

Original Article

Body Mass Index, Physical Activity and Sleep Duration among Students of a Tertiary Educational Institution in Northern Nigeria

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ABSTRACT

Background: Overweight and obesity increase the risk of cardiovascular diseases, metabolic disorders as well as some cancers. As leading causes of preventable death worldwide, overweight and obesity were estimated to cause 3.4 million deaths. Physical inactivity and sleep duration may contribute to this rising trend. This study assessed Body Mass index (BMI) and determined prevalence of overweight and obesity, and association with physical activity and sleep duration among students of Ahmadu Bello University Zaria, Nigeria. **Methods:** This was a cross-sectional study of 375 respondents who were selected through a multistage sampling technique. Respondents were interviewed using pre-tested structured self-administered questionnaire, sleep duration was assessed, weight and height were measured using standard techniques and BMI [(weight (kg)/height (m²)] was calculated. Data was analysed with the IBM® SPSS software (V.23). Associations between variables were tested, level of significance set at 5% (p ≤ 0.05). **Results:** Mean age of respondents was 22.4±2.9 years. The respondents were predominantly male, 257(68.5%). A total of 50(13.3%) were overweight while 10(2.7%) were found to be obese, mean BMI was 22.0±3.2 kg/m². Physical Activity (PA) pattern showed 89(23.7%) were inactive. Average sleep duration for all participants in this study was 7.0±1.4 hours with 45.6% of the participants having sleep duration less than 7 hours and 9.3% having 5 hours or less of sleep. There was no statistically significant association between BMI and physical activity and sleep duration. **Conclusion:** Majority of respondents had BMI within normal range. Although there was minimal physical activity among respondents, no association was found between BMI and physical activity or sleep.

Key words: Overweight, Obesity, Body Mass Index, Physical Inactivity, Sleep

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INTRODUCTION

Overweight and obesity are defined as abnormal or excessive fat accumulation which presents as a risk to health of individuals.[1]The worldwide prevalence rates of overweight and obesity continue to grow in adults and children, more than 1.9 billion adults were recorded overweight while 650million were obese in 2016.[1]Overweight and obesity are recognized public health problems especially as they have a strong link with several cardio metabolic disorders and some cancers, which in turn contribute to poor health outcomes and the attendant high and escalating costs to society.[1]Over 3 million people globally, are dying each year as a result of being overweight or obese in 2017 annually.—^[1,2]In sub-Saharan Africa, overweight and obesity are recorded as 30% and 10% of adults respectively.—^[3]On the other hand, Nigeria is possibly the most affected country in Africa with 20.3% to 35% adult prevalence of overweight and 8.1% to 22.2% adult prevalence of obesity,^[4] and the burden has extended to younger age-groups where 9% of children 5-9 years are either overweight or obese and will grow to become obese adolescents and young adults over time.—^[5,6]The fundamental cause of overweight and obesity is an energy imbalance between calories consumed and calories expended, other known risk factors, including dietary pattern, physical exercise, and sedentary lifestyle, also contribute. There are also a number of studies which indicate that sleep duration was also associated with overweight and obesity.—^[7]Nigeria is witnessing both demographic and epidemiologic transitions and these could be some of the possible reasons why the prevalence of non-communicable diseases is increasing. There is also a general misconception in Nigeria that obesity is a sign of affluence. Although there have been studies on prevalence of obesity in Nigeria, there is paucity of information on physical activity and sleep as factors associated with it. Establishment of these associations will be potentially useful in the holistic approach to the prevention of the rising

prevalence of obesity and other non-communicable cardiovascular diseases. The aim of this study was therefore to determine the prevalence of overweight and obesity, and also determine association with sleep and physical activity among apparently healthy students in tertiary educational institute in Zaria, Kaduna State north-west Nigeria.

METHODOLOGY

This was a descriptive cross-sectional study conducted among students of Ahmadu Bello University, a foremost tertiary educational institution located in Zaria, North West Nigeria. The student population is accommodated in two major campuses, located at Samaru and Kongo, there is also a pre-degree school in Funtua which is about 85 kilometres from the Samaru (main) campus, while the clinical students of the College of Medical Sciences are at the Shika campus. All campuses have available sporting, social and recreational facilities that include a gymnasium and social centres. The 17 faculties of the University are spread within these campuses; the university also has six institutes that are affiliated to it.[8]

The sample size was calculated using the formula:[9]

$$n = z^2 pq / d^2$$

Where n = minimum sample size, z = the percentage point of the standard normal distribution curve which the curve defines 95% confidence interval as 1.96, p = proportion of individuals who were overweight from previous study 35.1%. The q = complementary probability which is 1 – p, d = level of precision (maximum sampling error allowed) at 95% confidence limit i.e. 0.05. The minimum sample size was calculated to be 341, and a non-response rate of 10% (34.1) was added to it.

A total of 375 respondents were selected using a multistage sampling technique, eight of the 17 faculties were selected through simple random sampling by balloting, thereafter, and three departments from each of the selected faculties were selected via balloting, making a total of 24

departments. Equal number of respondents was then consecutively selected from each department; they were interviewed until the required sample size was achieved.

Data were collected at school during class time (day time) by the research team who were trained according to the research objectives. A semi-structured self-administered questionnaire was used to collect data from respondents, information were elicited on respondents' socio-demographic characteristics, physical activity and sleep pattern. Weight and height measurements were then taken. Analysis of data was done using IBM SPSS® software version 23.0. Means and standard deviations were obtained for the Body Mass Index (BMI) and presented on frequency tables. The Fishers' Exact Test was used for test of association between sleep duration and the categories of BMI while Chi-squared test was used to test for association between physical activity and BMI ranges. Overall, the gender distribution of BMI, and associations of BMI with sleep and physical activity were determined. Statistical significance was set at $p < 0.05$.

All body measurements were made by four trained research assistants using standard procedures. Body weights of respondents were taken in light clothing and without shoes, using a weighing scale which was standardised prior to its use, and was reset at zero reading before each measurement was done. Weight was taken to the nearest 0.1 kilogramme using a digital calibrated balance (model SECA 803, Seca GmbH & CO, Hamburg, Germany). Height was measured to the nearest 0.1 centimetre, using a portable stadiometer (model PORTROD, Health O Meter, USA). Body mass index (BMI) was then calculated from weight (in kilogrammes) divided by a square of the height (in metres).

The World Health Organisation's (WHO) categorisation of BMI (kg/m^2) was used: BMI of $< 18.5 \text{ kg}/\text{m}^2$ was underweight, BMI of $18.5\text{-}24.9 \text{ kg}/\text{m}^2$ was normal, BMI of $25\text{-}29.9 \text{ kg}/\text{m}^2$ was used to define overweight, while $\geq 30 \text{ kg}/\text{m}^2$ was used for definition of obesity. Participants were

deemed active if they engaged in the recommended levels of physical activity is at least for 30 minutes for at least three days in a week.

The timings for falling asleep and waking up were estimated to within 10 minutes, sleep duration was the difference between time respondent fall asleep and the time they wake from sleep. All respondents were asked about their sleep duration in last seven days prior to the interview. Short sleep duration was for 5 hours or less; the normal sleep duration was more than 5 hours but less than 9 hours and long sleep duration was for 9 hours or more.

Ethical clearance was obtained from the Health Research Ethics Committee of Ahmadu Bello University Teaching Hospital Shika-Zaria (HREC No.10/12/2015 D-U-N-S No.954524802). Information about the study was provided, following which consent was obtained from each respondent.

RESULTS

A total of 375 copies of questionnaire were administered and all were completely filled, this gave a response rate of 100%. Age range of respondents was 19-35 years, mean age was 22.4 ± 2.9 years, 332(88.5%) of them were 25 years or less. Most respondents were males, 68.5%. In total, 60(16.0%) were either overweight or obese. [Table 1] Physical Activity (PA) pattern showed 89(23.7%) were inactive. Average sleep duration for all participants in this study was 7.0 ± 1.4 hours with 45.6% of the participants having sleep duration less than 7 hours and 9.3% having 5 hours or less of sleep. [Table 2] The Mean BMI of all participants was calculated. [Table 3]

Table 1: Characteristics of participants n = 375

| Characteristics | BMI (kg/m ²) ranges (f/%) | | | | Total |
|-----------------|---------------------------------------|-----------|----------|---------|-----------|
| | <18.5 | 18.5-24.9 | 25-29.9 | =30 | |
| Participants | 25(6.7) | 290(77.3) | 50(13.3) | 10(2.7) | 375(100) |
| Female | 9(2.4) | 86(22.9) | 20(5.4) | 3(0.8) | 118(31.5) |
| Male | 16(4.3) | 204(54.3) | 30(8.0) | 7(1.9) | 257(68.5) |
| Short sleep | 2(0.5) | 27(7.2) | 6(1.6) | 0(0.0) | 35(9.3) |
| Normal Sleep | 20(5.4) | 238(63.5) | 41(10.9) | 9(2.4) | 308(82.2) |
| Long sleep | 3(0.8) | 25(6.6) | 3(0.8) | 1(0.3) | 32(8.5) |
| PA(inactive) | 4(1.1) | 67(17.8) | 16(4.3) | 2(0.5) | 89(23.7) |

Table 2: BMI ranges, sex, sleep duration and physical activity n = 375

| Sex | Sleep (hours) | BMI (kg/m ²) ranges | | | | FET/ ² |
|--------|---------------|---------------------------------|-----------|---------|--------|-------------------|
| | | <18.5 | 18.5-24.9 | 25-29.9 | =30 | |
| Female | <5 | 0(0.0) | 12(3.2) | 4(1.1) | 0(0.0) | 0.451 |
| | 5 to <9 | 6(1.6) | 60(16.0) | 15(4.0) | 3(0.8) | |
| | =9 | 3(0.8) | 14(3.7) | 1(0.3) | 0(0.0) | |
| Male | <5 | 2(0.5) | 15(4.0) | 2(0.5) | 0(0.0) | 0.711 |
| | 5 to <9 | 14(3.7) | 178(47.6) | 26(6.9) | 6(1.6) | |
| | =9 | 0(0.0) | 11(2.9) | 2(0.5) | 1(0.3) | |
| PA | Active | 21(5.5) | 223(59.5) | 34(9.2) | 8(2.1) | 0.418 |
| | Inactive | 4(1.1) | 67(17.8) | 16(4.3) | 2(0.5) | |

Table 3: Means, standard deviations and BMI ranges of the participants.

| BMI (kg/m ²) ranges | Frequency (%) | Mean ±SD |
|---------------------------------|---------------|----------|
| <18.5 | 25(6.7) | 17.6±0.7 |
| 18.5-24.9 | 290(77.3) | 21.2±1.7 |
| 25.0-29.9 | 50(13.3) | 26.9±1.4 |
| =30.0 | 10(2.7) | 31.8±1.6 |
| Total | 375(100) | 22.0±3.2 |

DISCUSSION

The overall prevalence of overweight was 13.3%, and obesity was found to be 2.7%. This finding is similar, but slightly higher than what was found in a study done in Edo State, southern Nigeria, where 11.1% and 1.7% overweight and obesity respectively were reported. Both studies have similar study populations and study designs. [10] Also, students from Kumasi, Ghana had similar but slightly lower values. [11] Upon comparison of the female participants to the males, 16.9% and 2.5% of females were overweight and obese respectively as against the 11.7% and 2.7% found among males. This is also comparable to findings of another study in Kaduna, north western Nigeria. [12] There is also similarity to findings of research from Cameroon, another West African

country. [13] The prevalence of overweight and obesity from this study is much lower than the 29.2% and 19.3% respectively from another study in Kaduna State north western Nigeria; [14] and 47.0% and 12.5% overweight and obesity respectively from Sokoto, Nigeria. [15] The differences in the study population as well as selection methods may account for the difference in prevalence. Also, this study population may have much younger and more active age participants.

The physical activity profile shows about a quarter of our respondents, across all the BMI ranges, do not meet the recommended level for a healthy life. A much higher prevalence of 41% was found in another study among Nigerian youths, where it also demonstrated female students and those with higher BMI were more likely to be physically inactive. [17] There is an alarming increase in sedentary status of Nigerian adults as shown by a systematic review of studies which showed the pooled crude prevalence of 52%. [18] On the other hand, the findings of this study is quite similar to the findings of a Norwegian study of university students that showed 23.3% male and 17.9%

female students respectively did meet the minimum recommended exercise frequency, duration and intensity.[17] What this study reveals is notable because of the public health implications of lack of physical activity .Regular physical activity is a key protective factor for the prevention and management of NCDs – indeed, those who meet recommended levels of physical activity have a 20–30% reduced risk of premature death.^[18] The overall prevalence of physical inactivity latest global estimates show that 1.4 billion adults (27.5% of the world's adult population) do not meet the recommended level of physical activity to improve and protect their health. [19]Wide differences in levels of physical activity exist between regions, countries, age groups and sexes. In adults in 2016, levels of inactivity in high-income countries (36.8%) were double those in low-income countries (16.2%). [20]In most countries women are less active than men, across all WHO regions, both women and men become less active as they get older, and young people are far less active than might be expected, more girls are inactive than boys in most countries (85% and 77.6% respectively). [20] If this alarming trend continues, the global target of a 15% relative reduction between 2018 and 2030 will not be met for adults. There is therefore an urgent need to scale and redouble efforts so that the full contribution of physical activity to health, well-being and the economy is realized.[19]

About 17% and 12.5 % of respondents who reported short and long sleep duration respectively had BMI more than or equal to 25(overweight/obese). Similar positive relationships were found by other researchers with mean sleep duration becoming lesser with increasing BMI.^[23,24] Generally the literature shows that health and well-being, together with optimal cognitive performance and quality of life are underscored by sleep.^[21] Insufficient sleep is a public health problem that affects productivity which in turn has high economic impact on economy. [22]It has been demonstrated unequivocally that duration, timing, and quality of

sleep critically affect physical and mental health. [23]Short and long sleep duration are positively associated with chronic diseases like obesity, type 2 diabetes, hypertension, and cardiovascular diseases among adults.[24,25]Other authors have provided evidence that show voluntary changes to usual sleep duration influence BMI independently of other factors.[26]

CONCLUSION

Overweight and obesity were higher among women, but no statistically significant associations between body mass index and physical activity or with sleep duration of the participants. The findings of this study underscore the need for early and proactive interventions to prevent overweight, obesity and their attendant complications.

Conflict of interest

The authors declare there is no conflict of interest.

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