ORIGINAL ARTICLES

Ann Ibd. Pg. Med 2017. Vol.15, No.1 7-15

PREVALENCE AND DETERMINANTS OF STUNTING AMONG PRIMARY SCHOOL CHILDREN IN RURAL AND URBAN COMMUNITIES IN OBAFEMI OWODE LOCAL GOVERNMENT AREA, SOUTHWESTERN NIGERIA

W.U. Adenuga[1], T.A. Obembe[2, 3], K.O. Odebunmi[4], and M.C. Asuzu[1]

1. Dept. of Community Medicine, Faculty of Clinical Sciences, College of Medicine, University of Ibadan
2. Dept. of Health Policy and Management, Faculty of Public Health, College of Medicine, University of Ibadan.
3. University of Witwatersrand, School of Public Health, Wits Education Campus, Johannesburg, South Africa.
4. Department of Palliative Medicine, University College Hospital, Ibadan, Ibadan.

Correspondence:
Dr. T.A. Obembe
Dept. of Health Policy and Mgt,
Faculty of Public Health,
College of Medicine,
University of Ibadan
Email: tobembe@cartafrica.org
Tel: +234-805-840-9495

ABSTRACT

Background: **Studies on stunting in children have largely focused on the under-five, establishing it as a strong predictor of mortality in these children. Few studies have documented the prevalence or determinants of stunting among school children in southwestern Nigeria. The aim of the study was to determine the prevalence and predictors of stunting among selected primary school children in rural and urban communities of Obafemi Owode Local Government Area, Ogun State.**

Methods: **A cross-sectional study of rural and urban primary school children was conducted. An interviewer-administered questionnaire was used to collect information on respondents' and parents' socio-demographic characteristics. Stunting was defined as height-for-age less than two standard deviations from the median height-for-age of the standard World Health Organization reference population. Using EPI-INFO version 6.03, children were classified as stunted if z-scores of height-for-age were less than 2 standard deviations below the National Centre for Health statistics (NCHS)/WHO median. Height and weight were taken using a stadiometer and weighing scale respectively. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) Version 16.0 while predictors were determined using logistic regression at 95% level of significance.**

Results: **A total of 1,160 primary school children were studied with 52.2% from rural schools. Males constituted 57.1% and 51.8% in the rural and urban school respectively. Prevalence of stunting among rural school children was 46.2%, and was significantly higher ($p \leq 0.001$) than among urban children at 33.8%. Younger children <10 years (OR: 0.088; 95CI: 0.052 - 0.150) and children between 11-12 years (OR: 0.534; 95CI: 0.322 - 0.886) were at a significantly lower risk of stunting both in rural schools compared to children >13 years.**

Conclusion: **The prevalence of stunting was high especially among pupils from schools in the rural communities. This underscores the need for urgent feasible and effective nutrition programs for primary school children especially those in rural schools within the study area.**

Keywords: Stunting, School children, Undernutrition, Millennium development goals, Sustainable development goals

BACKGROUND

Malnutrition has continued to persist in both developed and developing countries.[1,2] Stunting is an indicator of chronic malnutrition which may lead to poor mental development later in life.[3] Stunting typically represents a cumulative process of reduced growth that predominantly occurs before three years of age and persists into school age.[4]

Globally, prevalence of stunting amongst school age children typically varies from place to place ranging from 9.3-24.0% in Latin America and Caribbean to as high as 20.2-48.1% in Africa.[5] In South Africa the prevalence for stunting is 18.0%, whereas it is as high as 42.0% and 50.0% in mid and Eastern Africa respectively.[6] Nationally, prevalence of stunting among primary school children ranges from 11.5% in Anambra, 11.8 % in Onitsha to as high as 60% in Kebbi State.[7,8] In Nigeria, the progress towards halving the proportion of people suffering from hunger under the Millennium Development Goals (MDGs)[9] has hitherto been slow and daunting.

Stunting has profound effects on the health of children. It predisposes to heightened risks of severe infections as a result of immune-compromised responses.[10] Stunting has also been implicated in increased

morbidity and mortality, reduced physical, neurodevelopmental and economic capacity and an elevated risk of metabolic disease into adulthood.[11] Under-nutrition significantly interferes with a number of bodily functions such as immunity (cell-mediated immune responses)[12] antibody responses and cytokine production[13], that as a result provoke poor health outcomes in early infancy and childhood.[14,15]. Most importantly, the high prevalence of bacterial and parasitic diseases in poor and developing countries have continued to exacerbate the effect of stunting in children.[16]

Risks of stunting are high in children as a result of heightened vulnerabilities to "low dietary intake, inaccessibility to food, inequitable distribution of food within the household, improper food storage and preparation, dietary taboos and infectious diseases"[16]. Significant associations have been established between early childhood stunting and late onset adulthood depression with elevated self-reported conduct problems.[17] The consequences of stunting iterated above demonstrate the need to investigate and implement interventions to address the problem amongst school children. Furthermore, the 'double burden of malnutrition', (in which households have a stunted child and an overweight mother) makes stunting as a form of under-nutrition quite worrisome.[18-20]

Numerous studies have investigated and provided broader national estimates of stunting[8], even though key health-related targets in the Millennium Development Goals and the Sustainable Development Goals supports concerted calls to eradicate poverty and hunger whilst also bridging inequities in health.[21] Bearing this in mind, there is a dire need for comparative statistics across wealth quintiles and vulnerable populations that can inform formulation and adoption of feasible policies at the strategic and operational levels of government in order to curtail the effects of stunting in Nigeria and sub-Saharan Africa. The objective of this study was to document the prevalence of stunting and its determinants amongst rural and urban students in selected primary school pupils of South-Western Nigeria.

METHODS

This cross-sectional study was conducted in selected public primary schools in Obafemi-Owode Local Government Area (LGA) in Ogun Central Senatorial District. The LGA is predominantly rural with a total of 161 public primary schools and 63 private primary schools. In addition there are 41 health facilities owned by the LGA and these are made up of 3 comprehensive health centres, 22 health centres, 8 health clinics and 8 health posts.[22] The study was carried out in the third term of the 2007/2008 academic year. Data collection was between May and July 2008.

The target population consisted of children from public primary schools in Obafemi-Owode Local Government Area. Sample size for comparison of two independent groups[23] was used to deduce a minimum sample size of 400 participants per group. A multi-stage sampling technique was utilized to recruit a total of 1,160 grade 4 pupils across the study sites. This class was purposively chosen because most of the pupils were old enough to answer the questions correctly and were not preparing for national examinations at the time of data collection (as those in grades 5 and 6). Pupils with chronic ailments were excluded from the study.

List of all primary schools was obtained from Obafemi-Owode Local Government Education Authority and were stratified into urban and rural categories. Based on the population of primary four (4) pupils in all the schools, a total of 62 rural and urban were selected using proportionate allocation. In each school that was selected, grade 4 pupils were considered as a cluster and all eligible students that met inclusion criteria were interviewed. Out of 1,400 consent forms given out, 1,160 forms were returned resulting in a response rate of 82.9%. Six hundred and six (606) and 554 pupils were selected from the rural and urban schools respectively. A semi-structured pretested interviewer-administered questionnaire was used to obtain information on socio-demographic characteristics. Anthropometric measurements (weight and height) were both used to compute nutritional status which was done with the help of trained community health workers. Before weights and height measurements were taken, pupils were requested to come dressed in lightweight clothing while the scale was returned to zero before every subsequent measurement was taken. The weight and height of each child were measured using a standard balanced beam scale with attached measuring rods according to World Health Organization standards.[24] All weight and height measurements were taken twice to ensure accuracy. Independent variables for the study included both socio-demographic characteristics of respondents and anthropometric measurements of respondents. Dependent variable used in this study was presence or absence of stunting. Stunting was assessed by measuring Height-for-age (stunting) Z-scores calculated using Centre for Disease Control (National Centre for Health Statistics)/World Health Organization reference values[25] with EPI-INFO software package version 6.03. Children were classified as stunted if the Z-scores

were <-2 standard deviations below the median values of the international reference.[25,26]

Data were analysed using the Statistical Package for the Social Sciences (SPSS) Version 16. Frequency distributions of the quantitative variables were obtained. Differences in proportions were tested using the chi-square test for categorical variables. The Fisher's Exact test was used to compare proportions in tables with >20% of the cells having expected counts less than 5. Statistical significance level was set at P <0.05. Multivariate logistic regression analysis was carried out to identify predictors for stunting in the study population.

Prior to data collection, ethical approval was obtained from the Health Research Committee of Federal Medical Centre, Abeokuta and the Ogun State Universal Basic Education Board respectively. Informed consent was obtained from parents while assent was obtained from pupils above the age of 12. Only the children who gave assent and parents that

Table 1: Association between socio-demographic characteristics by location only

Variable	Rural N=606 (%)	Urban N=554 (%)	Total N=1160 (%)	X^2	*p*-value
Age (years)					
≤10	259 (42.8)	231 (41.7)	490 (42.2)	2.449	0.294
11 -12	236 (38.9)	237 (42.8)	473 (40.8)		
≥13	111 (18.3)	86 (15.5)	197 (17.0)		
Mean ±SD	11.1 ±1.7	11.1 ±1.5	11.1 ±1.6		
Sex					
Male	346 (57.1)	287 (51.8)	633 (54.6)	3.268	0.071
Female	260 (42.9)	267 (48.2)	527 (45.4)		
Birth Order					
1 – 4	383 (63.2)	386 (69.7)	769 (66.3)	5.428	0.020*
≥5	223 (36.8)	168 (30.3)	391 (33.7)		
Caregiver					
Both parents	460 (75.9)	458 (82.7)	918 (79.1)	10.42	0.005*
Grandparents	91 (15.0)	50 (9.0)	141 (12.2)		
**Others	55 (9.1)	46 (8.3)	101 (8.7)		
Stunting					
Yes	280 (46.2)	187 (33.8)	467 (40.3)	18.652	<0.001*
No	326 (53.8)	367 (66.2)	693 (59.7)		
Clinical Characteristics					
Weight (kg) Mean ± SD	25.9 ± 4.9	28.1 ± 5.2	27.0 ± 5.2	t = -7.287	<0.001*
Height (cm) Mean ± SD	131.8±7.5	133.5±8.1	132.6±7.9	t = -3.539	<0.001*
Respondents' Family Characteristics by location					
Mothers' socio-demographic characteristics by location					
Educational status					
No formal	150 (24.8)	112 (20.2)	262 (22.6)	38.960†	<0.001*
Primary	341 (56.3)	252 (45.5)	593 (51.1)		
Secondary	110 (18.2)	169 (30.5)	279 (24.1)		
Post-secondary	4 (0.7)	16 (2.9)	20 (1.7)		
Tertiary	1 (0.2)	5 (0.4)	6 (0.5)		
Occupation					
Civil servant	10 (1.7)	34 (6.1)	44 (3.8)	15.968	<0.001*
Traders/artisans/farmers	596 (98.3)	520 (93.8)	1116 (96.2)		
Fathers' socio-demographic characteristics by location					
Educational status					
No formal	115 (19.0)	88 (15.9)	203 (17.5)	55.210†	<0.001*
Primary	344 (56.8)	232 (41.9)	576 (49.7)		
Secondary	142 (23.4)	199 (35.9)	341 (29.4)		
Post-secondary	4 (0.7)	26 (4.7)	30 (2.6)		
Tertiary	1 (0.1)	9 (1.6)	10 (0.9)		
Occupation					
Civil servant	33 (5.4)	69 (12.5)	102 (8.8)	17.730	<0.001*
Traders/Artisans/Farmers	573 (94.6)	485 (87.5)	1058 (91.2)		

** - Statistically significant **Others – Uncles and Aunts † -Fisher's Exact Test*

gave their informed consent were enrolled into the study. All information and findings were treated with strict confidentiality.

RESULTS

Socio-demographic Characteristics of Respondents

Mean age of respondents was 11.1 ± 1.6 years with majority of participants less than 10 years (42.2%). There was a male preponderance (54.6%) with a greater number of respondents within the first four children in the family (66.3%). More respondents lived with both parents (79.1%). A greater proportion of mothers (96.2%) and fathers (91.2%) of participants were either traders, artisans or farmers. Highest educational status attained was primary education for both mothers (51.1%) and fathers (49.7%) (Table 1).

Table 2: Bivariate associations by school location and nutritional status

	Rural				Urban			
Socio-demographic Characteristics	Stunted n (%)	Not Stunted n (%)	X^2	p-value	Stunted n (%)	Not Stunted n (%)	X^2	p-value
Age (years)								
≤10	54 (19.3)	205(62.9)	122.01	0.001*	31(16.6)	200(54.5)	92.477	0.001*
11 -12	144(51.4)	92(28.2)			98(52.4)	139(37.9)		
≥13	82(29.3)	29(8.9)			58(31.0)	28(7.6)		
Sex								
Male	167(59.6)	179 (54.9)	1.379	0.240	96(51.3)	191(52.0)	0.025	0.875
Female	113(40.4)	147(45.1)			91(48.7)	176(48.0)		
Birth order								
1-4	178(63.6)	205(62.9)	0.031	0.861	129(69.0)	257(70.0)	0.064	0.801
≥5	102(36.4)	121(37.1)			58(31.0)	110(30.0)		
Caregiver								
Parents	202(72.1)	258(79.1)	7.736	0.021*	152(81.3)	306(83.3)	4.628	0.099
Grandparents	43(15.4)	48(14.7)			23(12.3)	27(7.4)		
Others	35(12.5)	20(6.2)			12(6.4)	34(9.3)		
Respondents' Family Characteristics and prevalence of stunting by school location								
Mother's type of marriage								
Monogamous	143(51.1)	150(46.0)	1.544	0.214	90(48.1)	202(55.0)	2.375	0.123
Polygamous	137(48.9)	176(54.0)			97(51.9)	165(45.0)		
Children by mother								
1-4	107(38.2)	131(40.2)	0.245	0.621	73(39.0)	176(48.0)	3.982	0.046*
≥5	173(61.8)	195(59.8)			114(61.0)	191(52.0)		
Children by father								
1-4	62(22.1)	75(23.0)	0.064	0.800	43(23.0)	114(31.1)	3.971	0.046*
≥5	218(77.9)	251(77.0)			144(77.0)	253(68.9)		
Respondents' mothers' socio-demographic characteristics and stunting by location								
Educational Status								
Lower	221(78.9)	270 (82.8)	1.485	0.223	126(67.4)	238(64.9)	0.352	0.553
Higher	59 (21.1)	56 (17.2)			61(32.6)	129(35.1)		
Marital Status								
Currently Married	224(80.0)	262 (80.4)	0.013	0.910	156(83.4)	311(84.7)	0.163	0.687
Not currently married	56(20.0)	64 (19.6)			31 (16.6)	56 (15.3)		
Occupation								
Civil Servants	7 (2.5)	3(0.9)	2.316	0.200†	9(4.8)	25(6.8)	0.859	0.354
Traders, Artisans, Farmers	273(97.5)	323(99.1)			178(95.2)	342(93.2)		
Fathers' socio-demographic characteristic and stunting by location								
Educational status								
Lower	213(76.1)	246(75.5)	0.031	0.861	119(63.6)	201(54.8)	3.993	0.046*
Higher	67(23.9)	80(24.5)			68(36.4)	166(45.2)		
Occupation								
Civil servant	11(3.9)	22(6.8)	2.326	0.127	17(9.1)	52(14.2)	2.930	0.087
Traders/artisans/farmers	269(96.1)	304(93.2)			170(91.9)	315 (85.8)		
Number of wives								
1-4	276(98.6)	317(97.2)	1.273	0.400†	185(98.9)	358(97.5)	1.217	0.349†
≥5	4 (1.4)	9(2.8)			2(1.1)	9(2.5)		

** - Statistically significant* *† -Fisher's Exact Test*

Table 3: Predictors of stunting

	Rural			Urban		
	Odd's Ratio	**95%CI**	**p-value**	**Odd's Ratio**	**95%CI**	**p-value**
Age (yrs)						
≤10	0.088	0.052-0.150	0.000**	0.065	0.036-0.121	<0.001**
11 -12	0.534	0.322-0.886	0.015**	0.300	0.174-0.520	<0.001**
≥13	1.0			1.0		
Caregiver						
Parents	0.545	0.285-1.044	0.067	2.545	1.162-5.576	0.020**
Grandparents	0.623	0.287-1.349	0.230	4.032	1.498-10.855	0.006**
Others	1.0			1.0		
Children by mother						
1-4	*	*	*	0.701	0.408-1.205	0.199
≥5				1.0		
Children by father						
1-4	*	*	*	0.968	0.523-1.792	0.919
≥5				1.0		
Father's religion						
Christianity	*	*	*	0.726	0.484-1.089	0.121
Islam				1.0		
Father's Education						
Lower	*	*	*	1.326	0.876-2.007	0.182
Higher				1.0		
Father's Occupation						
Civil Servant	*	*	*	0.677	0.349-1.314	0.249
Traders, artisan, farmers				1.0		

**Variables not included in logistic regression model due to non-significance on bivariate analysis;*

*** Statistically significant*

Overall, 467 (40.3%) pupils were stunted. Mean weight and height for the respondents were 26.97 ± 5.2 (kg) and 132.6 ± 7.9 (cm) respectively (Table 1). Significantly more respondents with birth order of over 5 and living with grandparents, stunting, reduced weight, reduced height were more likely to be residing in the rural areas ($p = 0.02$, $p= 0.05$, $p<0.001$, $p<0.001$, $p<0.001$ respectively) compared to the urban counterparts. As regards the mothers of respondents, even though primary education (as the highest educational status attained) and occupation (as trader, artisans, or farmers) were observed in both rural and urban regions, the effect was significantly more likely to be observed in the rural areas compared to the urban ($p<0.001$, $p<0.001$). This pattern was also found in fathers as primary education and occupation as traders/artisans/farmers were more likely in the rural regions compared to the urban ($p<0.001$, $p<0.001$) (Table 1).

For both the rural and urban pupils, age 11-12 years were more likely to be stunted compared to other age groups ($p<0.001$). In the both rural and urban regions, stunting was more likely to be observed in pupils who were currently living with both parents, however significant only in rural areas ($p=0.021$) (Table 2). Stunting was significantly more likely to be found in urban children if children by mother ($p=0.046$) and father ($p=0.046$) exceeded 5. Likewise, lower educational status of fathers in urban schools showed significant association with stunting in children ($p=0.046$) (Table 2).

The odds of finding a child stunted in the rural schools was significantly less among ages less than 10 (OR: 0.088; 95CI: 0.052-0.150) and 11-12 years (OR: 0.534; 95CI: 0.322-0.886) when compared with 13 years of age and above (Table 3). Likewise among urban pupils, the odds of stunting was significantly less among ages less than 10 (OR: 0.065; 95CI: 0.036 - 0.121) and 11-12 years (OR: 0.300; 95CI: 0.174-0.520) when compared with 13 years of age and above (Table 3).

Though not a significant finding, the odds of stunting amongst rural students living with either parents (OR: 0.545; 95CI: 0.285-1.044) or grandparents (OR: 0.623; 95CI - 0.287- 1.349) was less compared to the students that stayed with other family members. Contrary to the findings in the rural schools, the odds of stunting in the urban schools was about 2.5 times and 4 times more likely when students stayed with parents (OR:

2.545; 95CI:1.162-5.576) and grandparents (OR: 4.032; 95CI:1.498-10.855) respectively (Table 3).

DISCUSSION

Majority of our participants were between the age range of 10 – 12 years, which is comparable with age estimates of the 2013 Nigerian Demographic Health Survey (NDHS) report[27] it is quite disturbing that some pupils over the age of 13 years could still be found in 4th grade of selected primary schools in Nigeria.

The overall prevalence of stunting in our study was high compared to other countries such as Russia[28] or Latin America[25] where prevalence of 3.3% and 17.9% respectively were reported. Our findings are also much higher than seventeen percent in another study[29], the difference must however be interpreted cautiously as the methodology and standards utilized to generate statistics essentially vary from one another. The most widely used being the Centers for Disease Control and Prevention 2000 (CDC-2000) and World Health Organization 2007 (WHO-2007) criteria.[28]

Factors associated with stunting among school-age children in our study were rural location, respondents' age. The odds of stunting among rural primary school pupils was almost twice its occurrence among the urban pupils. This significant higher levels found among rural compared to urban pupils offers credence to findings from literature that also report stunting more among children in rural than urban locations[30,31]. Godoy and colleagues argue that rural ubiquity of stunting is probably because children as a result of lower productivity may tend to attract less medical attention when compared to adults.[32] This higher prevalence of stunting may be as a result of a greater burden of intestinal parasitic infections in rural areas compared to urban[31] or the increased risk of stunted mothers that is commoner in rural areas compared to the urban.[33] The increased likelihood of stunting with increased age which was a significant finding in our study mirrors what is documented in literature.[34] In this study, child aged 10–14 years had a 2.9 fold risk of stunting compared to younger age group. The increased likelihood of stunting associated with this age group could be due to increased risk of helminth infections[35] that is associated with lesser degrees of cleanliness or hygienic practices.[36]

Our study substantiates the literature which indicate a positive association between birth order over 5 and child malnutrition[14,16], nevertheless, the birth order (or children more than 5 in a family) was found to be commoner in rural compared to their urban areas in our study. Furthermore, the educational status of both parents as demonstrated in our study findings to be significantly associated with stunting buttresses existing literature[14] and emphasizes the importance of educational status on stunting. The increased focus on younger age groups for school feeding programs such as the FRESH initiative (Focusing Resources on Effective School Health) may contribute to the protective effect of stunting among younger age groups as portrayed in our study.[37] Furthermore, the occurrence of child labour that is commoner with older age groups or adolescents and its impact on under-nutrition is also a documented possibility that is extensively substantiated in literature and a plausible explanation for the stunting which is noticed to be increased with age in our study.[38] The increased odds of stunting among children living with either parents or grandparents negates what obtains from literature[8] and which necessitates deeper research as to why this is so. Busy schedules that are much more associated with urban parents is arguably proposed in by Pandey, *et al* (2016) as factors that could predispose children to mal-nutrition.[39]

The findings from this study ought to be considered in view of some limitations. First, just as in studies using cross-sectional study design, we can only deduce associations but we could not establish causality or temporality of events. Secondly, there is a strong possibility that our estimates of stunting could be underestimated. Primarily because some of our respondents were excluded due to lack of parental informed consent and also because all our respondents were recruited only from schools. Estimates provided by this study would have to be applied cautiously to populations outside the primary school students thus reducing the generalizability of our findings. Studies have been conducted to estimate prevalence of stunting in various settings and countries, however to the best of our knowledge, this is one of the first studies to be conducted among school age children in Abeokuta, Nigeria and that provide factors that influence stunting exclusively with special cognizance of rural-urban dichotomy. Notable strengths of our study include the selection of a large and representative sample of school children and a high participation rate of children.

CONCLUSION/POLICY ISSUES

In conclusion, we found that the prevalence of stunting was higher among pupils from rural schools. Thus, the need for urgent feasible and effective nutrition programs for primary school children especially those in rural schools cannot be over-emphasized. The study also confirms location and age of pupils as significant predictors of stunting. In order to reduce the burden of stunting among pupils and eradicate malnutrition in all its forms (under Goal 2 of the sustainable

development goals)[40], we advocate the need for focused and concerted efforts by the government to stimulate innovative policies that can stem the occurrence of stunting. Public health campaigns that promote consumption of balanced diets, discourage unhealthy lifestyle habits are advocated for to improve interventions for stunting. Furthermore, proper education of parents are also required to enhance acceptability of health interventions that are implemented to improve the nutritional status of children.

DECLARATIONS

Ethics Approval and Consent to Participate

Ethical approval to conduct the study was obtained from Federal Medical Centre ethics review board – FMCA/238/Vol III. Proper community entry was later observed by obtaining approval from the appropriate community leaders. The study was thoroughly explained to participants. Verbal and written consents to participate was obtained before commencement of the study.

Consent for Publication

Not Applicable

Competing Interests

None declared

Funding

N/A

Authors' Contributions

WU and MC conceptualized the study, drafted the study protocol. WU supervised the data collection. WU and TA carried out the data analysis. KO conducted the literature search. TA wrote the initial draft manuscript. All authors read and approved the final manuscript.

Acknowledgements

We are grateful for the support of the Ministry of Education, University Basic Education Board, the Federal Medical Centre and Obafemi/Owode Local Government Education Authority, the participating school principals, the teacher-liaison for health and all Grade 4 students and their parents.

Authors' Information

W.U. is a senior registrar with the Department of Community Medicine, Faculty of Clinical Sciences, College of Medicine, University of Ibadan.

T.A. is a lecturer with the Department of Health Policy and Management, Faculty of Public Health, College of Medicine, University of Ibadan. He is also currently a doctoral candidate with the University of Witwatersrand, Johannesburg South Africa.

K.O. is a medical practitioner in the Hospice and Palliative Unit of University College Hospital. She is also a registrar in the Department of Family Medicine, University College Hospital.

M.C is a clinical epidemiologist; professor of public health and Community Medicine and Consultant Community and Occupational Physician with the University College Hospital.

REFERENCES

1. **Lee J,** Houser RF, Must A, de Fulladolsa PP, Bermudez OI. Socioeconomic disparities and the familial coexistence of child stunting and maternal overweight in Guatemala. Econ Hum Biol. Elsevier B.V.; 2012;10(3):232–241.
2. **Ferreira HS,** Florêncio TMMT, Vieira EF, Assunção ML. Stunting is associated with wasting in children from the semiarid region of Alagoas, Brazil. Nutr Res. 2008;28(6):364–367.
3. **Drake L,** Maier C, Jukes M, Partikios A. School age Children: Their Nutrtion and Health. Partnersh Child Dev. 2002;25(1):5–8.
4. **Drake L,** Maier C, Jukes M, Patrikios A, Bundy D, Gardner A, et al. School age children their health and nutrition. Standing Commitee Nutr. 2002;25(1564–3743):1–77.
5. **Pridmore P.** Impact of health on education access and achievement: a cross-national review of the research evidence. Consortium for Research on Educational Access, Transitions and Equity (Create). 2007; 1-62.
6. **Pei L,** Ren L, Yan H. A survey of undernutrition in children under three years of age in rural Western China. BMC Public Health. BMC Public Health; 2014;14(1):121.
7. **Ndukwu CI,** Egbuonu I, Ulasi TO, Ebenebe JC. Determinants of undernutrition among primary school children residing in slum areas of a Nigerian city. Niger J Clin Pract. 2013;16(2):178–183.
8. **Adekanmbi VT,** Uthman OA, Mudasiru OM. Exploring variations in childhod stunting in Nigeria using league table, control chart and spatial analysis. BMC Public Health. 2013;13(361):1–7.
9. United Nations. The Millennium Development Goals Report (MDGR). New York United Nations Department of Economic and Social Affairs. 2010.
10. **Matrins VJB,** Toledo Florêncio TMM, Grillo LP, Franco MDCP, Martins P a., Clemente APG, *et al.* Long-Lasting Effects of Undernutrition. Int J Environ Res Public Heal. 2011;8(6):1817–1846.
11. **Prendergast AJ,** Humphrey JH. The stunting syndrome in developing countries. Paediatr Int Child Health. 2014;34(4):250–265.

12. **Bharati S,** Chakrabarty S, Som S, Pal M, Bharati P. Socio-economic determinants of underweight children in West Bengal, India. Asian Pac J Trop Med. Hainan Medical College; 2010;3(4):322–327.
13. **Amare B,** Moges B, Fantahun B, Tafess K, Woldeyohannes D, Yismaw G, *et al.* Micronutrient levels and nutritional status of school children living in Northwest Ethiopia. Nutr J. Nutrition Journal; 2012;11(1):108.
14. **Biswas S,** Bose K. Sex differences in the effect of birth order and parents' educational status on stunting: a study on Bengalee preschool children from eastern India. Homo. 2010;61(4):271–276.
15. **Bove I,** Miranda T, Campoy C, *et al.* Stunting, overweight and child development impairment go hand in hand as key problems of early infancy: Uruguayan case. Early Hum Dev. Elsevier Ltd; 2012;88(9):747–751.
16. **Girma W,** Genebo T. Determinants of the Nutritional Status of Mothers and Children in Ethiopia. Calvert Maryl USA; ORC MAcro. 2002;38–143.
17. **Galler JR,** Bryce CP, Waber DP, *et al.* Infant malnutrition predicts conduct problems in adolescents. Nutr Neurosci. 2012;15(4):186–192.
18. **Daboné C,** Delisle HF, Receveur O. Poor nutritional status of schoolchildren in urban and peri-urban areas of Ouagadougou (Burkina Faso). Nutr J. BioMed Central Ltd; 2011;10(1):34.
19. **Mohiddin L,** Phelps L, Walters T. Urban malnutrition: a review of food security and nutrition among the urban poor. Nutrtion Work Int Public Nutr Resour Gr. 2012;(October):1–56.
20. **Caleyachetty R,** Rudnicka AR, Echouffo-Tcheugui JB, Siegel KR, Richards N, Whincup PH. Prevalence of overweight, obesity and thinness in 9-10 year old children in Mauritius. Global Health. Globalization and Health; 2012;8(1):28.
21. **Acharya M.** Universal health coverage as a distinct sustainable development goals target: dispelling doubts and underlining implications. Front public Heal. 2015;3(October):1–3.
22. Ogun State Government, Nigeria, the gateway state [Internet]. 2014 [cited 2016 Jan 16]. Available from: www.ogunstate.gov.ng
23. Two-Sample Tests. Part II- Introduction to Hypothesis Testing [Internet]. Sage Publications; 2010. p. 193–205. Available from: www.sagepub.com/sites/default/files/upm-binaries/40287_Chapter9.pdf
24. World Health Organization. Training Course on Child Growth Assessment, Geneva, WHO. WHO Child Growth Standards. 2008.
25. **de Onis M,** Blossner M. WHO Global Database on Child Growth and Malnutrition. 1997.
26. **de Onis M,** Onyango AW, Borghi E, *et al.* Comparison of the World Health Organization (WHO) Child Growth Standards and the National Center for Health Statistics/WHO international growth reference: implications for child health programmes. Public Health Nutr. 2006;9(7):942–947.
27. National Population Commission (NPC) [Nigeria] and ICF International. Nigeria Demographic and Health Survey 2013. Abuja Niger Rockville, Maryland, USA. NPC and ICF International; 2014;
28. **Khasnutdinova SL,** Grjibovski AM. Prevalence of stunting, underweight, overweight and obesity in adolescents in Velsk district, north-west Russia: A cross-sectional study using both international and Russian growth references. Public Health. Elsevier Ltd; 2010;124(7):392–397.
29. **Senbanjo IO,** Oshikoya KA, Odusanya OO, Njokanma OF. Prevalence of and risk factors for stunting among school children and adolescents in Abeokuta, Southwest Nigeria. J Heal Popul Nutr. 2011;29(4):364–70.
30. **Ogunba BO.** Diet Diversity in Complementary Feeding and Nutritional Status of Children Aged 0 to 24 Months in Osun State, Nigeria. ICAN Infant, Child, Adolesc Nutr. 2010;2(6):330–335.
31. **Opara KN,** Udoidung NI, Opara DC. The impact of intestinal parasitic infections on the nutritional status of rural and urban school-aged children in Nigeria. Int J MCH AIDS. 2012;1(1):73–82.
32. **Godoy R,** Magvanjav O, Nyberg C, *et al.* Why No Adult Stunting Penalty or Height Premium? Estimates from Native Amazonians in Bolivia. Econ Hum Biol. 2010;8(1):88–99.
33. **Senbanjo IO,** Olayiwola IO, Afolabi WA, Senbanjo OC. Maternal and child under-nutrition in rural and urban communities of Lagos state, Nigeria: the relationship and risk factors. BMC Res Notes. 2013;6:286.
34. **Francis L,** Kirunda BE, Orach CG. Intestinal helminth infections and nutritional status of children attending primary schools in Wakiso District, Central Uganda. Int J Environ Res Public Health. 2012;9(8):2910–2921.
35. **Sanchez AL,** Gabrie JA, Usuanlele MT. Soil-transmitted helminth infections and nutritional status in school-age children from rural communities in Honduras. PLoS Negl Trop Dis. 2013;7(8):e2378.
36. **Dearden KA,** Schott W, Crookston BT, *et al.* Children with access to improved sanitation but not improved water are at lower risk of stunting compared to children without access: a cohort study in Ethiopia, India, Peru, and Vietnam. BMC

Public Health [Internet]. BMC Public Health; 2017;17(1):110. Available from: http://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-017-4033-1

37. **Pappas G,** Agha A, Rafique G, *et al.* Community-based approaches to combating malnutrition and poor education among girls in resource-poor settings: report of a large scale intervention in Pakistan. Rural Remote Health. 2008;8(3):820.
38. **Duyar I,** Ozener B. Growth and nutritional status of male adolescent laborers in Ankara, Turkey. Am J Phys Anthr. 2005;128(3):693–698.
39. **Pandey KK,** Pal Singh M, Singh RD. A study of maternal status, household structure and children's nutitional status in India. Rom J Popul Stud. 2016;10(1):77.
40. **Hawkes C,** Popkin BM. Can the sustainable development goals reduce the burden of nutrition-related non-communicable diseases without truly addressing major food system reforms? BMC Med. BMC Medicine; 2015;13(1):143.