Černelič Bizjak M, Adamič K. Binge eating in a Slovenian population-based sample of adults. Zdr Varst. 2023;62(1):39-47. doi: 10.2478/sjph-2023-0006.

BINGE EATING IN A SLOVENIAN POPULATION-BASED SAMPLE OF ADULTS

HRANJENJE Z IZGUBO NADZORA NA SLOVENSKEM POPULACIJSKEM VZORCU ODRASLIH

Maša ČERNELIČ BIZJAK[1*], Katarina ADAMIČ[1]

[1]University of Primorska, Faculty of Health Sciences, Polje 42, 6310 Izola, Slovenia

Received: Sep 5, 2022
Accepted: Nov 17, 2022

Original scientific article

ABSTRACT

Introduction: Binge eating is the most common form of disordered eating associated with obesity, reduced quality of life, and medical and psychological comorbidities. It therefore affects the well-being of individuals. This underscores the fact that it is a serious public health problem. The study aimed to investigate binge eating and anxiety across gender, age and body mass index in a large population sample of adults in Slovenia.

Methods: A total of 3,310 adult volunteers participated in this cross-sectional study. Questionnaires, including a binge eating and anxiety scale and an eating behaviour questionnaire, were completed by 1,487 subjects (90.9% female, ages 18 to 69).

Results: The frequency of reported binge eating was 29.9%, with 9.8% of participants reporting severe binge eating, and the presence of overweight and obesity was high (41.8%). BMI was associated with this problematic eating, and explained 5.4% of the variation in binge eating. Importantly, anxiety was the most important factor related to binge eating, with younger participants and women reporting significantly more anxiety.

Conclusion: The high presence of binge eating, obesity and anxiety in the Slovenian population-based sample is worrying. Anxiety is clearly an important factor in understanding the relationship between negative affect and binge eating, as it accounts for a greater proportion of the variance in binge eating symptoms than BMI. Particularly concerning was the fact that the youngest participants showed the greatest anxiety. Targeting anxious adolescents and females is important from a health perspective because it can impact the physical and mental health of the population in the long term.

Keywords:
binge eating, anxiety, emotional eating, obesity, public health

IZVLEČEK

Uvod: *Hranjenje z izgubo nadzora (angl. binge eating) je najpogostejša oblika motenega prehranjevanja, povezana z debelostjo, zmanjšano kakovostjo življenja, zdravstvenimi komorbidnostmi in psihološko disfunkcijo ter tako vpliva na dobro počutje posameznika. Gre torej za resen javnozdravstveni problem. Namen raziskave je bil raziskati to moteno prehranjevanje in anksioznost glede na spol, starost in indeks telesne mase na velikem populacijskem vzorcu odraslih v Sloveniji.*

Metode: *V tej presečni študiji je sodelovalo 3.310 odraslih prostovoljcev. 1.487 (90,9 % žensk, starih od 18 do 69 let) je izpolnilo vprašalnike v celoti. Uporabili smo vprašalnik hranjenja z izgubo nadzora, anksioznosti in vprašalnik o prehranjevalnem vedenju.*

Rezultati: *Pogostost motenega prehranjevanja je bila 29,9-odstotna, pri čemer je 9,8 % udeležencev poročalo o hudem hranjenju z izgubo nadzora. Prisotnost prekomerne telesne mase in debelosti je bila visoka (41,8 %). ITM je bil povezan s tem problematičnim prehranjevanjem. Anksioznost je bila statistično pomembno povezana z motenim prehranjevanjem, izgubo nadzora, pri čemer so mlajši udeleženci in ženske poročali o znatno višji anksioznosti.*

Sklep: *Zaskrbljujoče je visoko poročanje o hranjenju z izgubo nadzora, debelosti in anksioznosti med odraslimi v Sloveniji. Predvsem pa rezultati opozarjajo na pomen anksioznosti, saj je očitno pomembno povezana s problematičnim hranjenjem, ki skupaj z visokim ITM lahko dolgoročno vpliva na fizično in psihično zdravje v populaciji. Skrb vzbujajoč je rezultat, da so bili mladi tisti, ki so izkazovali najvišjo anksioznost. Usmerjanje na anksiozne mladostnike in ženske tako ni pomembno samo z vidika duševnega zdravja, zdi se, da tudi za preprečevanje potencialno resnih posledic, kot so debelost ali druge zdravstvene komorbidnosti.*

Ključne besede:
hranjenje z izgubo nadzora, anksioznost, čustveno hranjenje, debelost, javno zdravje

***Corresponding author:** Tel. + 386 41 964 157; E-mail: masa.cernelic@fvz.upr.si

1 INTRODUCTION

Many constructs related to eating have been proposed to explain obesity, such as binge eating and emotional eating, both of which emphasise loss of control over food intake. Because food intake and eating behaviours are the result of numerous complex regulatory mechanisms involving both homeostatic and hedonic/non-homeostatic processes, obesity may manifest as eating in the absence of energy or metabolic deficits (1). A typical aspect of non-homeostatic eating (i.e. eating outside the physiological sensation of hunger) is binge eating, which is classified as disordered eating behaviour because it describes a type of inappropriate behaviour pattern and habit. It is characterised by eating more than normal in a given period of time and feeling a loss of control while eating (2). Because is characterised by episodes of overeating, it is a form of compulsive overeating (3). Binge eating is a major public health problem (4), in and of itself and because of the negative psychological and physical health complications associated with it (5), such as increased risk of mental disorders and obesity.

Studies report very high prevalence rates of binge eating in young adults, especially those whose weight status is classified as overweight/obese. In a recent study, 48.6% of young adults with overweight/obesity reported higher rates of binge eating than their normal-weight peers (29.3 vs. 15.8% in women, 15.4 vs. 7.5% in men) (6). A meta-analysis has estimated the prevalence of binge eating among adolescents with overweight/obesity to be 31.2%, and exploratory analyses have suggested that prevalence increases among adolescents who receive weight management treatment (7).

In adults, binge eating has also been associated with overweight/obesity, both cross-sectionally (8) and longitudinally (9). In a sample of 2,134 adolescents, binge eating reported at baseline predicted the onset of obesity at ten-year follow-up, demonstrating the importance of understanding the relationship between binge eating and weight across an individual's lifespan (10). Disordered eating behaviours are more common in women than in men (11). A previous study of binge eating in a sample of Slovenian adults showed that women had higher levels of binge eating symptomatology and emotional eating than men (12), and according to some data, 62% of middle-aged participants in Slovenia have inappropriate eating habits (13). A study of a sample of adolescents showed that the number of individuals with binge-eating problems was relatively high among secondary school students (14).

In addition, binge eating is a key behaviour in eating disorders, such as binge eating disorder (BED), bulimia nervosa and the binge-purge type of anorexia nervosa (2, 15). BED is the most common eating disorder, occurring in approximately 10–15% of people in the community (16, 17) and is associated with food addiction, as they share a common symptom – binge eating (18–20). Importantly, BED is associated with adverse medical and psychosocial outcomes and is often associated with multiple somatic and psychiatric conditions, including obesity, metabolic syndrome, substance use disorders and mood disorders (21–23).

Despite the strong association with binge eating, some factors have received little attention in the general population and beyond. These include emotional eating, anxiety, and demographic factors such as gender and body weight, which are thought to be important contributors to the association with binge eating (24–26). The concept of emotional eating refers to the tendency to eat in response to emotional triggers, such as negative/positive emotions or stress (27–28), and may be associated with overeating in response to food-related stimuli such as the sight and smell of attractive foods (29). Overall, emotional distress (e.g. depression, anxiety) may be associated with binge eating and could predispose individuals to develop and/or maintain inappropriate eating behaviours.

The prevalence of obesity and eating disorders is increasing worldwide (30). It is estimated that 51% of the population will be obese by 2030 (31), with prevalence expected to peak between 2026 and 2054. The US and the UK are projected to reach the highest levels first, followed by other European countries (32). Because obesity is one of the greatest health challenges of the 21st century in many countries (33), it is worthwhile examining individual differences in eating behaviours. These are likely, at least in part, to explain individual differences in obesity (34). Considering that both conditions are related to many other health problems, the main objective of the study was to examine binge eating in a sample of adults from the general population and to explore the factors that might be related to food intake.

2 METHODS

2.1 Study protocol

Male and female volunteers from the general Slovenian population were invited to participate in the study. The inclusion criteria were a minimum age of 18 and active informed consent obtained through voluntary participation by anonymous participants. This study was conducted in accordance with the guidelines of the Declaration of Helsinki. All procedures were approved by the Commission for Scientific and Research Work, Faculty of Health Sciences, University of Primorska (No 011544-609-32/2021). The study was conducted between April and May, 2021.

2.2 Instruments

2.2.1 Binge Eating Scale (BES)

To assess binge-eating symptoms a 16-item scale was used (35) to measure binge eating behaviour (e.g. eating large amounts of food) and affective/cognitive symptoms (e.g. feelings of guilt, feelings of loss of control) that occur before or after eating with loss of control. The scale was translated into Slovenian. The sum scores were calculated so that a higher score/number indicated a higher severity of binge-eating symptoms, and the sum of the items identified 18 or more individuals who exhibited binge-eating behaviours. In our study, Cronbach's alpha was 0.91.

2.2.2 State-Trait Anxiety Inventory (STAI-X2)

The STAI-X2 questionnaire has been used as a reliable measure to assess anxiety as a trait (36). It measures the amount of anxiety experienced in a stressful situation. The STAI-X2 contains 20 items, which are scored on a four-point scale, with subscale scores ranging from 20 to 80 and higher scores indicating higher anxiety. Previous studies have used 45 points or higher as an indicator of high anxiety levels (37). In our study, Cronbach's alpha was 0.93.

2.2.3 Dutch Eating Behaviour Questionnaire (DEBQ)

The DEBQ contains 33 items for identifying three possible types of overeating: emotional, restricted and external (38, 39). It was translated into Slovenian. In our study, we focused on assessing emotional eating (e.g. 'Do you crave food when you are angry?') and therefore used 13 items. Participants rated the extent to which a single item or statement applied to them on a five-point scale, with a higher score indicating higher emotional overeating. In our study, Cronbach's alpha was 0.95.

2.2.4 BMI

BMI was determined based on self-report data, following the example of extensive and reputable research using subjective methods, i.e. based only on height/mass reporting rather than direct anthropometric measurements (40). Although studies point to the possibility of reporting bias, self-reported height and weight data show good agreement with direct anthropometric measurements. Criticism of self-reported data is therefore considered unjustified. BMI based on self-reported height and weight data is therefore a valid measure when direct measurements are not possible (41, 42). Participants' BMI was calculated using the following formula: BMI=body weight (kg)/(body height (m^2)).

2.3 Data collection and procedure

Participants completed the questionnaire via an online survey site 1KA (43), and the link to the survey was disseminated via the faculty website, social networks, internet forums (e.g. Med.Over.Net.), and local radio. The goal was to obtain as many responses as possible. Online data collection also allowed for greater geographic heterogeneity in the sample, potentially leading to a more open presentation of sensitive topics and reducing the burden on participants, as some researchers have pointed out (26). Data collection followed ethical requirements: no personal information was collected, respondents had the freedom to decline participation or withdraw from the study at any time, and participants were informed of the objectives of the study before the survey began. Because the study involved only self-report questionnaires, no risks were anticipated. Because we did not have information on the proportion of individuals who engaged in binge eating, we used 0.5 to estimate the sample size as follows: n=0.5 (1-0.5) 1.96/0.05)=384.2 To ensure that the estimated 95% confidence interval for the proportion of individuals engaged in binge eating was within 5% of the true proportion, a sample size of 385 was required for the purposes of the study.

2.4 Statistical analysis

All variables were tested for normal distribution (Kolmogirov-Smirnov or Shapiro-Wilk test). Cronbach's alphas were calculated to assess the internal consistency of the measurement instruments. The Mann-Whitney t-test was used to examine differences between groups. Analysis of variance (ANOVA) was used to test the hypotheses for the comparison of means between age groups and BMI groups. If a significant p-value was statistically significant, a post hoc test (multiple comparisons) was performed. Homogeneity of variances between groups was tested using Levene's test and Bonferroni's method for multiple comparisons. Spearman's correlation analyses were performed to examine the associations between the studied variables. Hierarchical multiple regression was used to determine the relationships between the studied variables. P-values <0.05 were considered statistically significant, and the confidence level was 95%. All these analyses were performed using IBM SPSS Statistics 20.

3 RESULTS

3.1 Subjects' characteristics

A total of 3,310 subjects participated in the study, 1,487 of whom completed the entire survey. The characteristics of the subjects are shown in Table 1. The final analytical sample included 1,352 women (90.9%) and 135 men (9.1%) aged between 18 and 69.

Calculated BMI ranged from 14.86 kg/m^2 to 52.97 kg/m^2, with an average BMI of 25.14 kg/m^2 (SD=5.35). Participants were divided into four groups according to BMI. The results showed that the majority of participants (54.8%) were classified as normal weight, 3.4% as underweight, 25.1% as overweight and 16.6% as obese (Table 3).

Table 1. Characteristics of subjects included in the study (n=1,487).

Characteristics	Female	Male
n (%)	1352 (90.9)	135 (9.1)
Age group: n (%)		
18–19	71 (5.2)	4 (2.9)
20–29	519 (38.4)	54 (39.7)
30–39	369 (27.3)	30 (22.8)
40–49	260 (19.2)	28 (20.6)
50–59	108 (7.9)	15 (11.0)
60–69	25 (1.8)	4 (2.9)
Body weight (kg)	60.04±13.61*	87.49±18.70*
Body height (cm)	161.53±6.6*	180.74±7.12*
BMI (kg/m^2)	25.72±5.4*	26.72±5.3*

Abbreviation: BMI, body mass index.
*Values are expressed as means ± SD.

3.3 Descriptive statistics and differences in studied variables

The mean of the BES total score was 13.14 (SD=9.15), ranging from 0 to 42. A total of 70.1% (n=1,042) of participants reported no to minimal binge eating, 20.1% (n=299) reported mild to moderate binge-eating, and 9.8% (n=146) reported severe binge eating. Anxiety scores ranged from 20 to 80, with a score of 45 or higher indicating a clinically significant level of anxiety (26). A high level of anxiety were experienced by 31% of participants. Emotional eating scores ranged from 13 to 65, with a higher score indicating higher emotional eating (Table 2). On average, participants exhibited low/average levels of emotional eating (M=30.73; SD=12.26) and, according to the available norms for the emotional eating subscale (28), 37.7% exhibited high to very high levels of emotional eating behaviour.

Women were significantly more likely to report binge eating ($t=4.41$, $p<0.001$), more anxiety symptoms ($t=2.59$, $p<0.01$) and more emotional eating ($t=6.02$, $p<0.001$), and younger participants reported more anxiety symptoms than older participants ($F=6.6$, $p=0.001$) (Table 3). Participants who were obese or overweight were significantly more likely to report binge eating ($F=58.6$, $p=0.001$) and emotional eating ($F=35.6$, $p=0.001$) than participants who were normal weight or underweight (Table 3).

Table 2. Descriptive statistics of reported binge eating, anxiety and emotional eating measures (n=1,487).

Measure	Mean (SD)
Binge eating (score)	13.14 (9.15) *
Absent to minimal binge eating (%)	70
Mild to moderate binge eating (%)	20.1
Severe binge eating (%)	9.8
Anxiety (score)	40.50 (10.78) *
Mild (very low/low) (%)	21.4
Moderate (normal) (%)	33.8
Severe (high) (%)	23.8
Very high (%)	20.7
Emotional eating (score)	30.73 (12.26) *
Low emotional (%)	5.2
Average (%)	58.1
High (%)	15.2
Very high emotional (%)	21.5

Note: *Values are expressed as means ± SD

3.4 Relations between binge eating, anxiety, emotional eating, age and BMI

The Spearman analysis revealed that binge eating was significantly correlated with anxiety ($r=0.46$, $p<0.001$), BMI ($r=0.40$, $p<0.001$), gender ($r=-0.12$, $p<0.001$) and age ($r=-0.06$, $p<0.01$) (Table 4). A hierarchical multiple regression analysis, with binge eating as the dependent variable, revealed that age and gender contributed significantly to the regression model ($F(2, 1487)=11.41$, $p>0.00$) and explained 1.5% of the variation in binge eating (gender $\beta=-0.11$; $p=0.00$; age $\beta=-0.05$; $p=0.05$). BMI explained an additional 5.4% and anxiety an additional 18.3% ($\beta=0.45$; $p=0.000$) of the variation in binge eating. Together, these variables explained 26.7% of the variation in binge eating (total $R2=0.267$; $p=0.000$).

4 DISCUSSION

The main objective of this study was to investigate the association between binge-eating behaviour, anxiety and emotional eating in a population-based sample of adults in Slovenia, and to assess differences by gender, BMI, and age. In this study, self-reported binge eating was 29.9%, with 20.1% of participants reporting moderate binge eating and 9.8% reporting severe binge eating. The self-reported frequency is higher than some reports, e.g. 9.9% (44) and 5% (45), but lower than the highest frequency of binge eating recorded to date, i.e. 44% (46). The differences in reporting of binge eating might be related to the demographic diversity of the sample studied. The sample in this study was dominated by women (90.9%), and the majority of participants were between 20 and 39 years old. In addition, the proportion of overweight and obese individuals was high (41.8%), which may explain the high number of reported binge-eating behaviours in our sample.

Table 3. Frequencies and percentages of the survey participants by gender, age and BMI group, and the differences between the analysed scores and demographic characteristics (n=1,487).

		Binge eating (score)			Anxiety (score)			Emotional eating (score)		
	n (%)	M (SD)	Difference between groups	p-value	M (SD)	Difference between groups	p-value	M (SD)	Difference between groups	p-value
Gender										
Males	1352	9.85	t = 4.4	<0.001***	38.21	t=2.6	<0.01**	1.90	t=6.0	<0.001***
	(90.9)	(7.7)			(10.1)			(0.8)		
Females	135	13.47			40.73			2.41		
	(9.1)	(9.2)			(10.8)			(0.9)		
Age group										
18–19	75	13.4	F= 1.1	0.33	44.8	F=6.6	<0.001***	2.3	F=0.9	0.5
	(5.0)	(8.6)			(11.1)			(0.8)		
20–29	565	13.3			41.7			2.4		
	(38.0)	(8.8)			(10.6)			(0.9)		
30–39	400	13.7			40.2			2.4		
	(26.9)	(9.3)			(10.9)			(0.9)		
40–49	286	12.5			38.0			2.3		
	(19.2)	(9.6)			(9.8)			(0.9)		
50–59	122	12.2			39.8			2.2		
	(8.2)	(9.1)			(11.5)			(0.8)		
60–69	39	11.4			39.1			2.2		
	(2.7)	(9.3)			(11.6)			(1.1)		
Body mass index										
BMI<18.5:	50	8.62	F=58.6	<0.001***	43.2	F=3.5	0.02	1.9	F=35.6	<0.001***
underweight	(3.4)	(7.7)			(11.8)			(0.7)		
BMI 18.5-24.9:	816	11.14			40.0			2.2		
normal weight	(54.9)	(8.3)			(10.3)			(0.8)		
BMI≥25.0:	374	14.27			40.1			2.4		
overweight	(25.2)	(8.9)			(10.9)			(0.9)		
BMI≥30.0:	247	18.9			42.1			2.8		
obesity	(16.6)	(9.4)			(11.7)			(1.0)		

Abbreviation: t-value denotes the difference between two groups using a Student's paired samples t-test. F-value denotes difference between the groups using ANOVA.
*p<.05. **p<.01. ***p<.001.

Table 4. Linear and hierarchical multiple regression analysis with binge eating as the dependent variable.

Predictor	Dependent variable Binge eating						
	r	ΔR^2	F	*p*	*β*	t	*p*
Step 1		0.015	11.41	0.00			
Age (years)	-0.06*				-0.05*	-0.19	0.05*
Gender	-0.12**				-0.11***	-4.28	0.00***
Step 2		0.069	37.15	0.00			
BMI	0.40**				0.24***	9.35	0.00***
Step 3		0.267	108.60	0.00			
Emotional eating	0.01				0.02	0.72	0.471
Anxiety	0.46**				0.45***	20.04	0.00***
Total R^2		0.267					

Notes: n=1,487; *Hierarchical regression involving the entry of predictor variables into the analysis in steps (stepwise). Linear correlation obtained from Spearman (r). ΔR2=the change in R2 value for each subsequent step of the model resulting from the addition of a predictor to the regression equation. ß=the beta values in regression are the estimated coefficients of the explanatory variables. A p-value of less than 0.05 was considered to be statistically non-significant.

Indeed, the results of this study showed a significant association between binge eating and higher BMI.

Furthermore, they show a statistically significant positive association between anxiety and binge eating in a large sample of adults. This finding is consistent with previous studies that have shown a positive association between anxiety and binge-eating symptoms (47, 48) in the general population (26). Our results also show that anxiety accounted for 18.3% of the variation in this problematic eating behaviour. Similarly, previous research has shown that anxiety has a significant impact on the severity of binge eating (47, 49), and that loss of control is an important feature of both anxiety and binge eating (24, 25, 49). The mechanisms by which anxiety promotes binge eating are not fully understood (47). One explanation is that binge eating is a calming behaviour for anxious people, comparable to nail biting, smoking, alcohol use or drug use, or that eating is a means of coping with these anxieties (25). In fact, anxiety is a component of negative affect that has been shown to play an important role in the development and maintenance of eating disorders such as binge eating (30), and is the most common precursor to disordered eating (49). In general, there is still a need for a better understanding of the role of anxiety, as anxiety symptoms are generally high in individuals who engage in binge eating.

Moreover, participants with higher BMI who reported more anxiety were more prone to binge eating and had a more pronounced tendency to overeat. The results of our study of the general population sample show that women had statistically significant higher rates of binge eating, anxiety and emotional eating than men. The lower rates of binge eating among men in our study can be explained by the findings that risk factors for binge eating differ between genders (26, 30). Moreover, participants with higher BMI had statistically significant higher levels of emotional eating and binge eating. Given that obesity has become a major health problem in Slovenia (50) and worldwide (18), and that, according to some data, 62% of middle-aged participants in Slovenia have inappropriate eating habits (13), the binge eating revealed in our sample is cause for concern. Moreover, younger participants reported significantly higher anxiety scores than older participants. Interestingly, a recent study (51) on binge drinking found that this risky behaviour is very common among young adults. Because the term ‘binge’ refers not only to eating but also to extreme and uncontrolled activities (e.g. drinking, eating, fasting), this overall finding warns us that risky behaviours among the young population are a serious health problem.

Importantly, BMI is one variable that has been linked to binge eating. It has been proposed as a relevant causal factor in disordered eating in conjunction with emotional eating (12), although BMI has often been treated as an outcome (52). A potential complication with BMI is that binge eaters who engage in frequent intense exercise are, due to their high calorific expenditure, not necessarily overweight (53).

Since we conducted the study after the third wave of Covid-19 and the subsequent lockdown in Slovenia, the higher levels of anxiety and disordered eating could also be related to that particular time and to the lockdown. Indeed, during the early phase of the spread of Covid-19, researchers (54) demonstrated a relationship between population anxiety levels, psychological distress and prevention efforts. Although some studies (55) observed a decrease in health-related habits, such as alcohol consumption, after the initial lockdown, it has been suggested that an increase in these problematic habits may follow in the future. The data to date shows that the higher percentage of meals consumed at home, such as pizza and pasta (56), affected individual behaviours. Many people reported having eaten more during the lockdown and having had more unhealthy eating habits, such as the consumption of comfort foods (57). Crucially, some of them attributed these changes to higher anxiety (57, 58).
This study has some limitations. The first limitation is that the results cannot be statistically extrapolated to the population, and that statistical inferences (e.g. hypothesis tests and p-values) cannot be drawn based on a sample of the population, with the error term based on sampling error. Second, the proportion of women and men was not equal, making it difficult to generalise about gender differences. Although this study showed that women have higher levels of binge eating than men, future studies should replicate this finding with a larger sample of men to increase the reliability of the group means. Moreover, data collection was based on self-reporting, which is a subjective method, and most questionnaire responses were given by young people. Similarly, other authors (59) have reported that the younger population are more likely to complete the questionnaire when it is posted online. In addition, self-reported height and weight were used to calculate BMI. Several studies indicate that self-reported weight and height should be used with caution, as middle-aged men and women are more likely to have biases; in particular, weight tends to be underestimated and height overestimated. BMI is not an appropriate indicator of diet, as higher BMI may be due to other factors (e.g. increased muscle mass, pregnancy, postpartum), as well as mental illness and treatment with medications that increase appetite and decrease energy expenditure.

As far as we know, this is the first study in Slovenia with a large sample of adult women and men with different BMI in the field of disordered eating research. The results of this study may be a starting point for the planning of appropriate interventions to identify at-risk individuals prone to negative emotionality and binge-eating symptoms at an

early stage, as this may affect the individual's subsequent mental and physical health. As mentioned previously (60), strategies to improve the overall health of the population rely on an adequate diagnosis of disease-causing factors so that educational interventions and targeted campaigns can be adapted with the aim of changing inappropriate eating habits, as well as accessible nutrition counselling provided as needed by qualified dietitians at primary health centres (59). In addition, the study findings provide evidence for other areas of work, e.g. by refining both cognitive-behavioural approaches, which have been shown to be a successful way of addressing BE symptoms (26) and developing more comprehensive obesity prevention and treatment programmes. For example, in order to prevent the use of food as a coping mechanism, the incorporation of emotion recognition and understanding, as well as coping strategies, may be more effective than focusing on just one. The research on binge eating by Barnhradt et al. (61) suggests that learning mindfulness can help people use more appropriate ways to cope with stress. Some (62) studies of binge eating in the general population have even suggested the promotion of a Mediterranean diet in the general population may play a key role in preventing BE episodes and the resulting potential weight gain, but conclude that further research is needed for this.

5 CONCLUSION

This study contributes to a relevant line of research in the field of disordered eating behaviours, particularly binge eating, and helps us to better understand this widespread problem in today's society. It provides data on the relationship between binge eating and other comorbid variables, and shows that dysfunctional eating habits, such as binge eating, are associated with negative emotions such as anxiety, BMI, gender and age. Female participants and those with overweight or obesity were significantly more likely to report binge eating and emotional eating, and younger participants and females were significantly more likely to report anxiety. As binge eating is a risk factor for adverse health outcomes, the goal is not only to identify vulnerable populations for targeted interventions (e.g. gender, age, weight status), but also to identify risk factors that can be modified for prevention purposes. Health professionals should therefore closely monitor not only the current weight status of adults, but also their coping strategies, as binge-eating behaviour can be understood as a coping strategy in response to emotions. In an anxious state (with a lower or absent ability to regulate emotions), failure to regulate eating may occur, leading to unhealthy eating habits and increasing the likelihood of binge eating. Future studies should emphasise the above relationship and include some additional individual factors that may underlie high levels of binge eating and fat intake, such as the drive for thinness, body dissatisfaction, some behavioural patterns (impulsivity, loss of control), and eating styles/habits. All of these could help advance the field of eating behaviours that distinguish anxiety-induced eating in obesity and binge eating. This study paves the way for future investigations of the causal structure of associations between dysfunctional eating, gender and anxiety in all age groups in population-based Slovenian samples.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

FUNDING

The author(s) received no specific funding for this work.

ETHICAL APPROVAL

The study was approved by the Commission for Scientific and Research Work, Faculty of Health Sciences, University of Primorska (No 011544-609-32/2021).

REFERENCES

1. Liu CM, Kanoski SE. Homeostatic and non-homeostatic controls of feeding behavior: distinct vs. common neural systems. Physiol Behav. 2018;193:223-31. doi: 10.1016/j.physbeh.2018.02.011.
2. American psychiatric association. Diagnostic and statistical manual of mental disorders. 5th ed. Arlington, VA, 2013.
3. Saules KK, Herb KM. Sex and gender differences in compulsive overeating. In: Cottone P, Moore CF, Sabino V, Koob F, editors. Compulsive eating behavior and food addiction: Emerging Pathological Constructs. 2019;389-418.
4. Austin SB. A public health approach to eating disorders prevention: it's time for public health professionals to take a seat at the table. BMC Public Health. 2012;12:854. doi: 10.1186/1471-2458-12-854.
5. Higgins DM, Dorflinger L, MacGregor KL, Heapy AA, Goulet JL, Ruser C. Binge eating behavior among a national sample of overweight and obese veterans. Obesity. 2013;21:900-03. doi: 10.1002/oby.20160.
6. Nagata JM, Garber AK, Tabler JL, Murray SB, Bibbins-Domingo K. Prevalence and correlates of disordered eating behaviors among young adults with overweight or obesity. J Gen Intern Med. 2018; 33(Suppl 8):1337-43. doi: 10.1007/s11606-018-4465-z.
7. He J, Cai Z, Fan X. Prevalence of binge and loss of control eating among children and adolescents with overweight and obesity: an exploratory meta-analysis. Int J Eat Disord. 2016;50(Suppl 2):91-103. doi: 10.1002/eat.22661.
8. De França G, Gigante D, Olinto, M. Binge eating in adults: prevalence and association with obesity, poor self-rated health status and body dissatisfaction. Public Health Nutr. 2014;17(Suppl 4):932-8. doi: 10.1017/S1368980013000591.
9. Marchitelli S, Mazza C, Lenzi A, Ricci E, Gnessi L, Roma P. Weight gain in a sample of patients affected by overweight/obesity with and without a psychiatric diagnosis during the Covid-19 lockdown. Nutrients. 2020;12(Suppl 11):3525. doi: 10.3390/nu12113525.

10. Quick V, Wall M, Larson N, Haines J, Neumark-Sztainer D. Personal, behavioral and socio-environmental predictors of overweight incidence in young adults: 10-yr longitudinal findings. Int J Behav Nutr Phys Act. 2013;10(Suppl 37):1–13. doi: 10.1186/1479-5868-10-37.
11. Beccia AL, Baek J, Jesdale WM, Austin SB, Forrester S, Curtin C, et al. Risk of disordered eating at the intersection of gender and racial/ethnic identity among US high school students. Eat Behav. 2019;34(Suppl 1): 101299. doi: 10.1016/j.eatbeh.2019.05.002.
12. Černelič-Bizjak M, Guiné RPF. Predictors of binge eating: relevance of BMI, emotional eating and sensivity to environmental food cues. Food Sci Nutr. 2021;52(Suppl 1):171-80. doi: 10.1108/NFS-02-2021-0062.
13. Tement M, Selič-Zupančič P. Quality of life and health status in middle-aged presumed healthy Slovenian family practice attendees. Zdr Varst. 2021;60:182-9. doi: 10.2478/sjph-2021-0026.
14. Tomori M, Rus-Makovec M. Eating behavior, depression, and self-esteem in high school students. J Adolesc Health. 2000;26(Suppl 5):361-7. doi: 10.1016/s1054-139x(98)00042-1.
15. Udo T, McKee SA, White MA, Masheb RM, Barnes RD, Grilo CM. Sex differences in biopsychosocial correlates of binge eating disorder: a study of treatment-seeking obese adults in primary care setting. Gen Hosp Psychiatry. 2013;35:587-91. doi: 10.1016/j.genhosppsych.2013.07.010.
16. Goldschmidt AB, Loth KA, MacLehose RF, Pisetsky EM, Berge JM, Neumark-Sztainer D. Overeating with and without loss of control: associations with weight status, weight-related characteristics, and psychosocial health. Int J Eat Disord. 2015;48:1150-57. doi: 10.1002/eat.22465.
17. Udo T, Grilo CM. Prevalence and correlates of DSM-5 eating disorders in nationally representative sample of United States adults. Biol Psychiatry. 2018;84:345-54. doi: 10.1016/j.biopsych.2018.03.014.
18. Davis C. From passive overeating to "food addiction": a spectrum of compulsion and severity. ISRN Obes. 2013;10:1–20. doi: 10.1155/2013/435027.
19. Kalon E, Hong, JY, Tobin C, Schulte T. Psychological and neurobiological correlates of food addiction. Int Rev Neurobiol. 2016;129:85-110. doi: 10.1016/bs.irn.2016.06.003.
20. Kakoschke N, Aarts E, Verdejo-García A. The cognitive drivers of compulsive eating behavior. Behav Neurosci. 2019;12:338. doi: 10.3389/fnbeh.2018.00338.
21. Hudson JI, Lalonde JK, Coit CE, Tsuang MT, McElroy SL, Crow SJ et al. Longitudinal study of the diagnosis of components of the metabolic syndrome in individuals with binge-eating disorder. Am J Clin Nutr. 2010;91:1568-73. doi: 10.3945/ajcn.2010.29203.
22. Thoronton LM, Watson HJ, Jangmo A, Welch E, Wiklund C, von Hausswolff-Juhlin Yet al. Binge-eating disorder in the Swedish national registers: Somatic comorbidity. Int J Eat Disord. 2017;50:58-65. doi: 10.1002/eat.22624.
23. Welch E, Jangmo A, Thornton LM, Norring C, von Hausswolff-Juhlin Y, Herman BK et al. Treatment-seeking patients with binge-eating disorder in the Swedish national registers: clinical course and psychiatric comorbidity. BMC Psychiatry. 2016;16:163.doi: 10.1186/s12888-016-0840-7.
24. Casu G, Gremigni P, Masheb R. Emotional overeating questionnaire: a validation study in Italian adults with obesity, overweight or normal weight. Eat Weight Disord. 2019;25:1747-54. doi: 10.1007/s40519-019-00821-6.
25. Rosenbaum DL, White KS. The role of anxiety in binge eating behavior: a critical examination of theory and empirical literature. Health Psychol Res. 2013;1:19. doi: 10.4081/hpr.2013.e19.
26. Rosenbaum DL, White KS. The relation of anxiety, depression, and stress to binge eating behavior. J Health Psychol. 2015;20:887-98. doi: 10.1177/1359105315580212.
27. Bongers P, Jansen, A. Emotional eating is not what you think it is and emotional eating scales do not measure what you think they measure. Front Psychol. 2016;7:1932. doi: 10.3389/fpsyg.2016.01932.
28. Cardi V, Leppanen, J, Treasure J. The effects of negative and positive mood induction on eating behaviour: a meta-analysis of laboratory studies in the healthy population and eating and weight disorders. Neurosci Biobehav Rev. 2015;57:299-309. doi: 10.1016/j.neubiorev.2015.08.011.
29. Van Strien T. Causes of emotional eating and matched treatment of obesity. Curr Diab Rep. 2018;18:35. doi: 10.1007/s11892-018-1000-x.
30. Kukk, K. Risk factors of binge eating and overeating – towards an integrated model: doctoral thesis. Estonia: Institute of Psychology, University of Tartu, 2020.
31. Finkelstein EA, Khavjou OA, Thompson H, Trogdon JG, Pan L, Sherry B, et al. Obesity and severe obesity forecasts through 2030. Am J Prev Med. 2012;42(Suppl 6):563-70. doi: 10.1016/j.amepre.2011.10.026.
32. Janssen F, Bardoutsos A, VidraN. Obesity prevalence in the long-term future in 18 European countries and in the USA. Obesity facts. 2020; 13, 514-527.
33. World Health Organization. Obesity and Overweight. Accessed June 17th, 2022 at: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight .
34. Vainik U, García-García I, Dagher, A. Uncontrolled eating: a unifying heritable trait linked with obesity, overeating, personality and the brain. Eur J Neurosci. 2019;50:2430-45.
35. Gormally J, Black S, Daston S, Radin D. The assessment of binge eating severity among obese persons. Addict Behav. 1982;7:47-55. doi: 10.1016/0306-4603(82)90024-7.
36. Lamovec T. Priročnik za psihologijo motivacije in emocij. Ljubljana, Slovenija: Filozofska fakulteta, Oddelek za psihologijo, 1988.
37. Barnes LLB, Harp D, Jung WS. Reliability Generalization of Scores on the Spielberger State-Trait Anxiety Inventory. Educ Psychol Meas. 2002;62:603-18. doi: 10.1177/0013164402062004005.
38. van Strien T, Frijters JER, Bergers GPA, Defares PB. The Dutch eating behavior questionnaire (DEBQ) for assessment of restrained, emotional and external eating behavior. Int J Eat Disord. 1986;5:295-315.
39. van Strien T. DEBQ: Dutch eating behaviour questionnaire: manual. Thames Valley Test Company: Bury St Edmunds, 2002.
40. Buhr KJ. The BMI bias: the validity problems of using self-reported data to measure body mass index. J Obes Weight Loss Ther 2020;10:397.
41. Davies A, Wellard-Cole L, Rangan A, Allman-Farinelli M. Validity of self-reported weight and height for BMI classification: A cross-sectional study among young adults. Nutrition 2020; 71:110622. doi: https://doi.org/10.1016/j.nut.2019.110622.
42. Hodge JM, Roma S, McCullough ML, Gapstur SM, Patel AV. Validation of self-reported height and weight in a large, nationwide cohort of U.S. adults. PLoS One 2020;15. doi: https://doi.org/10.1371/journal.pone.0231229.
43. 1KA (Version 17.05.02) [software]. 2017. Ljubljana: Faculty of Social Sciences. Accessed June 17th, 2022 at: https://www.1ka.si.
44. Andrés A, Saldaña, C. Body dissatisfaction and dietary restraint influence binge eating behavior. Nutr Res. 2014;34:944-50. doi: 10.1016/j.nutres.2014.09.003.
45. Chao A, Grey M, Whittemore R, Reuning-Scherer J, Grilo CM, Sinha R. Examining the mediating roles of binge eating and emotional eating in the relationships between stress and metabolic abnormalities. Int J Behav Med. 2016;39:320-32. doi: 10.1007/s10865-015-9699-1.
46. Napolitano MA, Himes S. Race, weight, and correlates of binge eating in female college students. Eat Behav. 2011;12:29-36. doi: 10.1016/j.eatbeh.2010.09.003.
47. Becker KR, Plessow F, Coniglio KA, Tabri N, Franko DL, Zayas LV et al. Global/local processing style: explaining the relationship between trait anxiety and binge eating. . Int J Eat Disord. 2017;50:1264-72. doi: 10.1002/eat.22772.
48. Pokrajac-Bulian A, Tkalčić M, Ambrosi-Randić N. Binge eating as a determinant of emotional state in overweight and obese males with cardiovascular disease. Maturitas. 2013;74:352-56. doi: 10.1016/j.maturitas.2013.01.007.

49. Sultson H, Kukk K, Akkermann K. Positive and negative emotional eating have diferent associations with overeating and binge eating: construction and validation of the positive-negative emotional eating scale. Appetite. 2017;116:423-30. doi: 10.1016/j.appet.2017.05.035.
50. Bilban, M. Debelost - javnozdravstveni problem delovne populacije. Delo in varnost. 2018;63: 30-41.
51. Lukács A, Szabó A, Horváth E, Máté Z, Erdős C, Molnár R, et al. Students in danger: binge drinking behaviour and associated factors in Hungary. Zdr Varst. 2021;60:244-52. doi: 10.2478/sjph-2021-0033.
52. Mccuen-Wurst C, Ruggieri M, Allison KC. Disordered eating and obesity: associations between binge-eating disorder, night-eating syndrome, and weight-related comorbidities. Ann N Y Acad Sci. 2018;1411(Suppl 1):96-105. doi: 10.1111/nyas.13467.
53. Stapleton P, Mcintyre T, Bannatyne A. Body image avoidance, body dissatisfaction, and eating pathology: is there a difference between male gym users and non-gym users?. Am J Mens Health. 2016;10(Suppl 2):100-9. doi: 10.1177/1557988314556673.
54. Velikonja NK, Erjavec K, Verdenik I, Hussein M, Velikonja VG. Association between preventive behaviour and anxiety at the start of the COVID-19 pandemic in Slovenia. Zdr Varst. 2021;60:17-24. doi: 10.2478/sjph-2021-0004.
55. Radoš Krnel S, Kilian C, Hovnik Keršmanc M, Roškar M, Koprivnikar H. Changes in the use of alcohol and tobacco in Slovenia during the first wave of the SARS-COV-2 pandemic. Zdr Varst. 2022;6:6-13. doi: 10.2478/sjph-2022-0003.
56. International Food Information Council. 2020 Food & health survey. Accessed October 30th, 2022 at: https://foodinsight.org/wp-content/uploads/2020/06/IFIC-Food-and-Health-Survey-2020.pdf.
57. Scarmozzino F, Visioli F. Covid-19 and the subsequent lockdown modified dietary habits of almost half the population in an Italian sample. Foods. 2020;9(Suppl 5):675. doi: 10.3390/foods9050675.
58. Ammar A, Brach M, Trabelsi K, Chtourou H, Boukhris O, Masmoudi L, et al. Effects of COVID-19 home confinement on eating behaviour and physical activity: results of the ECLB-COVID19 international online survey. Nutrients. 2020;12(Suppl 6):1583. doi: 10.3390/nu12061583.
59. Lunar K, Kozjek N, Kovač M. Changes in eating habits in breast cancer patients. Zdr Varst. 2021;60(1):65-71. doi: 10.2478/sjph-2021-0010.
60. Guiné Raquel P, Duarte J, Ferrão A, Ferreira M, Correia P, Cardoso A, et al. The eating motivations scale (EATMOT): development and validation by means of confirmatory factor analysis (CFA) and structural equation modelling (SEM). Zdr Varst. 2021;60(1):4-9. doi: 10.2478/sjph-2021-0002.
61. Barnhart WR, Braden AL, Dial LA. Understanding the relationship between negative emotional eating and binge eating: the moderating effects of acting with awareness and non-reactive mindfulness. J Clin Psychol. 2021;77(Suppl 9):1954-72. doi: 10.1002/jclp.23123.
62. Andrés A, Saldaña, C. Body dissatisfaction and dietary restraint influence binge eating behavior. Nutr Res. 2014;34(Suppl 11):944-50. doi: 10.1016/j.nutres.2014.09.003.