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## ORIGINAL RESEARCH

# Malnutrition Survey among Children Aged One to Five Years in an Out-Patient Setting

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## Abstract

**Background:** Malnutrition, though rarely listed as the direct cause, is estimated to contribute to more than half of all childhood deaths in the developing countries. The vicious cycle of poverty, recurrent infections and ignorance remain the major predisposing factors to this disease.

**Objectives:** To determine the prevalence of malnutrition among children aged one to five years attending the Out-Patient Department (OPD) of a Nigerian Specialist Hospital, to describe the major associated co-morbidities and associated socio-cultural factors.

**Methods:** All the children aged 1 to 5 years attending the OPD of Mother and Child Hospital, Akure, Nigeria were recruited into the study from September 2018 to November 2018. In addition to basic bio-data, sociodemographic data, and clinical diagnoses, the Z-scores of the anthropometric parameters were calculated using the WHO *AnthroPlus* software.

**Results:** A total of 577 children were studied with a male preponderance of 58.1%. The prevalence of underweight, stunting and wasting were 18.5%, 15.9% and 20.8% respectively. Malaria was the leading co-morbidity both in its complicated and uncomplicated forms. The identified associated socio-cultural factors included low socioeconomic status, large family size and some paternal social habits.

**Conclusion:** The prevalence rate of malnutrition among the children was high despite the high literacy and socioeconomic status of the parents.

**Keywords:** *Childhood, Malnutrition, Stunting, Underweight, Wasting, Nigeria.*

## Introduction

Malnutrition occurs in children as a result of either recent or past inadequate food intake. [1] The World Health Organization (WHO) defines malnutrition as an imbalance between nutrient and energy supply, and the body's demand for

them to ensure growth, maintenance and specific functions. [2] Malnutrition is a major public health problem affecting more than 900 million individuals, [3, 4] and accounting either directly or indirectly, for about 54% of childhood deaths worldwide. [2, 3] In the year 2019, globally, 144 million children under the age of five years were

stunted, 47 million were wasted and 38 million overweight. [5] The global prevalence of stunting, underweight and wasting was 21.3%, 13.3% and 7.3% respectively. [5] The prevalence rates were higher in Nigeria with 43.6%, 31.5% and 10.8% respectively. [2, 3, 5] This portends grave consequences for the future of Nigerian children.

Substantial efforts made to reduce under-five mortality rates in the last two decades, as initiated by the defunct Millennium Development Goals (MDG's) project of the United Nations, led to a drop in the under-five mortality rate of about 53% from 9 per 1000 (1990) to 4.3 per 1000 deaths (2015), but with minimal effect on stemming malnutrition.[2] Survivors with chronic under-nutrition often develop growth failure, poor intellectual and physical development, increased susceptibility to infections and higher incidences of other chronic diseases such as truncal obesity, cardiovascular diseases and Type 2 Diabetes mellitus. [5, 6] Such children grow up to become adults with poor intellectual performance and therefore, of low productivity. Furthermore, the girl-child who suffers chronic malnutrition may become a stunted adult with poor development of the pelvic bones resulting in cephalo-pelvic disproportion during childbirth and increased risk of a difficult delivery. This also poses more dangers to their future offspring. The cumulative effects of these include low productivity and increased burden of children with neurological deficits, not only to an already over-stretched health system but also to the entire economy of the nation.

Despite enhanced economic development worldwide in the last two decades, there has been minimal impact on stemming the tide of the malnutrition scourge. Children less than five years are mostly affected. [4 - 6] Therefore, this vulnerable age group must constitute a focus for early identification and treatment to reduce the burden of the disease. While there is no racial or

sexual predilection to the development of the disease, a strong link of poverty with malnutrition has been established, particularly in developing countries. [1, 6]

The nutritional status of children is assessed using growth parameters. Under-nutrition, a form of malnutrition can be classified into three; stunting, wasting and underweight. Stunting (height for age less than -2 Standard deviation (SD) of the WHO Child Growth Standards mean) reflects the cumulative effects of prolonged undernutrition and infections which may pre-date birth; it is an indication of a long-term restriction of a child's growth potential.[6 - 8] Wasting (weight for height less than -2 SD of the WHO Child Growth Standards mean), in children is a symptom of acute undernutrition, usually as a consequence of insufficient food intake or a high incidence of infectious diseases, especially diarrhoea. [6, 9, 10] Underweight (weight for age less than -2 SD of the WHO Child Growth Standards mean) is an indicator of acute malnutrition. [8] The mid-arm circumference (MAC) can also be used for the assessment of nutritional status, the major determinants being the bulk of arm muscle and subcutaneous fat. [7] MAC is less affected than weight and height-based indices. [7] Most children presenting to the hospital with undernutrition usually have accompanying ailments.

Therefore, the objectives of the study included the determination of the prevalence of malnutrition among children aged one to five years attending the Out-Patient Department (OPD) of a Nigerian Specialist Hospital and the description of the major associated comorbidities and predisposing socio-cultural factors.

## **Methods**

### *Study location*

The study was carried out at the Mother and Child Hospital, Akure (MCHA), Nigeria. It is a very busy, purpose-built 100-bed (60 obstetrics and 40 paediatric beds), public health facility providing specialized free health services to the populace in the state capital and surrounding communities. Akure is the capital of Ondo State, in the south-west geo-political zone of Nigeria with a land expanse of 991 square kilometres. [11]

### **Ethical considerations**

Ethical clearance was obtained from the Research and Ethics committee of the MCHA, while informed consent was obtained from parents of all the children recruited into the study.

### **Study design**

This was a cross-sectional and hospital-based study.

#### *Inclusion criteria*

Children aged one to five years presenting at the Children Emergency Unit and the Out-patient Department (OPD) of the MCHA from September 2018 to November 2018.

#### *Exclusion criteria*

All children with underlying chronic illnesses such as tuberculosis and congenital abnormalities were excluded from the study.

### **Data Collection**

All subjects were duly evaluated to determine the clinical diagnosis and other co-morbidities. The critically-ill were hospitalized while the others were treated on an out-patient basis. The sex, age, ethnicity, address, parents' bio-data, social history and habits were documented in a research proforma. The anthropometric parameters i.e weight, height, occipitofrontal circumference (OFC), and mid-arm circumference (MAC) of each child were also recorded.

### **Anthropometric measurements**

#### **Bodyweight**

Each child was weighed using the RGZ-20 weighing scale which was calibrated in grams to

the nearest 25g. It was adjusted for zero error before each reading. Other measures taken to ensure the reliability of results included weekly standardization of the weighing scale, using known weights.

#### **Length/height**

The length was measured in centimetres to one decimal place for children less than two years using a metal anthropometric linear rule fixed to a horizontal flat board. The board had a fixed head plate at the zero end of the metal rule and a sliding footplate. An assistant held the baby in position, making sure that the head was flushed with the fixed headboard, the eye-sockets were in the same vertical plane as the external auditory meati, the back was flat on the board and the knees were straight. The investigator then slid the footplate to gently touch the sole of the child's foot and read off the length. [12] The stadiometer (RGZ-20) was used for the children above two years of age.

#### **Weight-for-age**

The Modified Wellcome Classification [10, 13] was also used to screen the children because it is one of the methods used for clinical diagnosis of malnutrition by clinicians. It classifies malnutrition into kwashiorkor, underweight kwashiorkor, underweight, marasmus and marasmic kwashiorkor based on the percentage of expected weight-for-age and the presence or absence of oedema. Between 60 and 80% of expected weight defined underweight in the absence of oedema or underweight-kwashiorkor when oedema was present, greater than 80% with oedema was kwashiorkor, under 60% of the expected weight was marasmus in the absence of oedema, and marasmic-kwashiorkor when oedema was present. [7, 13]

Age and sex standardized Body Mass Index Z-scores (BAZ) were defined using the World Health Organization (WHO) [7, 8, 14] Growth Standards BMI-for-age Z-score cut-points of  $< -2.0$ ,  $> 1.0$ ,  $> 2.0$  and  $> 3.0$  defining wasting,

risk of overweight, overweight and obesity, respectively. Normal anthropometric Z-score was defined as -1.0 SD to +1.0 SD. [15] Height-for-Age Z-score (HAZ) cut-points of < -2.0 indicates stunting and -1.0 SD to +1.0 SD was taken as normal height-for-age, while > +1.0 indicated that the raw data was +1 SD above the reference point. Weight-for-Age Z-score (WAZ) cut point of < -2.0 defined low weight-for-age (underweight) and raw data > +1.0 indicated normal weight-for-age. WAZ, however, reflected body mass relative to chronologic age and it may be influenced by both height-for-age and weight-for-height. [7]

#### Mid Arm Circumference (MAC)

The MAC was measured to the nearest 0.1 cm with a non-stretchable tape at the mid-point between the tip of the shoulder and the tip of the elbow (olecranon process and the acromion). [7, 16] MAC <11.5cm indicated severe acute malnutrition and risk of death. MAC between 11.5cm -13.5cm indicated mild to moderate malnutrition needing counselling, supplementation and growth monitoring while MAC > 13.5cm indicated good nutritional status.

#### Family size

Family size was defined as the number of people in the family. A family was described as small if it comprised six or less, including the father and the mother. On the other hand, a large family comprised the father, the mother and more than four children. [17]

#### Socio-economic status

The socio-economic status of each family was determined using the model described by Ogunlesi *et al.* [18] taking into account maternal income, education and occupation as well as paternal income, education and occupation. There were five socio-economic classes (I to V) which were ranked in descending order with class I being the highest and class V, the lowest. For the current study, the classes were grouped

as an upper socioeconomic class (SEC) (classes I and II) middle SEC (class III) and lower SEC (classes IV and V).

#### Data Analysis

The data were analysed using the Statistical Package for Social Science (SPSS) version 20.0 (Windows Inc; Chicago, IL, USA). The anthropometric Z-scores were calculated using the WHO *AnthroPlus* software [15] derived using the WHO Child Growth Standards. Normal anthropometric Z-score was defined as -1.0 SD to +1.0 SD. [15] Comparison of the socio-demographic parameters of malnourished and normal participants (using BAZ) was subjected to Carls Pearson's Chi-Square test. Statistically significant difference was defined by *p* values <0.05.

## Results

#### General and socio-demographic characteristics

A total of 1,050 children attended the OPD during the period of study. Of this number, 577 (55%) patients were aged 1 to 5 years. Three hundred and forty-seven (60.1%) were aged between 1 and 2 years while 230 (39.9%) were above 2 years of age. The mean age ( $\pm$  SD) at presentation was 2.6 $\pm$ 2.1 years. In all, 58.1% were males with a male-to-female ratio of 1.4: 1.

All the parents were married. Table I shows the socio-demographic characteristics of the children. Over half (53.2%) of them belonged to the upper socio-economic class, 17% were in the middle class while 29.8% were in the lower socio-economic class.

The majority of the children were of the Yoruba extraction (90.1%). The mean family size was 5.2 $\pm$ 1.2 with 69% of the children belonging to small-sized families while 176 (30.5%) belonged to large-sized families. Further, 272 (47.1%) of the mothers had tertiary level education, while 217 (37.6%) and 83 (14.4%) had secondary and

primary education respectively; only 5 (0.9%) were not formally educated. Majority of the fathers (89.8%) fathers neither smoked nor drank alcohol.

Using the modified Wellcome classification of malnutrition, 78 (13.5%) of the children had marasmus, 99 (17.2%) had underweight, while 400 (69.3%) were normal (Table II). The MAC of 81 (14.0%) children were less than 11.5cm (severe acute malnutrition), 79 (13.7%) had mild to moderate malnutrition while 417 (72.3%) were well-nourished.

The distribution of the children according to the Z-scores of the anthropometric parameters is shown in Table III. Analysis of the BAZ revealed that 120 (20.8%) of the children had BAZ of  $<-2$  SD and 410 (71.1%) subjects had normal BAZ. Ninety-two (15.9%) were stunted while 376 (65.2%) had normal height/length. On the other hand, 107 (18.5%) had underweight while 430 (74.5%) had normal weight-for-age. The mean ( $\pm$ SD) values of the BMI, height/length and weight are also presented as a footnote to Table III.

Table IV shows the comparison of the socio-demographic parameters of malnourished and well-nourished children (using BAZ). There were more malnourished children in the age group 1 to 2 years compared to the other age groups but the difference was not statistically significant. There were significantly more malnourished children among the lower (75.9%) and middle socio-economic classes (90.0%) compared to the upper socio-economic class (47.2%). There was also a significantly higher frequency of malnutrition among the children from large-sized families and among those whose fathers indulged in alcoholism or cigarette smoking.

Table V shows the various co-morbidities in the children at the time of presentation. Malaria was the leading co-morbidity (37.6%) both in its complicated and uncomplicated forms. This was followed by Upper Respiratory Tract Infections (15.8%) and gastroenteritis (13.3%). Sepsis and pneumonia were less frequent co-morbidities.

## Discussion

Wasting was the most frequent (20.8%) form of malnutrition in the present study. This value is higher than the prevalence rate reported from Lagos (10%)<sup>[19]</sup> and Ondo State in general (6.6%).<sup>[20]</sup> It is also higher than the prevalence rate reported from the South-eastern part of Nigeria (11.9%), south-south (11.1%), southwest (10%), northeast (19.5%), and northcentral (11.7%) parts of Nigeria.<sup>[20]</sup> This observation may be attributed to the fact that the children in the present study were ill children recruited from a health facility whereas the children in the national survey were randomly selected from the general population of apparently healthy Nigerian children. Acute illnesses associated with fever (leading to increased metabolism) coupled with the loss of appetite will culminate in acute malnutrition.

The study location is a referral centre and the facility is accessed by mixed groups of people from the township, the neighbouring villages and adjacent States. Though the population is a relatively literate and predominantly high socio-economic class, yet the recorded prevalence rate of malnutrition is high hence, the magnitude of the problem must be met with a response that reflects the scale and gravity of the situation. The study revealed that 18.5% of the children were underweight while the prevalence rate of stunting was 15.9%.

**Table I: Socio-demographic characteristics of the study participants**

	<i>Frequency</i>	<i>Percentage</i>
<b>Age (Years)</b>		
1-2	347	60.1
>2-5	230	39.9
<b>Sex</b>		
Male	335	58.1
Female	242	41.9
<b>Socio-economic classes</b>		
Lower	172	29.8
Middle	98	17.0
Upper	307	53.2
<b>Family size</b>		
≤6 people	401	69.5
>6 people	176	30.5
<b>Mothers' level of education</b>	83	14.4
Primary		
Secondary	217	37.6
Tertiary	272	47.1
None	5	0.9
<b>Ethnic groups</b>		
Yoruba	520	90.1
Igbo	20	3.5
Edo	4	0.7
Others	33	5.7
<b>Paternal social habits</b>	518	89.8
No alcoholism or tobacco smoking		
Alcoholism only	52	9.0
Alcoholism and tobacco smoking	7	1.2

**Table II: Weight-for-Age (modified Wellcome) classification and mid-arm circumference of the subjects**

<i>Weight as a percentage of normal</i>	<i>Frequency</i>	<i>Percentage</i>
< 60	78	13.5
60 – 80	99	17.2
>80	400	69.3
<b>Total</b>	<b>577</b>	<b>100.0</b>
<b>MAC (cm)</b>		
<11.5	81	14.0
11.5-13.5	79	13.7
>13.5	417	72.3
<b>Total</b>	<b>577</b>	<b>100.0</b>

MAC - Mid Arm circumference; None had oedematous malnutrition.

Table III: Distribution of the study participants by the Z-Scores of their anthropometric parameters

Anthropometric Z-scores	Frequency	Percentage
<b>BAZ</b>		
< -2.0	120	20.8
< -1.0 to > +1.0	410	71.1
> +2.0	39	6.8
> +3.0	8	1.4
<b>HAZ</b>		
< -2.0	92	15.9
< -1.0 to > +1.0	376	65.2
> +2.0	98	17.0
> +3.0	11	1.9
<b>WAZ</b>		
< -2.0	107	18.5
< -1.0 to > +1.0	430	74.5
> +2.0	38	6.6
> +3.0	2	0.4

Mean BMI: 16.7±7.6 kg/m<sup>2</sup>; Mean length/height: 86.6±14.0 cm; Mean body weight: 12.5±8.8 kg  
 BAZ: Body Mass Index-for-Age Z-score; HAZ: Height-for-Age Z-score; WAZ: Weight-for-Age Z-score.

The prevalence rate of underweight reported by Akeredolu, *et al.* [19] in Lagos (13%) was lower whereas the prevalence rate of stunting was higher (16.3%) compared to the findings in the present study. Similar to earlier reports from Enugu [13] and Ghana, [2] there was no significant difference concerning gender in the current study. All the parents in this study were married; therefore, the issue of unwanted pregnancy was not a confounder. Forty-seven per cent of the mothers had tertiary level education while only 0.9% of them never went to school, therefore, expectedly, ignorance should be minimal in this population. Yet, the prevalence rates of malnutrition were high. This implies that the community probably needs to imbibe better child-care practices to reverse this trend.

Wasting represents a more accurate reflection of the effects of current or recent illnesses and short-term food shortage, resulting in weight loss. It also indicates tissue and body fat deficit when the bodyweight is compared to the expected value

for height. [15, 19, 21] Infections, particularly frequent or persistent diarrhoea, pneumonia, sepsis and malaria tend to undermine a child's nutritional status. [2] In the current study, malaria was the most prevalent co-morbidity both in its complicated and uncomplicated forms. This is similar to the finding in an earlier study conducted in the same centre [22] and Benin. [23] Malaria was closely followed by Upper Respiratory Tract Infections (URTI) and gastroenteritis. Sepsis and pneumonia were less common co-morbidities in the current study; similar to earlier reports from Enugu [13] while only diarrhoea was the major co-morbidity in the Ghanaian study. [2] The socio-cultural factors associated with malnutrition in the current study included low socioeconomic status, large family size and use of alcohol and cigarette smoking by fathers. The reason for this may be that poor and large families, already with low purchasing power for adequate nutritious foods for their families also deduct money for these social habits.



Table IV: Comparison of the socio-demographic parameters of malnourished and normal participants (using BAZ)

	<i>Malnourished</i>	<i>Normal</i>	$\chi^2$	<i>df</i>	<i>p-value</i>
<b>Age (Years)</b>					
1- 2	217 (59.3)	130 (61.6)	0.301	1	0.597*
>2 - 5	149 (40.7)	81 (38.4)			
<b>Sex</b>					
Male	223 (60.9)	112 (53.1)	3.386	1	0.066
Female	143 (39.1)	99 (46.9)			
<b>Family size</b>					
≤ 6	251 (68.6)	150 (71.1)	0.423	1	0.022
> 6	115 (31.4)	61 (28.9)			
<b>Socio-economic Classes</b>					
Lower	123 (33.6)	39 (18.5)	96.074	2	0.000
Middle	98 (26.8)	10 (4.7)			
Upper	145 (39.6)	162 (76.8)			
<b>Paternal social habits</b>					
No alcoholism or tobacco smoking	317 (86.7)	201 (95.3)	6.364	2	0.001
Alcoholism only	43 (11.7)	9 (4.3)			
Alcoholism and tobacco smoking	6 (1.6)	1 (0.4)			

\*Fishers Exact test

Figures in parentheses are percentages of the total in columns

The significant association between lower socioeconomic status and malnutrition, as observed in the current study is comparable to the findings in Enugu [13] and Ghana. [2] Family size of greater than six was associated with malnutrition in the current study, similar to earlier findings from Ile-Ife, southwest, Nigeria where the total number of people in a family is reportedly related to the incidence of adverse circumstances. [24] The study further showed that the food available to larger families (> 4 children) per head was frequently lower than that available to smaller families and this difference reflected in the growth rate of the children. [24] Other researchers from Ethiopia also reported similar findings that children living in households with greater than or equal to five family members were 2.72 times more likely to be malnourished than those children living in households with smaller family size. [25]

The prevalence rate of stunting in the current study was 15.9%. Stunting reflects a process of failure to reach linear growth potential as a result of suboptimal health and/or nutritional conditions. [7] On a population basis, stunting can also be explained from the point of view of chronic food deprivation either from inadequate intake, poor quality food, poverty, ignorance and continued co-morbidities with associated loss of appetite. [7] Stunting is a common occurrence in the developing world, Nigeria inclusive, due to the aforementioned factors. [11] However, the prevalence rate of stunting in the current study is lower than rates reported from Ilorin (23.6%), [26] Lagos (16.3%) [19] and Jos (18%) [27] all within Nigeria but higher than in Tanzania (13%). [28] These children with stunting are usually prone to poor brain development and subsequently low intelligent quotient. [21] Another grave

consequence of stunting is premature death in this set of children; unfortunately, more than 90%

of the world's stunted children reside in Africa. [21]

**Table V: Pattern of co-morbidities among the study participants**

<i>Co-morbidities</i>	<i>Frequency</i>	<i>Percentage</i>
Uncomplicated malaria	132	22.8
Severe malaria	95	16.5
URTI	91	15.8
Gastroenteritis	77	13.3
Sepsis	52	9.1
Pneumonia	38	6.6
Acute severe asthma	21	3.6
Bronchiolitis	17	2.9
Meningitis	12	2.1
Sickle Cell Anaemia	8	1.4
Others	34	5.9
<b>Total</b>	<b>577</b>	<b>100.0</b>

Others - Accidental poisoning, Febrile convulsion, and Congenital Heart Diseases.

URTI - Upper Respiratory Tract Infections.

On the other hand, the prevalence rate of underweight in the current study was 18.5%. It is lower than the national figure of 31.5%, [20] but higher than the rate reported from Lagos (13%). [19] Malnutrition generally is the underlying cause of morbidity and mortality in a large proportion of under-five children in Nigeria. It contributes to more than 50 per cent of deaths of children in this age group. [1, 11] It also causes direct structural damage to the brain, impairing motor development and exploratory behaviour. [11, 21] The Wellcome classification and the use of MAC in the current study revealed that 13.5% and 14.0% respectively of the children had one form of malnutrition or the other. This rate is higher than the 3.1% reported from Ilorin, [29] northcentral Nigeria. This situation calls for a new approach to improving the health of the Nigerian child. Policies, legislation and funding are needed to improve health care delivery. Policies and strategies which highlight adequate infant and child feeding, complementary feeding, de-worming (to improve the nutritional status), immunization against the childhood killer diseases, hand-washing, water and food sanitation (to reduce morbidity and mortality),

use of the insecticide-treated mosquito nets to prevent malaria and of course the improved health of the mothers which in turn affect the health of the children, need to be popularized.

### Conclusion

The prevalence rate of malnutrition among under-five children in the current study was high, though the parents were literate and the majority belonged to the upper socio-economic class. Malaria was the leading co-morbidity both in its complicated and uncomplicated forms. Malnutrition is more likely to occur in children with acute illness and this, therefore, suggests that routine nutritional assessment of ill children should be done for early identification and institution of proper steps to ameliorate the clinical conditions of the affected children for subsequent nutritional rehabilitation.

**Authors' Contributions:** ORO and AAO conceived and designed the study and collected the data. AMT analysed the data. All the authors participated in

drafting the manuscript. All the authors approved the final version of the manuscript.

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