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Prevalence of Underweight:
A Matter of Concern among Adolescents in Osun State, Nigeria

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Abstract: Prevalence of undernutrition among adolescents in developing world has shown a decline during the last decade. Adolescents make up approximately 20% of the world's population. There is a dearth of research on adolescent nutrition in developing countries. The aim of this cross sectional study was to determine the prevalence of undernutrition, overweight and obesity as measured by Body Mass Index (BMI) in a representative sample of adolescents aged 10-19 years in Osun State of Nigeria. Adolescents (n = 401) from 32 schools in urban and rural districts of the state responded to a sociodemographic questionnaire. Body mass index for age was calculated and the prevalence of underweight, overweight and obesity was determined based on WHO/NCHS value of <5th, 85th and 95th percentiles respectively. The results consisted of 182 boys and 219 girls. The prevalence of underweight was 20.1% in the study area, which was higher among the rural adolescents (22.4%) than urban (18.7%) and 25.8% and 15.1% among boys and girls respectively. The prevalence of overweight was 3.2% with 4.1% from urban and 1.5% from rural, while 1.1% were boys and 5.0% were girls. Only 0.5% urban girls were obese. Prevalence of underweight was significantly higher in boys at mid adolescence (24.2%, p<0.02), boys who were involved in jobs after school hours (13.7%, p<0.06) and who do not travel regularly (22.5%, p<0.12). While among girls who reside with extended family member (11.9%, p<0.05). In conclusion, adolescents living in Osun state, Nigeria are at high risk of underweight.

Key words: Adolescents, underweight, overweight, obesity, prevalence

Introduction
Adolescence is characterized by rapid physical growth and sexual development, accompanied by changes in the percentage of body fat. Adolescent underweight has been identified as a risk factor for underweight in adulthood and it increases adult and child morbidity and mortality by leading to a variety of adverse health outcomes and low birth weight in babies (Cole et al., 2000; Oner et al., 2004). Undernutrition is still prevalent in developing countries and continues to be a primary cause of poor health (Sawaya et al., 2004; Nandy et al., 2005). In Asian countries, the incidence of low birth weight predicts the prevalence of underweight during pre-school and subsequent years. Childhood and adolescent stunting adversely affects the health of adults (Mason et al., 1999).

The prevalence of malnutrition is much higher in South Asia than in developing countries in other regions. The risk factors for cardiovascular disease originate in youth and early adulthood (Berenson et al., 1992). Numerous studies have reported that cardiovascular disease risk factors are associated with adiposity in children, childhood overweight and obesity are associated with an increased prevalence of cardiovascular disease risk factors (Teixeira et al., 2001) and persistent obesity is associated with the development of adverse adult cardiovascular disease risk profile (Srinivasan et al.,

1996). Childhood obesity has become a severe health problem in some developing countries, especially during the last few decades (Ribeiro et al., 2003).

In contrast to children and adults, relatively little information is available about gender differences in weight status among adolescents (Wang et al., 2002; Ribeiro et al., 2003). However, it has recently been estimated that the prevalence of adolescent obesity is increasing not only in developed countries but also in some developing countries in which malnutrition used to be the major nutritional disorder. During adolescence, the Body Mass Index (BMI) is the preferred method of expressing the body fat percentiles of groups. It is widely accepted that a BMI between the 85th and 95th percentiles is defined as overweight and a BMI greater than the 95th percentile as obesity (Chu, 2001; Barlow and Dietz, 1998; Dietz and Bellizzi, 1999) while BMI that is less than 5th percentile is regarded as underweight.

The aim of this study was to determine prevalence of underweight, overweight and obesity in a representative sample of adolescent aged 10-19 years living in Osun State, Nigeria and to compare the prevalence among boys and girls.

Materials and Methods
Osun State, with a land area of 925,100 hectares or 9,251 km^2 and an estimated projected population of

Table 1: Mean±SD height, weight and Body Mass Index (BMI) of adolescents according to age and sex

Age (yr)	No. of subject		Height (m)		Weight (kg)		BMI (kg/m^2)	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
10.00	-	2	--	1.59 ±0.01	--	53.00±5.66	--	20.95 ±1.86
11.00	-	1	--	1.44 -	--	48.00-	--	23.15-
12.00	3	5	1.47±0.07	1.46±0.09	37.33±6.80	44.20±10.32	17.17±1.66	20.40±2.19
13.00	8	17	1.50±0.14	1.48±0.76	43.50±9.10	42.40±7.43	19.10±1.54	19.13±2.05
14.00	30	38	1.47±0.99	1.53±0.06	41.07±6.70	48.16±6.79	18.74±1.69	20.62±2.64
15.00	37	54	1.54±0.86	1.53±0.08	47.16±10.74	48.30±5.76	19.60±2.73	20.34±3.18
16.00	29	39	1.57±0.09	1.54±0.05	49.41±7.70	49.48±6.59	20.06±2.05	20.48±2.28
17.00	28	24	1.61±0.09	1.52±0.05	52.92±8.59	52.45±5.17	20.19±1.80	22.65±2.55
18.00	29	21	1.62±0.07	1.55±0.05	54.07±6.83	53.61±7.74	20.511.69	22.252.46
19.00	18	18	1.63±0.06	1.56±0.62	57.90±4.04	52.47±6.07	21.932.17	21.371.37

2,184,569 in 1998 is divided into 30 Local Government Areas (LGAs) with urban and rural districts. During the study period between September and November 2004, 239,829 adolescents aged 10-19 years according to WHO definition were attending government schools (Osun State Ministry of Education).

The adolescents were the subjects of the cross sectional population study conducted in both urban and rural areas of the state with the use of a multistage stratified, random sampling technique. The original objective was to collect a sample size which is one fifth of the adolescents aged 10-19 years who registered for the school year 2004/2005. A list of names of government schools was obtained from the Department of Planning, Research and Statistics, Ministry of Education. Thirty two schools were selected randomly of these, 25 were proportionally selected from urban areas and 7 from rural areas.

The final sample size was determined by the following steps. First, the number of subject living in urban and rural was estimated at 80% and 20% respectively since some of the subjects in rural area attend schools in urban area. The number of students selected from each school was determined according to the total number of students at each school. Finally, the classrooms were chosen on a systematic random basis and each adolescent was selected randomly from a classroom. Available statistics shows that Osun State has the highest number of children attending school in the nation (FOS, 1996).

The survey instrument which is a structured questionnaire was conducted on 450 students from various schools of these, 401 were included for analysis; 49 were excluded because of incomplete survey. Experts were trained in the correct methods for taking anthropometric measurements of the subjects. To minimize errors in measurement, scales were checked for accuracy by weighing an object of known weight. Height was measured by a portable stadiometer attached to the scales. The necessary posture was taken for the measurement. The portable scale and stadiometer were calibrated daily. Weight was measured in kilograms and height in meters. The BMI was calculated as the ratio of the body weight in kilograms to the square of the height in meters.

The data were entered and processed on an IBM computer by SPSS (Statistical Package for the Social Sciences, Chicago, IL, USA. Descriptive Statistics on BMI, weight and height were calculated. Estimates of the prevalence of underweight, overweight and obesity were based on the NCHS/WHO cut off points values, which defined underweight as a BMI below the 5th percentile, overweight as a BMI equal to or greater than the 85th percentile and less than the 95th percentile for sex and age. Obesity as a BMI equal to or greater than 95th percentile for age and sex.

Correlation analysis was done to test the relationship of some demographic characteristics of the subjects to BMI at p<0.05 value for significance.

Results

The final sample of adolescents aged between 10 and 19 years consisted of 182 boys and 219 girls. The final sample in this study consisted of 401 adolescents after removal of all outliners. The mean values (±SD) of weight, height and calculated BMI in relation to age are shown in Table 1. The prevalence of underweight, overweight and obesity for adolescents of different ages according to age and sex are shown in Table 2. The prevalence of underweight, overweight and obesity for adolescents according to location and sex are shown in Table 3.

The prevalence of underweight, overweight and obesity was 25.8%, 1.1% and none respectively among boys and 20.0%, 3.2%, 0.5% among girls. The prevalence of underweight was highest at 15 years of age among boys (8.2%) and at 14 years among girls (4.1%). The prevalence of overweight was observed at age 15 among boys (1.1%) and between 14 and 19 years among girls (5.0%). The incidence of obesity was noticed among female at age 15 and 18 years (0.5%) and none among male. While, the prevalence of underweight, overweight and obesity was 18.7%, 4.1%, 0.7% respectively among urban and 22.4%, 1.5% and

Table 2: Prevalence (%) of underweight, overweight and obesity among adolescents according to age and sex

Age (yr)	Boys			Girls		
	Under weight	Over weight	obesity	Under weight	Over weight	obesity
10	-	-	-	-	-	-
11	-	-	-	-	-	-
12	66.7	-	-	20.0	-	-
13	37.5	-	-	47.1	-	-
14	43.3	-	-	23.7	5.3	-
15	40.5	5.4	-	11.1	3.7	1.9
16	20.7	-	-	15.4	2.6	-
17	14.3	-	-	4.2	8.3	-
18	10.3	-	-	9.5	9.5	4.8
19	14.3	-	-	-	66.7	-

Table 3: Prevalence (%) of underweight, overweight and obesity among adolescents according to location and sex

Location	Boys			Girls		
	Under weight	Over weight	obesity	Under weight	Over weight	obesity
Urban	25.0	1.7	-	12.8	6.0	1.3
Rural	26.3	-	-	20.0	2.9	-

Table 4: Prevalence (%) of underweight, overweight and Obesity among adolescents according to sex and personal and household characteristics

Measure	Boys			Girls		
	Under weight	Over weight	Obesity	Under weight	Over weight	Obesity
Age						
Early adolescence (10-12)	1.1	-	-	0.5	-	-
Mid adolescence (13-15)	24.2	1.1	-	14.6	4.1	0.9
Late adolescence (16-19)	0.5	9.3	-	-	0.9	-
P value	0.02			NS		
Household type						
Monogamy	-	1.6	-	2.3	0.5	0.5
Polygamy	7.7	-	-	3.2	1.4	-
Extended	18.1	1.1	-	11.9	3.2	0.5
P value	NS			0.05		
Household size						
≤ 6	12.6	-	-	8.2	3.6	0.5
7-11	8.8	0.5	-	4.6	1.4	0.5
≥ 12	4.4	0.5	-	2.3	-	-
P value	NS			NS		
No of hours spent outside the home						
≤ 8	17.0	0.5	-	10.5	3.7	0.5
≥ 9	6.6	0.5	-	4.6	1.4	0.5
P value	0.05			NS		
Job involvement after school hours						
Yes	13.7	-	-	9.6	1.8	0.5
No	12.1	1.1	-	5.0	3.2	0.5
P value	0.061			NS		
Frequency of traveling						
Regular	3.3	-	-	0.9	0.5	-
Non regular	22.5	1.1	-	14.2	4.6	0.9
P value	0.120			NS		

none among rural adolescents. The prevalence of underweight, overweight and obesity was highest at 14 years (6.0%), 15 years (1.5%) and 15 and 18 years (0.7%) respectively among urban. While, the prevalence of underweight and overweight was highest at ages 14-16 years (13.4%) and 18 years (1.5%) among rural.

The prevalence of underweight, overweight and obesity according to the adolescents' personal and household indicators are shown in Table 4. The results of the correlation analysis showed that the prevalence of underweight and overweight was significantly higher in boys at mid adolescents (24.2% and 9.3% respectively

1.10%

□Underweight
■Overweight   25.80%
□ Obesity
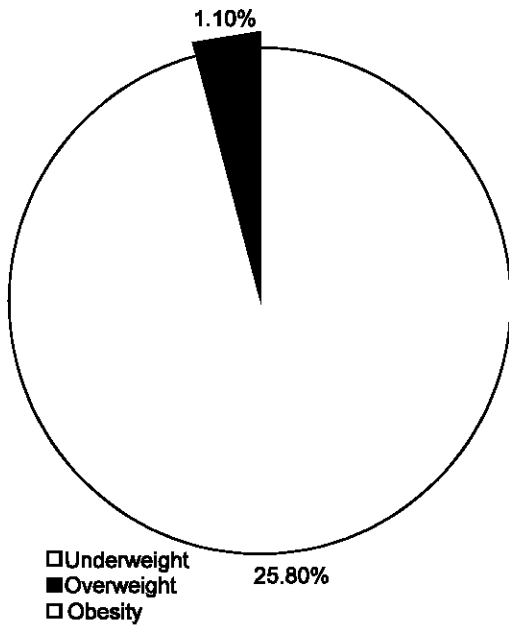
Fig. 1: Distribution of boys according to underweight
        and overweight

0.50%

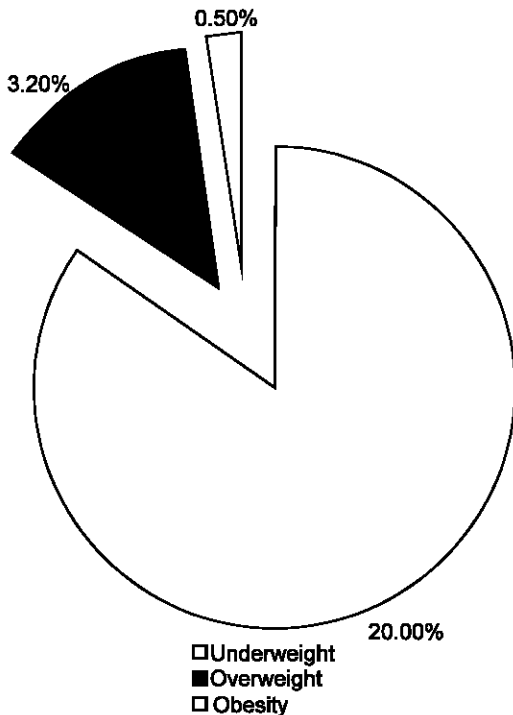3.20%

20.00%

□Underweight
■Overweight
□ Obesity

Fig. 2: Distribution of girls according to underweight,
        overweight and obesity

at p<0.02). While the prevalence of underweight was significantly higher in girls who lived with extended family members (11.9%, p<0.05), boys who were involved in

jobs after school hours (13.7%, p<0.061), boys who do not travel out of their place of abode regularly (22.5%, p<0.120).

The prevalence of underweight, overweight and obesity in boys and girls are shown in Fig. 1 and 2.

Discussion

Adolescent malnutrition in developing countries is beginning to receive the attention it deserves. Although data on adolescent nutritional status in Asia and Africa is sparse, that which exists suggests a generally higher prevalence of adolescent undernutrition in South Asia than in South-East Asia or sub Saharan Africa and a higher prevalence in rural than in urban areas (Laquatra, 2000; Carderio *et al.*, 2006).

In South Asia, a high prevalence of undernutrition (50% or move with BMI <5th percentile WHO/NCHS references) among adolescents have been recorded. Undernutrition and overweight is a global problem, especially overweight and obesity spreading even to developing world, where it is an increasing threat to health. One third of all deaths globally already stem from ailments linked to excess weight and low consumption of food. The prevalence of overweight and obesity in children has recently been investigated in several countries. The overall prevalence of underweight, overweight and obesity in this study was 20.0%, 3.2% and 0.5% respectively.

Underweight, overweight and obesity are increasing worldwide and are emerging as major risk factors for several chronic diseases. Hence, it is important that countries monitor the weight status of children and adolescents. WHO/NCHS recommends the use of BMI percentiles. This study found a high prevalence of underweight and low prevalence of overweight among adolescent boys and high prevalence of underweight, overweight and low prevalence of Obesity among girls in the study area. Many studies show that overweight and obesity in adolescence are powerful indicators of adulthood overweight and related disease (Al-Sendi *et al.*, 2003). A similar study conducted in the Gulf Region reported that the overall prevalence of obesity among Bahraini boys and girls between 12 and 17 years of age was high, especially in girls (21% in boys, 35% in girls (Gargari *et al.*, 2004) which is in collaboration with the girls in this study.

Although the prevalence of overweight and obesity was high in both Bahrain and Qatar, a striking finding of this study was that the prevalence was higher among girls than boys. A study of high school girls in Iran found that the prevalence of overweight and obesity were 10.1% and 3.9% respectively (Livingstone, 2000).

A similar study of adolescents in Istanbul found that the prevalence of overweight and obesity were 11.3% and 1.6%, respectively, among boys and 10.6% and 2.1% among girls (Oner *et al.*, 2004). Some studies found

significant sex differences in the prevalence of overweight and obesity. Most studies from Asia and Europe e.g, Taiwan (Chu, 2001), Hungary (Elmadfa *et al.*, 1993) and Austria (Sibai *et al.*, 2003) found a higher prevalence among adolescent boys and girls which is contrary to the pattern in this study. In Qatar, the prevalence of underweight was 8.6% in boys and 5.5% in girls (Bener, 2006). These figures are lower than the 14.4% for boys and 11.1% for girls reported from Istanbul (Oner *et al.*, 2004) which is similar to the pattern in this study.

In this study, prevalence of underweight was higher among boys than girls while the prevalence of overweight was higher among girls than boys. None of the boys in the study area was obese while 0.5% of girls was obese, which implied that girls were more at risk of overweight and obesity than boys, while boys were more at risk of underweight than girls. Though the prevalence of underweight in both sexes was high (25.1%) in boys and (15.1%) in girls in the study area.

Health professionals may play a key role in promoting good dietary behaviour among adolescents. Other interventions may involve health education through mass media to influence nutritional norms and practices. Such interventions, aimed at better health awareness and more physical activity, should be monitored for their effectiveness.

Limitation of the study: A limitation of the study is that the measurements of the subjects could be performed only once, so that some measurement errors might not be accounted for.

Also, the study did not provide direct indications of the natural history of overweight and obesity in this population. Despite these limitations, the data presented in this study provide a valuable profile of the physical characteristics of a major segment of the adolescents in Osun State, Nigeria.

Conclusions: This study found a high prevalence of underweight and overweight in the adolescent population in the study area, especially among boys (underweight) and girls (overweight). The prevalence of obesity was found in girls and none in boys.

There is a need to establish a national control programme for the prevention and treatment of malnutrition and related complications. All age groups and segments of society should be targeted.

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