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Nutritional Status of Preschool Aged Children in Anambra State, Nigeria

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Abstract: *Eradicating childhood malnutrition is important if childhood mortality must be reduced. Reduction of childhood mortality is the fourth agenda on the eight point Millennium Development Goals (MDGs). In order to assess the nutritional status of under-five year old children in Anambra State Nigeria, South Eastern Nigeria, a population based cross-sectional study was carried out using a survey of anthropometric data. Data was collected from 1188 pre-school age children from rural communities in Local Government Areas distributed within the three geopolitical zones of the State. Analysis of data was done using WHO Anthro statistical software (Version 3.2.2). Anthropometric indices and cut-offs based on WHO (2006). Normalized reference tables were used to assess degree of malnourishment. Malnutrition was defined as indices below minus two (-2) standard deviation from the median values of the standard WHO (2006) reference population. Result of the work showed that the rate of stunting, wasting and underweight were 1.1% 24.9% and 0.8% respectively. Labourers, plumbers, tailors, nurses and vulcanizers consisted the parental groups whose children/wards had weight-for-height Z-scores below minus 2 (two) standard deviation from the median value of the reference (WHO 2006) This result suggests that steps should be taken towards preventing seasonal increases in the prevalence of acute malnutrition in rural areas in the South Eastern Nigeria.*
Keywords: *Acute malnutrition, stunting, wasting, underweight, MDGs, WHO (2006) standard, Anambra State.*

I. Introduction

Malnutrition can be defined as all deviations from adequate nutrition. It still remains a major source of concern in developing countries (de Onis *et al.,* 2012). The consequences of malnutrition can be serious in childhood. Under-nutrition is responsible for 35% of disease burden of under-five year old children (Black *et al.,* 2008). It contributes to about 3.5 million deaths in children within the age group (Black *et al.,* 2008). Present research findings including follow up of intervention trials indicate that chronic malnutrition can have long-term negative consequences on various aspects of child development (Dewey and Begum, 2011). This results to poor cognitive function (Kar *et al.,* 2008) and learning deficits in children (World Bank, 2006). There is growing evidence of the link between childhood under-nutrition and chronic diseases in adulthood (de Onis *et al.,* 2010). Poor physical and health condition of adult in a population can affect the economy directly through loss of productivity and can as well aggravate poverty leading to further malnutrition among children in the population.

It is important therefore to detect malnutrition early in individual children and in the population so as to institute intervention plans aimed at eradicating childhood malnutrition and hence reduce childhood mortality. Reduction of childhood mortality is the 4^{th} agenda on the eight (8) point Millennium Development Goals (MDGs) and the attainment of a comprehensive set of development goals can be accelerated if given a nutritional perspective and approach (Ibe, 2012).

Nutritional assessment in under-five year old children can be carried out using anthropometric indicators which include stunting, wasting and underweight. In nutritional anthropometry, a child's index is compared with an internationally accepted reference population and children who fall below the recommended cut-offs are classified as malnourished. A malnourished child is one who has failed to attain the expected values for any of the nutritional indicators (e.g length-for-age, weight-for-height or weight-for-age) as compared with a healthy child of the same sex and age in the reference population (WHO Multi-growth Reference Study group, 2006). Depending on the references and descriptors used, malnutrition is defined as an anthropometric index below the -2 standard deviation from the median value of the reference population or below the fifth (5^{th}) percentile for a given anthropometric index.

Low weight-for-height relative to a child of same sex and age in a reference population is referred to as wasting. Wasting is normally used as an indicator of current nutritional status and can be used for screening of children at risk of childhood mortality and for measuring short term changes in nutritional status. It reflects a recent and severe process that has led to substantial weight loss. It may be the consequence of starvation or severe diseases (Diarrhoea in particular) but can also be due to chronic conditions. Weight-for-height reflects proper body proportion or harmony of growth. It is particularly sensitive to acute growth disturbances. Lack of

evidence of wasting in a population however does not rule out the absence of current nutritional problem (WHO 1989).

Weight-for-age reflects body mass relative to age. It is a composite measure of weight-for-age and weight-for-height. It combines the effect of long term and short term health and nutritional problems and represents a convenient measure of both linear growth and body proportion. Weight-for-age can be used for the diagnosis of underweight in children (WHO, 1986).

Low weight-for-age relative to a child of same sex and age in a reference population is referred to as "lightness" while long term "underweight" is commonly used to refer to severe pathological deficits in weight-for-age.

Stunting can be defined as failure to achieve one's genetic potential for height (Golden, 2009). Many genetic and environmental factors modify stature: Growth hormone deficiency, impaired kidney function, psychological deprivation and under-nutrition. Although stature has a genetic basis, there is increasing evidence of the strength that environmental factors such as poverty, and high frequency of infections have on the determination of final stature. Some workers suggest that environmental conditions are stronger determinants of stature compared to genetic factors in adverse conditions. Children throughout the world can reach their growth potential if they are nurtured in healthy environments under optimal health and nutritional care practices (Golden, 2009). In regions of poverty or warfare, for example, environmental factors like chronic malnutrition during childhood or adolescence may account for delayed growth and/or marked reduction in adult stature even without the presence of any medical conditions. Growth trends in such situations would show significant deviations from genetic expectations for the average height for a group of people with related genetic background that are under the same socio-economic conditions. Genetics is a major factor in determining the height of individuals but it is far less influential in regard to populations. Average height is relevant to the measurement of the health and wellness (i.e standard of living and quality of life) of populations (In Rona *et al.,* 2000) and physical growth has long been recognized nutritionally as an important public health indicator for monitoring nutritional status and health in populations (Tomkms *et al.,* 1981; Cesar *et al.,* 19994; Man *et al.,* 1998)

Low height-for-age (Stunting) or linear growth retardation is the best measure of child health inequalities as it is a multi-facet nutritional indicator which captures various dimensions of child health, development and environmental influence (Cole, 2003; Garza and de Onis 2004; Grantham-Mcgregor *et al.,* 2007; de Onis *et al.,* 2011). It reflects chronic malnutrition accumulated during pre or post natal periods because of poor nutrition and health (e.g chronic insufficient protein and energy intake) (Cogil, 2003; Dewey and Begun 2011). Stunting becomes irreversible after a certain age. The growing scientific evidence of its association with micronutrient deficiencies, poor cognitive development and school achievement, obesity, economic productivity in adulthood and poor reproductive outcomes (Black *et al.,* 2008; Dewey and Begum, 2011) makes it an important health hazard (World bank, 2006). Nutritional stunting due to poor living environment is estimated to affect over 178 million children (appox $1/3^{rd}$ of under-five year old) in developing countries in 2005 (de Onis, 2008). Stunting is a major contributor to the 2.2 million deaths among children (< 5 years) worldwide (Black *et al.,* 2008). The fifth report on World Nutrition situation states that stunting affects 147 million preschool children in developing countries, while 10 million of such children are believed to be Nigerians (UN-SCN, 2004). Globally, childhood stunting decreased from 39.7% in 1990 to 26.7% in 2010 and the prevalence is expected to reduce to 21.8% by 2020 (de Onis, 2008). This rate of reduction is still grossly inadequate if the Millennium Development Goal I (MDG I) of eradicating extreme poverty and hunger by 2015 in Africa must be achieved. United Nations Children's Fund (UNICEF) estimates that the prevalence of childhood stunting in Nigeria at 41% (de Onis et al., 2004). This indicates that stunting remains a major public health problem in the country and calls for action.

There exist variations in the patterns of childhood stunting within Nigeria. Victor et al., (2013) used data from birth histories including the 2008 Nigerian Demographic and Health Survey to estimate childhood stunting in the 36 states of Nigeria including the Federal Capital Territory. They reported that childhood stunting in Nigeria on the average was as high as 39% and ranged from 11.5% in Anambra state to as high as 60% in Kebi State.

Results of previous surveys (Ergo *et al.,* 2009; Akubugwo *et al.,* 2013b) suggested that the use of the WHO (2006) standard together with the Z-score as an anthropometric descriptor appeared to be a better predictor of chronic malnourishment in the under-five year old. Its use in child nutritional assessment studies was therefore recommended.

In Anambra State, Nigeria, previous nutritional surveys have revealed high incidences of malnutrition amongst pre-school aged children (Nnanyelugo, 1980). Okorigwe and Okeke (2009) observed a 7.7% incidence of stunting amongst pre-school age children in the same State by the National Center for Health and Statistics (NCHS) criteria. While Akubugwo *et al.,* (2013) recorded a prevalence of 6.9% by the same criterion. Majority of past under-five nutritional assessment carried out in Anambra State have been based on older references and not on the presently recommended WHO standard.

Monitoring childhood stunting in the country based on the more recent nutritional standards is important for performance evaluation of impacts of set intervention goals. This work is intended at estimating the current prevalence of childhood stunting, acute malnutrition and underweight in Anambra State, Nigeria based on the WHO (2006) standard and the Z-score. The work also presents the influence of parental occupation on childhood stunting, acute malnutrition and underweight.

II. Methods

Study Area

Anambra state is one of the 36 states in Nigeria. Its location co-ordinates are $6^0$20N, 7^0.00 E. Created on 27th August 1999, its capital is Awka. It covers an area of 4,844km^2 and has a population of 4,055,048 (DHS, 1999). Administratively, it is divided into 3 senatorial or geopolitical zones (Anambra North, Anambra South and Anambra Central Senatorial Zones respectively) each comprising seven (7) Local Government Areas. These are: Anambra Central senatorial zone; comprising Awka North, Awka South, Njikoka, Dunukofia,Aniocha, Idemili North and Idemili south. Anambra South comprising: Orumba North and South, Aguata, Ihiala, Ekwusigo, Nnewi North and South. Anambra North senatorial zone: comprising Onitsha North and South, Ogbaru,Oyi, Aghamelun, Anambra East and West (National population commission, 2010). Each local government is in turn divided into localities. For the purpose of this survey, Local Government Areas within Zones were taken as primary sampling units (PSU) or clusters.

The samples for this survey were selected using a two stage cluster design consisting of six Local Government Areas. In the first stage, the Local Government Areas were selected with a probability proportional to the size of Geopolitical Zone. The second stage involved the sampling of primary schools from the selected Local Government Areas in the three zones. Primary schools sampled were all from rural areas with varying degrees of urban influences.

Study Design

The study was a population-based cross-sectional study which used a survey of anthropometric data collected from under-five old children in rural communities distributed within the three (3) geopolitical zones of Anambra State.

Sampling Technique

Data Collection: A stratified two stage cluster sampling technique was employed in this survey and data was collected by visiting schools and taking anthropometric data from under-five year old children between June and July 2013. Other relevant information such as age, sex, parental background etc were collected using structured questionnaires. Anthropometric data was collected as recommended by Cogil (2003).

Ethical Consideration: Permission was sought from the relevant school authorities. All study participants, parents/guardians gave informed consent before their children/wards participation. All information provided in the questionnaires was confidential. The study was carried out in agreement with the directives layed down in the Helsinki declaration.

Variables

Nutritional status was measured by height-for-age (H/A) weight-for-age (W/A) and weight-for-height (W/H) Z-scores (i.e HAZ, WAZ and WHZ respectively). This means a child index as compared to the median value of the anthropometric index for a child of the same age and sex in the WHO (2006) reference population divided by the standard deviation in the reference population. Malnutrition and severe malnutrition were defined as anthropometric indices below minus two (-2) and minus three (-3) standard deviation (SD) from the median values of the standard WHO reference population (Monteiro *et al.,* 2002; Van de Poel *et al.,* 2008).

STATISTICAL ANALYSIS

Anthropometric indices and cut-offs based on WHO (2006) Normalized reference tables of Weight-for-height, Weight-for-age and Length-for-age and mean Z-sores were used to assess degree of malnourishment. WHO Anthro (Version 3.2.2) was used for data analysis. Means and standard deviations of each parameter were used to summarize the data for each age group. Z-score values of the various nutritional indicators were further correlated to the parental background using statistical package for social science (SPSS) version 17.

III. Results

Table 1: Prevalence of low length/height-for-age (stunting) by gender and age group in a sample of 1188 children from Anambra State.

Age range (Month)	Sex	Number	% below Z≤2SD	% below Z≤3SD	Mean Z-sore	SD
0 -5	Boys	0	0	0	-	-
	Girls	0	0	0	-	-
	Combined	0	0	0	-	-
6 - 11	Boys	5	0	0	3.80	0.42
	Girls	6	0	0	2.65	0.00
	Combined	11	0	0	3.51	0.67
12 -23	Boys	60	0	0	2.67	2.24
	Girls	67	0	0	2.75	1.52
	Combined	127	0	0	2.71	1.89
24 -35	Boys	128	0.9	0	2.66	1.90
	Girls	140	2.3	1.5	2.43	2.22
	Combined	268	1.6	0.8	2.53	2.08
36 - 47	Boys	158	0.7	0.0	2.17	1.64
	Girls	164	1.9	1.2	2.21	1.64
	Combined	322	1.3	0.6	2.19	1.64
48 - 60	Boys	245	1.2	0.8	1.90	1.46
	Girls	215	0.5	0.5	1.94	1.41
	Combined	460	0.9	0.7	1.92	1.43
0 - 60	Boys	596	0.9	0.4	2.20	1.69
	Girls	592	1.3	0.9	2.20	1.72
	Combined	1188	1.1	0.6	2.20	1.71

No case of stunting was noticed among the under 2 years old population. There was no significant difference in the rate of stunting observed within age ranges 24 -35, 36 – 47 and 48 – 60 months of age. Total rate of stunting in the entire population is 1.1% . Rate of stunting seemed to be higher amongst girls in most of the age groups

Table 2: Prevalence of low weight-for-age (underweight) by gender and age group in a sample of 1188 children from Anambra State.

Age range (Month)	Sex	Number	% below Z≤2SD	% below Z≤3SD	Mean Z-sore	SD
0 -5	Boys	0	-	-	-	-
	Girls	0	-	-	-	-
	Combined	0	-	-	-	-
6 - 11	Boys	5	0	0	1.46	0.94
	Girls	6	0	0	1.84	0.93
	Combined	11	0	0	1.67	0.91
12 -23	Boys	60	0	0	1.03	1.24
	Girls	67	0	0	1.20	0.96
	Combined	127	0	0	1.12	1.10
24 -35	Boys	128	0.8	0	0.58	1.02
	Girls	140	0.0	0	0.77	0.95
	Combined	268	0.4	0	0.68	0.99
36 - 47	Boys	158	0.0	0	0.67	0.96
	Girls	164	3.0	2.4	0.58	1.10
	Combined	322	1.6	1.2	0.62	1.04
48 - 60	Boys	245	0.4	0.4	0.40	0.93
	Girls	215	1.4	0.5	0.24	0.81
	Combined	460	0.9	0.4	0.33	0.88
0 - 60	Boys	596	0.3	0.2	0.58	1.01
	Girls	592	1.4	0.8	0.59	1.00
	Combined	1188	0.8	0.5	0.58	1.01

No case of underweight was observed among children below 2 years old. Underweight was more prevalent amongst the girls compared with the boys in the population (1.4% against 0.3%). Total population prevalence of underweight was 0.8% including 0.5% rate of severe underweight.

Table 3: Prevalence of low weight-for-length (wasting) by gender and age group in a sample of 1188 children from Anambra State.

Age range (Month)	Sex	Number	% below Z≤2SD	% below Z≤3SD	Mean Z-sore	SD
0 -5	Boys	0	-	-	-	-
	Girls	0	-	-	-	-
	Combined	0	-	-	-	-
6 - 11	Boys	5	25	25	-1.23	2.41
	Girls	6	50	16.7	-1.43	1.92
	Combined	11	40	20.0	-1.37	2.00
12 -23	Boys	60	26.5	16.3	-1.20	1.54
	Girls	67	35.5	19.4	-1.36	1.55
	Combined	127	31.5	18.0	-1.29	1.54
24 -35	Boys	128	33.3	15.1	-1.45	1.42
	Girls	140	27.0	11.7	-1.00	1.64
	Combined	268	30.0	13.3	-1.21	1.55
36 - 47	Boys	158	18.8	8.10	-0.88	1.65
	Girls	164	22.5	10.6	-0.93	1.56
	Combined	322	20.7	9.30	-0.91	1.60
48 - 60	Boys	245	18.8	4.70	-1.05	1.23
	Girls	215	26.0	6.90	-1.33	1.06
	Combined	460	22.2	5.80	-1.19	1.16
0 - 60	Boys	596	23.1	9.40	-1.12	1.45
	Girls	592	26.7	10.8	-1.14	1.45
	Combined	1188	24.9	10.1	-1.13	1.45

40% of children 6 – 11 months were wasted including 20% who were severely wasted. Prevalence of wasting decreased as the age ranges increased. Total population prevalence of wasting was 24% including 10.1% rate of severe wasting. It should be noted that this data was collected during the farming season which in Nigeria and in the south-East in particular is associated with scarcity and increase in price of staple foods

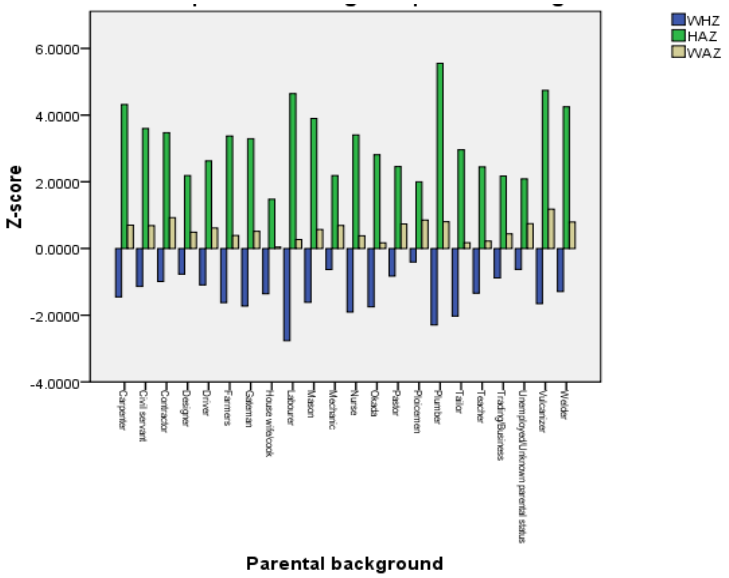

Figure 1: Mean W/H, H/A and W/A Z-score chart for groups of children with different parental backgrounds. Low levels of weight-for-height was more prevalent in the groups

IV. Discussion

In this study, a total of 1.1% out of the 1188 under-five year children included in this study were found to be stunted, 24.9% were wasted while 0.8% were underweight.

Stunting: Poverty has a more detrimental effect on linear growth than on body weight (Black *et al.*, 2008). Poor living conditions including household insecurity, low parental education, unavailability or lack of access to quality health care and unhealthy living environments are among the major factors determining growth rate. Stunting is therefore used as direct growth measure of the quality of life of the entire population and as an

indicator of food adequacy. This is because adverse conditions that are closely related to the general standard of living invariably affect growth of a child. Low length-for-age is therefore the best measure of child health inequalities as it is a multifacet nutritional indicator which captures various aspects of child health development and environmental influence (Cole, 2003; CPS, 2004; Garza and de Onis, 2004; Gartha-Mcgregor *et al.,* 2007; de Onis *et al.,* 2011).

The result of this work showed that no case of stunting was noticed among under two (2) year old children. Stunting rates across the age ranges showed a greater improvement compared with the pattern observed in previous surveys carried out in Anambra State (Akubugwo et al., 2013 a and b), where a 7.0% prevalence rate of stunting was observed among the under-five population in Anambra State. There was no significant difference in the rate of stunting observed within the age ranges 24 – 35, 36 – 47 and 48 – 60 months. Rates of stunting seemed to be higher amongst girls in most of the age groups.

Underweight: No case of underweight was observed amongst children below two (2) years old. A higher prevalence (1.6%) of underweight was observed amongst the 36 – 47 months age range compared with children within 24 – 36 months (0.4%) and 48 – 60 months (0.9%). Underweight was more prevalent amongst the girls compared with the boys in the population (1.4% as against 0.3%).
Total prevalence of underweight observed amongst the under-five population in the State was 0.8%. This includes 0.5% of severely underweight children. This value is much lower than the prevalence rate of 23% obtained during the Nigerian Demographic Health Survey of 2006.

Wasting: The most prevalent form of malnutrition observed in the State was wasting (24.9%). This result is consistent with the pattern observed in previous study (Akubugwo *et al.,* 2013), where the observed prevalence of wasting was consistently higher than the rates of stunting and underweight in all the three geopolitical zones of Anambra State. 40% of children 6 – 11 months were wasted including 20% who were severely wasted. This age range recorded the highest percentage of wasting. This indicates that children in this age range were more susceptible to the factors that predispose pre-school age children in the population to wasting. Wasting is an indication of acute malnourishment (Cogil, 2003). The rate of wasting observed in this study can be attributed to seasonal variations in the availability of food. The survey data was collected during the raining or farming season. In farming communities in South-Eastern Nigeria, the planting season is usually associated with scarcity of the major staple crops such as cocoyam, potatoes and corn. Rural dwellers usually survive on cassava, snails and vegetables which are available during this period as well as dried cocoyam and corn which are stored during the harvest season. The total population prevalence of wasting was 24.9% including 10.1% rate of severe wasting.

Wasting (Acute Malnutrition) increases a child's risk of dying; in its severe form, it increases a child's mortality risk by nine times as compared to children who are not undernourished. It is possible that there are seasonal variations in the prevalence rate of wasting and steps must therefore be taken to prevent increases in the prevalence of acute malnutrition amongst the under-five rural population in Anambra State, especially during the planting seasons. In 2006, the Nigerian Demographic and Health Survey (DHS) indicated that 14% of Nigerian children aged 0 – 59 months were wasted. This study records a much higher (24.9%) rate (an indication of chronic malnutrition).

The total rate of childhood stunting observed in this work showed a drastic reduction compared with prevalence observed on previous studies (Nnayelugo, 1980; NDHS, 2006; Victor *et al.,* 2008; Okoroigwe and Okeke 2008; Akubugwo *et al.,* 2013). Victor et al (2008) observed that Anambra State in South Eastern Nigeria and Lagos State in South Western Nigeria had the lowest rates of childhood stunting in Nigeria. In their study which was aimed at examining the variations in childhood stunting amongst the 36 States of the country. They observed the least stunting prevalence rate of 11.5% in Anambra State followed by 16% in Lagos State. This inferred that there are special practices from this States that could be identified as good practices. Subsequent studies have shown a consistent reduction in the rates of stunting in Anambra State. Okoroigwe and Okeke (2008) observed a 7.7% rate by NCHS criteria while Akubugwo et al (2013) observed a stunting prevalence of 7.0 and 6.9% by WHO standard and the NCHS reference respectively.

This current study observed a much lower rate of stunting (1.1%). This trend shows that there is a consistent reduction in stunting rate in the state from 1980 till date. This development is commendable. All the participants in this work were drawn from rural communities. It can therefore be inferred that the lower prevalence of stunting observed in this study may be partly attributed to improved food availability and access to farm lands in rural communities in Anambra State compared with the urban settlers who have to contend with the high inflation rate in the country in managing their scarce finances to provide adequate food for their children and wards. Enlightenment programs being organized for rural dwellers by churches and NGOs on good health practices, home management and child nutritional practices may be having positive impact on the life and well being of the rural communities in Anambra State. Those good health practices employed by the State

educational and health institutions should be sustained and emulated by other States in the Country in order to help achieve the MDG 1.

The higher prevalence of stunting amongst the older age ranges (3 – 4 and 4 – 5 years) which were 1.3% and 0.9% respectively is a pointer to the fact that less attention is being paid to the diet of children in these age ranges. This may probably be because they are considered more independent than children in the lower age ranges. This same pattern was observed in a previous survey carried out in the same State (Akubugwo *et al.,* 2013). No case of stunting was observed amongst under two year old children. This trend is an improvement compared with what was observed previously by the same workers (Akubugwo et al 2013) where higher rates of stunting was observed among 1 – 2 year old children compared with 3 – 4 year old children.

Tables 1, 2 and 3 showed that the prevalence of low levels of all the three nutritional indicators was slightly higher amongst girls compared with boys. Although this difference was not much, this observation still suggests that more attention to be paid to the nutrition of the girl child.

Low levels of nutritional indicators and parental background: The z-score values for the various groups of children show that there was no significant level of wasting and underweight amongst children from different parental background. Low level of weight-for-height was more prevalent in the population. Labourers, plumbers, tailors, nurses and vulcanizers consisted the parental groups whose children/wards had weight-for-height Z-sores below minus 2 (two) standard deviation from the median value of the reference (WHO, 2006) population. It should be noted here that the majority of the nurses encountered in the local Governments Areas from which data for the study was obtained were those with low qualifications who either worked in private hospitals or operated patent medicine stores.

V. Conclusion

The result of this work warrants further studies to identify what processes that are peculiar to this State. Such processes should be recommended and adopted by other States especially the Northern States of Nigeria in order to reduce the prevalence rates of stunting and underweight in other states in Nigeria, particularly the Northern states

Optimal nutritional status results when children have access to affordable, diverse nutrient rich food, appropriate maternal and child care practices and adequate health services, safe water supply and a healthy environment. It is suggested that the Anambra State Government and all stake holders intensify effort aimed at eliminating all forms of childhood malnutrition and ensure a healthy under-five population in the State.

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References

[1]. Akubugwo, E.I Okafor I. N Ezebuo, F.C**.** Nwaka, A.C and Okafor, S.O (2013b**)** Prevalence of stunting amongst pre-school age children from selected towns in Anambra south Senatorial zone *International Journal of Life Sciences Biotechnology and Pharma Research* 2 (4): 127 – 136

[2]. Akubugwo, E.I., Okafor I. N ., Ezebuo, F.C. and Nwaka, A.C (2013a) Comparative Prevalence of Low Levels of Nutritional Indicators Using NCHS and WHO Reference/Standards *International Journal of Research and Reviews in Pharmacy and Applied science* 3(3) 413-431

[3]. Black R.E. Allen L.H., Bhutta Z.A., Caulifield L.E., de Onis M., Ezzati M., *et al* (2008), Maternal and Child undernutrition: global and regional exposures and health consequences. *Lancet* **371:** 417-440.

[4]. Cesar, G.V., Fuclis S.C., Flores, J.A., Fonseea W., Kirkwood B. (1994) Risk Factors for Pneumonia in a Brazilian metropolitan area. Pediatres **93** (6pt1):977-85.

[5]. Cogil, B. (2003) Anthropometric Evaluation and Annual Monitoring Indicators: In Anthropometric indicators measurement guide. Food and Nutrition Technical Assistance project, academy for educational development. Washington D.C.

[6]. Cole, T.J and Flegal, K.M (2003) Establishing standard definition of child's malnutrition. *B.M.C Journal* vol 19 (4): pp 40-68.

[7]. de Onis, M (2008) Child undernutrition based on the new WHO growth standards and rates of reduction to 2015. SCN News 36: 12 – 6

[8]. de Onis, M., Blossner, M., Borghi, E., (2012). Prevalence and trends of stunting among pre-school children. *Public Health Nutrition.* **15** :142-8.

[9]. de Onis, M., Blossner, M., Borghi, E., Frorgillo, E.A. and Morris, R (2004) Estimates of global prevalence of childhood underweight in 1990 and 2015 JAMA **291**: 2600 – 6

[10]. Demographic health survey (1999) Federal Office of Statistics (Nigeria and UNICEF) Multiple indicator cluster survey (1999). Nigeria (MICS). Lagos: Federal Office of Statistics and UNICEF, December 14, 2000.
[11]. Dewey, K.G and Begum, k (2011) Long-term consequences of stunting in early life. Maternal and Child Nutrition 7 (suppl. 3), 5-18
[12]. Ergo, A., Gwatkin D.R., Sheker M., (2009). What difference do the new WHO Child Growth Standard make for the prevalence and socio-economic distribution of undernutrition? *Food Nutr. Bill* **30** (1): 3-15.
[13]. Ergo, A., Gwatkin D.R., Sheker M., (2009). What difference do the new WHO Child Growth Standard make for the prevalence and socio-economic distribution of undernutrition? *Food Nutr. Bill* **30** (1): 3-15.
[14]. Garza C., de Onis M. (2004) Rationale for developing a new nutritional growth reference. *Food Nutri. Bull,* **25**(Supp. 1): 55-12.
[15]. Garza, C and de Onis, M (2004) Rational for developing a new nutritional growth reference. Food Nutrition Bulletin, 25 (sopp. 1): pp 12-55.
[16]. Golden, M.H (2009) Proposal recommended nutrient densities for moderately malnourished children. Food and Nutrition Bulletin 30 (3 supp.), S267 – S342
[17]. Gratham-McGregor., S Chevny, Y.B., Cueto, S., Glewwe, P., Richter, L and Stropp, B (2007) Developmental potential in the first 5 years for children in developing countries *Lancet* **369** 60 – 70
[18]. Ibe, S.N (2012) Using Scientific knowledge to achieve MDGs in 21st century. Is it attainable? A key note address delivered at the Maiden scientific conference of the faculty of science, Anambra State University, Uli. 3rd – 5th September, 2012.
[19]. In Rona, R.J., Mahabir, O., Roche, B., Chinn, S. and Gulliford, M.C. (2003) "Social inequalities and children height in Trinidad and Tobago" European Journal of Clinical Nutrition 57 (1) 143 – 50
[20]. Kar B., Rao, S. and Chandramouli, B (2008) Cognitive development in children with chronic protein energy malnutrition. Behavioral and Brain Functions 4 31
[21]. Man W.D., Weber M., Palmer A. (1998) Nutritional status of children admitted to hospital with different diseases and its relationship to outcome in the Gambia, West African *Trop Med. Int. Health* **3:** 678-86. Medline web of science.
[22]. Monterio, C.A., Conde, W.L. and Popkin, B.M., (2002) Is Obesity replacing or adding to undernutrition? Evidence from different social classes in Brazil. *Public Health Nutr*., **5**(1A):105-112.
[23]. Nnanyelugo, D.O (1980). The Nutritional Status of Children in Nigeria. Anambra State Experience: an assessment of existing nutritional practice, anthropometry, food intakes and suggested improvements. University of Nigeria press Nsukka.
[24]. Nnanyelugo, D.O., (1980). The Nutritional status of children in Nigeria. Anambra state experience: an assessment of existing nutritional practice, anthropometry, food intakes and suggested improvements. University of Nigeria press Nsukka.
[25]. NPC (2010) National population commission workshop on compendium of localities in Nigeria in the South-East geopolitical zone (Anambra State)
[26]. Okoroigwe F, Okeke E (2009). Nutritional Status of Pre-school children aged 2-5 years in Aguata L.G.A. of Anambra State. *International journal of nutritional and metabolism* vol. **1**(1) Pp. 009-013.
[27]. UN – SCN (2006) United Nations Standing Committee on Nutrition Report on the World situation: Nutrition for improved development outcomes. www.unscn.org/en/publication/rwn/.
[28]. Van de Poel, E., Hosseinpoor, A.R., Speybroeck, N., Van Ourti, J. and Veya, J (2008) Socioeconomic inequality in malnutrition in developing countries. Bull World Health Org. **86**: 282 – 91
[29]. Victor, T.A., Olalekan, A.U. and Oludare, M.M (2013) Exploring variations in childhood stunting in Nigeria using large table, cont chart and spatial analysis. BMC Public Health 13: 261 doi: 10:1186/1471 – 2458 – 13 -361
[30]. WHO Multicentre Growth Reference Study Group (2006) Assessment of differences in linear growth among populations in the WHO Multicentre Growth Reference Study. *Acta Paediatrica Supplement* **450** 56 – 65
[31]. World Bank (2006) Repositioning Nutrition as central to development. A strategy for large-scale action. The world bank; Washington, DC, USA http://siteresources.worldbank.org/NUTRITION/RESOURCES|281846-1131636806329/Nutritionstrategy.pdf. (Accessed on 13. sep. 2010)