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Original Research Article

Association of body mass index and psychological stress in medical students: a cross-sectional study

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ABSTRACT

Background: Stressful life circumstances have many known negative implications on personal health. Medical students are especially exposed to very stressful life which may impact their health and behaviour. So, This study aimed to analyze the association between psychological stress and BMI in medical students in Sikkim.
Methods: This cross-sectional study measured BMI and stress in 132 MBBS students from Sikkim, India between the age group of 18-26 years. The relation between them was analyzed using the student t-test and Pearson's correlation. P value<0.05 was taken as significant.
Results: Higher grades of BMI were associated with higher values of total stress, but the P value (0.85) was not significant. BMI and weight were also higher in groups with greater severity of stress (mild, moderate and severe), but the associations were not significant (p=0.035).
Conclusions: This study shows no significant association between stress and BMI in medical students. However, higher BMI values were seen with increased total stress and the degree of stress. Further studies with larger sample sizes and diverse regions may provide a conclusive association between stress and BMI. Universities must adopt measures to minimize stress and stress-associated changes in BMI in medical students. Psychological and stress-related counselling should be given to at-risk students to prevent eating disorders.

Keywords: BMI, Psychological, Stress

INTRODUCTION

Stress has always been considered a significant contributing factor to obesity, as stressful conditions lead to poor dietary habits, smoking, addiction and lack of exercise, each acting as an independent factor leading to obesity.[1] Medical education has always been stressful and a high level of stress not only results in a negative effect on the cognitive functioning and performance of students in a medical school but is also associated with physical problems, which in turn may lead to more psychological and emotional disturbances among these vulnerable population leading to a vicious cycle. These physical problems in the form of faulty eating habits leading to overweight and obesity are a significant concern among the youth today. The medical curriculum itself is demanding and with the fast-paced and unhealthy lifestyle practices among medical students, there is an ever-increasing possibility of these students suffering from psychological distress as well as physical problems of obesity. Nowadays, Obesity is a serious health problem throughout the world among adults, children, teenagers and adolescents.[2] It is known to be associated with life-threatening and debilitating disorders like cardiovascular, metabolic and many other non-communicable diseases.[3] The World Health Organization (WHO) defines stress as "the reaction people may have when presented with the demands and pressures that do not match their knowledge and abilities and which challenge their ability to cope".[4] There are many known negative impacts of stressful life

circumstances on personal health. Stress can not only lead to elevated blood pressure, headaches, sleep disorders, chest pains, anxiety and several other problems; it can severely affect the quality of life and decrease an individual's likelihood of developing and practicing healthy habits. WHO, in 1994, at its Geneva Convention on "The Health of Young People: A Challenge and a Promise," stated that the young student population has always been vulnerable to different stress domains because of a highly competitive environment, especially in pursuing higher professional education.[5] Globally, studies have shown that reported levels of stress among medical students range anywhere from 25% to 75%. According to a systematic review, the stress prevalence in medical students in India varies from 5.0% to 96.8%. The pooled prevalence rate of the sample (n=5354) was 51.3% (95% confidence interval: 42.8%–59.8%) based on the random effects model.[6] Medical students tend to have more significant psychological distress than the general population. A considerable degree of psychological morbidity has been reported among medical students, ranging from stress, interpersonal problems and suicidal ideation to psychiatric disorders.[7] Medical students not only cope with the normal stressors of everyday life but also deal with the stressors specific to the curriculum.[8] Stress may cause changes in dietary behaviour, hormonal changes and BMI. These factors may cause some people to gain more weight, while others may gain less or even lose weight when stressed.

Psychological stress increases the risk of future weight gain among adults aged with a higher baseline body mass index (BMI) but not for adults with a lower baseline BMI.[9] In Asian subjects, the risk associated with cardiovascular diseases and diabetes occurs at lower levels of BMI when compared with the white population. Thus, this study would be useful in finding the knowledge gap about whether psychological stress affects BMI.

Further, such a study has not been undertaken before among medical students in Sikkim. Most importantly, this study would highlight the need for early diagnosis of stress and its management among medical students, as well as adopting healthy lifestyle measures to prevent the conditions leading to obesity.

Fahad et al in their community-based cross-sectional study, found a highly significant correlation between stress and body weight (p=0.004). They also observed a highly significant correlation between body weight and the number of meals per day (p=0.000), stress level (p=0.00) and dealing with stress(p=0.017). They deduced that the prevalence of obesity and overweight status in the college student populace has become a rapidly increasing occurrence.[10] Verma et al conducted a retrospective observational study to illustrate a relationship between stress and the development of overweight/obesity. They found a positive correlation between PSI and BMI, indicating a significant effect of stress on eating behaviors.[11] A longitudinal cohort study conducted by Kivimaki et al in populations outside the United States has produced mixed results.[12]

METHODS

Study design and setting

This cross-sectional study was carried out between February 2020 and February 2021. One hundred and thirty-three MBBS students at Sikkim Manipal Institute of Medical Sciences, Gangtok were taken as the study population. Total of 132 students based on random selection, between 18 and 26 years of age with no history or evidence of any chronic disease or addiction, were included in the study. The university's Ethical Committee approved the project and all the participants signed a written consent form before joining the project.

Outcome measures

Anthropometric measurements

Standardized protocols were used to measure body weight and height and BMI was calculated by dividing weight in kilograms by height in square meters per WHO guidelines. The Participants were then classified into four categories based on their BMI, using the WHO alternative BMI classification for the Asian population. Underweight= BMI (<18.5), normal=BMI (18.5-22.9), At Risk=BMI (23-24.9), Obese I=BMI (25 to 29.9) and obese II=BMI (≥30).

Medical student's stressor questionnaire

The MSSQ measures the six domains of stress: Academic related stressors (ARS; I), Intrapersonal and interpersonal-related stressors (IRS; II), Teaching and learning-related stressors (TLRS; III), Social related stressors (SRS; IV),

Drive and desire related stressors (DRS; V), Group activities related stressors (GARS; VI).[13] MSSQ is a valid and reliable instrument with good psychometric properties that can be used to identify students' stressors and measure their intensity. Reliability analysis shows that the MSSQ has high internal consistency, as Cronbach's alpha coefficient value was 0.95, more than the acceptable cut-off point 0.6.[14]

Statistical analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) 20.0 software (IBM Corp., Armonk, NY). Continuous data were expressed in terms of mean and standard deviation. Means were compared using Student's t-test.

The descriptive statistics are displayed using percentages and proportions. Pearson's correlation test determined the correlation between stress and BMI. The level of significance is set at $p<0.05$.

RESULTS

There were 132 subjects included in this study. The majority (46.27%) of study participants were in the age group of 21-23 years, followed by 36.57% in 19-20 years and 17.16% in the 24-26% years age group. The mean age of the participants was 21.14 years. The majority (62.69%) of the participants were female undergraduate medical students and only (37.31%) of the participants were males. Students of Sikkimese ethnicity were 46.27%, while 53.73% were non-Sikkimese. According to the modified BG Prasad classification 2019, the maximum number of participants, 50.75%, belonged to the upper class, followed by the Lower class (23.88%), 15.67% in the lower middle class and 9.70% in the upper-middle class category. The majority, 61.19% of study participants, resided in hostels, 25.37% attended college from their own homes and 11.94% stayed in rented accommodation (Table 1).

The comparison of total stress among different grades of BMI showed that in the maximum number of subjects, 80 (60.15%) had normal weight, 20 (15.03%) were underweight, 25 (18.79%) were overweight and 8 (6.01%) were obese. The value of total stress in medical students was higher in higher grades of BMI, but the association was not statistically significant as the p value was <0.05 (Table 2).

A comparison of anthropometric parameters and BMI with degrees of stress demonstrated a rise in the mean stress score with an increase in the stress, being minimum in normal weight and maximum in obese. All the 133 subjects were divided into four groups: Underweight (BMI<18.5 kg/m^2), Normal weight (BMI=18.5-22.9 kg/m^2), Overweight (BMI=23-24.9 kg/m^2) and Obese (BMI ≥25 kg/m^2). Age and height were not significantly different among various degrees of stress as the p value is >0.05, but the values of BMI and weight were higher in groups with greater severity of stress (Table 3).

No significant correlation (neither positive nor negative) was found between different anthropometric, BMI and domains of stress parameters. Different domains of stress parameters analyzed were ARS=academic-related stressors, IRS=intrapersonal and interpersonal-related stressors, TLRS=teaching and learning-related stressors, SRS=social-related stressors, DRS=drive and desire-related stressors and GARS=group activity-related stressors (Table 4).

Table 1: Distribution of study participants according to their sociodemographic profile.

Parameters		Frequency	%
Age (in years)	19-20	49	36.57
	21-23	62	46.27
	24-26	23	17.16
	27-29	0	0.00
Gender	Male	50	37.31
	Female	84	62.69
Academic year	1st MBBS	34	25.37
	2nd MBBS	33	24.63
	3rd MBBS	33	24.63
	4th MBBS	34	25.37
Ethnicity	Sikkimese	62	46.27
	Non-Sikkimese	72	53.73
Socio- economic status	Upper class	68	50.75
	Upper middle class	13	9.70
	Middle class	0	0.00
	Lower middle class	21	15.67
	Lower class	32	23.88
Place of residence	Hostel	82	61.19
	Home	34	25.37
	Paying guest	2	1.49
	Rented	16	11.94

Table 2: Comparison of total stress among different grades of BMI.

Parameters	Under weight (n=20)	Normal weight (n=80)	Overweight (n=25)	Obese (n=8)	Total (n=133)	P value
		(Mean±SD)				
Total stress	1.51±0.69	1.51±0.82	1.60±0.68	1.67±0.71	1.56±0.75	0.85

All values are in mean and SD. SD: Standard Deviation.

Table 3: Comparison of anthropometric parameters and BMI with degrees of stress.

Parameters	Mild stress (n= 20)	Moderate stress (n=80)	High Stress (n=25)	Severe Stress (n=8)	P value	Total stress (n=133)
	Mean±SD	Mean±SD	Mean±SD	Mean±SD		Mean±SD
Age (years)	21.85±1.30	21.53±1.50	21.5±1.58	21.75±2.05	0.85	21.59±1.51
Weight (kg)	57.12±6.98	59.5±9.68	61.24±10.08	62.12±10.09	0.61	61.26±9.88
Height (m)	1.65±0.91	1.62±0.84	1.62±0.79	1.61±0.73	0.45	1.63±0.84
BMI (kg/m^2)	21.9±3.45	22.09±3.24	23.30±3.55	23.67±4.72	0.35	23.24±4.29

Table 4: Pearson's correlation coefficient between different anthropometric, BMI and domains of stress parameters.

Parameters	Age		Height (m)		Weight(kg)		BMI (kg/m^2)	
	R	P	R	P	R	P	R	P
ARS	0.030	0.732	0.045	0.604	0.113	0.195	0.074	0.398
IRS	-0.22	0.805	-0.086	0.326	-0.076	0.387	-0.019	0.829
TLRS	-0.50	0.570	-0.075	0.392	-0.017	0.843	0.024	0.783
SRS	0.021	0.813	-0.104	0.233	0.029	0.743	0.087	0.319
DRS	0.083	0.345	-0.107	0.219	-0.021	0.809	0.037	0.671
GARS	0.66	0.450	0.066	0.450	-0.008	0.930	-0.008	0.930

DISCUSSION

In this study, the prevalence rate of obese (6%) and overweight (19%) was not very high and 60% of the students were of average body weight. This finding is similar to the study by Goswami et al where 03.6% of students were obese, only 15.9% of students were overweight and most of the students (71.7%) were of normal body weight.[15] Another study reported that 69.6% of participants had normal BMI, were 22.1% overweight and were only 8.2% obese.[16]

This study did not find statistical significance in the correlations between psychological stress and BMI and between psychological stress and body weight. However, all subjects demonstrated an increase in the total stress score with an increase in BMI, being minimum in normal weight and maximum in obese. The values of BMI were also higher, with an increase in stress severity.

This is in line with the studies done by Rizvi et al and Saleem et al. Both studies do not show any significant association of stress with BMI.[17,18] Another study carried out among 973 students from 13 college campuses across the U.S. found no significant differences between stress and categorical body mass index scores.[19]

Two longitudinal studies suggested a positive association between stress and BMI.[20] Two large cross-sectional studies demonstrated a weak positive association.[21,22] At the same time, one study showed no association.[23] Another survey by Shimanoe et al supports a positive association between psychosocial stress and BMI, although the magnitude of the association is very weak.[24] A study by Serafi et al demonstrated stress-associated weight gain in the participants and observed that the more the stress prevalence and stress score increases, the more BMI will increase from normal to overweight and obese.[25]

In this study, no association was found between different domains of stress parameters and other anthropometric variables and BMI. Six domains of stress analyzed were academic-related stressors (ARS), intrapersonal and interpersonal-related stressors (IRS), teaching and learning-related stressors (TLRS), social-related stressors (SRS), drive and desire-related stressors (DRS) and group activity-related stressors (GARS). Similarly, a study by Tantawy et al, showed no significant relationship between BMI and academic stress.[26] In contrast, another study reported that individuals with higher levels of perceived stress had higher BMI values and greater mean BMI changes than those with lower stress levels after a 5 years follow-up.[27]

An individual's response to stress, i.e., coping strategies adopted by the person, ultimately determines the association between psychosocial stress and health-related outcomes.[28,29] Lower coping strategies might be associated with higher BMI; in contrast, positive reappraisal and problem-solving had a positive association with BMI.[30] The effective use of different coping strategies, such as regular exercise and prayers, can reduce stress-induced physical and mental problems.[31] The prevalence of stress in this study was 84.96%, with most students (60.15%) suffering from moderate stress. All the students suffered from some stress, scoring at least a point in different stress domains. This finding of the high prevalence of stress coincides with various other Indian studies on stress among medical students. The prevalence of stress in other countries is Turkey (27%), the UK (45%), Nepal (20.9%), Bangladesh (54%) and Malaysia (41%).[32]

This may be due to differences in personal traits, cultural backgrounds and coping skills.[33,34] The association between stress and BMI is possibly due to stress-induced hormonal imbalance, which might increase body weight and BMI.[35]

Cortisol, a major stress hormone, leads to obesity due to the accumulation of triglycerides in adipocytes.[36] Cortisol also influences our bodies' immune system, metabolic functions and nervous system. Acute stress responses in young people may be adaptive and may not impose a health burden, but chronic stressors can lead to emotional distress, weakened immunity and metabolic dysfunction.

So, authors can conclude that medical education is stressful and could be one of the essential causes of overweight and obesity in medical students. The strength of this study is that MSSQ, a validated tool, was used to assess the stress level of medical students, which can identify the specific source of stress.

The study population in this research consisted of medical students of Sikkim, so the findings cannot be generalized to the populations of other countries. Biochemical investigations demonstrating stress-induced hormone release were not included in the present study.

CONCLUSION

In the current study, we noticed an increase in BMI with an increase in stress prevalence and stress score, though not significant. Student counselling, time management programs and appropriate recreational opportunities should be provided to the students, especially for stress-prone students and those with low coping capabilities.

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