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ORIGINAL ARTICLE

Associations of adult ADHD symptoms with binge eating spectrum conditions, psychiatric and somatic comorbidity, and healthcare utilization

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Objective: To investigate the associations of symptoms of attention deficit hyperactivity disorder (ADHD) with binge eating spectrum conditions (BESC) (binge eating disorder [BED], bulimia nervosa [BN], and recurrent binge eating [RBE]), psychiatric and somatic comorbidity, and healthcare utilization in a representative sample of a Brazilian city.
Methods: A household survey of 2,297 adult residents of the city of Rio de Janeiro was conducted. The Adult Self-Rating Scale Screener (ASRS-6) was used to assess ADHD symptoms. BESC was assessed using the Questionnaire on Eating and Weight Patterns-5 (QEWP-5) and confirmed by telephone interview. Standardized questionnaires were used to assess psychiatric comorbidity. Closed-ended questions investigated somatic comorbidity and healthcare utilization.
Results: ADHD symptoms were highly associated with BESC (BED: OR = 13.2, 95%CI 4.3-40.6; BN: OR = 27.5, 95%CI 5.9-128.7; RBE: OR = 5.8, 95%CI 2.9-11.4). However, with further adjustment for psychiatric comorbidity (depression, anxiety, alcohol use, and impulsivity), the ORs were no longer significant. Healthcare resource utilization was significantly higher in participants with ADHD and BESC but lost significance after controlling for psychiatric comorbidity.
Conclusion: ADHD was associated with an increased prevalence of BESC and greater healthcare utilization. Nonetheless, there was an essential interplay among psychiatric comorbidity in the associations of ADHD and BESC.

Keywords: Attention-deficit/hyperactivity disorder; binge eating; binge eating disorder; bulimia nervosa; healthcare utilization

Introduction

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder conceptualized as a persistent pattern of inattention, disorganization, and hyperactivity-impulsivity that interferes with general functioning or development.[1,2] Though initially considered a disorder that only affects children, it is now recognized that symptoms may persist into adulthood.[3,4] Based on a recent systematic review, the pooled prevalence of symptomatic adult ADHD worldwide was 6.76%, representing 366.33 million cases – a considerable global public health burden.[5] A recent population-based survey in Brazil found an ADHD prevalence of 4.59% using the Adult Self-Rating Scale Screener (ASRS-6).[6] The clinical picture of ADHD changes from childhood to adulthood; with age, hyperactive/impulsive symptoms wane and inattentive symptoms predominate along with signs of executive dysfunction. These changes make recognition difficult. In addition, psychiatric and somatic comorbidities have been associated with adult ADHD, which poses additional diagnostic challenges.[7,8]

Growing evidence suggests a positive association between ADHD and disordered eating, particularly binge-eating spectrum behaviors.[9,10] Kaisari et al.[11] systematically revised the literature on the association of ADHD and eating disorders (ED) and concluded there is moderate/high-strength evidence of the association between ADHD and bulimia nervosa (BN) symptoms, and moderate-strength evidence that ADHD is linked with eating behaviors related to overeating, including binge eating disorder (BED) symptoms.[11] Adults with ADHD are about four times more likely to present with an ED syndrome compared to those without ADHD (odds ratio

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[OR] = 4.09 [2.32-7.20]).[12] It is hypothesized that the interplay between ADHD and ED may involve aspects related to impulsivity[13] and hyper-responsivity to food-related stimuli in reward areas, among other factors.[14]

However, given that ADHD and ED frequently coexist with additional psychopathologies such as mood, anxiety, and substance use disorders, it is crucial to consider comorbidity when examining the relationship between ADHD and binge eating spectrum conditions (BESCs).[15] For instance, Ziobrowski et al.[16] reported that the links between lifetime ADHD and ED in a U.S. community sample were significantly weakened after accounting for demographic factors and psychiatric comorbidities. Although the pathophysiological mechanisms are still unclear, the presence of comorbid ED in subjects with ADHD may impact diagnosis, course of illness, and choice of treatments.[17,18]

The complex interplay between ADHD, nutritional status, and medical disorders has been less explored. Higher levels of body mass index (BMI) (kg/m^2) have been consistently reported in association with ADHD.[19] A meta-analysis reported that obesity was more prevalent in adults with ADHD (28.2%, 95%CI 22.8-34.4) than in those without ADHD (16.4%, 95%CI 13.4-19.9), and in children with ADHD (10.3%, 95%CI 7.9-13.3) compared with those without ADHD (7.4%, 95%CI 5.4-10.1).[20] ADHD was also significantly associated with overweight. Li et al.[21] found the pooled prevalences of obesity and overweight in subjects with ADHD to be 19.3 and 31.2%, respectively – significantly higher than in those without ADHD.[21] As BESCs have been associated with higher BMIs, it is essential to investigate the impact of ED symptoms in people with this comorbidity. DeZwann et al.,[22] assessing a representative community sample in Germany, reported that having adult ADHD significantly increased the odds of an individual being obese. This relationship was still significant after controlling for confounders such as socioeconomic status, depression, and anxiety symptoms or purging behavior. Notably, in this study, after controlling for the presence of binge eating, the likelihood of the association between obesity and adult ADHD decreased somewhat but remained significant, suggesting that binge eating behavior only partly explains this association. Beyond overweight/obesity, a systematic review reported an association between adult ADHD and increased risk of other medical conditions such as asthma, sleep disorders, migraine, and celiac disease. Less robust associations have been reported for other disorders, such as irritable bowel syndrome, chronic fatigue syndrome, fibromyalgia, and diseases of the circulatory system, among others.[8]

Another under-studied area in subjects with adult ADHD is healthcare utilization. A cohort study using the Swedish Total Population Register investigated individuals newly diagnosed with ADHD between the ages of 30-45 years and individuals without ADHD matched by birthdate, birth county, and sex.[23] Adults with newly diagnosed ADHD showed higher levels of healthcare utilization for psychiatric and somatic comorbidities relative to adults without ADHD. However, there is a lack of information about the impact of the associations of multimorbidity (multiple co-occurring chronic diseases)[24] with adult ADHD and use of healthcare services.

To address the limitations of prior work, this study aimed to investigate the associations between symptoms of ADHD with BESCs (BED, BN, and recurrent binge eating [RBE]), psychiatric and somatic comorbidity, and healthcare utilization in a representative sample of a metropolitan Brazilian city. We hypothesized that individuals with ADHD would have higher rates of BESC (BED, BN, and RBE) and healthcare utilization compared to those in the general population, but that this association would be modulated by the presence of somatic and medical comorbid conditions.

Methods

Study design

This study was part of a broader investigation into binge eating and related factors within the general population of Rio de Janeiro, Brazil, a major city in a middle-income country.[25] The research employed an in-person household survey method, utilizing a stratified and clustered probability sampling approach conducted in three stages: selection of census enumeration areas, households, and eligible adults. Participants were randomly selected from households containing more than one individual within the specified age range. The sampling framework was based on data from the Brazilian Demographic Census conducted by Instituto Brasileiro de Geografia e Estatística (IBGE).[26]

The sample included adults aged 18-60 years; pregnant and breastfeeding women were excluded.

Procedures

After selecting the sample, interviewers contacted each chosen household and invited them to participate in a survey concerning eating behaviors and mental health. Data collection took place between September 2019 and February 2020. Out of 2,985 eligible households, 688 declined, resulting in a participation rate of 77%. A total of 2,297 individuals participated in the study. Trained interviewers administered a research questionnaire on tablets and measured participants' height and weight.

Demographics

The following sociodemographic characteristics were collected: sex, age, and self-defined race/ethnicity.

Attention deficit hyperactivity disorder symptoms

The new version of the ASRS-6 was used for this epidemiological sample.[27] Response categories were never, rarely, sometimes, often, and very often. The never response option scored 0 for all questions; the highest scores were 5 for questions 1 and 2, 4 for question 5, 3 for question 6, and 2 for question 4, resulting in a summary scale with scores ranging from 0 to 24. The optimal threshold was 14 or higher, with sensitivity above

90% and few false-positive results. In our sample, as reported previously,[6] individuals were grouped into scores ranging from 14 to 24 (ADHD-positive) and those with scores equal to or lower than 13 (ADHD-negative).

Body mass index

Weight was measured on a digital scale (Plenna®, São Paulo, Brazil), and height was measured using a portable stadiometer (model 206; Seca®, Hamburg, Germany). Participants were weighed and measured barefoot, wearing light clothing, with arms hanging alongside the body. BMI was calculated as weight (kg)/height^2 (m^2) and was categorized according to the World Health Organization (WHO) cutoffs (underweight: < 18.5; healthy weight: 18.5-24.9; overweight: 25-29.9; obesity: $\geqslant 30$).

Psychiatric comorbidity

The Brazilian version of the Patient Health Questionnaire (PHQ-9) was used for self-reported depressive symptoms.[28] Significant depressive symptomatology was defined by a PHQ-9 score of 10 or higher.[29] For anxiety screening, the General Anxiety Disorder-7 (GAD-7) questionnaire, validated for use in Brazil, was used.[30] A cutoff of 8 or more defined significant anxiety symptomatology. Alcohol-related problems were assessed using the Brazilian version of the Alcohol Use Disorders Identification Test (AUDIT),[31] with alcohol use defined by a cutoff point higher than 8. Impulsivity was assessed using a single dichotomous question that was previously used in an epidemiological study of this trait in the general population: "Most of the time throughout your life, regardless of the situation or whom you were with, have you often done things impulsively?"[32]

Somatic comorbidities

Information about chronic diseases and other injuries was obtained through the following question, adapted from the Brazilian National Health Survey[33]: "Has any doctor ever given you a diagnosis of (disease X)?" We collected data related to arterial hypertension, diabetes mellitus, heart disease, asthma, arthritis, work-related musculoskeletal diseases (WRMSDs), spine problems (e.g., chronic back or neck pain, lumbago, sciatic pain, vertebra, or "disc trouble"), migraine, chronic muscle pain, fibromyalgia, and gastrointestinal syndromes (gastroesophageal reflux disease and irritable bowel syndrome). Multimorbidity (multiple co-occurring chronic diseases) was estimated by the sum of medical comorbidities and was categorized as 0, 1, 2, and 3 or more.[24]

Binge eating spectrum conditions

In the first stage of the survey, 2,297 participants completed the Questionnaire on Eating and Weight Patterns-5 (QEWP-5) for BED, BN, and RBE screening. The QEWP-5 is a self-report instrument developed to screen for BED and BN according to DSM-5 criteria.[34] The Brazilian version of the questionnaire was validated in a sample from the general population and showed satisfactory psychometric properties.[35] For this study's purposes, RBE was identified when individuals reported objective binge eating episodes at least once a week in the last 3 months but did not meet full criteria for BED (i.e., at least three of five binge-eating-associated features and marked distress regarding the episode).[36] In the second stage, all screen-positive cases were interviewed by telephone by two PhD students experienced in ED assessment to confirm BED and BN diagnoses. The interviews were conducted using the ED section of the structured clinical interview for DSM-IV (SCID-P),[37] adapted to DSM-5 criteria (American Psychiatric Association[1]). All interviews were reviewed by a senior psychiatrist (JCA) who was experienced in the field of ED and had not seen the QEWP-5 answers.

Healthcare utilization

Data on health services utilization – outpatient consultations, contact with emergency rooms, hospital admissions, and medication use – were collected. We used questions extracted from the National Health Survey[33] that seek to capture different patterns of inequality between types of services: medical consultations (general practitioner or mental health professional), hospitalizations, and reports of the usual source of care, the latter being used as a proxy for continuity of care. The following questions were used: 1) Medical consultations – "Have you consulted a doctor in the last 12 months?"; "How many times have you consulted a doctor in the last 12 months?"; 2) Contact with emergency units – "Have you attended an emergency unit in the last 12 months?"; "How many times have you attended an emergency unit in the last 12 months?"; 3) Hospital admissions – "Have you been admitted to the hospital in the last 12 months?"; "How many times have you been admitted to the hospital in the last 12 months?"; and "Do you normally use the same health service or doctor when you need care?"

Statistical analysis

All statistical analyses were performed considering weights and the complex survey design through Proc Survey procedures in the Statistical Analysis System (SAS), release 9.5 (SAS, 2003). The weighted prevalence (%) of ADHD and 95%CIs were computed. Differences in means were estimated using the PROC SURVEYMEANS procedure. For comparisons of frequencies, the SUR VEYFREQ and Wald chi-square test were used. Logistic regression models estimated the OR of ADHD with BESC, morbidity, and health care utilization, with and without adjustment for confounding. The alpha level was defined as 0.05 across all analyses.

Ethics statement

The research ethics committee of Instituto de Psiquiatria, Universidade Federal do Rio de Janeiro, approved the study protocol. All study participants provided written informed consent.

Results

The sample consisted of 2,297 participants, of whom 101 (4.59%) endorsed symptoms of ADHD according to the ASRS-6 questionnaire. Overall, ADHD symptoms were significantly more frequent in females and individuals of younger age. Subjects with ADHD symptoms displayed significantly higher rates of obesity according to BMI (38.7%, 95%CI 24.9-52.6) compared to their counterparts (27.6%, 95%CI 24.8-30.3). In addition, those subjects with symptoms of ADHD had a significantly higher prevalence of psychiatric comorbidities, such as symptoms of depression, anxiety, alcohol use, and general impulsivity (Table 1).

Those with ADHD symptoms reported higher frequencies of heart disease, asthma, spine problems, migraine, chronic muscle pain, fibromyalgia, gastroesophageal reflux, and irritable bowel syndrome (Table 3). Furthermore, considering the occurrence of multimorbidity (defined as the number of clinical comorbidities varying from 0 to 3 or more), a significantly higher percentage of individuals with ADHD symptoms (34.8%, 95%CI 23.5-46.1) (12.8%, 95%CI 5.7-23.5) had three or more comorbid somatic conditions.

Table 1 Weighted frequencies of demographic characteristics and comorbidities stratified by ADHD status

Characteristics	ADHD (n=101)		Non-ADHD (n=2,196)		p-value[†]
Gender					
Male	**22 (30.4)**	**15.9-44.9**	**868 (49.1)**	**46.2-51.9**	**0.02**
Female	**79 (69.6)**	**55.1-84.1**	**1,328 (50.9)**	**48.0-53.8**	
Ethnicity					
White	34 (27.2)	14.5-39.8	874 (37.8)	34.4-41.2	0.24
Black	21 (25.7)	12.5-38.9	381 (19.1)	16.7-21.6	
Mixed[‡]	46 (47.1)	33.5-60.6	941 (43.1)	40.1-46.0	
Age, years					
18-30	**34 (48.4)**	**34.1-62.7**	**533 (31.5)**	**27.4-35.6**	**0.04**
31-45	**35 (29.1)**	**17.4-40.8**	**766 (36.8)**	**33.2-40.4**	
46-60	**32 (22.5)**	**13.1-31.9**	**897 (31.7)**	**29.1-34.2**	
Depression					
Yes	**68 (61.2)**	**46.3-76.1**	**211 (8.7)**	**6.6-10.8**	**< 0.0001**
No	**33 (38.8)**	**23.9-53.7**	**1,985 (91.3)**	**89.2-93.3**	
Anxiety					
Yes	**66 (60.2)**	**47.2-73.3**	**227 (9.5)**	**7.3-11.6**	**< 0.0001**
No	**35 (39.8)**	**26.7-52.8**	**1,969 (90.5)**	**88.4-92.7**	
Alcohol use					
Yes	**24 (26.7)**	**17.5-36.0**	**137 (6.1)**	**4.5-7.7**	**< 0.0001**
No	**77 (73.3)**	**64.0-82.5**	**2,059 (93.9)**	**92.3-95.4**	
Impulsivity					
Yes	**80 (82.7)**	**73.8-91.5**	**968 (41.0)**	**36.0-46.1**	**< 0.0001**
No	**21 (17.3)**	**8.5-26.2**	**1,228 (59.0)**	**53.9-64.0**	
BED					
Yes	**12 (11.2)**	**3.9-18.5**	**17 (0.9)**	**0.2-1.7**	**< 0.0001**
No	**89 (88.8)**	**81.5-96.1**	**2,179 (99.1)**	**98.3-99.8**	
BM					
Yes	**8 (8.8)**	**0.0-18.4**	**9 (0.3)**	**0.1-0.7**	**< 0.0001**
No	**93 (91.2)**	**81.6-100.0**	**2,187 (99.7)**	**99.3-99.9**	
Recurrent BE					
Yes	**17 (17.1)**	**8.1-26.0**	**73 (3.4)**	**2.4-4.4**	**< 0.0001**
No	**84 (82.9)**	**74.0-91.1**	**2,123 (96.6)**	**95.6-97.5**	
BMI = x[§]					
Underweight	**8 (8.4)**	**0.0-17.4**	**54 (3.5)**	**2.0-4.9**	**0.02**
Normal weight	**28 (34.5)**	**23.0-46.1**	**657 (31.5)**	**28.3-34.8**	
Overweight	**23 (18.3)**	**10.2-26.3**	**801 (37.4)**	**34.4-40.5**	
Obesity	**41 (38.7)**	**24.9-52.6**	**568 (27.6)**	**24.8-30.3**	

Data presented as n (%) and 95%CI.
Bold type denotes statistical significance.
ADHD = attention deficit hyperactivity disorder; BE = binge eating; BED = binge eating disorder; BMI = body mass index; BN = bulimia nervosa.
[†] Wald chi-square test.
[‡] Brown, yellow, and indigenous.
[§] Weight (kg)/height (m^2).

Binge eating spectrum conditions

Participants with ADHD displayed significantly higher rates of all categories of BESCs (Table 1). ADHD symptoms were significantly and strongly associated with BED (OR: 13.2, 95%CI 4.3-40.6), BN (OR: 27.5, 95%CI 5.9-128.7), and RBE (OR: 5.8, 95%CI 2.9-11.4) (Table 3). The associations between ADHD symptoms and BESC were still significant after controlling for BMI status and the presence of somatic comorbidity. However, they lost significance when adjusted for psychiatric comorbidities (depression, anxiety, alcohol use, and impulsivity) (Table 3).

Healthcare utilization

Overall, healthcare utilization was higher in participants with ADHD symptoms compared to those without ADHD. The former reported significantly more emergency unit attendances (50.5%, 95%CI 39.0-62.0) and hospitalizations (9.6%, 95%CI 3.6-15.5) compared to the latter (27.2%, 95%CI 24.0-30.4 and 4.4%, 95%CI 3.4-5.4, respectively) (Table 3). Those participants with symptoms of ADHD and BESC displayed significantly higher rates of all forms of health care utilization such as medical consultations, emergency unit attendance, and hospitalizations. Of note, the significance of emergency unit attendance and hospitalizations persisted even after adjustment for somatic multimorbidity. Nevertheless, all aspects of healthcare utilization of participants with ADHD symptoms associated with BESCs lost significance after controlling for psychiatric comorbidity (Table 4).

Discussion

This is the first study to explore the relationship of symptoms of ADHD in adults with BESC, psychiatric/

Table 2 Weighted frequencies of somatic comorbidities and health services utilization according to ADHD status

Variables	ADHD (n=101)		Non-ADHD (n=2,196)		p-value[†]
Clinical comorbidities					
Arterial hypertension	30 (22.7)	13.9-31.6	497 (19.6)	17.4-21.9	0.47
Heart disease	**14** (9.3)	3.3-15.4	112 (4.7)	**3.8-5.6**	**0.04**
Diabetes	13 (8.7)	3.1-14.3	159 (6.1)	4.4-7.8	0.31
Asthma	**14 (14.9)**	**3.7-26.1**	**162 (6.7)**	**5.3-8.1**	**0.03**
Arthritis	8 (8.3)	1.5-15.0	121 (4.1)	3.1-5.0	0.07
WRMSDs	7 (5.9)	1.49-10.2	63 (2.9)	1.8-4.0	0.08
Spine problems[‡]	**37** (34.0)	22.4-45.6	381 (16.0)	13.1-19.0	**0.0002**
Migraine	**31** (29.3)	17.9-40.6	278 (11.3)	9.6-13.0	< **0.0001**
Chronic muscle pain	**39** (33.8)	22.3-45.3	347 (14.5)	12.3-16.8	< **0.0001**
Fibromyalgia	**5** (5.1)	0.0-10.5	19 (0.7)	0.2-1.3	**0.0007**
Gastroesophageal reflux	**17** (14.3)	7.4-21.2	88 (3.4)	2.3-4.4	< **0.0001**
Irritable bowel syndrome	**4** (3.2)	0.0-6.6	19 (0.9)	0.3-1.6	**0.04**
Multimorbidity[§]					
0	**31 (37.5)**	**22.1-52.8**	**1,098 (54.5)**	**50.8-58.3**	**0.0002**
1	**19 (17.7)**	**6.9-28.3**	**490 (21.2)**	**18.4-24.0**	
2	**9 (10.0)**	**2.3-17.8**	**276 (11.5)**	**9.5-13.6**	
3 or more	**41 (34.8)**	**23.5-46.1**	**316 (12.8)**	**5.7-23.5**	
Health services utilization					
Medical consultation	76 (72.6)	61.4-83.8	1,508 (66.6)	63.2-69.9	0.30
Emergency unit attendance	**51 (50.5)**	**39.0-62.0**	**601 (27.2)**	**24.0-30.4**	< **0.0001**
Hospitalization	**10 (9.6)**	**3.6-15.5**	**103 (4.4)**	**3.4-5.4**	**0.02**

Data presented as n (%) and 95%CI.
Bold type denotes statistical significance.
ADHD = attention deficit hyperactivity disorder; WRMSDs = work-related musculoskeletal disorders.
[†] Wald chi-square test.
[‡] Chronic back or neck pain, lumbago, sciatic pain, vertebra, or disc trouble.
[§] Clinical comorbidities.

Table 3 OR of the association of ADHD status and BESC, adjusted for BMI, multimorbidity, and psychiatric comorbidities

BESC	Model 1 Unadjusted		Model 2 Adjusted for BMI		Model 3 Adjusted for multimorbidity[†]		Model 4 Adjusted for psychiatric comorbidities[‡]	
BED	13.2*	4.3-40.6	16.5*	4.6-59.4	7.7*	2.2-26.5	1.9	0.4-10.1
BN	27.5*	5.9-128.7	29.3*	6.8-125.6	24.4*	4.6-129.4	3.8	0.8-18.6
Recurrent BE	5.8*	2.9-11.4	5.9*	2.9-12.1	5.5*	2.7-11.0	3.1	1.0-9.4

Data presented as OR and 95%CI.
Wald chi-square test: OR, CI.
ADHD = attention deficit hyperactivity disorder; BE = binge eating; BED = binge eating disorder; BESC = binge eating spectrum conditions; BN = bulimia nervosa; OR = odds ratio.
[†] Number of clinical comorbidities (varying from 0 to 3 or more).
[‡] Depression, anxiety, alcohol use, impulsivity.
* $p < 0.05$.

Table 4 OR of the association of ADHD status and BESC with health services utilization, adjusted for multimorbidity and psychiatric comorbidities

Health services use	Model 1 Unadjusted		Model 2 Adjusted for multimorbidity†		Model 3 Adjusted for psychiatric comorbidities‡	
Medical consultations	3.3*	1.1-10.3	2.6	0.8-8.6	2.3	0.8-6.9
Emergency unit attendance	3.6*	1.5-8.5	3.0*	1.7-7.5	2.1	0.9-5.1
Hospitalization	4.2*	1.4-12.8	3.2*	1.1-9.4	3.1	0.8-11.9

Data presented as OR and 95%CI.
Wald chi-square test: OR, CI.
ADHD = attention deficit hyperactivity disorder; BESC = binge eating spectrum conditions; OR = odds ratio.
† Number of clinical comorbidities (varying from 0 to 3 or more).
‡ Depression, anxiety, alcohol use, impulsivity.
* $p < 0.05$.

somatic comorbidity, and healthcare utilization in a representative sample of a middle-income country. Our findings suggest that adults with ADHD symptoms have a significantly higher rate of BESCs (BED, BN, and RBE). However, this association was explained by the presence of psychiatric comorbidities. In addition to that, individuals with ADHD symptoms and BESC reported significantly higher rates of healthcare resource utilization, but again, after adjusting for psychiatric comorbidity, the previously observed association lost statistical significance.

As previously reported by Mattos et al.,[6] we found that 4.59% (101/2,297) of our sample had symptoms of ADHD according to ASRS-6. Those with ADHD symptoms displayed more psychiatric symptoms (depression, anxiety, alcohol use) and general impulsivity. We also found higher rates of comorbid somatic conditions and increased healthcare resource utilization among individuals with ADHD symptoms. This might be due to the cumulative effect of both conditions on overall health.[8] It is possible that the chronic stressors associated with ADHD, coupled with the physical health implications of BESC, create a synergistic impact, leading to a higher prevalence of medical comorbidities.[38] This, in turn, may drive individuals with ADHD symptoms to seek healthcare more frequently.[23] Additionally, the presence of psychiatric comorbidities could further amplify healthcare needs, as individuals may require comprehensive and integrated treatment approaches addressing both mental and physical health concerns.[39,40] Another hypothesis is that, due to their symptoms, people with ADHD may be less likely than non-ADHD peers to adhere to medical regimens, which would further worsen their health.[41]

Previous research has also observed a higher prevalence of BED and related conditions among individuals with ADHD.[42,43] This is consistent with systematic reviews[11,12] suggesting moderate-strength evidence that ADHD is positively associated with specific types of disordered eating behaviors characterized by overeating, such as BED/BED symptoms or BN/BN symptoms. However, the authors noted that there was little information regarding direct and indirect factors influencing those associations. Thus, it would be crucial to analyze the impact of other factors usually associated with these disordered eating behaviors, such as BMI[44] and somatic and psychiatric comorbidity.[45] In our study, after controlling for BMI and somatic clinical conditions, the associations between ADHD symptoms and BESC were still significant. However, the associations were no longer significant when we controlled for BMI and psychiatric comorbid conditions. That co-occurrence of BMI and psychiatric comorbidities influences this association echoes findings from similar studies, emphasizing the complex interplay between ADHD and mental health conditions.[46] These collective findings contribute to a growing body of evidence supporting the need for comprehensive assessment and tailored interventions for individuals with ADHD and concurrent mental health concerns.[8,11]

In contrast to our findings, some research contests the relationship between ADHD symptoms and BESC, offering alternative explanations or attributing the association to demographic or cultural factors.[47,48] Other studies challenged the purported impact of psychiatric comorbidity on this relationship, suggesting that the association between ADHD symptoms and BED is direct and independent of other factors.[13,49] Discrepancies in findings across studies may arise due to variations in sample characteristics, methodologies, or cultural factors, emphasizing the need for ongoing research to refine our understanding of the complex interrelationships between ADHD, BESC, and associated comorbidities.

Several hypotheses should be considered to explain our findings about the relationship between ADHD symptoms and BESC, psychiatric/somatic comorbidity, and healthcare utilization. Some authors[9] have previously suggested hypotheses that are not mutually exclusive: 1) inattention and/or impulsivity, as well as emotional dysregulation, increase vulnerability to binge eating; 2) ADHD and binge eating share common neurobiological bases; 3) binge eating contributes to ADHD; or 4) psychopathological factors common to both binge eating and ADHD mediate the association. In addition, the co-occurrence of psychiatric comorbidities might act as an additional factor, exacerbating the severity of both ADHD symptoms and BESCs.[8]

Our study highlights the importance of comprehensive assessments and integrated interventions for individuals presenting with symptoms of both ADHD and BESCs,[17] especially in middle-income countries, where such relationships have been less explored.[25] Clinicians should be aware of the potential impact of psychiatric comorbidity, recognizing its role in modeling the manifestation and severity of both ADHD symptoms and eating-disordered behaviors.[11] Customized treatment approaches

addressing both mental health and eating behaviors can play a fundamental role in improving outcomes for this population.[50] Of note, there is a growing body of evidence suggesting that executive functions are impaired in both ADHD[51] and binge eating.[52] Thus, this interface may open promising perspectives for the future and have important implications for treatment. For example, treatment for ADHD can focus on building skills that address executive functioning and help organizing a structure around meals, meal planning and, consequently, controlling binge eating behavior. Additionally, the heightened healthcare utilization and increased medical comorbidities observed among individuals with ADHD symptoms and BESCs demonstrate the need for an interdisciplinary approach to care, involving collaboration between mental health and medical professionals to address the varied healthcare needs of these individuals and reduce the burden of this association.[23]

Longitudinal studies are warranted to elucidate the temporal trends of the relationship between ADHD symptoms and BESC, as well as the impact of psychiatric comorbidities. Exploring cultural and socioeconomic factors that may influence these relationships in different cultures would also contribute to a more balanced understanding. Future interventional studies, considering the challenges posed by coexisting ADHD and BESCs, could lead to the development of targeted management approaches. Furthermore, research focusing on healthcare system adaptations to deal with the specific needs of those individuals would be crucial for informing policymakers and improving patient outcomes.

This study's strength lies in its use of internationally validated screening instruments for ADHD symptoms, BESCs, and psychiatric comorbidity; its large, representative, general-population sample; trained interviewers; and data weighting.[25] However, certain limitations should be considered. Although the ASRS-6 has good psychometric properties, it identifies only symptomatic ADHD, potentially resulting in an overestimation of ADHD prevalence, since other DSM-5 criteria – particularly age at onset and impairment – are not taken into consideration. Although relying on self-reports instead of clinical interviews with informants (a common practice in epidemiological surveys) constrains our ability to ensure that reported ADHD symptoms stem from ADHD rather than other conditions, overestimation seems unlikely, given that the prevalence in our sample (4.6%) is consistent with a meta-analysis of population studies.[53] The same holds true for psychiatric symptoms that may mimic ADHD. Additionally, incorporating two questions addressing medical comorbidity introduces a potential recall bias that may lead to underestimating prevalence rates.

In summary, our results uncover a previously overlooked connection between ADHD symptoms and an increased occurrence of BESCs (including BED and BN as well as RBE episodes) in this population. Importantly, this association seems to be influenced by the presence of psychiatric comorbidities (depression, anxiety, alcohol use, and impulsivity), highlighting the importance of understanding how mental health conditions interact directly or indirectly with disordered eating behaviors. Furthermore, the observed increase in medical comorbidities and healthcare utilization among individuals with ADHD symptoms underscores the extended healthcare needs of this group. These findings stress the importance of healthcare strategies that address both mental and physical health aspects for individuals dealing with ADHD symptoms and disordered eating behaviors. Additionally, the study underscores the need for future investigations, interventions, and healthcare policies designed to tackle the challenges posed by this intricate relationship, particularly in middle-income countries, where such inquiries are notably limited.

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References

1 American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision (DSM-IV-TR). Arlington: American Psychiatric Publishing; 2022.
2 Faraone SV, Bellgrove MA, Brikell I, Cortese S, Hartman CA, Hollis C, et al. Attention-deficit/hyperactivity disorder. Nat Rev Dis Primers. 2024;10:11.
3 Johnson J, Morris S, George S. Attention deficit hyperactivity disorder in adults: what the non-specialist needs to know. Br J Hosp Med (Lond). 2020;81:1-11.
4 Faraone SV, Biederman J, Mick E. The age-dependent decline of attention deficit hyperactivity disorder: a meta-analysis of follow-up studies. Psychol Med. 2006;36:159-65.
5 Song P, Zha M, Yang Q, Zhang Y, Li X, Rudan I. The prevalence of adult attention-deficit hyperactivity disorder: a global systematic review and meta-analysis. J Glob Health. 2021;11:04009.
6 Mattos P, de Moraes CEF, Sichieri R, Hay P, Faraone SV, Appolinario JC. Adult ADHD symptoms in a large metropolitan area from Brazil: prevalence and associations with psychiatric comorbidity, bullying, sexual abuse, and quality of life. J Atten Disord. 2024;28:1082-91.
7 Williams OC, Prasad S, McCrary A, Jordan E, Sachdeva V, Deva S, et al. Adult attention de fi cit hyperactivity disorder: a comprehensive review. Ann Med Surg (Lond). 2023;85:1802-10.
8 Instanes JT, Klungsøyr K, Halmøy A, Fasmer OB, Haavik J. Adult ADHD and comorbid somatic disease: a systematic literature review. J Atten Disord. 2018;22:203-28.
9 Cortese S, Bernardina BD, Mouren M. Attention-deficit/hyperactivity disorder (ADHD) and binge eating. Nutr Rev. 2007;65:404-11.
10 Ravi P, Khan S. Attention deficit hyperactivity disorder: association with obesity and eating disorders. Cureus. 2020;12:e12085.
11 Kaisari P, Dourish CT, Higgs S. Attention deficit hyperactivity disorder (ADHD) and disordered eating behaviour: a systematic review and a framework for future research. Clin Psychol Rev. 2017;53:109-21.
12 Nazar BP, Bernardes C, Peachey G, Sergeant J, Mattos P, Treasure J. The risk of eating disorders comorbid with attention-deficit/hyperactivity disorder: a systematic review and meta-analysis. Int J Eat Disord. 2016;49:1045-57.
13 Ryan D, Sadek J. Risk and adversity factors in adult patients with comorbid attention deficit hyperactivity disorder (ADHD), binge eating disorder (BED), and borderline personality disorder (BPD): a naturalistic exploratory study. Brain Sci. 2023;13:669.
14 Kessler RM, Hutson PH, Herman BK, Potenza MN. The neurobiological basis of binge-eating disorder. Neurosci Biobehav Rev. 2016;63:223-38.
15 Katzman MA, Bilkey TS, Chokka PR, Fallu A, Klassen LJ. Adult ADHD and comorbid disorders: clinical implications of a dimensional approach. BMC Psychiatry. 2017;17:302.
16 Ziobrowski H, Brewerton TD, Duncan AE. Associations between ADHD and eating disorders in relation to comorbid psychiatric disorders in a nationally representative sample. Psychiatry Res. 2018; 260:53-9.
17 Svedlund NE, Norring C, Ginsberg Y, von Hausswolff-Juhlin Y. Are treatment results for eating disorders affected by ADHD symptoms? A one-year follow-up of adult females. Eur Eat Disord Rev. 2018;26:337-45.
18 Svedlund NE, Norring C, Ginsberg Y, von Hausswolff-Juhlin Y. Are attention deficit hyperactivity disorder symptoms stable irrespective of recovery from eating disorders? A 1-year follow-up of adult females. Eur Eat Disord Rev. 2021;29:133-43.
19 Brunault P, Frammery J, Montaudon P, De Luca A, Hankard R, Ducluzeau PH, et al. Adulthood and childhood ADHD in patients consulting for obesity is associated with food addiction and binge eating, but not sleep apnea syndrome. Appetite. 2019;136:25-32.
20 Cortese S, Moreira-Maia CR, St Fleur D, Morcillo-Peñalver C, Rohde LA, Faraone SV. Association between ADHD and obesity: a systematic review and meta-analysis. Am J Psychiatry. 2016;173:34-43.
21 Li YJ, Xie XN, Lei X, Li YM, Lei X. Global prevalence of obesity, overweight and underweight in children, adolescents and adults with autism spectrum disorder, attention-deficit hyperactivity disorder: a systematic review and meta-analysis. Obes Rev. 2020;21:e13123.
22 De Zwaan M, Gruß B, Müller A, Philipsen A, Graap H, Martin A, et al. Association between obesity and adult attention-deficit/hyperactivity disorder in a German community-based sample. Obes Facts. 2011; 4:204-11.
23 Garcia-Argibay M, Pandya E, Ahnemark E, Werner-Kiechle T, Andersson LM, Larsson H, et al. Healthcare utilization and costs of psychiatric and somatic comorbidities associated with newly diagnosed adult ADHD. Acta Psychiatr Scand. 2021;144:50-9.
24 van den Akker M, Buntinx F, Knottnerus JA. Comorbidity or multimorbidity. Eur J Gen Pract. 1996;2:65-70.
25 Appolinario JC, Sichieri R, Lopes CS, Moraes CE, da Veiga GV, Freitas S, et al. Correlates and impact of DSM-5 binge eating disorder, bulimia nervosa and recurrent binge eating: a representative population survey in a middle-income country. Soc Psychiatry Psychiatr Epidemiol. 2022;57:1491-503.
26 Gov.br. Instituto Brasileiro de Geografia e Estatística [Internet]. Population census. [cited 2024 Aug 14]. https://www.ibge.gov.br/en/statistics/social/labor/18391-2010-population-census.html?lang=en-GB
27 Ustun B, Adler LA, Rudin C, Faraone SV, Spencer TJ, Berglund P, et al. The world health organization adult attention-deficit/hyperactivity disorder self-report screening scale for DSM-5. JAMA Psychiatry. 2017;74:520-7.
28 Fraguas R Jr, Henriques SG Jr, De Lucia MS, Iosifescu DV, Schwartz FH, Menezes PR, et al. The detection of depression in medical setting: a study with PRIME-MD. J Affect Disord. 2006;91:11-7.
29 Kroencke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001;16:606-13.
30 Moreno AL, De Sousa DA, De Souza AMFLP, Manfro GG, Salum GA, Koller SH, et al. Factor structure, reliability, and item parameters of the Brazilian-Portuguese version of the GAD-7 questionnaire. Temas Psicol. 2016;24:367-76.
31 Lima CT, Freire ACC, Silva APB, Teixeira RM, Farrell M, Prince M. Concurrent and construct validity of the audit in an urban Brazillian sample. Alcohol Alcohol. 2005;40:584-9.
32 Chamorro J, Bernardi S, Potenza MN, Grant JE, Marsh R, Wang S, et al. Impulsivity in the general population: a national study. J Psychiatr Res. 2012;46:994-1001.
33 Instituto Brasileiro de Geografia e Estatística (IBGE). Pesquisa nacional de saúde [Internet]. 2003 [cited 2017 Feb 1]. www.ibge.gov.br/busca.html?searchword=pesquisa+nacional+de+sa%C3%BAde
34 Yanovski SZ, Marcus MD, Wadden TA, Walsh BT. The Questionnaire On Eating And Weight Patterns-5: an updated screening instrument for binge eating disorder. Int J Eat Disord. 2015;48: 259-61.
35 de Moraes CEF, Appolinário JC, Mourilhe C, de Freitas SR, da Veiga GV. Reliability of the Brazilian version of the questionnaire on eating and weight patterns-5 (QEWP-5). Eat Weight Disord. 2021;26: 2463-70.
36 Munsch S, Becker E, Meyer A, Schneider S, Margraf J. Recurrent binge eating (RBE) and its characteristics in a sample of young women in Germany. Eur Eat Disord Rev. 2007;15:385-99.
37 First MB, Spitzer RL, Gibbon M, Williams JBW. The structured clinical interview for DSM-IV Axis I disorders: patient edition. New York: Biometrics Research; 1995.
38 da Luz FQ, Hay P, Touyz S, Sainsbury A. Obesity with comorbid eating disorders: associated health risks and treatment approaches. Nutrients. 2018;10:829.

39 Hay P, Palavras MA, da Luz FQ, dos Anjos Garnes S, Sainsbury A, Touyz S, et al. Physical and mental health outcomes of an integrated cognitive behavioural and weight management therapy for people with an eating disorder characterized by binge eating and a high body mass index: a randomized controlled trial. BMC Psychiatry. 2022; 22:355.
40 Stickley A, Koyanagi A, Takahashi H, Ruchkin V, Inoue Y, Kamio Y. Attention-deficit/hyperactivity disorder and physical multimorbidity: a population-based study. Eur Psychiatry. 2017;45: 227-34.
41 Dehnavi AZ, Zhang-James Y, Draytsel D, Carguello B, Faraone SV, Weinstock RS. Association of ADHD symptoms with type 2 diabetes and cardiovascular comorbidities in adults receiving outpatient diabetes care. J Clin Transl Endocrinol. 2023;32:100318.
42 Brewerton TD, Duncan AE. Associations between attention deficit hyperactivity disorder and eating disorders by gender: results from the National Comorbidity Survey Replication. Eur Eat Disord Rev. 2016;24:536-40.
43 Bleck J, DeBate RD. Exploring the co-morbidity of attention-deficit/ hyperactivity disorder with eating disorders and disordered eating behaviors in a nationally representative community-based sample. Eat Behav. 2013;14:390-3.
44 Fuemmeler BF, Østbye T, Yang C, McClernon FJ, Kollins SH. Association between attention-deficit/hyperactivity disorder symptoms and obesity and hypertension in early adulthood: a population-based study. Int J Obes (Lond). 2011;35:852-62.
45 Yao S, Kuja-Halkola R, Martin J, Lu Y, Lichtenstein P, Norring C, et al. Associations between attention-deficit/hyperactivity disorder and various eating disorders: a Swedish nationwide population study using multiple genetically informative approaches. Biol Psychiatry. 2019;86:577-86.
46 Jacob L, Haro JM, Koyanagi A. Attention deficit hyperactivity disorder symptoms and disordered eating in the English general population. Int J Eat Disord. 2018;51:942-52.
47 Davis C, Patte K, Levitan RD, Carter J, Kaplan AS, Zai C, et al. A psycho-genetic study of associations between the symptoms of binge eating disorder and those of attention deficit (hyperactivity) disorder. J Psychiatr Res. 2009;43:687-96.
48 Zwennes CTC, Loth CA. "Moments of Failure": coping with attention deficit hyperactivity disorder, sleep deprivation, and being overweight: a qualitative hermeneutic-phenomenological investigation into participant perspectives. J Addict Nurs. 2019;30:185-92.
49 Inoue Y, Howard AG, Stickley A, Yazawa A, Gordon-Larsen P. Sex and racial/ethnic differences in the association between childhood attention-deficit/hyperactivity disorder symptom subtypes and body mass index in the transition from adolescence to adulthood in the United States. Pediatr Obes. 2019;14:e12498.
50 Keshen AR, Hilbert A, Taylor V, Harris AL, Trappenberg N, Sadek J, et al. Effect of stimulant medication on loss of control eating in youth with attention deficit/hyperactivity disorder: a prospective, observational case series study protocol. J Eat Disord. 2022;10:152.
51 Cortese S, Comencini E, Vincenzi B, Speranza M, Angriman M. Attention-deficit/hyperactivity disorder and impairment in executive functions: a barrier to weight loss in individuals with obesity? BMC Psychiatry. 2013;13:286.
52 Duchesne M, Mattos P, Appolinário JC, de Freitas SR, Coutinho G, Santos C, et al. Assessment of executive functions in obese individuals with binge eating disorder. Braz J Psychiatry. 2010;32:381-8.
53 Polanczyk G V, Salum GA, Sugaya LS, Caye A, Rohde LA. Annual research review: a meta-analysis of the worldwide prevalence of mental disorders in children and adolescents. J Child Psychol Psychiatry. 2015;56:345-65.