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COMPARATIVE PREVALENCE OF LOW LEVELS OF NUTRITIONAL INDICATORS USING NCHS AND WHO REFERENCE/STANDARDS

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ABSTRACT

Nutritional status of pre-school children (0-5 year age group) is of paramount importance because the foundation for lifetime health, strength and intellectual vitality is laid during this period. This study was aimed at assessing the nutritional status of children below five years of age, in nine towns distributed within the three senatorial zones of Anambra State. Anthropometric data were collected between 2nd to 30th June, 2012. A total of 1662 children were included in the study. Every child was subjected to anthropometric measurements using standard technique. Data analysis was done using WHO ANTHRO software (Version 3.2.2) and was based on NCHS 2000 and WHO (2006) reference/ standard. Recommended indicators and cutoffs (<-2SD) were used to classify malnutrition. Total population prevalence for stunting, wasting and underweight were 4.3%, 7.98% and 2% by NCHS criterion and 5.2%, 8.8% and 1.5% by WHO Standards. In all the areas studied, more children were classified as stunted and wasted by the WHO criteria when compared with the NCHS reference. On the other hand, a lower proportion of children were classified as underweight by WHO standard when compared with NCHS reference. The result of this work suggests that the WHO 2006 standard seems to be a better predictor of nutritional status among under-five year old children.

INTRODUCTION

Malnutrition contributes to about 3.2 million deaths each year. It still remains a problem in the developing nations (de Onis et al., 2012). Assessment of nutritional status of under-five year old children is carried out using anthropometric indices of malnutrition which include stunting, wasting and under-weight. A new child growth standard was recently introduced by the World Health Organization (WHO) for use in deriving indicators of nutritional status of the world's under-five population. The standards are based on the growth of infants from six different regions of the world who were fed according to WHO and United Nations Children's Fund (UNICEF) feeding recommendations (de Onis and Garza 1999; de Onis et al., 2004a; de Onis et al., 2004b; WHO-MGRS, 2006a). The MGRS data used for the generation of the WHO (2006) growth charts was from more nationally representative and the growth charts therefore represents a prescriptive standard rather than a reference. The WHO (2006) growth charts represented growth of children occurring under optimal conditions or under the best health practices (de Onis, 2006) and without economic, environmental, nutritional or genetic limitations to their individual development. It is presently advocated that the previously recommended international growth reference devised by the National Center for Health Statistic (NCHS) be replaced by the new WHO (2006) growth standards for nutritional assessment of the world's under-five population (Seal and Kerac, 2007; UN/SCN, 2007). Prevalence of nutritional indicators estimated using the NCHS reference are expected to differ from those based on the WHO (2006) standard because there are differences in the median values of the various anthropometric indicators between the two reference/standard (WHO, 2006b). It is important to investigate these apparent differences in the prevalence of malnutrition obtained using these two criteria in different settings as this will throw more light on the implications for their use in assessing child nutritional status or monitoring the progress of child health and nutrition programmes. Some recent studies have investigated the pattern of the difference in prevalence of malnutrition obtained when NCHS (2000) and WHO (2006) criteria are used in nutritional status assessment of under-five year old children (Seal and Kerac, 2007; Fenn and Peny, 2008; Prost et al., 2008). More field studies are required to evaluate the new WHO (2006) growth standards in Nutritional assessment studies in Anambra State as majority of nutritional assessment studies carried out in Anambra State of Nigeria have been based on older references such as the Harvard and the NCHS (2000)references.

This work is therefore aimed at carrying out a survey of nutritional anthropometric data amongst under-five year old children from three senatorial zones in Anambra State. The specific objectives include determining the relative prevalence of various forms of malnutrition in the study areas and to compare the prevalence of the various forms of malnutrition obtained using the NCHS (2000) charts with those obtained using the new WHO (2006) standard.

METHODOLOGY

A descriptive cross-sectional survey was carried out in the month of June, 2012. A sample size of 1662 was drawn comprising under-five year old children from three senatorial zones (South, Central and North) in Anambra State. Participants included pupils in primary schools, attendees at scheduled immunization visits in pediatric hospitals as well as children from individual households. Official consent was obtained from the various hospital authorities and school authorities as well as from parents before embarking on data collection. Structured questionnaires filled by parents or guardians were used to collect some required information. Anthropometric data for each child was collected using standardized equipments and

methods as recommended by Cogil (2003). Trained research assistants were employed for data collection and to explain details of the components of the questionnaire to illiterate parents. Weight measurements were taken using electronic weighing balance while the height measurements were taken with a Harpenden Pocket Studiometer and readings were recorded to the nearest 0.1cm

Height measurements were taken with height meters mounted against a wall. Supine length measurements and other data from under 1 year old attending immunization clinics were collected with the help of trained health workers at the various health institutions. Height measurements of participants above one year who could stand erect were taken with the children standing barefooted and shoulders erect. Readings were taken on the meter against the vertex of the head. Height-for-age, weight-for-age and weight-for-length Z-scores were obtained from standard growth chart (NCHS 2000 and WHO 2006) and recommended cutoffs (<-2SD) were used to classify malnourished children. Data was analyzed using the WHO-Anthro software (Version 3.2.2) and growth retardation prevalence for the under five year old was estimated by the proportion of nutritional indicators below -2SD Z-score of the references population.

RESULTS

Sex	**WAZ <-2**		**HAZ <-2**		**WHZ <-2**	
	NCHS	**WHO**	**NCHS**	**WHO**	**NCHS**	**WHO**
Boys	3.3	2.7	4.9	5.3	8.3	9.6
Girls	5.1	42	9	9	6.9	10.2
Combined	4.1	3.4	6.8	7.0	7.6	9.9

Table 1: Comparative prevalence of low level of nutritional indicator by sex in Anambra South (all age) using NCHS and WHO Reference

Table 1 shows that percentage of children that had a low weight-for-age or was underweight by NCHS reference was higher than that obtained with the WHO Standard while the percentage of children classified as wasted and stunted by NCHS reference was lower than that of children classified as wasted and stunted by WHO standard.

Categories in a sample of 585 children in Anambra South

	> 6		6-11months		12-23months		24-35months		36-47months		48-59months		Total	
	NCH	WHO	NCHS WH0		NCHS	WHO	NCHS WHO		NCHS	WHO	NCHS	WHO	NCHS	WHO
HAZ <-2	0	0	0	0	6.3	6.8	0.7	0.7	7.1	7.1	12	12.7	6.8	7
No Examined	1	1	8	7	86	89	165	165	159	159	160	160	579	581
WAZ <2	1	0	0	0	0	0	1.8	0.6	6.3	6.3	6.9	5.6	4.1	3.4
No Examined	1	1	8	7	86	89	165	165	159	159	160	160	579	581
WHZ <2	0	0	0	7.1	15.9	18.8	12	14.4	6.3	6.4	2.5	3.8	7.6	9.9
No Examined	1	1	8	7	86	89	165	165	159	159	160	160	579	581

Table 2: Comparative prevalence of low levels of nutritional indicators by age

Prevalence values shown on table 2 above were based on NCHS REF (2000) and WHO(2006) standard respectively. Prevalence of stunting in the total population was higher (7.0%) by the WHO standard compared with the NCHS reference (6.8%). Prevalence of wasting in total population was higher (9.9% by WHO standard compared with the NCHS reference 17.6%) In the total population, more children were classified as wasted and stunted by WHO standard while more children were classified as underweight by NCHS reference. Age group 48-59 months showed the highest prevalence of stunting (12.79/12%) by both WHO and NCHS criteria. Age group 12-23 months showed the highest prevalence of wasting (18.8% and 15.9% respectively) by WHO and NCHS criteria. Both criteria revealed similar rates of underweight in children between 36-47months old.

Sex	WAZ<-2SD		HAZ<-2SD		WHZ<-2SD	
	NCHS	WHO	NCHS	WHO	NCHS	WHO
Boys	0.8	0.4	2.9	2.5	7.3	7.5
Girls	1.2	1.2	0.4	0.4	3.6	6.4
Combined	1	0.8	1.6	1.4	5.4	6.9

Table 3: Comparative Prevalence of low levels of nutritional indicators by gender in a sample of 509 children in Anambra Central

Prevalence values shown on table 3 above were based on NCHS REF (2000) and WHO (2006) standard respectively. Prevalence of underweight and stunting were low in this population by both NCHS and WHO criteria. By both criteria, wasting showed the highest prevalence 6.9% and 5.4% respectively compared with other nutritional indicators

Age group	WAZ<-2SD		HAz<-2SD		WHz<-2SD	
	NCHS	WHO	NCHS	WHO	NCHS	WHO
0-5	0.0	0.0	0.0	0.0	0.0	0.0
6-11	0.0	0.0	0.0	0.0	0.0	0.0
12-23	0.0	0.0	6.5	0.0	3.6	3.3
24-35	2.4	1.6	0.9	0.9	9.8	13.2
36-47	0.6	0.6	1.7	2.3	4.0	5.2
48-59	0.6	0.6	1.2	1.2	4.2	5.0
Total	1.0	0.8	1.6	1.4	5.4	6.9

Table 4: Comparative Prevalence of low levels of nutritional indicators (z<-2SD) by age range in a sample of 509 children from Anambra central

Prevalence values shown on table 4 above were based on WHO standard and NCHS reference respectively. There was no incidence of low levels of any of the nutritional indicators in under 12 month old children by either the WHO or the NCHS criteria. More children (6.9%) were classified as wasted by the WHO standard compared with the NCHS reference (5.4%) There was very little difference in the prevalence of stunting (1.4% and 1.6%) and wasting (0.8% and 1.0%) obtained using the WHO standard and NCHS reference respectively.

	Indicators					
	W/A Z <-2SD		H/A Z <-2SD		W/H Z <-2SD	
Sex	**NCHS**	**WHO**	**NCHS**	**WHO**	**NCHS**	**WHO**
Boys	0.7	0.3	4.2	8.7	9.0	9.1
Girls	0.4	0.0	4.4	5.1	12.5	13.3
Combined	0.5	0.2	4.3	6.9	10.7	11.2

Table 5: Comparative prevalence of low levels of nutritional indicators by sex in a sample of 568 children from Anambra North

By both criteria, the nutritional indicator with the highest prevalence of low levels was wasting followed by stunting and lastly by underweight. More children were classified as wasted and stunted by WHO (2006) standard while less children were classified as underweight.

	>6		**6-11months**		**12-23months**		**24-35 months**		**36-47 months**		**48-59**		**Total**	
	NCHS	WHO	NCHS	WHO	NCHS	WHO	NCHS	WHO	NCHS	WHO	NCHS	WHO	NCHS	WHO
H/AZ<-2%	0	0	0	0	29	29	5.9	12.8	0.6	1.9	1.6	1.6	4.3	6.9
Number Examined	0	0	1	1	31	32	191	190	157	157	188	188	568	568
W/A Z<-2	0	0	0	0	3.1	0	0	0	1.3	0.6	1.6	0	0.5	0.2
Number Examined	0	0	1	1	31	32	191	190	157	157	188	188	568	568
W/H Z<-2	0	0	0	0	0	0	7.4	9.2	19.4	20.3	8.6	7.0	10.7	11.2
Number Examined	0	0	1	1	31	32	191	190	157	157	188	188	568	568

Table 6: Comparative prevalence of low Nutritional indicators by age categories in Anambra North

Prevalence of stunting (Low H/A) in the total population was higher (6.9%) by the WHO standard compared with the NCHS reference (4.3%). Prevalence of wasting (Low W/H) in the total population was higher (11.2%) by WHO standard compared with the NCHS reference (10.7%). In the entire population, more children were classified as wasted and stunted by WHO standard while less children were classified as underweight by NCHS reference. Age group 12-23months showed the highest prevalence of stunting (29% & 29% respectively) by both criteria. Age group 36-47 months showed the highest prevalence of wasting by both WHO and NCHS criteria (i.e. 20.3% and 19.4%) respectively. Higher or equal rates of underweight were observed in all age groups by NCHS criteria compared with WHO standard.

Region	**Sex**	**Indicators**		
		W/H	**W/A**	H/A
Anambra South	Boys	8.3	3.3	4.9
	Girls	6.9	5.1	9
	Combined	7.6	4.1	6.8
Anambra North	Boys	9	0.7	4.2
	Girls	12.5	0.4	4.4
	Combined	10.7	0.5	4.3
Anambra Central	Boys	7.3	0.8	2.9
	Girls	3.6	1.2	0.4
	Combined	5.4	1	1.6

Table 7: Prevalence of low levels (Z-score <-2SD) of Nutritional Indicators by sex in a sample of 1662 children from the three Geopolitical zones of Anambra State

Prevalence values shown on table 7 above are based on NCHS (2000) reference. Prevalence of wasting (low weight-for-height Z-scores) was highest amongst children from Anambra Central. A higher percentage of girls from Anambra Central were wasted compared with boys indicating that the girls were more susceptible to the adverse situation that produced the high rate of wasting in the region. Children from Southern zone recorded the second highest rate of under-weight. The lowest rate of wasting was observed in Anambra North. Highest prevalence of stunting (6.8%) was observed amongst

children from the South. A higher percentage of girls (9%) from this region were stunted compared with boys (4.9) The second highest rate (4.3%) of stunting was observed among children from the Central zone. The least rate of stunting was observed in the Northern zone. Children from the southern region recorded the highest (4.1%) rate of underweight. Rate of underweight in both Northern and Central regions were relatively lower.

Region	**Sex**	**Indicators**		
		W/H	**W/A**	H/A
Anambra South	Boys	9.6	2.7	5.3
	Girls	10.2	4.2	9
	Combined	9.9	3.4	7
Anambra North	Boys	9.1	0.3	8.7
	Girls	13.3	0.0	5.1
	Combined	11.2	0.2	6.9
Anambra Central	Boys	7.5	0.4	2.5
	Girls	6.4	1.2	0.4
	Combined	5.9	0.8	1.4

Table 8: Prevalence of low levels (Z-score <-2SD) of Nutritional Indicators by sex in a sample of 1662 children from the three geopolitical zones of Anambra State

Prevalence values shown on table 8 are based on WHO (2006) Criteria. Prevalence of wasting was highest amongst children from Anambra Central. A higher percentage of girls from Anambra Central were wasted compared with boys from the same region. Children from the Southern zone recorded the second highest rate of wasting. The lowest rate of wasting was observed in Anambra North Highest prevalence of stunting (7%) was observed amongst children from the South. A higher percentage of girls (9%) from the region were stunted compared with boys (5.3%). The second highest rate of stunting was observed amongst children from the Central zone. The least rate of stunting was observed in the Northern zone. Children from the Southern region recorded the highest (3.4%) prevalence of underweight. Rates of underweight amongst children from both Northern and Central regions were relatively lower compared with children from the southern zone.

	Indicators					
	WHO			NCHS		
Region	H/AZ<-2SD	W/A Z<-2SD	W/HZ<-2SD	H/AZ<-2SD	W/A Z<-2SD	W/HZ<-2SD
Anambra South	7.0	3.4	9.9	6.8	4.1	7.6
Anambra North	6.9	0.2	11.2	4.3	0.5	10.7
Anambra Central	1.4	0.8	6.9	1.6	1.0	5.4

Table 9: Total prevalence of low level of nutritional indicators (Z<-2SD) in the Three Regions using WHO standard and NCHS Reference

Prevalence values shown on table are based on WHO (2006) Criteria. Prevalence of low levels of the three nutritional indicators obtained with WHO standard followed the same pattern as observed with NCHS (2000) reference. This pattern was consistent in all three regions .i.e. %wasting>%stunting>%underweight. Prevalence values shown on table are based on NCHS (2000) Reference. By NCHS and WHO criteria, the group of children from Anambra South recorded the highest prevalence of low levels of H/A Z-score, and low levels W/A Z-score. Anambra Central recorded the highest prevalence of low levels of W/H Z-scores by both NCHS and WHO reference/standard.

Indicators

	W/H		W/A		H/A	
Sex	NCHS	WHO	NCHS	WHO	NCHS	WHO
Girls	8.63	10.04	2.25	1.72	5	5.6
Boys	8.24	8.80	1.67	0.597	4.3	4.9
Combined	7.99	9.42	1.84	1.504	4.3	5.2

Table 10: Comparison of total population prevalence of low levels of Nutritional indicators (<-2SD) by sex using NCHS and WHO reference/standard

Prevalence shown on table 10 above were based on NCHS (2000) and WHO (2006) criteria respectively.

Prevalence of wasting and stunting in entire population was higher by the WHO (2006) standard.

Prevalence of underweight was lower by WHO (2006) standard.

Regions/indicators **H/AZ<-2DS**	**No. exam.**	**>6**	**No. Exam**	**6-11**	**No. exam.**	**12-23**	**No. exam.**	**24-35**	**No. exam.**	**36-47**	**No. exam**	**48-60**	**No. Exam**	**Total**
Anambra South	1	0	7	0	89	6.8	165	0.7	159	7.1	160	12.7	581	7.0
Anambra North	0	0	1	0	32	29	190	12.8	157	1.9	188	1.6	568	6.9
Anambra Central	0	0	5	0	36	0	125	0.9	180	2.3	166	1.2	512	1.4
W/AZ<-2DS														
Anambra South	1	0	7	0	89	0	165	0.6	159	6.3	160	5.6	581	3.4
Anambra North	0	0	1	0	32	0	190	0	157	0.6	188	0.0	568	0.2
Anambra Central	0	0	5	0	36	0	125	1.6	180	0.6	166	0.6	512	0.8
W/H Z<-2DS														
Anambra South	1	5.0	7	7.1	89	18.8	165	14.4	159	14.4	160	3.8	581	9.9
Anambra North	0	0	1	0	32	3.0	157	12.8	157	12.8	188	7.0	568	11.2
Anambra Central	0	0	5	0	36	3.3	125	13.2	180	5.2	166	5.0	512	6.9

Table 11: Prevalence Of Low Levels of Nutritional Indicators (Z<-2SD) By Age group In the Three Regions

Prevalence values shown on table are based on WHO (2006) Criteria. No incidence of low levels of nutritional indicators was observed amongst under 12 month old children from all the regions. The highest prevalence of stunting (7.0%) was observed in children from Anambra South. The highest prevalence of underweight (3.4%) was observed among the same group of children. The highest prevalence of wasting (11.2% was observed in children from Anambra Central.

Regions/indicators H/AZ<-2DS	No. exam.	>6	No. exam	6-11	No. exam.	12-23	No. exam.	24-35	No. exam.	36-47	No. exam.	48-60	No. exam	Total
Anambra South	1	0	8	0	86	6.3	165	0.7	159	7.1	160	1.2	579	6.8
Anambra North	0	0	1	0	31	29	191	5.9	157	0.6	188	1.6	568	4.3
Anambra Central	1	0	5	0	34	6.5	124	0.9	180	1.7	166	1.2	509	1.6
W/AZ<-2DS														
Anambra South	0	1	8	0	86	0	165	1.8	159	6.3	160	6.9	579	4.1
Anambra North	0	0	1	0	31	3.1	157	0	191	1.3	188	1.6	568	0.5
Anambra Central	0	0	5	0	34	0	124	2.4	180	0.6	166	0.6	509	1
W/H Z<-2DS														
Anambra South	1	0	8	0	86	15.9	165	12	159	6.3	160	2.5	579	7.6

Anambra North	0	0	1	0	31	0	157	7.4	191	19.4	188	8.6	568	10.7
Anambra Central	0	0	5	0	34	3.6	124	9.8	180	4.0	166	4.2	509	5.4

Table 12: Prevalence of Low Levels Of Nutritional Indicators (Z<-2SD) By Age Group in the Three Regions Using NCHS

Prevalence values shown on table 28 above are based on NCHS (2002) Reference . No incidence of low levels of nutritional indicators was observed amongst under 12 month old children from all the regions. The highest prevalence (6.8%) of stunting was observed in children from Anambra South. The highest prevalence of underweight (14.1%) was observed among the same group of children. The highest prevalence (10.7%) of wasting was observed in children from Anambra Central followed by children from Anambra South (7.6%).

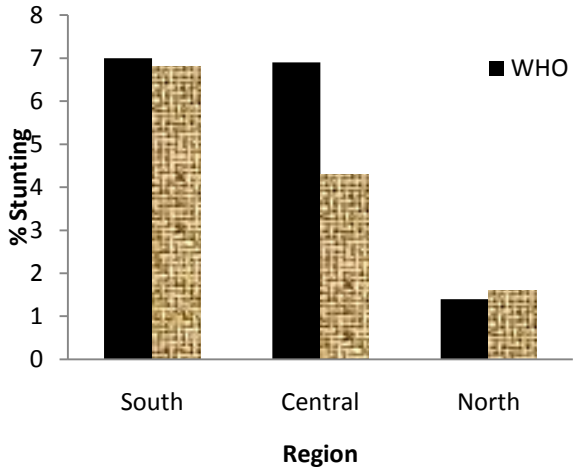

Figure 1: Comparative prevalence of stunting in the three zones (WHO 2006 and NCHS 2000 references)

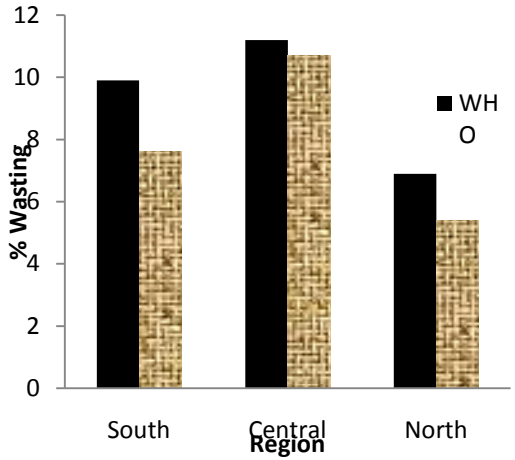

Figure 2: Comparative prevalence of wasting in the three zones (WHO 2006 and NCHS 2000 references)

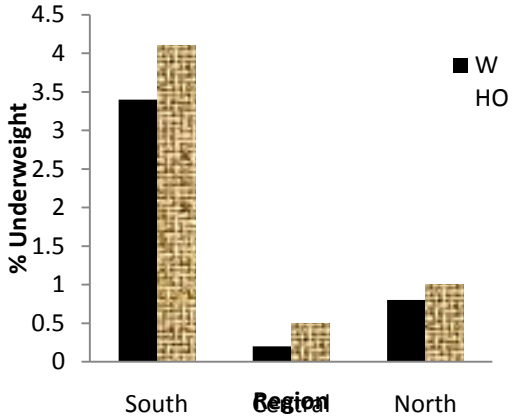

Figure 3: Comparative prevalence of underweight in the three zones (WHO 2006 and NCHS 2000 references)

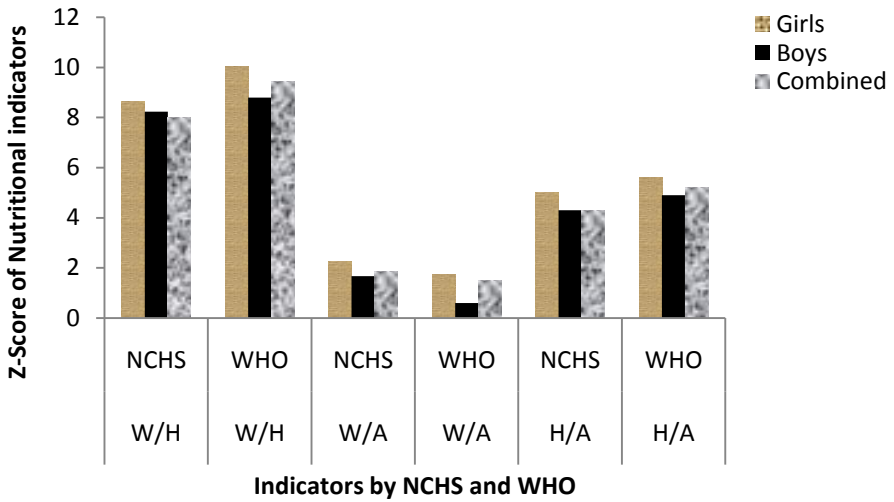

Figure 4: Comparison of total population prevalence of low levels of Nutritional indicators (<-2SD) in all region for sex using NCHS and WHO ref.

Discussion and Conclusion

The Nigerian National Survey conducted by Demographic and Health Survey (DHS) in 1999 placed the proportion of stunted children (i.e. percentage of children with H/A Z scores <-2SD) under five (5) years of age at 43% including severe stunting (i.e. H/A Z-scores <-3SD).

Prevalence of Malnutrition in Anambra South

A study in Aguata Local Government Area of Anambra state by Okorigwe and Okeke (2009) revealed a 7.7% prevalence of stunting among under-five year old children using NCHS reference. The present study revealed a 7.0% prevalence of low Height-for-age among the same population of children selected from Ihiala, Uli, and Nnewi all in Anambra South Geopolitical zone of Anambra State, using the same reference (NCHS) (Table 10). A higher prevalence of stunting was observed among the female population compared with the male. The respective prevalence were 9% and 5.3%. The prevalence of stunting was highest (12.0%) amongst children between 4-5 years old followed by 3-4 years old children (7.1%) and 1-2 year old children (6.3%). The prevalence of stunting observed among 2-3 years old in the region was relatively lower (0.7%) while there was no record of stunting amongst less than 12 months old children (Table 11).

The higher prevalence (6.3%) of stunting observed among 1-2year old children compared with those within the age range 2-3years (0.7%) could be linked to poor weaning practices as well as to the long periods of the day that these children (1-2years old) who attend day care centers and nursery schools are kept away from their homes. Operators of educational outfits may not be able to pay enough attention to the quality and timing of feeding that these children would obtain if they are left at home with their mothers during the same hours. Stunting is an indicator of chronic malnutrition. The trend is reversible if detected in the earlier ages i.e. before 2years of age (Cogil, 2003). The detection of stunting amongst this age group (1-2years) is therefore significant because in children over 2 years of age such chronic insufficient protein and energy intake that are associated with stunting may not be easily reversible (Cogil, 2003). The improved trends observed in children within age group 2-3 years may probably be due to the fact that children within this age range have developed comparatively better feeding skills and are better able to eat greater amounts and more variety of adult food from the family pot. The prevalence of stunting amongst the older age ranges (2-4 and 4-5 years which are respectively 7.1% and 12.0%) also points to the fact that less attention is being paid to the diet of children in these age groups probably because they are considered more independent than children in the lower age ranges. No incidence of stunting was observed amongst the age group 0-1 in this study. This could be attributed to the improved feeding practices and gradual weaning process now popularly advocated and practiced amongst most mothers for children within this age group. Many of the mothers practiced exclusive breast feeding at least up to six months and subsequently combined breast feeding with improved weaning formulae that have been largely introduced to women through primary health care programmes. Fashakin and Ogunsola (1987) ; Akinrele and Edwards (1971) and Fashakin *et al.,* (1986) also reported that a mixture of cowpea, melon, soybean and ogi (pap) was found to be superior to any single protein source in protein efficiency ratio, net protein retention, biological value and net protein utilization.

The higher prevalence of stunting observed amongst girls in the region suggests that more attention should be paid to the nutrition of the girl child. This is important since stunting in girls has been associated with the development of narrow pelvic bones.

The most prevalent form of malnutrition observed in this region was wasting (i.e. low weight for length) with a prevalence of 7.6% and 9.9% by the NCHS and WHO criteria respectively (Table 1 and 2; Figure 2). This was followed by stunting (low height-for-age). The rates of stunting obtained using NCHS and WHO criteria were close (6.8% and 7.0% respectively). The prevalence rates of underweight (low weight-for-age) were equally lowest by either criterion (4.17% and 3.4% respectively).

The prevalence (by NCHS criteria) of wasting and stunting obtained in this study were close to the values (7.6% and 7.7%) reported by Okoroigwe and Okeke (2009) in Aguata Local Government Area of Anambra South senatorial zone.

By WHO (2006) standard, more children in this region were classified as wasted and stunted while a lower percentage was classified as underweight.

Going by both NCHS and WHO criteria, the age groups with the highest prevalence of underweight were the 4-5 years old and 3-4 old children. This was followed by 2-3 years old children. Underweight increased with increasing age.

Table 2 showed that similar estimates of stunting prevalence was obtained in all age groups by both NCHS and WHO reference/standard respectively with the WHO standard giving slightly higher values within some age ranges. The differences however were not significant. The age range 48-59 had the highest prevalence (12% and 12.7%) followed by 36-47 months (7.1% and 7.1% respectively) and 12-23 months 6.3% and 6.8% by NCHS and WHO

reference standard respectively. This rate of stunting (chronic malnutrition) observed in the later age group is important. Stunting is an indicator of chronic malnutrition and children over two years of age are less able to respond to nutritional intervention than younger children. This result also suggest that school lunch programme should be instituted in nursery/primary schools in order to compensate for the nutritional deprivation that under 2years old suffer due to the long periods that children of this age group are kept away from their homes. The frequency and quality of feeding they receive is less because of the weaker feeding skills they possess. The improved trend (a prevalence of 0.7%) observed in children within the age group 2-3 years may probably be due to their relatively improved feeding skills and ability to eat greater and quality and more variety of adult food from the family pot. A higher prevalence of stunting was observed among 1-2 years old compared with 2-3 years old. Result of this work also indicates that children in the older age group are also been neglected and require more nutritional attention. No case of stunting was observed among under one year old children in Anambra South. Table 2 shows that the prevalence of acute malnutrition (i.e. low weight for length) by both NCHS and WHO criteria was highest with the age range 12-23 old (15.8% and 18.8% respectively). This was followed by 24-35 months old (12% and 14.4%) and then by 36-47 month old children (6.3% and 6.4% respectively).

Prevalence of Low Levels of Nutritional Indicators in Anambra North

Anambra North followed the same pattern observed in Anambra South (Table 5 and 6). The most prevalent form of malnutrition observed in this region was wasting with a prevalence of 10.7% and 11.2% by the NCHS and WHO criteria respectively (Table 6). This was followed by stunting (low height – for- age) with a rate of 4.3% and 6.9% by the NCHS and WHO criteria respectively (Table 6). The prevalence rate of underweight was lowest i.e. 0.5% and 0.2% by both NCHS and WHO standards respectively (Table 6). By the WHO standard, more children were classified as wasted and stunted while a lower percentage was classified as underweight when compared with NCHS 2000 reference. This observation agrees with the work of Schwarz *et al.,* (2008) who compared the prevalence of undernutrition among Gabonese children based on three growth reference/ standards (NCHS/1977, the CDC 2000 and the WHO 2006) and found that the prevalence of wasting and stunting was significantly higher among 3 month-old children when the 2006 WHO Growth Standards was applied. The same workers also observed that the prevalence of stunting among 15 month-old children was lower based on the CDC 2000 reference.

Going by the NCHS and WHO criteria, the age group with the highest prevalence of stunting in Anambra North was 12-23month old which recorded a prevalence rate of stunting of 29% by both criteria (NCHS or WHO). The age ranges 24-35 and 36-47 respectively recorded stunting rates of 5.9% and 12.8% and 0.6% and 1.9% by NCHS and WHO criteria respectively. Again the high rate of stunting (chronic malnutrition) observed within 1-2 year old children is important because stunting among young infants could be contributed to by poor maternal nutrition (Dewey and Begom, 2011).

The prevalence rates of acute malnutrition (low weight-for-length) or wasting was high among the older children 24 months-60months or 2-5years. No case of wasting was recorded among less than two years old in Anambra North.

Prevalence of Malnutrition in Anambra Central

Like the other two region studied, the pattern of malnutrition found in Anambra central was similar. Wasting was the form of malnutrition with the highest prevalence i.e. 5.4% and 6.9% respectively by NCHS and WHO criteria respectively (Table 4). This was followed by stunting with a prevalence of

1.6% and 1.4% by NCHS reference and WHO standard respectively. Underweight was the least prevalent form of malnutrition and the respective prevalence by NCHS/ WHO reference/standard were 1% and 0.8% respectively. A higher percentage of children were classified as wasted by WHO (2006) standard. The total prevalence rate of stunting by both criteria were very close (For stunting, the rates were 1.6% and 1.4% and for underweight, 1% and 0.8%) by NCHS and WHO respectively. Although the rate obtained with WHO was slightly less for both parameters (i.e. stunting and underweight). A lower percentage of girls were classified as stunted using both criteria (0.4% in each case) compared with boys 2.9% and 2.5% respectively by NCHS and WHO reference / standards. More girls in this region were classified as underweight by both criteria (1.2% in each case) compared with boys 0.8% and 0.4% by NCHS and WHO criteria respectively. Also lower percentages (3.6% and 6.4%) of girls were classified as wasted by NCHS and WHO criteria respectively compared with boys (7.3% and 7.5%).

In the region, the prevalence of stunting was highest (6.5%) among children aged 12-23 months. Prevalence of wasting was highest (9.8%) among the age group 24-35 months by NCHS and WHO criteria respectively. No form of malnutrition was observed in children under one year by NCHS and WHO criteria. The result of the study also showed that the prevalence of low levels of all the nutritional parameters assessed was higher amongst girls in the total population when compared with boys (Table 10 and Figure 4). This observed pattern was similar in all three regions whether the NCHS reference or the WHO standard was used.

The result of this work revealed that prevalence of wasting was highest (by both NCHS and WHO reference/standard). This was followed by stunting and lastly by underweight (Figure 1, 2 and 3). This pattern was consistent in the three regions.

The result of this study agrees with that of Padula *et.al.,* (2012) who carried out a study in Argentina to compare the estimate of various forms of child-hood malnutrition based on the 2006 WHO Child Growth Chart, the 1977 National Centre for Health Statistics (NCHS) International Growth Reference and 1987 Argentine Pediatary Society Committee of Growth and Development Reference (APS reference) revealed that the prevalence of underweight was higher with the WHO standard than with other references up to the 1st six months. For the rest of ages, prevalence was lower with the WHO standard. Stunting prevalence was higher with WHO (2006) standard compare to the NCHS up to 6 months and lower at 2-5 years of age. They concluded that the new WHO standard appeared to be a better predictor of malnutrition which was solid and reliable for diagnosis and treatment of nutritional diseases. Another group of workers Rousham *et al. (2011),* calculated NCHS and WHO height for age z-score with the use of cross-sectional data from 20,605 school children aged 5-17years in eleven low income countries. In children, the estimated prevalence of low weight- for-height (WHO reference) was consistently higher than the prevalence of wasting (NCHS reference) by as much as 9% in girls and 18% in boys.

Ergo *et al* (2009), evaluated the extent to which the use of the new WHO (2006) standard affect the estimated prevalence and social economic distribution of stunting and underweight amongst children in a large number of low and middle income countries. They analyzed demographic and health survey data for stunting and underweight in 41 low and middle income countries with the new standard and compared the result with those produced by analysis of the same data using the old growth references. The result revealed that the prevalence of stunting increased with the adoption of the new standard by 5.4% on the average (95%CI; 5.1, 5.7). The prevalence of underweight, decreased in all but two of the countries by an average of 2.9% (95% CI; 2.7, 3.2).

The result of a child nutritional survey carried out by Tarozzi, (2008) in India, suggested that the new WHO growth standard will project a lower prevalence of overall underweight children and provide superior growth monitoring than older standard like IAP standard (Indian Academy of Pediatrics Standard which is based on Harvard Scale) especially, in the first six months of life amongst severely malnourished children.

Conclusion

In one of the towns in the study area (Uli town in Anambra South senatorial zone), it was noticed in the course of the study that much of the economic burden of feeding the children, paying their school fees as well as providing other basic needs of the child rests mainly on the women population. The women in rural communities constitute a greater percentage of the rural agricultural work force. Reducing the work load of women as well as social financial responsibilities placed on them will enable them save more time and energy for attending to the children.

Finally, complementary breastfeeding should continue into the second year and more attention should be paid to the nutrition of the older child and the Girl child. The use of the WHO 2006 charts seems to be more appropriate for children nutritional screening. This is because it permits the detection of a higher number of nutritional risk among children enabling more children to benefit from early nutritional intervention. (Mei *et al.,* 2008).

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