ORIGINAL ARTICLE e-ISSN: 2349-0659 p-ISSN; 2350-0964

Body Mass Index as an Indicator of Depression and Stress-induced Eating Disorders among College Students in Delhi, India

Jain Rita[1]*, Das Deboshree[2], John M. Salome[3]

Abstract

Obesity accounts for a wide range of psychosocial, medical, and health consequences in adolescence leading to depression and low self-esteem which further aggravate eating disorders among individuals. The aim of the study is to observe the association of eating disorders and depression among college students with their body mass index (BMI) status. The study consisted of 460 students studying in different colleges of Delhi from varying disciplines and academic years. The study utilized Patient Health Questionnaire-9 and Eating Disorder Examination questionnaire to assess the depression levels of participants and their level of eating disorder. The study also collected data on the height and weight of the study participants. The association of weight status with eating disorder and depression severity was assessed using multivariate analysis of variance. Significant difference in levels of eating disorder and depression was observed (Wilks' lambda: 0.897) among study participants by BMI status. The *post hoc* tests exhibited mean differences for eating disorders and depression by BMI groups to be higher for overweight compared to underweight (1.196) and normal (0.817) categories at $P < 0.001$. Mean depression score was also observed to be significantly higher for overweight individuals compared to underweight (3.42) and normal (2.53). The study emphasizes the need for strategic plans to increase awareness among the youth on the health implications of eating disorders and its effect on mental health of individuals. The present study suggests perceived body image as a potential risk factor for unhealthy eating habits and signs of depression among college students.

Keywords: Adolescence, Body mass index, Depression, Eating disorder, Obesity

Asian Pac. J. Health Sci., (2022); DOI: 10.21276/apjhs.2022.9.3.37

Introduction

Numerous national and international studies have shown obesity and depression among youth as a major health problem and its alarmingly increased prevalence during the past decade makes it a serious public health concern.[1] Approximately 39% of the world adult population were obese in 2014 indicating that the prevalence has almost doubled since 1975.[2] The prevalence of obesity among adolescents in India is increasing at a faster pace than the world average. It has increased from 2.2% to 5.1% since 1998 to 2015.[3]

Obesity accounts for a wide range of psychosocial, medical, and health consequences in adolescence and is likely to follow through into adulthood. Thus, it is important to investigate the relationship between obesity and depression with eating behavior. Both obesity and depression can be attributed to abnormal functioning of the hypothalamic-pituitary-adrenal axis and serotonin imbalances. In particular, various studies show that overweight adolescents are at a higher risk of experiencing peer victimization and weight-based stigma, which can result in eating disorders and depression. These stressful events may be contributing factors that lead to depression in obese youth. Likewise, lack of physical activity, weight concerns, body dissatisfaction linked psychological distress such as depression and low self-esteem further aggravate eating disorders among individuals trapping them into an unhealthy cycle of obesity and depression which can severely hamper their development.[4,5]

College is a time of tremendous change in an adolescent's life opening them up to stress at various levels. Many biological and psychological changes during the adolescence period may lead to depression indirectly. During college, students move toward independence and they sometimes struggle to find a balance between physical and mental health. Multiple lifestyle choices, peer pressure for body image, competition, and poor coping skills are some of the factors that put them at an increased risk for depression.

Chronic stress is hypothesized to be involved in the etiology of obesity (stress is assumed to be a breeding ground for obesity). A meta-analysis including eight longitudinal studies concluded that there exists a bi-directional relationship between depression and obesity.[6] All these factors indicate a need for research on obesity and eating disorders among college students as college experiences have the potential to influence diet, physical activity, and lifestyle behavior well into adulthood.[7]

[1]Department of Statistics, Ram Lal Anand College, University of Delhi, India.

[2]Research Scholar, International Institute of Population Sciences, Mumbai, Maharashtra, India.

[3]Department of Microbiology, Ram Lal Anand College, University of Delhi, India.

Corresponding Author: Dr Rita Jain, Department of Statistics, Ram Lal Anand College, University of Delhi, Benito Juarez Marg, South Campus, Dhaula Kuan, Delhi - 110 021, India. E-mail: ritajain.stat@rla.du.ac.in/ritajain313@gmail.com. Phone # +91 9891491019

How to cite this article: Rita J, Deboshree D, Salome JM. Body Mass Index as an Indicator of Depression and Stress-induced Eating Disorders among College Students in Delhi, India. Asian Pac. J. Health Sci., 2022;9(3):184-187.

Source of support: Nil.

Conflicts of interest: None.

Received: 11/12/2021 **Revised:** 04/01/2022 **Accepted:** 12/02/2022

Objective

The present paper aims to study the association of eating disorder and depression among college students taking into account the weight status of the students to identify the groups which are most vulnerable.

Methods

The study was conducted in various colleges of Delhi using online questionnaires during the first wave of the COVID-19 pandemic. The study sample consisted of 460 students from different colleges, disciplines, and academic years across Delhi. The study sample comprised 236 (51.3%) boys and 224 (48.7%) girls. Participation was purely voluntary and a formal consent was taken from each of the participants before the start of the survey. All personal markers were removed before analysis of data to ensure confidentiality of the study participants. Questionnaire was approved by the Institutional Research Committee and due consent was taken to conduct the study. The majority (93%) of the sample consisted of individuals in the age group 18–22 years. All the statistical analysis of data was carried out using SPSS (v20). Data are available at https://github.com/ritajain311/BMI-MH

Inclusion Criteria

Undergraduate and postgraduate students who were in the adolescent age-group 18–24 years were included in the study.

Exclusion Criteria

Students who did not meet the inclusion criteria, who were unwilling to participate, and those who submitted incomplete data were excluded from the study.

Measurements

The study utilized two questionnaires to assess the stress and anxiety levels of participants and their level of eating disorder. The height and weight of participants were recorded to arrive at their body mass index (BMI). The following publicly available questionnaires were used for data collection in this study.

Patient Health Questionnaire (PHQ 9) for Adolescent Stress and Anxiety

The PHQ 9 was administered to the study participants to assess their stress and anxiety level. The PHQ 9 questionnaire consists of nine items on a 4 point Likert scale. The questions include components that assess an individual's level of energy, status of appetite, amount of sleep they get, feelings of depression or hopelessness, concentration level, and the pleasure they find in things and about thoughts of hurting oneself over past 2 weeks. A relative score for each stress component scale was calculated by adding scores of the items, belonging to that scale and dividing the sum by the number of scale items. An absolute summary score ranges from 0 to 27 that was obtained by adding up individual scores of all nine items.[8]

Eating Disorder Examination Questionnaire (EDE-Q) for Eating Behavior of the Respondents

EDE-Q is a 28 item self-report measure to assess and diagnose eating disorders. It has four types of subscales – 13 items on restraint, six items on eating concern, three items on shape concern, and seven items on weight concern. The questions have to be answered on the basis of experiences of eating attitudes and behaviors in the past 4 weeks, that, 28 days. Participants mark their response to each item on a 7-point Likert scale.

For three subscale, namely, restrain, eating concern, and shape concern, 7-point Likert scale was divided as follows: No days, 1–5 days, 6–12 days, 13–15 days, 16–22 days, 23–27 days, and every day; whereas for the weight concern subscale, the Likert score was divided as: 0 Not at all, 1–2 Slightly, 3–4 Moderate, and 5–6 Markedly.[9]

Height and Weight for BMI Calculation

An earlier study reported good reliability between college students' self-reported and measured height and weight and that such data can be used for arriving at BMI.[9] BMI was determined through participants' self-reports of height and weight. Participants were categorized based on their BMI into three groups using the WHO cutoffs for BMI. Participants with BMI <18.5 kg/m^2 were categorized as underweight, those between 18.5 and 24.9 kg/m^2 were considered to be in the normal range and those with BMI 25.0 kg/m^2 and higher were categorized as overweight/obese. Here, we combined the groups overweight and obese since very few individuals were present in the overweight category.[10]

Statistical Analysis

The effect of weight status on eating disorder and depression severity was assessed using multivariate analysis of variance (MANOVA), with BMI categorized into underweight, normal, and overweight/obese as the independent variable. MANOVA is used to test for the difference of means in two or more vectors. Testing of multiple dependent variables was accomplished by creating new dependent variables that maximize group differences. These artificial dependent variables were linear combinations of the measured dependent variables.[11] The Wilks' Lambda statistic was used for the measurement of strength of association in MANOVA. The value of Wilks' lambda statistic ranges from 0 to 1, the lower values of Wilks' lambda correspond to larger group dispersion, that is, the groups are well separated and higher the values of Wilks' lambda correspond to poorly separated groups.[12]

Results

Table 1 shows that nearly 14% of the study participants were underweight while about 18% of the participants were overweight or obese. The majority of the students were categorized as having a normal BMI based on self-reported height and weight. The EDE administered to the participants indicated that about 2.4% of the students had some form of eating disorder with a higher percentage observed among girls (3.6% of the female participants) as compared to boys. The PHQ-9 indicated about 60% of the students suffered from varying degrees of depression. About 29% of the participants showed mild symptoms of depression while 17% displayed symptoms of moderate level of depression, about 9% displayed signs of moderately severe depression and over 5% displayed signs of severe depression based on the PHQ-9 questionnaire.

Table 2 shows cases the mean and standard deviation of the scores of the subscales of eating disorder scale as well as the overall measure of eating disorder for the study participants. It indicates

that weight and body shape were the leading concern for eating disorders among the study participants. The table also shows large variation in the depression scores measured by the PHQ-9 questionnaire. The test for correlation displayed a significant positive correlation between eating disorder, depression, and BMI status among college students at 1% level of significance (Table 3).

The MANOVA results for difference in EDE and depression scores by BMI status of the study participants were observed to be significant based on Wilks' lambda test at $P < 0.001$ (Table 4). Significant univariate differences were observed for eating disorder scores by BMI status of the study participants. The mean difference observed for eating disorders showed mean scores for eating disorders to be significantly higher for participants with normal BMI compared to those who were underweight and the mean eating disorder score was observed to be significantly higher for those who were overweight compared to participants with normal or underweight BMI status. The univariate differences observed for depression score by BMI status were also found to be significant. Significant mean difference was observed between depression scores of underweight and overweight study participants and normal and overweight study participants, respectively. All mean differences observed for eating disorder and depression scores by BMI status were significant at $P < 0.05$.

Table 1: Sample distribution of college students by selected background characteristics

Characteristics	*Sample size (n)*	*Percentage (%)*
Age group		
<18	7	1.5
18–22	429	93.3
22 and above	24	5.2
Sex		
Male	236	51.3
Female	224	48.7
BMI		
Underweight	64	13.9
Normal	314	68.3
Overweight/obese	82	17.8
Eating Disorder		
None	449	97.6
Presence of eating disorder (EDE≥4)	11	2.4
Depression		
None	184	40
Mild	131	28.5
Moderate	78	17.0
Moderately severe	42	9.1
Severe	25	5.4
Total	460	100

Table 2: Descriptive statistics related to eating disorder and depression score among college students

Scale	*Mean*	*S.D.*	*Min-Max*
Eating disorder scale (EDE)	1.146	1.137	0.00–5.24
Restraint	0.853	1.207	0.00–6.00
Eating concern	0.717	0.971	0.00–4.60
Shape concern	1.566	1.505	0.00–6.00
Weight concern	1.448	1.441	0.00–6.00
Depression (PHQ)	7.528	6.116	0.00–27.00

Table 3: Pearson's correlation between BMI status, depression, and eating disorder among college students

	BMI	*Eating disorder*	*Depression*
BMI		0.305[b]	0.164[b]
Eating disorder			0.431[b]

[b] indicates $P<0.01$

Discussion

The present study indicates a significant difference in the levels of eating disorder and depression among the study participants by their BMI status. The results show a significant increase in levels of eating disorder and depression level with an increase in BMI and that the distribution of eating disorder and depression is well separated by BMI status of individuals. The probable association between obesity, eating disorder, and depression has been studied repeatedly over time in scientific literature. This is mainly due to the fact that these factors carry a high prevalence and an increased risk of many diseases and mortality.[13] Evidence from both cross-sectional and longitudinal studies support independent relationships of obesity with depression and binge eating. These problems are found to be more prevalent in severely obese individuals with a BMI exceeding 40 kgm^2 (Class III obesity; a BMI of >40 kgm^2).[14] Another meta-analysis on the relationship between obesity and depression among Americans confirmed that obesity increased the risk of depression, most notably for clinically-diagnosed depression. In addition, depression was found to be predictive of developing obesity indicating a two-way association between obesity and depression, leading to an unhealthy cycle of physical and mental health issues among individuals.[15]

Many cross-sectional studies have found that the stressful life of youth combined with bodily and psychological changes leads to depression and obesity.[6] The previous studies have shown a positive association between being overweight and depression and also indicate an increased risk of depression among obese men.[15,16] An earlier study stated that people with obesity had a 55% increased risk of developing depression over time, and that depressed people had a 58% increased risk of obesity.[15] Conversely, some studies in the past have also presented different outcomes with regard to the relationship between obesity and depression. These studies indicated a higher risk of depression among underweight females and males compared to those with normal BMI and a lower risk of depression among those who were obese. This result, however, was not significant.[17] A study

Table 4: MANOVA results for association of eating disorder and depression to weight status among college students.

	Underweight n=64	*Normal n=314*	*Overweight/Obesity n=82*	*F*	*Mean difference (Post Hoc test)*
Eating disorder	0.674	1.053	1.870	25.650 [a]	UW<N (0.379 [c]) UW<OW (1.196 [c]) *n*<OW (0.817 [c])
Depression	6.312	7.201	9.732	7.227 [a]	UW<OW (3.42 [c]) UW<N (0.89 [c]) *n*<OW (2.53 [c])

Wilks' Lambda 0.897 [a] ; F=12.717; [a]$P<0.001$; [c]$P<0.05$.

has also pointed out that no significant correlation exists between obesity and depression.[18] These contradictions probably arise due to variations in the sample selected for each of the studies and the existing cultural and socio-economic diversity in the study area. Our study focuses on the association of BMI status, depression, and eating disorders as these are found to be associated with numerous health complications, including hypertension, cardiovascular disease, metabolic syndrome, and increased mortality.[18] The early part of college is influential for body image development due to the confluence of multiple factors, including living in close contact with peers, making important decisions about health and social life independent of adult supervision, and participating in groups like sororities and team sports that put an emphasis on appearance and unhealthy eating behaviors.[19] The study findings put emphasis on the need to put appropriate strategies in place to make youth aware of the potential pitfalls of eating disorders such as binge eating, irregular diet, and guide them toward healthy life choices that emphasize leading a healthy life rather than focusing on body image perception.[20] Especially, during the pandemic when most individuals are under considerable amounts of stress, eating disorders and depression can greatly affect their health and development.

Conclusion

The present study emphasizes the need to focus on the association of physical health with eating disorders and depression among college students. It concentrates on the changes that come about in the life of students while transitioning from the school to a college environment and the arising adverse effects that could potentially hamper their development due to unhealthy eating habits. The findings from the study include a strong positive association between weight status of youth and eating disorders. Positive relationships are also observed for weight status and depression among college students. The increase in levels of eating disorder and depression with weight status suggests that perceived body image of an individual can potentially affect their eating habits and can also lead to signs of depression.

Limitations

Since the study data were collected using an online questionnaire, the data on participant's weight and height were self-reported rather than measured during the data collection process. However, studies in the past have shown self-reported height and weight to give reliable estimates. Furthermore, the study utilizes the PHQ-9 questionnaire to estimate the level of depression among the study participants without medical supervision. Indicating that it cannot be treated as a clinical diagnosis of depression, it can, however, be considered a useful tool to measure the prevalence of symptoms of depression in the target population.

Acknowledgments

We are thankful to college authorities for providing institutional support in conduction of project

References

1. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Med 2006;3:e442.
2. World Health Organization. Obesity: Preventing and managing the global epidemic. Report of a WHO consultation. World Health Organ Tech Rep Ser 2000;894:18-30.
3. Cesare D, Bentham M, Stevens J, Zhou GA, Danaei B, Lu G. *et al.* Trends in adult body-mass index in 200 countries from 1975 to 2014: A pooled analysis of 1698 population-based measurement studies with 19·2 million participants. Lancet 2016;387:1377-96.
4. Garden SK, Choate LH. The college experience for women: Progress and paradox. In: Choate, LH, editor. Girls' and Women's Wellness: Contemporary Counseling Issues and Interventions. United States: American Counselling Association; 2008. p. 117-41.
5. Harring HA, Montgomery K, Hardin J. Perceptions of body weight, weight management strategies, and depressive symptoms among U.S. college students. J Am Coll Health 2010;59:43-50.
6. Luppino FS, de Wit LM, Bouvy PF, Stijnen T, Cuijpers P, Penninx BW, *et al*. Overweight, obesity, and depression: A systematic review and meta-analysis of longitudinal studies. Arch Gen Psychiatry 2010;67:220-9.
7. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: Validity of a brief depression severity measure. J Gen Intern Med 2001;16:606-13.
8. Desai MN, William CM, Betty S, Terrill B. Risk factors associated with overweight and obesity in college students. J Am Coll Health 2018;57:109-14.
9. Jennings KM, Phillips KE. Eating disorder examination-questionnaire (EDE-Q): Norms for clinical sample of female adolescents with anorexia nervosa. Arch Psychiatr Nurs 2017;31:578-81.
10. Quick V, Byrd-Bredbenner C, Shoff S, White A, Lohse B, Horacek T, *et al.* Concordance of self-report and measured height and weight of college students. J Nutr Educ Behav 2015;47:94-8.
11. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet 2004;363:902.
12. Smith H, Gnanadesikan R, Hughes J. Multivariate analysis of variance (MANOVA). Biometrics 1962;18:22-41.
13. Patel S, Bhavsar CD. Analysis of pharmacokinetic data by wilk's lambda (An important tool of manova). Int J Pharm Sci Invent 2013;2:36-44.
14. Penninx BW, Beekman AT, Honig A, Deeg DJ, Schoevers RA, van Eijk JT, *et al*. Depression and cardiac mortality: Results from a community-based longitudinal study. Arch Gen Psychiatry 2001;58:221-7.
15. Faulconbridge LF, Bechtel CF. Depression and disordered eating in the obese person. Curr Obes Rep 2014;3:127-36.
16. Nemiary D, Shim R, Mattox G, Holden K. The relationship between obesity and depression among adolescents. Psychiatr Ann 2012;42:305-8.
17. Zhao Z, Ding N, Song S, Liu Y, Wen D. Association between depression and overweight in Chinese adolescents: A cross-sectional study. BMJ Open 2019;9:e024177.
18. Hong SM, Hur YI. Relationship between obesity and depression in Korean adults: Korea national health and nutrition examination survey 2014. Medicine (Baltimore) 2017;96:e9478.
19. Da Luz FQ, Hay P, Touyz S, Sainsbury A. Obesity with comorbid eating disorders: Associated health risks and treatment approaches. Nutrients 2018;10:829.
20. Gillen MM, Lefkowitz ES. Gender and racial/ethnic differences in body image development among college students. Body Image 2012;9:126-30.