....times.

5. Medical History (From patient's clinical notes)

1. Current symptoms 1. …….. Duration……

2…… Duration……..

3…… Duration……

2. Current diagnosis…….

3. Has the child been diagnosed with malnutrition today? [ ] Yes [ ] No

If yes state type [ ] Wasting z Score----- [ ] Stunting z Score-----

[ ] Underweight z Score-----

4. Any known chronic illness? [ ] Yes [ ] No If yes state…….

5. Has this child been admitted in the last 6 months? [ ] Yes [ ] No

If yes state the diagnoses 1st admission …….. ……

2nd admission ……. 3rdadmission……

ANTHROPOMETIC MESUREMENTS

Weight 1st---------- 2nd ---------- Height 1st----------2nd----------

APPENDIX II: CONSENT FORM

Study no:

Hospital No:

Investigator: Dr. Edith Apondi

Cell: 0721 818157

Investigators statement

I, Dr.Apondi wish to ask you to allow your child to take part in a research study. This study is about taking measurements of your child i.e. weight, height, arm circumference and head circumference. These will be recorded and later compared to measurements that have been recommended to see if your child is growing appropriately. The purpose of this consent is to give you the information you require so as to help you decide whether you will or not take part in this study. In case of any concerns or questions regarding this study, do feel free to contact me on this mobile no: 0721818157.

Introduction and procedure

The best way to know if your child is growing as required or not is to have routine growth measurements taken. A compromised growth put the child at increased risk of many illnesses. In case of compromised growth, the child may get severe and frequent illnesses. These illnesses further worsen the child's nutritional status.

This study seeks to find out your child's nutritional status using new WHO guidelines. These guidelines help to demonstrate to you what your child's growth should be if the conditions for growth were optimum. It therefore will illustrate to you what growth level your child is versus what it should be. This will guide us to give you appropriate advice regarding his/her nutritional status.

You will be asked a number of questions that on average will take 15 min of your time then your child will be measured to get growth assessment measurements.
The information you give will help us provide better care for admitted children in future.

All the care your child needs will not be interrupted by your agreement to take part in this study. No form of monetary compensation will be availed to you for your participation.

Voluntariness

This study is fully voluntary. You are free to decline to participate or withdraw from the study at any stage, and this will not compromise your child's care in the hospital.

Benefits

The study will help the medical staff at the ward to know the nutritional status of children being admitted to the ward at assist to provide the necessary advice and management. The hospital personnel will be able to have information from which to base the need to put in place various systems to deal with malnourished children in the future.

Risks

No direct or indirect risks are anticipated in this study. The care of your child is of paramount importance throughout the study.

Confidentiality

All information you provide will be handled with utmost confidence. All the research records are stored securely without your name or the name of your child and only researchers will be able to view this information.

Questions

You are free to ask any questions about the study. If there is any part that you do not understand, kindly ask questions about it.

Caregiver's statement

I, the guardian of ----------(name of child) have had the research explained to me .I have understood all that has been read to me and my questions have been addressed to my satisfaction. I understand that I can change my mind at any stage and it will not affect me or my child in any way.

I agree to take part in this research.

Caregivers signature---------- Date ----------

Caregivers name ---------- Time ----------

I certify that I have followed all the specific procedures for obtaining informed consent.

Investigators signature ---------- Date ----------

Investigators name ---------- Time ----------

If caregiver cannot read an interpreter will be used and thumb print of the care giver taken

Thumbprint of caregiver as named above ----------

APPENDIX III: STANDARD OPERATING PROCEDURE: ANTHRPOMETRIC MEASUREMENTS[23]

There will always be 2 members of the data collection team during the process as each measurement will be taken by two people and for height measurement an assistant will be required. The subjects will be required to have minimal clothing at the start and completely undressed when weight is being taken for children still using diapers. Children less than 24 months will have their length taken supine and above 24 months standing height will be taken. Should a child be found unmanageable, time will be given to calm down before proceeding.

1. **Weight**

Infants' weight will be measured using an infant beam balance scale with 100gm increment. The scale will be place on a firm stable table. The other children will be weighed using a standing (adult type) beam balance scale also with 100gm increment. It will be placed on a firm uncarpeted floor.

Method:

Children aged 24 and above will be required to have minimal clothing at the start and completely undressed for those below this age. For infants, the scale will be covered with paper. The kilogram and gram sliding beam weights will then be placed directly over their respective zeroes then the screw on the adjustable zeroing weight or counter weight will be loosened. The screw will be moved until the beam balances, and then tightened on the counter-weight. The data collection assistant will then place the child on his/her back or sitting on the tray of the scale, making sure the child is centered in the tray and is not touching anything off of the scale tray including other parts of the

scale. The data collector will then move the kilogram weight until the first notch where the beam falls, then move the weight back one notch. The gram weight will then be slowly moved across the beam until it is balanced. Measurement will then be taken to the nearest 100 gram and recorded.

The same procedure will be done for the older children except that they will be stepping onto the center of the platform of the weighing scale. Their weight will also be taken to the nearest 100 grams.

The scale will be zeroed before each weighing and calibrated after every six hour session. The weights will be taken with the child undressed and calm.

2. **Recumbent length or standing height**

Recumbent length will be measured in children younger than 24 months or under 85 cm long if age is not known or those who are too ill to stand.

Method:

The child will be made to lie parallel to the long axis of the board and the crown of the head placed against the fixed board. The head will be gently held by an assistant so that the child is facing directly up with the line of sight (Frankfort plane) is at a right angle to the board .The measurer will then hold the knees together and push then down against the measuring board with one hand then bring them to full extension. The movable board will then be brought up against the heels with the other hand until in contact with the feet. The movable board will then be secured as the feet are withdrawn from contact with the board. The length will be read and recorded to the nearest 0.1 cm

Standing height will be taken for children older than 24 months or taller than 85 cm ensuring the mid-axillary line is parallel to the measuring board and the head in the Frankfort position.

APPENDIX IV: GUIDELINES ON ESTABLISHING NUTRITIONAL INDICATORS IN INFANTS AND YOUNG CHILDREN

All the current nutritional indicators are sought using mother's recall of the previous day except for early initiation of breastfeeding and ever breastfed which uses mother's historic recall. These are then analyzed as per the WHO guidelines below:
Ref: Indicators for assessing infant and young child feeding practices (WHO-2008) [22].

1. **Early initiation of breastfeeding:** Proportion of children born in the last 24 months who were put to the breast within one hour of birth

$$\frac{\text{Children born in the last 24 months who were put to the breast within one hour of birth}}{\text{Children born in the last 24 months}}$$

Notes:

• This indicator is based on historic recall.

2. **Exclusive breastfeeding under 6 months:** Proportion of infants 0–5 months of age who are fed exclusively with breast milk

$$\frac{\text{Infants 0–5 months of age who received only breast milk during the previous day}}{\text{Infants 0–5 months of age}}$$

Notes:

• This indicator includes breastfeeding by a wet nurse and feeding expressed breast milk.

3. **Continued breastfeeding at 1 year:** Proportion of children 12–15 months of age who are fed breast milk

$$\frac{\text{Children 12–15 months of age who received breast milk during the previous day}}{\text{Children 12–15 months of age}}$$

4. **Minimum dietary diversity:** Proportion of children 6–23 months of age who receive foods from 4 or more food groups

$$\frac{\text{Children 6–23 months of age who received foods from} \geq 4 \text{ food groups during the previous day}}{\text{Children 6–23 months of age}}$$

Notes:

• The 7 foods groups used for tabulation of this indicator are:

— grains, roots and tubers

— legumes and nuts

— dairy products (milk, yogurt, cheese)

— flesh foods (meat, fish, poultry and liver/organ meats)

— eggs

— vitamin-A rich fruits and vegetables

— other fruits and vegetables

• Consumption of any amount of food from each food group is sufficient to "count", i.e., there is no minimum quantity,

5. **Minimum meal frequency:** Proportion of breastfed and non-breastfed children 6–23 months of age who receive solid, semi-solid, or soft foods (but also including milk feeds for non-breastfed children) the minimum number of times or more.

The indicator is calculated from the following two fractions:

$$\frac{\text{Breastfed children 6–23 months of age who received solid, semi-solid or soft foods the minimum number of times or more during the previous day}}{\text{Breastfed children 6–23 months of age}}$$

and

$$\frac{\text{Non-breastfed children 6–23 months of age who received solid, semi-solid or soft foods or milk feeds the minimum number of times or more during the previous day}}{\text{Non-breastfed children 6–23 months of age}}$$

Notes:

• Minimum is defined as:

— 2 times for breastfed infants 6–8 months

— 3 times for breastfed children 9–23 months

— 4 times for non-breastfed children 6–23 months

— "Meals" include both meals and snacks (other than trivial amounts1), and frequency is based on caregiver report.

6. **Minimum acceptable diet:** Proportion of children 6–23 months of age who receive a minimum acceptable diet (apart from breast milk).

This composite indicator will be calculated from the following two fractions:

Breastfed children 6–23 months of age who had at least the minimum dietary diversity and the minimum meal frequency during the previous day

Breastfed children 6–23 months of age

and

Non-breastfed children 6–23 months of age who received at least 2 milk feedings and had at least the minimum dietary diversity not including milk feeds and the minimum meal frequency during the previous day

Non-breastfed children 6–23 months of age

APPENDIX V: WHO GUIDELINES FOR ASSESSING SEVERITY OF MALNUTRITION

WHO guidelines usually based on prevalence of moderate malnutrition in a population is used to assess the need and the urgency of need for nutritional intervention for that population[25].

Indicator	Severity of malnutrition by prevalence ranges (%)			
	Low	Medium	High	Very high
Stunting	<20	20-29	30-39	>=40
Underweight	<10	10-19	20-29	>=30
Wasting	< 5	5-9	10-14	>=15

Classification for assessing severity of malnutrition by prevalence ranges among children under 5 years of age by WHO