



Assessing Household Food Security Status and Nutritional Outcome among Underprivileged Children (10-19 Years) from East Senatorial District of Lagos State, Nigeria

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Abstract

Background: The purpose of this research work was to assess household food security and its nutritional implications on adolescents from selected Local Government Areas of Lagos, Nigeria.

Methodology: A cross-sectional study was conducted among school children (9- 20 years) in public and private secondary schools between March and June, 2017. The participants (2000) were selected from rural and urban communities using multistage sampling technique from three Local Government Areas of Lagos State. Information on bio-data and household Food insecurity access scale (HFIAS) were collected using pre-tested and semi- structured questionnaire. Height and weight of the participants were measured using standard methods. Data were analysed using statistical package, and results were presented descriptively. Chi-square test and odd ratio were calculated to compare means and relationship between parameters ($P < 0.05$).

Results: The socio-economic status of respondents parents were as follows: for educational attainment, 19.1% completed primary school, 33.1% secondary school and 27.8% tertiary level; while the remaining (20.0%) had no formal education. The average monthly income of the family heads showed that 63.7% earned less than twenty-five thousand Naira per month (\$71.4), while the remaining earned above. Occupation of the family head were farming (44.1%), self-employed (31.1%) and civil servants (21.8%). The prevalence of household food insecurity were mildly (15.9%), moderately (8.0%) and severely (4.6%), while the remaining families were food secured (71.6%). The mean weight, height and BMI of the female and male respondents were 47.6 ± 1.4 - 48.4 ± 1.7 kg, 1.57 ± 0.01 - 1.61 ± 0.00 m and 19.6 ± 0.3 - 19.3 ± 0.4 kg/m² respectively. The prevalence of underweight was higher in male adolescents (47.1%) than female (38.0%) counterparts, whereas, the prevalence of overweight/obese in female (7.6%) was higher when compared to that of male (6.0%) counter parts. Statistically, there was significant ($OR=1.03$, $P=0.004$) relationship between the household food security status and nutritional status outcomes of the participants.

Conclusion: This study finding showed high prevalence of household food insecurity, underweight and emerging cases of overweight and/or obesity among adolescents. Hence, there is a need for nutrition and economic intervention programmes in order to improve optimal nutrition among the children.

Keywords: Household food security; Nutritional implications; Adolescents

Introduction

Food insecurity is a common problem among the low-income households in developing countries of the world. Food insecurity is a condition whereby all people did not have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life [1]. The three basic components of food security policies, and programs in developing countries are availability (i.e., having sufficient quantities of appropriate food available), accessibility (having adequate income or other resources to access food), and utilization/consumption (having adequate dietary intake and the ability to absorb and use nutrients in the body) [1].

The utilization component of household food security is influenced by many factors such as nutrition knowledge and beliefs, access to healthcare, water, and sanitation services and practices relating to the management of childhood illness and hygiene [2]. Scientific study has reported that

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Table 1: Socio-economic status of the head of the family in Lagos State.

Parameters	Percentage of respondents (%)
Head of family educational attainment	
NO formal education	20
Primary school	19.1
Secondary	33.1
Tertiary institution	27.8
Head of family monthly income in Naira	
< 25,000	63.7
> 25,000	36.3
Head of family occupation	
Farming	44.1
Self-employed	31.1
Civil servants (< Grade Level08)	14.5
Civil servants (> Grade Level08)	7.3

Three hundred and fifty Naira (N350) = one Dollar (\$1)

household food insecurity can negatively affect food consumption in terms of reducing dietary variety, nutrient intake, and nutritional status of household members [3]. Epidemiological researches have established a positive association between household food insecurity and childhood growth indicators such as weight gain [4,5]. Whereas some other studies have also found no relationship with weight and height gain among children [6-8].

The relationship between poverty, household food security and children's nutrition and health has been widely reported by several studies [9-11]. Household food security level mainly relies on income and purchasing power of household members, and not just inadequate production of food commodities [12,13]. Studies have shown that growing up in conditions of poverty has negative effects on quality of dietary intakes, health, growth and cognitive development [14-16], and it increases the risk of mortality among children [17,18]. Nutritional studies have reported that efforts to improve the quality of dietary intakes of children in many parts of developing countries have been remarkably slow [19], due to several factors like rise in cost of food commodities [20] and poverty [21].

The nutritional consequences of food insecurity experience include poor dietary intake, nutritional status and physical well-being of the family members, particularly children [22]. Scientific study has reported that nutritional status of children is a key indicator to assess the nutritional and health status of a population experiencing food crisis as children are the most vulnerable to nutritional imbalances [23].

Methodology

Study location

The study was conducted in selected Local Government Areas of Lagos State, Nigeria. Three Local Government Areas (LGAs), (i.e., Imota LCDA, Ikosi Ejinrin LCDA and Ikorodu North LCDA) out of six in Lagos East Senatorial district were randomly selected for this study. The selected Local Government Areas were predominantly Yoruba ethnic group, and were blessed with articulate populace who constitute a virile and productive workforce. The people in the communities were either civil servants, workers in the private industries or self-employed.

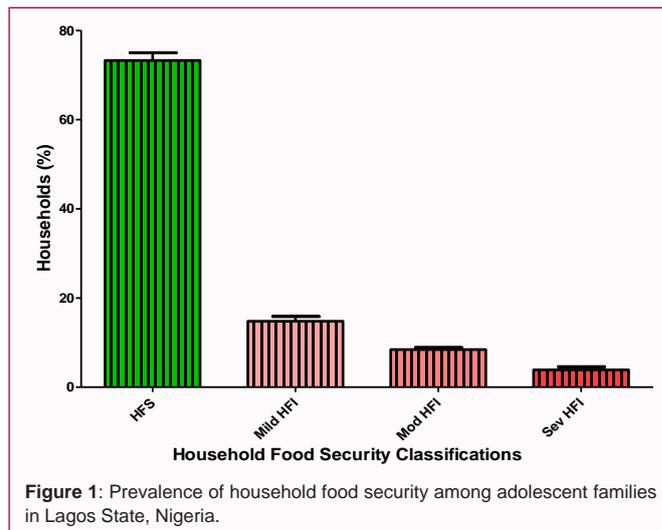


Figure 1: Prevalence of household food security among adolescent families in Lagos State, Nigeria.

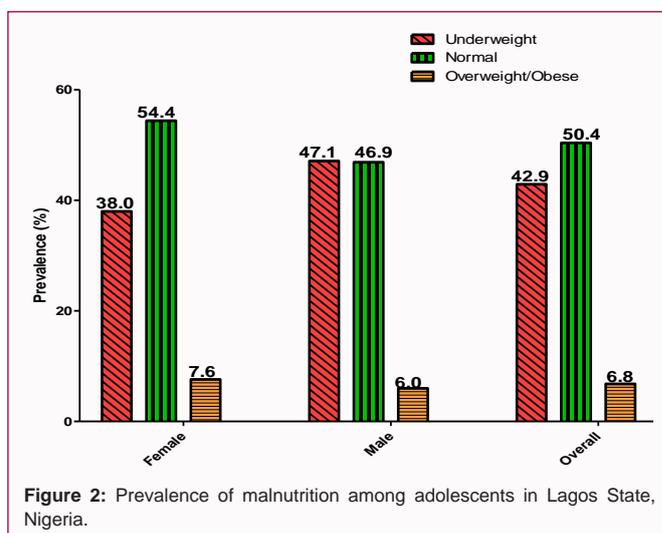


Figure 2: Prevalence of malnutrition among adolescents in Lagos State, Nigeria.

Study design, target population and sample size determination

A cross-sectional study was conducted among schoolchildren (10-20 years) in public and private secondary schools between March and June, 2017. The participants were selected from rural and urban communities using multistage sampling technique. To obtain a representative sample, the three LGAs were considered as clusters. Two public and one private secondary schools were randomly selected from each cluster, and within the schools, each level from junior secondary school (JSS 1) to senior secondary school (SSS 3) was treated as a stratum. Using the class register as the sampling frame, proportionate number of males and females were selected using simple random techniques from each stratum.

The sample size was determined on the basis of an estimate of 50% of prevalence of malnourished (underweight) children, a 5% level of precision and a confidence level of 95%, using the formula for calculating sample size as described by Gahlinger and Abramson. This generated a sample size of 317 from each local, and with total population size of 2000 adolescents.

Data collection

Data were collected by trained health researchers using structured self-administered questionnaires designed in English language and

Table 2: Anthropometric measurements and body mass index of adolescents.

Age	Weight			Height			BMI		
	Female	Male	overall	Female	Male	overall	Female	Male	overall
10	33.4 ± 0.3	45.2 ± 0.4	39.3 ± 0.4	1.47 ± 0.02	1.61 ± 0.02	1.54 ± 0.00	15.9 ± 0.2	18.0 ± 0.2	16.9 ± 0.1
11	42.6 ± 0.4	31.1 ± 0.3	36.9 ± 0.4	1.51 ± 0.01	1.55 ± 0.02	1.53 ± 0.00	18.9 ± 0.2	14.1 ± 0.1	16.5 ± 0.3
12	41.1 ± 0.4	41.8 ± 0.4	41.4 ± 0.4	1.53 ± 0.02	1.51 ± 0.01	1.52 ± 0.02	18.1 ± 0.1	18.8 ± 0.1	18.4 ± 0.2
13	46.3 ± 0.5	42.3 ± 0.6	44.3 ± 0.4	1.56 ± 0.02	1.55 ± 0.02	1.55 ± 0.01	19.7 ± 1.2	18.2 ± 1.5	18.9 ± 0.2
14	46.9 ± 0.4	44.9 ± 0.5	45.9 ± 0.5	1.57 ± 0.02	1.62 ± 0.01	1.59 ± 0.02	19.5 ± 1.3	18.3 ± 0.7	18.9 ± 0.4
15	50.5 ± 3.5	49.3 ± 3.3	49.9 ± 2.5	1.60 ± 0.01	1.61 ± 0.01	1.60 ± 0.00	20.4 ± 2.2	19.6 ± 2.3	20.0 ± 2.0
16	52.0 ± 1.5	52.2 ± 3.5	52.1 ± 2.3	1.61 ± 0.02	1.62 ± 0.00	1.61 ± 0.02	20.6 ± 1.6	20.5 ± 2.1	20.5 ± 2.0
17	53.7 ± 3.3	55.5 ± 2.4	54.6 ± 4.1	1.61 ± 0.00	1.65 ± 0.01	1.63 ± 0.02	21.3 ± 0.1	20.7 ± 2.2	20.9 ± 1.5
18	54.4 ± 3.3	58.2 ± 3.6	56.25 ± 3.5	1.61 ± 0.00	1.65 ± 0.02	1.63 ± 0.01	21.7 ± 2.7	22.2 ± 2.2	21.9 ± 0.3
19	55.1 ± 2.5	60.1 ± 3.6	57.6 ± 1.5	1.66 ± 0.02	1.66 ± 0.00	1.66 ± 0.01	20.8 ± 1.2	22.7 ± 1.5	21.8 ± 2.0
20	47.5 ± 1.4	51.5 ± 2.5	49.5 ± 1.5	1.62 ± 0.01	1.75 ± 0.02	1.69 ± 0.02	18.6 ± 0.2	19.5 ± 0.2	19.1 ± 0.1
Total	47.6 ± 1.4	48.4 ± 1.7	47.9 ± 1.4	1.57 ± 0.01	1.61 ± 0.00	1.59 ± 0.01	19.6 ± 0.3	19.3 ± 0.4	19.4 ± 1.3

Table 3: Relationship between Nutritional Status and Household Food Security.

Parameters	Underweight	Normal	Row total	Statistics
Household Food Security	520(26%)	836(42%)	1,356	OR = 1.03
Household Food Insecurity	243(12.2%)	401(20.1%)	644	X = 0.062
Column Total	763	1,237	2,000	df = 1
				P = 0.004

local language. The questionnaires were given to the students to take home for their parents to fill after adequate demonstration on how to fill the questionnaire had been explained. The students were informed to return the questionnaire in the following school day; and those students whose their questionnaires were adequately filled were finally recruited for the study. The questionnaire was designed to collect information on the following.

Socio-economic status

The socioeconomic status was determined using the parameters like students parental/caregiver’s occupations, educational attainments and monthly incomes. Using these parameters for assessing socio-economic status of children has earlier been reported by Boey [24].

Household food insecurity assessment scale

Household food insecurity access was measured using items from the validated Household Food Insecurity Access Scale (HFIAS) that was specifically developed for use in developing countries [25-28]. The HFIAS consists of 9 items specific to an experience of food insecurity occurring within the last month. Each respondent indicated whether they had encountered the following at household level due to lack of food or money to buy food in the last one month: (1) worried about running out of food, (2) lack of preferred food, (3) the respondent or another adult had limited access to a variety of foods due to a lack of resources (4) forced to eat un preferred food due to lack of resources, (5) eating smaller portions, (6) skipping meals, (7) the household ran out of food, (8) going to sleep hungry, and (9) going 24 h without food. To determine the status of food insecurity the average HFIAS score was computed and then household food insecurity access prevalence (HFIAP) categories (food secure, mild, moderately and severely food insecure) was generated [29]. The percentage of households that fall in each food insecurity access scale category, that

is, mildly, moderately and severely, was calculated relatively to the population size of the study.

Anthropometric measurements

Anthropometric measurements (height and weight) of the children were measured using the standard techniques described by Gibson [30]. All measurement was carried out in the morning between 9 am and 12 pm noon. Weight was measured using a digital weighing scale (Model 880, Seca, Hamburg, Germany) calibrated to the nearest 0.1 kg. Height was measured using a portable measuring unit (Seca Body meter Model 208, Seca, Hamburg, Germany) calibrated to the nearest 0.1 cm. When measuring height, the subject stands straight looking ahead, with Frankfurt plane horizontal, with shoulders blades, buttocks, and heels almost together touching measurement board, arms at sides, legs straight, knees together and feet flat. The instruments were validated daily to ensure consistence in measurements. The body mass index was calculated, with the children categorized as overweight/obese, normal and underweight according to age [31].

Ethical approval/ informed consent

The study protocol was approved by the ethics committee of Federal University of Technology, Akure, Nigeria (FUTA/2017/019). Informed consent was obtained from parents and guardians of the school children, while the participants were informed that the study would not cause them any harm, and also there was no penalty for those who declined.

Statistical analysis

Data was processed using the Statistical Package Software for Social Sciences (SPSS) - 16 computer software. The means of anthropometric measurements (i.e., height and weight) were expressed in mean (± SE). The descriptive values were also expressed

as percentages of the study population. For nutritional index, that is, Body Mass Index (BMI-for-age) was calculated and the distributions were expressed in percentage of the proportion. Chi-square was used to determine level of significance ($p < 0.005$) between the categories of nutritional classifications and gender (male and female adolescents).

Results and Discussion

The study population was adolescents (10-20 years) in secondary schools. The population size was 2000 participants, and out of which 52.3% were males; while the remaining were females (47.7%). The socio-economic status of respondents' parents is presented in (Table 1). The educational attainment of the family head of respondents showed that 19.1% completed primary school, 33.1% secondary school and 27.8% tertiary education; while the remaining parents (20.0%) did not have any formal education. The average monthly income of the family heads showed that 63.7% earned less than twenty-five thousand Naira per month (\$71.4), while the remaining head of families earned above twenty-five thousand Naira per month (\$71.4). The occupation of respondents' family head showed that large proportion engaged in farming (44.1%), while others were self-employed (31.1%) and civil servants (21.8%). From the present study, it could be deduced that large proportion of the study population earned less than one dollar (\$1) per day, and this indicates level of poverty [32]. It is well established that low-income can lead to household food insecurity, which in turns causes continuously insufficient nutrient intakes of household members, hence, poor growth and health status [33,34].

The prevalence of household food insecurity of the adolescents' families in Lagos state is presented in (Figure 1). The prevalence of households were 15.9%, 8.0% and 4.6% for mildly, moderately and severely food insecure respectively, while the remaining families were food secured (71.6%). The proportion of households who were food insecure in this present study could be attributed to low-income that common among the respondents, due to economic recession in the country. However, the prevalence of food insecurity observed in this present study was comparatively lower when compared to the findings from other developing countries [35-37].

The mean anthropometric measurements and body mass index (BMI) of adolescents is presented in (Table 2). The mean weight, height and BMI of the female and male respondents were 47.6 ± 1.4 - 48.4 ± 1.7 , 1.57 ± 0.01 - 1.61 ± 0.00 and 19.6 ± 0.3 - 19.3 ± 0.4 respectively, and these values were higher when compared to the values obtained by Ahmad et al. [38], who reported weight of 46.4 ± 11.5 and 47.1 ± 9.2 kg, height of 158.2 ± 11.2 and 155.7 ± 6.5 cm and BMI of 18.3 ± 2.7 and 19.3 ± 3.1 kg/m² for male and female adolescents respectively in Sokoto State of North-Western Nigeria. In this presents study, the mean weight, height and BMI of respondents were increasing with age, and were higher in male than female, except for BMI, where female had the higher values compared to male counterparts. This observation could be attributed to the variation in genetic and hormonal factors [39].

The prevalence of underweight and overweight/obesity among the adolescents is presented in (Figure 2). Prevalence of underweight was higher in male adolescents (47.1%) than female (38.0%) counterparts, whereas, the prevalence of overweight/obese in female (7.6%) was higher when compared to that of male (6.0%) counterparts. The disparity between prevalence of underweight and overweight/obesity among male and female adolescents in this present study could be attributed to factors like gender, genetic and degree of physical

Table 4: Correlations between age, weight, height and body mass index (BMI) of Adolescents.

		Age	Weight	height	BMI
Age	Pearson Correlation	1	0.541**	0.233**	0.310**
	Sig. (2-tailed)		0	0	0
	N	2000	2000	2000	2000
Weight	Pearson Correlation	0.541**	1	0.353**	0.746**
	Sig. (2-tailed)	0		0	0
	N	2000	2000	2000	2000
Height	Pearson Correlation	0.233**	0.353**	1	-0.073**
	Sig. (2-tailed)	0	0		0.001
	N	2000	2000	2000	2000
BMI	Pearson Correlation	0.310**	0.746**	-0.073**	1
	Sig. (2-tailed)	0	0	0.001	
	N	2000	2000	2000	2000

** : Correlation is significant at the 0.01 level (2-tailed)

activities [40,41]. Besides, it is evident that female adolescents are usually engage in consumption of high calorie drinks and sedentary activities like watching television and indoor games when compare to male counterparts, and these may have all contributed to increase in overweight/obesity [42,43]. The high prevalence of underweight and overweight/obesity that was observed among adolescents in this present study agreed with other report [44-46]. The overall prevalence rate (6.8%) of obesity in this present study was lower than those obtained in developed countries like USA (15%), UK (20%), France (14%), Russia (6.7%), and China (3.6%) [47]; and this variation could be due to differences in economic standards.

The association between the respondents' household food security status and nutritional outcome is shown in (Table 3). The nutritional status, that is, body mass index, of the respondents was significantly and positively associated with household food security (OR=1.03, $p=0.004$). This finding agreed with other scientific studies [48-51]. Epidemiological studies have established that household food insecurity influence nutritional outcome of children by compromising the quantity and quality of their dietary intakes [52,53]. (Table 4) shows that there was positive and negative correlation between BMI and weight and height of adolescents respectively. The relationship between growth patterns (i.e., weight and height gained) in children are the main indicators that commonly used to assess the nutritional and health outcome of a population as children are the most vulnerable to nutritional imbalances [54].

Conclusion

The present study evaluated household food security status and nutritional status of adolescents from selected local government areas of Lagos state, Nigeria. The findings showed high prevalence of household food insecurity among the respondents' families, which varied between mildly, moderately and severely, while nutritional outcome of the respondents equally showed high prevalence of underweight and emerging prevalence of overweight and/or obesity among adolescents. In view of this, there is a need for nutrition and economic intervention programmes to ensure optimal nutrition among the children. This would go a long way in promoting good nutrition and health status of the children, and also economic development of the country.

References

1. FAO. The State of Food Insecurity in the World 2012: economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition. Rome: FAO. 2012.
2. Wolfe WS, Frongillo EA. Building household food-security measurement tools from the ground up. *Food Nutr Bull.* 2001;22:5-12.
3. Osei A, Pandey P, Spiro D, Nielson J, Shrestha R, Talukder Z, et al. Household food insecurity and nutritional status of children aged 6 to 23 months in Kailali District of Nepal. *Food Nutr Bull.* 2010;31(4):483-94.
4. Dubois L, Farmer A, Girard M, Porcherie M. Family food insufficiency is related to overweight among preschoolers. *Soc Sci Med.* 2006;63(6):1503-16.
5. Casey PH, Simpson PM, Gossett JM, Bogle ML, Champagne CM, Connell C, et al. The association of child and household food insecurity with childhood overweight status. *Pediatrics.* 2006;118(5):e1406-13.
6. Kaiser LL, Melgar-Quinonez HR, Lamp CL, Johns MC, Sutherlin JM, Harwood JO. Food security and nutritional outcomes of preschool-age Mexican-American children. *J Am Diet Assoc.* 2002;102(7):924-9.
7. Bhattacharya J, Currie J, Haider S. Poverty, food insecurity, and nutritional outcomes in children and adults. *J Health Econ.* 2004;23(4):839-62.
8. Rose D, Bodor J. Household food insecurity and overweight status in young school children: results from the Early Childhood Longitudinal Study. *Pediatrics.* 2006;117(2):464-73.
9. Coakley A. 'Healthy eating: food and diet in low income households'. Administration. 2001;49(3):87-103.
10. WHO/NHD. A global agenda for combating malnutrition: progress report. Geneva, World Health Organization. 2000 (document WHO/NHD/00.6).
11. WHO. Childhood nutrition and progress in implementing the International Code of Marketing of Breast-milk Substitutes. Geneva, World Health Organization. 2002 (document A55/14).
12. Gladwin CH, Thomson AM, Peterson JS, Anderson AS. Addressing Food Security in Africa via Multiple Livelihood Strategies of Women Farmers. *Food Policy.* 2001;26(2):177-207.
13. Motbainor A, Worku A, Kumie A. Level and determinants of food insecurity in East and West Gojjam zones of Amhara Region, Ethiopia: a community based comparative cross-sectional study. *BMC Public Health.* 2016;16:503.
14. Ivanovic DM, Leiva BP, Perez HT, Inzunza NB, Almagia AF, Toro TD, et al. Nutritional status, brain development and scholastic achievement of Chilean high school graduates from high and low intellectual quotient and socio-economic status. *Br J Nutr.* 2002;87(1):81-92.
15. Ivanovic RM, Forno HS, Castro CG, Ivanovic DM. Intellectual ability and nutritional status assessed through anthropometric measurements of Chilean school-age children from different socioeconomic status. *Ecol. Food and Nutr.* 2000;39(1):1-25.
16. de Onis M, Frongillo EA, Blossner M. Is malnutrition declining? An analysis of changes in levels of child malnutrition since 1980. *Bull World Health Organ.* 2000;78(10):1222-32.
17. Alaimo K, Olson CM, Frongillo EA, Briefel RR. Food Insufficiency, Family Income, and Health in US Preschool and School-Aged Children. *Am J Public Health.* 2001;91(5):781-6.
18. Goudet SM, Kimani-Murage EW, Wekesah F, Wanjohi M, Griffiths PL, Bogin B, et al. How does poverty affect children's nutritional status in Nairobi slums? A qualitative study of the root causes of undernutrition. *Public Health Nutr.* 2017;20(4):608-19.
19. Crawley J. Reducing the burden of anemia in infants and young children in malaria-endemic countries of Africa: From evidence to action. *Am J Trop Med Hyg.* 2004;71(2):25-34.
20. Keikhaei B, Zandian K, Ghasemi A, Tabibi R. Iron-deficiency anemia among children in southwest Iran. *Food Nutr Bull.* 2007;28(4):406-11.
21. Cutts DD, Pheley AM, Geppert JS. Hunger in mid-western inner city young children. *Arch Pediatr Adolesc Med.* 1998;152(5):489-93.
22. Frongillo EA, Chowdhury N, Ekstorm EC, Naved TR. Understanding the experience of Household food Insecurity in rural Bangladesh leads to a measure different from that used in other countries. *J Nutr.* 2003;133(12):4158-62.
23. Jesmin A, Yamamoto SS, Malik AA, Haque MA. Prevalence and determinants of chronic malnutrition among preschool children: a cross sectional study in Dhaka City, Bangladesh. *J Health Popul Nutr.* 2011;29(5):494-9.
24. Boey CC, Omar A, Arul PJ. Correlation among academic performance, recurrent abdominal pain and other factors in Year-6 urban primary-school children in Malaysia. *J Paediatr Child Health.* 2003;39(5):352-7.
25. Maxwell D, Cladwell R, Langworthy M. Measuring food insecurity: can an indicator based on localized coping behaviors be used to compare across contexts?. *Food Policy.* 2008;33(6):533-40.
26. Frongillo EA, Nanama S. Development and validation of an experience based measure of household food insecurity within and across seasons in northern Burkina Faso. *J Nutr.* 2006;136(5):1409S-19S.
27. Coates J, Anne SA, Bilinsky P. Household Food Insecurity Access Scale (HFAS) for measurement of households food access: Indicator guide (Version 3). Food and Nutrition Technical Assistance Project (FANTA), Washington D.C: Academy for Educational Development. 2007.
28. Knuettel D, Demment M, Kaiser L. Validation of the household food insecurity access scale in rural Tanzania. *Public Health Nutr.* 2010;13(3):360-7.
29. Jebena MG, Taha M, Nakajima M, Lemieux A, Lemessa F, Hoffman R, et al. Household food insecurity and mental distress among pregnant women in Southwestern Ethiopia: a cross sectional study design. *BMC Pregnancy Childbirth.* 2015;15:250.
30. Gibson R. In: Principles of Nutritional Assessment, 2nd Edition. New York: Oxford University Press. 2005:41-64.
31. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ.* 2000;320(7244):1240-3.
32. Raheem S, Ayeni JO, Fashedemi AO. Easing the "Disease" of Poverty in Nigeria. *Developing Country Studies.* 2014;4(19):55-66.
33. Sanni LO. Trend in the drying of cassava products in Africa. In: Makoto Nakatani, Katsumi Komaki, editors. Proceedings of the 12th international society for tropical root crops. 2002:113-120.
34. de Onis M. WHO Child Growth Standards: Length/Height-for-Age, Weight-for-Age, Weight-for-Length, Weight-for-Height and Body Mass Index-for-Age: Methods and Development. Geneva: WHO. 2006.
35. Regassa N, Stoecker BJ. Household food insecurity and hunger among households in Sidama district, southern Ethiopia. *Public Health Nutr.* 2012;15(7):1276-83.
36. McDonald CM, McLean J, Kroeun H, Talukder A, Lynd LD, Green TJ. Household food insecurity and dietary diversity as correlates of maternal and child undernutrition in rural Cambodia. *Eur J Clin Nutr.* 2015;69(2):242-6.
37. Shinsugi C, Matsumura M, Karama M, Tanaka J, Changoma M, Kaneko S. Factors associated with stunting among children according to the level of food insecurity in the household: a cross-sectional study in a rural community of South-eastern Kenya. *BMC Public Health.* 2015;15:441.
38. Ahmad MM, Ahmed H, Airede K. Body mass index among school adolescents in Sokoto, North-Western Nigeria. *Sahel Medical Journal.* 2013;16(1):5-9.

39. Dubois L, Ohm KK, Girard M, Tatone-Tokuda F, Pe'russe D, Hjelmberg J, et al. Genetic and Environmental Contributions to Weight, Height, and BMI from Birth to 19 Years of Age: An International Study of Over 12,000 Twin Pairs. *PLoS ONE*. 2012;7(2):e30153.
40. Wenthe PJ, Janz KF, Levy SM. Gender similarities and differences in factors associated with adolescent moderate – vigorous physical activity. *Pediatr Exerc Sci*. 2009;21(3):291-304.
41. Afrifa-Anane E, Agyemang C, Codjoe SN, Ogedegbe G, Aikins AD. The association of physical activity, body mass index and the blood pressure levels among urban poor youth in Accra, Ghana. *BMC Public Health*. 2015;15:269.
42. Pearson N, Biddle SJ. Sedentary behavior and dietary intake in children, adolescents, and adults: A systematic review. *Am J Prev Med*. 2011;41(2):178-88.
43. Lowry R, Michael S, Demissie Z, Kann L, Galuska DA. Associations of Physical Activity and Sedentary Behaviors with Dietary Behaviors among US High School Students. *J Obes*. 2015:876524.
44. Izuora AN. Skinfold thickness, body mass index and the prevalence of obesity in school children aged 5 to 18 years in Lagos state, Nigeria. May 2007. A dissertation submitted to the National Postgraduate Medical College of Nigeria. Lagos State, Nigeria: The National Post Graduate Medical College of Nigeria. 2007.
45. Ben-Bassey UP, Oduwole AO, Ogundipe OO. Prevalence of overweight and obesity in Eti-Osa Local government area, Lagos, Nigeria. *Obes Rev*. 2007;8(6):475-9.
46. Cordeiro LS, Wilde PE, Semu H, Levinson FJ. Household Food Security Is Inversely Associated with Undernutrition among Adolescents from Kilosa, Tanzania. *J Nutr*. 2012;142(9):1741-7.
47. Dehghan M, Akhtar-Danesh N, Merchant TA. Childhood obesity, prevalence and prevention. *Nutr J*. 2005;4:24.
48. Cook JT, Frank DA. Food security, poverty, and human development in the United States. *Ann NY Acad Sci*. 2008;1136:193-209.
49. Cook JT, Frank DA, Berkowitz C, Black MM, Casey PH, Cutts DB, et al. Food insecurity is associated with adverse health outcomes among human infants and toddlers. *J Nutr*. 2004;134(6):1432-8.
50. Alam MA, Rahman MA, Flora MS, Karim MR, Sharif MPI, Ahmad A. Household Food Security and Nutritional Status of Rural Elderly. *Bangladesh Med J*. 2011;40(3):8-11.
51. Saha KK, Frongillo EA, Alam DS, Arifeen SE, Persson LA, Rasmussen KM. Household food security is associated with growth of infants and young children in rural Bangladesh. *Public Health Nutr*. 2009;12(9):1556-62.
52. Ali D, Saha KK, Nguyen PH, Diressie MT, Ruel MT, Menon P, et al. Household food insecurity is associated with higher child undernutrition in Bangladesh, Ethiopia, and Vietnam, but the effect is not mediated by child dietary diversity. *J Nutr*. 2013;143(12):2015-21.
53. Jemal Z, Hassen K, Wakayo T. Household Food Insecurity and its Association with Nutritional Status among Preschool Children in Gambella Town, Western Ethiopia. *J Nutr Food Sci*. 2016;6:566.
54. Ajao KO, Ojofeitimi EO, Adebayo AA, Fatusi AO, Afolabi OT. Influence of Family Size, household food security status, and Child Care Practices on the Nutritional Status of Under-five Children in Ile-Ife, Nigeria. *Afr J Reprod Health*. 2010;14(4):117-26.