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Article *in* Journal of Biosciences and Medicines · January 2020

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Scientific Research Publishing

Journal of Biosciences and Medicines, 2020, 8, 169-178
https://www.scirp.org/journal/jbm
ISSN Online: 2327-509X
ISSN Print: 2327-5081

A Study of Anthropometric Indices among Pupils in Rural Communities around Kainji Dam, Niger State

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How to cite this paper: Adewale, B., Osuolale, K.A., Rahman, N.O., Sulyman, M.A. and Akindele, S.K. (2020) A Study of Anthropometric Indices among Pupils in Rural Communities around Kainji Dam, Niger State. *Journal of Biosciences and Medicines*, **8**, 169-178.
https://doi.org/10.4236/jbm.2020.86016

Received: November 29, 2019
Accepted: June 15, 2020
Published: June 18, 2020

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Abstract

The physical and mental development of pupils could be arrested by inadequate food intake and infection with immediate and long term consequences. This has implications on decreased school performances, lower intelligent quotient levels, poor psychosocial development, and decreased cognitive functions. This study assessed the growth and body fat distribution among pupils aged 5 - 19 years. A cross-sectional study was conducted among pupils from five primary schools in different communities around Kainji Dam. This assessment was based on a comparison with reference standards set by the World Health Organization to determine their deviations. A qualified registered nurse carried out physical measurements to obtain age, height, and body weight using electronic weighing scale and stadiometer. Data were analyzed using Anthroplusv1.0.4 software. The overall prevalence of stunting was 21.5% with 8% being severely stunted. The prevalence of thinness was 35.2% with 11.2% being wasted while the overall prevalence of underweight was not calculated for children > 10 years old. The prevalence of underweight for 5 - 10 years old children was 16.9% with 2.4% being severely underweight. The curves for both male and female children deviated from normal distribution. Females have higher percentage of stunting than males. This study revealed a high prevalence of thinness and stunting which is the consequence of poor nutrition arising from multifaceted and interrelated circumstances such as poor feeding, eating practices and repeated infection. Intervention such as Home Grown School Feeding Programme of the Government is a right step in improving the nutritional status of pupils in rural communities.

Keywords

Anthropometric Indices, Pupils, Malnutrition

1. Introduction

Malnutrition remains a public health problem in developing countries due to its adverse effects on human performance, growth, and development, especially in children. It is one of the most important underlying causes of death in children in developing countries especially during the first five years of life [1] and affects the physical, mental, social wellbeing and child development [2]. Fon *et al.* [3] affirmed that malnutrition accounts for the mortality rate of about 9 million children below 5 years old annually while Shibily *et al.* [4] also reported that 50% of deaths in children are attributed to malnutrition. Anthropometric indices are widely recognized indicators of the nutritional status of children [5] [6]. These indicators are based on physical body measurements such as height and weight (in relation to age and sex). Anthropometric indicators are useful both at an individual level to assess compromised health or nutrition well-being. This information can be valuable for screening children for interventions and for assessing the response to interventions and at a population level to assess the nutritional status within a country, region, community, or socioeconomic group and to study both the determinants and the consequences of malnutrition. According to the World Health Organization (WHO) "malnutrition is the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions" [7]. The term malnutrition is frequently used synonymously with undernutrition. Srivastava *et al.* [8] and Sumbele *et al.* [9] classified undernutrition in children into three categories such as stunting, wasting and underweight.

Stunting is defined as a low height-for-age for children and it measures the past (chronic) child undernutrition. Stunting is frequently associated with repeated exposure to adverse economic conditions, poor sanitation and interactive effects of poor energy, nutrient intake, and infection. Stunting reflects failure to receive adequate nutrition over a long period of time and is affected by recurrent and chronic illness. A child is considered stunted if the child is too short for his/her age [10]. Children with z-scores < -2 are said to be stunted and those < -3 are severely stunted. Wasting is defined as low weight-for-height or low BMI for age for children, measuring current or acute undernutrition and is closely tied to mortality risk. It is generally associated with recent illness, weight loss or a failure to gain weight [1]. A child is considered wasted if the child is too thin or weighs too little for his/her height. The weight-for-height indicator also can be used to assess the extent to which children are overweight or obese, which is an increasing problem among children worldwide [10]. Children with z-scores < -2 are said to be wasted and those < -3 are severely wasted. Underweight is defined as low weight-for-age and it reflects past (chronic) and present (acute) undernutrition. Low weight-for-age indicates a history of poor health or nutritional deficiencies, including recurrent illness and/or starvation. Weight-for-Age indicates an assessment of whether a child weighs too little for his/her age. A child can be underweight for his/her age because the child is stunted, wasted or both [10].

Children with *z*-scores < −2 are said to be underweight and those < −3 are considered as severely underweight. In this study, however, malnutrition is referred to as undernutrition. An estimated 100 million people globally, have been reported to have experienced stunting or wasting due to infections [11] [12]. A comprehensive review of literature has shown that anthropometric measurements are highly reliable in determining nutritional status compared with other sophisticated methods such as hydro-densitometry, dilution techniques, radio-labeled potassium, and electronic bio-impedance among others but their use is restricted by their complexity and cost. Limited surveys have been conducted regarding anthropometric indices among rural agrarian communities. This study which aimed at examining intensively the growth and body fat distribution of school-aged children living in rural communities around Kainji dam in Niger State and their deviations from the standard set by WHO [13] will add to the body of knowledge and available data for rural children in Nigeria.

2. Materials and Methods

2.1. Study Site and Population

This study was conducted among pupils from five primary schools in different communities around Kainji Dam, located in Niger State in the North-Central Region of Nigeria. The district has a total surface area of 1243 km^2 and located between longitude 4.6037˚E and latitude 10.3619˚N. Each of the communities has an average population of about 1500 inhabitants who are mainly petty traders and farmers. Meetings were held with the Parents-Teachers' Association to explain the aim of the study and seek their consent. Participation of pupils in the study was voluntary and participants were allowed to withdraw at any time during the study.

2.2. Study Design

A cross-sectional study was conducted in June 2019 among pupils from five primary schools to examine the growth and body fat distribution of pupils living in rural communities around the Kainji Dam in Niger State, Nigeria. All the pupils present in the schools on the day of the survey and who assented to take part were interviewed using a questionnaire to collect data on age, sex, height, and weight. A qualified registered nurse carried out physical measurements to obtain age, height, and body weight using electronic weighing scale and stadiometer. The height and weight of each child were measured to determine their anthropometric indices. Weight was measured without shoes and with minimum clothing, using an electronic weighing scale to the nearest 0.1 kilograms (kg). Height was also measured to the nearest 0.1 centimeter (cm) in bare feet with participants standing upright against a mounted stadiometer. Both measurements were recorded in the individual's questionnaire. Weight-for-age *z*-score (WAZ), Height-for-age *z*-score (HAZ) and Body Mass Index-for-age *z*-score (BMIAZ) were estimated to

assess underweight, stunting and wasting status, respectively as indicators of undernutrition. Age, sex, height, and weight were used to evaluate nutritional status. The WAZ, HAZ and BMIAZ were compared with WHO Growth Reference Standards using Anthroplus software (Anthro-Plus v1.0.4, WHO, Geneva, Switzerland). Pupils were classified as underweight, stunted or wasted, respectively when their *z*-scores fell two or more standard deviations below the reference mean. The formulae were inbuilt in the software as the raw data supplied into the software were normalized and returned in that format as standard.

2.3. Inclusion and Exclusion Criteria

Pupils were included in the study if their parents/legal guardians gave their oral consent during the parents teachers' association meeting and if the pupils gave their assent and were willing to participate in the study. Pupils who were sick or suffering from severe medical conditions were excluded from the study.

2.4. Ethical Consideration

Ethical clearance was obtained from Nigerian Institute of Medical Research, Institutional Review Board. The study was conducted in accordance with the tenets of the Helsinki Declaration of 1964 as amended in 2013 and guidelines of Good Clinical Practice. Participation was voluntary.

2.5. Sampling Method and Sample Size Determination

Each of the schools was purposively selected as each of the communities had only one school. Anthropometric measurements were taken from children in the only school in each community following the names as listed in the class register. A total of 5 schools were selected and informed parental oral consents were given to all pupils present from grade 1 to 6, for information and approval for their children to participate in the study.

The minimum number of the sample size for the study was calculated from the formula:

$$n = \frac{z^2 p(1-p)}{d^2}$$

where n is the sample size, z is the selected critical value of desired confidence level and in a two-tailed test it is equal to 1.96, p is the estimated prevalence of malnutrition in women, which was taken as 9%, based on an earlier report by NFCN survey for Nigeria [14] and d is the desired level of precision.

$$n = \frac{1.96^2 \times 0.09(1-0.91)}{0.03^2}$$

n = 350, with an addition of 17% of n to account for error.

Therefore, total sample size of 410 pupils was used for the study.

2.6. Data Collection

Prior to the commencement of the study, parents and teachers' meeting was convened and the parents gave oral consent for their children to take part in the survey. Visits were made to all the purposively selected schools at the study sites. Administrative permissions were sought from various head-teachers and the goal of the study explained to both the teachers and pupils. Pupils were identified by assigning unique code to each of them. Quantitative data were collected as primary data for this study.

2.7. Statistical Analysis

The primary data collected from the field were entered into Microsoft Excel 2010 spreadsheet saved in text (MS-DOS) and then exported to WHO Anthro Plus software for analysis. Graphs were drawn using the same software. Anthropometric indices such as HAZ, WAZ, and BMIAZ scores were calculated to assess the growth and body fat distribution among pupils in the selected schools.

3. Results

A total of 410 pupils living in rural communities around the Kainji dam were included in the study. Among the pupils studied, 42.2% were females and the mean age was 1.90 ± 0.41 (**Table 1**). The overall prevalence of stunting was 21.5% with 8% being severely stunted. The prevalence of thinness was 35.2% with 11.2% being wasted (**Table 2**) while the overall prevalence of underweight was not calculated for pupils > 10 years old. The prevalence of underweight for 5 - 10 years old pupils (n = 210) in the study population was 16.9% with 2.4% being severely underweight. The overall prevalence of stunting for male primary school children was 25.3 % with 9.7% being severely stunted while 36.2% of the male children were thin with 12.9% being wasted. Males were more stunted and thin than their female counterparts (**Figure 1** & **Figure 2**). The prevalence of underweight and severely underweight for male pupils were 18.7% and 14.6%, respectively for 5 - 10 y/o children (n = 210) in the study population. The curves for both male and female children deviated from normal distribution (**Figure 3**). Males have higher percentage of stunting than Females (**Figure 1**). Stunting (80%) was also found more predominant among pupils between (15 - 19) years of age (**Table 2**).

4. Discussion

In general, the nutritional status of children in Nigeria has gradually improved over the last decade [15]. The proportion of children who were stunted declined from 41 percent in 2008 to 37 percent in 2013 [15]. This study revealed a high prevalence of thinness and stunting though lower than the national prevalence. This was the consequence of poor nutrition arising from multifaceted and interrelated circumstances such as poor feeding, eating practices and repeated infection. The prevalence of wasting obtained in the current study was lower than

Table 1. Socio-demographic characteristics of pupils.

Characteristics	*n*	%
Gender		
Male	237	57.8
Female	173	42.2
Parent Occupation		
Farmer	149	36.3
Fisherman	53	12.9
Civil Servant	123	30
Trader	29	7.1
Artisan	18	4.4
Miner	29	7.1
Driver	9	2.2
Age Group	***n***	**Mean**
All Participants	410	1.90
6 - 8	170	1.0
9 - 11	120	2.0
12 - 14	110	3.0
15 - 17	10	4.0

Table 2. Descriptive statistics of anthropometric indices among pupils in rural communities around Kainji Dam, Niger State.

	HAZ	WAZ	BAZ	*n*	Age Group
Mean	−0.7	-	−1.59	410	61 - 228 months (5 - 19 yrs)
S.D.	1.59	-	1.16		
% below −2 S.D.	21.5	-	35.2		
% below −3 S.D.	8	-	11.2		
Mean	0.25	-0.81	−1.53	210	61 - 119 months (5 - 9 yrs)
S.D.	1.25	1.15	1.3		
% below −2 S.D.	2.4	16.9	35.7		
% below −3 S.D.	0	2.4	13.5		
Mean	−1.64	-	−1.63	190	120 - 179 months (10 - 14 yrs)
S.D.	1.26	-	0.98		
% below −2 S.D.	39.5	-	33.2		
% below −3 S.D.	15.3	-	8		
Mean	−2.59	-	−2.28	10	180 - 228 months (15 - 19 yrs)
S.D.	1.17	-	0.76		
% below −2 S.D.	80	-	66.7		
% below −3 S.D.	40	-	22.2		

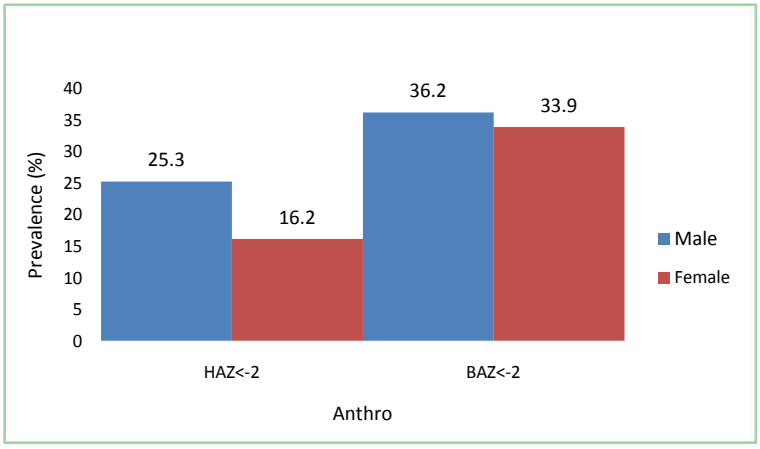


Figure 1. Showing degree of stunting and thinness among the pupils by gender.

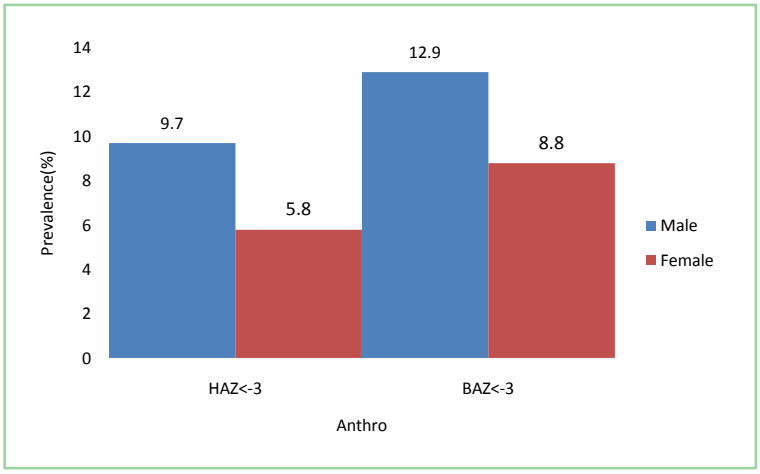


Figure 2. Showing severe stunting and wasting among the pupils by gender.

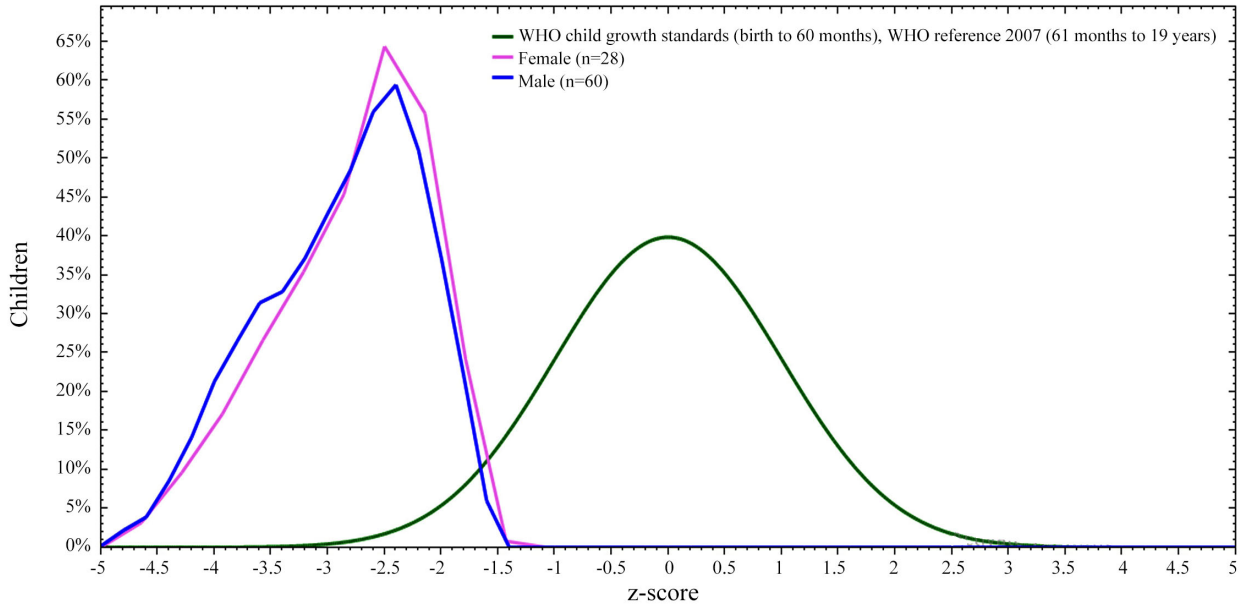


Figure 3. Showing deviation of the male and female pupils from normal distribution.

that reported among pupils in Ghana [16] and Ethiopia [17] respectively but higher than what was reported in Enugu [18] an urban settlement in Nigeria. This was in agreement with previous studies that reported a higher prevalence of undernutrition in rural areas than that of urban areas [5] [15] [19]. Ogbo *et al.* [20] suggested that the higher prevalence of undernutrition in rural areas relative to urban areas was due to a series of less favourable socioeconomic conditions which in turn, translated to lack of adequate and appropriate diet and less caring practices for children by their parents who were largely illiterates. In this study there was higher prevalence of stunting among males than females. According to Ayogu *et al.* [21] sex was an independent determinant of stunting among children and the higher prevalence among males than females was in agreement with the study of Kabubo-Mariara *et al.* [22] who reported that boys were more likely than girls to suffer from chronic and acute under-nutrition. Lenhart *et al.* [23] reported that girls were less likely to be active than boys. Girls were more sedentary when compared to boys and besides, males have higher basal metabolic rates. These factors may lead to higher energy expenditure among the males and in the face of inadequate intake may lead to higher prevalence of under-nutrition especially stunting, an index of chronic nutrition deprivation [21]. According to Khan *et al.* [5], male children are more vulnerable to develop malnutrition because they require comparatively more calories for growth and development [24] and the distribution of both males and females in this community showed a deviation from the WHO standard normal distribution which indicated that both sexes were malnourished but it was more in males than females.

5. Conclusion

Intervention such as Home Grown School Feeding Programme of the Government is a right step in improving the nutritional status of pupils in rural communities. Further studies would be carried out to evaluate other factors such as education, micronutrients and helminth infections among the study participants.

6. Limitation of the Study

Weight-for-age reference data are not available beyond age 10 because this indicator does not distinguish between height and body mass in an age period where many children are experiencing the pubertal growth spurt and may appear as having excess weight (by weight-for-age) when in fact they are just tall.

The majority of the parents of the pupils were illiterates who could not read and write and those that were classed as civil servants were the lowest cadre who barely completed the primary education so there was not difference between this class of people and the farmers as they also engage in farming activities.

Acknowledgements

The authors will like to acknowledge the cooperation of Borgu Local Govern-

ment Education Authority as well as the Head Teachers of the various schools. The support of Mrs Oladipo and Honourable Musa is hereby acknowledged.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Rodríguez, L., Cervantes, E. and Ortiz, R. (2011) Malnutrition and Gastrointestinal and Respiratory Infections in Children: A Public Health Problem. *International Journal of Environmental Research and Public Health*, **8**, 1174-1205. https://doi.org/10.3390/ijerph8041174

[2] Senbanjo, I.O., Olayiwola, I.O. and Afolabi, W.A.O. (2016) Dietary Practices and Nutritional Status of Under-Five Children in Rural and Urban Communities of Lagos State, Nigeria. *Nigeria Medical Journal*, **57**, 307-313. https://doi.org/10.4103/0300-1652.193854

[3] Fon, P.N., Shub, D.B., Assob, J.C., Kamga, H.L. and Ndoboe, P.K. (2014) Prevalence and Determinants of Malnutrition among Children Consulting at the Buea Regional Hospital, South West Cameroon. *Scientific Journal of Medical Science*, **3**, 337-344.

[4] Shibily, R.M. (2016) Prevalence of Malnutrition and Proportion of Anaemia among the Malnourished Children Aged 1-5 Years in a Rural Tertiary Care Centre, South India. *International Journal of Contemporary Pediatrics*, **3**, 362-366. https://doi.org/10.18203/2349-3291.ijcp20160838

[5] Khan, S., Zaheer, S. and Safdar, N.F. (2019) Determinants of Stunting, Underweight and Wasting among Children < 5 Years of Age: Evidence from 2012-2013 Pakistan Demographic and Health Survey. *BioMed Central Public Health*, **19**, 358. https://doi.org/10.1186/s12889-019-6688-2

[6] De Onis, M. and Blossner, M. (2003) The World Health Organization Global Database on Child Growth and Malnutrition: Methodology and Application. *International Journal Epidemiology*, **32**, 518-526. https://doi.org/10.1093/ije/dyg099

[7] WHO (2000) Nutrition for Health and Development—A Global Agenda for Combating Malnutrition. WHO, Geneva, 94.

[8] Srivastava, A., Mahmood, S.E., Srivastava, P.M., Shrotriya, V.P. and Kumar, B. (2012) Nutritional Status of School-Age Children—A Scenario of Urban Slums in India. *BioMed Central*, **70**, 8. https://doi.org/10.1186/0778-7367-70-8

[9] Sumbele, I.U.N., Bopda, O.S.M., Kimbi, H.K., Ning, T.R. and Nkuo-Akenji, T. (2015) Nutritional Status of Children in a Malaria Meso Endemic Area: A Cross-Sectional Study on Prevalence, Intensity, Predictors, Influence on Malaria Parasitaemia and Anaemia Severity. *BioMed Central*, **15**, 1099. https://doi.org/10.1186/s12889-015-2462-2

[10] Munisi, D., Kihamia, C., Jones, C. and Msoffe, P. (2014) Soil-Transmitted Helminths Infections, Malnutrition, and Anaemia among Primary School Children in Northern Tanzania. *IMTU Medical Journal*, **5**, 15-21.

[11] Shang, Y., Tang, L.H., Zhou, S.S., Chen, Y.D., Yang, Y.C. and Lin, S.X. (2010) Stunting and Soil Transmitted-Helminth Infections among School-Age Pupils in Rural Areas of Southern China. *Parasites & Vectors*, **3**, 97. https://doi.org/10.1186/1756-3305-3-97

[12] World Development Report (2011) Investing in Health.

https://openknowledge.worldbank.org/bitstream/handle/10986/5976/9780195208900ch04.pdf?sequence=8

[13] WHO (2009) WHO AnthroPlus for Personal Computers Manual: Software for Assessing the Growth of the World's Children and Adolescents. WHO, Geneva. http://www.who.int/growthref/tools/en

[14] Bain, L.E., Awah, P.K., Geraldine, N., Kindong, N.P., Sigal, Y., Bernard, N., *et al.* (2013) Malnutrition in Sub-Saharan Africa: Burden, Causes and Prospects. *Pan African Medical Journal*, **15**, 120. https://doi.org/10.11604/pamj.2013.15.120.2535

[15] National Population Commission (NPC) [Nigeria] and ICF International (2013) Nigeria Demographic and Health Survey 2013. Abuja, Rockville.

[16] Prince, A. and Laar, A. (2014) Nutrition Status of School-Age Children in the Nkwanta South District-Volta Region of Ghana. *European Science Journal*, **10**, 310-327.

[17] Wolde, M., Berhan, Y. and Chala, A. (2015) Determinants of Underweight, Stunting and Wasting among Schoolchildren. *BioMed Central Public Health*, **15**, 8. https://doi.org/10.1186/s12889-014-1337-2

[18] Nze, J.N., Oguonu, T., Ojinnaka, N.C. and Ibe, B.C. (2019) Physical Growth and Nutritional Status Assessment of School Children in Enugu, Nigeria. *Nigeria Journal of Clinical Practice*, **20**, 64-70. https://doi.org/10.4103/1119-3077.180067

[19] Maziya-Dixon, B., Akinyele, I.O., Oguntona, E.B., Nokoe, S., Sanusi, R.A. and Harris, E. (2004) Nigeria Food Consumption and Nutrition Survey 2001-2003 Summary. International Institute of Tropical Agriculture, Ibadan.

[20] Ogbo, F.A., Page, A., Idoko, J., Claudio, F. and Agho, K.E. (2015) Trends in Complementary Feeding Indicators in Nigeria, 2003-2013. *BioMed Journal Open*, **5**, e008467. https://doi.org/10.1136/bmjopen-2015-008467

[21] Ayogu, R.N.B., Afiaenyi, I.C., Madukwe, E.U. and Udenta, E.A. (2018) Prevalence and Predictors of Under-Nutrition among School Children in a Rural South-Eastern Nigerian Community: A Cross Sectional Study. *BioMed Central Public Health*, **18**, 587. https://doi.org/10.1186/s12889-018-5479-5

[22] Kabubo-Mariara, J., Ndemge, G.K. and Mwabu, D.K. (2008) Determinants of Children's Nutritional Status in Kenya: Evidence from Demographic and Health Surveys. *Journal of African Economies*, **18**, 363-387. https://doi.org/10.1093/jae/ejn024

[23] Lenhart, C.M., Hanlon, A. and Kang, Y. (2012) Gender Disparity in Structured Physical Activity and Overall Activity Level in Adolescence Evaluation of Youth Risk Behavior Surveillance Data. *International Scholarly Research Network*, **2012**, Article ID: 674936. https://doi.org/10.5402/2012/674936

[24] Kavosi, E., Rostami, Z.H., Kavosi, Z., Nasihatkon, A., Moghadami, M. and Heidari, M. (2014) Prevalence and Determinants of Under-Nutrition among Children under Six: A Cross-Sectional Survey in Fars Province Iran. *International Journal of Health Policy and Management*, **3**, 71. https://doi.org/10.15171/ijhpm.2014.63

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