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Full Length Research Paper

Age and sex trends in the prevalence of obesity among different youth populations in South-East Nigeria

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There is need to continually monitor and document the trends of overweight and underweight in the public health context of developing nations so as to suitably adjust public health strategies and disease management approaches. This study reported the BMI trends of 2 different youth populations in southeast Nigeria. 2732 secondary school students were selected through a multi-stage sampling technique and their body mass indices obtained. The prevalence of overweight, obesity and underweight were determined using Body Mass Index (BMI). The findings were compared with the data of a cohort of medical school undergraduates (n=131). Approximately 75% and 66% respectively of secondary and tertiary students were underweight. The prevalence of overweight was 3% in secondary and 19% in tertiary student populations. Obesity was less than 1% in both groups. Only 21.99% and 14.52% respectively of the younger and older youth populations had normal BMI. The current mean prevalence of obesity among Nigeria youth populations was <1% while that of overweight was 11%. Underweight had a staggering rate of 70.5%, probably among the highest in the region. Both underweight and overweight have shown a rising trend. Underweight was commoner in females. Data indicates urgent need for containment measures.

Key words: Obesity, overweight, underweight, prevalence, Nigerian, youths, Age/Sex trend.

INTRODUCTION

Once considered a problem only in high-income countries, overweight and obesity are now dramatically on the rise in low- and middle-income countries (WHO, 2#06a). At least one in three of the world's adult population is overweight and almost one in 10 is obese and over 20 million children under age five are overweight (WHO, 2006b).

The prevalence of obesity has more than doubled in the past 20 years (Cameron et al, 2003). According to the International Obesity task force, an estimated 300 million people around the world are obese i.e. have a BMI >30. Childhood obesity is a growing problem and 25% or more children in Australia, Iran and the U.S. are obese while more than fifty percent of the adult population in the same countries are either overweight or obese (Brownell et al, 2005).

In an Italian cohort, the percent overweight and obesity were 24% and 8.4% with a greater proportion occurring among the male population (De Vito et al, 2004). Similarly, among a Thai population the prevalence of obesity and overweight were 3.5% and 19.2% in males while in females, it was 8.8 % and 33.9%respectively (Aekplakorn et al., 2004).

Childhood obesity has been identified as a risk factor for a number of health conditions including heart disease, stroke, diabetes (Smith, 2007), high blood pressure, asthma, sleep apnea, gallstones, kidney stones, infertility, and many types of cancers (Daniels et al., 2005; Freedman et al., 2007).

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The health impacts of obesity are deep and wide, and extend beyond individuals to communities and nations. For instance, in the U.S., obesity is the second commonest cause of death among adults (Cawley et al., 2012) and second highest cause of cancer (Danaei et al., 2009). The health care costs of obesity in the U.S. were estimated at $190 billion in 2005, (Cawley et al, 2012) being cost of medical care, lost work hours and lost manpower from obesity-related illnesses and deaths respectively. There is even a defence dimension. About 30 percent of young Americans are now too heavy for military enrolment (*Mission: Readiness.* Too Fat to Fight*. Washington, DC: Mission: Readiness; 2010*).

In many Nigerian cultures however, overweight is a socially acceptable index of wellbeing especially in this era of HIV/AIDS whereas underweight is perceived as indicative of ominous illnesses especially AIDS. Same is true for South Africa. Nearly one third of women in South Africa are now severely overweight (Van Der Merwe, 2006). The study noted that a combination of new fears and traditional and cultural factors encourage excessive weight gain. South Africa's AIDS epidemic is driving a new health crisis in the country as women, fearful of appearing to be HIV positive, are becoming obese in record numbers (Van Der Merwe, 2006). There are reports of characteristic sequence of change in diets and reduction in physical activity contributing to higher prevalence of obesity and type 2 diabetes (Tucker et al., 2001).

Childhood and adolescent obesity prevalence has steadily increased in industrialized nations in the past 20 years and current rates range between 6 and 30% (De Vito et al, 2004). Several studies showed that risk factors for weight gain in school age are strongly linked to low physical activity and family environmental factors such as parents' education, job, number of family members, etc. However, underweight is also an important public health issue, more so in developing countries (Nwobodo, 2006) and is also associated with much stigmatization in the many African cultures. In the poorer parts of the developing world, underweight is also quite a problem of its own. In reality however, underweight in Nigeria is more often a manifestation of under nutrition.

It is uncertain in Nigeria what the trend of these two indices is among most population sub groupings. There is scant data on trends of obesity and related issues in Nigeria especially against the background of rapidly changing diet and lifestyles including more fats, animal products, and refined foods low in fibre.

Obesity and overweight monitoring is useful in planning nutritional activities and health educational programmes. Effective public health policy requires information on prevalence of obesity and overweight. This study is aimed at determining and documenting the prevalence of overweight and obesity and the current BMI status of youth populations in south-east Nigeria. Findings from this study will create awareness, document BMI trend among Nigerian youth population. In addition, it will provide basis of assessment of nutritional and child health programme and form the frame work for effective health policy guidelines not just for Nigeria but also for other developing countries in Africa. Inculcating and/or expanding nutritional education and healthy living in primary and secondary school curricula may enhance awareness and behavioural change. It would be necessary that approval for establishment of private primary and secondary school in Nigeria should make the availability of field and track exercise facilities a mandatory requirement to enhance physical activities. Also, policy guided regulation of fast foods in terms of availability and content may all add to the containment measures.

METHODS AND MATERIALS

Study Population

2 different study populations were chosen; the first was a total of 2732 secondary school students randomly chosen from secondary schools spread across Anambra State. (n=2732) through a multistage sampling technique. First the schools were clustered by local government areas and then stratified by sex of students. Schools were randomly selected from each cluster and selected schools were further stratified into year of study. The stipulated number of students per year of study was then selected systematically from the students' register. Consent was obtained from both the school authorities and the students themselves.

The second study population was a cohort of medical students of the Nnamdi Azikiwe University in Anambra State of all years of study who were randomly recruited into the study following an informed consent of all recruits. The Nnamdi Azikiwe University Medical School Ethics Committee approved the study. A total of 131students participated (n=131).

Determination of the Height and Weight

The weight of the students was determined using the Gadwink bathroom scale with the students wearing their normal light school dresses. An allowance of an average of 3kg was made for clothing for the subjects and final weight values were adjusted accordingly.

The height of all subjects was determined using an Avery scale with the subjects wearing no shoes.

Determination of Age

The ages of the students were as supplied by the students for each short health questionnaire developed

Table 1. Characteristics of the subjects.

Indices	Secondary school students (N=2732)	Comparative undergraduate data (N=131)
Mean age (yrs)	13	21.18
Range	10-16	
		17-30
Mean weight (Kg)	39	64.5
Range	9.5-104	48-85
Mean height (cm)	142cm	170cm
Range	64.8-196.5cm	155-189cm
Mean BMI	17.94	22.25
Range	4.1-43.84	17.6-29.1
Mean LBM	33.27	50.01
Range	8.42-76.84	34-66

Table 2. Percentage distribution of BMI status of the subjects.

Category	No of subjects (n=2732)	Percent for each category	Percent for each of Comparative undergraduate data	Mean percentage prevalence
Underweight	2048	74.96	66.13	70.50
Normal	601	21.99	14.52	18.26
Overweight	75	2.75	19.35	11.05
Obesity	08	0.29	0	0.15
Total	2732	100%	100%	100%

for this study and data capture. The validity of the ages of the students were further confirmed by their proof of age as contained in their students registers at the school registry given that age falsification is a common occurrence among adolescent subjects in many Nigerian cultures.

Calculating the BMI

The calculation and classification was based on the determination of the body mass index (BMI) using the Quetelet index formula of

BMI = Weight in kg / (Height in Meters)^2

Classification was based on the cut-offs as developed by the WHO namely:

- BMI<20=underweight
- BMI=20-24.5= normal
- BMI=25-29.9 =overweight
- BMI> 30=obese

The LBM of both populations were also calculated using the formula (James, 1976).

LBM = (1.10 x Weight in Kg) - 128 x (Weight in Kg^2 /(100 x Height in Meters^2)

Statistical analyses

Microsoft Excel software was used to determine the mean age, mean BMI for males and females and the percent overweight, obesity or underweight among the population studied.

RESULTS

The results of the analyses are summarized in Tables 1-5 and Figures 1-4.

The mean age, weight, height, BMI and lean body mass of the subjects were shown in table 1. Our results confirm the complete absence of obesity among the subjects studied (Table 2). Also underweight appears to be a common occurrence among the student groups at rates

Table 3. Percentage prevalence of BMI status of all subjects by sex.

Category	No of subjects n=2732			Percent for each category			Percent for each of Comparative undergraduate data		
	Male	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
Underweight	928	1120	**2048**	33.97	41.00	**74.96**	30.18	36.05	**66.13**
Normal	392	209	**601**	14.35	7.65	**21.99**	8.38	6.04	**14.52**
Overweight	43	32	**75**	1.57	1.17	**2.75**	11.06	8.29	**19.35**
Obesity	3	5	**08**	0.1!	0.18	**0.29**	0	0	**0**
Total	1366	1366	**2732**	50.00%	50.00%	**100%**	49.62%	50.38%	**100%**

Table 4. Proportion of underweight subjects in males and females groups.

Sex	Underweight	Not Underweight	Total
Male	928	438	**1366**
Female	1120	246	**1366**
Total	**2048**	**684**	**2732**

Chi-square approximation test, p<0.0001, very significant.

Table 5. Proportion of overweight subjects in males and females groups.

Sex	Overweight	Not overweight	Total
Male	43	1323	**1366**
Female	32	1334	**1366**
Total	**75**	**2657**	**2732**

Chi-square approximation test, p=0.2416, not significant

of 38.52% and 32.08% respectively among the female and male populations studied (Tables 2 and 3).

Table 3 shows that the mean percent prevalence of underweight, overweight and obesity among the female students population were 38.52, 4.74 and 0.06 respectively whereas the prevalence of underweight, overweight and obesity among the male population were 32.08, 6.32 and 0.09 respectively. The scatter plot of the BMI of all the subjects is as in the figures 2 and 3. From the results, the female population has the following features relative to the males:

- A higher prevalence of underweight.
- A lower prevalence of overweight.
- Lower leans body mass relative to their male counterparts.

Also the average weight of the females was lower relative to the males namely 60.38 Kg as compared with 68.10kg for the males (Table 1). In contrast, the male average age was 21.18 compared to 20.8 for the females.

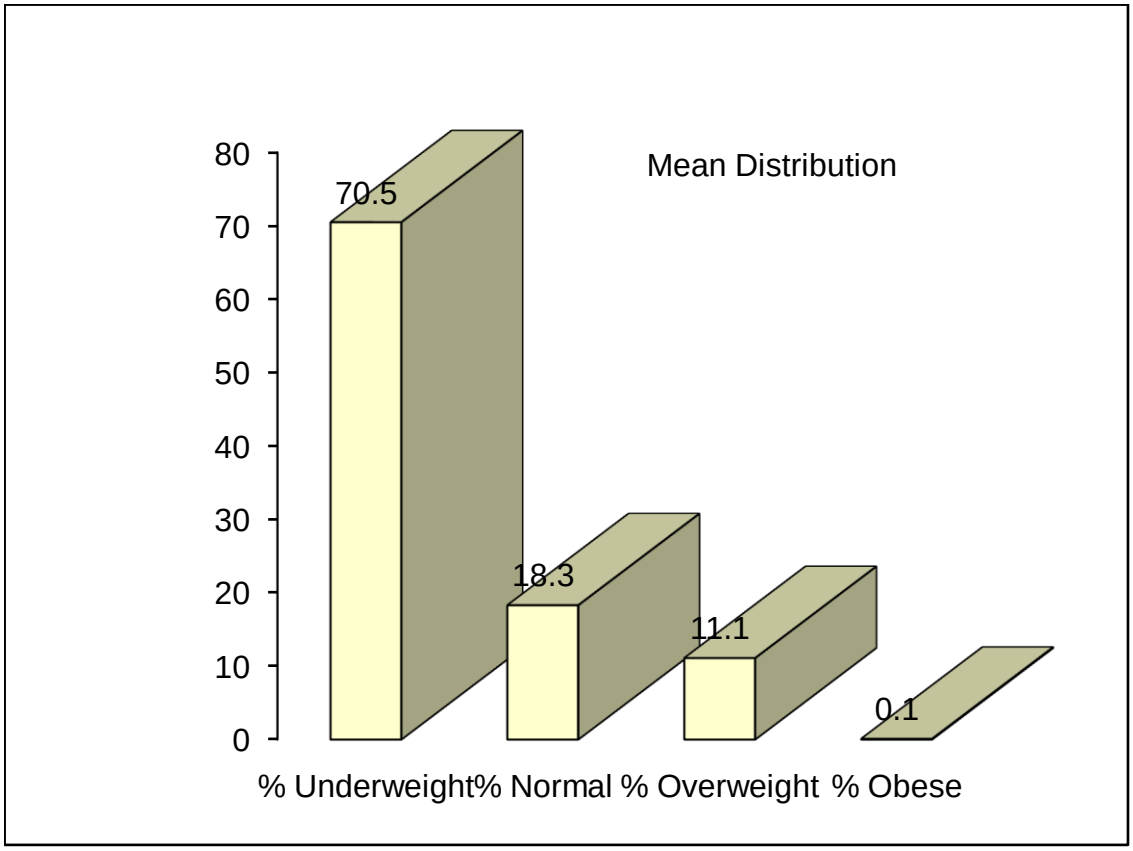
The prevalence of obesity for the student population was approximately, zero.

The two-sided P value is 0.7470 for Fisher's Exact Test of the difference between the mean prevalence of under-weight/over-weight in both sexes, considered not statistically significant. However, there was a significant difference in the proportion of subjects who were underweight and those who were not (Table 4). No significant difference was observed for overweight. (Table 5)

DISCUSSIONS

Our results showed a relatively high rate of both overweight and underweight among the subjects. Both conditions have worsened over time. A previous study of adolescents aged 10-19 from 32 schools in a south west Nigerian state reported a prevalence of underweight of 20.1% and overweight of 3.2% (Olumakaiye et al., 2008). In our study mean prevalence of underweight and

Figure 1. Mean Percentage Distribution of Underweight, Normal, Overweight and Obese Subjects in Both Groups.



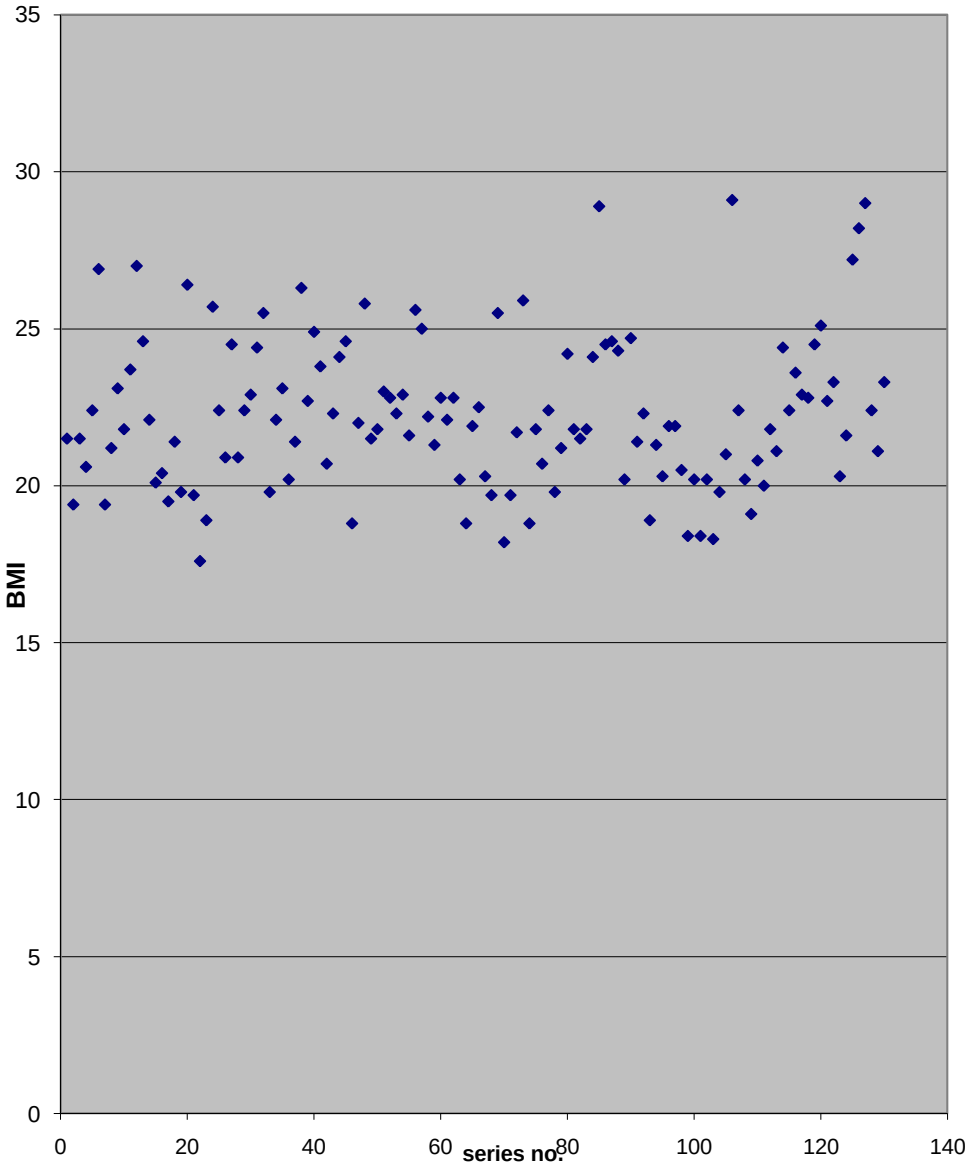
overweight was 70.5% and 11% respectively (Table 2). These figures represent approximately four-fold increase in prevalence. The dramatic increase in the percentage overweight from 2.75% to 19.35% between the younger and the older groups indicates the propensity for obesity with increasing age which strongly suggests rising obesity prevalence in the adult population. Besides age, physical activity level may have contributed to the observed difference. A large number of the secondary school children walk to school from home and engage in greater range of sporting activities when compared to their tertiary student counterparts. The finding of rising overweight and underweight compares well with data from some other countries in the region (Toriola et al., 2012). Specific prevalence rates however vary. For example, in 2008, the average BMI among men in the Democratic Republic of the Congo was the lowest in the world at 19.9 as against 26.9 in South Africa (Finucane et al., 2011).

A number of theories seek to explain why obesity is on the rise around the world. Migration of people from rural to urban areas has changed diets to include more fast food and less traditional diets. In Mexico, childhood obesity barely existed twenty years ago, whereas a recent municipal study in Mexico City showed that 30% of elementary school children and 45% of adolescents were overweight (Malkin, 2005). In our study, diets were influenced mostly by the availability of food.

Some analysts blame, or at least associate, the United States and its fast-food culture with the obesity problem. A report published in the American Journal of Preventive Medicine looked at linkages between the prevalence of McDonald's restaurants per 1000 people living in Scotland and England. The report found that in lower-income areas there were more fast food restaurants. Similar studies performed in Australia and the United States show that there are 2.5 times more fast food restaurants in poor areas than rich ones (Paterson, 2005). It is however uncertain if there were close association with poverty and the frequency of obesity in our study groups.

A Rand Corporation study found that obesity is not linked to the number of fast food restaurants, but to the price of fresh produce. Children gain more weight in areas where the price of fresh fruits and vegetables are expensive (Sturm et al, 2005). Our study took place in mostly in semi-urban areas, where vegetables and fresh farm produce would typically be cheaper than in the urban cen-

Figure 2. Distribution of Bmi of the Medical School Undergraduate Population.



tres. It is thus possible that the cheaper price of healthy foods in these areas was a factor which contributed to the results obtained.

Main risk factors for developing obesity seem to be linked to parents' nutritional conditions, mother's educational level and children's physical inactivity and these should lead to intensified efforts at preventive interventions both at family level -focused on parents and at school (De Vito et al, 2004). These factors need to be taken into consideration when developing strategies to tackle obesity and overweight in the developing world.

Underweight was the most prevalent BMI status found in this study among different adolescents groups. Chi square approximation test of proportion indicated a significantly higher prevalence of underweight in females than males ($p<0.0001$). The high prevalence of underweight and complete absence of obesity as found in this study contrasted reports from other African countries. In South Africa 10% of women surveyed in the South African Demographic and Health Survey, aged between 15-24 years, were obese (Puoane et al., 2002). Also the result of 2002 national youth risk behavior survey in south Africa found higher prevalence of underweight in males than females (Reddy et al., 2009). Cultural differences may play a role in these observations. Egypt in 1996 had the highest average BMI in the world at 26.3 (Martorell et al., 2000). In 1998, 1.6% of 2–6 year olds, 4.9% of 6–10 year olds, 14.7% of 10–14 year olds, and 13.4% of 14–18 year olds were obese. 45% of urban women and 20% of the rural population were obese (Galal, 2002). In Ghana

Figure 3. Distribution of Bmi of the Secondary School Student Population

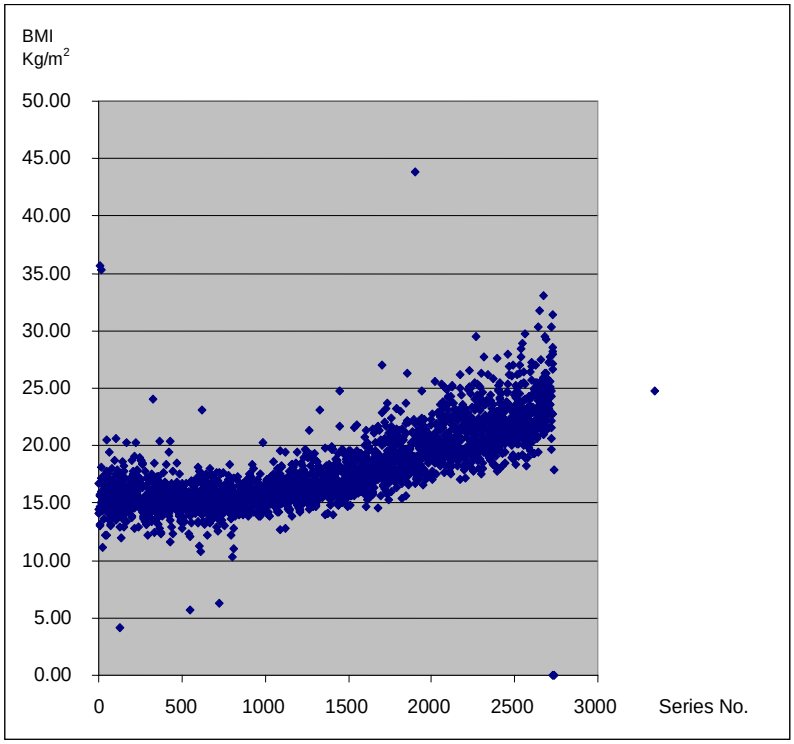
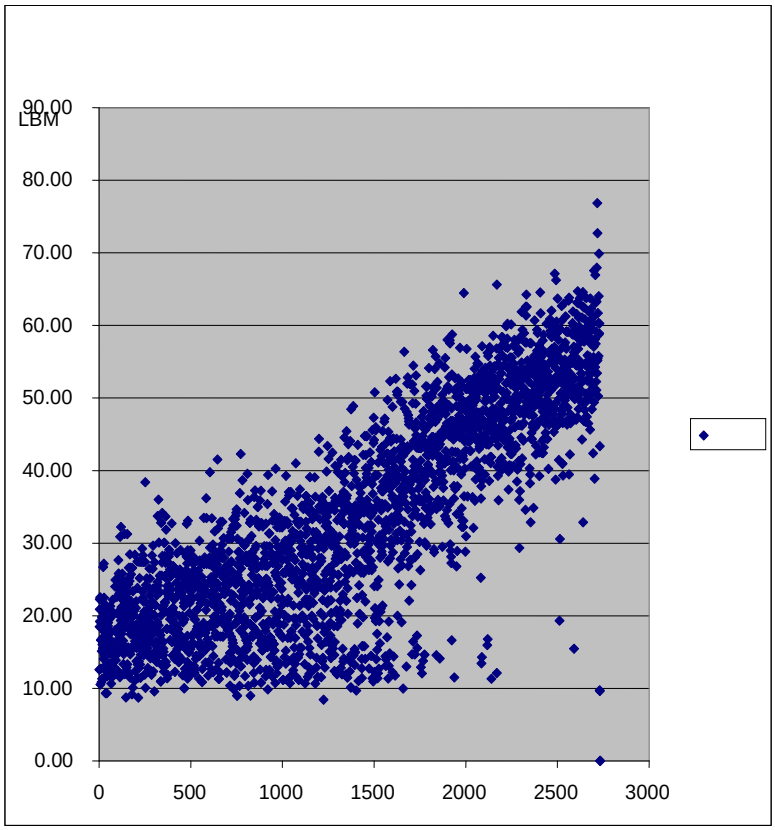


Figure 4. Lean Body Mass of the Subjects.



the prevalence of overweight and obesity combined was found to be 8.5% and more than 80% were normal (Mogre et al., 2013).

Low BMI in Nigeria appears to characterize previous reports. Olumakaiye et al. (2008) reported obesity prevalence of <1% among adolescents in south-west Nigeria. In FAO Report (2010), Nigeria was among the countries where the percentage of low BMI in women increased in both rural and urban areas. The high percentage of underweight in adolescents in Nigeria may have reflected the poor socioeconomic status of the rural and suburban populations of the country. The cultural practice of placing more care on the male children could explain the observed higher prevalence of underweight among the females. The high percentage of overweight recorded among the adult group may be age-related (Toriola *et al.,* 2012) or may have also resulted from their social background, being medical students most probably from middle to upper socioeconomic class. Ultimately there is a growing incidence of obesity in face of malnutrition. As it stands only 21.99% and 14.52% respectively of adolescents and young adults had normal BMI. This obviously is worrisome. Behavioural, genetic and environmental factors affect obesity. (Daniels et al., 2005). It is necessary that all possible factors leading to overweight/obesity be elucidated and effective containment measures put in place to avert the huge burden of disease associated with obesity.

CONCLUSION

The current prevalence of obesity among different Nigerian youth populations is <1%. There was a sharp increase in overweight with increasing age, from 2.75% for 10-16 years to 19.35% for 17-30 years suggesting a possibility of high/rising prevalence of obesity in the adult population. Underweight was the predominant BMI status among Nigerian youth accounting for 74.96% of the study population. This figure was about the highest in the region. Underweight was significantly higher in females than males. Both underweight and overweight have shown a rising trend. Less than 23% of the study groups had a normal BMI.

The greater danger of overweight in Nigeria appears to be its acceptance as wellbeing akin to the proverbial lion in sheep clothing. Effective containment measures will hinge on continuous monitory of BMI trend and awareness creation; curricula change on physical and health education as well as regulation of content, sale and consumption of fast foods.

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