Association between Household Food Insecurity and Malnutrition among School Aged Children in Nnewi Southeast Nigeria

[1*]Nkechinyere G. Obichukwu, [1],[2]Clement C. Ezechukwu, [1],[2]Jacinta C. Elo-Ilo, and [1],[2]Amala O. Odita.

[1]*Department of Paediatrics, Nnamdi Azikiwe University Teaching Hospital, PMB 5025 Nnewi, Anambra State.*

[2]*Department of Paediatrics, College of Health Sciences, Nnamdi Azikiwe University, Awka Anambra State.*

***Corresponding author:** giftedkechi@yahoo.com*

ABSTRACT

Background: *Malnutrition in school aged children can predispose to infectious diseases, non-communicable diseases and death. Numerous risk factors of childhood malnutrition has been published with generation of instituted policies, yet the complications of childhood malnutrition is still not abated in our locality. Hence the need to explore the effect of house hold food insecurity (HHFIS) on childhood malnutrition.*

Objective*: To determine the prevalence of malnutrition and the association between HHFIS and malnutrition among 6-12-year-old primary school pupils in Nnewi Southeast Nigeria.*

Methods: *This cross-sectional descriptive study was carried out on 270 primary school pupils. Socio-demographic data was collected using a pretested interviewer administered questionnaire. Information on food availability in the home was collected and used to grade HHFIS into food secured household, moderate food insecurity, Household food insecurity, Severe HHFIS/child hunger. Data was analyzed using Statistical Package for Social Sciences (SPSS) software version 21.0. Level of significance for tests of association was set at 5%.*

Results*: The result showed that 143(53%) were males and 127(47%) were females. Seventy-five (27.8%) were wasted, 21(7.8%) had severe wasting, 18(6.7%) had underweight, 17(6.3%) were overweight, while 9(3.3%) had obesity and 3(1.1%) were stunted. Low Socio-Economic Class (SEC) and HHFIS, were associated with under-nutrition. ($p < 0.05$) While high SEC and HHFIS were associated with overweight/obesity ($p < 0.05$).*

Conclusion*: The prevalence of under nutrition was high among 6-12 year old school children in Nnewi. Prompt and adequate provision of household food security can help mitigate the impact of malnutrition in the sub region.*

Keywords: *HHFI, childhood malnutrition, Nnewi.*

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INTRODUCTION

Malnutrition occurs with imbalance in energy supply and consumption, more so among school aged children where 60% of total body growth and neurocognitive development occurs.1,2 Severe malnutrition was described in 1920 and it occurs more in developing countries and in chronically ill hospitalized children in developed countries.[3,4] In 1930, Cecily Williams described

childhood malnutrition as "Kwashiorkor" and noted the increased risk of death if interventions were delayed.[5,6] In 1985, United Nation Children's fund (UNICEF) documented nearly four million African children death each subsequent year following complications of childhood malnutrition.[7] Currently, World Health organization (WHO) together with United Nations (UN), since 2016 have embarked on dietary interventions to achieve a world free of childhood malnutrition by 2025.[8] Some Nigerian studies,[9,10] and similar studies done in some developing countries, [11-13] reported high prevalence of malnutrition. This shows that malnutrition is still a public health problem in African sub-region.

Household food security occurs when all the members of the household have physical, social and economic access to sufficient, safe and nutritious food at all times either from its own production or through purchase; which meets their dietary needs and food preferences for healthy living.[14] If these conditions are not met, then the household is said to have food insecurity.[15,16]Household food insecurity has been noted to be associated with childhood malnutrition.[17] Childhood malnutrition is more prevalent in households with food insecurity than households with food security.[18]This is primary malnutrition in the absence of childhood illness. Children from severely food insecure home were 21% more likely to be stunted than those from food secured house hold.[19] Studies done in Ethiopia have shown that food insecure homes were significantly associated with occurrence of under-nutrition.[20,21] Their findings were similar to the result gotten in a study done in Sokoto, Nigeria.[22] This may be because of inadequate intake of energy and nutritious food that usually occur in food insecure homes. Though most of these studies were done among under five children, it shows a reflection of what will be obtained in an older child from same home, though the burden may differ. Household food insecurity was found to be significantly associated with occurrence of overweight/obesity in some studies.[16,23,24]This may be following the concept of food deprivation and disordered eating behavior that arises associated with depression and physical inactivity that can culminate in overweight/obesity.

There has been many identified risk factors of childhood malnutrition in our environment like age,[25] sex,[26] low birth weight,[27] SEC, [28] and dietary factor like low feeding frequency.[2] Proper identification of other risk factors of childhood malnutrition will help immensely to mitigate the burden of malnutrition on school age children in our environment. Therefore a need to carry out research on the prevalence of childhood malnutrition and other dietary related risk factors like household food insecurity in our community. This study thus determined the prevalence of childhood malnutrition and the association of HHFIS to occurrence of malnutrition among primary school children in Nnewi Southeast Nigeria.

Material and Methods

The study was conducted in Nnewi metropolis which is the second largest city in Anambra state Southeastern Nigeria.29 Nnewi metropolis comprises, four autonomous quarters thus: Otolo, Uruagu, Umudim and Nnewichi. As of 2006, Nnewi has an estimated population of 391,227, according to the Nigerian census.29 The city spans over 2789Km^2 in Anambra state. The major occupation of the indigenes is trading and farming with few civil servants. The city has a large market popularly known as Nkwo Nnewi that specializes in motorcycle and motor spare parts sales, however, it is also a market for other miscellaneous goods and food wares.29

There were 302 primary schools in Nnewi from the data obtained from Nnewi North Local Government secretariat; 30 were government owned schools (public school) while 272 were private schools. The proportion of public school to private schools in Nnewi was 1: 9. Each of the four autonomous quarters in Nnewi has at least 2-3 of each of the public and private primary schools respectively. These primary schools have school children in classes one to six.

Study Design

The study was a descriptive, cross-sectional study.

The study population comprised six- to twelve-year-old primary school children in Nnewi Metropolis.

Inclusion Criteria

1) Six to twelve-year-old primary school children in Nnewi selected by Probability sampling techniques and are willing to participate.

Exclusion Criteria

1) Children whose parents/caregivers were not available during periods of data collection.
2) Children with chronic diseases that may impair communication or by their nature may contribute to malnutrition.
3) Children whose ages cannot be ascertained.

Sample size was calculated using the formulae for cross sectional observational study.thus: Minimum sample size n = z^2Pq/d^2.30[31]

Where: n= The desired sample size when population is greater than 10,000

Z=The standard normal deviate, usually set at 1.96

P= the proportion in the target population estimated to have a particular characteristic.

The prevalence of Normal weight Primary School children in Anambra state is 85.2%, so the prevalence of malnutrition among these children is 14.8%.9

q=1.0-p ; q=1.0-0.148; q =0.852

d=degree of accuracy desired, set at 0.05

Therefore n= $(1.96)^2$x 0.148x 0.852/ $(0.05)^2$; n= 194

Minimum sample size = 194

Since some children selected for the study could not agree to participate, so a response rate of 80% was allowed. The adjusted sample size (N_s) was = n/0.8.31; N_s=194/0.8; N_s= 243

Attrition factor of 10% was accommodated, because some initial respondents could not get to the end of the research. Hence the corrected sample size (N_c) was= 243/0.9

N_c =270 was the corrected sample size.

So two hundred and seventy, 6 to 12 year old primary school children in Nnewi that met the inclusion criteria were recruited for the study.

Stratified multistage sampling methods was used to select the participants: Data obtained from Nnewi North Local Government secretariat on the list of schools in Nnewi showed that there were 302 primary schools in Nnewi; 30 were government owned schools (public school) while 272 were private schools. The proportion of public school to private school in Nnewi was 1: 9. Ten primary schools were selected from 302 primary schools sampling frame in Nnewi metropolis in the proportion of 1:9 (public: private). So, in stage 1 of multi stage sampling, one public and nine private primary schools were selected from the 302 list of the primary schools in Nnewi sampling frame. The public schools were selected by simple random sampling. That was done by writing the names of the public primary schools separately on different pieces of paper which was folded and put in a sealed bag and shaken. Thereafter one school was chosen randomly from the bag. An individual who was not part of the study was engaged in that selection to avoid selection bias.

Also 9 (nine) private primary schools were selected from the sampling frame of the list of 272 private schools in Nnewi using systematic sampling technique of choosing one private school after every 30 private primary schools. So a total of 10 schools were used for the study, one public primary school and 9 private primary schools.32 Approval for the 10 selected primary schools were gotten from the Anambra State Universal Basic Education Board (ASUBED), Awka. Also, approval was gotten from the Management Board and Parents Teachers Association (PTA) of each of the selected schools for the study.

In stage 2, the number of participants used from each of the selected ten primary schools were determined using a proportionate stratified sampling allocation formulae as follows:33

$$\frac{\text{The total population of the index school X the total sample Size}}{\text{Sum of the Population of the ten schools selected for the study.}}$$

For proper representation of different age ranges, the allocated sample size for each of the selected 10 primary schools were equally divided among

the six grades of each school (stage 3). The allotted sample size for each grade were also divided equally among the number of classes in each grade (stage 4).

The number of participants allotted for each class, were selected by simple random sampling technique using a statistical table of random numbers, until the required participants for each class were selected (stage 5). Number code was given to each of the selected participant. School record of birth certificate of each enrolled child was used to establish the child's age.

Data Collection

Three research assistants (Health workers) were involved in the data collection after training by the investigator prior to commencement of data collection. The detailed information about the study was given to the parents/caregivers by the researcher before enrolment into the study. During the data collection, the parent/caregiver of the selected participants were met individually after school dismissal for data collection as they come to take their wards home. Pre-tested standardized semi-structured questionnaire was used by the investigator and research assistants to collect relevant information. The questionnaire was interviewer administered, and the following information was gotten thus: child's age, sex, social economic class(SEC) using Oyedeji's social classification method,34[35] into upper SEC, medium SEC and low SEC. The research assistants were involved with administration of questionnaires and taking measurements of height and weight of the selected pupils using standard methods. The height and weight measurement were used to establish each child's nutritional status using the WHO Z scoring system. According to WHO, Demographic and Health Survey (DHS), Multiple Indicator Cluster Survey (MICS) and UNICEF joint definition, the clinical diagnosis of different nutritional status were made thus: Stunting as Height for Age Z-score(HAZ) < -2, Wasting as BMI for age Z score< -2, Underweight as Weight for Age Z score (WAZ) < -2, Normal nutritional status as Weight for Age Z score between> -2 and < +2, Overweight as BMI for age between +1 and +2 Z score and Obesity as BMI for age> +2 Z score.36

Grading of household food insecurity was done using Fanta/Cornell Questionnaire method which was a nine questions on food availability in the home. The household food insecurity grade was done depending on the response to the nine household food availability questions in the Fanta/Cornell Questionnaire into Food secure-Category I, Moderately food insecurity- Category II, Food insecurity- Category III, and Extremely food insecurity/child hunger- Category IV depending on their response to the questions on the scale.37

Data Entry and Cleaning

All completed questionnaire and proforma were coded before entry into the statistical package for social science (SPSS) software version 21.0 windows for analysis. Frequencies and percentages were used to summarize categorical variables like sex, nutritional status and parents' socio-economic status. The continuous variables like age of the respondents were summarized using median. The outcome (dependent) variable was nutritional status. They were grouped into under-nutrition (underweight, stunting and wasting) and overweight/obesity group. Each of the group was compared differently with normal nutritional status group on their association with each of the independent variables. The independent variables (categorical variable) were household food insecurity grades and they were summarized using frequencies and percentages.

Data Analysis

Categorical variables like sex, age groups, parents' socioeconomic class, grades of household food (in)security, were tested for association to Malnutrition (dependent/outcome variables) using Pearson's Chi-square (and Fisher's exact test where appropriate) for bivariate analysis, and binomial logistic regression for multivariate analysis. Binomial logistic regression analysis was done to control for confounders on the effects of the independent variables on the dependent variables (under-nutrition and overweight/obesity). Odds ratio was used to determine the magnitude of the relationship at 95% confidence level. P-value <0.05 was considered statistically significant.

Ethical Considerations

Ethical review was done and approval obtained from the ethics committee of NAUTH Nnewi with reference number NAUTH/CS/66/VOL.11/132/2018/067; also approval for the study was gotten from ministry of Education in Anambra state (Anambra State Universal Basic Education Board- ASUBEB) before commencement of the study. Written informed consent was obtained from the School Parent Teacher Association and written informed assent was gotten from participants' ≥ 7-year-old before enrollment into the study. The parents/care givers of the participants were reassured that the study would cause no harm and there would be no additional discomfort to the child. Confidentiality was maintained at all times throughout the study and afterwards. Subjects did not incur extra cost by participating in this study and there was no financial inducement.

Follow-up

Participants diagnosed to be malnourished were referred to Paediatrics nutrition/gastroenterology clinic in NAUTH Nnewi for appropriate management and follow up. The parents/caregiver of the identified malnourished children were engaged in proper nutritional counseling session on the need for immediate nutritional rehabilitation. They were also advised on the need to keep to hospital appointments and follow-up.

RESULTS

A total of 272 primary school aged children (6-12years) were enrolled into the study, however 2 subjects had incomplete data and thus were excluded from data analysis. So, 270 participants were enrolled for data analysis. 143(53%) were males, while 127(47%) were females giving a male to female ratio of 1.13:1. The participants from upper SEC were 61(22.6%) while 91(33.7%) were from middle SEC, and 118(43.7%) were from low SEC. The age distribution of the participants had right (positive) skewness with the median age in the 6-8-year age group. Table1 shows the socio-demographic characteristics of the study population.

TABLE 1: Socio-demographic characteristics of the selected subjects for the study.

Characteristics	Frequency n=270	Percent
Gender		
Male	143	53.0
Female	127	47.0
Age groups (years)		
6-8	148	53.8
9-12	122	45.2
Socio-economic class		
Upper	61	22.6
Middle	91	33.7
Low	118	43.7

Table II: Prevalence Of Different Nutritional Status

NUTRITIONAL STATUS	PREVALANCE N(%)
Normal	164 (60.7)
Wasting	75(27.8)
Severe Wasting	21(7.8)
Underweight	18(6.7)
Overweight	17 (6.3)
Obesity	9(3.3)
Stunting	3(1.1)

Table III: Differences in Prevalence of Normal Nutritional Status and Under nutrition by Age, Sex and Socioeconomic Class.

Variables	Nutritional status	Under-nutrition	χ^2 (p-value)
	Normal		
	n= 164(%)	n= 80(%)	
Age			**1.361(0.243)**
6-8years	95(57.9)	40(50)	
9-12years	69(42.1)	40(50)	
Sex			**1.448(0.229)**
Male	85(51.8)	48(60)	
Female	79(48.2)	32(40)	
SEC			**9.336(0.009)***
High	38(23.2)	6(7.5)	
Medium	55(33.5)	29(36.3)	
Low	71(43.3)	45(56.3)	

***Statistically significant,** χ^2 **= Chi square**

Table IV: Differences in Prevalance of Normal Nutritional Status and Overweight/Obesity by Age, Sex and Socioeconomic Class.

Variables	Nutritional status	Overweight/Obesity	**χ^2 (p-value)**
	Normal		
	n= 164(%)	n= 26(%)	
Age			**0.575(0.488)**
6-8years	95(57.9)	13(50)	
9-12years	69(42.1)	13(50)	
Sex			**1.606(0.205)**
Male	85(51.8)	10(36.5)	
Female	79(48.2)	16(61.5)	
SEC			**19.343(<0.001)***
High	38(23.2)	17(65.4)	
Medium	55(33.5)	6(23.1)	
Low	71(43.3)	3(11.5)	

*Statistically significant, χ^2 **= Chi square**

TABLE V: The Association of Dietary Risk Factors and Undernutrition.

Variables	**Nutritional status**	**Under-nutrition**	**χ^2 (p- value)**
	Normal	**n = 70(%)**	
	n= 112(%)		
Feeding frequency			**0.379(0.644)**
1-2 times a day	46(41.1)	32(45.7)	
3 or more times	66(58.9)	38(54.3)	
Grade of HHFIS			**161.0(<0.001)***
Food secure	4(3.6)	0(0)	
Mild insecurity	81(72.3)	1(1.4)	
Moderate insecurity	25(22.3)	12(17.1)	
Severe insecurity	2(1.8)	57(81.4)	

*Statistically significant, χ^2 =Chi square
HHFIS= House Hold Food Insecurity

TABLE VI: The Association of Dietary Risk Factors and Overweight/obesity.

Variables	Normal Nutritional status	Overweight/Obesity	χ^2 (p- value)
	n=112(%)	n = 21(%)	
Feeding frequency			**0.924(0.472)**
1-2 times a day	46(41.1)	11(52.4)	
3 or more times	66(58.9)	10(47.6)	
Grade of HHFIS			**49.48(<0.001*)**
Food secure	4(3.6)	0(0)	
Mild insecurity	81(72.3)	2(9.5)	
Moderate insecurity	25(22.3)	7(33.3)	
Severe insecurity	2(1.8)	12(57.1)	

*Statistically significant, **χ^2 =Chi square, HHFIS =House hold food insecurity.**

Prevalence of Malnutrition

More than half of the participants had normal nutritional status 164(60.7%), while 75(27.8%) of the children were wasted and out of these wasted children, 21(7.8%) were severely wasted. The prevalence of different nutritional status was displayed in Table II.

Nutritional Status With Respect to Age, Sex and Social Economic Class

Age

Prevalence of normal nutrition was 95(57.9%) among 6-8-year-old and 69(42.1%) among 9-12-year-old. The prevalence of under-nutrition was equally distributed among the two age groups 40(50%) respectively. Similarly, there was equal prevalence of overweight/obesity among the two age groups, 13(50%) respectively. (P > 0.05).

Sex

Prevalence of overweight/obesity was more among females 16(61.5%) than the males 10(38.5%) participants while the prevalence of under-nutrition was more among the male 48(60%) than female 32(40%) participants. P > 0.05

Socioeconomic Class (SEC)

The prevalence of under-nutrition was high among children from low SEC 45(56.3%). The influence of SEC on occurrence of under-nutrition was 19.6%, P =0.009. Children from low SEC were 9 times more likely to have under-nutrition when compared to children from higher SEC. The prevalence of overweight/obesity was high among children from high socioeconomic class 17(65.4%). The contribution of SEC to occurrence of overweight/obesity was 32.8%, Fisher exact test < 0.001. Children from high SEC were 18 times more likely to have overweight/obesity when compared to those from lower SEC. These results were shown in Tables III and IV below.

Association of Household Food Insecurity and Malnutrition

Two hundred and three subjects (75.2%) of the study population with adequately reported household food security grade were enrolled into the final analysis of its association with childhood malnutrition.

Among children with under-nutrition 57(81.4%) had severe household food insecurity. House hold food insecurity accounted for 86.3% of under-nutrition, $p < 0.001$. The influence of household food insecurity to occurrence of overweight /obesity was 69.5%, $p < 0.001$. These were shown in Tables V and VI below.

DISCUSSION

This study was aimed at determining the prevalence of malnutrition, and its association with HHFIS among six to twelve-year-old primary school children in Nnewi.

The prevalence of childhood malnutrition was found to be 39.3% among school aged children in Nnewi and this is unacceptably high. Wasting was found to be the most prevalent form of malnutrition among these children similar to what was reported among school aged children in Aladimma, Owerri.[2] In contrast, the prevalence of wasting in this study was higher than what was reported among Kenyan school age children.[38] The noted differences between our findings and that of Dorcas in Kenya may be because our study population was made up of predominantly children from lower socioeconomic class than the Kenyan study. This shows that the higher the socioeconomic class, the lower the odds for childhood malnutrition, therefore it is imperative for parents to improve on their SEC class as a strategy in eradication of malnutrition among school aged children.

The prevalence of stunting from this study was low similar to what was reported among school children in Enugu [39] among school children in Anambra.[9] In contrast, the prevalence of stunting was much lower than what was reported in Enugu,[10] , in a rural community in Southwestern Nigeria [25] and other studies in some developing countries. [11,13,40] This noted differences may be as a result of differences in the methodology adopted, as the index study was done only on 6-12 year old primary school children excluding adolescents. Since studies has shown that prevalence of malnutrition increases with the increasing age of the study population.[11,41]

The prevalence of overweight and obesity was high in this study. Similar results were reported by other studies. [42,39] In contrast, findings from this study was lower than what was reported in South Africa.[43] This difference in the result may stem from the fact that the index study population were majorly from low and middle SEC unlike in the study done in South Africa [43] as the study was done only on high SEC school children. Also, overweight/obesity was found to be more among high SEC participants in this study. Furthermore, other differences in the socio-demographic factors like sex and age may have played a role in the noted differences in prevalence of overweight and obesity.

Socio Economic Class was found to be significantly associated with the rates of malnutrition. From our findings, low SEC significantly increased the prevalence of under-nutrition, while higher SEC is significantly associated with overweight/obesity. This is in congruence with reports in the work done in Enugu,[44], in Lahore Pakistan, [45] and in Sri lanka. [46] However, our findings are at variance with the findings from similar studies done in Australia,[47] and in Michigan USA.[48] This noted differences may be because the index study area (Nigeria) is economically poorer than Australia and USA. As the developing countries perceive overweight/obesity as an evidence of good living which can easily be achieved by high SEC families, unlike in Developed countries like Australia and USA.[28] More so, the index study area being economically poorer country, where children from high SEC homes with food insecurity have more tendency of consuming fast foods and junk sweetened snacks with high calorie and low nutrients,[49] unlike in developed economically richer countries like Australia and USA.[47]

This study found that household food insecurity was significantly associated with occurrence of under-nutrition. This result was similar with the findings in similar studies done in Ethiopia,[20,21] in a study carried out in Malaysia.[27] and in a study carried out in Sokoto, Nigeria.[22] In contrast to our findings, similar study done in Ghana reported no association between food insecurity and under-nutrition.[13]

The difference in findings may stem from the fact that the index study used interviewer administered, pre-tested FANTA/Cornell scale to measure household food insecurity grade to limit recall bias, unlike the study done in Ghana that used a household food security questionnaire adapted from Nutritional Database of Department of Food and Nutrition in University of Ghana. Furthermore, the study population of this study were predominantly of low and middle SEC that were found to have higher rate of household food insecurity than the study population in the Ghananian study which were predominantly of children from high SEC. Children from food insecure homes have more tendency to develop under-nutrition because of the associated poor nutrient intake in such homes.

HHFIS was found to be 73 times more likely to be associated with the occurrence of overweight/obesity in this study. This result was similar to the findings among American children (OR = 5),[24] among Brazillian children (OR = 3.29), [16] and among Iranian children (OR = 2.02).[50] Though the odds for occurrence of overweight/obesity in the index study was higher than that reported in these studies. This may be because of the differences in the study area with differing socio-cultural practices and also differences in the methodology adopted as the present study used interviewer administered FANTA/Cornell house hold food insecurity scale in assessing the HHFIS grade of the participants unlike other studies where different scales were used. This may have accounted for the differences noted in the value of odds of HHFIS grade to occurrence of overweight/obesity. In contrast to the result of the index study, some other similar studies found that there were no relationship between HHFIS and occurrence of overweight/obesity.[51,52] The association of HHFIS grade with occurrence of overweight/obesity as reported in this study could be caused by disordered eating behavior following financial stress induced hormonal changes, decreased activity from poor housing and cycle of food shortage with compensatory over-consumption when food is available that usually occur in a food insecure homes from developing countries where the index study was done. Most of the study participants were from homes with moderate to severe food insecurity.

CONCLUSIONS

This study found that the prevalence of malnutrition (wasting, underweight, overweight/obesity) were still high among 6-12-year old school children in Nnewi. Household food insecurity and low SEC were associated with under-nutrition while household food insecurity and high SEC were associated with overweight/obesity. Proper nutritional counseling on the need of adequate house hold food security can mitigate the impact of childhood malnutrition in the study area.

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