



Facultad de Estudios Superiores
IZTACALA

Binge eating disorder symptomatology and its association with depression, anxiety and stress: a cross-sectional study in medical students

Sintomatología del trastorno por atracón y su asociación con depresión, ansiedad y estrés: estudio transversal en estudiantes de Medicina

María Fernanda Bárcenas Torres, Ofelia Gómez Landeros,
José Arturo Granados Cosme, Luis Roberto Aguilar Sandoval

Licenciatura en Medicina, Universidad Autónoma Metropolitana, Cd. Mx., México

Recibido: 2023-06-07

Revisado: 2023-07-20

Aceptado: 2023-08-02

Autores de correspondencia: mfernandabarcenas13@gmail.com (M.F. Bárcenas-Torres)

Financiamiento y Agradecimientos: Ninguno

Conflicto de intereses: Los autores declaran no tener conflicto de intereses.

Resumen. Los estudiantes de Medicina tienen mayor riesgo de desarrollar trastornos de la conducta alimentaria incluyendo trastorno por atracón (TPA) comparado con la población general. El objetivo de esta investigación fue identificar si la formación médica influye en la presencia de síntomas de TPA en dos muestras de estudiantes de Medicina en una universidad de Ciudad de México. Se diseñó un estudio transversal en el que se aplicó una encuesta a dos muestras representativas, una de estudiantes del primer año y otra a estudiantes de último año con los instrumentos: DASS-21 y QEWP-5. En conjunto, en ambas muestras se encontró una alta prevalencia de TPA (12%). Los alumnos de último grado presentaron 2.63 (OR) veces más probabilidades de presentar TPA que los de primer año. El TPA tiene una fuerte asociación con depresión (OR = 9.1), ansiedad (OR = 4.3) y estrés (OR = 5.38). Las mujeres independientemente del grado académico mostraron mayor probabilidad de padecer

depresión ($OR = 1.82$), ansiedad ($OR = 1.7$) y estrés ($OR = 1.5$) comparado con hombres. La sintomatología de TPA tiene una alta prevalencia entre los estudiantes de medicina que participaron en este estudio y se correlaciona con factores psicosociales, así como el grado académico.

Palabras clave: Estudiantes de Medicina, trastornos de la conducta alimentaria, trastorno por atracón, depresión, ansiedad, estrés psicológico.

Abstract. Medical students have a higher risk of developing eating disorders, including binge eating disorder (BED), in relation to the general population. The aim of this research was to identify if medical education influences the presence of BED symptoms in two samples of medical students in a university in Mexico City. A cross-sectional study was conducted in which a survey was applied among two representative samples; one of first-year medical students and the other of final-year medical students. The instruments applied were DASS-21 and QEWP-5, and overall, a high prevalence of BED (12%) was found in both samples. Final-year students were 2.63 (OR) times more likely to have BED symptoms than first-year students. BED had a strong association with depression ($OR = 9.1$), anxiety ($OR = 4.3$) and stress ($OR = 5.38$). Regardless of academic level, females showed an increased probability of developing depression ($OR = 1.82$), anxiety ($OR = 1.7$) and stress ($OR = 1.5$) compared to males. BED symptomatology had a high prevalence among medical students who participated in this study and it correlates with psychosocial factors as well as academic grade.

Keywords: Students, Medical, feeding and eating disorders, binge-eating disorder, depression, anxiety, stress, psychological.

Introduction

Eating is inherently rewarding and pleasurable but when it is characterized by pathological, compulsive food consumption and a sense of lack of control over eating behavior, it is called *binge eating disorder* (BED). The features of a binge eating episode are: eating in a discrete period of time, eating an amount of food that is definitely larger than what most individuals would eat and feeling a sense of lack of control regarding eating, eating much faster pace than normal, eating until feeling uncomfortably full, eating despite not feeling physically hungry, eating alone because of embarrassment, feeling disgusted with oneself, depressed, or very guilty after overeating (Giel et al., 2022). These episodes must be regular, at least once a week for at least 3 months, and must not be accompanied by compensatory behaviors like self-induced vomiting, intense physical exercise, use of laxatives or fasting (American Psychiatric Association [APA], 2013).

BED was formally recognized for the first time by the *International Classification of Diseases* in 2019 (World Health Organization [WHO], 2019), and it was added to the *Diagnostic and Statistical Manual of Mental Disorders* in 2013 as a separate entity from bulimia under the section of *Feeding and Eating Disorders* (APA, 2013).

Like other mental disorders, BED pathophysiology is multifactorial and complex (Giel et al., 2022). On a neuroendocrine level, it is suggested that ghrelin has a key role in BED, triggering reinforcement mechanisms associated with food reward and impulse behaviors (Micioni Di Bonaventura et al., 2021). However, another hormone is also part of the pathophysiology given that the frequency of binge-eating episodes was found to be positively associated with leptin levels (Cassioli et al., 2020).

People with BED exhibit heightened sensitivity to rewarding stimuli and elevated activity in reward-related brain regions (including the orbitofrontal cortex, ventral striatum and insula) during food-cue

Table 1. Diagnostic Criteria for Binge eating disorder:

-
- A. Recurrent episodes of binge eating, an episode being characterized by:
- 1) Eating, in a discrete period of time (e.g., in any 2-h period), an amount of food that is definitely larger than most people would eat during a similar period of time
 - 2) A sense of lack of control during the episodes, e.g., a feeling that one can't stop eating or control what or how much one is eating
- B. During most binge episodes, at least three of the following behavioural indicators of loss of control:
- 1) Eating much more rapidly than usual
 - 2) Eating until feeling uncomfortably full
 - 3) Eating large amounts of food when not feeling physically hungry
 - 4) Eating large amounts of food throughout the day with no planned mealtimes
 - 5) Eating alone because of being embarrassed by how much one is eating
 - 6) Feeling disgusted with oneself, depressed, or feeling very guilty after overeating
- C. Marked distress regarding binge eating.
- D. The binge eating occurs, on average, at least once per week for the past 3 months.
- E. The binge eating is not associated with the recurrent use of inappropriate compensatory behavior as in bulimia nervosa and does not occur exclusively during the course of bulimia nervosa or anorexia nervosa
-

Source: American Psychiatric Association-APA, 2013

exposure (Romei, Voigt & Verdejo-Garcia, 2020). A German study that most supports the above (in which 93.3% of the participants were females, age range of 19-63) investigated the frontal network using functional near-infrared spectroscopy during a food-specific go/no-go task to assess inhibitory control in patients with BED compared to healthy controls. Their results suggested that patients with BED have limited resources to activate the prefrontal cortex when asked to inhibit a reaction concerning food-specific stimuli (Veit et al., 2021).

To analyze food-related impulsivity, one study in Germany (in which 85% of the participants were females, mean age 39) compared patients with BED and a control group without BED and analyzed impulsive gaze behavior towards food vs. neutral stimuli, measured using two eye-tracking paradigms, one addressing reward sensitivity and another addressing inhibitory control. The results of this study suggest that food-related impulsivity represents an underlying mechanism of BED (Schag et al., 2021).

A review examined 18 experimental studies and found evidence indicating that negative emotions

serve as triggers for binge eating as short-term palliation of these emotions (Leehr et al., 2015). An Iranian study in female patients with obesity (mean age 37.85) who had sought bariatric surgery found that individuals with obesity and comorbid BED exhibit greater emotional dysregulation compared to those with only obesity or food addiction (Ahmadkaraji et al., 2023).

Compared with healthy participants, patients with BED have worse decision-making skills, inhibitory control, cognitive flexibility, and a more severe attenuated food-related attentional bias (Giel et al., 2022). Moreover, patients with BED make riskier decisions compared with patients without BED. In patients with BED, it is more common to choose immediate rewards over delayed rewards, based on emotional state (Steward et al., 2017).

Not only the brain has a role in the pathophysiology of BED. Recent research suggests that intestinal microbiota may have a role in dysregulated appetite. One study in Belgium recruited male and female participants aged 18 to 65 years and compared genomic DNA extracted from stools samples using a PSP spin stool DNA kit. The investigation found that individuals with BED had increased levels of *Anaerostipes* and

decreased Akkermansia, Desulfovibrio and Intestinimonas compared with the levels in people without BED, although the significance of these differences is unknown (Leyrolle et al., 2021).

On a genetic level, the estimated heritability is between 0.39 and 0.57 (Javaras et al., 2008; Mitchell et al., 2010). A case-control family study and a twin study have identified several polymorphisms associated with genes involved in energy homeostasis, food intake and satiety, and body weight that may be important in regard to the pathophysiology of this disorder (Reichborn-Kjennerud et al., 2004). Twin studies have shown that the heritability of BED is 41-57%. The specific biological systems involved are: serotonergic genes (Serotonin 5-HT transporter, serotonin receptor 2C and serotonin receptor 2A), dopaminergic genes (Dopamine D2 receptors, ankyrin repeat and kinase domain containing 1, opioid receptor μ -1, dopamine active transporter DAT, catechol-O-methyltransferase and Dopamine D3 receptors), appetite regulation genes (serum levels of pancreatic peptide YY hormone are decreased) and others (glucocorticoid receptor, melanocortin 4 receptor, brain derived neurotrophic factor, human prepro-neuropeptide-Y, prepro-ghrelin, fatty acid amide hydrolase, fat mass and obesity and circadian locomotor output cycles kaput) (Manfredi et al., 2021; Donato et al., 2022).

The epidemiology of BED is still emerging; one meta-analysis of studies completed before 2018 found an estimated past-year prevalence in adults of 1.3% with it being more prevalent in women; 1.5% in women and 0.3% in men (Giel et al., 2022). Two meta-analyses resulted in an overall estimated prevalence of 1.32% BED and 3.0% subclinical BED in children and adolescents (Kjeldbjerg & Clausen, 2023). The prevalence in Latin America is estimated to be between 3.53% (Kolar, Rodriguez, Chams & Hoek, 2016) and 15.7% (Villalobos et al., 2018). Furthermore, BED is prevalent in all socioeconomic groups and the mean age at onset is 23 years old (Burton & Abott, 2019; West, et al., 2019).

Previous studies showed a high risk of mental health problems in medical students, probably due to academic stress, extremely high workloads, the need for continuous study, and exposure to illnesses

and death during their medical education. A national survey from the United Kingdom found that medical students are more likely to experience a broad range of mental health problems, including depression, anxiety, burnout, and eating disorder tendencies (Wilkinson, 2023). A systematic review of depression and anxiety in medical students in China showed a higher prevalence of anxiety and depression compared to the general population (Mao, 2019).

Stress is a major influence on the lifestyles of medical students and their eating habits (Ngan et al., 2017). Stress is defined as a mental or emotional state of tension due to constant demanding situations. Some studies have found that medical students are exposed to high levels of stress (Guízar et al., 2023, Cumberow et al., 2023, Ragab et al., 2021). There is evidence supporting the fact that stress affects behaviors and habits that compromise health, for example, individuals under stress consume more high-calorie food (Hyldelund, 2022., IP et al., 2023). Systematic research pooled data which showed that the risk of developing eating disorders was 10.5% among medical students (Jahrami et al., 2019). A cross-sectional survey of medical students in Romania found that there was an elevated tendency of developing eating disorders (Brumboiu et al., 2018). This forces us to consider the relationship between medical education, stress and the damage to mental health and its impact on eating habits, as a complex interaction that can be observed more frequently in those who have been studying Medicine for a longer amount of time.

According to the epidemiology in Mexican medical students, one study in a university from Mexico City showed that 9.7% of participants had binge-eating episodes (Pérez & Montano, 2020), this highlights the impact of BED on medical education.

This investigation's research aim was therefore to identify whether medical education influences on the development of BED symptoms in two samples of medical students in a university in Mexico City. The working hypothesis was that: if medical training influences on BED symptoms, then final-year students would show a higher prevalence of BED symptomatology and a higher risk of BED compared to first-year students.

Method

Study design

This is an observational, analytical, and cross-sectional study designed to determine the prevalence of binge-eating symptoms among medical students and to determine if there is a link between binge-eating symptoms and psychosocial factors. Given the premise that different degrees of stress are experienced during medical training, we assumed that the prevalence of BED would increase as one progresses through medical school. To determine if medical training causes a higher prevalence of BED symptoms, we compared a group of first-year students (considered unexposed to academic requirements and high workload) and a group of final-year students (considered exposed to academic requirements and high workload). It should be mentioned that final-year students are completing their undergraduate medical internship.

Participants

To demonstrate the aforementioned association, we carried out a survey on the two representative samples; one group of first-years, the other of final-years. First, we identified the total number of students enrolled in first-year ($N_1 = 176$ students), and final-year ($N_2 = 160$ students); for each group a systematic sample was calculated (95% confidence level, 3% margin of error), resulting in a total of 151 students in the first-year group (m_1); and a total of 140 students in the final-year group (m_2).

Inclusion criteria for this study was that participants were enrolled in medical training program at the university where the study was made. We excluded those who did not agree to participate, students not enrolled and students who were not present on the day of the survey application.

Instruments

The survey consisted of three sections: informed consent and sociodemographic data, evaluation of the presence of symptoms related to depression, anxiety, stress, and evaluation of BED.

To evaluate symptoms related to depression, anxiety, and stress, we applied the short form of Depression, Anxiety Stress Scales (DASS-21) composed

of 21 items that measure current symptoms of the conditions. Participants were asked to use a 4-point combined severity/frequency scale to rate the extent to which they had experienced each item over the past week. The scale ranged from 0; did not apply to me at all, to 3; applied to me very much, or most of the time (Lovibond & Lovibond, 1995). Scores for depression, anxiety, and stress were calculated by totaling the scores for the relevant items. Depression (items: 3, 5, 10, 13, 16, 17, 21): 5-6 mild depression, 7-10 moderate depression, 11-13 severe depression, ≥ 14 extremely severe depression. Anxiety (items: 2, 4, 7, 9, 15, 19, 20): 4 mild anxiety, 5-7 moderate anxiety, 8-9 severe anxiety, ≥ 10 extremely severe anxiety. Stress (items: 1, 6, 8, 11, 12, 14, 18): 8-9 mild stress, 10-12 moderate stress, 13-16 severe stress, ≥ 17 extremely severe stress (Clinik Lab, 2020).

The reliability of the DASS-21 scale for the Mexican sample was $\alpha = 0.81$ for depression, $\alpha = 0.76$ for the anxiety, $\alpha = 0.79$ for stress, and $\alpha = 0.86$ for the entire scale (Gurrola et al., 2006). In another Mexican study where the reliability of the instrument was verified, the result was a global Cronbach's alpha of 0.911; for depression an $\alpha = 0.758$, for anxiety $\alpha = 0.732$ and $\alpha = 0.826$ for stress (García-Rivera, Maldonado-Radillo & Barón, 2014). The total Cronbach's alpha of the present study was 0.952; for depression $\alpha = 0.903$, anxiety $\alpha = 0.862$, stress $\alpha = 0.890$, and it is very similar to the aforementioned studies.

We used the Questionnaire on Eating and Weight Patterns (QEWP-5) to identify individuals who have binge eating episodes. This questionnaire can differentiate between patients with BED and patients with bulimia nervosa (Yanovski et al., 2015). It contains 13 items with a dichotomous scale response format, which are scored according to decision rules proposed by the authors. The QEWP-5 was translated, adapted, and validated in Mexico. The QEWP-5 score correlated positively (Kappa = .60) with the Eating Disorders Diagnostic Interview which is a diagnostic method (López et al., 2011; López et al., 2021). If the students answered positively to the two initial questions (binge eating episode characteristics according to DSM-V), and negatively to the items corresponding to purging behaviors, the probable diagnosis of BED was confirmed.

DASS-21 and QEWP-5 do not make a diagnosis, so their internal validity was a limitation.

Procedure

The items of the scales were imported into Google Forms. Then we invited the students to participate anonymously and voluntarily. The link to the online, self-administered questionnaire was distributed to final-year students through WhatsApp, and for first-year students we went to their classrooms to share the link. This procedure was repeated until the quotas defined by the sample calculation were covered. The data collection took place between August 2022-September 2022. The first section of the form consisted of a brief introduction, the aim of the study and objective, data confidentiality information, and an informed consent question in which only individuals who agreed to participate were directed to the next section.

Statistical analysis

The present study sought to correlate the academic grade, the presence of depressive and anxious symptoms and the level of stress with BED symptoms.

All statistical analyses were carried out using the Statistical Package for Social Sciences (SPSS) software version 25.0. An alpha level of (.05) was considered for all the statistical tests used in the study. The data was analyzed according to variable types. The descriptive analysis for the prevalence of BED, depression, anxiety, and stress symptoms was done by calculating the frequencies and percentages. The association between the incidences was analyzed using Chi square (χ^2) and Odds Ratio (OR) tests (Ranganathan, 2021; McHugh, 2022).

Ethical considerations

All participants were briefed about the study design and objectives and they were informed about the type of data that would be collected. All procedures performed in this study were in accordance with the ethical standards of the 1964 Helsinki declaration and its later amendments or comparable ethical measures. All study participants gave informed consent and consciously agreed to take part in the study.

Results

A total of 291 subjects were included in the study (151 first-year students and 140 final-year students). In the group of first-year students, men accounted for 28.5% ($n = 43$) and women for 71.5% ($n = 108$). In the group of final-year students, men accounted for 39.3% ($n = 55$) and women for 60.7% ($n = 85$). The calculated prevalence of the total sample showed that 68% of the students had symptoms of depression, 61.1% had symptoms of anxiety, 62.5% had symptoms of stress, 12% had BED symptoms, and 66.6% had comorbidities (the combination of two or more of the following: depression, anxiety, and stress symptoms). (See table 2).

Both groups had a similar prevalence of symptoms of depression (first-year students 67.5% vs final-year students 68.5%), symptoms of anxiety (first-year group 62.2% vs final-year group 60%), and comorbidities (first-year group 65.5% vs final-year group 67.8%). However, there were differences in the prevalence

Table 2. Prevalence of depression, anxiety, stress, comorbidities, and BED by gender

	Men		Women		Total	
	N	%	N	%	N	%
Depression	98	33.6	193	66.3	291	100
Anxiety ^a	58	29.2	140	70.7	198	68.0
Stress	51	28.6	127	71.3	178	61.1
Stress	55	30.2	127	69.7	182	62.5
Comorbidities ^b	58	29.8	136	70.1	194	66.6
BED	13	37.1	22	62.8	35	12

Note: BED: binge eating disorder

^aMild anxiety was excluded and only the prevalence of moderate, severe, and extremely severe anxiety was considered since there is no "no anxiety" category.

^bCombination of two or more of the following: depression, anxiety, and stress.

Table 3. Prevalence of depression, anxiety, stress, comorbidities and BED by year and gender

	First-year students						Final-year students					
	Men		Women		Subtotal		Men		Women		Subtotal	
	N	%	N	%	N	%	N	%	N	%	N	%
Depression	43	28.5	108	71.5	151	51.9	55	39.3	85	60.7	140	48.1
Anxiety ^a	24	55.8	78	72.2	102	67.5	34	61.8	62	72.9	96	68.5
Stress	20	46.5	74	68.5	94	62.2	31	56.4	53	68.5	84	60
Comorbidities ^b	22	51.2	67	62	89	58.9	33	60	60	70.6	93	66.4
BED	23	53.4	76	70.3	99	65.5	35	63.6	60	70.6	95	67.8
BED	5	11.6	6	5.6	11	7.3	8	14.5	16	18.8	24	17.1

Note: BED, binge eating disorder

^aMild anxiety was excluded and only the prevalence of moderate, severe, and extremely severe anxiety was considered since there is no "no anxiety" category.

^bCombination of two or more of the following: depression, anxiety, and stress.

of symptoms of stress between the first-year group (58.9%) and the final-year group (66.4%), and BED symptoms between the first-year group (7.3%) and the final-year group (17.1%). Moreover, the prevalence of all the mentioned symptomatology was higher in women than in men: symptoms of depression (70.7% vs 29.2%), symptoms of anxiety (71.3% vs 28.6%), symptoms of stress (69.7% vs 30.2%), BED symptoms (62.8% vs 37.1%), and comorbidities (70.1% vs 29.8%). (See table 3).

Women showed more symptoms overall than men for depression (OR = 1.82), anxiety (OR = 1.7) and stress (OR = 1.5), but there was no significant difference in BED symptoms between women (OR = .84) and men (OR = 1.18). Women were at nearly twice the risk of developing symptoms of depression, anxiety, and stress, but there was no difference between women and men in the risk of developing BED symptoms.

The presence of BED symptoms was nine times more likely to be accompanied by symptoms of depression (OR = 9.1, $p = .004$, $X^2 = 12.6$), four times more likely to be accompanied by symptoms of anxiety (OR = 4.3, $p = .001$, $X^2 = 10.09$), and five times more likely to be accompanied by symptoms of stress (OR = 5.38, $p < .001$, $X^2 = 11.5$)

Participants with symptoms of stress were strongly associated with symptoms of depression (OR = 16.42, $p < .001$, $X^2 = 98.25$), symptoms of anxiety (OR = 17.72, $p < .001$, $X^2 = 107.25$), and BED symptoms (OR = 5.38, $p < .001$, $X^2 = 11.5$)

In relation to the academic year the participants were in, there were no significant associations in the first-year group and the mentioned psychopathology: symptoms of depression (OR = .95, $p = .85$, $X^2 = .03$), symptoms of anxiety (OR = 1.09, $p = .69$, $X^2 = .15$), symptoms of stress (OR = .72, $p = .18$, $X^2 = 1.73$), and BED symptoms (OR = .37, $p = .009$, $X^2 = 6.67$). Similarly, there were no differences in the participants in final-year related to the presence of symptoms of depression (OR = 1.04, $p = .85$, $X^2 = .03$), symptoms of anxiety (OR = .90, $p = .69$, $X^2 = .15$), and symptoms of stress (OR = 1.37, $p = .18$, $X^2 = 1.73$), but there was a difference in BED symptoms (OR = 2.63, $p = .009$, $X^2 = 6.6$). Final-year students were almost three times more likely to have BED symptoms. (See table 4)

Discussion and conclusion

The aim of this research was to identify whether medical education influences the presence of BED symptoms. We determined the prevalence of binge-eating symptoms and its relationship with depression, anxiety, and stress among undergraduate medical students.

In the present study, the results reveal that the prevalence of BED symptoms is higher (12%) compared to the worldwide prevalence for the years from 2018 to 2020 (1.3%; Giel et al., 2022), and compared

Table 4. Statistical associations

		OR	P	X ²
Women	Depression	1.82	.02	5.33
	Anxiety	1.7	.02	5.18
	Stress	1.5	.10	2.60
	BED	.84	.78	.07
Men	Depression	.54	.02	5.33
	Anxiety	.56	.02	5.18
	Stress	.66	.10	2.60
	BED	1.18	.64	.21
Depression	BED	9.1	<.001	12.60
	Anxiety	4.3	.001	10.09
	Stress	5.38	<.001	11.50
	Depression	16.42	<.001	98.25
Anxiety	BED	17.72	<.001	107.25
	Stress	17.72	<.001	107.25
	Depression	9.1	<.001	12.60
	Anxiety	4.3	.001	10.09
Stress	BED	5.38	<.001	11.50
	Depression	16.42	<.001	98.25
	Anxiety	17.72	<.001	107.25
	BED	5.38	<.001	11.50
BED	Depression	9.1	<.001	12.60
	Anxiety	4.3	.001	10.09
	Stress	5.38	<.001	11.50
	Depression	9.1	<.001	12.60
First-year students	Depression	.95	.85	.03
	Anxiety	1.09	.69	.15
	Stress	.72	.18	1.73
	BED	.37	.009	6.67
Final-year students	Depression	1.04	.85	0.03
	Anxiety	.90	.69	0.15
	Stress	1.37	.18	1.73
	BED	2.63	.009	6.67

Note: OR, odds ratio, X², Chi square; BED, binge eating disorder

to the prevalence in Latin America (3.53%; Villalobos et al., 2018), but it is very similar to the one observed in a meta-analysis that studied medical students using EAT-26 scale (10.4%; Jahrami et al., 2019). This higher rate could be due to different tools used to define the presence of binge-eating symptoms rather than making a diagnosis of BED. The outcome of higher prevalence in this research could be associated to academic requirements, high workload, and exposure to illnesses and death during their medical studies.

The female to male ratio (22:13) in this study is similar (6:4) in proportion compared to a nationally

representative survey of the United States household population (Hudson et al., 2007) and is more balanced compared to the ratio of others ED (Guerdjikova et al., 2019). Regarding prevalence, it is higher in females (62.8% vs 37.1%) but there is no association in these differences (OR = .84 in females vs OR = 1.18 in males). We can also compare this data to a meta-analysis that used DSM-5 criteria that has determined that the prevalence varies between 0.2%-3.6% in women, and 0.03%-1.2% in males in the general population (Keski-Rahkonen, 2021).

Women have a strong association with depression (OR = 1.82, $p = .02$, $X^2 = 5.33$) and anxiety (OR = 1.7, $p = .02$, $X^2 = 5.18$).

Stress was associated with anxiety (OR = 17.72, $p = <.001$, $X^2 = 107.25$), depression (OR = 16.42, $p = <.001$, $X^2 = 98.25$), and BED (OR = 5.38, $p = <.001$, $X^2 = 11.5$). In turn, anxiety (OR = 4.3, $p = .001$, $X^2 = 10.09$) and depression (OR = 9.1, $p = <.001$, $X^2 = 12.6$) were associated with BED. We can thus suggest that stress in this study is the bridge between anxiety, depression, and their relation to BED.

The current research indicates that BED symptoms are significantly related to stress (OR = 5.38, $p = <.001$, $X^2 = 11.5$). This finding is supported by the literature (Colles, Dixon & O'Brien, 2008; Bentley et al., 2015)

It is well established that BED co-occurs with other mental health conditions like mood disorders (70%) and anxiety disorders (16%; Udo & Grilo, 2019; Lydecker & Grilo, 2021) which is also observed in the current study, there is significant association between BED and symptoms of anxiety (OR = 4.3, $p = .001$, $X^2 = 10.09$), and this is consistent with former studies (Jung et al., 2017). In addition, the association between BED and symptoms of depression is significantly consistent with other studies (OR = 9.1, $p = <.001$, $X^2 = 12.6$; Carriere et al., 2019).

Compared to a study at a Palestine University in which researchers used DASS-21 and Binge Eating Disorder Screener-7, concluding that a significantly higher score on depression, stress and anxiety was found among binge eaters, our study reports similar results using DASS-21 and QEWP-5 (Badrasawi & Zidan, 2019).

This study had some limitations that should be considered. It only included participants from one

university which means that the results are not representative of all medical students in Mexico City, neither of all medical students or the whole university population, which would require a multicenter study. Nevertheless, the current study provides worthy data on the prevalence of BED symptoms and their association with stress, anxiety, and depression. Another limitation was that the instruments used do not make a diagnosis, they just evaluate the symptoms associated with depression, anxiety, stress, and BED. Moreover, this study did not identify or exclude students who had depression, anxiety or eating disorder diagnoses prior to university.

A similar Mexican study evaluated the prevalence of BED symptoms in medical students from a private university, and physics postgraduate students (both master's and doctorate) from a public institute with a total sample of 100 students. Compared to our study, our sample is homogeneous and bigger. Furthermore, in addition to prevalence, we identified associations and mediating factors such as depression, anxiety, stress, and academic grade.

The present study reveals that the prevalence of binge eating symptoms was high among medical students in this university. It was further demonstrated that there was no association between the academic grade and depression, anxiety, or stress, but there was a correlation between the academic grade and BED, which can lead us to postulate that the longer the students are exposed to medical education, the higher risk they have of developing BED. It also suggests that BED symptoms were associated with psychosocial factors such as depression, stress, and anxiety. This research also reveals a strong association between females and the psychosocial factors mentioned, compared to males.

Given that BED is an under-recognized and undertreated condition, and that this study addresses specific associations that other authors have not, it is difficult to compare with other populations, but urges the consideration to undertake future research that takes into consideration psychological, demographic, and other factors associated with BED, including the precise factors which lead students to develop BED symptoms and the interaction of these factors.

The high prevalence of BED among medical students requires ongoing monitoring, accurate diagnosis, and management interventions to reduce the prevalence of this disorder. There is a legitimate need for further field research, particularly in parts of the world where the prevalence of BED and other mental health disorders in medical students has been under-investigated. Finally, future epidemiological studies are encouraged to follow a prospective study design so that the same students can be assessed over time and include other variables (e.g. family history of eating and mental health disorders, eating habits) and using additional tools to screen comorbidities. This will provide an opportunity to understand the association between BED risk and other pathologies.

References

- Ahmadkaraji, S., Farahani, H., Orfi, K., & Fathali, F. (2023). Food addiction and binge eating disorder are linked to shared and unique deficits in emotion regulation among female seeking bariatric surgery. *Journal of Eating Disorders*, 11(1). <https://doi.org/10.1186/s40337-023-00815-x>
- American Psychiatric Association (APA). (2013). *Diagnostic and statistical manual of mental disorders* (5a. ed).
- Badrasawi, M. M., & Zidan, S. J. (2019). Binge eating symptoms prevalence and relationship with psychosocial factors among female undergraduate students at Palestine Polytechnic University: a cross-sectional study. *Journal of Eating Disorders*, 7(1). <https://doi.org/10.1186/s40337-019-0263-1>
- Bentley, C., Gratwick-Sarll, K., Harrison, C., & Mond, J. (2015). Sex differences in psychosocial impairment associated with eating disorder features in adolescents: A school-based study: Adolescent Sex Differences in ED Impairment. *The International Journal of Eating Disorders*, 48(6), 633–640. <https://doi.org/10.1002/eat.22396>
- Brumboiu, M. I., Cazacu, I., Zunquin, G., Manole, F., Mogosan, C. I., Porrovecchio, A., Peze, T., Tavalacci, M.-P., & Ladner, J. (2018). Nutritional status and eating disorders among medical students from the Cluj-Napoca University centre. *Medicine and Pharmacy Reports*, 91(4), 414–421. <https://doi.org/10.15386/cjmed-1018>
- Burton, A. L., & Abbott, M. J. (2019). Processes and pathways to binge eating: development of an integrated cognitive and behavioural model of binge eating.

- Journal of Eating Disorders*, 7(1). <https://doi.org/10.1186/s40337-019-0248-0>
- Carriere, C., Michel, G., Féart, C., Pelay, H., Onorato, O., Barat, P., & Thibault, H. (2019). Relationships between emotional disorders, personality dimensions, and binge eating disorder in French obese adolescents. *Archives de Pédiatrie: Organe Officiel de La Société Française de Pédiatrie*, 26(3), 138–144. <https://doi.org/10.1016/j.arcped.2019.02.008>
- Cassioli, E., Rossi, E., Squecco, R., Baccari, M. C., Maggi, M., Vignozzi, L., Comeglio, P., Gironi, V., Lelli, L., Rotella, F., Monteleone, A. M., Ricca, V., & Castellini, G. (2020). Reward and psychopathological correlates of eating disorders: The explanatory role of leptin. *Psychiatry Research*, 290(113071), 113071. <https://doi.org/10.1016/j.psychres.2020.113071>
- Colles, S. L., Dixon, J. B., & O'Brien, P. E. (2008). Loss of control is central to psychological disturbance associated with binge eating disorder. *Obesity (Silver Spring, Md.)*, 16(3), 608–614. <https://doi.org/10.1038/oby.2007.99>
- Cummerow, J., Obst, K., Voltmer, E., & Kötter, T. (2023). Medical students' coping with stress and its predictors: a cross-sectional study. *International Journal of Medical Education*, 14, 15–22. <https://doi.org/10.5116/ijme.63de.3840>
- Clinik Lab: Laboratorio de Psicología (2020, June 16). *Pregrados y Posgrados en Bogotá*. <https://blogs.konradlorenz.edu.co/files/dass>
- Donato, K., Ceccarini, M. R., Dhuli, K., Bonetti, G., Medori, M. C., Marceddu, G., Precone, V., Xhufi, S., Bushati, M., Bozo, D., Beccari, T., & Bertelli, M. (2022). Gene variants in eating disorders. *Focus on anorexia nervosa bulimia nervosa and binge-eating disorder*. <https://doi.org/10.15167/2421-4248/JPMH2022.63.2S3.2772>
- García-Rivera, B., Maldonado-Radillo, S., & Barón, M. R. (2014). Estados afectivos emocionales (depresión, ansiedad y estrés) en personal de enfermería del sector salud pública de México. *Summa psicológica*, 11(1), 65–72. http://pepsic.bvsalud.org/scielo.php?script=sci_arttext&pid=So719-448x2014000100006
- Giel, K. E., Bulik, C. M., Fernandez-Aranda, F., Hay, P., Keski-Rahkonen, A., Schag, K., Schmidt, U., & Zipfel, S. (2022). Binge eating disorder. *Nature Reviews. Disease Primers*, 8(1). <https://doi.org/10.1038/s41572-022-00344-y>
- Guerdjikova, A. I., Mori, N., Casuto, L. S., & McElroy, S. L. (2019). Update on binge eating disorder. *The Medical Clinics of North America*, 103(4), 669–680. <https://doi.org/10.1016/j.mcna.2019.02.003>
- Guízar, D. P., Sampieri, R., Inclán, V., & Muñoz, A. (2023). Perceived academic stress in Mexican medical students. The role of sex emotional distress, burnout, academic-social support, current abuse experiences, and coping strategies. *Salud mental (Mexico City, Mexico)*, 46(3), 155–163. <https://doi.org/10.17711/sm.0185-3325.2023.020>
- Gurrola, G. M., Balcázar, P., Bonilla, M. P., & Virseda, J. A. (2006). Estructura factorial y consistencia interna de la escala de depresión ansiedad y estrés (DASS-21) en una muestra no clínica. *Psicología y Ciencia Social*, 8(002), 3–7.
- Hudson, J. I., Hiripi, E., Pope, H. G., Jr, & Kessler, R. C. (2007). The prevalence and correlates of eating disorders in the national comorbidity survey replication. *Biological Psychiatry*, 61(3), 348–358. <https://doi.org/10.1016/j.biopsych.2006.03.040>
- Hyldelund, N. B., Dalgaard, V. L., Byrne, D. V., & Andersen, B. V. (2022). Why being 'stressed' is 'desserts' in reverse—the effect of acute psychosocial stress on food pleasure and food choice. *Foods (Basel, Switzerland)*, 11(12), 1756. <https://doi.org/10.3390/foods11121756>
- Ip, C. K., Reztitis, J., Qi, Y., Bajaj, N., Koller, J., Farzi, A., Shi, Y.-C., Tasan, R., Zhang, L., & Herzog, H. (2023). Critical role of lateral habenula circuits in the control of stress-induced palatable food consumption. *Neuron*. <https://doi.org/10.1016/j.neuron.2023.05.010>
- Jahrami, H., Sater, M., Abdulla, A., Faris, M. A.-I., & AlAnsari, A. (2019). Eating disorders risk among medical students: a global systematic review and meta-analysis. *Eating and Weight Disorders: EWD*, 24(3), 397–410. <https://doi.org/10.1007/s40519-018-0516-z>
- Javaras, K. N., Laird, N. M., Reichborn-Kjennerud, T., Bulik, C. M., Pope, H. G., & Hudson, J. I. (2008). Familiality and heritability of binge eating disorder: Results of a case-control family study and a twin study. *The International Journal of Eating Disorders*, 41(2), 174–179. <https://doi.org/10.1002/eat.20484>
- Jung, J.-Y., Kim, K.-H., Woo, H.-Y., Shin, D.-W., Shin, Y.-C., Oh, K.-S., Shin, E.-H., & Lim, S.-W. (2017). Binge eating is associated with trait anxiety in Korean adolescent girls: a cross sectional study. *BMC Women's Health*, 17(1). <https://doi.org/10.1186/s12905-017-0364-4>
- Keski-Rahkonen, A. (2021). Epidemiology of binge eating disorder: prevalence, course, comorbidity, and risk factors. *Current Opinion in Psychiatry*, 34(6), 525–531. <https://doi.org/10.1097/ycp.0000000000000750>
- Kjeldbjerg, M. L., & Clausen, L. (2023). Prevalence of binge-eating disorder among children and adolescents: a systematic review and meta-analysis. *European Child & Adolescent Psychiatry*, 32(4), 549–574. <https://doi.org/10.1007/s00787-021-01850-2>
- Kolar, D. R., Rodriguez, D. L. M., Chams, M. M., & Hoek, H. W. (2016). Epidemiology of eating disorders in Latin America: A systematic review and meta-analysis.

- Current Opinion in Psychiatry*, 29(6), 363–371. <https://doi.org/10.1097/yco.0000000000000279>
- Leehr, E. J., Krohmer, K., Schag, K., Dresler, T., Zipfel, S., & Giel, K. E. (2015). Emotion regulation model in binge eating disorder and obesity - a systematic review. *Neuroscience and Biobehavioral Reviews*, 49, 125–134. <https://doi.org/10.1016/j.neubiorev.2014.12.008>
- Leyrolle, Q., Cserjesi, R., Mulders, M. D. G. H., Zamariola, G., Hiel, S., Gianfrancesco, M. A., Rodriguez, J., Porthault, D., Amadiou, C., Leclercq, S., Bindels, L. B., Neyrinck, A. M., Cani, P. D., Karkkainen, O., Hanhineva, K., Lanthier, N., Trefois, P., Paquot, N., Cnop, M., ... Delzenne, N. M. (2021). Specific gut microbial, biological, and psychiatric profiling related to binge eating disorders: A cross-sectional study in obese patients. *Clinical Nutrition* (Edinburgh, Scotland), 40(4), 2035–2044. <https://doi.org/10.1016/j.clnu.2020.09.025>
- López, X., Mancilla, J. M., Vázquez, R., Alvarez, G., & Franco, K. (2011). Un estudio exploratorio sobre propiedades psicométricas del Cuestionario de Patrones de Alimentación y Peso-Revisado (QEWPR). *Revista Psicología.Com*, 1–11.
- López, X., Vázquez, R., Mancilla, J.M., & Balderrama, R. (2021). Instrumentos de evaluación del trastorno por atracón en población de habla hispana. *Revista Mexicana de Trastornos Alimentarios*, 11(1), 32–51. <https://doi.org/10.22201/fesi.20071523e.2020.1.626>
- Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy*, 33(3), 335–343. [https://doi.org/10.1016/0005-7967\(94\)00075-u](https://doi.org/10.1016/0005-7967(94)00075-u)
- Lydecker, J. A., & Grilo, C. M. (2022). Psychiatric comorbidity as predictor and moderator of binge-eating disorder treatment outcomes: an analysis of aggregated randomized controlled trials. *Psychological Medicine*, 52(16), 4085–4093. <https://doi.org/10.1017/S0033291721001045>
- Manfredi, L., Accoto, A., Couyoumdjian, A., & Conversi, D. (2021). A systematic review of genetic polymorphisms associated with binge eating disorder. *Nutrients*, 13(3), 848. <https://doi.org/10.3390/nu13030848>
- Mao, Y., Zhang, N., Liu, J., Zhu, B., He, R., & Wang, X. (2019). A systematic review of depression and anxiety in medical students in China. *BMC Medical Education*, 19(1). <https://doi.org/10.1186/s12909-019-1744-2>
- McHugh, M. L. (2022). Use of the Odds Ratio in clinical research. *Journal of Quality in Health Care & Economics*, 5(3), 1–5. <https://doi.org/10.23880/jqhe-16000278>
- Micioni Di Bonaventura, E., Botticelli, L., Del Bello, F., Giorgioni, G., Piergentili, A., Quaglia, W., Cifani, C., & Micioni Di Bonaventura, M. V. (2021). Assessing the role of ghrelin and the enzyme ghrelin O-acyltransferase (GOAT) system in food reward, food motivation, and binge eating behavior. *Pharmacological Research: The Official Journal of the Italian Pharmacological Society*, 172(105847), 105847. <https://doi.org/10.1016/j.phrs.2021.105847>
- Mitchell, K. S., Neale, M. C., Bulik, C. M., Aggen, S. H., Kendler, K. S., & Mazzeo, S. E. (2010). Binge eating disorder: a symptom-level investigation of genetic and environmental influences on liability. *Psychological Medicine*, 40(11), 1899–1906. <https://doi.org/10.1017/S0033291710000139>
- Ngan, S. W., Chern, B. C. K., Rajarathnam, D. D., Balan, J., Hong, T. S., & Tiang, K.-P. (2017). The relationship between eating disorders and stress among medical undergraduate: A cross-sectional study. *Open Journal of Epidemiology*, 07(02), 85–95. <https://doi.org/10.4236/ojepi.2017.72008>
- Pérez, P., & Montano, L. M. (2012). Estudio del riesgo de presentar trastornos alimentarios en un grupo de estudiantes de licenciatura y posgrado de instituciones mexicanas. *Revista Espacio I+D Innovación Más Desarrollo*, 9(23), 54–68. <https://doi.org/10.31644/imasd.23.2020.a04>
- Ragab, E.A., Dafallah, M.A., Salih, M.H., Osman, W.N., Osman, M., Miskeen, E., Taha, M. H., Ramadan, A., Ahmed, M., Abdalla, M. E., & Ahmed, M. H. (2021). Stress and its correlates among medical students in six medical colleges: an attempt to understand the current situation. *Middle East Current Psychiatry*, 28(1). <https://doi.org/10.1186/s43045-021-00158-w>
- Ranganathan, P. (2021). An introduction to statistics: Choosing the correct statistical test. *Indian Journal of Critical Care Medicine: Peer-Reviewed, Official Publication of Indian Society of Critical Care Medicine*, 25(S2), S184–S186. <https://doi.org/10.5005/jp-journals-10071-23815>
- Reichborn-Kjennerud, T., Bulik, C. M., Tambs, K., & Harris, J. R. (2004). Genetic and environmental influences on binge eating in the absence of compensatory behaviors: A population-based twin study. *The International Journal of Eating Disorders*, 36(3), 307–314. <https://doi.org/10.1002/eat.20047>
- Romei, A., Voigt, K., & Verdejo-Garcia, A. (2020). A perspective on candidate neural underpinnings of Binge Eating Disorder: Reward and homeostatic systems. *Current Pharmaceutical Design*, 26(20), 2327–2333. <https://doi.org/10.2174/1381612826666200309152321>
- Schag, K., Leehr, E. J., Meneguzzo, P., Martus, P., Zipfel, S., & Giel, K. E. (2021). Food-related impulsivity assessed by longitudinal laboratory tasks is reduced in patients with binge eating disorder in a randomized controlled trial. *Scientific Reports*, 11(1). <https://doi.org/10.1038/s41598-021-87231-w>

- Steward, T., Mestre-Bach, G., Vintró-Alcaraz, C., Agüera, Z., Jiménez-Murcia, S., Granero, R., & Fernández-Aranda, F. (2017). Delay discounting of reward and impulsivity in eating disorders: From anorexia nervosa to binge eating disorder: Delay discounting and EDs. *European Eating Disorders Review: The Journal of the Eating Disorders Association*, 25(6), 601–606. <https://doi.org/10.1002/erv.2543>
- Udo, T., & Grilo, C. M. (2019). Psychiatric and medical correlates of DSM-5 eating disorders in a nationally representative sample of adults in the United States. *The International Journal of Eating Disorders*, 52(1), 42–50. <https://doi.org/10.1002/eat.23004>
- Veit, R., Schag, K., Schopf, E., Borutta, M., Kreutzer, J., Ehlis, A.-C., Zipfel, S., Giel, K. E., Preissl, H., & Kullmann, S. (2021). Diminished prefrontal cortex activation in patients with binge eating disorder associates with trait impulsivity and improves after impulsivity-focused treatment based on a randomized controlled IMPULS trial. *NeuroImage. Clinical*, 30(102679), 102679. <https://doi.org/10.1016/j.nicl.2021.102679>
- Villalobos, A., Unikel, C., Hernández-Serrato, M. I., & Bojorquez, I. (2020). Evolución de las conductas alimentarias de riesgo en adolescentes mexicanos, 2006-2018. *Salud Publica de Mexico*, 62(6,v-Dic), 734–744. <https://doi.org/10.21149/11545>
- West, C. E., Goldschmidt, A. B., Mason, S. M., & Neumark-Sztainer, D. (2019). Differences in risk factors for binge eating by socioeconomic status in a community-based sample of adolescents: Findings from Project EAT. *The International Journal of Eating Disorders*, eat.23079. <https://doi.org/10.1002/eat.23079>
- Wilkinson, E. (2023). Medical students face high levels of mental health problems but stigma stops them getting help. *BMJ (Clinical Research Ed.)*, 933. <https://doi.org/10.1136/bmj.p933>
- World Health Organization (WHO). (2019). ICD-11: International Classification of Diseases 11th Revision: The global standard for diagnostic health information. *ICD-11*. <https://icd.who.int/>
- Yanovski, S. Z., Marcus, M. D., Wadden, T. A., & Walsh, B. T. (2015). The Questionnaire on Eating and Weight Patterns-5: An updated screening instrument for binge eating disorder: QEWP-5. *The International Journal of Eating Disorders*, 48(3), 259–261. <https://doi.org/10.1002/eat.22372>