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RESEARCH

Assessment of nutritional status of in-school adolescents in Ibadan, Nigeria

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Background: Adolescents are tomorrow's adult population, hence their health and well-being are crucial. The objective of this study was to determine the nutritional status of in-school adolescents in Ibadan, south-western Nigeria.
Method: A descriptive cross-sectional survey was conducted on 93 in-school adolescents attending a diabetes mellitus sensitisation and education programme, selected by simple random sampling (the ballot method) using a self-administered, semi-structured questionnaire. Anthropometric measurements were carried out on the subjects by trained researchers. Data were analysed using SPSS® software, version 17.
Results: Study subjects comprised 29 males (31.2%) and 64 females (68.8), with an overall mean age of 15.67 (± 1.25) years. All of them were in senior grades of their secondary education. Approximately 90% of respondents' parents had attained at least secondary education. The television was the most popular source of health information for the study subjects (33.3%). Nearly a third of them were underweight [body mass index (BMI) < 18.5 kg/m^2] and 7.6% of them were overweight or obese (BMI ≥ 25 kg/m^2). However, the prevalence of underweight was higher in the male respondents than in their female counterparts (41.4% vs. 23.4%, respectively). Statistically significant differences were also observed when the mean BMI and mean BMI percentiles for age and sex were compared ($p < 0.05$ in both instances).
Conclusion: The study showed that malnutrition, and especially undernutrition, is still a problem in adolescents, with a higher prevalence in boys. Nutrition education in schools, and special programmes like the one attended by the study subjects, would help considerably in improving the health and well-being of the nation's adolescents; tomorrow's adult population.

Keywords: anthropometry, in-school adolescents, nutritional status

Introduction

Adolescents are tomorrow's adult population, and their health and well-being are crucial. Yet, interest in the health of adolescents is relatively recent, and a focus on their nutrition even more so.[1] The term "adolescents", as defined by the World Health Organization (WHO), includes persons aged 10–19 years. Being in transition, adolescents may no longer benefit from the attention and care usually given to children, and may not obtain the protection associated with adulthood either. Adolescents make up roughly 20% of the total world population. Adolescents have an even higher demographic weight in developing countries, i.e. approximately 26% in Salvador, compared to 14% in USA. In 1995, there were 914 million adolescents living in the developing world, contributing 85% to their total number. Their number is expected to reach 1.13 billion by the year 2025. Nutrition influences growth and development throughout infancy, childhood and adolescence. However, nutrient needs are greatest during adolescence.[2] Many adolescents are in school, which provides an effective and efficient opportunity for large portions of the population beyond the students themselves to be reached, including school personnel, families and community members.[1] Overall, nutritional status is better assessed with anthropometry in adolescence, as well as at other stages of the life cycle. Anthropometry is the single most inexpensive, noninvasive and universally applicable method of assessing body composition, size and proportion.[3]

However, because of important changes in body composition during adolescence, and particularly during the puberty-related growth spurt which varies in its timing, conducting an assessment of obesity or undernutrition is more complex in adolescents than it is in adults or younger children. Much less is known and carried out with respect to adolescent anthropometry than in it is for the younger age groups. It is possible that rapid changes in somatic growth in adolescence, problems of dealing with variations in the maturation rate, and difficulties involved in separating normal variations from those associated with health risks, have been deterrents to the development of a corpus of scientific knowledge linking adolescent anthropometry with determinants and outcomes.[1] Adolescence may represent a window of opportunity in which to prepare nutritionally for a healthy adult life.[4] Nutritional deficiencies have far-reaching consequences, especially for adolescent girls. If their nutritional needs are not met, they are likely to give birth to undernourished children, thus transmitting under-nutrition to future generations.[5] In developing countries, many children with mild to moderate malnutrition survive to reach adolescence, when malnutrition tends to remain mild but chronic, being detectable only by anthropometric measurement. On the other hand, relatively well nourished children may develop malnutrition in adolescence as a result of acquired dietary habits, influenced by obsession with thinness.[6] Many developing countries face an increasing dual burden of under- and over-nutrition.[7] It has been thought that adolescents have the lowest mortality among the different age groups. Therefore, they have been a low priority in terms of nutritional status assessment.[8] Body mass index (BMI) has been recommended for use as a screening tool for overweight, obesity and thinness in adults and adolescents.[9] However, only a few studies in Nigeria have studied sex differences with respect to the level of undernutrition in adolescent boys and girls.[10–12]

This study set out to assess the nutritional status of in-school adolescents in Ibadan, south-western Nigeria, with a view to determine the prevalence of malnutrition and to observe gender differences, if any, in the nutritional status of the respondents.

Method

A descriptive cross-sectional study was conducted on 93 (29 males and 64 females) randomly selected in-school adolescents aged 13–18 years, from eight public and two privately owned secondary schools in Ibadan, Nigeria, who attended a programme organised by Strategies for Improving Diabetes Care in Nigeria (SIDCAIN). The programme was organised to educate and sensitise the attendees on issues relating to diabetes mellitus, and especially its risk factors and prevention. Ibadan is the capital city of Oyo State in south-western Nigeria, and is the third largest metropolitan area by population in Nigeria, after Lagos and Kano, with a population of 1 338 659, according to the 2006 national census.[13] Numerous public and private schools are located in the city which is also the seat of the first teaching hospital in Nigeria, the University College Hospital.

Study subjects were selected by simple random sampling (the ballot method). On arrival at the programme venue, the participants were informed of the proposed study and 93 of the 180 eligible participants in attendance (60 males and 130 females) were selected by ballot method after initial categorisation by their schools. The aim was to recruit 50% of them. The students in attendance were selected by their school authority to participate. (Enquires were not made as to criteria for the selection). The accompanying teaching staff members viewed the questionnaires and gave their approval for the students to participate in the study. Having received written approval from the Osun State University Human Research and Ethical Review Committee and verbal consent from the participants, it was not considered necessary to obtain written consent from the study subjects who were minors, although verbal consent was obtained from them. The teaching staff accompanied the students from each school to the programme, since most of the respondents were below the age of consent.

The research instrument was a self-administered, three-section, semi-structured questionnaire. Information was collected from respondents on socio-demographic characteristics, and their eating habits and physical activity. Anthropometric measurements were carried out on the respondents (weight and height) by four experienced trained research assistants. The research assistants were members of the SIDCAIN research team, who although they had experience in data collection, were trained on appropriate data collection methods for this study, i.e. on how to take the weight and height measurements of the study subjects. Weight was measured with the aid of a portable calibrated weighing scale (Camry® model EB1002) to the nearest 0.1 kg, and a standard stadiometer was used to measure the height of each subject. Both measurements were taken using standard procedures, as described by the WHO.[14] BMI and BMI percentiles for age and sex were then calculated for each respondent using the Centers for Disease Control and Prevention's (CDC) online "Child and teen BMI calculator". The software generates the BMI and the BMI percentiles of children and teens using the parameters of the height, weight, age and sex data provided.

Results

Of the 93 respondents studied, 2 (2.2%) were 13 years old, 68 (73.1%) between 14 and 16 years of age, and 23 (24.7) 17–19 years old. Therefore, the respondents' ages were between 13 and 19 years, with a mean age of 15.67 years (± 1.25 years). The median age was 16 years and the modal age 15 years. All of the respondents were in the senior classes of their secondary education. They comprised 29 (31.2) males and 64 (68.8) females, mostly from public schools (81.7%). Two thirds of them originated from a family with four or fewer children. Most of them were Christians (83.9%) and from monogamous families (92.5%). Most of the respondents' parents had attained at least secondary education (Table 1).

The majority (95.7%) of the study subjects indicated that they belonged to at least one social club or organisation based at their schools. Only 4 (4.3%) of the respondents did not belong to a social club (Figure 2). The named clubs and organisations were health, press, Brigade, Jets, a literary and debating society and the SIDCAIN Eaglets.

The most popular source of health information for the studied youngsters was television (33.3%), followed by the Internet (18.3%) and then radio (16.1%). (Figure 2).

Table 2 shows that nearly one third (29%) of the study subjects had a BMI of less than 18.5 kg/m^2, 59 of them (63.4%) were of a normal or healthy weight, while 5 (5.4%) were overweight and 2 (2.2%) had a BMI of ≥ 30 kg/m^2 (obese). As shown in Table 2, more than one third (36.4%) of the study subjects qualified as being malnourished (underweight, overweight and obese) when their anthropometric indices were computed based on BMI only.

When the BMI percentiles for age and sex were computed, 6 (6.6%) of respondents were underweight, 80 (86.0%) were of healthy weight, while 5 (5.4%) were at risk of overweight and two were obese. From Table 3, more than three quarters of the study subjects (86%) were of healthy weight, and only 14% were malnourished or at risk of malnutrition (underweight, at risk of overweight and overweight). Bivariate analysis of the content of this table using the chi-square test did not reveal any gender difference among the study subjects ($p = 0.436$).

Table 4 shows the results of the computed BMI of the subjects by gender. As shown in Table 4, 41.4% of the boys were underweight, whereas only 23.4% of the girls were underweight. Bivariate (chi-square) analysis of the results did not show any statistical significance across gender ($p = 0.164$).

Table 5 shows the comparison of the study subjects' mean BMI and BMI percentile results across their gender using Student's *t*-test. The *t*-test comparison of the mean BMI and mean BMI percentiles for the age and sex of the study subjects by gender showed differences that proved to be statistically significant ($p < 0.05$ in both instances).

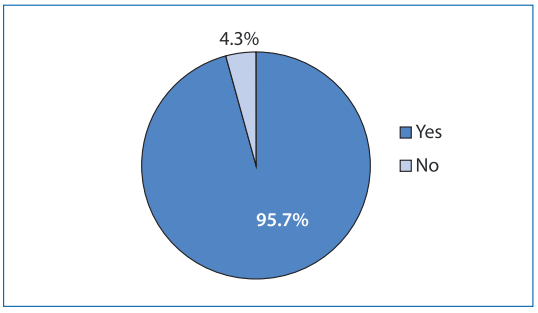

Figure 1: Respondents' membership of a social organisation or club

Table 1: Sociodemographic characteristics of the respondents (***n*** = 93)

Characteristic	Frequency (%)
Age group	
≤ 13 years (early adolescence)	2 (2.2)
14–16 years (mid-adolescence)	68 (73.1)
≥ 17 years (late adolescence)	23 (24.7)
Gender	
Male	29 (31.2)
Female	64 (68.8)
Religion	
Christianity	78 (83.9)
Islam	15 (16.1)
Tribe	
Yoruba	77 (82.7)
Igbo	10 (10.8)
Hausa or other	6 (6.5)
Class	
Senior secondary 1	4 (4.3)
Senior secondary 2	26 (28.0)
Senior secondary 3	63 (67.7)
Family setting	
Monogamous	86 (92.5)
Polygamous	7 (7.5)
No of children in family	
1–4	62 (66.7)
5–10	31 (33.3)
Father's educational level	
No formal education or primary	5 (5.4)
Secondary	28 (30.1)
Post-secondary	60 (64.5)
Mother's educational level	
No formal education or primary	10 (10.8)
Secondary	28 (30.1)
Post-secondary	55 (59.1)

Interpretation of the results

According to the CDC, the BMI (kg/m^2) results were interpreted as follows: < 18.5 kg/m^2 was considered to be underweight, 18.5–24.9 kg/m^2 a normal or healthy weight, 25–29.9 kg/m^2 overweight and ≥ 30 kg/m^2 obese. The results were interpreted as follows for BMI percentiles for age and sex: < 5th percentile was considered to be underweight, 5th–84th normal, 85th–94th at risk of overweight and ≥ 95th overweight.

The generated data were analysed using descriptive statistics, such as means, standard deviations, percentages and frequencies. Chi-square statistics were calculated to compare the nutritional indices of the respondents with their gender distribution. The BMI and BMI percentiles of the adolescent boys and girls were determined and subsequently compared using Student's *t*-test for the purpose of observing any overall differences in their nutritional indices by gender. Data analysis was performed using SPSS® version 17 and the level of statistical significance for analysis was set at $p < 0.05$.

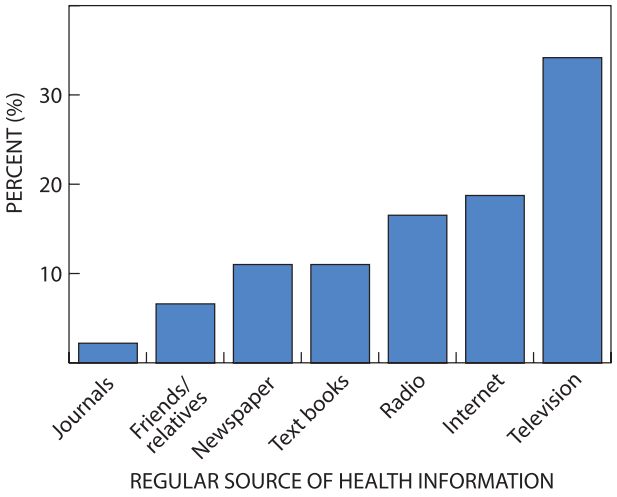

Figure 2: Respondents' regular source of health information

The weight status of the study subjects was computed based on the BMI and BMI percentiles for age and sex. Because of variations in the literature as to the use of BMI in adults and adolescents,[8] the CDC created software for BMI percentile calculation for children aged 2–20 years because of peculiarities in the growth pattern during this period.

Limitations of the study

The study subjects' characteristics and responses to some questions, such as membership of social clubs and organisations and the most popular source of health information, may not be a typical representation of the adolescents in the study location (Ibadan) since they were simply recruited at a health-related programme venue and their selection to attend the programme might have been influenced by their school authorities, amidst the consideration of various factors.

Discussion

Findings from this study revealed that the respondents' parents were educated, a possible contributor to the fact that most (more than a half) of them had a healthy nutritional status, especially when the BMI percentile for age and sex was used to assess nutritional status. Also, most of the respondents belonged to a social organisation and although these associated activities were not explored in this study, such activities may have influenced the respondents' nutritional status. However, the findings from this study showed that based on BMI, 29% of the adolescents were thin or undernourished (having a BMI < 18.5 kg/m^2), 59 (63.4%) were of a normal or healthy weight, while 5 (5.4%) were overweight and 2 (2.2%) obese. However, when the BMI percentiles for age and sex were computed, only 6.4% were underweight, 86% were of normal weight and the remaining 7.6% were overweight or obese. This contrasts with the findings of Deshmukh et al., who reported that the majority of their adolescent study subjects were thin (53.8% had a BMI < 5th percentile), 44% were normal and 2.2% overweight.[15] The findings of this study, in relation to undernutrition prevalence in adolescents, are similar to those of Dey, et al.,[16] who in their study conducted on adolescents in India, found that 28–40% of their study subjects were undernourished when two different criteria were used to assess nutritional status. However, Dey et al. Reported thinness to be significantly more prevalent in girls than in boys, a finding that is contrary to the present study, which found underweight to be more prevalent in boys than in girls, but which is in agreement with a previous study conducted by Shahabuddin et al., who reported that boys (75%) were more affected in this regard than girls (59%).[17]

Table 2: Weight status of the study subjects based on body mass index*

Weight status (body mass index)	Frequency (%)
Underweight (< 18.5 kg/m^2)	27 (29)
Normal (18.5–24.9 kg/m^2)	59 (63.4)
Overweight (25–29.9 kg/m^2)	5 (5.4)
Obese (≥ 30 kg/m^2)	2 (2.2)
Total	**93 (100)**

*: $n = 93$

Table 3: Weight status based on body mass index percentiles by sex of the study subjects*

Body mass index percentile for age and sex	Gender		
	Male (%), $n = 29$	Female (%), $n = 64$	Total (%), $n = 93$
< 5th (underweight)	3 (10.3)	3 (4.7)	6 (6.4)
5th–84th (healthy weight)	25 (86.2)	55 (85.9)	80 (86)
85th–94th (at risk of overweight)	1 (3.5)	4 (6.3)	5 (5.4)
≥ 95th (overweight)	0 (0)	2 (3.1)	2 (2.2)
Total	29 (100)	64 (100)	93 (100)

*: chi-square (likelihood ratio) = 2.278, df = 3, $p = 0.436$ (not statistically significant)

Table 4: Weight status of the study subjects based on body mass index by gender*

Weight status (body mass index)	Gender		
	Male (%), $n = 29$	Female (%), $n = 64$	Total (%), $n = 93$
Underweight (<18.5 kg/m^2)	12 (41.4)	15 (23.4)	27 (29)
Normal (18.5–24.9 kg/m^2)	16 (55.2)	43 (67.2)	59 (63.4)
Overweight/obese (≥25 kg/m^2)	1 (3.4)	6 (9.4)	7 (7.6)
Total	29 (100)	64 (100)	93 (100)

*: chi-square (likelihood ratio) = 3.622; df = 2, $p = 0.164$ (not statistically significant)

Table 5: Comparison of mean body mass index and mean BMI percentiles for the age and sex of the study subjects by gender

Composite variable	*n*	Mean	Standard Deviation	*t*	*p*
Body mass index (kg/m^2)					
Male	29	19.21	1.98	2.249	0.027*
Female	64	20.58	3.00		
Body mass index percentile for age or sex					
Male	29	28.45	23.16	3.591	0.001*
Female	64	48.14	25.07		

*: statistically significant

The Indian National Nutrition Monitoring Bureau also reported a higher prevalence of undernutrition in males aged 14–17 years (73%) than in their female counterparts (60.4%).[18]

Conclusion

From this study, it is evident that the problem of adolescent undernutrition is not negligible as more than a quarter of the study respondents had a low BMI, especially the boys. This points to the fact that adolescent nutrition in the study area needs greater attention.

Larger studies, with a much greater sample size and which are possibly multicentred in nature, with a focus on nutrient consumption and other factors, are required to explore reasons for the observed differences in nutritional status gender wise. Nutrition education, through an improved school curriculum, healthy policies and adolescent-directed messages through the various mass media, could be employed to address adolescent undernutrition in the study area.

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