European Journal of Nutrition & Food Safety
5(3): 190-201, 2015, Article no.EJNFS.2015.018
ISSN: 2347-5641

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Comparative Analysis of the Nutritional Status of Under-five Children and their Mothers in Rural and Urban Areas of Anambra State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author NNE headed the project. Author POUA conducted the analysis and interpretation and drafted the manuscript. Author EDA was involved in the early work and assisted with the interpretation of the results. Author CCI was in charge of data management. All authors were involved in the critical revision of the manuscript for important intellectual content and approved the final manuscript.

Article Information

DOI: 10.9734/EJNFS/2015/17392

Original Research Article

Received 12th March 2015
Accepted 18th April 2015
Published 19th May 2015

ABSTRACT

Aim: Malnutrition in the form of under-nutrition is still a major public health problem in developing countries of sub-Saharan Africa including Nigeria. This study compares the nutritional status of under-five children and their mothers in rural and urban areas of Anambra State Nigeria.
Methodology: This was a comparative cross-sectional study carried out in one urban and two rural local government areas of Anambra State, Nigeria namely Awka South, Dunukofia and Anaocha respectively. A total of 657 mother-child pairs were selected from eligible households using the multistage sampling technique. Data on household food security was obtained from the mothers using semi-structured, interviewer-administered questionnaires while anthropometric measurements were carried out on the children and their mothers using weighing scales and height boards.
Results: The overall prevalence of stunting, wasting and underweight among the under-five children in this study were 15.1%, 18.1% and 10.4% respectively, and the proportions were higher in the rural area than in the urban. The prevalence of stunting (height < 152 cm) in the mothers was 7.9% in the rural area compared to 9.1% in the urban area. Majority of the women were overweight (BMI ≥ 25.0), more in the urban (69.3%) than in the rural (59.2%).

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Conclusion: This study confirmed that under-five under-nutrition remains a serious public health problem in Anambra State, Nigeria. In order to reduce child morbidity and mortality to which malnutrition contributes significantly, concerted effort must be made by the government to improve child and maternal nutritional status by directing attention to improving household food security through developing and implementing policies that improve the livelihoods of the population.

Keywords: Nutritional status; under-fives; mothers; rural; urban; Nigeria.

1. INTRODUCTION

Malnutrition can be described in several ways; e.g. as a state in which the normal requirements of the body for one or several nutrients are not being met termed under-nutrition or as a state where there is excess intake of energy and /or nutrients termed over-nutrition [1]. Excessive or inadequate intake of macro- and micronutrients could result in either over- or under-nutrition [2]. Under-nutrition is found in every society of the world and children are at the greatest risk. It is the most prevalent form of malnutrition in sub-Saharan Africa (SSA) and is endemic in many developing countries.

Under-nutrition in the form of stunting, wasting and underweight, is endemic in Nigeria, and is clearly seen from results of national surveys such as the NDHS 2008 and MICS 2011 [3,4]. Stunting or low height-for-age (HFA) is indicative of chronic under-nutrition, the result of prolonged episodes of under-nutrition both of the pregnant mother and of the young infant, most importantly during the first 2 years of life [5]. In contrast, wasting or low weight-for-height (WFH) is indicative of acute malnutrition as a result of exposure to a relatively short duration of inadequate food intake often complicated by concurrent infective illness that cause weight loss [3,6]. Underweight is a composite index of HFA and WFH, which takes into account both acute and chronic malnutrition and is measured with the weight-for-age (WFA) index [3].

There is considerable evidence from literature of high levels of child malnutrition found in Nigeria [7-12] and many other developing countries of sub-Saharan Africa [13-15]. Malnutrition increases children's susceptibility to infections; they are more likely to die from common childhood ailments like diarrhoeal disease, malaria and respiratory infection. Those who survive are locked into a vicious cycle of recurring sickness and faltering growth due to frequent illness that cause further decline in their nutritional status [16].

Rural-urban differences have also been observed in the pattern of under-five malnutrition in SSA. Malnutrition is on average, higher in rural areas compared to urban areas; however socioeconomic inequalities are higher in urban areas than in rural areas [17]. The nutritional status of a mother and her child are intricately related. Her nutritional status during pregnancy can affect the body size and composition of her offspring [18]. Maternal nutritional status working alone or synergistically with infections during pregnancy largely determines a child's birth weight in most developing countries [6]. Being born with a low birth weight has serious implications for a child's mental and physical development well into adulthood[6].

Although under-nutrition is the most prevalent form of malnutrition in developing countries especially those in sub-Saharan Africa (SSA), a double burden of persistent under-nutrition with increasing prevalence of over-nutrition in the form of overweight and obesity is being observed in developing countries in transition including Nigeria, while hunger, food insecurity, underweight and other forms of under-nutrition still persist [19,20]. Obesity is a well-recognized risk factor for many non-communicable diseases including cardiovascular disease, type 2 diabetes mellitus, musculoskeletal disorders such as osteoarthritis and respiratory disorders such as sleep apnoea [19,21].

Most studies have associated co-existence of adult obesity and child under-nutrition with urban areas, however in rural Kenya, Mburu and Okello [22] found a prevalence of 22% of households with undernourished children whose mothers were obese [22]. Worldwide, over 10 million children under the age of 5 years die every year from preventable and treatable illnesses despite effective health interventions and malnutrition accounts for at least 50% of these deaths [15]. The situation is no less bleak in Nigeria as results from the 2008 Nigeria Demographic and Health Survey (NDHS) show that 41% of children under five are stunted, 14% are wasted and nearly one in four children is underweight [3].

This study was aimed at determining and comparing the nutritional status of under-five children and their mothers between rural and urban sub-populations in Anambra State, Nigeria.

2. METHODOLOGY

The study areas were Dunukofia, Anaocha and Awka South Local Government Areas, all located in Anambra Central senatorial zone, Anambra State, South Eastern Nigeria. Although Awka South is an urban local government area while Dunukofia and Anaocha are typical rural Local Government Areas (LGAs), they all share some similarities. The predominant ethnic group is Igbo and the language mainly spoken is Igbo. Christianity is the predominant religion while others are traditional religion and Islam. All the communities lie within the tropical rain forest region although most of the original rain forest has been lost due to clearing for commerce, farming and human settlement. Two distinct seasons are observed, a rainy season (annual mean rainfall of 161.9 millimetres) that starts from April to September and a dry season that lasts from October to April. The soil is generally fragile and lacks cohesion such that with poor agricultural practices and bush burning, land in these LGAs and indeed most of Anambra State is especially vulnerable during the rainy season to both sheet and gully erosion and landslides. The topography of these areas is not only undulating but forms a basin surrounded by highlands which drains finally into the Omambala River (from which Anambra State derives its name).

The study design was a community-based comparative cross-sectional survey. The study population comprised mothers aged 15-49 years and their children aged 0-59 months living in households in Ukpo (Dunokofia), Ichida (Anaocha) and Awka (Aka South) for at least one year prior to commencement of the research study.

Inclusion Criteria were households that had non-pregnant women of child-bearing age (15-49 years) with at least one child under the age of five years (0-59 months). Households with pregnant women and other mothers who did not meet the criteria as mentioned above were excluded from the study. Pregnant women were excluded due to physiological conditions of pregnancy that affect weight gain such as water retention which frequently leads to oedema; postural, hormonal and other physiological conditions [23]. This would have affected the comparability of anthropometry between pregnant and non-pregnant women.

Sample Size Determination: The minimum sample size to determine a difference in nutritional status between a rural and an urban community that is significant at the 5% level and with an 80% chance of detecting the difference (power) was calculated using the formula for comparison of two proportions [24]. Making use of figures 30.4% and 20.4% (proportions of food secure rural and urban households, respectively) [25] and anticipating a non-response of 10%, a minimum sample size of 330 per sub-population was calculated. Multiplying by a factor of 2, the total sample size for the study was obtained as 660.

Sampling Technique: A multi-stage sampling technique was used to select 330 households each from the rural and urban sub-populations to obtain a total sample of 660 households. From the 21 LGAs in Anambra state, two LGAs (Dunukofia and Anaocha) were selected from the rural stratum and one (Awka South) from the urban stratum by simple random sampling. Next Ukpo and Ichida communities (both identical in number of wards and population size) were selected from Dunukofia and Anaocha LGAs respectively while Awka community was selected from Awka South all by simple random sampling. Households were then sampled from all the wards in the three study communities as follows: three hundred and thirty (330) households were selected from Awka, 165 from Ukpo and 165 from Ichida to obtain the total sample size of 660 households. The number of households to be sampled in each ward was determined by dividing the total number of households to be sampled in each community by the number of wards in that community. Using the modified cluster sampling technique, neighboring households were successively sampled until the sample size in each ward was achieved. Only one child under five years was recruited per household. If a household had more than one eligible child, one was selected by simple random sampling using the balloting method.

Study instruments: A pre-tested, semi-structured, interviewer-administered questionnaire was used to collect information on socio-demographic characteristics, nutritional intake and anthropometric measurements of each mother and child pair.

Data Collection Methods: Weight and height of the mothers and children were obtained using standardized methods described by Omuemu and Ofili [7]. Height was measured for the mother / child pairs using a ShorrBoard® infant / child / adult portable height-length measuring board [26]. All anthropometric data were used to calculate summary indices for nutritional status – weight-for-age (WFA), weight-for-height / length (WFH), height-for-age (WFA) and body mass index (BMI).

Nutritional status was measured through the use of anthropometric data. WHO child growth standards were used to determine the nutritional status of children and the standard deviation of scores (z-scores) was calculated for the anthropometric measures - weight-for-age (WAZ), weight-for-height / length (WHZ), height-for-age (HAZ) using the following formula [15].

Z-score = (individual value – median value of the reference population)/SD value of the reference population

A cut-off point of –2 standard deviations (SD) below the median of the WHO Multicentre Growth Reference Study population[27] was used for each anthropometric measure of child (0-19years) nutrition status. Based on this, underweight, stunting and wasting were defined as WAZ < -2, HAZ < -2 and WHZ < -2 respectively. Overweight children (<2 years) were defined as having a WHZ >2 SD above the median of the reference population, while overweight children (including mothers<19years) were defined as having BAZ >1. The recommended cut-off criteria for determining overweight and obesity status are different for children birth to five years and five to 19 years of age. In this study, while BAZ was used to assess children 2 to 19 years, WHZ was used to assess children zero to 2 years because there is a lack of convincing evidence that BMI for age is more effective than weight for age or weight for length at assessing adequacy of feeding, and under- and overweight in children younger than two years of age [28]. Maternal (ie >19 years) nutritional status was measured with weight (in kg) and height (in metres) and body mass index (BMI, kg/m^2). A cut-off of 1.52 m was used to indicate short maternal stature [29]. A BMI of < 18.5 kg/m^2 was classified as underweight while ≥25.0 kg/m^2 was classified as overweight/pre-obese and ≥30.0 kg/m^2 / as obese.

2.1 Data Analysis

Out of a total of 660 questionnaires distributed, 657 were returned correctly filled in, giving a response rate of 99.5%. Households were classified under the following socio-economic classes: I, II, III, IV and V and for subsequent analysis these were further collapsed into: upper class (I and II), middle class (III) and lower class (IV and V) [30]. The social class is derived from occupation and education scores of the father and mother. The average of the 4 scores gives the socio-economic class. Round off to the nearest whole number if a fraction is obtained. An overall score of: 1-2 = high social class (I & II), 3= middle social class (III), while 4-5 = low social class (IV & V). Frequency distributions of the dimensions of child nutritional status namely HFA, WFH and WFA (and BAZ where applicable) were developed. Relevant means and proportions were also calculated while Chi-squared analysis and independent sample t-test were used as tests of statistical significance. Chi-square test was applied in the comparison of discrete nominal variables, while the t-test was used to compare continuous variables and f-test derived as a result of multivariate analyses. A statistically significant finding was set at $p<0.05$.

2.2 Ethical Considerations

Approval for this study was obtained from to the Ethical Committee of the Nnamdi Azikiwe University Teaching Hospital (NAUTHEC). Written informed consent was obtained freely and without coercion from the respondents and respect for the confidentiality of the data obtained from them was ensured.

3. RESULTS

A total of 660 questionnaires were administered, 330 in each of the rural and urban samples, however, 657 questionnaires were analyzed giving a response rate of 99.5%.

Table 1 summarizes the socio-demographic characteristics of the respondents and their children stratified by rural or urban residence. The rural mothers had a mean age of 31.6±6.1 years while the mean age for the urban-dwelling mothers was 30.3±6.7 years. There were 9 (2.7%) teenage mothers (15-19 years) in the urban population but none in the rural sample. A statistically significant difference exists between the mean ages of the rural and urban

mothers / respondents (p=0.011) and their age distributions (p=0.015). Majority of the respondents were married at the time of the study, comprising 92.0% and 88.8% of the rural and urban respondents respectively. Statistically significant differences between the rural and urban communities were also observed in the educational status of the respondents (p<0.001) and socioeconomic status (p<0.001). Majority of the households in both sub-populations had more than four members (rural: 254 households, 77.4%; urban: 209 households, 63.5%). This difference in the size of households was also statistically significant (p <0.001). The total study population of under-five children had a mean age of 27.5±17.8 months. The mean age of the children in the rural communities was significantly higher than that of the urban children, 29.1±17.2 vs. 25.9±18.3 months, respectively (p = 0.021). Children in the 12-35 months age group had the highest proportions in the rural sample (42.6%). In contrast, the 36-59 months age group had the highest proportion in urban sample (42.6%). The difference in under-five age distribution between the rural and urban sub-populations was statistically significant (p=0.002). The overall mean birth weight was 3.28±0.52 kg and there was a statistically-significant difference in the mean birth weights between the rural and urban children (p = 0.010).

Table 2 summarizes anthropometric indices for the study sample of under-five children stratified by place of residence. Ninety-nine children (15.1%) in the total sample were stunted (HAZ below -2 SD), 119 (18.1%) were wasted (WHZ below -2 SD), whereas 68 (10.4%) were underweight for age (WAZ below -2 SD). A higher proportion of stunting was found among under-five children in the rural area compared to the urban under-five children. A total of 53 children (16.2%) in the rural area were found to be stunted, of whom 18 (5.5%) were severely stunted (HFA < -3 SD). A higher prevalence of wasting was found among the rural under-five children than those in the urban area. Seventy-three children (22.2%) were wasted, of whom (6.1%) were severely wasted. The urban sample had 46 children (13.9%) wasted out of which 12 (3.6%) were severely wasted. This difference was statistically significant (p < 0.001). More under-five children were found to be underweight in the rural area than in the urban area. Thirty-eight children (11.6%) had low weight-for-age z-scores below -2 SD out, of whom 6 (1.8%) had WFA below -3 SD. Underweight children made up 9.1% of the urban sample, of whom 9 (2.7%) were below -3 SD. These differences were, however, not statistically significant (p = 0.354).

The table also shows the nutritional status of the mothers stratified by place of residence. Using 152 cm as the cutoff point, the difference in the prevalence of stunting between mothers in the rural and urban communities was not statistically significant (7.9% vs. 9.1%; p = 0.584). The mean BMI for the urban women was higher than that of the rural women (urban: 27.6±5.5 kg/m2; rural: 26.3+±4.8 kg/m^2) and this was statistically significant (p = 0.001). The distribution of BMI categories also differed significantly between the mothers in the rural and urban populations (p = 0.024).

Table 3 shows that in the rural sub-sample, stunting was highest among children in the 24-35 months (20.8%) and 48-59 months (20.8%) age groups. Furthermore, the 24-35 months age group was most affected by severe stunting than the rest of the age groups. Among the urban children, the 36-47 months and 48-59 months age groups had higher proportions of stunted children, 23.9% and 23.9%, respectively. Severe stunting was found more among the 36-47 months age group (36.4%) than in the rest of the urban sub-sample. The pattern of the weight-for-height index across the age groups of the rural and urban children under five shows that wasting was highest among the rural children, in the 24-35 months age group (36.9%) and this group also accounted for the highest proportion of severely wasted children in the rural sample (35.0%). In the same vein, the 24-35 months age group also had the highest proportions of wasted children (36.9%) and severely wasted children (50.0%) in the urban sample. The 24-35 months age group in the rural population had the highest number of underweight children, 12 (31.6%) in total. The same age group was also the worst affected in the urban population as 11 (36.7%) children were found to be underweight for their age.

Table 4 shows the nutritional profiles of the sampled households based of the child's weight-for-age and the mother's body mass index stratified by place of residence. Overall, the nutritional profile "normal child-overweight mother" was predominant and this was the same for the rural and urban households (rural: 54.0%; urban: 63.2%) but significantly more prevalent in urban than rural households (p<0.04). The next most common profile was "normal child-normal mother" (rural: 32.0%; urban: 25.2%),

Table 1. Socio demographic characteristics of the mother-child pairs

Socio-demographic characteristic	Rural (n = 328)	Urban (n = 329)	Total (n = 657)	Test statistic	p-value
Age of mother (years)					
15-19	0 (0)	9 (2.7)	9 (1.4)		
20-29	139 (42.4)	155 (47.1)	294 (44.7)	F =15.864	0.015
30-39	146(44.5)	130(39.5)	276 (42)		
40-49	43(13.1)	35(10.7)	78 (11.9)		
Mean±SD	31.6 ±6.1	30.3±6.7	30.9±6.4	t = 2.562	0.011
Marital status					
Single	9 (2.8)	14 (4.3)	23 (3.5)	F = 3.429	0.553
Married	302 (92.0)	292 (88.8)	594 (90.4)		
Others	17(5.2)	23 (7.0)	40(6.1)		
Mothers education					
No formal education	4 (1.2)	2 (0.6)	6 (0.9)	F = 18.19	0.000
Primary	57 (17.4)	30 (9.1)	87 (13.2)		
Secondary	220 (67.1)	216 (65.7)	436 (66.4)		
Tertiary	47 (14.3)	81 (24.6)	128 (19.5)		
Socio-economic class					
Upper class	5 (1.5)	27 (8.2)	32 (4.9)		
Middle class	43 (13.1)	55 (16.7)	98 (14.9)	χ^2 = 18.659	0.000
Lower class	280 (85.4)	247 (75.1)	527 (80.2)		
Size of household					
≤ 4 members	74 (22.6)	120 (36.5)	194 (29.5)	χ^2 = 15.28	0.000
> 4 members	254 (77.4)	209 (63.5)	463 (70.5)		
Mean±SD	6.05±1.87	5.32±1.90	5.68±1.92	t = 5.024	0.000
Sex of child					
Female	163 (49.7)	169 (51.4)	332 (50.5)	χ^2 = 0.184	0.668
Male	165 (50.3)	160 (48.6)	325 (49.5)		
Age of children (in months)					
0– 11	68(20.7)	89(27.1)	157 (23.9)	χ^2 = 19.451	0.002
12 – 35	140(42.6)	100(30.3)	240 (36.5)		
36 – 59	120(36.6)	140(42.6)	260 (23.7)	t = 2.312	
Mean±SD	29.1±17.2	25.9±18.3	27.5 ± 17.8		0.021
Birth weight of child					
<2.5kg	3 (0.9)	9 (2.7)	12 (1.8)	F = 3.177	0.142
≥2.5kg	325 (99.1)	320 (97.3)	645 (98.2)		
Mean±SD	3.33±0.49	3.23±0.53	3.28±0.52	t = 2.596	0.010

Values are number (%) unless otherwise stated. F = Fisher's exact

but markedly higher among rural than urban households ($p<0.05$). Both the "underweight child-overweight / obese mother" and "underweight child-normal mother" profiles are significantly more prevalent in the rural than the urban households ($p<0.03$ each).

4. DISCUSSION

There was a significant difference in the mean ages of the respondents in both sub-populations and majority of the respondents were married at the time of the survey. Women in the urban area had higher levels of education and higher socio-economic status compared to the rural women. These findings are consistent with results from the National Demographic and Health Survey (NDHS) of 2008 [3] that showed higher levels of education among urban women than rural women. Larger household sizes were observed more in the rural area than in the urban. The 2008 NDHS also reported larger households (greater than nine members) more among rural dwellers than urban [3]. However, the average household sizes obtained in this study for the rural (6.05 persons) and urban (5.32) samples are higher than the national averages reported for rural and urban areas in the NDHS (4.6 persons and 4.1 persons, respectively) [3]. As seen from the results, majority of the households in both sub-populations had more than four family members (rural: 77.4%; urban: 63.5%). A cross-sectional survey in Lagos, Nigeria also found a higher prevalence of large households of more than four members (52.7%) among its study population [31] although the prevalence is lower than the values obtained in this present study. These results however contrast with the prevalence documented for an urban community in Edo State of Nigeria where majority of the

Table 2. Nutritional status of children aged 0 – 59 months and mothers stratified by place of residence

Nutritional status of children	Rural (n = 328)	Urban (n = 329)	Total (n = 657)	Test Statistic	p-value
Height-for-age Z score					
Below -3 SD	18 (5.5)	11 (3.3)	29 (4.4)	χ^2 = 1.803	0.406
Below -2 SD*	53 (16.2)	46 (14.0)	99 (15.1)		
-2 SD to +2 SD	275 (83.8)	283 (86.0)	558 (84.9)		0.621
Mean Z-score±SD	-0.416±1.3	-0.471±0.43	-0.444±0.9	t = 0.495	
Weight for height z-score					
Below -3 SD	20 (6.1)	12 (3.6)	32 (4.9)	χ^2 = 18.888	0.000
Below -2 SD*	73 (22.2)	46 (13.9)	119 (18.1)		
-2 SD to +2 SD	224 (68.3)	217 (66.0)	441 (67.1)		
Above +2 SD	31 (9.5)	66 (20.1)	97 (14.8)		
Mean Z-score±SD	-0.505±1.96	-1.290±1.38	0.394±1.2	t = -6.571	0.000
Weight-for-age z-score					
Below -3 SD	6 (1.8)	9 (2.7)	15 (2.3)	χ^2 = 3.252	0.354
Below -2 SD*	38 (11.6)	30 (9.1)	68 (10.4)		
-2 SD to +2 SD	284 (86.6)	291 (88.5)	575 (87.5)		
Above +2 SD (BAZ >1	6 (1.8)	8 (2.4)	14 (2.1)		
for children 2-5yrs)	-0.586±1.37	-0.391±1.1	-0.489±1.23	t = -2.025	0.043
Mean Z-score±SD					
Nutritional indices† of mothers	**Rural (n = 328)**	**Urban (n = 329**	**Total (n = 657)**	**Test Statistic**	**P value**
Height of mother					
< 152 cm (HAZ<-2SD for	26 (7.9)	30 (9.1)	56 (8.5)	χ^2 =0.299	0.584
mothers≤19yrs)	302 (92.1)	299 (90.9)	601 (91.5)		
≥ 152 cm					
BMI category (kg/m^2)					
Underweight< 18.5	9 (2.7)	8 (2.4)	17 (2.6)		
Normal 18.5–24.9	125 (38.1)	93 (28.3)	218 (33.2)	χ^2 =7.494	0.024
Overweight/pre-obese					
** 25.0 – 29.9	131 (40.0)	145 (44.1)	276 (42.0)		
Obese ** ≥ 30.0	63 (19.2)	83 (25.2)	146 (22.2)		
Total	328 (100.0)	329 (100.0	657 (100.0)	t = - 3.246	0.001
Mean±SD	26.3±4.8	27.0±5.2	27.6±5.5		

*** Assessed for mothers aged ≤19 years old using BAZ>1 for overweight, pre-obese or obese.*
**Includes children who are below -3 SD from the WHO Child Growth standards population median.*
Values are number (%) unless otherwise stated. † Values are number (%) unless otherwise stated.

households had smaller family sizes of less than four members (74.7%) [7].

This study showed that overall, 15.1% of the under-five children were stunted, 18.1% wasted and 10.4% were underweight for age. The level of low weight-for-age compares well with the 10.0% reported for the South East region of Nigeria in the 2008 NDHS [3] but is much higher than the prevalence of 4.5% documented in the 2011 Nigeria Multiple Indicator Cluster Survey (MICS Nigeria) [4]. A higher level of wasting and lower level of stunting compared to the 2008 NDHS were, however, observed in this study. In comparison, Odunayo and Oyewole[8] obtained much higher levels of stunting and underweight and a lower level of wasting in their study in Ifewara, Nigeria, 26.7%, 23.1% and 9%, respectively[8] , whereas Ajao et al[11] obtained overall prevalence rates of 39.3%, 6.3% and 14.1% for stunting, wasting and underweight, respectively, among rural and urban settlements in Ile-Ife, Nigeria [11]. These findings indicate that there is considerable variability in the nutritional status of children in different parts of the country such that national averages may not clearly depict what really occur at community and household levels. It may also have arisen as a result of differences in methodology employed in both studies. Nevertheless, the lower prevalence of stunting in this study compared to the NDHS findings points to possible improvements in child nutrition that may have occurred since the last national survey was carried out five years ago, and may have reduced the prevalence of chronic malnutrition in Anambra State and possibly Nigeria as a whole. On the one hand, chronic malnutrition in children has long-term consequences; stunted children are likely to accumulate body fat especially central fat

Table 3. WHZ and WAZ of rural and urban children (0-59 months) stratified by age

Age in months	Weight-for-height z-score (WHZ)			
Rural (n=328)	**Below -3 SD (n=20)**	**Below -2 SD*(n=73)**	**-2SD to +2SD (n=224)**	**Above +2 SD (n =31)**
<6	2 (10.0)	8 (11.0)	15 (6.7)	6 (19.4)
6-11	2 (10.0)	3 (4.1)	31 (13.9)	5 (16.1)
12-23	2 (10.0)	8 (11.0)	59 (26.3)	3 (9.7)
24-35	7 (35.0)	27 (36.9)	38 (17.0)	5 (16.1)
36-47	4 (20.0)	13 (17.8)	37 (16.5)	3 (9.7)
48-59	3 (15.0)	14 (19.2)	44 (19.6)	9 (29.0)
Urban (n = 329)	**Below-3 SD (n=12)**	**Below -2 SD*(n=46)**	**-2SD to +2SD (n=217)**	**Above +2 SD (n = 66)**
<6	1 (8.3)	7 (15.2)	44 (20.3)	5 (7.6)
6-11	1 (8.3)	4 (8.7)	23 (10.6)	6 (9.1)
12-23	0 (0.0)	2 (4.4)	37 (17.1)	6 (9.1)
24-35	6 (50.0)	17 (36.9)	35 (16.1)	3 (4.5)
36-47	4 (33.4)	13 (28.3)	33 (15.2)	5 (7.6)
48-59	0 (0.0)	3 (6.5)	45 (20.7)	41 (62.1)
	Weight-for-age Z score			
Rural (n = 328)	**Below -3 SD (n = 6)**	**Below -2 SD* (n= 38)**	**-2SD to +2SD (n=284)**	**Above +2 SD (n = 6)[#]**
<6	1 (16.7)	5 (13.1)	24 (8.5)	0 (0.0)
6-11	1 (16.7)	2 (5.3)	36 (12.7)	1 (16.7)
12-23	0 (0.0)	5 (13.2)	62 (21.8)	3 (50.0)
24-35	0 (0.0)	12 (31.6)	58 (20.4)	0 (0.0)
36-47	2 (33.3)	6 (15.8)	46 (16.2)	1 (16.7)
48-59	2 (33.3)	8 (21.0)	58 (20.4)	1 (16.7)
Urban (n = 329)	**Below -3 SD (n = 9)**	**Below -2 SD* (n= 30)**	**-2SD to +2SD (n=231`)**	**Above +2 SD (n = 8)**
<6	0 (0.0)	5 (16.7)	51 (17.5)	0 (0.0)
6-11	1 (11.1)	1 (3.3)	29 (10.0)	2 (25.0)
12-23	0 (0.0)	0 (0.0)	42 (14.4)	3 (37.5)
24-35	0 (0.0)	11 (36.7)	45 (15.5)	0 (0.0)
36-47	7 (77.8)	9 (30.0)	40 (13.7)	2 (25.0)
48-59	1 (11.1	4 (13.3)	84 (28.9)	1 (12.5)

[#]Note that BAZ was used to determine cut off point (BAZ>1) for children aged 2-5years
**Includes children who are below -3 SD from the WHO Child Growth standards population median. Values are number (%) unless otherwise stated.*

predisposing them to diseases such as hypertension and diabetes in adulthood[6]. Acute malnutrition, on the other hand, is caused by recent nutritional deficiency working synergistically with other factors such as concurrent infective illness [22] (e.g. malaria) that are still highly endemic in this environment. This may account for the higher level of wasting observed in this study. It remains to be seen what the picture for Nigeria will be in the next round of the NDHS. Nevertheless, the prevalence of under-nutrition still remains high as seen in this study.

Consistent with patterns reported in NDHS 2008 [3], MICS Nigeria [20] and previous studies carried in Lagos and Nepal [6,15] higher levels of stunting, wasting and underweight were observed in the rural areas than the urban area in this study. The rural-urban differences in this study still point to socio-economic and environmental inequalities between rural and urban dwellers. This was confirmed in this study by the higher risk of stunting with decreasing socio-economic class observed more among the rural children than in the urban. However, the prevalence of stunting (14.0%) in the urban area compared to the rural areas (16.2%) suggests that the urban advantage is gradually being eroded due to deterioration in living conditions of urban dwellers as a result of rapid population growth that has surpassed available social amenities [32].

The 24-35 months age group was the worst affected according to all three anthropometric indices. The Ile-Ife study [11] also observed similar findings with the prevalence of wasting and underweight being highest after the age of two years among its study population. Nyahurucha et al. [12] in their study in Tanzania also found this age group to be the most affected

Table 4. Household nutritional profiles based on child's weight-for-age and mother's BMI

Profile	Number of households (%)			Test statistic (z)	p-values	F	p-value
	Rural (n = 328)	Urban (n = 329)	Total (n=657)				
Underweight child-overweight / obese mother	17 (5.2)	20 (6.1)	37 (5.6)	0.22	p>0.05		
Underweight child-normal mother	20 (6.1)	10 (3.1)	30 (4.6)	3.6	P<0.03		
Underweight child-underweight mother	1 (0.3)	0 (0.0)	1 (0.2)	4.0	P<0.03	P=9.577	0.069
Normal child-overweight/obese mother	177 (54.0)	208 (63.2)	385 (58.6)	2.4	P<0.04		
Normal child-normal mother	105 (32.0)	83 (25.2)	188 (28.6)	1.99	P<0.05		
Normal child-underweight mother	8(2.4)	8(2.4)	16(2.4)	0	P=1		
Total	328 (100.0)	329 (100.0)	657 (100.0)				

Statistically significant, F = Fisher's exact test

by under-nutrition [12]. A probable reason for this finding is that most children would have ceased breast feeding by the age of two years, but complementary feeding may be inadequate or inappropriate. In addition, they may be exposed to infectious agents in food, water and the environment resulting in reduced dietary intake and weight loss [4,8,11]. This phenomenon was also observed in another study[33] on worldwide timing of growth faltering involving the three anthropometric indices (WAZ, WHZ and HAZ) which established that WAZ faltered rapidly from 3 to 12 months of age, WHZ declined until 15 months of age while HAZ hitherto close to the reference value at birth, declined sharply until the age of 2 years, after which mean values remained stable between 1.5 and 2 SDs below the reference [33].

Based on the body mass index, the overall prevalence of under-nutrition (BMI < 18.5 kg/m^2) among the mothers in this study was 2.6%. This is much lower than the 6.7% reported in Lagos State, Nigeria [22] and outside the range of 5-20% reported for African women [6]. In addition, this study showed a high prevalence of overweight/obesity (BMI ≥ 25.0 kg/m^2) among the women in the study sample (64.2%) albeit a higher prevalence in the urban community (69.3%) than in the rural (59.2%). The co-existence of child under-nutrition and maternal overweight/obesity is clearly seen from the thirty-seven households overall (5.6%) that had an underweight child and an overweight/obese mother with the prevalence being higher among the urban households than the rural households (6.1% versus 5.2%). Dietary diversity in the household may be affected when there is food and financial shortage and households may resort to consuming limited food choices and food items which are more likely to be high in fat and energy density. The co-existence of child under-nutrition and maternal overweight/obesity should, however, be interpreted with caution as another study has pointed out that stunted child / overweight mother pairs may represent a statistical artifact, not a distinct entity[34]. Nevertheless, it still implies that the households in this study have the twin burden of dealing with the problems of under-nutrition and overweight/obesity in the same household, the so-called Double-Burden phenomenon [22]. This has implications not only for households but for the health system at large. Childhood malnutrition increases the risk and severity of common childhood ailments such as malaria, diarrhoeal disease and pneumonia, whereas adult obesity is linked to hypertension and diabetes [20]. Occurrence of these diseases in the same household could place a heavy financial burden on the family and lead to catastrophic financial losses from health and hospital bills with little available income for adequate nutrition.

5. CONCLUSION

The study showed that child under-nutrition remains a serious public health problem in Nigeria from the results of child malnutrition among households in rural (Ukpo and Ichida) and urban (Awka), Anambra State. Specifically,

the "underweight child-overweight / obese mother" and "underweight child-normal mother" profiles are more prevalent among the rural households than the urban ones.

6. RECOMMENDATIONS

In order to reduce child morbidity and mortality to which undernutrition contributes significantly, concerted effort must be made by the government, non-government organizations, the private sector and communities to improve child and maternal nutritional status. A holistic approach targeting all levels of prevention should be taken:

1. Primordial prevention of undernutrition in children should direct attention towards implementing policies that improve the nutrition and livelihoods of the Nigerian population, in both rural and urban areas.
2. Primary prevention aimed at improving the nutritional status of mothers will reduce the risk of a child being born with a low birth weight and being at risk for undernutrition.
3. Secondary preventive measures involving the early diagnosis and treatment of undernourished children need to be emphasized through adequate training of community health workers at the primary health care level.
4. Finally, although stunting cannot be reversed, tertiary measures to prevent children from becoming more malnourished should be explored such as a school breakfast programme in Anambra State [25].

In all these, a lot more attention should be directed at the rural households without necessarily ignoring their urban counterparts.

7. LIMITATIONS OF THE STUDY

Being a household survey, the study effectively excludes residents who do not live within the context of households such as street children and the homeless population. It is also not representative of migrant groups and people who had resided in the study areas for less than a year prior to the start of the study. Furthermore, the result of this study is only generalizable to the state and not the National level because the sample used is only representative of Anambra state. Finally, most of the information was obtained from maternal report with no means of independent verification.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history.php?iid=855&id=30&aid=9301