VOLUME 39, NUMBER 12
December 2022

ISSN 0189 - 160X

WAJM

WEST AFRICAN JOURNAL OF MEDICINE

ORIGINALITY AND EXCELLENCE IN MEDICINE AND SURGERY

OFFICIAL PUBLICATION OF
THE WEST AFRICAN COLLEGE OF PHYSICIANS *AND*
WEST AFRICAN COLLEGE OF SURGEONS

www.wajmed.org

WEST AFRICAN JOURNAL OF MEDICINE

TABLE OF CONTENTS

WEST AFRICAN JOURNAL OF MEDICINE

ORIGINAL ARTICLE

Predictors of Undernutrition among School-Age Children in Abakaliki, Nigeria

Prédicteurs de la Dénutrition chez les Enfants d'Âge Scolaire à Abakaliki au Nigeria

[1]*A. A. Umeokonkwo, [2]C. D. Umeokonkwo, [1]U. M. Ibekwe, [3]C. Manyike, [1]N. P. Udechukwu, [4]C. B. Ibe

ABSTRACT

BACKGROUND: Undernutrition remains a major public health problem, especially in developing countries. Identification of factors affecting undernutrition among school-age children will guide prioritization of interventions. We determined the predictors of underweight, thinness and stunting among this age group.

METHODS: A descriptive, cross-sectional study was conducted among 780 school children aged 6 to 12 years using a multistage probability sampling method. An interviewer-administered questionnaire was used to document socio-demographic information and potential predictors of undernutrition. Weight and height were measured using SECA® weighing scale and stadiometer. Body Mass Index (BMI), Z scores of the weight-for-age, BMI-for-age and height-for-age were calculated using the WHO Anthro plus software. Data was entered and analyzed using the Epi Info version 7.2. Multiple logistic regression was used to identify the predictors of undernutrition at 5% level of significance.

RESULTS: Of a total of 751 pupils, 397 (52.9%) were females and 595 (79.2%) were in public schools. Significant predictors of underweight were lower maternal education (adjusted odds ratio (aOR) 2.7; 95%CI: 1.33–5.44) and age 10–12years (aOR 5.0; 95%CI:1.49–17.05). Thinness was predicted by age 10-12years (aOR 3.1; 95%CI 1.32–7.27) and rural dwelling (aOR 2.2; 95%CI:1.2–4.08) whereas stunting was predicted by age 10–12 years (aOR 5.2; 95%CI:2.14–12.68) and rural dwelling (aOR 2.3; 95%CI 1.3–4.1)

CONCLUSION: Undernutrition was higher among rural dwellers, at age 10 to 12 years and with low maternal education. **WAJM 2022; 39(12): 1299–1304.**

Keyword: Predictor; Undernutrition; School-age children; Stunting; thinness; Underweight.

RÉSUMÉ

BACKGROUND: La dénutrition reste un problème majeur de santé publique, en particulier dans les pays en développement. L'identification des facteurs affectant la dénutrition chez les enfants d'âge scolaire guidera la priorisation des interventions. Nous avons déterminé les prédicteurs de l'insuffisance pondérale, de la maigreur et du retard de croissance dans ce groupe d'âge.

MÉTHODES: Une étude descriptive et transversale a été menée auprès de 780 écoliers âgés de 6 à 12 ans en utilisant une méthode d'échantillonnage probabiliste à plusieurs degrés. Un questionnaire administré par un enquêteur a été utilisé pour documenter les informations sociodémographiques et les prédicteurs potentiels de la dénutrition. Le poids et la taille ont été mesurés à l'aide d'un pèse-personne SECA® et d'un stadiomètre. L'indice de masse corporelle (IMC), les scores Z du poids pour l'âge, de l'IMC pour l'âge et de la taille pour l'âge ont été calculés à l'aide du logiciel Anthro plus de l'OMS. Les données ont été saisies et analysées à l'aide du logiciel Epi Info version 7.2. La régression logistique multiple a été utilisée pour identifier les prédicteurs de la dénutrition au niveau de signification de 5%.

RÉSULTATS: Sur un total de 751 élèves, 397 (52,9%) étaient des femmes et 595 (79,2%) étaient dans des écoles publiques. Les prédicteurs significatifs de l'insuffisance pondérale étaient le faible niveau d'éducation de la mère (odds ratio ajusté (aOR) 2,7 ; 95%CI : 1,33-5,44) et l'âge de 10-12 ans (aOR 5,0 ; 95%CI:1,49-17,05). La maigreur était prédite par l'âge de 10-12 ans (aOR 3,1 ; 95%CI 1,32-7,27) et le logement rural (aOR 2,2 ; 95%CI:1,2-4,08) tandis que le retard de croissance était prédit par l'âge de 10-12 ans (aOR 5,2 ; 95%CI:2,14-12,68) et le logement rural (aOR 2,3 ; 95%CI 1,3-4,1).

CONCLUSION: La dénutrition était plus élevée chez les habitants des zones rurales, à l'âge de 10 à 12 ans et avec une faible éducation maternelle. **WAJM 2022; 39(12): 1299–1304.**

Mots clés: Prédicteur ; Dénutrition; Enfants d'âge scolaire; Retard de croissance; Maigreur; Insuffisance pondérale.

[1]Department of Paediatrics, Alex Ekwueme Federal University Teaching Hospital, Abakaliki, Ebonyi State, Nigeria.
[2]Department of Community Medicine, Alex Ekwueme Federal University Teaching Hospital, Abakaliki, Ebonyi State, Nigeria.
[3]Department of Paediatrics, Ebonyi State University, Abakaliki, Ebonyi State, Nigeria.
[4]Department of Paediatrics, University of Nigeria, Nsukka, Enugu State, Nigeria.
***Correspondence:* Dr. Adanna Anthonia Umeokonkwo,** Department of Paediatrics, Alex Ekwueme Federal University Teaching Hospital, Abakaliki, Ebonyi State, Nigeria. Email: adannaumeokonkwo@gmail.com
Abbreviations: BMI, Body Mass Index.

INTRODUCTION

The second Sustainable Development Goal (SDG) focuses on reducing hunger to zero by the year 2030. The global progress towards achieving this has not been optimum due to multiple factors bordering on food insecurity and climate change among others. Adequate nutrition is necessary for optimal growth and development of a child throughout life. Target 2.2 of the SDG goal two focuses attention on under-five children. Researchers also often pay attention more on the under-five children with little attention paid on children outside this age bracket. Interventions are often not targeted at school age children due to paucity of data on the predictors of under nutrition among them. Many factors have been reported to be associated with undernutrition among school age children. The household food insecurity amidst other socio-economic and environmental influences impact on the child's health resulting in poor growth, poor physical activity, increased risk of infections, poor school performance, early school dropout, and reduced productivity later in life.[1–3]

Childhood undernutrition is a major public health problem in middle- and low-income countries, contributing greatly to childhood morbidity and mortality. It is a complex health problem with multi-factorial aetiology.[4] It results from the interplay of a number of predictors including a person's genetic makeup.[5–7] Undernutrition encompasses underweight, thinness and stunting. Undernutrition can start before birth and continue thereafter.[8] School age children are generally thought to be less vulnerable to effects of food shortage.[9] However, studies have reported that this age group contributes significantly to childhood undernutrition figures.[8–10] The impact of undernutrition goes beyond the affected child to the nation's economy. United Nations Children's fund (UNICEF) ranked Nigeria the second country worldwide with highest burden of stunted children. Most studies done on predictors of undernutrition focused on preschool population. No study in the study area had looked at predictors of undernutrition among school age children. This study assessed the predictors of underweight, thinness and stunting among school-aged children in Abakaliki metropolis.

METHODS

Study Setting, Sampling Technique and Study Instrument

Abakaliki is a metropolitan city, the capital of Ebonyi State, Southeast Nigeria. The city is not entirely urban and is predominately made up of civil servants and traders. The educational system in the area is regulated by the government. The government-owned public schools were highly subsidized whereas the privately owned schools do not receive any form of subsidy and so parents pay much higher for their children to attend such schools. There are more private schools in the urban and densely populated areas in the city that the rural areas. The study was a descriptive cross-sectional study among school children aged 6 to 12 years. The participants were selected using multistage probability sampling technique. A structured, pretested and interviewer-administered questionnaire was used to collect information from the participants. The details of the sampling technique, study instrument, and data collection have earlier been reported.[10]

Statistical Analysis

Information on the socio-demographic characteristics of the children, parents' socio-demographic characteristics and anthropometric indices were examined for completeness and errors, entered and analyzed using the Epi Info version 7.2, (CDC Georgia, United States of America 2017). Weight-for-age Z score was calculated for participants 6–10 years while BMI-for-age and height-for-age Z scores values were calculated for those 6–12 years using the WHO Anthro Plus version 3.1. The Z scores were used to categorize and estimate the proportion of children that are underweight, thin and stunted.[10] "Underweight was assessed by using weight for age, thinness by using BMI for age and stunting by using height for age measure. Z score of less than –2Z was classified as underweight, thin or stunted. Z score of between –2Z and –3Z were classified as moderate while Z scores of less than -3Z were classified as severe".[10] Bivariate analysis was carried out to examine the relationship between the dependent variables (underweight, thinness and stunting) and the independent variables (sociodemographic characteristics of the child and parents) using chi-square test statistics. For each of the dependent variables, the factors with a p-value of 0.2 or less were selected and modelled in a multiple logistic regression at a p-value of 0.05 to determine the predictive variables. We used a p-value of 0.2 in order to include variables which may not be strong enough to show significant association alone in bivariate logistic analysis but may do so when coupled with other variables in the final model (multivariate analysis).

Ethical Consideration

The ethical clearance was obtained from the Research and Ethics Committee of Federal Teaching Hospital Abakaliki. Permission was sought from Ebonyi State Ministry of Education, Universal Basic Education Board for public schools and the Proprietors /Administrators of the private schools. Consent was obtained from the parents/guardians and assent obtained from the pupils before the study. Privacy and confidentially of the pupils and their parents were maintained throughout the study. Participants' personal identifiable information were not captured. The questionnaires and data were handled securely. Information provided was used for research purpose only.

RESULTS

Out of the 780 participants selected, 751 participants gave consent and completed the study giving a response rate of 96.3%. The mean age of the pupils was 8.8±1.7 years. About 44% of their mothers were traders, 32.4% of the fathers and 26.2% of the mothers attained tertiary level of education. Five hundred and forty (73%) of the pupils resided in the urban area. Age, place of residence, school ownership type, maternal education, family type and social class were associated with underweight (Table 1) in bivariate analysis at p-value less than 0.20 but when modelled into

Table 1: Factors associated with Underweight among the Pupils aged 6 to 10 years

Variable	Underweight (%)	Normal (%)	Chi Square	p value	Adjusted OR (95%CI)	p value
Age Group (years)						
6 to less than 8	9 (4.5)	191 (95.5)	9.556	**0.0084**	1	
8 to less than 10	25 (9.6)	235 (90.4)			2.0 (0.9–.5)	0.079
*10 to 12	5 (20.8)	19 (79.2)			5.0 (1.5–17.1)	0.009
Gender						
Male	18 (7.8)	213 (92.2)	0.0421	0.8374		
Female	21(8.3)	232 (91.7)				
Place of Residence						
Urban	24 (6.6)	342 (93.4)	4.562	**0.0327**	1	
Rural	15 (12.7)	103 (87.3)			1.4 (0.7–3.0)	0.341
School Ownership Type						
Public	39 (10.8)	321 (89.2)	14.610	**<0.001**		
Private	0 (0.0)	124 (100.0)				
Mother's Education						
Primary education or less	21 (15.0)	119 (85.0)	12.814	**<0.001**	2.7 (1.3–5.4)	**0.006**
Secondary education or more	18 (5.2)	326 (94.8)			1	
Father's Education						
Primary education or less	12 (8.3)	132 (91.7)	0.021	0.885		
Secondary education or more	27 (7.9)	313 (92.1)				
Family Type						
Monogamous	30 (7.3)	384 (92.8)	2.544	**0.111**	1	
Polygamous	9 (12.9)	61 (87.1)			1.2 (0.5–2.8)	0.694
Social Class						
Class 1	0 (0.0)	62 (100.0)	13.233	**0.010**		
Class 2	5 (4.3)	112 (95.7)				
Class 3	16 (10.5)	137 (89.5)				
Class 4	13 (10.6)	110 (89.4)				
Class 5	5 (17.2)	24 (82.8)				

Logistic regression modeled for age, place of residence, mother's education and family type. Social class and school ownership type were excluded because of the zero frequency.

**Age 10-12 years, here captured only 10 years because WHO growth chart for underweight does not consider children greater than 10years.*

multivariable logistic regression, the significant predictors of underweight were lower maternal education (adjusted odds ratio (aOR) 2.7; 95%CI: 1.33–5.44) and pupils' age 10–12 years (aOR 5.0; 95%CI: 1.49–17.05, Table 1).

The bivariate analysis for thinness showed that pupils' age, gender, place of residence, school ownership type, mothers' education, fathers' education, social class and family type were associated with thinness at p value less than 0.20 (Table 2). In the multivariate analysis, pupil age 10–12 years (aOR 3.1; 95%CI 1.32–7.27) and rural dwelling (aOR 2.2; 95%CI:1.2–4.08) were the significant predictors of thinness among the study population at p value less than 0.05 (Table 2). With respect to stunting, age, place of residence, school ownership type, mothers' education, fathers' education, family type and social class were significant at p value less than 0.20 at bivariate analysis (Table 3). However, after accounting for effect of age, school type, family type, maternal education, place of residence, and class of study in logistic regression, age 10–12 years (aOR 5.2; 95%CI:2.14–12.68) and rural dwelling (aOR 2.3; 95%CI 1.3–4.1, Table 3) remained predictors of stunting.

DISCUSSION

This study examined the predictors of underweight, thinness and stunting among the school age children. Maternal education and age of the pupils were identified as significant predictors of underweight. The odds of being underweight was three times more in pupils whose mothers received primary education or less compared to those whose mothers attained secondary or tertiary education. The relationship between low maternal education and underweight has been reported.[4,11–15] This is expected as better educated mothers are likely to earn higher and are more likely to spend more on the health and nutrition of their children. An educated mother, even in the presence of lack, is better able to prioritize child nutrition and wellbeing. This reflects the pivotal role of female education in the prevention of underweight in the study area and underlines the important role of female education in the child survival strategies.

The study showed that the likelihood of being underweight increased with age. School children aged

Table 2: Factors associated with Thinness among the Pupils

Variable	Thinness (%)	Normal (%)	Chi-Square	p-value	Adjusted OR (95%CI)	p value
Age Group (years)						
6 to less than 8	7 (3.5)	193 (96.5)	17.053	**<0.001**	1	
8 to less than 10	12 (4.6)	249 (95.4)			1.1 (0.4–3.0)	0.813
10 to 12	35 (12.1)	255 (87.9)			3.1 (1.3–7.3)	0.009
Gender						
Male	31 (8.8)	323 (91.2)	2.463	**0.117**	1.5 (0.9–2.8)	0.150
Female	23 (5.8)	374 (94.2)			1	
Place of Residence						
Urban	25 (4.6)	523 (95.4)	20.987	**<0.001**	1	
Rural	29 (14.3)	174 (85.7)			2.2 (1.2–4.1)	0.015
School Ownership Type						
Public	51 (8.6)	544 (91.4)	8.186	**0.004**	2.0 (0.5–7.8)	0.300
Private	3 (1.9)	153 (98.1)			1	
Mother's Education						
Primary education or less	22 (9.8)	203 (90.2)	3.223	**0.0726**	1	
Secondary education or more	32 (6.1)	494 (93.9)			1.4 (0.6–3.0)	0.565
Father's Education						
Primary education or less	21 (9.1)	209 (90.9)	1.870	**0.171**	1	
Secondary education or more	33 (6.3)	488 (93.7)			1.4 (0.6–3.5)	0.398
Family Type						
Monogamous	39 (6.1)	597 (93.9)	6.971	**0.008**	1	
Polygamous	15 (13.0)	100 (87.0)			1.5 (0.7–3.0)	0.289
Social Class						
Class 1	2 (2.5)	79 (97.5)	11.574	**0.021**	1	
Class 2	8 (4.6)	165 (95.4)			1.1 (0.2–6.1)	0.884
Class 3	20 (7.5)	246 (92.5)			1.5 (0.3–7.8)	0.617
Class 4	15 (8.6)	160 (91.4)			2.4 (0.4–15.1)	0.365
Class 5	9 (16.1)	47 (83.9)			3.5 (0.4–32.4)	0.236

The logistic modelled include all the variables in the table.

10 to 12years were five times more likely to be underweight compared to those aged 6 to less than 8 years. This pattern has previously been reported.[16] It is probably due to the increased physical activity and nutritional requirement associated with the growth spurt experienced at about this age which is the age of puberty.

Age and place of residence of the pupils were significant predictors of thinness. Pupils living in rural parts of the metropolis were twice as likely to be thin as those in the urban areas. This may be related to poverty and ignorance as most of their parents were subsistent farmers and of lower educational status. Also, those that were aged 10–12years were thrice more likely to be thin than those aged 6 to less than 8years. Thinness was similarly reported to be more prevalent in this age group among Ethiopian children.[16,17] This may be related to increased physical activity coupled with high nutritional demand as nutritional attention is usually given to younger siblings first. This is because they are assumed healthier population and therefore, less vulnerable to effect of food shortage.

The significant predictors of stunting were pupils' age and place of residence. The odds of being stunted was noted to be five times greater in children aged 10–12years compared to those aged 6 to less than 8years. This is probably because feeding at this age is not closely supervised by adults when compared to younger age groups who may as well have more access to food and care. Again, this age group are usually more active, lose more energy and have less access to food.[16] The implication of this is that their physical strength to work as adult may be affected with associated economic loss to the individuals and the nation at large. Therefore, special nutrition and health programs should be put in place to reverse this trend. The inverse relationship between age and stunting has previously been reported.[16,18–20]

Residing in rural area was a significant independent predictive factor for being stunted among the study population. This is similar to the observations reported in earlier studies.[20,22–24] This calls for efforts to improve food security and the economic well-being of the rural dwellers. The intervention of Federal government in providing school meals for school children needs to focus more on rural schools.

CONCLUSION

Age of the pupils, maternal education and place of residence were the significant predictors of undernutrition. Therefore, tackling under-

Table 3: Factors associated with Stunting among the Pupils

Variable	Stunted (%)	Normal (%)	Chi-Square	p value	Adjusted OR (95%CI)	p value
Age Group (years)						
6 to less than 8	6 (3.0)	194 (97.0)	28.419	**<0.001**	1	
8 to less than 10	18 (6.9)	243 (93.1)			2.0 (0.8–5.2)	0.165
10 to 12	48 (16.6)	242 (83.4)			5.2 (2.1–12.7)	<0.001
Gender						
Male	34 (9.6)	320 (90.4)	0.0002	0.988		
Female	38 (9.6)	359 (90.4)				
Place of Residence						
Urban	33 (6.0)	515 (94.0)	29.730	**<0.001**	1	
Rural	39 (19.2)	164 (80.8)			2.3 (1.3–4.1)	0.002
School Ownership Type						
Public	68 (11.4)	527 (88.6)	11.204	**<0.001**	1.8 (0.5–5.9)	0.345
Private	4 (2.6)	152 (97.4)			1	
Mother's Education						
Primary education or less	34 (15.1)	191 (84.9)	11.309	**<0.001**	1	
Secondary education or more	38 (7.2)	488 (92.8)			1.0 (0.5–2.1)	0.983
Father's Education						
Primary education or less	31 (13.5)	199 (86.5)	5.791	**0.016**	1.5 (0.7–3.3)	0.306
Secondary education or more	41 (7.9)	480 (92.1)			1	
Family Type						
Monogamous	53 (8.3)	583 (91.7)	7.533	**0.006**	1	
Polygamous	19 (16.5)	96 (83.5)			1.1 (0.6–2.1)	0.777
Social Class						
Class 1	3 (3.7)	78 (96.3)	33.069	**<0.001**	1	
Class 2	7 (4.1)	166 (95.9)			0.7 (0.2–3.0)	0.615
Class 3	27 (10.2)	239 (89.8)			1.4 (0.4–5.6)	0.630
Class 4	19 (10.9)	156 (89.1)			1.9 (0.4–9.4)	0.435
Class 5	16 (28.6)	40 (71.4)			4.8 (0.8–31.2)	0.097

All the variables except gender were modelled in the multiple logistic regression.

nutrition in the metropolis requires a holistic approach. Federal and State Ministries of Education should strengthen female education especially in rural areas since this has impact on child nutrition and survival. Community outreaches should be organized to educate mothers on how to use locally available food crops to provide optimum nutrition for their children.

Conflict of Interest

The authors have no conflict of interest to declare.

Funding

The authors did not receive any funding for this work.

REFERENCES

1. Schmeer KK, Piperata BA. Household food insecurity and child health. *Matern Child Nutr.* 2017; **13:** e12301
2. Amoah JA. Appraisal of malnutrition on academic performance of students in the basic schools in Ghana. *American Journal of Food Science and Health.* 2019; **5:** 38–45.
3. French B, Outhwaite LA, Langley-Evans SC, Pitchford NJ. Nutrition, growth, and other factors associated with early cognitive and motor development in Sub-Saharan Africa: a scoping review. *J Hum Nutr Diet.* 2020; **33:** 644–669.
4. Veghari G. The relationship of ethnicity, socio-economic factors and malnutrition in primary school children in North of Iran: A cross-sectional study. *Journal of Research in Health Sciences.* 2013; **13:** 58–62.
5. Martorell R, Young MF. Patterns of Stunting and Wasting: Potential Explanatory Factors. *Advances in Nutrition.* 2012; **3:** 227–233.
6. Reinhardt K, Fanzo J. Addressing Chronic Malnutrition through Multi-Sectoral, Sustainable Approaches: A Review of the Causes and Consequences. *Frontiers in Nutrition.* 2014; **1:** 13–24.
7. Victora CG, Adair L, Fall C, Hallal PC, Martorell R, Richter L, *et al.* Maternal and child undernutrition: consequences for adult health and human capital. *The Lancet.* 2008; **371:** 340–357.
8. Mesfin F, Berhane Y, Worku A. Prevalence and associated factors of stunting among primary school children in Eastern Ethiopia. *Nutrition and Dietary Supplements.* 2015; **7:** 61–68.
9. Drake L, Maier C, Jukes M, Patrikios A, Bundy D. School-age children: their nutrition and health. *SCN News.* 2002; (25): 4–30.
10. Umeokonkwo AA, Ibekwe MU, Umeokonkwo CD, Okike CO, Ezeanosike OB, Ibe BC. Nutritional status of school age children in Abakaliki metropolis, Ebonyi State, Nigeria. *BMC Pediatrics.* 2020; **20:** 114.
11. Igbokwe O, Adimorah G, Ikefuna A, Ibeziako N, Ubesie A, Ekeh C, *et al.*

Socio-demographic determinants of malnutrition among primary school aged children in Enugu, Nigeria. *Pan African Medical Journal.* 2017; **28:** 248. doi: 10.11604/pamj.2017.28.248.13171
12. Srivastava A, Mahmood SE, Srivastava PM, Shrotriya VP, Kumar B. Nutritional status of school-age children – A scenario of urban slums in India. *Archives of Public Health.* 2012; **70:** 8. doi: 10.1186/0778-7367-70-8.
13. Abuya BA, Ciera J, Kimani-Murage E. Effect of mother's education on child's nutritional status in the slums of Nairobi. *BMC Pediatrics*. 2012; **12:** doi: 10.1186/1471-2431-12-80.
14. Makoka D, Masibo PK. Is there a threshold level of maternal education sufficient to reduce child undernutrition? Evidence from Malawi, Tanzania and Zimbabwe. *BMC Pediatrics*. 2015; **15:** doi: 10.1186/s12887-015-0406-8.
15. Syahrul S, Kimura R, Tsuda A, Susanto T, Saito R, Ahmad F. Prevalence of underweight and overweight among school-aged children and it's association with children's sociodemographic and lifestyle in Indonesia. *International Journal of Nursing Sciences*. 2016; **3:** 169–177 doi: 10.1016/j.ijnss. 2016. 04. 004.
16. Degarege D, Degarege A, Animut A. Undernutrition and associated risk factors among school age children in Addis Ababa, Ethiopia. *BMC Public Health*. 2015; **15:** 375–383. doi: 10.1186/s12889-015-1714-5.
17. Gebregyorgis T, Tadesse T, Atenafu A. Prevalence of Thinness and Stunting and Associated Factors among Adolescent School Girls in Adwa Town, North Ethiopia. *International Journal of Food Science.* 2016; **2016:** 8323982–90. doi: 10.1155/2016/8323982
18. Senbanjo IO, Oshikoya KA, Odusanya OO, Njokanma OF. Prevalence of and risk factors for stunting among school children and adolescents in Abeokuta, Southwest Nigeria. *Journal of health, Population, and Nutrition.* 2011; **29:** 364–370.
19. Abah R, Okolo S, John C, Ochoga M, Adah R. Nutritional status of school-children in Jos East Local Government Area of Plateau State, North Central Nigeria. *Journal of Medicine in the Tropics*. 2017; **19:** 56–59.
20. Yasmin G, Kustiyah L, Dwiriani CM. Risk Factors of Stunting among School-Aged Children from Eight Provinces in Indonesia. *Pakistan Journal of Nutrition*. 2014; **13:** 557–566.
21. Mohamed S, Hussein MD. Prevalence of Thinness, Stunting and Anemia Among Rural School-aged Sudanese Children: A Cross-sectional Study. *Journal of Tropical Pediatrics.* 2015; **61:** 260–265.
22. Bello B, Ekekezie O, Afolabi OT. Dietary pattern and nutritional status of primary school pupils in a South Western Nigerian state: A rural urban Comparison. *African Journal of Food Science*. 2016; **10:** 203–212. doi: 10.5897/AJFS2016.1439
23. Mohamed FN. Comparative Study of Nutritional Status of Urban and Rural School Girls Children Khartoum State, Sudan. *Journal of Science and Technology.* 2011; **12:** 60–68.
24. Amare Zelellw D, Gebreigziabher BG. Prevalence and Associated Factors of Stunting Among Schoolchildren, in Debre Markos Town and Gozamen Woreda, East Gojjam Zone, Amhara Regional State, Ethiopia, 2013. *Journal of Nutrition & Food Sciences.* 2014; **s8:** 1–5.