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Comparative Assessment of the Nutritional Status of Institutionalised and Non-Institutionalised Nigerian Children Using Anthropometric Parameters

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Abstract

Background: Malnutrition impacts millions of children around the world, and institutionalisation appears to make children more susceptible to malnutrition when compared to their non-institutionalised counterparts.

Objective: To compare the use of anthropometric indices in the assessment of the nutritional status of institutionalised and non-institutionalised Nigerian children.

Methods: It was a school-based, cross-sectional comparative study conducted at 48 selected day schools and four residential care institutions (orphanages and special schools), all in Umuahia, Nigeria. Socio-demographic data of the subjects were collected with an interviewer-administered questionnaire. Weight and height measurements were computed using the WHO Anthro/AnthroPlus software.

Results: The prevalence of malnutrition was higher in institutionalised children, with stunting, wasting and underweight occurring in 37.5%, 24.3% and 12.5%, respectively and 17.1%, 13.8% and 7.2%, respectively, for non-institutionalised children. The differences in the rates of stunting, wasting, and underweight between the two study groups were statistically significant ($p < 0.001$, $p = 0.01$, and 0.03 , respectively). A greater number of institutionalised children (62.7%) were acutely ill two weeks before the study than the non-institutionalised children (39.3%). Children in public-owned institutions were more malnourished than those in private institutions ($p = 0.009$).

Conclusion: The prevalence of malnutrition in institutionalised children was higher than that of their non-institutionalised peers. Periodic nutritional assessment of children in institutional care is essential for accurate planning and implementation of targeted intervention programmes to reduce morbidity and mortality associated with malnutrition.

Keywords: Institutionalised care, Malnutrition, Orphanage, Stunting, Wasting.

Introduction

Nutrition is crucial in the overall health and development of every child. It is the entire process of intake, absorption, and utilisation of

food substances by the human body.^{1,2} The influence this has on an individual can be described as nutritional status^{3,4}, and its assessment can be based on anthropometric, biochemical, clinical, or dietary characteristics.^{5,6}

Any deviation from the expected normal is best referred to as malnutrition, which affects millions of children globally and is responsible for about 20% of child deaths worldwide.^{1,5,6} In 2016, the World Health Organisation estimated that 155 million children were stunted, 52 million were wasted, and 41 million were overweight, with a debilitating impact on the health of children.^{5,6} The most recent National Demographic and Health Survey (2018) indicated that 37% of Nigerian children were stunted, 7% were wasted, and 22% were underweight.⁷ Despite a slight improvement from the 2013 survey, Nigeria still ranked among the countries with the highest rates of malnutrition, particularly among institutionalised children.⁷

Recent studies revealed that the child's place of residence, whether in an institutionalised or non-institutionalised setting, influences their nutritional status.^{8-16]} An institution for children is defined as a group living arrangement for more than ten children, without parents or surrogate parents, where care is provided by paid adult carers.^{9,17} This definition encompasses children in orphanages, special schools, summer camps, boarding schools, and juvenile detention centres.¹⁷⁻¹⁹ Conversely, non-institutionalised children are those living with their parents or guardians in a usual home environment.^{20, 21}

Globally, there are notable variations in the prevalence of malnutrition between institutionalised and non-institutionalised children.^{5, 20} An estimated 2.7 to 9 million children live in institutionalised care worldwide, with 5% to 79% being malnourished, varying across ages, sites, and countries.^{5, 20} In Africa, Teferi *et al.*²² reported a prevalence of 4.4% to 34.8% among institutionalised children in Ethiopia. In Nigeria, studies have shown that 3.3% to 28.6% of children in institutionalised care were malnourished.^{5, 6, 10, 11} However, these studies primarily focused on children under five

years of age. Several studies have also assessed the nutritional status of institutionalised and non-institutionalised children.¹⁰⁻¹⁶ However, most of these studies are not comparative and involved under-five children only. Therefore, the objective of the present study was to determine and compare the nutritional status of institutionalised and non-institutionalised Nigerian children aged 1-15 years using anthropometric indices (weight-for-age, weight-for-height, height-for-age, and BMI). The study sought to provide valuable information that supports advocacy for the implementation of age-appropriate interventional programs, especially in institutional care settings.

Methods

Study site

The study was conducted in Umuahia, the capital city of Abia State, Nigeria. It comprises two Local Government Areas (LGAs): Umuahia North and Umuahia South. According to the 2006 National Population Census, Umuahia has a population of 359,230, but is projected to be 947,000 in 2024.²³⁻²⁵

Study design

This was a comparative cross-sectional study conducted in schools and institutions.

Study population

The study involved institutionalised and non-institutionalised children aged 1 to 15 years living in Umuahia North and Umuahia South LGAs in Abia State.

Sample size determination

The formula for comparing two proportions was used to determine the minimum sample size of 152 participants.²⁶

$$N = \frac{2(Z_{\alpha/2} + Z_{\beta})^2 P(1-P)}{(P_1 - P_2)^2}$$

Using the prevalence rate of 25.6%²⁷ for stunting among children living in institutionalized homes and 41.6%¹² among school children in a rural community, both in southeast Nigeria, in South-

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eastern Nigeria. The final calculated sample size was 137 in each arm of the study, and this was rounded off to 152 to accommodate 10% non-responses.

Inclusion criteria for institutionalised children

Apparently healthy, aged 1-15 years and living in institutional care for at least three completed months.

Inclusion criteria for non-institutionalised children

Apparently healthy children aged 1-15 years residing in individual homes, receiving home-based care and attending day schools in the same community hosting residential care facilities.

Exclusion criteria for both institutionalised and non-institutionalised children

History of medical conditions known to affect growth, such as congenital heart disease, HIV/AIDS, sickle cell disease, cleft lip/palate, and cerebral palsy; use of medications known to affect growth, such as steroids; and lower limb deformities.

Sampling method

Subjects who met the inclusion criteria were enrolled consecutively from orphanages, special schools, nursery, primary and secondary schools until the calculated sample size was achieved for each study group. Subjects were stratified into sex and age groups to ensure an evenly distributed selection in both study groups. A multistage sampling technique was used in selecting subjects enrolled in the study as described below:

Selection of institutionalised children

The institutionalised children were recruited first and then matched with their non-institutionalised counterparts using sex (males and females) and age (1-5 years, 6-10 years, 11-15 years) stratifications. The four government-accredited institutional facilities in Umuahia and the

children who met the inclusion criteria were recruited consecutively until the desired number was achieved.

Selection of non-institutionalised children

First stage - Selection of wards: The twelve wards in Umuahia North and ten wards in Umuahia South were grouped into rural and urban categories and then alphabetically arranged and numbered. A total of twelve wards were randomly selected for the study: six from Umuahia North (three rural and three urban) and six from Umuahia South (all rural).

Second stage - Selection of schools: A comprehensive list of all the schools in the 12 selected wards in Umuahia North and Umuahia South was outlined alphabetically. Ten per cent (10%) of each of the public and private schools in Umuahia North and Umuahia South were selected, respectively, for this study. The ratio of public to private schools was 1:2. Therefore, schools were randomly selected using a ratio of 1:2 such that, when a public school was randomly selected, two private schools were similarly selected for both LGAs, respectively. This was done until the desired sample size of forty-eight schools was achieved.

Third stage - Selection of class: Classes were randomly selected from the different strata of pupils/students, i.e. pre-nursery, nursery, primary, junior secondary and senior secondary.

Fourth stage - Selection of pupils at the class level: Pupils were chosen from pre-nursery to senior secondary. With the aid of the class registers, the pupils were arranged in alphabetical order by their surnames. In schools where certain classes had more than one arm for the same class, the arms were pooled together before the selection of pupils. A systematic and simple random sampling technique was used. After selecting the first pupil by simple random sampling, systematic sampling using an interval

of 5 was used to select the other eligible subjects until the desired class sample size was reached.

Ethical approval

Ethical clearance was obtained from the Health Research Ethics Committee of the Federal Medical Centre, Umuahia (FMC/QEH/G.596/Vol.10/588) and the Ministry of Health, Abia State (ASMH/EC/22/011) before commencement of the study. Formal permission to recruit children in orphanages/special schools and school children was obtained from the Ministry of Women Affairs/Social Development, Abia State (MWASD/AD/23/TI/8) and the Ministry of Education, Abia State (MOE/S.402/T/9) respectively. The details of the study were explained to the parents, guardians, caregivers, teachers and proprietors of the various institutions/schools, and only those who gave their consent were enrolled for the study. An informed consent form written in English, Igbo, Yoruba and Hausa was filled and signed or thumb-printed by the consenting parents/caregivers. Assent was also obtained from children older than seven years.

Data collection

The socio-demographic characteristics of the study participants were obtained using an interviewer-based questionnaire. All anthropometric measurements were obtained by the researcher and the trained assistants using standard protocols. Each child was weighed with minimal clothing, without shoes and standing on a portable digital clinical weighing scale (SECA 881 digital scale, Germany), calibrated in 5g units with an accuracy of greater than +0.15% and a maximum weight of 150kg.²⁸ The height was measured using a stadiometer (SECA 213 stadiometer, Germany), with a maximum height of 205cm and an accuracy of 0.5cm.²⁸ The length was measured using an infantometer for children aged <2 years, with a measuring scale of up to 99cm (SECA 417 Mobile measuring board,

Germany).²⁸ The measurements were taken twice for each subject, and the mean of the two readings was recorded. If any pair of readings exceeded the maximum allowable difference for a given variable (weight > 100 g, height/length > 0.7 cm), the variable was measured again; if necessary, the third set of readings for the affected variable was obtained.

Data analysis

The data were analysed using the Statistical Package for Social Sciences (IBM SPSS version 27). The mean and standard deviations were calculated for each anthropometric index. Weight-for-height (WHZ), height-for-age (HAZ), weight-for-age (WAZ) and BMI-for-age (BAZ) Z-scores were computed from the WHO Growth Reference using the WHO Anthro software version 3.2.2 (for children <5years) and WHO Anthroplus version 1.0.4 (for children 5-19years).²⁹

With reference to WHO Multi-centre Growth Standard/reference,²⁹ stunting was defined as height/length-for-age < -2SD, wasting as Weight for height/length (for < 5years) or BMI for age (for ≥ 5years) < -2SD, underweight as weight for age < -2SD, overweight as weight for height/length > +2SD while obesity was defined as weight for height > +3SD and normal if z scores was between -2 to +1SD.³⁰

Comparisons between calculated mean values of the anthropometric measurements were made between the two groups of children using the Student's t-test, while Chi-Square and Fisher's Exact tests were used to compare the prevalence of underweight, wasting, stunting, overweight, and obesity. All the statistical tests were two-tailed, with $p < 0.05$ considered significant.

Results

A total of 320 children were recruited for this study. After excluding 16 children due to unavailability (7) and incomplete data entry (9), 304 children were enrolled.

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Among the 152 institutionalised study participants, 75 (49.3%) were males, and 77 (50.7%) were females. The non-institutionalised group also had an equal distribution of males and females, with 76 (50.0%) each, resulting in a male-to-female ratio of 1:1 in both study groups. The median age of institutionalised children was

8 years, which was compared with that of non-institutionalised children (9 years). There was a significant difference in the socioeconomic classes of institutionalised children compared to non-institutionalised children, as shown in Table I.

Table I: Socio-demographic characteristics of the study participants

Variables	Institutionalised n (%)	Non- institutionalized n (%)
Age group (years)		
1 to 5	47 (30.9)	49 (32.2)
6 to 10	52 (34.2)	50 (32.9)
11 to 15	53 (34.9)	53 (34.9)
Sex		
Male	75 (49.3)	76 (50.0)
Female	77 (50.7)	76 (50.0)
Tribe		
Igbo	143 (94.1)	144 (94.7)
Others (Yoruba, Hausa, Efik, Ibibio)	9 (5.9)	8 (5.3)
Social Class		
Upper	27 (17.8)	35 (23.0)
Middle	102 (67.1)	55 (36.2)
Lower	23 (15.1)	62 (40.8)
Local Government Area		
Umuahia North (Urban)	125 (82.2)	76 (50.0)
Umuahia South (Rural)	27 (17.8)	76 (50.0)
School type		
Private	60 (39.5)	100 (65.8)
Public	71 (46.7)	52 (34.2)
Mission	21 (13.8)	0 (0.0)
Class		
Not in school	5 (3.3)	0 (0.0)
Nursery	37 (24.3)	48 (31.6)
Primary	106 (69.7)	39 (25.7)
Secondary	4 (2.6)	65 (42.8)

There was a significant variation ($p = 0.03$) in the weight-for-age Z-scores between institutionalised and non-institutionalised

children (Table II). There was no significant variation ($p = 1.0$) in weight-for-height Z-scores between the two groups (Table II), while there

was a significant difference ($p = 0.01$) in the Body-Mass-Index Z-scores of the two groups. The reasons for institutionalising a child were as follows: special education needs and disability

(visual impairment) (46.7%), special education only (21.7), poverty and orphaning (9.9%), as shown in Table III.

Table II: Comparison of the nutritional status of children in the institutionalised and non-institutionalised settings

Variables	Institutionalised	Non-institutionalized	Statistics	COR	p-value
	n (%)	n (%)		(95CI)	
Weight-for-Age Z-score criterion					
Normal	88 (88.9)	92 (92.9)	FT = 9.69	1	0.03*
Moderate Underweight	6 (6.0)	4 (4.1)		14.19	
Severe Underweight	5 (5.1)	3 (3.0)		8.51	
Weight-for-Height Z-score criterion					
Normal			FT = 0.21	-	1
Moderate Wasting	41 (87.2)	42 (85.7)			
Severe Wasting	3 (6.4)	4 (8.2)			
	3 (6.4)	3 (6.1)			
Height/length-for-Age Z-score criterion					
Normal					
Moderate Stunting	95 (62.5)	126 (82.9)	FT = 25.93	1	<0.001
Severe Stunting	42 (27.6)	24 (15.8)		1.14	
	15 (9.9)	2 (1.3)		0.86	
BMI-for-age z-score criterion					
Normal	60 (57.2)	79 (76.7)	FT = 11.93	1	
Underweight	8 (7.6)	4 (3.9)		2.73	0.01
Moderate Wasting	20 (19.0)	10 (9.7)		1.42	
Severe Wasting	11 (10.5)	4 (3.9)		1.42	
Overweight	6 (5.7)	5 (4.8)		0.39	
Obesity	0 (0.0)	1 (1.0)			

FT = Fisher's Exact Test; COR - Crude Odd Ratio; CI - Confidence Interval;

WFA for children <10yrs. WFH for children <5yrs (ICh n = 47, NICH n = 49). HFA for children 0 to 19 years. BFA for children >5yrs (ICh n = 105, NICH n = 103).

Disability had the highest association with malnutrition among other reasons for institutionalisation, as shown in Table IV.

Children in public-owned institutions were more malnourished than children in non-public institutions. The variation in their height-for-age

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Z-scores was statistically significant ($p = 0.009$), as shown in Table V.

A significant number of institutionalised children had a history of acute illness two weeks before the study, as shown in Table VI.

Table III: Reasons for institutionalisation among institutionalised children

Reasons for institutionalisation	Institutionalised
	n (%)
Special education and disability (visually impaired)	71 (46.7)
Education alone	33 (21.7)
Poverty and orphaned	15 (9.9)
Disability alone	3 (2.0)
Others (Abandonment, deprivation)	30 (19.7)

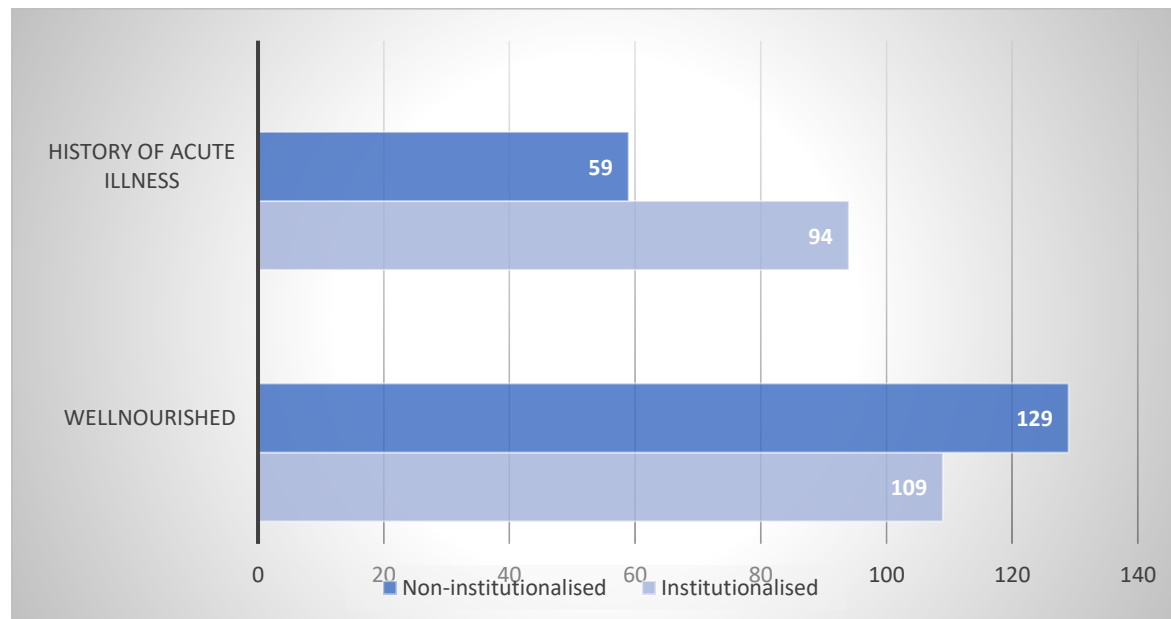


Figure 1: Nutritional status and history of acute illness among institutionalised and non-institutionalised children.

Discussion

The findings revealed that institutionalised children are more stunted, wasted and underweight when compared to non-institutionalised children. This is similar to what has been reported by several studies.^{18,27,30,31} However, it varied with what Izuka *et al.*¹⁰ reported in Lagos, where children in non-institutionalised settings were found to be more underweight. It is important to note that the study

in Lagos was restricted to children under five years of age, and only one of the twenty-seven orphanages in the study is owned by the Lagos State government, while the rest were privately-owned. The study has shown that most institutionalised children were in public institutions. In addition, children in public institutions, especially under-fives, tend to be more underweight when compared to those in

private institutions, which tend to be more obese.
33,34

Children who are underweight experience suboptimal growth, poor psychological development, compromised immune functions, and are at greater risk of long-term health complications. Inadequate nutritional intake and increased vulnerability to infections are

consequences of psychosocial deprivation, a high children-to-caregiver ratio and a lack of consistent, responsive care, which limit individualised attention to nutritional needs, hence the risk of underweight. Improving their nutritional intake, environmental sanitation and caregiver-to-child ratio will positively impact their nutritional status.

Table IV: Comparison between selected reasons for institutionalisation in relation to the types of malnutrition among institutionalised children

Variables	Poverty/orphanhood n (%)	Education n (%)	Disability n (%)	Abandonment n (%)	p-value
Height-for-age					
Normal	13 (86.6)	29 (87.9)	48 (64.9)	25 (83.3)	N/A
Moderate stunting	1 (6.7)	4 (12.1)	24 (32.4)	3 (10.0)	
Severe stunting	1 (6.7)	0 (0.0)	2 (2.7)	2 (6.7)	
BMI-for-age					
Normal	14 (93.3)	26 (78.8)	49 (66.2)	22 (73.3)	N/A
Moderate wasting	1 (6.7)	4 (12.1)	17 (23.0)	1 (3.3)	
Severe wasting	0 (0.0)	2 (6.1)	8 (10.8)	2 (6.7)	
Overweight	0 (0.0)	1 (3.0)	0 (0.0)	5 (16.7)	

NA – Not applicable.

Table V: Comparison between the types of institutions in relation to the types of malnutrition among institutionalised children

Variables	Private n (%)	Public n (%)	Mission n (%)	p-value
Height-for-age				
Normal	51 (85.0)	45 (63.4)	19 (90.4)	0.009
Moderate stunting	7 (11.7)	24 (33.8)	1 (4.8)	
Severe stunting	2 (3.3)	2 (2.8)	1 (4.8)	
BMI-for-age				
Normal	46 (76.7)	46 (64.8)	19 (90.4)	N/A
Moderate wasting	5 (8.3)	17 (23.9)	1 (4.8)	
Severe wasting	3 (5.0)	8 (11.3)	1 (4.8)	
Overweight	6 (10.0)	0 (0.0)	0 (0.0)	

Wasting often indicates acute malnutrition, typically resulting from acute significant food shortage and/or disease that affects nutritional

intake. In this study, the children in institutional care exhibited higher rates of wasting compared to those living outside institutions. A comparable

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higher prevalence was observed in other studies across the world among institutionalised children.^{13, 16, 18, 22, 27, 31} This may be because the overall impact of institutionalisation on the growth and development of children is generally negative due to their vulnerability to acute infections, which have been linked to wasting.^{19,35} In the present survey, notably higher cases of acute illnesses were observed among institutionalised children two weeks before the study compared to the non-

institutionalised children, which may have negatively impacted their nutritional status. Children presenting with acute illness in institutional settings frequently exhibit wasting due to limited access to health facilities, delayed healthcare-seeking when the children are ill, reduced nutritional intake due to ill-health and presence of co-morbidities, highlighting the need for timely intervention.

Table VI: History of acute illness among institutionalised and non-institutionalised participants

Variables	Institutionalized	Non-institutionalized	Statistics	p-value
	n (%)	n (%)	χ^2	
History of acute illness				
Yes	94 (61.8)	59 (39.1)	31.2	<0.001
No	58 (38.2)	93 (60.9)		
Common symptoms				
Fever	30 (31.9)	19 (32.2)		
Cough	12 (12.8)	9 (15.3)		
Catarrh	33 (35.1)	21 (35.6)		
Diarrhoea	7 (7.4)	3 (5.1)		
Vomiting	12 (12.8)	7 (11.8)		

This study also reported worse nutritional indices among children with disabilities compared to those without disabilities within the same institutionalised care. Similar findings were reported by Ukegbu *et al.* among blind adolescents in Abia State.¹⁶ Thus, the need for greater focus on improving nutrition for children in institutions, especially those with disabilities, as reported in the present study.³

Stunting, an indicator of chronic malnutrition, was higher among institutionalised children. Similar findings had been documented in Owerri.²⁷ The prevalence of stunting (37.5%) in the index study among institutionalised children is, however, lower than the findings in Kenya (59.0%).¹⁸ Whereas the present study excluded all children with chronic illnesses, Braitstein and

coworkers in Kenya involved institutionalised subjects with diseases such as HIV and TB, which are known to affect growth and development, hence may account for the higher prevalence of stunting. Stunting is triggered by long-term deficiency of nutrient intake, and it is an indicator of prolonged malnutrition and linear growth failure. The latter consequently has a significant effect on the cognitive development and other aspects of growth in children. Stunting, which had the highest prevalence in the present study among both the institutionalised and non-institutionalised children, is known to increase the risk of death, poor cognitive function and lower productivity in adulthood. Stunting in institutionalised children is a critical indicator of systemic neglect and chronic deprivation. It reflects not only inadequate nutrition but also

poor psychosocial care, limited stimulation, and repeated illness. The effects are long-term, often irreversible, and extend well into adulthood, affecting health, productivity, and quality of life.

³⁶ Thus, interventions by the government and NGOs towards sustained food availability and food security are necessary to ensure optimal physical growth and development.

Limitations

The study was carried out in four government-approved institutions in Umuahia, potentially limiting the generalizability of observed nutritional status to the over twenty other institutions in the state.

Conclusion

Institutionalised children demonstrated poorer nutritional status when compared to non-institutionalised children using anthropometry such as weight and height/length measurements. The comparative analysis reveals significant differences in anthropometric indices of both study groups, highlighting the influence of the institutional care environment on the growth and development of children. These findings underscore the need for routine growth monitoring for children in institutional care, targeted programs and policies to promote optimal growth in all children, regardless of their living arrangement.

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