ORIGINAL ARTICLE

Determinants of undernutrition among primary school children residing in slum areas of a Nigerian city

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Abstract

Background: Undernutrition remains the largest contributor to the global disease burden. Different factors affecting the nutritional status of children need to be studied to determine those to be targeted in a country like Nigeria, characterized by widespread poverty and inequitable distribution of wealth.

Objective: This study was aimed at ascertaining the relationship between prevailing socioeconomic and environmental factors, and the nutritional status of children residing in a typical urban slum.

Materials and Methods: A cross-sectional descriptive study of 788 children aged 6-12 years selected by stratified, multistage random sampling method from public primary schools in slum and non-slum areas of Onitsha was carried out. Their nutritional status was determined using anthropometric measures. The socioeconomic and environmental variables of interest were analyzed to determine their relationship with undernutrition in the children.

Results: Socioeconomic status was the major determinant of nutritional status in this study. Poor housing also affected the nutritional status of the slum children who were significantly from poorer families than those residing in non-slum areas ($\chi^2 = 66.69$, $P = 0.000$).

Conclusion: This study highlights the need for an effective nutrition program targeted at school children in urban slums surrounded by factors predisposing them to undernutrition.

Key words: Determinants, school-aged children, undernutrition

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Introduction

Undernutrition is one of the leading causes of childhood morbidity and mortality in many developing countries.[1,2] Evidence of high levels of nutritional deprivation in school-aged children has spurred increasing global interest in their nutrition and health.[3] The determinants of optimal child nutrition and growth are multifactorial, but dependent basically on adequate and appropriate nutrition largely influenced by socioeconomic factors and a normal health status.[4]

In Nigeria and other developing countries, the poor are the fastest growing segment of the urban population. This has led to the proliferation of urban slums. The residents have higher rates of childhood malnutrition, morbidity, and mortality, compared to those in the more privileged neighborhoods.[5,6] Even though nationally representative surveys often exclude these slum areas considered to be illegal settlements, the Millennium Development Goals are set to achieve as one of the targets significant improvement in the lives of at least 100 million slum dwellers by 2020.

Few recent studies have examined the factors responsible for undernutrition in school-aged children in Nigeria and other African countries.[7-9] This population of children has been largely neglected as research interests have focused mainly on preschoolers who are presumed more vulnerable.[10,11] However, interventions on school-aged children could supplement efforts in the preschool years

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to reduce undernutrition and related negative effects on child health and education.[3] The findings of this study are expected to draw attention to the need to reevaluate policies especially in terms of improvements in distribution across disadvantaged areas and age groups.

Materials and Methods

This cross-sectional, descriptive survey was carried out in Onitsha metropolis, a major commercial and industrial center, between September and December 2010. The metropolis which covers about 50 km^2 has some adjoining towns and many suburbs in addition to Onitsha North and Onitsha South Local Government Areas.[12] The population density of the low-, medium-, and high-density areas of Onitsha is 600, 1000, and 15,000 persons, respectively, per square kilometer. Four slums identified in Onitsha metropolis include the Okpoko, Mammy market, Otu, and Prison slums.[12] These slums are characterized by a very high population density of more than 44,000 persons per square kilometer, with lack of provisions for public facilities and amenities. The Okpoko slum, the largest suburban slum in Nigeria, has a population density of 4.4 million per square kilometer.[12]

The study population included all public primary school children aged 6 to 12 years in the slum and non-slum areas of Onitsha metropolis. Those who had lived for less than a year in the study area and those with chronic ailments were excluded. In Onitsha metropolis, there are totally 22 public primary schools located within the slums with a total population of 13,296 school children. In the non-slum areas of Onitsha, there are 58 public primary schools with a total population of 29,793 school children [Anambra State Universal Basic Education Board (ASUBEB)].

The minimum sample size of 768 was estimated using a standard formula.[13] Approval for this study was obtained from the Research and Ethical Committee of Nnamdi Azikiwe University Teaching Hospital and the ASUBEB. Written informed consent was obtained from the parents or guardians of the children after explaining clearly in writing, and verbally, where necessary, the nature and objectives of the study. Certain modifications for standardization were effected as deemed necessary following information obtained from a pilot study.

Subject selection

A multi-stage stratified random sampling technique was applied to select the study children. Thirty percent of the entire public schools in the slums, making a total number of six schools, were randomly selected. Six schools were also selected from the non-slum areas as control. The class registers formed the sampling frame in each school and the children were grouped on the basis of age and gender. The age at last birthday as provided by the respondents was verified using the school registers. Four hundred and eighty children each were randomly and systematically selected from the study group (slum) and the control group (non-slum). The number of pupils selected from each school in the slums was determined pro rata based on the school population and the total number of children from each age group and gender. If a child selected was absent from school, the next child on the list was picked. The selection ratio per age group and gender in the non-slum areas was dependent on the number obtained from the same age group and gender in the slum areas.

Consenting parents or guardians were invited to the schools where a questionnaire on the demographic characteristics of participants, environment, and socioeconomic status was interviewer-administered. Some trained assistants helped with the administration of the questionnaires only. The second stage of the study involved the general physical examination of the children and a measurement of their heights and weights.

Weights of the children were measured using a Hana bathroom scale, model BR 9011, ISO 9001:2000 certified by SGS, placed on a flat surface. Each child to be weighed was dressed in a lightweight gown or pants. The weight was recorded to the nearest 0.5 kg. Before commencing weighing daily, the scale needle was returned to zero. Thereafter, a standard known weight was placed to assess the accuracy and reliability of the scale.

Height was measured to the nearest 0.5 cm using a locally constructed and well-calibrated wooden stadiometer with a movable headpiece perpendicular to the vertical backboard.[14] The subject would stand with the heels, buttocks, shoulders, and head touching the vertical backboard, the neck slightly stretched, and eyes looking directly ahead. The readings were taken after the headpiece had been gently brought down until it compressed the hair without exerting any pressure on the head. The quality of the measurements was assessed by randomly re-measuring the weights and heights of some of the children.

The social stratification was carried out using the Oyedeji classification and the Rutstein/Gwathkin wealth index [asset score derived from the 2003 Nigerian Demographic and Health Survey (NDHS)]. Quantitative data were analyzed using Microsoft Office Excel 2007, SPSS version 17, and Epi-info version 3.5.1 software packages. Frequency distributions of variables were represented in tables. Means and standard deviations of the continuous variables; weight, height, weight-for-age, and height-for-age were calculated. Tests of statistical significance were carried out using the appropriate statistical test. The Student's *t*-test (unpaired) was used for means, and the Chi-square test was used to compare differences between proportions. The statistical tests were carried out at significance (*P* value) of less than 0.05.

Results

A total of 788 children, matched for both sex and age, were studied. The children studied included 398 (50.5%) males and 390 (49.5%) females. In both localities, male:female ratio was 1.02:1 and the mean age of the respondents was 8.9 ± 1.9 years. Significantly, most of the children from both localities were Ibos ($\chi^2 = 20.65$, $P = 0.000$).

Socioeconomic characteristics

The socioeconomic characteristics were determined by the parental educational attainment and occupation, ownership of certain assets, and family income. Both parents from most of the households in the two groups had at least a primary education. In both areas, most mothers had secondary education, while most fathers had primary education, with no significant difference in the educational status of the parents [Table 1].

Table 2 shows the social classification of the families of the children studied based on Oyedeji social class (parental education and occupation) and quintile class (asset scoring from 2003 NDHS). A greater percentage of the mothers in the slums than non-slum areas were unemployed, while more of those with higher profile jobs were in the non-slum areas. These differences were not statistically significant. In the quintile classification, a significant proportion of the slum households belonged to the lowest quintile classes, 27.7% in class 1 and 28.7% in class 2 ($\chi^2 = 66.69$, $P = 0.0.000$), while only 13.7% of the households were in the highest quintile class. Conversely, the greatest percentage of the non-slum households (32.5%) belonged to the higher quintile class 4 [Table 2].

Table 1: Distribution of the children by parental educational attainment

Educational attainment	Slum *n*=394 (%)	Non-slum *n*=394 (%)	χ^2	*P* value
Mother				
Graduate	30 (7.6)	32 (8.1)	6.80, df=3	0.075
Senior secondary/OND with other professional qualification	1 (0.3)	0 (0.0)		
SSC/TCII	178 (45.2)	192 (48.7)		
Primary/JSC	169 (42.9)	142 (35.8)		
No formal education	15 (3.8)	17 (4.3)		
Do not know	1 (0.3)	12 (3.0)		
Father				
Graduate	13 (3.3)	8 (2.0)	2.98	0.560
Senior secondary/OND with other professional qualification	9 (2.3)	0 (0.0)		
SSC/TCII	147 (37.3)	140 (35.5)		
Primary/JSC	197 (50.0)	201 (51.0)		
No formal education	11 (2.8)	16 (4.1)		
Do not know	17 (4.3)	29 (7.4)		

A significant proportion of the mothers in the slum (58.1%) earned less than N10,000.00, while a greater proportion in the non-slum area earned higher, between N10,000 and N19,999 (33%) and between N20,000.00 and N49,999.00 (13.5%) than in the slum (25.6% and 8.1% respectively).

Environment

The predominant type of houses in the slums were significantly single room apartments (39.6%), two room apartments (29.2%), and non-permanent (20.8%), while two room apartments (35.8%), single room apartments (34.5%), and flats (19.3%) were commoner in the non-slum area ($\chi^2 = 54.55$, $P = 0.000$). A median of 5 and 3 families per sewage type (water closet and pit latrine) was found in the slum and non-slum areas, respectively. Significantly more families in the slum areas used pit latrines and resorted to use of bush ($\chi^2 = 92.4$, $P = 0.000$). Borehole water usually purchased from private individuals using water cans was the commonest source of water in both localities.

Relationship between socioeconomic factors and undernutrition in the children

Children from families of lower social class, Oyedeji class 4 in both localities and quintile classes 1 and 2 in the slums, were more stunted than their counterparts as shown in Table 3. Those in the lower quintile classes in the slums were significantly more stunted ($\chi^2 = 12.14$, $P = 0.006$) than those in higher quintile classes. The prevalence of stunting was relatively least amongst the children in both areas whose mothers were graduates or had SSCE with additional professional qualification or who earned higher. A greater percentage of the underweight children were in the lower social classes of both Oyedeji and the quintile category, but no significant association was demonstrated. The greatest percentages of the underweight children in both localities were those whose mothers earned less

Table 2: Distribution of the children by various social classifications

Social classification	Slum *n*=394 (%)	Non-slum *n*=394 (%)	χ^2	*P* value
Oyedeji classification				
Class 1 (highest)	0 (0.0)	1 (0.3)	3.91, df=2	0.141
Class 2	17 (4.3)	10 (2.5)		
Class 3	44 (11.2)	61 (15.5)		
Class 4	330 (83.8)	308 (78.6)		
Class 5 (lowest)	3 (0.8)	14 (3.6)		
Quintile class				
Class 1(lowest)	109 (27.7)	45 (12.4)	69.69	0.000
Class 2	113 (28.7)	85 (21.6)		
Class 3	59 (15.0)	42 (10.7)		
Class 4	59 (15.0)	128 (32.5)		
Class 5 (highest)	54 (13.7)	94 (23.9)		

than N10,000.00, with 68.5% in the slums and 65% in the non-slums. Even though most of the parents had some level of education, the bulk of those that were underweight in both localities were those whose parents had fewer years of formal education. In the slums, only 5.7% of the underweight were children whose mothers were graduates. The prevalence of stunting was relatively least amongst the children in both areas whose mothers were graduates or had SSCE with additional professional qualification than the others. The relationship between stunting and the various social classes is represented in Table 3.

Environmental factors and undernutrition in the children

The environmental factor that had a significant relationship with undernutrition was the house type in the slums only. Majority of the underweight and stunted in the slums were significantly those who resided in single rooms and those residing in non-permanent houses ($\chi^2 = 8.05$, $P = 0.017$ for underweight) ($\chi^2 = 7.08$, $P = 0.028$ for stunting) [see Tables 4, 5].

Relationship between health friendly measures and undernutrition in the children

There was a significant association between the absence of a BCG scar and underweight in the slums ($\chi^2 = 6.18$, $P = 0.012$). Majority of those who were underweight had no BCG scar. In the slums also, stunting was significantly associated with absence of a BCG scar ($\chi^2 = 5.54$, $P = 0.018$). None of the exclusively breastfed was underweight, and of all those who were stunted, only 2.9% were exclusively breastfed. Most mothers introduced cereals and family diet within the first 6 months of life, and this group of children constituted the majority of the undernourished.

Table 3: Distribution of stunting by social class in slum and non-slum areas

Social class	Slum		*P* value	Non-slum		*P* value
	Stunted *n*=66 (%)	Normal *n*=328 (%)		Stunted *n*=27 (%)	Normal *n*=367 (%)	
Oyedeji classification						
Class 1	0 (0.0)	0 (0.0)	0.281	0 (0.0)	1 (0.3)	F=0.38
Class 2	2 (3.0)	15 (4.6)		1 (3.4)	9 (2.5)	
Class 3	4 (6.1)	40 (12.2)		2 (7.4)	59 (16.1)	
Class 4	59 (89.4)	271 (82.6)		22 (81.5)	286 (77.9)	
Class 5	1 (1.5)	2 (0.6)		2 (7.4)	12 (3.3)	
Quintile score						
Class 1	26 (39.4)	83 (25.3)	0.006	4 (14.8)	45 (12.3)	0.934
Class 2	20 (30.3)	93 (28.4)		5 (18.5)	80 (21.8)	
Class 3	12 (18.2)	47 (14.3)		4 (14.8)	38 (10.4)	
Class 4	0 (0.0)	59 (18.0)		8 (29.6)	120 (32.7)	
Class 5	8 (12.1)	46 (14.0)		6 (22.2)	84 (22.9)	

Table 4: House type and underweight in slum and non-slum areas

House type	Slum		*P* value	Non-slum		*P* value
	Underweight *n*=35 (%)	Normal *n*=269 (%)		Underweight *n*=20 (%)	Normal *n*=284 (%)	
Non-permanent (shack or tent)	7 (20.0)	56 (20.7)	0.017	3 (15.0)	17 (6.9)	0.697
Single room	21 (60.0)	100 (37.2)		8 (40.0)	102 (35.9)	
Two rooms	5 (14.3)	83 (30.9)		2 (10.0)	102 (35.9)	
Flat	1 (2.9)	23 (8.6)		5 (25.0)	56 (19.7)	
Others-bungalow and duplex	1 (2.9)	7 (2.6)		2 (10.0)	7 (2.5)	

Table 5: House type and stunting in slum and non-slum areas

House type	Slum		*P* value	Non-slum		*P* value
	Stunted *n*=66 (%)	Normal *n*=328 (%)		Stunted *n*=27 (%)	Normal *n*=36 (%)	
Non-permanent	15 (22.7)	67 (20.6)	0.028	4 (14.8)	23 (6.3)	0.401
Single room	34 (51.5)	121 (37.1)		8 (29.6)	128 (34.9)	
Two rooms	13 (19.7)	102 (31.3)		9 (33.3)	132 (36.0)	
Flat	3 (4.5)	25 (7.7)		4 (14.8)	72 (19.6)	
Others	1 (1.5)	13 (3.9)		2 (7.4)	12 (3.2)	
Bungalow and duplex						

Discussion

This study confirms that undernutrition in children is largely a consequence of the prevailing socioeconomic and environmental factors. The predominance of stunting as the major form of undernutrition in this study, similar to other studies in Nigeria,[8,14,15] suggests the existence of long-term nutritional deprivation in these children who were predominantly from the lower socioeconomic classes. Stunting, which is a measure of overall social deprivation, may be a consequence of the progressively worsening economic situation in Nigeria with rising cost of foods and other necessities of life.[16] Longstanding nutritional deprivation is thus commoner in Nigerian children than acute severe undernutrition which is commoner in children residing in war-torn areas and areas faced with acute food shortages. It is well known and documented that children stunted at school age are likely to have been exposed to poor nutrition since early childhood.[1]

The higher prevalence of undernutrition amongst the slum dwellers in this study is similar to what was documented in the cities of Brazil, India, Cote d'Voire, Ethiopia, Niger, and Morocco by The State of the World Cities Report of 2006/2007.[17] This disparity may be related to widespread poverty, a major determinant of the individuals' environmental characteristics. This is more so considering that the majority of the undernourished in the index study were significantly those residing in poor-quality houses. Most children in the slums unlike in the non-slum areas resided in non-permanent or single room apartments and this group significantly contributed to the higher percentage of the undernourished. Other studies in Africa and beyond reporting similar findings have attributed this disparity to differences in the social class in the areas studied which influenced the overall living standard, type of housing, quality of education, affordability of adequate food, and appropriate health services.[17-19]

In the index study, more of the people residing in the slum areas belonged to the lower socioeconomic classes compared to those in the non-slum areas. Using the quintile classes derived from the asset score, this disparity was significant. More than half of the children in the slums were from the lowest two quintiles and these made up the majority of the undernourished. Children from the lower quintile class were significantly more malnourished than those from higher quintile classes. The World Bank, the 2003 and 2008 NDHS, and the 2004 Nigerian Demographic and health survey Educational data Survey (NDES) documented similar observations.[15,20-22] Despite the area of residence, however, mothers with higher educational attainment had less undernourished children in this study. Educated mothers are known to be more likely to adopt health-friendly measures, and in the index study, children whose mothers had better health-friendly attitude were generally better nourished. Educated mothers are also better able to manage meager resources to provide essentials, thus having healthier children than illiterate mothers. This compares favorably with the findings of other studies on childhood malnutrition in which maternal formal education influenced a reduction of the prevalence of malnutrition.[15,20,23-25]

In this study, undernutrition was more prevalent among children whose mothers earned the least. Higher maternal income was associated with better anthropometric indices of children in the slum and non-slum areas: None amongst those children in the slums whose mothers earned N20,000 or more was stunted. This may be explained by the fact that financially empowered mothers are more likely to use their earnings for the welfare of their children, including their nutrition and seeking of medical care at the first sign of a child's illness.

Conclusion

Socioeconomic status is the major determinant of nutritional status in this study. Poor housing, poor maternal income and education contributed to the poor nutritional status of the slum children. Strategies to educate more women and financially empower them through gainful employment can never be overemphasized as a result of the obvious benefit of increased spending power as well as education of women on the health and nutritional status of children. There should be advocacy to get the government to provide better housing and sewage facilities for her populace as the environment significantly affects the nutritional and overall well-being of children. The need for a school feeding program targeted at poor regions is emphasized.

This index study was school-based. This limits the generalization of the findings of the study as it excluded children who were not attending school. A higher prevalence of undernutrition may have been obtained if it were a community-based study as children who are more malnourished are less likely to go to school, or are more likely to be absent owing to ill health associated with malnutrition. Also, children from families that cannot afford to pay for school uniforms and other accessories may not attend even the free public schools. This may also have been the reason for the very low prevalence of severe forms of undernutrition in the study. Further epidemiological studies incorporating both school and non-school attenders are required.

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