

**Title:** Perceived stress and its relationship with the body composition of undergraduate students of a medical college in Nigeria.

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## **Abstract**

**Background:** Stress among medical undergraduates has been reported to be on the increase with subsequent tendency towards obesity. However, the association between perceived stress and body composition has yet to be determined.

**Objective:** This cross-sectional study was undertaken to determine the relationship between perceived stress and body composition among undergraduates of the College of Medicine, University of Lagos, Nigeria.

**Methods:** Three hundred and twenty-nine apparently healthy undergraduates (165 males and 164 females) with ages between 17 to 35 years participated in the study. Physical characteristics such as weight, height, body mass index (BMI), and body composition indices were measured using standard procedures. Questionnaires were administered to assess the levels of perceived stress of the participants. The data were analyzed using mean, standard deviation and Spearman's Correlation Coefficient analysis.

**Results:** The mean stress level was low ( $27.33 \pm 10.60$ ). There were significant relationships between the body composition indices and perceived stress with visceral fat having the strongest relationship ( $p = 0.004$ ) while BMI had the least correlation ( $p = 0.037$ ). There were also significant relationships between age, gender and body composition indices. The percentage muscle mass, visceral fat, and body fat had significant relationships with the gender of the participants.

**Conclusion:** Visceral fat, BMI, and percentage muscle mass increased with an increase in perceived stress level, and females had a lower level of perceived stress than males.

**Key Words:** Body composition; Perceived stress; Medical students

## Introduction

A disturbing trend in college students' health is the reported increase in student stress (Sax, 1997), which has been found to be largely related to academic pressure (Tineke, 2011). The potential for an experience to elicit a physiological stress response and the strength of the response is dependent on a number of factors, which include the individual's subjective perception of the stressor (McEwen and Gianaros, 2010, Kern and Friedman, 2011). Thus, when stress is perceived negatively or becomes excessive, it results in physical and psychological impairment (Haugland, 2003).

Stress is referred to as the body's reaction to a change that requires physical, mental or emotional adjustment or response (Morrow, 2011). Part of this response may involve metabolic changes that could increase abdominal adiposity (Dallman, and la Fleur, 2004). This is important, especially since epidemiological studies have found that central fat distribution is related to adverse psychological states, such as depression and anxiety (Juster et al, 2010). Therefore, learning to deal with and reduce stress is extremely important (National Institutes of Health, 2001).

Excess abdominal adiposity is associated with a range of cardiovascular and metabolic diseases such as Type 2 diabetes and hypertension, as well as morbidity due to cardiovascular disease (Wilson et al, 2002, Hirani et al, 2007). Increase in chronic daily stress, regardless of origin, in combination with increased availability of foods high in calories (Dallman, 2010) create an environment conducive for the development of obesity and other metabolic disturbances (McEwen, 1998). The hypothesis that stress might facilitate the development of obesity during adolescence is supported (Huybrechts et al, 2014). Studies have suggested that obesity, or being

overweight or underweight in humans and most animals, does not depend on body weight but on the amount of body fat (Kershaw and Flier, 2004).

Percentage body fat refers to the amount of fat mass in regard to the total body weight of an individual, expressed as a percentage (%) and depends on the fat distribution. It can be referred to as visceral fat or subcutaneous fat. Visceral fat is categorized as normal (1-9), high (10-14) or very high (15-30) (Gallagher et al, 2000). Several mechanisms are hypothesized to influence the deposition of visceral adipose tissue, and one of the more interesting theories posited involves the interaction of psychological stress and stress hormones on the neuroendocrine system, resulting in metabolic changes in the body (Bjorntorp, 1996).

It is also possible to adjust or habituate to repeated stress, and the ability to do so is determined by the way an individual perceives a situation. Habituation to repeated stress is effected through an allostatic response that initiates a complex adaptive pathway, resulting in long-lasting physiological changes. Failure to reduce the stressor or adjust to the demands of the allostatic response may lead to negative metabolic and psychological health consequences due to wear and tear on the body as a consequence of frequent or prolonged activation of these pathways (McEwen, 2010b), which is known as allostatic load (Juster et al, 2010; Macaffey et al, 2012).

Studies have also shown that females are able to cope better with stress through an adaptive social response regulated by the hormone oxytocin (Taylor, 2000), which in turn is controlled by the hormone estrogen. Prior studies have established a high level of stress in undergraduates in medical school (Hamza et al. 2011). The relative paucity of information about the relationship between body composition and perceived stress during the years of medical undergraduate training in Nigeria warranted this study. The study was therefore designed to determine the pattern of body composition and its relationship with perceived stress among the undergraduate

students of the College of Medicine, University of Lagos (CMUL), Nigeria and thus provide useful information on the relationship between body composition indices and perceived stress among medical undergraduates.

## **Methods**

This study involved 329 male and female students between the ages of 17 to 35 years, recruited from the population of healthy undergraduate students of the CMUL, Nigeria. The study included 200 level (second year) to 600 level (sixth year) registered undergraduate students of CMUL with no physical disabilities and no obvious or reported disease condition. Students on medication that are known to cause weight gain or on a weight reduction diet were excluded from the study. Participants were recruited using a convenience sampling method.

Prior to commencement of the study, ethical approval was sought and obtained from the Health Research and Ethics Committee of Lagos University Teaching Hospital, Idi-Araba, Lagos. Participants were informed about the procedure, purpose and significance of the study, and informed consent was obtained before participation in the study.

## ***Instrumentation***

The materials used for this study included a height metre (Schultz, Germany) to measure height, body composition monitor (OMRON BF511, Japan) to measure the body composition, and Stress Questionnaire for Students (Ministry of Social Security, National Solidarity and Reform Institutions, Mauritius, 2012) to assess the level of perceived stress. The questionnaire consisted of two main domains. Section A gives the socio-demographic data of the students, which includes their course of study, level of study, family background and sponsorship. Section B consists of a 20-item questionnaire that reflects how students feel in the course of their study with five response options: 0-Never, 1-Rarely, 2-Sometimes, 3-Often, 4-Very often. The

maximum score, which is a summation of the scores of the responses, is 80, and this depicts the highest level of perceived stress. The scores were rated as follows: 0-20: good control over stressors; 21-40: low level of stress; 41-60: medium level of stress; and 61-80: high level of stress. The questions included concerns about getting good grades, understanding what is taught, having enough time for leisure, feeling tired and sleeping more than normal, to feeling depressed and out of touch with social activities.

The aim and objectives of the study were carefully explained to each participant, including details of the research procedure. Participants were given adequate information on how the procedure would be carried out. Questionnaires were distributed by hand to the participants and self-administered, after which the measurements were carried out. The body composition measurements included weight, height, body mass index (BMI), percentage body fat, percentage visceral fat and percentage muscle mass.

### ***Data analysis***

Statistical Package for Social Sciences (SPSS) version 17.0 for Windows was used for data entry and analysis. Descriptive statistics of mean, percentage, tables and charts were used to summarize and illustrate the data collected. Spearman's Correlation Coefficient was used to determine the relationship between body adiposity components and perceived stress. The designated level of statistical significance was  $p < 0.05$ .

### **Results**

A total of 360 copies of the Student Stress Questionnaire were distributed to the participants. Three hundred and twenty nine copies of the questionnaires were returned, giving a response rate of 91.4%. Table 1 shows the mean values of the age, weight, height, BMI, percentage body fat, muscle mass, visceral fat, and stress levels of the participants in this study. They included 165

(50.2%) males and 164 (49.8%) females. There were significant differences in the age, weight, percentage body fat, percentage muscle mass, visceral fat and stress levels between the male and female participants of the study. The majority of the females had a normal range of muscle mass while the males predominantly had high muscle mass (Table 1).

**Table 1: Physical Characteristics and Body Composition Values of the Participants**

	Male	Female	<i>t</i> - value	<i>p</i> -value
	Mean $\pm$ SD	Mean $\pm$ SD		
Age (years)	21.34 $\pm$ 2.53	20.05 $\pm$ 1.89	0.686	>0.01*
Height (m)	1.74 $\pm$ 0.07	1.64 $\pm$ 0.07	7.603	0.593
Weight (kg)	68.39 $\pm$ 12.02	58.98 $\pm$ 9.95	-0.667	<0.01*
BMI (kg/m <sup>2</sup> )	22.59 $\pm$ 3.27	22.19 $\pm$ 3.50	- 18.795	0.505
Body fat (%)	16.78 $\pm$ 6.51	31.21 $\pm$ 7.37	37.163	<0.01*
Muscle mass (%)	41.96 $\pm$ 3.93	28.13 $\pm$ 2.69	-3.681	<0.01*
Visceral fat	4.40 $\pm$ 2.98	3.38 $\pm$ 1.38	5.126	<0.01*
Stress level	29.83 $\pm$ 11.49	25.09 $\pm$ 9.51	4.682	<0.01*

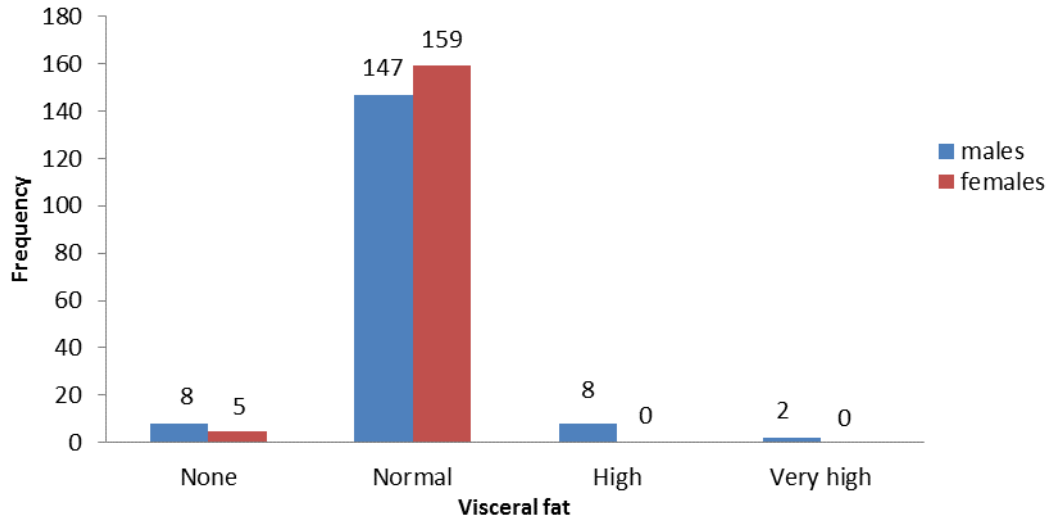
**Keys:** BMI = Body Mass Index; 0 – 20 = No stress; 21 – 40 = Low stress level; 41 – 60 = Medium stress level; 61 – 80 = High stress level

There was no significant difference in the height and BMI between the male and female participants (Table 1). Figures 1, 2 and 3 illustrate the patterns of body composition for both male and female participants.

The pattern of visceral fat levels was similar in both males and females with both genders predominantly having a normal range of visceral fat (Figure 1). Females had a higher percentage of body fat than the males (Figure 2) while the males were observed to have higher levels of stress than their female counterparts (Figure 3). There were significant correlations between body composition indices and perceived stress.

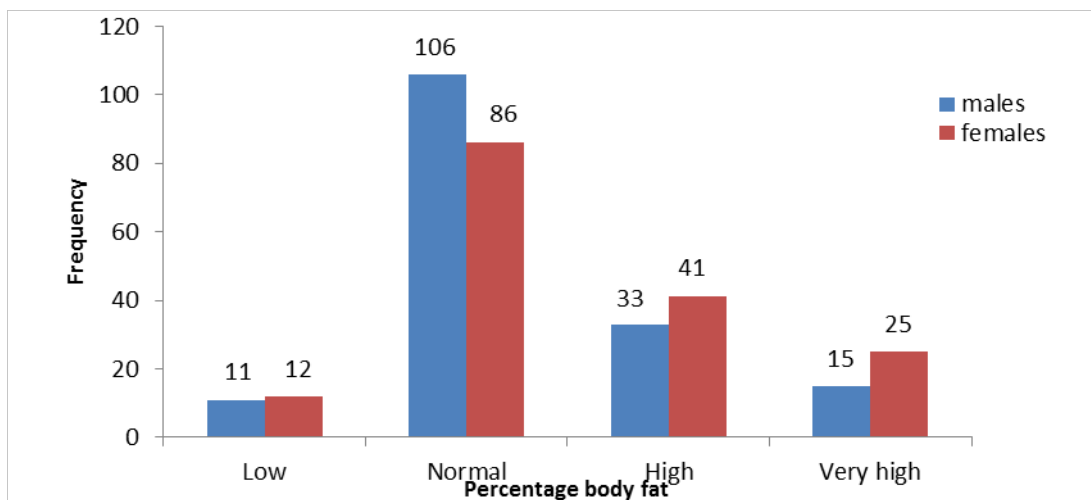
**Figure 1: Visceral fat level of participants**

**Figure Legends:** Low: 0; Normal: 1-9; High: 10-14; Very high: 15-30.



**Figure 2: Percentage body fat of participant**

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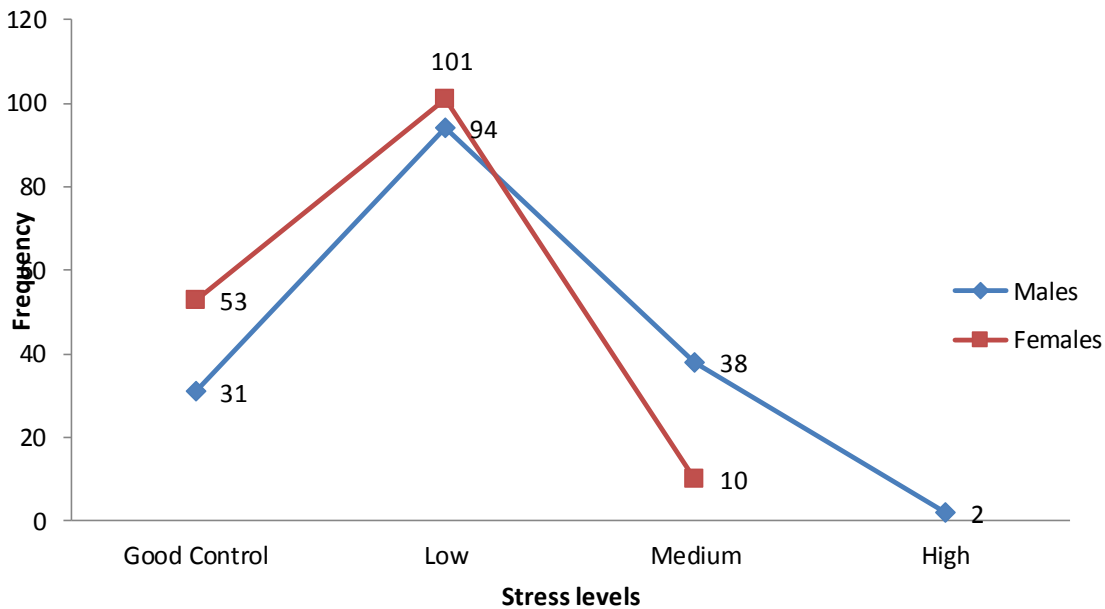


Visceral fat had the strongest relationship with perceived stress ( $r = 0.157, p = 0.004$ ) while BMI had the least correlation with perceived stress ( $r = 0.115, p = 0.037$ ) (Table 2). Table 3 shows the relationship between body composition indices, age, and gender among the participants. BMI



had no significant relationship with age and gender while the percentage muscle mass, visceral fat and percentage body fat had significant relationships with the gender of the participants.

**Figure 3: Perceived stress levels in both genders**



**Table 2: Relationship between participants’ body composition indices and perceived stress levels**

Variables	r-value	p-value
Body Mass Index	0.115	0.037*
Percentage body fat	-0.120	0.030*
Percentage muscle mass	0.139	0.012*
Visceral fat	0.157	0.004*

**Table 3: Relationship between body composition indices, age and gender of the participants**

Variables	Age		Gender	
	r-value	p-value	r-value	p-value
Body Mass Index	0.089	0.108	-	
Percentage body fat	-0.166**	0.003	0.745**	<0.001
Percentage muscle mass	0.186	0.001	-0.850**	<0.001
Visceral fat	0.250	0.000	-0.161**	0.003

Key: \*\* Correlation is significant at the 0.01 level (2-tailed); \* at the 0.05 level (2-tailed).

## Discussion

This study is pertinent because it has been suggested that a stress reaction occurs as a result of the interaction between stressors and the way an individual perceives and reacts to those stressors rather than being caused by the stressors alone (Adam and Epel, 2007).

Our findings show that the majority of the students, especially the females, had a low perception of stress in spite of the rigours of the medical undergraduate training. This is in contrast to some previous studies that showed a high level of stress in medical undergraduates, especially in females (Saipanish, 2003; Hamza et al, 2011). Findings from this may be due to an allostatic response on the part of the students whereby the majority of them have been able to habituate to the stressors (McEwen, 1998). However, considering the long-term negative effect of habituation on physical and mental health, it may not augur well for the health of the students, especially as most of the students with high visceral fat had a low perception of stress. This is important as a prior study reported that stress in medical school is likely to predict later mental health problems (Tyseen et al, 2001), and prior epidemiological studies have found that central fat distribution is related to adverse psychological states, such as depression and anxiety (Bjomtorp, 1993).

It was also observed that most of the students who reported moderate to high levels of perceived stress and had high visceral fat were males; thus, males have a greater tendency to visceral adiposity and higher levels of stress than females. Studies have shown a role for estrogen and oxytocin in the allostatic response to stress (Taylor, 2000; Tamre et al, 2002). The coping strategies mediated by these hormones would make it easier for the female students to habituate and no longer perceive the stressors as threatening. In addition, the fact that most of the students had a low perception of stress compared with prior studies in other climes may be due to environmental and social factors that are peculiar to Africa. A recent study reported that

allostatic load, which is a measure of cardio-metabolic risk, is associated with growing up in neighborhoods in which poverty levels increase (Gene et al, 2014). A possibility is that many of the students had been exposed to various stressors in the course of growing up as a result of the environment, especially since it was reported by Theal and colleagues (2012) that neighborhoods are important in the development of a child's stress process. It would, however, be necessary to further find an association between the socio-economic background and perceived stress in the students. Females, on the other hand, had significantly higher total body fat than their male counterparts. This could be due to the fact that female sex hormones cause fat to be stored in the buttocks, thighs, and hips while males are likely to have fat stored in the belly, due to sex hormone differences (Kershaw et al, 2004).

A prior cross-sectional study of men found that although self-reported stress scores did not correlate with BMI, they were directly related to body composition (Yamamoto et al, 2007), as has also been observed in both genders in this study . This was not unexpected as a previous study had concluded that lean women with high Waist-to-Hip Ratio (WHR) may be at higher risk for greater cortisol exposure and the attendant metabolic risks (Kissebah and Krakower, 1994).

This study demonstrated that the pattern of reaction to perceived stress among the respondents is at variance with what is reported by other studies, which may be explained by environmental differences since it appears the students were able to habituate to the stressors and thus had good coping abilities. It is imperative that preventive measures be undertaken to minimize stress among students in the medical school. . Identification of factors contributing to stress and effective counselling will have a greater impact on the mental and physical health of the students (Anil and Suresh 2011). School programs targeting stress management or coping skills are

important in reducing stress symptoms and enhancing coping skills (Kraag et al, 2006). Also, healthcare practitioners, particularly physiotherapists, should focus on designing programs with the goals of maintaining proper body composition and managing stress. Emphasis should be placed on regular exercise and reduction in sedentary lifestyle as there is growing evidence that an appropriate level of physical activity will not only provide immediate improvements in health status and quality of life but will also delay the onset of chronic diseases in adulthood, as well as establishing adherence to a healthy lifestyle that will last throughout life (Boreham & Riddoch, 2001).

The findings from this study have shown that BMI, visceral fat and percentage muscle mass increased with an increase in perceived stress levels while there was a decrease of percentage body fat. In addition, female students had a lower perceived stress level than males.

Some limitations to the study include the time of food intake, which could have affected the readings especially if a participant had eaten a heavy meal prior to the measurements. Also, the time of the day influenced some participants' willingness to participate in the study, and some participants were not available for measurements after completing the questionnaires and were therefore excluded.

It is suggested that further studies be done on the assessment of the actual stress response using cardiovascular parameters and the WHR and compare that with the perceived stress. This may reflect better the allostatic response by the respondents.

**Conflict of Interest:** The authors declare no conflict of interest.

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