Mal J Nutr 24(1): 25-34, 2018

Association between stunting and obesity among under-five children in urban and rural areas of Oyo State, Nigeria

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ABSTRACT

Introduction: Malnutrition contributes to more than one-third of all child deaths worldwide and accounts for over 50 percent of under-five deaths in Nigeria. Both overnutrition and undernutrition exist among under-five children, leading to double burden of malnutrition, a major risk factor for chronic diseases. The study was conducted to assess the association between stunting and obesity among under-five children in urban and rural areas of Oyo State, Nigeria. **Methods:** A cross-sectional survey was carried out using a four-stage random sampling technique to select 450 (214 males and 236 females) under-five children from Ibadan North (Urban) and Ido (Rural) Local Government Areas (LGAs) of Oyo State. A pre-tested, interviewer-administered semi-structured questionnaire was used to collect information on socio-demographic characteristics of respondents. Weight and height of the children were measured and categorized according to the WHO Child Growth Standards. **Results:** Mean age of children was 29.8±17.0 months (Ibadan North, 29.1±16.8; Ido, 31.9±17.4 months) with 52.6% being female. The prevalence of stunting, overweight and obesity was 32.9%, 14.4% and 20.2%, respectively. A total of 30.7%, 17.2% and 22.1% of children in Ibadan North and 40.6%, 5.0% and 13.9% in Ido LGA were stunted, overweight and obese, respectively. High proportion of obese children (43.5%) was stunted, indicating co-existence of obesity and stunting among the population. **Conclusion:** Double burden of overweight and stunting found in urban and rural young children indicate that public policies should emphasise on targeting both malnutrition conditions to prevent the subsequent health risks and complications.

Keywords: Stunting, obesity, overweight, preschool children, malnutrition

INTRODUCTION

Malnutrition contributes to more than one-third of all child deaths globally and accounts for over 50% of under-five deaths in Nigeria (WHO, 2016; UNICEF, 2015). Over- and under nutrition co-exist within the same population, leading to a dual burden of malnutrition which is a major risk factor for chronic diseases. Childhood obesity is one of the most serious public health challenges of the 21st century (WHO, 2000; WHO, 2015). The problem is global and is steadily affecting many low and middle-income

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countries, particularly in the urban setting (de Onis, Blössner & Borghi, 2010; UNICEF/WHO/World Bank, 2017). Globally, in 2016, about 41 million and 155 million under-five children were overweight and stunted respectively (UNICEF/WHO/World Bank, 2017). One quarter of all overweight and one third of all stunted children lived in Africa (World Bank, 2015; UNICEF / WHO / World Bank, 2017).

The problem of overweight and obesity affect both developed and developing countries. In poor countries, obesity with its associated chronic debilitating diseases co-exists with infectious diseases, which accompany undernutrition, giving a double burden of disease (de Onis *et al.*, 2010). The prevalence of overweight and obesity differs across nations. In Tehran, Iran the prevalence of overweight and obesity among children less than five years of age, were 12.0% and 23.7% respectively (Salehiniya *et al.*, 2016). De Arruda *et al.* (2014) reported that the prevalence of overweight and obesity in Alagoas, Northeast of Brazil was 23.9% and 7.8% respectively. In Africa, the prevalence of childhood overweight and obesity was 8.5% in 2010 and it is estimated to reach 12.7% in 2020 (de Onis *et al.*, 2010). The prevalence of overweight in African increased from 5.0% in 2000 to 5.2% in 2016 (UNICEF/WHO/World Bank, 2017).

Overnutrition in childhood stage will more likely lead to suffering from non-communicable diseases such as heart and kidney diseases, obesity and diabetes later in life (Black *et al.*, 2008). Stunting in children is associated with an increased risk for obesity due to impaired fat metabolism and other metabolic shifts. The main causes of stunting in children are poor maternal nutrition at conception, intrauterine nutrition, inadequate sanitation, inadequate breast feeding, delaying the addition of complementary feeding in addition to quality and quantity of food, and poor absorption of nutrients due to disease or parasites (WHO, 2013). The World Health Organisation (WHO) defines stunting for children as height/length for age less than the 5th percentile or <-2 standard deviation (SD), overweight as a *z*-score value >1 SD or 85th to <95th percentile of BMI-for-age, and obesity as *z*-scores >2 SD or ≥95th percentile of BMI-for-age (WHO, 2008). For stunting among under-five children, all regions of the world had witnessed a reduction in their prevalence rate. Africa witnessed a low decrease in stunting rate from 42.3% in 1990 to 31.2% in 2016 (UNICEF/WHO/World Bank, 2017). Even Nigeria has experienced a reduction from 50.5% in 1990 to 32.9% in 2014, though the rate of reduction is still very low (World Bank, 2015).

In Nigeria, the few studies that are available showed that the prevalence of obesity among preschool children in Enugu Metropolis was 0.5% (Odetunde *et al.*, 2014). Senbanjo & Adejuyigbe (2007) stated the prevalence of overweight and obesity in Ifewara Osun state as 13.7% and 5.2% respectively. Mezie-Okoye (2015) also reported that the prevalence of overweight and obesity among preschool children in Port Harcourt were 15.0% and 8.6%, respectively. However, there is still paucity of data on overweight and obesity among under-five children from many regions of the country. This study was conducted to assess the association between stunting and obesity among preschool children in Ibadan North and Ido Local Government Areas of Oyo State, Nigeria.

MATERIALS AND METHODS

Study area

The study which was descriptive cross-sectional in design was conducted in

Ibadan North (Urban) and Ido (Rural) Local Government Areas (LGAs) of Oyo State in Nigeria.

Sample size determination

The sample size was determined using the sample size formula for single proportion

$$n = \frac{Z^2 P q}{d^2}$$

Where n is the minimum sample size, Z=1.96 corresponding to 95% confidence interval, P=0.052 proportion of obese children in Nigeria (Senbanjo & Adejuyigbe 2007), d=level of precision taken at 5% acceptable margin of error, and q=1 – P.

The sample size was calculated based on statistics from previous studies on the prevalence of obesity in Nigeria. Using the prevalence of 5.2% among under five children in Nigeria (Senbanjo & Adejuyigbe 2007), P=0.052, q=0.948, d=0.05, Z=1.96.

$$n = \frac{1.962 \times 0.052 \times 0.948}{0.05^2}$$

n = 75.72

n = 75.72 + 10% allowance for non-response

n = 75.72+7.572 =82.572 = 83

The sample size calculation using P=0.052 from Senbanjo & Adejuyigbe (2007) yielded a sample size of 83. To have a larger sample size, P=0.5 was used for this study.

$$n \text{ therefore} = \frac{1.96 \times 1.96 \times 0.5 \times 0.5}{0.05 \times 0.05}$$

n = 384.16 + 15% allowance for non-response

n = 384.16 + 57.6 = 441.76

A total of 450 participants were recruited during the study in the two local government areas. The sample size for the LGAs was calculated based on the 2006 Census (NPC 2006) projected population for each of the LGAs proportionately.

Sampling procedure

A total of 450 apparently healthy under-five children (337 from Ibadan North and 113 from Ido LGAs) were recruited for the study using a four-stage systematic random sampling procedure:

(i) First stage: A sampling frame of all the local government areas in Oyo state was drawn and stratified into urban and rural areas based on World Bank classification of Oyo State in 1998. One urban (Ibadan North) and one rural (Ido) local government areas were selected using simple random sampling technique.

(ii) Second stage: A sampling frame of all the communities in the selected local government areas was drawn. Three communities were randomly selected from each of the local government areas using simple random sampling technique.

(iii) Third stage: Four hundred and fifty households were selected from the two communities using a systematic random sampling technique. A landmark was identified in the selected communities where a bottle was being spun (Rose, 2006; Araoye, 2004). The direction where the head of the bottle faced marked the starting point of the systematic random household selection. A household was selected after every K^{th} (9) houses. The K^{th} (sampling interval) was calculated by dividing the number of households in the LGAs (gotten from the national population council Oyo state) by the sample population. In the case where the selected household does not have an eligible child the next house was selected.

(iv) Fourth stage: The eligible child from the selected households was

sampled.

Research instruments and data collection procedure

A pre-tested, interviewer-administered, semi-structured questionnaire adapted from Nigeria demographic health survey (NDHS, 2008; NDHS, 2013), and National Health and Nutrition Examination Survey (NHANES 2007-2008; NHANES 2013-2014), were used. The instrument was administered to the mothers of the under-5 children with the questions being directed to their children (Gibson, 2005). Information was obtained on children's socio-demographic factors and physical characteristics such as anthropometric indices of weight and height. The anthropometric indices were used to calculate the body mass index for age. The height and weights of the children were measured to the nearest 0.1 cm and 0.5 kg respectively. Height was measured using non-stretchable metre rule when the child stands erect on a flat surface with a horizontal gaze. All measurements were taken with children wearing light clothing without shoes.

All instruments used were calibrated at the beginning of every section and readings were taking in duplicate to ensure accuracy and avoid error due to parallax. The readings were also recorded immediately.

Data analysis

The anthropometric data of children were analysed using the WHO Anthro software (WHO, 2010) and expressed as *z*-scores for each of the anthropometric indices of malnutrition against the WHO Child Growth Standards (WHO, 2006). The mean weight-for-age and mean height-for-age were calculated. The cut-off definition of overweight, obesity and stunting among the under-5 children was determined by the WHO Child Growth Standards 2006. Obesity was defined as *z*-score value >2 SD of BMI-for-age, overweight was defined as *z*-score value >1 SD of BMI-for-age, and stunting was defined as *z*-score value <-2 SD of height-for-age. Data were analysed using SPSS software version 19.0 (IBM Corp., USA). Pearson's correlation and multiple regression analysis was used to determine the association of variables with stunting, overweight and obesity. Statistical significance was set at $p<0.05$.

Ethical consideration

Ethical approval was obtained from the University of Ibadan/University College Hospital Institution Ethics Review Board. Permission and consent were also sought from the State Ministry of Health and leaders of the communities involved respectively.

RESULTS

The mean age of the 450 under-5 children was 29.8±17.0 months; Ibadan North LGA (urban area) 29.1±16.8 months and Ido LGA (rural area) 31.9±17.4 months (Table 1). A total of 47.6% of the children were males, 48.0% of the male and 51.6% of the female children were from Ibadan North LGA, while 47.6% males and 52.4% females were from Ido LGA. About one-third (30.6%) of the children (33.5% and 20.2% for Ibadan North and Ido LGAs) were first born while 13.8% were the fourth children. Children from urban LGA had higher mean weight while those from rural LGA had higher mean height with no significant differences in values ($p<0.05$). About two-third (64.4%) of the children (66.8% from Ibadan North, and 56.4% from Ido LGAs) were Christians by birth.

The overall prevalence of overweight and obesity among under-five children in the study area was 14.4% and 20.2%, (17.2% and 22.1% for Ibadan North and 5.0% and 13.9% for Ido LGAs) respectively (Figure 1; Table 2). Logistic Regression revealed a significant

Table 1: Demographic characteristics of the children

Characteristics	*Urban*	*Rural*	*Total*
		N (%)	
Age (months)			
0-6	27 (7.7)	7 (6.9)	34 (7.6)
7-12	43 (12.3)	11 (10.9)	54 (12.0)
13-24	87 (24.9)	23 (22.8)	110 (24.4)
25-36	74 (21.2)	23 (22.8)	97 (21.6)
37-48	62 (17.8)	14 (13.9)	76 (16.9)
49 -59	56 (16.0)	23 (22.8)	79 (17.6)
Sex			
Male	169 (48.4)	45 (44.6)	214 (47.6)
Female	180 (51.6)	56 (55.4)	236 (52.4)
Position of child among siblings			
First	117 (33.5)	20 (20.2)	137 (30.6)
Second	85 (24.4)	31 (31.30	116 (25.9)
Third	78 (22.3)	18 (18.2)	96 (21.4)
Fourth	45 (12.9)	17 (17.2)	62 (13.8)
Five and above	24 (6.9)	13 (13.1)	37 (8.3)
Religion of family			
Christianity	233 (66.8)	57 (56.4)	290 (64.4)
Islam	116 (33.2)	44 (43.6)	160 (35.6)
		Mean±SD	
Age (months)	29.1±16.8	31.9±17.4	29.8±17.0
Length (cm)	83.1±16.4	85.5±13.1	83.6±15.7
Weight (kg)	12.2±3.5	11.7±3.3	12.1±3.4

association between prevalence of obesity and stunting among the study population. High proportion (43.5%) of the obese children was stunted, indicating a co-existence of obesity and stunting (Table 3).

The socio-demographic determinants of nutritional status of children in this study are shown in Table 4. Factors such as sex, place of residence and age of the child were significant determinants of child nutritional status (p<0.05). The male children were 1.5 times more likely to be obese or overweight than the female children (OR=1.59; CI: 1.06-2.42), and obesity and overweight were 2.49 times higher among urban than the rural dwellers (OR=2.49; CI: 1.22-3.89). Apart from children between 12-24 months old, children from all other age groups were at least 2 times more likely to be overweight or obese than children between 0-6 months.

DISCUSSION

The prevalence of overweight in the study area (14.4%) is slightly higher than that reported for preschool children in Ifewara, Osun State (13.7%) by Senbanjo & Adejuyigbe (2007), but slightly lower than 15% reported for Port Harcourt, Nigeria (Mezie-Okoye, 2015). UNICEF/WHO/World Bank (2017) also reported an increase in global prevalence of overweight among under-five children from 5.0% in 2000 to 6.0% in 2016. The reported prevalence of obesity (20.6%) in this study is much higher than the reported values for prevalence of obesity in Ifewara (5.2%) and Port Harcourt

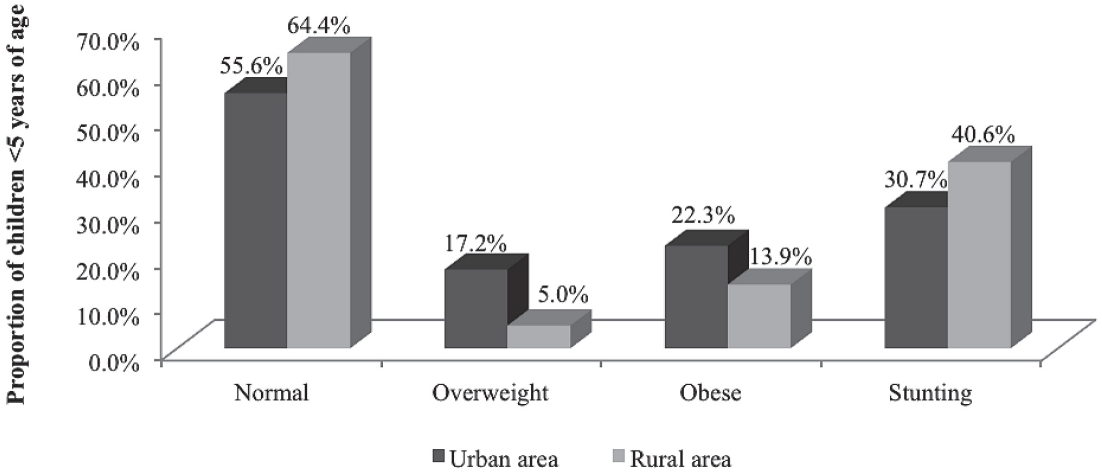

Figure 1. Nutritional status of the under-five children in the two LGAs

(8.6%) by Senbanjo & Adejuyigbe (2007) and Mezie-Okoye (2015) respectively. The National Health and Nutrition Examination Survey (1976-1980 and 2003-2006) report showed that the prevalence of obesity has increased for children aged 2-5 years from 5.0% to 12.4% (CDC, 2006).

Our finding on prevalence of overweight and obesity in the study area contradicts the prevalence of <2.3% in preshool children from developing countries reported by Martorell *et al.* (2009) that it does not appear to be a public health problem among preschool age children in Asia and Sub-Saharan Africa. One factor for the relatively high obesity prevalence among preschool children in this study may partly be associated with the kind of foods that they are provided, especially by busy working spouses. Young children are often given processed or semi-processed foods, which are energy-dense but low in essential nutrients.

The prevalence of stunting (32.9%) found in this study is lower than NDHS 2008 (41%) and 2013 (37%) report but higher than the value of 29.7% among urban and rural children in Nigeria reported by Samuel & Atinmo (2008). The magnitude of stunting in this study reflected that some of the children from the study have been exposed to inadequate nutrition over a long period of time. Since majority of the children

Table 2. Nutritional status of the under-five children

Nutritional status	*Urban*	*Rural*	*p-value*	*Total*
Stunted	107 (30.7)	41 (40.6)	0.041	148 (32.9)
Stunted	242 (69.3)	60 (59.4)		302 (67.1)
Not stunted				
Overweight	60 (17.2)	5 (5.0)	0.01	65 (14.4)
Overweight	289 (82.8)	96 (95.0)		385 (85.6)
Not overweight				
Obese	78 (22.3)	14 (13.9)	0.039	92 (20.4)
Obese	271 (77.7)	87 (86.1)		358 (79.6)
Not Obese				
Total	349 (100)	101 (100)		450 (100)

Table 3. Association between obesity and stunting among the children

	Not obese (%)	*Obese (%)*	*p-value*	*Total (%)*
Stunted	108 (30.2)	40 (43.5)	0.012	148 (32.9)
Not stunted	250 (69.8)	52 (56.5)		302 (67.1)
Total	358 (100)	92 (100)		450 (100)

	Multivariate logistic regression			
	Odds ratio	*p-value*	*95%CI*	
			Lower	*Upper*
Stunting and obesity	1.7	0.01	1.140	2.572

are reported not to have suffered from any prolong illness, it indicates that the prevalence in stunting may be due to inadequate nutrition and infectious disease such as diarrhoea, and not as a result of children being affected by recurrent and chronic illnesses.

The study revealed a significant association and coexistence of overweight and stunting among the sampled under-five children as 44% of the obese children were also stunted. An under-five child who is stunted is 1.7 times more likely to become obese than a non-stunted child in the study population. The finding of coexistence of obesity and stunting in this study is similar to that of Ramoteme *et al.* (2005) report that 19% of 3-year-old black South African children residing in Central Region of Limpopo Province, South Africa were both stunted and overweight; Symington (2015) discovered a significant correlation (r=-0.32) between BMI and height-for-age z-scores (p<0.0001), 68.4% of obese children were stunted, while only 13.6% of the normal and underweight group were stunted; the report of Gebremedhin (2015) also showed that overweight/obesity was three times more frequent in stunted children than in normal children; and also Duru *et al.* (2015) reported the prevalence of overweight/obesity, underweight, wasting and

Table 4. Relationship between socio-demographic factors and prevalence of overweight and obesity

Variables	*Multivariate logistic regression*			
	Odds ratio	*p-value*	*95%CI*	
			Lower	*Upper*
Sex				
Male	1.59	0.027	1.055	2.415
Female	0			
Age group				
0-6 months		0.021		
7-12 months	2.55	0.047	1.012	6.403
13-24 months	1.75	0.192	0.754	4.062
25-36 months	3.37	0.001	1.665	6.828
37-48 months	2.94	0.004	1.419	6.070
49 and above	2.40	0.024	1.125	5.140
Area				
Urban	2.49	0.009	1.217	3.890
Rural	0			

stunting among under-five children in households in rural communities in Imo State was 9.8%, 28.6%, 23.6% and 28.1%, respectively. The coexistence of obesity and stunting in this study shows a double burden of malnutrition in the two LGAs studied. This indicates a need for adequate nutrition and education intervention to prevent associated morbidity and mortality.

Among all the socio-demographic factors considered, only sex and location of the children were significant predictors of overweight and obesity. A male child is 1.5 times more likely to become overweight than a female child, and prevalence of overweight and obesity (combined) is 2.5 times higher in the urban areas (Ibadan North) than in the rural areas (Ido). These differences in the two LGAs may be due to the dietary pattern in this LGAs and level of physical exercise in the LGAs as children from rural areas are more exposed to physical activities such as walking and outdoor play, and may also consume less refined foods and more vegetables and fruits than those in the urban areas. This finding is similar to that of Martorell *et al.* (2009) who reported that overweight is more common among children in urban areas.

CONCLUSION

The prevalence of overweight and obesity among preschool age children in Nigeria is becoming a matter of public health significance and should no longer be handled with levity or be overlooked, as the implication of this increasing trend of overweight and obesity in children is a high burden of non-communicable diseases in the future for Nigeria. Therefore, the need for an urgent intervention cannot be over-emphasised. During the early years of life, focus should be on both under- and overnutrition for sustaining proper growth and development in children less than five years, as the double burden of malnutrition is now a trend in many countries of the world.

The emergence of overweight and obesity, which may be as a result of changes in dietary pattern from traditional foodstuff to convenience, ready-to-eat foods and snacks occurring in Nigeria warrant close monitoring of overweight prevalence in children so that preventive measures can be taken in a timely manner. The positive relationship between obesity and stunting observed in the study emphasised the need for timely nutritional and educational interventions to prevent associated morbidity and mortality.

Acknowledgement

The authors hereby show sincere appreciation to the community leaders and people of the communities where the study was carried out for their commitment and cooperation during the course of the survey, and to the mothers and children who were our respondents.

Authors' contributions

This study was collaboration between both authors. Bamisaye OB designed the study, supervised data collection, wrote the protocol and drafted the manuscript; Adepoju OT approved, supervised the design and protocol of the study, handled technical aspect and reviewed the manuscript.

Conflict of interest

The authors declare that there is no conflict of interest on the publication of information obtained from our study, as it was self-sponsored with no financial aid from any donor or organisation.

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