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Mariana da Rocha Mendonça

Duração do Sono e Compulsão Alimentar em Adultos Jovens

Porto Alegre
2024

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Trabalho apresentado como requisito parcial à obtenção do título de Bacharel em Psicologia do Instituto de Psicologia, Serviço Social, Saúde e Comunicação Humana da Universidade Federal do Rio Grande do Sul.
Orientadora: Profª. Lisiane Bizarro Araujo

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Porto Alegre, 12 de Dezembro de 2024.

BANCA EXAMINADORA:

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Dedico este trabalho à minha amada avó Ecilda,
em memória (1946-2024).

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Resumo

O objetivo deste estudo é investigar a relação entre duração do sono, índice de massa corporal (IMC), imprevisibilidade na infância e comportamentos de compulsão alimentar em adultos jovens. Participaram do estudo 347 pessoas, com idades entre 18 e 24 anos, todos com IMC regular (18,5-25kg/m²). Os dados foram coletados no projeto *Health Young at Risk for Obesity* (HYRO), aprovado pelo Comitê de Ética do Hospital de Clínicas de Porto Alegre (HCPA). Os participantes responderam aos instrumentos: Escala de Compulsão Alimentar (ECAP), Questionário de Cronotipo de Munique (MCTQ) e a Escala de Imprevisibilidade Familiar na Infância (EIFI). Foi realizada uma análise de regressão linear para identificar preditores de compulsão alimentar. Os principais achados indicam que sono insuficiente (<7 horas), maior IMC, gênero feminino e falta de cuidado e apoio durante a infância estão positivamente associados a maiores escores de compulsão alimentar. Mulheres apresentaram níveis significativamente mais altos de compulsão alimentar em comparação aos homens, apoiando evidências de vulnerabilidades de gênero relacionadas aos transtornos alimentares.

Palavras-chave: compulsão alimentar, duração do sono, índice de massa corporal, adultos jovens

Abstract

This study investigates the interplay between sleep duration, Body Mass Index (BMI), childhood unpredictability, and binge eating behaviors in young adults. The analysis is based on data from 347 participants aged 18 to 24, with normal BMI (18.5–25 kg/m²), collected as part of the Health Young at Risk for Obesity (HYRO), project approved by the Hospital de Clínicas de Porto Alegre Ethics Committee. The study employs validated instruments, including the Binge Eating Scale (BES), Munich Chronotype Questionnaire (MCTQ), and Family Unpredictability Scale in Childhood (EIFI). Regression analysis was performed to identify significant predictors of binge eating, assessed via the Binge Eating Scale (BES). Key findings indicate that insufficient sleep (<7 hours), higher BMI, female gender, and lack of nurturance during childhood are positively associated with higher binge eating scores. Women exhibited significantly higher levels of binge eating compared to men, supporting evidence of gendered vulnerabilities to eating disorders.

Keywords: binge eating, sleep duration, body mass index, young adults

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Introduction

Sleep quality is frequently compromised in individuals with mental disorders, often manifesting as insufficient sleep duration (Suna & Ayaz, 2022). These disruptions can have wide-ranging effects, but how much do they influence binge eating?

Binge Eating Disorder (BED) is classified among the primary eating disorders (ED) in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5-TR). It is characterized by recurrent episodes of consuming large quantities of food in a short period, accompanied by a feeling of lack of control. Affected individuals often cannot stop eating or regulate the amount and type of food consumed (APA, 2022).

According to DSM-5-TR, for a BED diagnosis, episodes must occur at least once a week for three months and be associated with significant emotional distress. These episodes typically involve at least three of the following behaviors: (1) eating more rapidly than usual; (2) continuing to eat until uncomfortably full, ignoring satiety signals; (3) consuming large amounts of food in the absence of hunger; (4) eating alone due to shame; and (5) feeling embarrassed, depressed, or guilty afterward (APA, 2022).

Given its high prevalence and associated health risks, BED is a primary clinical concern. Giel et al. (2022) reported that up to 30% of individuals with obesity seeking either behavioral or surgical weight-loss treatment also exhibit BED. This statistic highlights the clinical importance of BED, especially against a global backdrop of rising average BMI and the World Health Organization's classification of obesity as an “epidemic” and a significant public health issue.

Individuals with BED frequently report sleep disturbances. Allison et al. (2016) identified a higher incidence of disrupted sleep among individuals with eating disorder behaviors compared to those without such behaviors. Poor sleep quality has also been strongly associated with obesity, further compounding its significance (Blumfield et al.,

2018).

Understanding the interplay between sleep disturbances and binge eating is crucial for identifying modifiable factors that contribute to BED. Sleep disturbances influence food intake through hormonal shifts, such as elevated ghrelin and reduced leptin levels—hormones that regulate hunger and satiety—increasing appetite and decreasing the feeling of fullness. Additionally, heightened neural responses to food stimuli during periods of poor sleep can lead to preferences for high-calorie foods (Trace et al., 2012; Zerón-Rugerio et al., 2022). Such mechanisms suggest that sleep quality may contribute to eating patterns, including binge eating. Exploring this connection provides valuable insights into the multifaceted relationship between sleep and eating behaviors.

Related literature

The development and persistence of binge eating in BED are shaped by a combination of biological, social, and emotional factors. This includes impulsivity and emotional regulation changes, possibly contributing to dysregulated eating patterns. Research indicates that BED is associated with dysfunctions in reward processing, inhibitory control, and emotional regulation mechanisms (Giel et al., 2022).

Several risk factors have been identified for BED development, particularly weight-related concerns and body dissatisfaction. Individuals who have experienced violence, poverty, food insecurity, childhood abuse, and neglect are at higher risk for developing BED (Borg et al., 2022; Brewerton, 2022; Giel et al., 2022). BED prevalence may be exceptionally high among Black and Latin populations and sexual minorities (Giel et al., 2022; Romano & Heron, 2020).

Borg et al. (2022) examined the relationship between childhood maltreatment and eating behaviors, finding that high rates of emotional, physical, and sexual abuse are

prevalent among individuals with binge-eating disorder. Emotional abuse, in particular, showed the strongest associations with binge eating. These adverse experiences are linked to earlier onset, more severe clinical courses, and poorer treatment outcomes for BED.

In line with this, Brewerton (2022) analyzed the role of adverse childhood experiences (ACEs) in the development of eating disorders. The study highlighted a strong association between BE and childhood trauma, emphasizing the emotional and psychological impacts of such experiences. Social and community factors, including poverty, violence, and food insecurity, further elevate the risk of ACEs. These adverse experiences, such as abuse and neglect, act as critical triggers for the development of eating disorders like BED.

Da Luz et al. (2023) conducted a systematic review and meta-analysis of 31 studies with 4,448 participants, finding that individuals with recurrent binge eating experience significantly poorer sleep quality, encompassing increased hypersomnia, insomnia, and difficulty falling asleep. The analysis revealed moderate to large effect sizes, underscoring the severe sleep-related challenges in individuals with binge eating behaviors. These results align with prior findings suggesting that disrupted sleep quality is a prevalent and significant concern among those with binge eating disorder (BED).

Expanding on the neurobiological underpinnings of this relationship, Mehr et al. (2021) reviewed evidence suggesting that the dysregulation of the orexin (hypocretin) system, potentially triggered by chronic consumption of palatable foods, may connect sleep disturbances and BED. This dysregulation mirrors neural pathways observed in substance use disorders, pointing to overlapping mechanisms that may drive both binge eating and sleep disruption.

Furthering this understanding, Degasperi et al. (2024) conducted a systematic review comparing sleep quality across various eating disorder (ED) subtypes in 27 studies involving 711 ED patients and 653 healthy controls. Their findings indicated that all ED subtypes are

associated with poorer sleep quality, though distinct patterns emerge: anorexia nervosa impacts physiological sleep, while bulimia nervosa and BED more profoundly affect subjective sleep quality. Notably, some studies within this review suggested that ED treatments may also improve sleep quality, highlighting the potential for integrated treatment approaches to address both ED and sleep disturbances.

The impact of BE and related sleep disruptions extends to broader health patterns in college populations. Abanobi et al. (2023) found that individuals with binge eating disorder (BED) were more likely to have inadequate sleep on weekends, regardless of gender or depressive symptoms. Using item response theory to assess 547 university students (predominantly female with probable eating disorders), Pacella et al. (2024) identified insomnia symptoms that contributed significantly to sleep impairment, with insomnia-related distress emerging as a critical factor. Additionally, Suna and Ayaz (2022) identified an association between poor sleep quality and night eating syndrome (NES) and depressive symptoms among university students, reinforcing the complex interaction between sleep, mental health, and eating behaviors.

In addition to sleep, other behavioral and lifestyle factors, such as physical activity, warrant consideration. Evidence suggests that physical activity significantly improves mental health and psychological well-being in individuals with ED (Carollo et al., 2023). Although weight loss is not always a primary goal, physical activity has shown benefits in reducing binge eating episodes and improving mood, making it a relevant factor to explore within broader discussions of binge eating management (Blanchet et al., 2018).

Overall, these studies reinforce the importance of identifying and addressing interconnected and modifiable factors. Sleep quality, psychological distress, and physical activity may be essential factors in understanding and managing binge eating behaviors

better. This perspective may provide new insights into strategies for improving outcomes in individuals with BED.

This study

This study aims to expand the understanding of modifiable factors associated with binge eating behaviors, explicitly focusing on insufficient sleep hours. While previous research has shown a relationship between poor sleep and disordered eating patterns, few studies have explored this in detail, particularly by considering distinctive factors such as childhood food insecurity, neglect and support, and current physical activity.

Using a non-clinical sample from Brazil – a country with significant socioeconomic disparities – this research provides additional evidence to the existing literature on studies in high-income countries. Moreover, the participants were healthy young adults. This study offers a more comprehensive understanding of how these elements influence binge eating behavior by addressing distinctive factors, such as early-life adversities and lifestyle-related behaviors, alongside sleep quality.

Data

Participants

This study is part of the Health Young at Risk for Obesity (HYRO) project, approved by the Hospital de Clínicas de Porto Alegre (HCPA) Ethics Committee. The HYRO project investigates how obesity risk factors influence the eating behavior of young adults with a regular Body Mass Index (BMI = 18.5 to 25 kg/m²) aged 18 to 24. The project consists of three phases, each with distinct measurements. Data was collected in the first phase, which included an initial online screening to assess obesity risk factors, socio-demographic characteristics, and dietary and psychological factors related to eating behavior. Subsequent

phases included a dietary assessment conducted by nutritionists and a neuropsychological evaluation (Machado et al., 2023).

The inclusion and exclusion criteria were consistent across all phases. Inclusion criteria: adults aged 18 to 24. Exclusion criteria: self-reported autoimmune or neoplastic diagnoses or pregnancy. All participants provided informed consent online. Recruitment was conducted via social media platforms (Facebook, Instagram) and an instant messaging app (WhatsApp) in May 2020. Responses were collected through the platform SOS Surveying. Following the exclusion criteria, 347 participants were included in the study.

Instruments

Binge Eating Scale (BES)

This study used a Brazilian Portuguese version of the Binge Eating Scale – BES (Escala de Compulsão Alimentar Periódica - ECAP, Gormally et al., 1982), translated and adapted by Freitas et al. (2001). The BES assesses the severity of binge eating symptoms, encompassing affective, cognitive, and behavioral aspects. It consists of 16 items: eight measure behavioral manifestations (e.g., rapid eating or large food intake), while the other eight capture related emotions and thoughts (e.g., guilt, lack of control, or inability to stop eating) that occur before or after a binge episode. Each item is scored from 0 to 3 points (0 = no symptom severity, 3 = severe binge eating problems), with total scores ranging from 0 to 48. In this sample, the BES demonstrated high internal consistency ($\alpha = 0.92$).

Body mass index (BMI)

BMI (kg/m^2) was calculated based on participants' self-reported weight and height. Previous research indicates that self-reported measurements are a valid and reliable alternative to direct, in-person assessment (Spencer et al., 2002).

Munich Chronotype Questionnaire (MCTQ)

Sleep quality was assessed using the Munich Chronotype Questionnaire (MCTQ), developed by Roenneberg et al. (2003), to evaluate individuals' chronotypes, reflecting their natural sleep-wake patterns. The MCTQ includes 19 items covering sleep and wake times on both work and free days, daily energy levels, sleep onset latency, sleep inertia, and daylight exposure. Chronotype is determined by calculating the midpoint between sleep onset and wake-up time (mid-sleep) on free days, which serves as a reference phase. For most individuals, especially those without extreme early chronotypes, sleep patterns differ substantially between work and free days, often resulting in sleep debt during workdays. Consequently, mid-sleep on free days is adjusted to account for the sleep deficit accumulated over the workweek (Levandovski et al., 2013). The variable of interest was defined as insufficient sleep hours (less than 7 hours) reported in MCTQ.

Family Unpredictability Scale in Childhood (EIFI)

The *Escala de Imprevisibilidade Familiar na Infância* (EIFI), constructed and validated by Howat-Rodrigues, De Andrade, and Tokumaru (2012) consists of 27 items divided into the following factors: nurturance, meals, money. Items are rated on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree). The scores for each factor are summed to generate total subscales scores.

International Physical Activity Questionnaire (IPAQ)

The International Physical Activity Questionnaire (IPAQ) was validated in 12 countries by Craig et al. (2003) to measure physical activity. In this study we used an adapted version for Brazilian-Portuguese (Matsudo et al., 2001), establishing three levels of physical activity: insufficiently active, sufficiently active, and highly active.

Data Analysis

After descriptive statistics of the dataset, this study aimed to determine whether there is significant evidence of a relationship between sleep and binge eating in young adults, and between BMI and binge eating. To investigate the relationship between insufficient sleep (MCTQ), body mass index, and compulsive eating (ECAP), we estimated the following linear regression model:

$$\widehat{ECAP}_i = \widehat{\beta_1} + \widehat{\beta_2} \times Sleep_i + \widehat{\beta_3} \times BMI_i + \widehat{\beta_4} \times MET_i + \zeta$$

The variables of interest included Sleep (defined as insufficient sleep hours, where less than 7 hours is considered insufficient) and BMI. ζ is a vector of control variables, including money, meals, and lack of support and care (EIFI). The linear model was estimated using Ordinary Least Squares (OLS).

The assumptions of OLS must be made transparent to ensure the validity of the estimators in linear regressions (Ernst & Albers, 2017). OLS estimators are to be unbiased, consistent, and the most efficient unbiased estimators provided that certain assumptions are satisfied (Wilms et al., 2021). Tested assumptions were (1) Multicollinearity can lead to excessive sensitivity in the model parameters (Wooldridge, 2019). Although the absence of multicollinearity assumption does not affect the unbiasedness or consistency of the estimators, its presence can lead to excessive sensitivity in the model parameters (Wooldridge, 2019); (2) Spherical error variance: The hypothesis of spherical error variance was tested using Durbin-Watson test (error correlation) and Breusch-Pagan (homoscedasticity) (Ernest and Albers, 2017); (3) Normality of errors: Shapiro-Wilk test indicates that the residuals do not follow a normal distribution, although QQ-plot is reasonably linear; (4) Strict exogeneity: Antonakis et al. (2010) suggested that the primary sources of endogeneity in the linear regression model are common method bias, measurement errors, selection bias, omitted variables bias, and simultaneity. Testing directly the strict

exogeneity assumption (that the conditional expectation of the error is zero) is only possible with an instrument or establishing validity with a causal empirical strategy (Wilms et al., 2021). As suggested by Podsakoff et al. (2024), a confirmatory factor analysis was conducted to test for common method bias. A sensitivity analysis was performed to check the robustness of the results relating to omitted variable bias (Cinelli et al., 2020). Heckman tests were performed for the main variables to account for selection bias. These results are reported in the next section.

Results

Participants were 347 people, with a mean age of 20,78 (SD=1.80, 18-24). Of these, 100 participants (28,8%) were men, and 247 (71,2%) were women. Table 1 presents the sociodemographic characteristics.

In the correlation analyses, associations were found between ECAP, BMI, lack of nurturance (EIFI), and gender, with women displaying higher levels of binge eating. BMI showed a negative correlation with hours of sleep and a positive correlation with childhood neglect and support (EIFI). This indicates that individuals with fewer hours of sleep had higher BMIs, as did those with greater levels of childhood neglect and lack of support. The participants in our study sample had a regular BMI (18.5–25 kg/m²).

Additionally, gender was negatively associated with physical activity levels and insufficient sleep, with men engaging in more physical activity but sleeping less than women. These associations were also significant in Chi-square tests for physical activity and gender $\chi^2(2) = 20.6$, $p < .001$ (Cramér's V =.244) and for insufficient sleep and gender, a significant association was also found $\chi^2(1) = 5.98$, $p = 0.015$, (Cramér's V = 0.131). Table 2 displays the remaining results along with descriptive statistics for the variables.

Table 1

Sociodemographic Characteristics of Participants

Variable	Count	%
Ethnicity		
Other	12	3.5 %
White	312	89.9 %
Black	7	2.0 %
Mixed-race	13	3.7 %
Indigenous	1	0.3 %
Asian	2	0.6 %
Education level		
High school completed/Some post-secondary education	314	90.5 %
Undergraduate degree	23	6.6 %
Elementary school incomplete	2	0.6 %
High school incomplete	8	2.3 %
Physical activity level		
Inactive	129	37.2 %
Moderate	118	34.0 %
High	100	28.8 %
Sleep duration		
≥7 hours	296	85.3 %
<7 hours	51	14.7 %

Table 2

Spearman Correlations and Descriptive Statistics of the Variables

Variable	1	2	3	4	5	6	7	8	9	10
1. Age	—									
2. Sleep hours	-0.079	—								
3. EIFI Nurturance	0.067	-0.105	—							
4. EIFI Money	0.014	-0.067	0.202***	—						
5. EIFI Meals	0.001	0.018	0.267***	0.144**	—					
6. BMI	0.108*	-0.145**	0.130*	0.070	-0.001	—				
7. ECAP	-0.103	-0.058	0.171**	0.098	0.008	0.368***	—			
8. Gender	-0.246***	0.168**	-0.050	-0.020	-0.041	-0.132*	0.220***	—		
9. Insufficient Sleep	0.003	-0.369***	0.005	0.046	0.059	0.009	0.028	-0.131*	—	

10. MET	0.027	-0.080	0.005	-0.079	-0.023	0.073	-0.002	-0.220 ***	0.034	—
Mean (M)	20.78	7.64	1.59	1.85	2.24	22.81	11.17	0.71	0.15	1.92
SD	1.79	1.16	0.75	0.84	0.51	3.34	7.27	0.45	0.36	0.81
Min/Max	18/24	4.00/11.00	1.00/5.00	1.00/5.00	1.40/5.00	17.16/42.90	0/35	0/1	0/1	1/3

Note. Gender coded as Male=0, Female=1; Insufficient Sleep coded as No = <7, Yes = >=7.
*p < .05, **p < .01, ***p < .001

Estimation

The multiple linear regression model was significant (F(9, 337) = 16.4, p = .001), with R = .552 and R^2 = .304, indicating that the predictors explain 30.4% of the variability in ECAP. Insufficient sleep (*p* =.045), body mass index (*p* < .001), gender (*p* < .001), and lack of nurturance (EIFI) (p= .002) were the predictors positively associated with compulsive eating as assessed by ECAP. Table 4 summarizes the main results of the linear regression model.

Table 4

Main Results

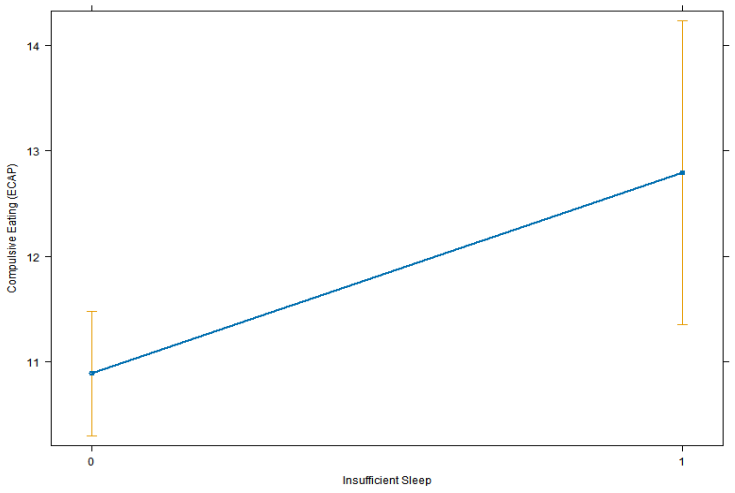
Preditor	**Estimates**	**SE**	***t***	***p***
Intercept	-9.614	4.978	-1.931	.054
Age	-0.333	0.191	-1.744	.082
Nurturance	1.515	0.487	3.109	.002
Money	0.280	0.407	0.688	.492
Meals	-0.467	0.696	-0.671	.503
BMI	0.973	0.101	9.584	<.001
Gender	4.484	0.783	5.725	<.001
Moderate physical activity	0.450	0.792	0.568	.570

High physical activity	0.042	0.844	0.050	.960
Insufficient sleep	1.901	0.945	2.011	.045

The results of the baseline regression (Table 1) indicate that BMI (β = 0.973, p-value < 0.001) and insufficient sleep (β = 1.901, p-value = 0.045) have significant and positive effects. An increase of one unit in BMI is associated, on average, with an increase of approximately one unit on the ECAP scale. In contrast, insufficient sleep (<7 hours) increases the ECAP score by an average of 1.9 units. Figure 1 below represents the marginal effect of sleep on ECAP.

Figure 1

Marginal Effect of Insufficient Sleep on ECAP



Additionally, EIFI Nurturance (β = 1.515, p-value = 0.002) demonstrates a significant positive effect, alongside BMI (β = 0.973, p-value < 0.001) and Gender (β = 4.484, p-value < 0.001). Age, while statistically significant, exhibits a small negative effect at the 10% significance level (β = -0.333, p-value = 0.082). Figure 2 represents the effect of BMI on ECAP, and Figure 3 represents the effect of Gender on ECAP.

Figure 2

Marginal Effect of BMI on ECAP

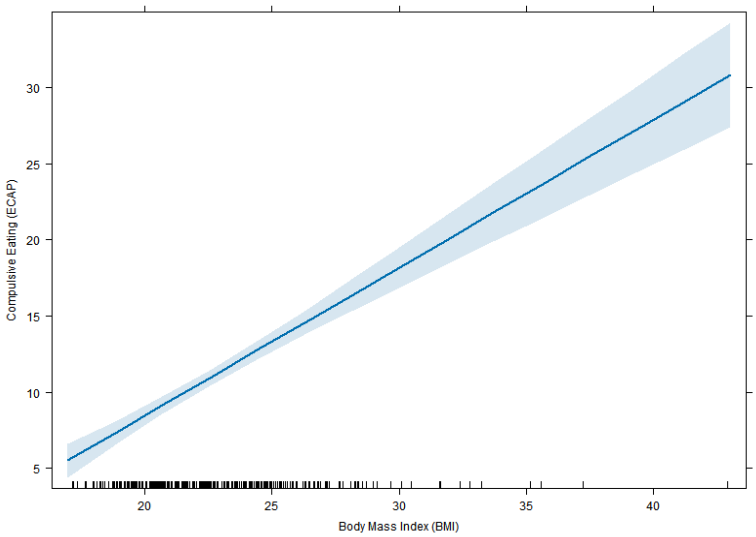


Figure 3

Marginal Effect of Gender on ECAP

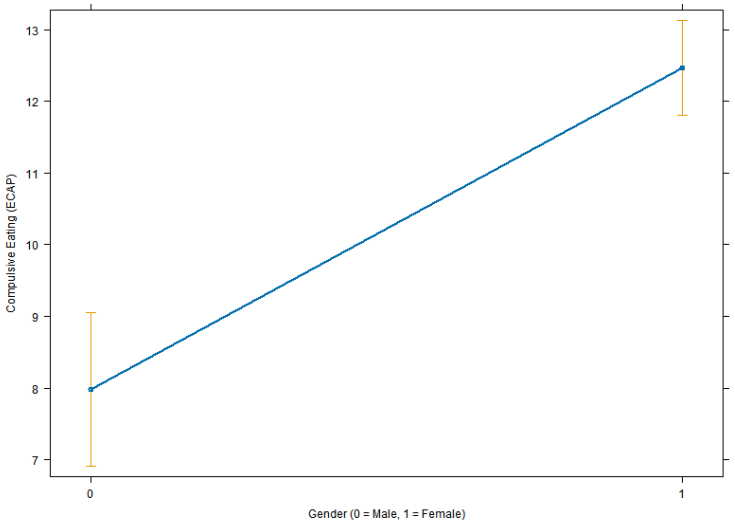
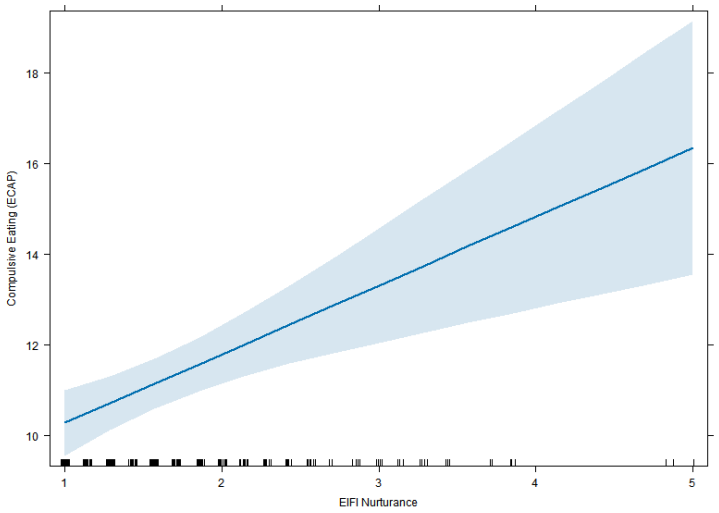


Figure 4

Marginal Effect of EIFI Nurturance on ECAP



Next, the evaluation examines whether the model meets the OLS assumptions and outlines the robustness checks used to address any violations.

1. **Multicollinearity:** Multicollinearity was assessed using the Variance Inflation Factor (VIF), with values close to 1 (range: 1.029-1.215) (see Appendix, Table B1) and tolerance values between 0.907 and 0.985, suggesting no multicollinearity among predictors.
2. **Spherical variance (error correlation and homoscedasticity):** The Durbin-Watson test yielded values close to 2 and non-significant (p-value = 0.4518), indicating no serial correlation of residuals. However, the Breusch-Pagan test detected heteroscedasticity (p-value = 2.336e-05), though the residuals' graphical distribution did not show clear patterns (see Appendix, Figure A1). To address this, robust standard errors were estimated, and results remained consistent at a 10% confidence level (see Appendix, Table B2, first column).
3. **Endogeneity:** A sensitivity analysis indicates that the effect of insufficient sleep on binge eating requires confounders to explain 10.37% of the residual variance to nullify it, whereas the effect of BMI is more robust, needing over 40.33% of the

residual variance for the same impact. Cook's' Distance values were below 1, indicating no influential outliers, and Heckman selection models did not reveal significant selection bias for gender and insufficient sleep (Appendix, Table B3).

4. **Normality:** The Shapiro-Wilk test showed non-normality of residuals, which impacts only small samples; however, given the sufficiently large sample size in this study (n=347), the violation of normality is unlikely to affect the validity of the regression results significantly; nevertheless, the QQ-Plot suggested non-linearity only at the tails (see Appendix, Figure A2). Bootstrap methods confirmed the significance of key variables (see Appendix, Table B2, second column).

These findings suggest that the regression results are robust and reliable, with no critical violations compromising their interpretability.

Discussion

This study adds to the existing literature by broadening the analysis to include sleep quality, childhood adversities, and physical activity within a young Brazilian population. These contributions complement previous findings and provide valuable insights into a relatively underexplored context. Insufficient sleep, body mass index, gender, and childhood neglect and support were the predictors positively associated with compulsive eating as assessed by ECAP.

The association between insufficient sleep and higher ECAP levels (coef. 1.901, $p = 0.045$, Figure 1) supports previous findings on this relationship. Da Luz et al. (2023) highlighted that poor sleep quality – including insomnia and difficulty falling asleep – is a common characteristic in individuals with binge eating disorder. Similarly, Degasperi et al. (2024) reported that subjectively poor sleep patterns are prevalent in eating disorders such as BED.

Insufficient sleep may be mediated by factors such as anxiety and depressive symptoms (Calderon, 2022). Trace et al. (2012) found that sleep problems are associated with binge eating in women, even after controlling for obesity and depression. Suna and Ayaz (2022) identified poor sleep quality as a significant predictor of Night Eating Syndrome (NES). However, this association disappeared after adjusting for depression, suggesting that depression may partially mediate the relationship between sleep and binge eating. The lack of direct control for depression in this study limits direct comparisons with the findings of these authors. Although depression was not included as a control variable in the present study, sensitivity analyses indicate that the results are moderately robust to potential confounders.

Thus, the results suggest that insufficient sleep was a key factor influencing BE behaviors in this study, with potential variations between genders. Poor sleep has been associated with disordered eating patterns, including emotional and compulsive overeating (Suna & Ayaz, 2022). This aligns with research indicating that poor sleep quality disproportionately affects women, often exacerbating psychological distress and maladaptive eating behaviors (Calderon et al. 2022; Degaspeti et al., 2024; Suna & Ayas, 2022). Therefore, these results underscore the interplay between gender, sleep quality, and binge eating, suggesting that women may be particularly vulnerable to the combined effects of insufficient sleep and societal pressures that amplify body dissatisfaction (Spalholz et al., 2016; Machado et al., 2023).

BMI was identified as a significant predictor of ECAP in this study (coef. 0.973, $p < 0.001$, Figure 2). Blanchet et al. (2018) argued that elevated BMI exacerbates binge eating episodes by dysregulating reward mechanisms and inhibitory control. Similarly, Giel al. (2022) emphasized that weight-related concerns and body dissatisfaction are risk factors for the development of ED. Calderon et al. (2022) and Köse and Tayfur (2021), also found that

individuals with higher BMI are more likely to exhibit disordered eating patterns, including emotional eating.

Social acceptance of obesity differs significantly between genders, influencing the perception of binge eating behaviors and the role of BMI. Striegel-Moore et al. (2009) observed a lower prevalence of perceived weight discrimination among men, suggesting a higher societal acceptance of obesity in men compared to women. Spahlholz et al. (2016) further noted that women are subjected to more weight-based discrimination, likely stemming from social ideals that equate thinness with attractiveness. At higher BMI levels, this disparity may be even more pronounced, with women experiencing heightened stigma and psychological distress (Spahlholz et al., 2016).

Building on these findings, this study found that women exhibited significantly higher levels of ECAP (coef. 4.484, $p < 0.001$, Figure 3). This aligns with Calderon et al. (2022), who reported that women are more prone to emotional eating, a subtype of BE often associated with psychological distress. Spahlholz et al. (2016) and Machado et al. (2023) identified higher levels of weight-based discrimination among women, likely driven by gender roles and social pressures prioritizing thinness as a standard of attractiveness. This emphasis on thinness, more relevant for women, perpetuates negative body image and contributes to eating disorders such as binge eating.

Although Köse and Tayfur (2021) observed a lower prevalence of emotional eating among individuals with higher levels of physical activity, this study did not find significant associations between physical activity and BE. This discrepancy may be attributed to the reliance on self-reported measures in the IPAQ, which are likely to recall bias and overestimation. Alternatively, mediating factors such as stress or sleep quality may influence the relationship between MET and ECAP, as Zerón-Rugerio et al. (2022) suggested.

Moreover, the role of nurturance (EIFI) in binge eating was highlighted in this study (coef. = 1.515, p = 0.002, Figure 4), supporting existing literature linking adverse childhood experiences to eating disorders. Borg et al. (2022) reported that emotional neglect and abuse during childhood are strongly associated with BED, while Brewerton (2022) emphasized that early adversities, such as poverty and food insecurity, contribute to the clinical progression of these disorders. Similarly, Machado et al. (2023) found that ACEs among females were associated with the presence of binge eating behavior. These findings suggest that social support may play an important protective role.

Limitations and future directions

This study has limitations that should be acknowledged. First, the reliance on self-reported physical activity measures through the IPAQ introduces potential recall bias. This may partly explain the lack of significant associations between MET and BE, despite findings by Köse and Tayfur (2021) suggesting a lower prevalence of emotional eating in individuals with higher activity levels. Future research should consider objective measures of physical activity to reduce bias and explore the potential mediating roles of stress and sleep quality, as suggested by Zerón-Rugerio et al. (2022).

Additionally, this study did not control for mental health factors such as depression and anxiety, which could mediate the relationship between sleep and eating behaviors. While previous studies (Calderon et al., 2022; Trace et al., 2012) demonstrated that sleep problems are significantly associated with BE after adjusting for depression, the absence of this variable in the present analysis limits direct comparisons. Future research should incorporate assessments of mental health to understand better its role in the interplay between sleep quality and binge eating.

Another potential limitation is the sample composition, predominantly young Caucasian women. This limits the generalizability of the findings to more diverse populations and restricts the ability to explore how racial and cultural factors may influence binge eating and related variables. Future studies should prioritize more diverse and representative samples to address these gaps and provide a broader understanding of these associations.

Lastly, the cross-sectional design prevents conclusions about causal relationships. Reverse causality and simultaneity cannot be ruled out, and longitudinal or experimental designs are recommended for future research to establish causality and better understand the dynamics of BED, sleep quality, and BMI.

Despite these potential limitations, this study contributes to the literature by exploring under-researched contexts, such as the Brazilian population, and advancing knowledge about gender differences in binge eating. The findings also highlight the associations between sleep quality, BMI, childhood adversities, and BED, with particular attention to the vulnerability of women to poor sleep and its compounded effects on psychological distress and disordered eating. These insights provide a foundation to future investigations and underscore the need for targeted interventions addressing sleep and mental health.

Conclusion

This study contributes to the growing evidence of the complex interplay of sleep quality, early-life adversities, and lifestyle behaviors in shaping binge eating behaviors. By using a non-clinical sample of healthy young adults from Brazil – a population underrepresented in the existing literature – this research provides insights into the associations between binge eating and modifiable factors, such as poor sleep quality and BMI, while also emphasizing the protective role of social support against the effects of childhood adversities.

Thus, it highlights the importance of addressing modifiable risk factors, such as sleep quality and BMI, in interventions targeting binge eating behaviors. By considering these factors with early-life adversities and gender-specific vulnerabilities, more effective strategies can be developed to reduce the prevalence and impact of binge eating.

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Appendix

Figures

Figure A1

Fitted value (ECAP) x Standard Residuals

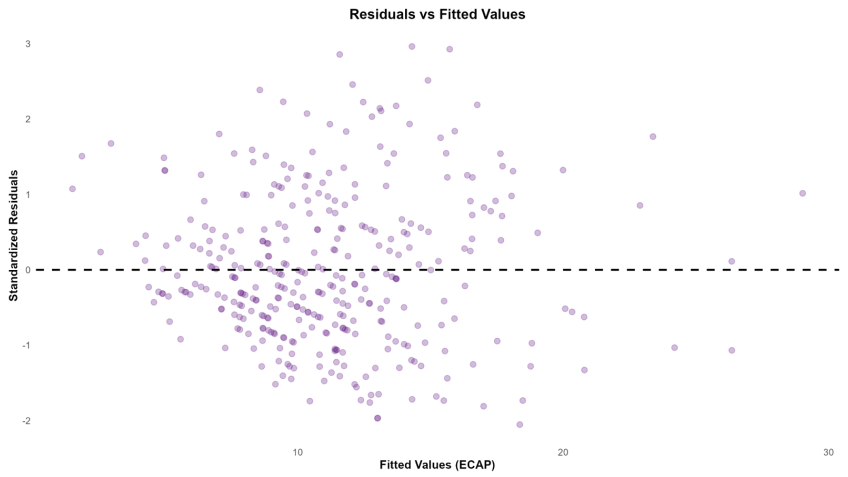
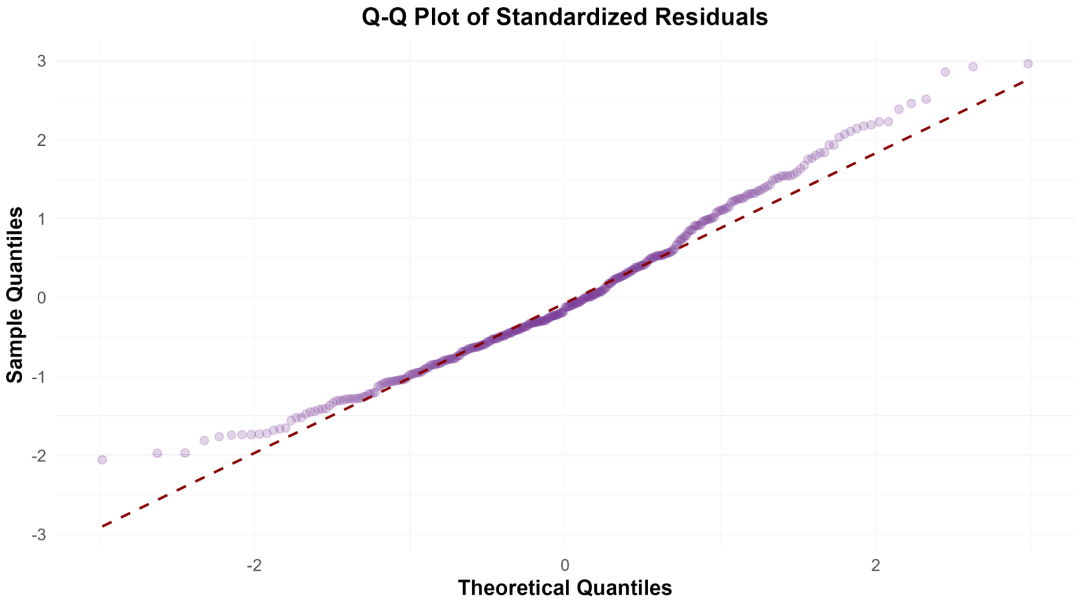


Figure A2

Plot for standardized residuals



Appendix B

Tables

Table B1

Variance Inflation Factor and Degrees of Freedom

Preditor	*GVIF*	*DF*
Age	1.074006	1
Nurturance	1.215703	1
Money	1.079414	1
Meals	1.172676	1
BMI	1.051552	1
Gender	1.156500	1
Physical Activity	1.095059	2
Insufficient Sleep	1.029804	1

Table B2

Robust and Bootstrap Confidence Intervals

Predictor	Robust (p-value)	Bootstrap (p-value)
Intercept	0.052	0.066
Age	0.089	0.084
Nurturance	0.004	0.000
Money	0.486	0.490
Meals	0.534	0.536
BMI	< 2.2e-16	0.000
Gender	7.992e-09	0.000
Moderate physical activity	0.579	0.596
High physical activity	0.959	0.962
Insufficient sleep	0.097	0.080

Table B3

Heckman selection models

Predictor	**Outcome equation estimates**	
	Insufficient sleep group	**Women group**
Age	0.48 (0.422)	-0.18 (0.577)
Meals	3.07 (0.025)	2.28 (0.000)
Money	-0.18 (0.883)	-0.04 (0.941)
Nurturance	0.97 (0.598)	-1.19 (0.190)
BMI	1.21 (0.000)	1.05 (0.000)
Moderate physical activity	-2.16 (0.391)	0.58 (0.554)
High physical activity	0.86 (0.754)	0.83 (0.582)
Gender dummy	10.81 (0.000)	-
Insufficient sleep	-	3.71 (0.004)
ϱ (Error correlation coefficient)	-0.3092 (0.534)	-0.3093 (0.420)