Original Article

Prevalence of nutrition associated ponderal outcomes among school children and adolescents in Ebonyi State, South-East Nigeria

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Abstract

Background: The prevalence of obesity, overweight, and underweight are increasing worldwide and have posed a significant public health concern over the last decade in developed and developing countries. Monitoring the weight status of children and adolescents is paramount in assessing for cardiovascular disease risk factors. **Objective:** The study was conducted to evaluate the prevalence of obesity, overweight and underweight among school children and adolescents in Ebonyi state, South-East Nigeria. **Materials and Methods:** A cross-sectional design was adopted, 1620 subjects (849 males and 771 females) 5–18 years of age, were randomly sampled. Anthropometric measurements include height and weight, body mass index (BMI) was derived from the ratio of weight per height squared. BMI-for-age <5th, 85th to <95th, and ≥95th percentile were classified as underweight, overweight and obese respectively, according to the International Obesity Task Force reference. **Results:** The prevalence of obesity, overweight and underweight were 12.6%, 11.9% and 7.6%, respectively, in the urban subjects and 1.5%, 2.3% and 20.3%, respectively, in the rural subjects. **Conclusion:** The prevalence of underweight among rural school children and adolescents is high, thus a need for nutritional intervention.

Key words: Ebonyi state, nutritional, obesity, overweight, South-East Nigeria, underweight

INTRODUCTION

Overweight and obesity in children and adolescents have posed a significant public health concern over

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the last decade in developed and developing countries, and their prevalence has reached epidemic proportions (Flegal *et al.,* 2001; Lobstein *et al.,* 2004; Obikili and Nwoye, 2006) The causes of overweight and obesity in children and adolescent are a combination of: Unhealthy eating patterns, lack of physical activity, genetics, lifestyle, behavioral, psychological, socio-cultural, and environmental influences (Polhamus *et al*., 2005; Obikili and Nwoye, 2006). Childhood obesity can lead to various additional health risk, including diabetes, high blood pressure, coronary heart disease, hyperlipidemia, musculoskeletal disorders, mental health issues, and asthma (Strawbridge *et al.,* 2000).

A number of studies have documented the prevalence of overweight and obesity in children and adolescent in Nigeria. It is, however, interesting to note that the patterns of overweight and obesity are sometimes inconsistent across national and regional boundaries (Musa *et al.*, 2012). Ben-Bassey *et al.*, (2007) documented the prevalence rates 3.7% and 0.4% for overweight and obesity, respectively, in Lagos and Funke (2008) in Osun documented 3.2% and 0.7% both in South-West Nigeria, while the study by Musa *et al.*, (2012) in Benue state, North-central Nigeria documented 9.7% and 1.7%, respectively. Recent studies have also reported a high prevalence of underweight in rural Nigerian communities (Sebanjo *et al*., 2011; Ene-Obong and Ekweagwu 2012).

Underweight, overweight and obesity are increasing worldwide and are emerging as major risk factors for several chronic diseases (Funke 2008). The need to monitor the weight status of children and adolescents is paramount. There is a dearth of research on ponderal outcomes among school children and adolescents in Ebonyi state South-East Nigeria. The aim of this study is to determine the prevalence and pattern of underweight, overweight and obesity in school children and adolescents in urban and rural Ebonyi state, South-East Nigeria.

MATERIALS AND METHODS

Area of Study

Ebonyi state is a mainland, South-Eastern state of Nigeria created on 1st October 1996, inhabited and populated primarily by the Igbo of South-Eastern Nigeria. The state has a total area of 5,533 km^2 (2,136 sq mi) located on 6°20′N 8°06′E, and has a population of about 2.176,947 (NPC 2009a). Ebonyi state is divided into 13 local government areas, which includes Abakaliki and Ikwo.

Abakaliki is an urban area and the state capital. Abakaliki city has an emerging high density of human structures, houses, commercial buildings, roads, and bridges. Abakaliki has a population of 149,683 that comprise 72,518 males and 77,165 females (NPC 2009b). Most of its inhabitants have nonagricultural jobs.

Ikwo is a rural area with numerous settlements; villages and hamlets, and large amounts of undeveloped land. Ikwo has a population 214,969 (NPC 2009b). Most of the inhabitants are peasant farmers.

Study Design and Sample Size

The study was a cross-sectional survey done by simple random sampling of school subjects aged 5–18 years. The study was carried out in Abakaliki and Ikwo categorized as an urban and rural area of Ebonyi state. Subjects were selected from Hope high international school, Abakaliki, which was selected because it attracts subjects from high and middle socioeconomic status and, from Enyigba community school and divine mercy comprehensive school, both in Ikwo.

The population of children and adolescents is 57,029 and 87,903 for Abakaliki and Ikwo respectively (NPC, 2009b).

According to Godden (2004) for population >50,000 (infinite population) the sample size can be computed using the formula below.

$$SS = \frac{Z^2 \times (P) \times (1 - P)}{C^2}$$

SS = Sample size.

Z = Z-value A (e.g., 1.96 for a 95% confidence level).

P = Percentage of population picking a choice, expressed as decimal.

C = Confidence interval expressed as decimal.

The sample size was computed as 658 and 661 for Abakaliki and Ikwo, respectively. However, a total of 1620 subjects were recruited for this study which consist of 849 males (52.4%) and 771 females (47.6%). 870 and 750 subjects were recruited from Abakaliki and Ikwo, respectively.

Anthropometry

Anthropometric measurements of height (H) and weight (W) were measured to the nearest decimal place with An Avery Height and weight scale (Avery, Birmingham, England). Body mass index (BMI) was calculated as weight per height squared.

$$BMI = \frac{W}{h^2}$$

The technique employed in taking measurement was in accordance with the guidelines suggested by WHO expert committee (1995).

Ethical Approval

Approval for the study was obtained from the Ethical Committee of Faculty of Basic Medical Sciences of Ebonyi state University and the school authorities concerned. Written informed consent was obtained from parents/guardians of the participants, and verbal consent from the students.

Statistical Analysis

The sample data were analyzed using SPSS IBM SPSS Statistics (IBM Corporation, New York, USA) computer software version 17.0. The data was expressed as the mean ± standard deviation. BMI-for-age $<5^{th}$, 85^{th} to $<95^{th}$, and $\geq 95^{th}$ percentile were classified as underweight, overweight, and obese, respectively, according to the International Obesity Task Force reference. The data were compared with the Centers for Disease Control and Prevention (CDC) 2000 reference growth charts.

RESULTS

Tables 1-3 show the mean H, W, and BMI, respectively, of urban and rural subjects by age and sex. There was an observed increase in mean height with age in both the urban and rural subjects ($r = 0.906$, $P = 0.000$). The mean weight increased with age ($r = 0.878$, $P = 0.000$) and the mean BMI also increased with age ($r = 0.656$, $P = 0.000$).

Table 4 shows the prevalence of obesity, overweight and underweight in both urban and rural subjects. The prevalence of obesity, overweight, and underweight in the urban subjects were 12.6%, 11.9%, and 7.6%, respectively; and 1.5%, 2.3%, and 20.3%, respectively, in the rural subjects. As shown in Table 4, the age-specific prevalence of overweight, obesity, and underweight shows a higher prevalence in children than in adolescents in both the urban and rural subjects. The gender-specific prevalence of obesity reveals 12.6% in both males and females in the urban sample and, 1.4 and 1.6% in males and females in the rural sample. The gender-specific prevalence of overweight shows 12.6 and 11.2 in males and females, respectively, in the urban sample and, 1.4% and 3.2% in males and females, respectively, in the rural sample. For underweight the prevalence was 8.8% and 6.3% in the males and females, respectively, in the urban sample and, 22.9% and 7.5% in males and females of the rural sample.

DISCUSSION

Secular trend in children's height and weight is on the rise and is proposed to be occurring most rapidly in urban areas and among the affluent (Delpeuch and Maire 1997; Uauy *et al.*, 2001). Belmont *et al.*, (1975) and Mohammadzaded *et al.*, (2010) in their separate studies documented that maternal education is associated with higher weight and height in children; and people who live in urban centers have more favorite weight than their rural peers. The findings of this study reveal: More weight and greater height in the urban subjects than their rural counterparts [Tables 1 and 2], and lower BMI values of the rural subjects (male and female) compared to their urban counterparts of same sex [Table 3]. The differences were significant ($P < 0.05$). The higher mean values of height, weight and BMI in the urban subjects compared to their rural counterparts is probably an effect of socioeconomic status which to a great extent determines the standard of living, lifestyle, affordability of health care, and nutritional status.

BMI-for-age chart has been used by most researchers for evaluating if the weight of an individual child is appropriate for his/her height and to determine obesity

Table 1: Mean Height+SD Of Urban and Rural subjects, according age and gender

Age	Urban					Urban				
	Males		Female		*P* value	Males		Female		*P* value
	No	Mean±SD	No	Mean±SD		No	Mean±SD	No	Mean±SD	
5	47	120.8±1.5	45	120.7±5.1	0.95	50	118.0±5.4	30	119.5±4.3	0.18
6	34	122.6±9.6	36	124.0±5.0	0.43	30	127.0±4.7	60	127.4±3.6	0.66
7	36	129.2±8.4	30	130.9±7.6	0.39	12	129.9±5.6	15	132.5±5.9	0.24
8	38	136.4±6.9	34	135.7±5.0	0.61	15	136.0±5.6	18	135.3±6.7	0.75
9	40	143.9±6.4	42	144.9±5.3	0.44	35	138.9±6.1	17	140.3±5.2	0.40
10	30	148.7±7.7	24	151.0±8.8	0.31	22	142.8±9.0	24	144.9±5.0	0.35
11	42	153.1±6.2	28	154.6±6.8	0.34	29	147.7±4.4	12	148.8±6.9	0.56
12	18	155.0±8.2	34	156.2±6.9	0.59	17	148.8±4.9	19	148.1±3.0	0.90
13	24	159.2±5.5	21	158.8±5.6	0.84	25	154.5±8.5	51	153.2±9.5	0.54
14	32	168.6±4.7	24	162.3±3.5	0.00	27	162.8±5.2	24	157.2±6.7	0.00
15	22	172.7±6.3	24	161.6±4.1	0.00	28	166.3±4.5	24	158.2±7.0	0.00
16	36	173.0±6.9	24	163.8±7.7	0.00	34	168.2±4.2	26	159.1±5.2	0.00
17	30	173.2±4.9	24	162.5±5.2	0.00	26	167.7±4.7	24	158.5±4.8	0.00
18	28	173.8±4.5	23	162.2±3.4	0.00	42	168.6±4.9	14	159.5±3.6	0.00

SD - Standard deviation

Table 2: Mean weight+SD of urban and rural subjects by age and sex

Age	Urban					Rural				
	Males		Female		*P* value	Males		Female		*P* value
	No	Mean±SD	No	Mean±SD		No	Mean±SD	No	Mean±SD	
5	47	24.0±4.9	45	23.1±4.3	0.36	50	19.1±2.8	30	18.9±3.1	0.84
6	34	27.6±6.2	36	26.8±6.3	0.60	30	22.0±2.2	60	21.6±3.9	0.53
7	36	28.0±7.2	30	27.1±4.1	0.51	12	25.5±3.1	15	25.5±4.4	1.00
8	38	31.4±7.1	34	30.0±6.0	0.34	15	27.2±3.4	18	26.4±3.1	0.49
9	40	32.1±8.5	42	35.3±8.4	0.09	35	29.9±4.5	17	33.5±7.6	0.04
10	30	38.6±10.7	24	40.3±11.5	0.59	22	34.6±6.0	24	36.6±5.6	0.25
11	42	40.5±6.0	28	45.0±9,7	0.02	29	35.4±4.2	12	38.8±6.8	0.06
12	18	43.2±7.5	34	49.1±8.9	0.01	17	38.9±5.2	19	40.9±3.8	0.20
13	24	47.0±8.0	21	53.2±7.0	0.01	25	42.3±5.5	51	45.5±8.5	0.05
14	32	55.3±6.3	24	59.7±4.2	0.00	27	46.4±5.3	24	51.9±4.2	0.00
15	22	64.0±9.1	24	58.7±4.2	0.01	28	54.8±4.4	24	50.4±5.4	0.00
16	36	67.2±6.3	24	59.3±6.8	0.00	34	57.1±5.0	26	51.3±6.5	0.00
17	30	69.7±11.2	24	60.8±7.2	0.00	26	59.0±4.7	24	50.4±5.0	0.00
18	28	68.3±6.4	23	60.1±4.7	0.00	42	58.2±5.1	14	51.0±5.0	0.00

SD - Standard deviation

Table 3: Mean BMI+SD of urban and rural subjects

Age	Urban					Rural				
	Males		Female		*P* value	Males		Female		*P* value
	No	Mean±SD	No	Mean±SD		No	Mean±SD	No	Mean±SD	
5	47	16.4±2.6	45	15.8±2.0	0.20	50	13.7±1.4	30	13.2±1.6	0.19
6	34	18.7±5.1	36	17.5±4.1	0.26	30	13.6±1.1	60	13.3±1.1	0.22
7	36	17.0±5.8	30	15.8±1.9	0.23	12	15.1±0.6	15	14.4±1.2	1.07
8	38	16.7±2.6	34	16.1±2.5	0.35	15	14.8±2.2	18	14.4±0.7	0.47
9	40	15.4±3.6	42	16.7±3.2	0.09	35	15.5±2.3	17	17.1±4.1	0.08
10	30	17.2±3.4	24	17.4±3.6	0.83	22	16.8±1.0	24	17.4±2.2	0.26
11	42	17.2±1.9	28	18.6±4.9	0.10	29	16.2±1.7	12	17.4±1.7	0.04
12	18	18.0±2.8	34	20.1±3.2	0.02	17	17.6±1.3	19	18.6±1.6	0.04
13	24	18.4±2.1	21	21.0±1.6	0.00	25	17.7±0.8	51	19.3±2.3	0.00
14	32	19.4±1.5	24	22.6±0.8	0.00	27	17.7±1.6	24	21.0±0.5	0.00
15	22	21.4±2.3	24	22.5±1.2	0.05	28	19.8±1.2	24	20.1±2.0	0.42
16	36	22.4±1.1	24	22.1±2.3	0.48	34	20.1±1.1	26	20.2±0.5	0.65
17	30	23.2±3.7	24	23.0±2.6	0.85	26	20.9±0.6	24	20.0±1.5	0.01
18	28	22.6±2.2	23	22.8±0.8	0.67	42	20.5±1.1	14	20.0±1.5	0.22

BMI - Body mass index, SD - Standard deviation

in children and adolescent. The prevalence of overweight and obesity between the urban and rural subjects varied greatly, being higher in the urban subjects. This finding is in keeping with a high prevalence of overweight/obesity in the urban areas and among the affluent. The urban subjects tend to be of high and middle socioeconomic status and have more enlightened parents who will ensure their wards get adequate nutrition and keep regular habits at a meal.

The prevalence of obesity in the urban subjects was lower than an earlier report by Owa and Adejuyigbe (1997), but was higher than those of Akpa and Mato (2008), Ahmad *et al.*, (2013). In the rural subjects, it was comparable to the findings of Funke (2008). Ene-Obong and Ekweagwu (2012) did not detect any case of obesity in rural school children and adolescent of Ebonyi state. This is not consistent with the findings of this study on the rural subjects. This observation suggests heterogeneity of ponderal related nutritional outcomes across communities, which could be attributed to the degree of development of the community, level of awareness, nutritional status, and genetics. Another probable reason is sample size. Ene-Obong and Ekweagu (2012) recruited 360 subjects (194 males and 166 females) which may not be enough to allow for a conclusive assertion on a rural population in Ebonyi state.

Ahmad *et al.*, (2013) documented a comparable gender-specific prevalence of obesity. The findings of this study generally show similarity. However, in children the prevalence of obesity was higher in the males than in the females and by adolescence it was higher in the females as observed in the urban subjects [Table 5]. Fat gain has been shown to occur in both boys and girls at the onset of adolescence, but it ceases and may even temporarily reverse in boys, while it continues throughout adolescence in girls (Lobstein *et al.*, 2004). The females

Table 4: Prevalence of under-weight, and obesity in urban and rural school children and adolescent in Ebonyi state compared with CDC and IOTF BMI-for-age percentile data

	Male (%)			Female (%)		
	<5th percentile	Over-weight 85th to 95th percentile	Obesity (>95th percentile)	<5th percentile	Over-weight 85th to 95th percentile	Obesity (>95th percentile)
Urban reference						
Children (6-9 years)	12.6	12.6	19.5	6	9.6	15.7
Adolescents (10-18 years)	4.2	12.5	4.2	6.7	13.3	8.3
Total	8.8	12.6	12.6	6.3	11.2	12.6
Rural						
Children (6-9 years)	46.2	3.8	3.8	40	-	4
Adolescents (10-18 years)	9.1	-	-	2.6	5.3	-
Total	22.9	1.4	1.4	17.5	3.2	1.6
CDC 2000	**Under-weight <5th percentile**	**Risk of over-weight 85th to 95th percentile**	**Over-weight (>95th percentile**	**Under-weight <5th percentile**	**Risk of over-weight 85th to 95th percentile**	**Over-weight (>95th percentile)**
Children (6-9 years)	13.6	15.7	8.0	19.2	13.3	4.3
Adolescents (10-18 years)	8.1	21.3	12.2	6.0	15.8	6.2
Total	9.7	19.7	11.1	9.9	15.0	5.6
IOTF		**Over-weight**	**Obese**		**Over-weight**	**Obese**
Children (6-9 years)		16.3	3.5		15.5	2.8
Adolescents (10-18 years)		27.5	7.1		20.0	3.9
total		24.3	6.1		18.7	3.6

BMI - Body mass index, CDC - Centers for Disease Control and Prevention, IOTF - International Obesity Task Force

lay down fat as a natural part of the ontogeny of their sexual and reproductive physiology, whereas the males gain proportionately more muscle mass rather than fat (McCarthy *et al.*, 2006 and Krebs and Primak, 2007). Sex differences in the pattern of obesity are possibly due to hormonal and genetic influence.

The findings of previous Nigerian study revealed female preponderance in overweight (Akesode and Ajibode, 1983 Owa and Adejuyigbe 1997; Ansa *et al.*, 2001 and Ahmad *et al.*, 2013). The gender-specific prevalence of overweight in this study shows comparable prevalence between males and females in the urban subjects, whereas in the rural subjects the prevalence rate was slightly higher in females [Table 5]. The contrast with previous findings suggests a regional/cultural variation. Nutritional associated ponderal growth outcomes may follow some adaptations peculiar to a geographical area or population, this may not allow for generalization.

The prevalence of overweight/obesity in this study was found to be higher in children than in adolescent [Table 5]. This shows that there is a high risk of developing obesity at childhood as earlier proposed by Bray *et al.* (2001). Several studies have documented the rising prevalence of obesity in children (Troiano and Flegal 1998; Freedman and Perry, 2000). This poses concern because of the likelihood of overweight/obese children to become overweight/obese adults and the consequent problems of adult obesity.

A number of factors responsible for the rising prevalence of obesity include: Increased food intake, changes in the pattern of food intake (consumption energy-dense fast food) and reduced levels of physical activity. Most school children in urban centers are driven to and fro school compared to the previous generation or the rural population who walk a distance to and fro school, it does contribute to the degree of physical activity. The more time spent watching television and playing games also contributes to inactivity, which are possible attributes of urban children.

The prevalence of underweight in the urban subjects of this study was comparable to that of CDC [Table 4]. However in the rural subjects, the prevalence of underweight is alarming, similar to an earlier report by Ene-Obong and Ekweagwu (2012) on school age children in the rural community of Ebonyi state. They documented that most school children in the rural communities were from agrarian homes and often consumed monotonous diets; a good number of the subjects in their study ate cassava-based diets for breakfast and dinner quite often. Less than 2.0% of their respondents consumed high

protein containing diets. Low maternal education in rural Ebonyi also contributes to the high prevalence of underweight (Ene-Obong and Ekweagwu 2012). Sebanjo *et al.* (2011) documented that an educated woman would implore childhood survival strategies such as adequate breastfeeding, immunization, oral rehydration therapy, and family planning. Educating women would be a useful step in the reduction of poor childhood nutrition issues such as underweight, overweight, and obesity.

CONCLUSION

The prevalence of underweight in rural school children and adolescents was high, whereas the prevalence of overweight and obesity was higher in urban school subjects. The pattern of these ponderal associated nutritional outcomes is gender-specific. This is in keeping with the findings of previous studies.

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Conflicts of Interest
There are no conflicts of interest.

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