Niger J Paediatr 2017; 44 (1): 7– 13

ORIGINAL

**Adam VY**
**Isah JA**

# Prevalence and comorbidities of childhood overweight and obesity among school aged children in an urban settlement in Benin City, Nigeria

DOI:http://dx.doi.org/10.4314/njp.v44i1.2

Accepted: 6th December 2016

Adam VY (✉)
Department of Community Health

Isah JA
Department of Child Health
University of Benin Teaching Hospital
Benin City Nigeria.
Email: Vincent.adam@uniben.edu.ng

**Abstract***: Background:* The prevalence of childhood overweight and obesity is rising worldwide and its impact spanning through adolescence to adulthood.
*Objectives:* This study aimed to determine the prevalence of overweight and obesity and the occurrence of high blood pressure and elevated blood glucose among school aged children in an urban settlement in Benin City, Nigeria.
*Design:* A cross-sectional, descriptive study was utilized.
Subjects and setting: A total of 195 school aged children residing in households in the selected ward were recruited for the study carried out between 2014 and 2015.
*Outcome measures:* Anthropometric measurements were recorded and used to determine the body mass indices (BMI) of the children. Also blood pressure measurements and random blood sugars of the respondents were determined to ascertain the blood pressure and glycaemic status of the children.
*Results:* The proportion of overweight respondents was 7.7% and 3.1% for obesity giving a combined proportion of 10.8% while that for underweight was 11.8% amongst the study respondents. The females, 18 (16.6%) had a significantly higher proportion of overweight and obesity than the males, 3 (3.5%) [p = 0.003]. The prevalence of hypertension was 6 (3.1%) and elevated blood glucose was 4 (2.1%).
*Conclusion:* The prevalence of overweight was 7.7% while that for obesity was 3.1%. Also, the prevalence of hypertension and elevated blood glucose was 3.1% and 2.1% respectively amongst the school aged children and females had a significantly higher proportion of overweight and obesity than males in the study. There is a need for public enlightenment towards promoting healthier lifestyle choices and screening of disease conditions early in childhood.

**Keywords:** Prevalence, Comorbidities, Overweight and obesity, School aged children, Nutritional status.

## Introduction

Obesity has been recognized for thousands of years as seen in Stone Age Statues that depicted the excessive roundness of the female human form. Hippocrates first pointed out the possible negative health effects of obesity when he observed that very fat individuals were more likely to die from sudden death than thin individuals.[1] It was commonly held belief that the heavier a child, the healthier he was, in order words 'the bigger the better'. This attitude began to change by the late 19th century and has continued to the present time with increasing recognition of the associated health risks of overweight and obesity (OWOB).[2,]

There is a global increase in the prevalence of overweight and obesity. The worldwide prevalence has doubled between 1980 and 2014, at present 35% of adults >20 years are overweight with 11% obese.[] In 2012, about 40 million children < 5 years were OWOB and the prevalence was 30% higher in developing countries than in developed countries.[5]

The children who are OWOB face the twin burden of diseases in childhood as well as increased morbidity and mortality in adulthood. In childhood, they often have breathing difficulties, increased risk of fractures, hypertension and psychological problems while in adulthood they have a higher risk of premature deaths, disability

and obesity.[6] The problem of OWOB in children is significant because of the associated health burden on the child and its implication on the health of the future adult population.[7]
In the United States (US), the third National Health and Nutrition Surveys (NHANES)[8] showed that there have been increases of OWOB in all age groups and across both gender over a period of 20 years from the NHANES II and NHANES III and that girls were more affected than boys. A similar increase was also reported in Japan where the frequency of obese school children between the ages of 6-14 years increased from 5% to 10% from 1974 to 1993.[9]

In a related study done to determine the prevalence of OWOB using data on 720 children aged 6-18 years in Ile-Ife, Nigeria. The results showed that 2.8% and 0.8% were overweight and obese respectively. Females were more likely than males to be obese.[10] Similar findings were obtained in another study conducted in Calabar, Nigeria, among 1,005 children and adolescents aged 6-18 years resident within the state. The results showed that the prevalence of obesity was 2.3% in the children aged 6-12 years. The BMI was higher in females than in the males.[11] A related study was done in the three senatorial districts in Benue State to assess the demographic variation in the prevalence of OWOB using 3240 children aged 9 to 16 years. The results showed that 88.5% had normal weights, 9.7% were overweight and 1.8% were obese. Females (20.3%) were more likely to be overweight than boys (16.2%).[12]

There is a dearth of information on the prevalence and comorbidities of childhood overweight and obesity in school aged children within Nigeria and particularly in Benin City. This study hopes to assess the presence of OWOB and associated comorbidities among school aged children in Egor Local Government Area, Edo State. The information derived from this study would therefore add to the available data on childhood overweight and obesity and may contribute to the formulation of health related policy at the school and Local Government level.

## Material and methods

This descriptive cross-sectional study was carried out in Uselu, an urban settlement and headquarters of Egor Local Government Area (LGA) in Benin City, Nigeria. Egor LGA which is one of the four LGAs making up Benin City comprises of 10 political wards. The LGA has an estimated population of 420,643 people, with 220,226 children aged <15years (2014 estimated population).[13] The study participants included school aged children (6-12 years) residing in households within the selected houses in the study area.
The minimum sample size for the study was determined using the Cochran formula for simple proportion.[14] $n = z^2pq/d^2$ where p = 11.4% (proportion of overweight Nigerian children in a study carried out in Uyo, Nigeria.[15] The calculated minimum sample size was 155, with an addition of 16 (non-response rate of 10%), 171 was obtained as the sample size. For the purpose of this study 195 school aged children were recruited.

A cluster sampling technique was utilized for this study. The urban settlement is divided into two by a major road on which the LGA secretariat is located. The area on the left of the major road was selected by simple random sampling through balloting and this formed a cluster. In the selected area, a total of 332 houses were enumerated consisting of 525 households. Those households that the parents gave their permission and who had children that met the inclusion criteria were selected for the study. A total of 195 children were selected for the study.
The tool for data collection was a researcher-administered structured questionnaire, pre-tested in Isiohor community in Ovia North-East LGA, Benin City. The questionnaire also contained details of the physical examination of the children including their weights, heights, BMI, blood pressure and random blood sugar. Research assistants comprised of four doctors and four final year medical students who were trained on how to obtain information using the questionnaire and carry out anthropometric measurements. This was done in order to ensure reliability of the information and the measurements obtained.

*Measures*

The heights of the respondents were measured using a stadiometer. The children pulled off their footwear and stood on the stadiometer (Axiom® RGZ – 160) according to the National Health and Nutrition Survey (NHANES) protocol.[16]Also, the weights of the children were measured with their normal household wears only. They were asked to empty their pockets, pull off sweaters or vests, belts and wrist watches and void before having their weights taken.[16] The children were weighed using a Seca® digital electronic scale (Seca gmbh & Co, Germany) with a calibration of 0.1kg. The Body Mass Index (BMI) was calculated using the formula, BMI= Weight (Kg) / Height$^2$ ($m^2$). Blood pressures were also taken with the children sitting in a comfortable chair using a mercury sphygmomanometer using standard procedures.[17] The blood pressure was measured twice and the mean value calculated and recorded for each child.

In addition, the blood sugars were determined using Accucheck® blood sugar kit. The thumbs of the children were cleansed with an alcohol swab, and pricked with an individual sterile lancet. A drop of blood was applied to the test strip and the blood sugar read off the screen of the meter. The instrument was standardized using the code strip standard that came with the kit. The kit was re-standardized after every 30 readings or before each day's activity whichever came first. The values obtained were documented. A parent/care giver was present during the examinations.

*Data analysis*

The data was analyzed using IBM SPSS version 21.0 (SPSS for Window Inc; Chicago, LL, USA) Statistical software and the WHO Anthroplus®. The socio-economic class was obtained using the protocol developed by Olusanya et al.[18] The purchase and consumption of sugar sweetened beverages was grouped into "often" (if consumed at least three times weekly) and "rarely" (if consumed at most once monthly). The age was summarized as mean ± standard deviation (SD), while the age-groups and BMI category of the respondents were represented as proportions. Fisher's exact test was utilized to determine association with level of significance set at $p \leq 0.05$.

The BMI of the respondents was further classified using the WHO Growth Reference for school-aged children and adolescents according to their age and gender.[19] The respondents with BMI < -2SD for age and sex (thinness and severe thinness) were classified as underweight, between the ≥ -2SD to ≤ 1SD were classified as normal; >1SD were classified as overweight; while >2 SD were classified as obese.
The mean blood pressure of the respondents were classified using the standard chart for age, sex and height.[20] The values ≤ 95$^{th}$ percentile were classified as normal, > 95$^{th}$ percentile was classified as hypertension. The random blood sugar values were classified thus: ≤ 140 mg/dl as normal and > 140 mg/dl as elevated.

*Ethical considerations*

Ethical clearance was obtained from the Ethics and Research Committee of the University of Benin Teaching Hospital (UBTH) [protocol number ADM/E22/A/VOL VII/1141]. Also, permission was obtained from the Heads of the communities within the selected EAs and the parents/ guardians of each of the selected children. Assent was obtained from children older than 8 years of age. The children who had abnormalities detected (elevated blood pressure and blood sugar) were referred to the Paediatric Cardiology and Endocrinology Units of UBTH respectively. The underweight and overweight/ obese children were referred to the Paediatric Gastroenterology/ Nutrition Unit of the same hospital for management and follow-up after educating them on adequate nutrition and importance of physical activities. All data obtained were treated with utmost confidentiality.

*Limitations*

Some of the information obtained from the children may have been subject to bias from recall and self-reporting. In addition, the blood sugar obtained from the respondents was a random blood sugar instead of fasting blood sugar or 2hr post prandial (2hrPP) which would have been a better marker of the glycaemic status of the school aged children. However, this would have been difficult to obtain in a community study.

**Results**

A total of 195 children were surveyed. More than half, 109 (55.9%) of the respondents were females. The mean age of the children was 8.6(± 2.0) years with 96 (49.2%) of them aged between 6-8 years. Majority, 117 (60.0%) of the participants were in the lower socio-economic class, with 189(96.9%) being Christians. About a tenth 21(10.8%) were from extended families and136 (69.7%) were Benin. Table 1

**Table 1:** Socio-demographic characteristics of the respondents

| Socio-demographic characteristic | Frequency (N = 195) | Percent (%) |
|---|---|---|
| *Age group (years)* | | |
| 6-8 | 96 | 49.2 |
| 9-10 | 59 | 30.3 |
| 11-12 | 40 | 20.5 |
| *Gender* | | |
| Male | 86 | 44.1 |
| Female | 109 | 55.9 |
| *Socioeconomic class* | | |
| Upper | 21 | 10.8 |
| Middle | 57 | 29.2 |
| Lower | 117 | 60.0 |
| *Ethnicity* | | |
| Benin | 136 | 69.7 |
| Igbo | 20 | 10.3 |
| Esan | 15 | 7.7 |
| Isoko | 11 | 5.6 |
| Urhobo | 8 | 4.1 |
| Yoruba | 5 | 2.6 |
| *Religion* | | |
| Christian | 189 | 96.9 |
| Muslim | 6 | 3.1 |
| *Family Type* | | |
| Nuclear | 174 | 89.2 |
| Extended | 21 | 10.8 |

Most, 160(82.1%) of the respondents took snacks in-between meals and 139(71.3%) had pastries as the snack. Only, 3(1.5%) of the respondents took either fruits or groundnut (legumes) and majority, 129(66.2%) had snacks once or twice daily. Sugar sweetened beverages were bought in 81(41.5%) of the homes of the respondents. Table 2

Of the 195 respondents, 151(77.4%) had normal BMI, while, 15(7.7%) and 6(3.1%) were overweight and obese respectively. Also, 23(11.8%) who were underweight. Almost all the respondents, 189(96.9%) and 191 (97.9%) were normotensive and normoglycaemic respectively. The prevalence of hypertension and elevated blood sugar was 4(3.1%) and 2(2.1%) respectively.
There was no significant difference in association between the glycaemic status of the respondents and the BMI classification of the respondents ($p = 1.000$). However, an equal proportion, 3(50.0%) of the respondents with elevated blood pressure were overweight or had normal weights. This association between the elevated

blood pressure and BMI of the respondents was statistically significant (p = 0.020). Table 3

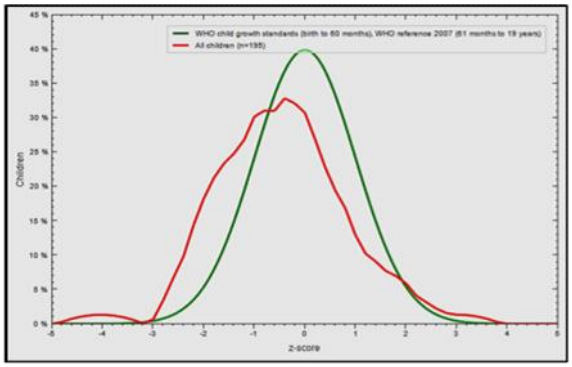
**Table 2:** The snacking pattern (intake, daily frequency and the type of snack taken in between meals) of the respondents

| Variable | Frequency (N) | Percent (%) |
|---|---|---|
| *Intake of snacks* | | |
| No | 35 | 17.9 |
| Yes | 160 | 82.1 |
| *Type of snack* | | |
| None | 35 | 17.9 |
| Pastries* | 139 | 71.3 |
| Soft drinks | 9 | 4.6 |
| Ice cream | 6 | 3.1 |
| Fruit | 3 | 1.5 |
| Groundnut | 3 | 1.5 |
| *Daily frequency* | | |
| None | 35 | 17.9 |
| 1-2 | 129 | 66.2 |
| 3-4 | 28 | 14.4 |
| ≥ 5 | 3 | 1.5 |
| Purchase of sugar sweetened beverages | | |
| Often | 81 | 41.5 |
| Rarely | 114 | 58.5 |
| Total | 195 | 100.0 |

*Pastries: Biscuits, Egg roll, Cake, Meat pie.

The mean BMI z score of the respondents was -0.46 (SD 1.23) and ranged from -4.04 to +3.03 which indicates that on the average, the study population consisted mainly of normal weight children although there was a wide spectrum from severe thinness (underweight) to obese respondents. Fig 1

**Fig 1:** Distribution of the BMI for age z-scores of the respondents compared with the WHO growth reference for school aged children and adolescents

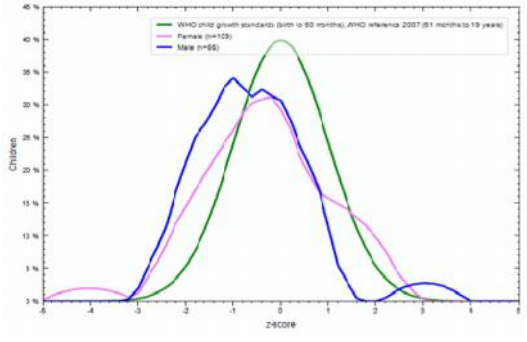



The mean BMI z score for the male respondents was -0.61, SD 1.13 while that for the females was -0.35, SD 1.31. Thus, both gender on the average had normal BMI. However, the males had a greater tendency to underweight than the female respondents. Fig 2

**Table 3:** The blood pressure, glycaemic status and the BMI of the respondents

| Variable | BMI category: Underweight | Normal | Overweight | Obese | Test statistic |
|---|---|---|---|---|---|
| | Frequency (%) | | | | |
| *Glycaemic status* | | | | | |
| Normal | 23(12.0) | 147 (77.0) | 15 (7.8) | 6 (3.2) | *Fisher's exact = 0.889* |
| Elevated | 0 (0.0) | 4(100.0) | 0 (0.0) | 0 (0.0) | *p = 1.000* |
| *BP status* | | | | | |
| Normal | 23 (12.2) | 148 (78.3) | 12 (6.3) | 6 (3.2) | *Fisher's exact = 8.886* |
| Elevated | 0 (0.0) | 3 (50.0) | 3 (50.0) | 0 (0.0) | *p = 0.020* |

**Fig 2:** Distribution of the BMI for age z score of the respondents according to gender compared with the WHO growth reference for school aged children and adolescents




## Discussion

The prevalence of overweight in this study was 7.7% which is lower than those reported in studies done in BenueState[12] and Ile-Ife, Osun State[10] in Nigeria and another study carried out in Khartoum, Sudan[21] with reported prevalence of 9.7%, 13.7% and 14.8% respectively. The observed prevalence of overweight in this study was higher than findings reported in several studies done in Southern Nigeria with reported prevalence of 6.7%, 5.7%, 4.1% and 1.6% in Abia,[22] Port Harcourt,[23] Anambra[24] and Owerri[25] respectively. The proportion of obesity observed in this study was akin to findings from several studies carried out in Nigeria, such as: 3.0% in Lagos[26] 2.8% in Ile-Ife,[10] and 2.3% reported in Calabar,[11] but higher than 1.8% in Benue State[12] and Owerri[25] including 0.8% in Abia.[22] The value was however lower than 5.9%, 5.2% and 10.5% reported in studies done in Port Harcourt,[23] Ile-Ife[27] in Nigeria and Khartoum, Sudan[21] respectively.

The varying values could be because of the different study populations comprising of only school aged children, a combination of school aged children and adolescents up to 18 years or adolescents only. This study re-

cruited school aged children only. Furthermore, the method used in defining overweight and obesity differed as some of the studies used the BMI alone or BMI percentiles. Also, different BMI percentile charts are available such as the NCHS/WHO chart of 1977 and the 2007 WHO percentile charts used in this study. It has been reported that these two reference charts differ significantly as the 2007 WHO chart used a more diverse population in the sampling and also used the growth curve of the exclusively breast fed child as the standard.[27] There is a need for uniformity in the assessment of OWOB amongst children to allow for adequate comparisons and monitoring to be done.

The large proportion of normal weight school aged children when compared with the WHO child growth standards is encouraging as it indicates that over two-thirds of the respondents likely have optimal nutritional status. It however does not exclude covert micronutrient deficiency. In addition, over a fifth of the respondents were malnourished if proportions of overweight, obese and underweight respondents are combined. This may indicate that some of the objectives of the National School Health Policy such as the improvement of the nutritional status of school children through provision of at least one adequate meal a day to school children and regular deworming[28] are being poorly implemented in the study area which may necessitate further studies involving the schools in order to assess the school feeding services in the study area.

The findings from this study show that the twin problem of underweight and OWOB was identified among the study respondents. This is similar to what other researchers have reported in South Africa[29] as well as in Osun State,[10,30] Uyo,[15] Owerri,[25] and Anambra[24] within Nigeria. This shows that the 'double-burden' of disease[31] as described is a burgeoning problem within the study locale. This is of public health significance as it is a reflection of the potential disease burden that the health systems within the study area may have to grapple with. This burden would therefore likely consist of the more traditional problems of infectious diseases as well as illnesses resulting from malnutrition and underweight and in addition face the impact of the non-communicable diseases (NCDs) such as hypertension, diabetes and obesity that have been linked with childhood OWOB.[6,7,32] The prevalence of underweight in the study (11.8%) was lower than 17.0%, 17.3% and 22.7% reported for Owerri,[25] Osun[30] and Edo State in general[33] which could possibly be because the study area is relatively better developed and more affluent than those combining rural settlements.

A high proportion of the respondents took snacks in-between meals especially pastries. Few took either fruits or groundnut (legumes). The use of fruits and nuts as snacks should be promoted and made readily available in the homes. Access to sugar sweetened beverages that are patronized by a high proportion of children, which was reported in this study should be minimized in order to reduce their consumption. Frequent consumption of sugar sweetened beverages will increase the caloric intake of the children and could result in weight gain which might predispose the respondents to overweight and obesity and their consequences.[34]

The study also revealed that almost all of the respondents were normotensive and normoglycaemic. The relatively low prevalence of elevated blood pressure and blood sugar is commendable and could be a reflection of the low proportion of overweight and obese respondents in this study. The proportion of respondents with high blood pressure in this study was 3.1% which is lower than 4.7%, 4.9%, and 5.6% reported in Port Harcourt, Nigeria,[23] Khartoum, Sudan[21] and Sarvabad, Iran[35] respectively. There was no significant association between OWOB and elevated blood sugar amongst the study respondents as all of those with elevated blood sugar had normal BMI z-score.

Furthermore, half of those with elevated blood pressure were overweight and this association was statistically significant. In addition, 2.0% of the respondents with normal BMI had elevated blood pressure in contrast to the overweight respondents where a quarter had elevated blood pressure. Obesity is known to be associated with elevated blood pressure due to the increased salt retention and hyperinsulinaemia[36,37] that is linked to this condition. The finding in this study is similar to that of a study done in Seychelles[38] in which the obese boys and girls had three and five times higher proportion respectively of elevated blood pressure when compared to their colleagues with normal BMI. This is important because in most cases these children are asymptomatic initially and might only present later with end organ damage which have the potential of reducing their life expectancy and quality of life.[39,40] In order to curb this, health screening for overweight and obesity amongst school aged children through full implementation and strengthening of the school health services should be done.

## Conclusion

In conclusion, the prevalence of overweight and obesity was 7.7% and 3.1%. Also, the prevalence of hypertension and elevated blood glucose was 3.1% and 2.1%, amongst school aged children and females had a higher proportion of OWOB than males in Egor Local Government Area, Benin City, Nigeria. There is a need for public enlightenment towards promoting healthier lifestyle choices such as good nutrition and increased physical activities including screening of disease conditions early in childhood. In addition, the use of fruits and nuts as snacks should be promoted by making these readily available in the homes instead of the less healthy alternative of sugar sweetened beverages. This can be done by encouraging home and/or community gardening.

**Conflict of Interest:** None
**Funding:** None

**Acknowledgement**

The authors wish to express their gratitude to the people of Uselu community for the cooperation granted the researchers during the study period.

**Reference**

1. Maqbool A, Stettler N, Stallings VA. Nutrition. In: Kliegman RM, Stanton DF, Schur NF, Geme JN, Behrman RE editors. Nelson Textbook of Paediatrics. 19th ed. Philadelphia: Saunders Elseiver. 2011: 160.
2. Allison DB, Matz PE, Pietrobelli A, Zannolli R, Faith MS. Genetic and environmental influences on obesity. In:Bendich A, Deckelbaum RJ, editors. Primary and secondary preventive nutrition. *Totowa NJ: Humana Press. 2001: 147-164.*
3. Federal Ministry of Health (Nigeria) Nutrition Division. National Policy on Infant and Young Child Feeding in Nigeria. Abuja.2005.
4. Lobstein T, Baur L, Uauy R. International Obesity Task Force: Obesity in children and young people: a crisis in public health. *Obes Rev 2004; 1: 4-104.*
5. St Onge M P, Keller K L, Heymsfield S B. Changes in childhood food consumption patterns: a cause for concern in light of increasing body weights. *Am J Clin Nutr 2003;78:1068–1073.*
6. WHO. Prioritizing areas for action in the field of population-based prevention of childhood obesity: a set of tools for Member States to determine and identify priority areas for action. Accessed January 2015. Available from www.who.int/dietphysicalactivity/childhood/Childhood_obesity.
7. Singh AS, Mulder C, Twisk JW, van Mechelen W, Chinapaw MJ. Tracking of childhood overweight into adulthood: a systematic review of the literature. *Obes Rev. 2008; 9: 474-88.*
8. World Health Organization. Population-based prevention strategies for childhood obesity: report of a WHO forum and technical meeting, Geneva, 15–17 December 2009.Geneva: *World Health Organization; 2010.*
9. World Health Organization. Obesity: Preventing and Managing the Global Epidemic. World Health Organization Technical Support Series 894: World Health Organization Geneva, Switzerland. 2000
10. Adegoke SA, Adeodu OO, Olowu WA, Elusiyan JBE. Prevalence of overweight and obesity among children in Ile-Ife. Department of Paediatrics, Obafemi Awolowo University Ile-Ife; 2009. (Unpublished report)
11. Ansa VO, Odigwe CO, Anah MU. Profile of body mass index and obesity in Nigerian children and adolescents. *Niger J Med. 2001; 10: 78-80.*
12. Musa DI, Toriola AL, Monyeki MA, Lawal B. Prevalence of childhood and adolescent overweight and obesity in Benue State, Nigeria. *Trop Med International Health. 2012; 17: 1365-1375.*
13. National Population Commission (Nigeria). Population distribution by sex, state, LGAs and senatorial districts: 2006 Census priority Table IV. Vol 3. Accessed May 2014. Available from www.population.gov.ng/.
14. Cochran WG. Sampling Techniques, 2nd Ed.,New York: John Wiley and Sons, Inc. 1963
15. Opara DC, Ikpeme EE, Ekanem US. Prevalence of stunting, underweight and obesity in school aged children in Uyo, Nigeria. *Pak. J Nutr. 2010; 9:459-466.*
16. Han ST, Sattar N, Lean M. Assessment of obesity and it's clinical correlation. *BMJ. 2006; 333: 695-698.*
17. Timmis A. Cardiovascular System. In: Sawash M, Glynn M eds. Hutchinson's Clinical Methods, an integrated approach to clinical practice. Sunders Elseiver: USA. 2007:77.
18. Olusanya O, Okpere E, Ezimokhai M. The importance of social class in voluntary fertility control in a developing country. *West Afr J Med. 1985;4:205-212.*
19. WHO. Growth reference data for 5 -19 years. Accessed June 2014. Available from www.who.int/growthref/en/ National Institute for Health (USA). Blood pressure levels for boys and girls by age and height percentile. Accessed June 2014. Available from www.nhlbi.nih.gov
20. Salman Z, Kirk GD, Deboer MD. High Rate of Obesity-Associated Hypertension among Primary School children in Sudan. *Int J Hypertens 2011:629492.*
21. Odenigbo UM, Nkwoala CC, Okpala OC. Impact of birth weight on the nutritional status and academic performance of school age children. *Paki J Nutri. 2010; 9: 1157–1161.*
22. Okoh BA, Alikor EA, Akani N. Prevalence of hypertension in primary school-children in Port Harcourt, Nigeria. *Paediatr Int Child Health. 2012; 32: 208–212.*
23. Nwabueze AS, Ilika AL, Azuike EC, Nwabueze NC, Obi KM *et al.* Assessment of nutritional status among primary pupils in rural and urban areas of Anambra State. *Euro J Preventive Med,* 2015;3(2): 34-38 doi: 10.11648/j.ejpm.20150302.14
24. Nnebue CC, Ilika AI, Uwakwe KA, Duru CB, Onah SK *et al.* Feeding practices and determinants of the nutritional status of pupils in a public primary school in Aladinma Owerri, Nigeria. *Intl J. Clin Nutrition, 2016; 4(1): 12-18 doi: 10.12691/ijcn-4-1-3*
25. Ben-Bassey UP, Oduwole AO, Ogundipe OO. Prevalence of overweight and obesity in Eti-Osa LGA, Lagos, Nigeria. *Obes Rev. 2007; 8:457-459.*
26. Sabageh AO, Ojofeitimi EO. Prevalence of obesity among adolescents in Ile- Ife, Osun State, Nigeria using body mass index and waist hip ratio: a comparative study. *Niger Med J. 2013; 54: 153-156.*
27. Federal Ministry of Education (Nigeria). National School Health Policy. Abuja, 2006. Accessed May 2015. Available from www.unicef.org/nigeria/school_health_policy.pdf.
28. Toriola AL, Moselakgnmo VK, Shaw BS Goon DT. Overweight, obesity and underweight in rural black South African children. *S Afr J Clin Nutr. 2012; 25: 57- 61.*

29. Adeomi AA, Adeoye OA, Bamidele JO, Abodunrin OL, Odu OO, Adeomi OA. Pattern and determinants of the weight status of school-age children from rural and urban communities in Osun State, Nigeria: a comparative study. *J Med Nutr Nutraceuticals, 2015; 4 (2):107-114*
30. Theobald NS, Suchindran C, North KE, Popkin BM, Gordon-Larsen P. Association of adolescent obesity with risk of severe obesity in adulthood. *JAMA. 2010; 304(18):2042-7.*
31. Gunnell DJ, Frankel SJ, Nanchahal K, Peters TJ, Snith GD. Childhood obesity and adult cardiovascular mortality: a 57 year follow up study based on the Boyd Orr cohort. *Am J Clin Nutr, 1998; 67(6): 1111- 1118.*
32. Edo State Ministry of Health. Edo State Government 2010-2020 Strategic Plan: Edo State Basic health and social data. 2009; 1- 121.
33. Ansa VO, Anah MU, Ndifon WO. Soft drink consumption and overweight/obesityamong Nigerian adolescents. *CVD Prevention Control, 2008: 3: 191-196*
34. Rezaeian S, Ahmadzadeh J, Esmailnasab N, Veisani Y, Shayan M, Moradi N. Assessment of Health and Nutritional Status in Children Based on School Screening Programs. *Health Scope,* 2014; 3(1): e14462 doi: 10.17795/ healthscope-14462
35. WHO. Prioritizing areas for action in the field of population-based prevention of childhood obesity: a set of tools for Member States to determine and identify priority areas for action. Accessed January 2015. Avaliable from www.who.int/dietphysicalactivity/ childhood/Childhood_obesity.
36. Chiolero A, Gray M, Anderson G, Burnier M, Paccaud F et al. Prevalence of elevated blood pressure and association with overweight in children of a rapidly developing country. *J Human Hyperten. 2007; 21:120-127.*
37. Scott IU, Siatkowski RM, Eneyin NM, Brodsky MC, Lam BL. Idiopathic intracranial hypertension in children and adolescents. *Am J Opth. 1997; 124: 253-255.*
38. Lindhal BI, Jihansson LA. Multiple cause-of death data as a tool for detecting critricial trends in the underlying cause statistics: a methodological study. *Scand J Soc Med. 1994; 22: 145-158.*
39. Franks PW, Hanson RL, Knowler WC, Sievers ML, Bennett PH et al. Childhood obesity, other cardiovascular risk factors and premature death. *N Engl J Med. 2010; 362:485-493*