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A Cross-sectional Study on Nutritional Status of Preschool Aged Children in Enugu Urban, Nigeria

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ABSTRACT

Reports on nutritional status of the preschool children in developing economies are very important and such studies require the use of World Health Organization (WHO) z-score system to enable international comparison. This study aimed to determine the nutritional status of preschool aged children in Enugu urban, South-East Nigeria. Four hundred and nine (409) preschool children aged 2-5 years were recruited from the schools using stratified multistage sampling method. Their anthropometry were measured, weight-for-age, height-for-age, weight-for-height and Mid Upper Arm Circumference (MUAC)-for-age were computed. The z-scores were calculated using the WHO/z-score international reference standard. The overall mean weight-for-age (W/A), height-for-age (H/A), weight-for-height (W/H) and MUAC-for-age were 17.7 ±3.7kg, 105.3 ±10.0cm, 15.8±1.4kg and 16.5 ±1.4cm respectively. Their mean z-scores were 0.92, 0.99, 0.51 and 0.35 respectively. The prevalence of underweight, wasting, stunting, low MUAC based on W/A, H/A, W/H below -2 z score of the WHO standards were 17.2%, 10.1%, 21.4% and 1.9% respectively. The prevalence of obesity using W/H greater than 2 z scores was 5.6%. The peak age incidence of malnutrition using all indices of nutritional status was 4 years. There is a high prevalence of malnutrition among preschool children in Enugu urban, Nigeria. Institution and implementation of urgent nutritional intervention programme targeting this age group is necessary to reduce this high prevalence in our environment and other developing countries.

Keywords: Nutritional status, Preschool, Nigeria, Childhood, Assessment

INTRODUCTION

Childhood nutrition remains a topical issue and a major health concern in the developing countries for health workers (Paediatricians and Public Health Officers), government and non-governmental agencies (Felgelman, 2011; de Onis et al. 2012). Due to the impact of nutrition on health, growth, as well as physical and cognitive development of children, there is need for growth monitoring and assessment of nutritional status since growth faltering precedes malnutrition by several months (de Onis et al. 2012; Enakshi and Sudha, 2012). Thus assessment of growth is an important aspect of paediatric practice because the health of a child is synonymous with growth (Felgelman, 2011; de Onis et al. 2012; Enakshi and Sudha, 2012).

The vulnerable period for malnutrition in children is the pre-school age (2-5 years) (Ahmad et al. 2011; Bhutta et al. 2017). Also, the greatest impact of malnutrition is seen in the same group of children (Oyedeji et al. 2002; Ahmed et al 2011, Jesmin et al. 2011, Panyandeli et al. 2013; Bhuttes et al. 2017. Preschool age group has also been observed to be relevant in the assessment of health indices, as their nutritional status has been noted to be a sensitive indicator of the health, well-being and social welfare of any community (de Onis et al. 2004). This underscores the need for a periodic and objective assessment of adequacy of growth in this group. Assessment of the nutritional status can be done using the physical examination, anthropometric, biochemical or radiological methods (Ebenebe and Ulasi, 2007). The anthropometric method remains the single most universally applicable, easiest and cheapest method (Ebenebe and Ulasi, 2007; Zemel and Stallings, 2008; de Onis et al. 2012;) yet effective and reliable (Zemel and Stallings, 2008) especially in the developing countries.

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The anthropometric parameters that have been identified to be fully descriptive of a child's growth status are height-for-age, weight-for-age, weight-for-height and mid-upper arm circumference (Ebenebe and Ulasi, 2007; de Onis et al. 2012).

As Nigeria has the largest child population in the West African sub-region, the nutritional status of her pre-school children impacts on the health and development of the sub-region and Africa generally (de Onis et al. 2004). Therefore, the pattern and magnitude of malnutrition in the pre-school aged population in Nigeria will be of significant relevance in the sub-region and even the continent. Reports show that about 2 in 5 Nigerian children are stunted while 30% are underweight as malnutrition contributes to nearly half of under-5 deaths (Black et al. 2013; NPC and ICF, 2014). The percentage of children in Nigeria who are wasted has steadily increased over the last decades from 11% in 2003 to 18% in 2013 (NPC and ICF, 2014). The sustainable development goal (SDG) target 2.3 is to end by 2030 all forms of malnutrition and achieve by 2025 the internationally agreed targets on stunting and wasting in children under 5 years of age (United Nations, 2015). For Africa to achieve this target, Nigeria's enormous contribution to malnutrition requires consideration. Thus, studies are needed from different parts of the country to examine and enhance improvement in the understanding of burden of malnutrition. Akinkpelu et al. (2014) in South-western Nigeria, as well as Aliyu et al. (2012) in the North reported significant levels of malnutrition among pre-school children. In the South Eastern part of Nigeria there are studies on school children but none on preschool children.

Studies on nutrition require the use of World Health Organization (WHO) z-score system to enable international comparison of its results (Ebenebe and Ulasi, 2007; de Onis et al. 2012). The Z-score system expresses the anthropometric value as a number of standard deviations or Z-scores below or above the reference mean or median value. A fixed Z-score interval implies a fixed height or weight difference for children of a given age (WHO, 2006). Use of this score system in assessing malnutrition in preschool children has been done in some zones in the country (Aliyu et al. 2012; Akinpelu et al. 2014). However, there is a paucity of such standardized studies in the South Eastern zone. Therefore, there is need for such studies in the zone as its lack creates some gap in knowledge about an important health parameter in the region. This study therefore aims at determining the nutritional status of preschool aged children in Enugu, South-East Nigeria using the WHO z-score. It is hoped that the results will not only add to the body of knowledge, but will also help in formulating intervention programmes to address malnutrition in Africa and other developing countries.

MATERIAL AND METHODS

This was a cross-sectional study carried out in Enugu metropolis, the capital city of Enugu state, South-East Nigeria. The study population were preschool children who were aged 2-5years. As most of these children will be attending nursery schools, a school-based study was a representative of the study population. All the nursery schools (public and private) registered at the State Ministry of Education, Enugu were used as the base for the children population. The subjects were selected from the schools using multistage sampling method after stratifying the schools according to their location into 3 density areas (high, medium and low).

The sample size was calculated using the formula (Araoye, 2003) $Z^2(P)(1-P)/d^2$ where Z=z score at 95% confidence limit (1.96), P=prevalence of malnutrition in Nigeria (36%), (Save the Children, 2015) d=degree of accuracy at 95% confidence limit (0.05). After the calculated minimum sampling size of 354, with 20% attrition rate bringing it to 443, a total of 450 preschool aged children were finally selected from 9 schools. The children included were those who have not been sick for two or more weeks. Excluded were children who had chronic ailment and those whose parents/caregivers declined consent. Four hundred and nine out of 450 parents/caregivers gave their consent. These 409 selected children had their physical examination as well as measurement of their weights, heights, and

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MUAC taken. These were undertaken by two people- a researcher who took the examinations and measurements, and a trained assistant who did the recording. The measurements were taken twice to ascertain their being within tolerance limit.

Weights were measured using a clinical spring balance scale (Healthscale No. RGZ-120II; permissible error ±1.5) with a platform. The measurement was read and recorded to the nearest 100grammes. The height was taken with a well-calibrated stadiometer (Seca 213 stadiometer) with a movable headpiece perpendicular to the vertical backboard. They were recorded to the nearest 0.1cm. The MUAC was measured using a well-calibrated, flexible, inelastic and crease-free tape at the midpoint between the acromium and olecranon. The measurement was recorded to the nearest 0.5cm.

The above anthropometric measurements were transformed into appropriate indices, weight-for-age, height-for-age, weight-for-height and MUAC-for age. The weight-for-age, weight-for-height, height-for-age and MUAC-for-age was computed with from the median values of the WHO reference standards. The z-scores for these anthropometric indices were calculated using WHO/Z-score international reference standard (WHO, 2006). The z-score criteria classify undernutrition as weight-for-age, weight-for-height, height-for-age and MUAC-for-age of less than -2 z-score of the reference values known as underweight, wasting, stunting and low MUAC respectively (Ebenebe and Ulasi, 2007). The Low MUAC <125mm corresponds to moderate wasting while <115mm corresponds to severe wasting. Overweight was defined as weight-for height greater than 120% or 2 z-score of the median reference value (de Onis and Blossner, 2000). Malnutrition is a state of nutrition resulting from imbalance between intake of essential nutrients and the body requirement for these nutrients (Ebenebe and Ulasi, 2007). It includes undernutrition (inadequate intake) and overnutrition (excess) (Ebenebe and Ulasi, 2007).

The study was approved by the Health Research Ethics Committee of the University of Nigeria Teaching Hospital (UNTH), Enugu. The State Ministry of Health gave clearance for the collection of data from schools while written informed consent was obtained from the parents/caregivers of the enrolled children after due explanation of the study procedure. The data were analysed using Statistical Package for the Social Sciences (SPSS) version 19. Frequencies and proportions were presented in tables. Mean and standard deviations of the variables were determined and chi-squared test was used to compare frequencies while means were compared using student's t-test. A p value of <0.05 was taken as statistically significant.

RESULTS

In this study, out of the 409 subjects, 192 (47.0%) were males while 217 (53.0%) were females giving a male: female ratio of 1:1.1. The ages studied were 2-5 years with a mean age of 3.67±1.05 years. The distribution of the children according to socio-demographic characteristics is shown in Table 1.

Table 1. Socio-demographic characteristics of subjects

Age (years)	Males n (%)	Females n (%)	Residential area (Density) Low(n)	Medium(n)	High(n)	Total (%)
2	34 (17.7)	36 (16.6)	18	22	30	70 (17.1)
3	46 (23.9)	58 (26.7)	27	37	40	106 (25.4)
4	60 (31.3)	66 (30.4)	38	39	49	126 (30.8)
5	52 (27.1)	57 (26.3)	31	46	32	109 (26.7)
Total	**192 (100)**	**217 (100)**	**114**	**144**	**151**	**409 (100)**

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In table 2, the overall mean weight-for-age, height-for-age, weight-for-height and MUAC-for-age were 17.7 ±3.7kg, 105.3 ±10.0cm, 15.8±1.4kg and 16.5 ±1.4cm respectively. Their mean z-scores were WAZ 0.92, HAZ 0.99, WHZ 0.51 and MUACz 0.35 respectively. The means for weight-for-age, height-for-age, weight-for-height and MUAC-for-age for males were 18.1 ±3.6kg, 105.9 ±10.0cm, 16.1±1.4kg and 16.7 ±2.1cm respectively whilst the corresponding measurements for the female children were 17.3 ±3.7kg, 104.9 ±10.1cm, 16.1±1.3kg and 16.3 ±1.6cm respectively. Though the mean values of these anthropometric parameters seem higher in males than females, the differences were not statistically significant ($p > 0.56$). There is also a noted progressive increase in the mean values of the anthropometric parameters with age.

Table 2. Anthropometric outcomes and -2 z-scores

Variables	Age (years)				Sex		Prevalence	X2	P
	2	3	4	5	Total	Male	Female	(-2 score)	
Anthropometry									
Weight(kg)	14.2±2.27	16.1±2.26	18.4±3.18	20.4±3.62	17.7±3.69	18.1±3.6	17.3±3.7		
Height(cm)	93.0±7.13	100.5±6.33	108.2±6.93	114.7±5.87	105.3±10.0	105.9±10.0	104.9±10.1		
W/H(kg)	15.4±1.3	15.8±1.4	15.8±1.4	15.9±1.4	15.8±1.4	16.1±1.4	16.1±1.3		
MUAC(cm)	15.6±1.21	16.5±1.78	16.5±1.54	16.9±1.97	16.5±1.40	16.7±2.1	16.3±1.6		
Undernutrition									
Underwt(%)	12 (17.1)	17 (16.3)	24 (19.0)	17 (15.0)	30 (15.6)	40 (18.4)	17.2	0.323	0.469
Wasting(%)	5 (7.1)	9 (8.7)	12 (9.5)	15 (13.8)	13 (6.7)	28 (12.9)	10.1	2.53	0.469
Stunting(%)	14 (20.0)	22 (21.2)	29 (23.0)	22 (20.2)	45 (23.4)	42 (19.4)	21.4	1.784	0.938
Low arm(%)	0 (0)	1 (0.9)	5 (4.0)	2 (1.8)	2 (1.0)	6 (2.8)	1.9	5.58	0.183

Also in Table 2, the prevalence of underweight, wasting, stunting, low MUAC based on W/A, H/A, W/H below -2 z score of the WHO standards were 17.2%, 10.1%, 21.4% and 1.9% respectively. The prevalence of obesity using W/H greater than 2 z scores was 5.6%. As also shown in the table, the prevalence of underweight, wasting, stunting and low arm size among the females were 18.4%, 12.9%, 19.4% and 2.8% whilst the corresponding prevalence in males were 15.6%, 6.7%, 23.4% and 1.0% respectively ($p > 0.05$).

Table 2 still shows the prevalence of malnutrition in children of different ages. The prevalence of wasting was highest in 5 year old children (13.8%) compared to others. Amongst 4 year old children, the prevalence of underweight (19%), stunting (23%) and low arm size (4.0%) were highest. However, the differences did not reach statistical significance ($p > 0.05$). The peak age incidence of malnutrition using all indices of nutritional status was 4 years of age.

Figure 1 displays the mean weight for age, height for age, weight for height and MUAC Z-scores by age. There is, generally, a progressive decline in the z-score values of these parameters from 2 to 5 years.

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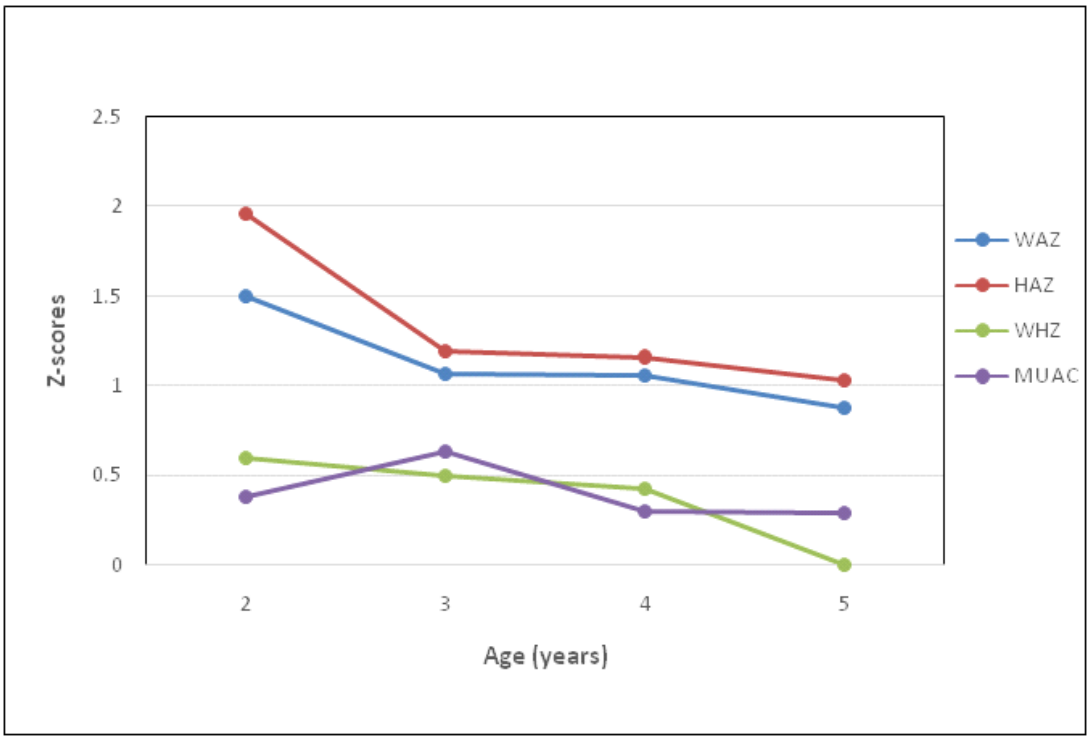

Figure 1: Weight for age, height for age, weight for height and MUAC Z-scores by age

Legend: WAZ-Weight-for age z-scores; HAZ-Height-for-age z-scores; WHZ-Weight-for-height z-scores; MUAC-Mid upper arm circumference z-scores

DISCUSSION

Childhood malnutrition remains a major public health problem in developing countries and threatens the growth and survival of children (de Onis 2012). In this study, the prevalence of stunting (21.4%) was lower compared with 12.1% obtained in a study in Kuwait (Al-Qaoud et al. 2015), though it agrees with the WHO predicted progressive decrease in developing countries from 29.2% in 2000 to 23.7% in 2020 (de Onis et al. 2012). This decline is slow when compared to that predicted for the developed countries due to population growth in developing countries (de Onis et al. 2012). According to works by different groups in Nigeria including Nigerian Demographic and Health Survey (DHS), National Bureau of Statistics (NBS) and Nigeria Multiple Indicator Cluster Survey (MICS) (NPC and ICF, 2014; NBS, 2013), the national prevalence of stunting in Nigeria has steadily declined from 41% in 2008 to 34.8% in 2011 and 32.2% in 2015. The latter figure is lower than what is obtained in 11 of the 19 Northern states in Nigeria compared to the Southern states where this study was carried out. This may not be unrelated to the increasing cases of internally displaced persons due to insurgency and arm conflicts in the Northern Nigeria. The most vulnerable groups in such situations are usually children and women. The prevalence of stunting in this study was higher than 17.4% documented in the Southwest Nigeria by Senbanjo et al. (2011), but lower than 48.1% noted in Ethiopia (Zelellw et al. 2013). The methodological differences between these and this study may have affected the results. Zelellw et al. (2013) in Ethiopia studied school-aged children, during which growth has been documented to be slow (Njokanma et al. 2007). Our study, however, was on pre-school age, period when steady velocity growth occurs between 2 and 3 years (Njokanma et al. 2017), and this may result in improvement in height-for-age as noted in this study. Contrarily, Senbanjo et al. (2011) subjects were both school children and adolescents between 5 and 19 years. Known period of peak height increase which occurs in late childhood and adolescents (Njokanma et al. 2007), possibly, may have resulted in lower prevalence of stunting in their

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study.

On the other hand, the prevalence of underweight (17.2%) was similar with value reported from a study in Nigeria (Aliyu et al. 2012). However, it is much lower than a projected increase from 24% in 1990 to 26.8% in 2015 for Africa (de Onis et al. 2004). The plausible reason for this might be the recognized secular trend of increase in growth parameters over years. The projection also considered the effect of Human Immunodeficiency Virus (HIV)/Acquired Immunodeficiency Syndrome (AIDS) pandemic together with political instability in African countries both of which are on decline in Nigeria. The finding is lower than the documented 20.9% national prevalence (NPC and ICF, 2014). However, the wide difference between this and the 6% underweight prevalence expected in Enugu state (NPC and ICF, 2014) may be difficult to explain.

Though this study was carried out in an urban part of the state, with majority of the subjects (37%) from high density area compared to low and medium density, it is possible that a higher prevalence of stunting, underweight and wasting could be got if the rural part is considered. Senbanjo et al. (2016) in South-West Nigeria had noted a significantly higher prevalence of underweight and stunting in rural compared to urban under-five children. An earlier study by Oninla et al. (2006) similarly reported a significantly lower W/A, H/A and W/H among rural than urban school children. There seems to be a consensus that other risk factors besides inappropriate and unavailability of food are responsible for these differences (Oninla et al. 2006; Senbanjo et al. 2016).

The progressive increase in the mean values of the studied parameters with age is understandable, as the effect of growth and development with age could possibly explain the finding. However, the peak age of undernutrition for preschool children in this study was 4 years, highlighting that undernutrition is more prevalent in older preschool children. It may be that the deficiency in growth of these children were mild and on-going starting from infancy and early preschool age and only became manifest at late preschool age. A similar finding was reported in Southwest Nigeria (Akinpelu at al. 2014), as well as in India (Mittal et al. 2007). It contrasted the findings from Kenya (Nungo et al. 2012) which noted a peak age of 3 years. This latter report (Nungo et al. 2012) showed that children in their early years were more undernourished. They attributed this to the interactive effects of poor weaning practices, incomplete immunization (resulting in recurrent illness) and poor sanitation. Again, considering the demand of growth which occurs between 2-3 years (Njokanma et al. 2007), it is possible that this and the attributed poor weaning diet coupled with poverty may have had additive effect on the nutritional status at this age.

The female predominance of undernutrition, though not significant, may be attributed to cultural priority placed on male children in African culture which may translate to better maternal and nutritional care of male children. Other workers (Ahmad et al. 2011; Panyandeh et al. 2013; Oyedeji et al. 2002) made similar observation, which Ahmad et al. (2011) in India attributed to age-long practice of societal neglect on female gender. Conversely, the findings by Nungo et al. (2012) in Kenya showed that males were more undernourished though no reason was advanced for this observation.

Despite the high prevalence of undernutrition in this study, overweight was observed to be as high as 5.6%. A similar trend has been previously reported in a study in Nigeria (Akinpelu et al. 2014) and in other developing countries noting a rising trend of 0.6% per year (de Onis and Blossner, 2000; de Onis et al. 2012). This is possibly due to the impact of westernization and reduced physical activities which is on the rise in developing countries and has increased risk of several medical conditions (Elullu et al. 2014).

CONCLUSION

In conclusion, the study showed that there is a high prevalence of undernutrition among preschool children in Enugu urban, South-East, Nigeria. This is more so in the older preschool children (4-5 years). Also, overweight malnutrition was observed to be on the high trend. These high prevalences in the se

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two extremes of nutritional status is a cause of great concern. As such, urgent nutritional intervention programme need to be instituted and implemented targeting this vulnerable age group. It is recommended that one of the cornerstones of modern therapy in undernutrition, ready-to-use therapeutic food (RUTF), could be used in the nursery schools as they are noted to remarkably reduce the prevalence as well as the number of undernourished children requiring inpatient care (Horton et al. 2008). Attention should also be directed on overweight which evidently has association with many serious medical conditions

Our study has limitations. A school-base instead of community-based assessment of nutritional status was done. Very poor families in which severely malnourished children are likely to belong to may not afford to send their children to schools even with the free Universal Basic Education operational in the state because of other costs aside school fees.

Measurements were undertaken by a researcher while an assistant did the recording. Though the measurements were taken twice to ascertain their being within tolerance limit, the 'gold standard' anthropometric measurement by WHO requires observers working in pair, collecting anthropometric data with each observer taking and recording a set of measurements which are compared later.

Conflict of interest: The authors declare that there is no conflict of interest.

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