

Binge eating disorder and food addiction occurrences among adult Jordanian women with obesity

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ABSTRACT

Introduction: The aim of the study was to estimate the occurrences of binge eating disorder (BED) and food addiction (FA) in Jordanian women with obesity and to explore their relationships with selected potential risk factors for obesity.

Methods: A descriptive case series design that involved a total of 842 women with obesity was conducted. The occurrences of BED and FA were evaluated using the Questionnaire on Eating and Weight Patterns-5 (QEWP-5) and Yale Food Addiction Scale 2.0 (YFAS 2.0). **Results:** The overlapping of BED and FA (BED+FA) was the most frequent category constituting 53.7%. The second highest category was BED comprising 25.0%, followed by FA comprising 9.0%. Body mass index (BMI) and waist circumference (WC) were significantly higher in the BED+FA group as compared to all other groups. The FA group (41.3%) had significantly the lowest level of sleeping hours. BED (58.0%) and BED+FA (66.1%) groups were significantly higher in consuming more than three snacks per day. BED and/or FA-free group had significantly higher level of water intake of >5 cups/day. **Conclusions:** The frequencies of BED and FA were relatively high among obese Jordanian women. The study demonstrated an overlap between BED and FA, highlighting its associations with increased BMI and WC in a selected sample of obese women. The study suggested that BED, FA, and the overlapping of both conditions were associated with greater tendencies towards an unhealthy pattern of eating practices, fluid intake, and sleeping habits.

Keywords: binge eating disorder, food addiction, obesity, women

INTRODUCTION

More than half of the adult population in developed countries are currently overweight or obese. Globally, the prevalence of obesity has increased by almost three times between 1997 and 2016. According to the World Health Organization (WHO) report in 2020, 39.0% of adults were overweight, and 13.0% were obese (Haththotuwa, Wijeyaratne & Senarath, 2020). Many studies on the prevalence of obesity

in Jordan revealed an increase in the obesity rate over the years. Khader *et al.* (2008) reported that the prevalence rate of obesity increased with age and varied by gender. The prevalence of overweight and obesity were 36.2% and 28.1% for men, and 28.8% and 53.1% for women, respectively, in northern Jordan (Khader *et al.*, 2008). Recently, it has been reported that the prevalence of overweight and obesity has reached an alarming rate of about 60.0% among

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men and women according to their body mass index (BMI) (Ajlouni *et al.*, 2020). One of the explanations for this increase in obesity rate over recent decades is environmental factors, particularly the availability of highly varied, palatable, and fattening foods that are associated with an increasing rate of eating disorder episodes. Other factors, such as lack of education, lack of resources, and increased pressure from the media, may also contribute to the increase in eating disorders and cause individuals to have distorted body figures (Myers & Wiman, 2014).

Eating disorders (EDs) are groups of disorders that are characterised by an ongoing disturbance of eating or eating-related behaviours, which lead to changes in the consumption or absorption of food, and significantly impair physical health or psychosocial functioning, leading to severe negative consequences (Myers & Wiman, 2014). According to a Citrome review, the most common ED in America is binge eating disorder (BED), with a prevalence of 2.6%. This prevalence rate is higher than the combined prevalences of anorexia and bulimia (Citrome, 2015). BED is one of the most recent eating disorders officially recognised by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (Black & Grant, 2014). BED affects approximately half of the people with obesity (BMI \geq 30kg/m²) and it is notably more common in women (3.5%) than in men (2.0%) (Citrome, 2015). BED can be described as a pattern of bingeing that occurs in the absence of regularity of compensatory behaviours, such as vomiting or laxative abuse (Citrome, 2015). There are also a variety of associated characteristics, such as fast consumption, eating until uncomfortably full, and eating without being hungry, eating alone, and feeling depressed or guilty (Myers & Wiman, 2014).

Disordered eating attitudes and behaviours consist of a number of various constructs, including negative attitudes towards weight and shape, unhealthy weight control behaviours, and binge eating (Hayes *et al.*, 2018). Individuals who do not meet the criteria for an eating disorder may engage in some forms of disordered eating behaviours, which in turn can increase the risk of eating disorders (Yu & Tan, 2016). It has been previously suggested that food addiction (FA) may be a sub-type of disordered eating and may indicate higher eating disorder severity. However, it has been proposed that BED may significantly overlap with the construct of FA (Burrows *et al.*, 2017). FA, according to the Food Addiction Institute, is a condition when one has no control over eating certain foods (Myers & Wiman, 2014). A craving for highly-palatable foods may lead to eating-related issues, such as obesity and eating disorders. Additionally, repetitive addictions that lead to excessive consumption could theoretically contribute to obesity and antagonise weight loss efforts (Gearhardt, Boswell & White, 2014). Although BED and FA share many characteristics, such as reduced control and continued use despite adverse consequences, the two disorders may be distinct. FA is mainly biochemical in nature.

There is probable evidence for the involvement of a range of neurotransmitters and hormones in eating disorders. Numerous investigations have revealed that obese patients exhibit a disruption in the dopamine system similar to that previously described in drug addiction (Gearhardt *et al.*, 2014). The Yale Food Addiction Scale (YFAS), a tool used to assess FA, was created in 2009 after all the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) guidelines for substance dependence were modified

to be applicable to eating behaviours (Gearhardt *et al.*, 2014). A study showed that the prevalence of FA was 5.4% (6.7% in females and 3.0% in males, respectively) and increased with obesity status in Canada (Pedram *et al.*, 2013). In contrast, a study that involved a representative German sample showed that younger individuals with obesity exhibited a higher prevalence rate of FA (17.2%) (Hauck *et al.*, 2017). A systematic review study concluded that weighted mean prevalence of FA, as diagnosed using the YFAS scale, was 19.9% and exhibited more than double in people with obesity as compared to individuals with healthy body weights. The authors also indicated that FA was more frequent in females as compared to males (12.2% and 6.4%, respectively) (Pursey *et al.*, 2014).

In Jordan, a cross-sectional survey that was undertaken using an online YFAS scale during the COVID-19 pandemic revealed that the prevalence of FA was 21.5% among individual adults; about 76.4% were diagnosed as severely food addicted (Musharbash *et al.*, 2021). In addition, most of the prevalence studies on BED or FA among Jordanian adults were done by using online surveys (Musharbash *et al.*, 2021) and were focused on special target groups such as adolescents (Mousa *et al.*, 2010); therefore, this might increase the risk of misdiagnosis of cases. To our knowledge, no previous study in Jordan has examined the prevalences of BED and FA in obese women by using a paper-based questionnaire filled in face-to-face by the researcher. Therefore, the main aim of the present descriptive study design was to estimate the occurrences of BED and FA in a sample of Jordanian women with obesity. The secondary aim was to explore the relationships of BED and FA with selected variables (i.e., socio-demographics, anthropometric

characteristics, eating and sleeping patterns, and water intake) as potential risk factors for obesity in Irbid, Jordan.

MATERIALS AND METHODS

A descriptive case series design was conducted among obese women who visited a private nutrition and counselling centre for the purpose of losing weight. The centre was located in Irbid, a city in northern Jordan.

Inclusion and exclusion criteria

A convenient sample of 842 women with obesity (BMI ≥ 30 kg/m²) was included in the study. Recruitment was undertaken over an eight-month period in 2021/2022. Prior to the commencement of the study, a study invitation flyer was distributed to all women on their first booking appointment at the nutrition and counselling centre throughout the study period. Women who expressed interest to participate in the study were recruited face-to-face at their first visit by the researcher, before receiving any weight management or counselling programme. Exclusion criteria were as follows: BMI ≤ 29.9 kg/m², specific diseases, such as major cardiovascular diseases, type II diabetes, polycystic ovary syndrome (PCOS), thyroid dysfunction, chronic renal failure, chronic liver diseases, renal calculi, depression, pregnancy, and on anti-depressant drugs.

Ethical approval

The protocol was approved by the Institutional Review Board (IRB) of the Deanship of Scientific Research at the University of Jordan (No.56-2022), and in accordance with the ethical guidelines described in the Declaration of Helsinki. All data were collected a confidential manner. Written informed consent was obtained from all participants before their interview.

Data collection

A set of questionnaires were used to collect data regarding eating and weight patterns, BED, and FA. To assess BED, a weight pattern questionnaire (QWP-5) was used, while FA was assessed using YFAS 2.0. To standardise the tools of assessment, to measure their reliability, and to meet the Jordanian cultural norms, a pilot study on the face validity of the survey instruments was conducted. The BED and FA assessment tools were translated into Arabic and content validity was assessed. The questionnaires were tested by a panel of academics in psychology, nutrition, and Arabic literature. The questionnaires were filled in face-to-face by the researcher using a paper-based questionnaire. In the current study, Cronbach's alpha for QWP-5 and YFAS 2.0 were 0.87 and 0.81, respectively.

Demographic questionnaire

Demographic and lifestyle characteristics of the participants were obtained through a constructed questionnaire, which provided information on age, education level, smoking status, employment, family history of FA and BED, sleeping hours, use of medications, as well as questions about certain eating habits and fluid intake.

Assessment of binge eating disorder

To assess BED, a previously translated and validated eating and weight patterns questionnaire (QWP-5) was used based on the new DSM-5 criteria. The QWP-5 questionnaire is a screening tool that can be used in research or clinical settings to identify persons who may have BED (Yanovski *et al.*, 2015). The QWP-5 contained 26 items to screen respondents for BED. It also recorded episodes of 'subjective-binge eating'. In order to meet the criteria for BED, patients must have recurrent episodes of bingeing, which was defined as an

excessive intake of food and a feeling of losing control. This eating episode should occur on an average of once per week for the last three months. The episodes must be accompanied by severe distress (Yanovski *et al.*, 2015).

Assessment of FA

The main diagnostic tool for FA was the standardised YFAS 2.0. The YFAS 2.0 scale composed of 35 items and used eleven criteria based on the DSM-5 criteria for addictive disorders. The scale counts indicated the number and severity of dependence symptoms. They ranged from never (0) to every day (7). FA was diagnosed with at least three symptoms and met the clinically significant criteria (Meule & Gearhardt, 2019).

Assessment of physical activity

The physical activity level of the participants was evaluated using the "General Practice Physical Activity Questionnaire" (GPPAQ) and subjects were grouped into four categories: inactive, moderately inactive, moderately active, and active (Heron *et al.*, 2014).

Anthropometric measurements

Body weight, height, and waist circumference (WC) were measured and recorded by a well-trained nutritionist according to standardised procedures. Weight and body fat percent were measured by a body composition scale analyser (InBody 570, South Korea). Height was measured using a stadiometer and was recorded to the nearest millimeter (mm). BMI was then calculated using the following equation: $BMI = \text{weight}/\text{height}^2$ (kg/m²). BMI equal to or greater than 30 kg/m² was indicative of obesity. Waist circumference was measured using a flexible nonstretch tape; the tape was placed at the narrowest part between the iliac bones and the lowest rib bones. Waist circumferences were measured

to the nearest 0.1 centimeter (cm). A measurement above 88 cm was considered as central obesity (Lee, 2010).

Statistical analysis

Statistical analysis was performed using the IBM SPSS Statistics for Windows version 20.0 (IBM, Corp, Armonk, New York, USA). Categorical variables were compared using the Pearson's chi-square test and continuous variables were compared using the one-way analysis of variance (ANOVA). The assessment of normality of the data is a prerequisite for many statistical tests; therefore, the Shapiro-Wilk test was used to test normality for all predictors. Based on the normality test, group differences were examined using parametric and non-parametric analyses as appropriate. Multivariate analysis was performed to determine the factors associated with BED. Data were presented as mean \pm standard error of mean (SEM) and frequency distribution.

RESULTS

Based on the participants' responses to QEWP-5 and YFAS 2.0, participants were classified into four groups as BED group (participants who met the QEWP-5 criteria), FA group (participants who met the YFAS 2.0 criteria), BED+FA group (participants who had an overlapping of BED and FA), and BED and/or FA-free group (if participants did not meet the diagnostic criteria of the QEWP-5 and YFAS 2.0). Figure 1 summarises the frequency distribution of BED, FA, and FA coincident with BED among the full sample of women with obesity. As presented in Figure 1, among the 842 respondents whose data were analysed, 86% ($n=725$) of women with obesity exhibited BED or FA or both BED+FA, while only 13.9% ($n=117$) did not meet any of the examined BED and FA criteria. About 23.5% of the participants (BED: $n=198$) had met the criteria for BED only, whereas 9.0% (FA: $n=75$) had met

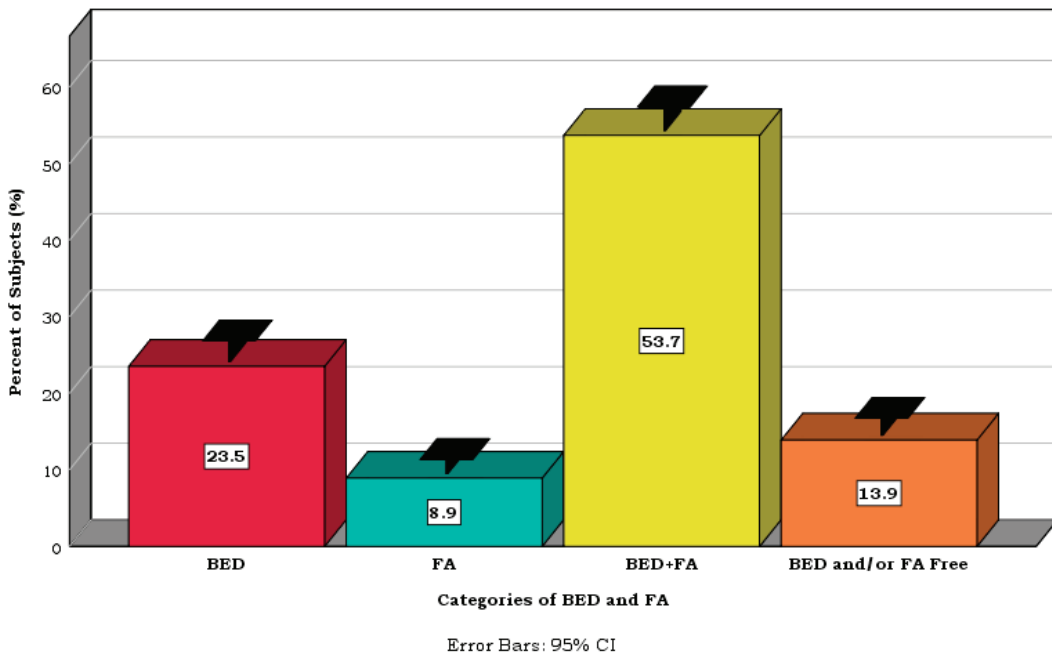


Figure 1. The frequency of binge eating disorder and food addiction in a sample of women with obesity

the criteria for FA only. Across the whole sample, the prevalence of overlapping BED and FA was found to be 53.6% (BED+FA: $n=452$). In fact, the frequency of women who had BED regardless of the presence of FA in the full sample was 79.0% ($n=650$). Of those with BED, 69.5% had met the criteria for FA as well (BED+FA: $n=452$).

Table 1 presents differences in selected anthropometric parameters in the studied population by BED and FA groups. Mean BMI was significantly higher in the overlapping BED and FA group (BED+FA) as compared to those from the BED and/or FA-free group (34.48 ± 0.18 kg/m² and 33.43 ± 0.32 kg/m², respectively; $p=0.013$). WC was

Table 1. Anthropometric, demographic and lifestyle characteristics of participants by eating disorder groups

Variables	BED $n=198$ n (%)	FA $n=75$ n (%)	BED+FA $n=452$ n (%)	BED and/or FA-free $n=117$ n (%)	Total $n=842$ n (%)	p^b
Age (y) ^a	29.1±0.5	29.0±0.8	29.8±0.3	29.4±0.6	29.5±0.2	0.499
BMI (kg/m ²) ^a	33.7±0.2	33.7±0.4	34.4±0.1*	33.4±0.3*	34.1±0.1	0.013
WC (cm) ^a	96.3±0.6	95.2±1.2*	98.0±0.5*	95.7±1.2	97.0±0.3	0.010
Body fat (%) ^a	47.6±0.3	47.7±0.5	47.3±0.2	47.4±0.4	47.4±0.1	0.879
Marital status						0.596
Married	118 (59.5)	45 (60.0)	286 (63.3)	67 (57.3)	516 (61.3)	
Single	78 (39.3)	29 (38.7)	156 (34.5)	50 (42.7)	313(37.2)	
Divorced	2(1.0)	1 (0.7)	7 (1.5)	0 (0.0)	10 (1.2)	
Widowed	0 (0.0)	0 (0.0)	3 (0.6)	0 (0.0)	3 (0.3)	
Education						0.022
< High school	17 (8.6)	8 (10.8)	49 (10.8)	20 (17.0)	94 (11.2)	
High school	64 (32.3)	10 (13.3)	134 (29.6)	34 (29.0)	242 (28.7)	
Diploma	20 (10.1)	10 (13.3)	37 (8.2)	13 (11.2)	80 (9.5)	
Bachelor	80 (40.4)	43 (57.3)	205 (45.4)	42 (36.0)	370 (43.9)	
Graduate	17(8.6)	4 (5.3)	27 (6.0)	8 (6.8)	56 (6.6)	
Employment						0.405
Yes	60 (30.3)	22 (29.3)	123 (27.2)	41 (35.0)	246 (29.2)	
No	138 (69.7)	53 (70.7)	329 (72.8)	76 (65.0)	596 (70.8)	
Smoking						0.029
Yes	43 (21.7)	21 (28.0)	142 (31.4)	25 (21.4)	231 (27.4)	
No	155 (78.3)	54 (72.0)	310 (68.6)	92 (78.6)	611 (72.6)	
Physical activity						0.302
Light	55 (27.8)	21 (28.0)	128 (28.3)	47 (40.2)	251 (29.8)	
Moderate	88 (44.4)	33 (42.3)	204 (45.1)	45 (38.5)	370 (44.0)	
Active	55 (27.8)	21 (28.0)	120 (26.5)	25 (21.3)	221 (26.2)	
Sleeping hours						0.037
< 6 hours/day	59 (29.7)	31 (41.3)	119 (26.3)	40 (34.1)	249 (29.5)	
> 6 hours/day	139 (70.2)	44 (58.6)	333 (73.6)	77 (65.8)	593 (70.4)	

y: years; BMI: body mass index; WC: waist circumference; BED: participants who met the binge eating disorder criteria; FA: participants who met the food addiction criteria; BED+FA: participants who had an overlapping of BED with FA; BED and/or FA-free: participants who did not meet the diagnostic criteria of BED and FA

^aMean±SEM

^bMean group differences by one-way ANOVA or Mann-Whitney U test based on normality. Statistical significance at $p\leq0.05$.

significantly higher in the overlapping BED and FA group (BED+FA) as compared to the FA group (98.00±0.50 cm and 95.28±1.24 cm, respectively; $p=0.010$). However, there was no significant difference in body fat percentage among the four group categories.

The demographic and lifestyle characteristics by groups from the BED and FA categories are presented in Table 1. There were no significant differences between groups regarding age, marital status, employment, and physical activity ($p>0.05$). The age of the participants ($N=842$) was similar across all groups of BED and FA categories, with an average of 29 years. Education levels differed significantly across groups ($\chi^2 =21.69$, $p=0.022$, $df=12$), with the BED and FA groups reporting a higher education level (Bachelor's degree) than participants in

the BED and/or FA-free group; however, 44.0% of the sample had a Bachelor's degree across all groups. Regarding smoking, majority of the participants from all groups were non-smokers, accounting for 72.6% ($n=611$), while 27.4% ($n=231$) were current smokers. Smoking status differed significantly across groups ($\chi^2=9.02$, $p<0.029$, $df=3$), with the overlapping BED and FA group (BED+FA) (31.4%) reporting more smokers than participants in the BED, FA, and BED and/or FA-free groups (21.7%, 28.0%, and 21.4%, respectively; $p<0.05$). About 29.5% ($n=249$) of the participants reported sleeping hours of <6 hours/day and 70.4% ($n=593$) had sleeping hours of >6 hours/day ($p=0.037$). Among all groups of the BED and FA categories, the FA group had a significantly lower level of sleeping time

Table 2. General eating pattern of participants by eating disorder groups

Variables	BED <i>n</i> =198 <i>n</i> (%)	FA <i>n</i> =75 <i>n</i> (%)	BED+FA <i>n</i> =452 <i>n</i> (%)	BED-and/or-FA-free <i>n</i> =117 <i>n</i> (%)	Total <i>n</i> =842 <i>n</i> (%)	<i>p</i>
Number of meals						0.011*
1 meal	22 (11.1)	18 (24.0)	76 (16.8)	26 (22.2)	142 (16.8)	
2 meals	133 (67.2)	36 (48.0)	247 (54.6)	65 (55.6)	481 (57.1)	
3 meals	43 (21.7)	21 (28.0)	129 (28.6)	26 (22.2)	219 (26.0)	
Skipping meals						0.008*
Breakfast (B)	63 (31.8)	13 (17.3)	135 (29.9)	29 (24.8)	240 (28.5)	
Lunch (L)	3 (1.5)	4 (5.3)	20 (4.4)	3 (2.6)	30 (3.6)	
Dinner (D)	67 (33.8)	19 (25.3)	92 (20.4)	33 (28.2)	211 (25.0)	
B & L	5 (2.5)	5 (6.7)	26 (5.7)	7 (6.0)	43 (5.1)	
B & D	17 (8.6)	13 (17.3)	50 (11.0)	18 (15.4)	98 (11.6)	
None	43 (21.7)	21 (28.0)	129 (28.5)	27 (23.0)	220(18.5)	
Number of snacks						<0.001*
None	3 (1.5)	6 (8.0)	2 (0.5)	12 (10.3)	23 (2.8)	
One snack	19 (9.6)	9 (12.0)	33 (7.3)	31 (26.5)	92 (10.9)	
Two snacks	61 (30.8)	26 (34.7)	118 (26.1)	20 (17.0)	225(26.7)	
≥ 3 snacks	115 (58.0)	34 (45.3)	299 (66.1)	54 (46.2)	502(59.6)	
Dining out						<0.001
Never	21 (10.6)	13 (17.3)	54 (12.0)	37 (31.6)	125(14.8)	
1-3/month	65 (32.8)	15 (20.0)	113 (25.0)	49 (41.9)	242(28.8)	
1-3/week	94 (47.5)	36 (48.0)	217 (48.0)	24 (20.5)	371 (44.0)	
4-7/week	18 (9.0)	11 (14.7)	68 (15.0)	7 (6.0)	104 (12.4)	

BED: participants who met the binge eating disorder criteria; FA: participants who met the food addiction criteria; BED+FA: participants who had an overlapping of BED with FA; BED and/or FA-free: participants who did not meet the diagnostic criteria of BED and FA.

*Pearson's Chi-square test (χ^2); statistically significance at $p<0.05$

(<6 hours/day), accounting for 41.3% (n=31) as compared to BED, BED+FA, and BED and/or FA-free groups (29.7%, 26.3%, and 34.1%, respectively).

The number and percent of subjects in each group across the various categories for eating pattern are presented in Table 2. The majority of the total sample (57.0%) ate only two meals per day; however, the BED group tended (67.2%) to consume two meals more frequently as compared to the FA, overlapping BED and FA (BED+FA), and BED and/or FA-free groups (48.0%, 54.6%, and 55.6%, respectively; $p<0.05$). Among the consumed meals, breakfast (28.5%) and dinner (25.0%) were the most skipped meals by all participants, whereas lunch (3.6%) was rarely skipped. However, there was a significant difference in the number of meals and snacks and dining out between groups. The BED group was significantly the highest in consuming two meals (67.0%) compared with all other groups ($p=0.011$). Regarding

the number of snacks, approximately 60.0% of the women with obesity reported consuming ≥ 3 snacks/day. The overlapping BED and FA group (BED+FA) was the highest in consuming three snacks or more per day, followed by the BED group with a frequency of 66.0% and 58.0%, respectively ($p<0.001$). Dining out 1-3 times per week was significantly higher in all BED and FA groups (BED, FA, and BED+FA), with a frequency of approximately 48.0% as compared to 20.0% in the BED and/or FA-free group ($p<0.001$). Interestingly, the FA and overlapping BED and FA (BED+FA) groups reported dining out four to seven times per week, with a frequency of 15.0% as compared to the BED and/or FA-free group, where the frequency was only 6.0%. The associations between water intake, obesity, and categories of BED and FA are illustrated in Figure 2. Drinking one to three cups of water per day was significantly higher in all categories

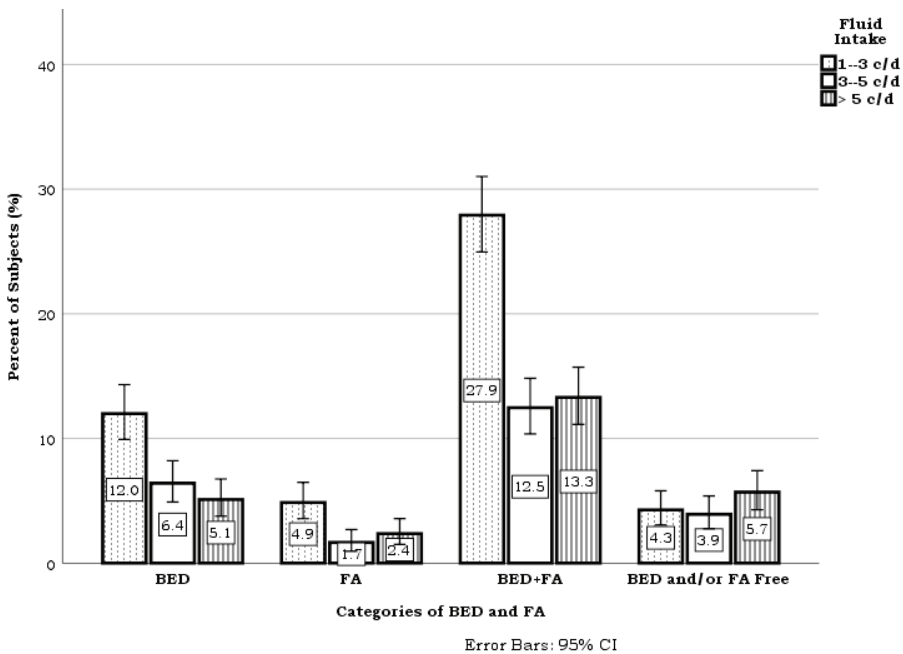


Figure 2. Associations between fluid intake and categories of binge eating disorder and food addiction among study population

of BED and FA groups (BED, FA, and BED+FA), with a frequency ranging from 51.0-54.0% as compared to 30.7% in the BED and/or FA-free group ($p<0.001$). Conversely, within groups, the BED and/or FA-free group had a significantly higher level of water intake of > 5 cups/day, with a frequency of 41.0% ($n=48$) as compared to the BED, FA, and BED+FA groups [21.7% ($n=43$ out of 198), 26.6% ($n=20$ out of 75), and 24.8% ($n=112$ out of 452), respectively].

The relative risks (RR) for obese women with BED as compared to obese women without BED in the presence of selected predictors are presented in Table 3. The model was adjusted for age and education level. When all predictors were entered into the model, only FA scores, number of snacks, and sleeping hours were significantly related to BED risk. Higher FA scores significantly

increased the risk of developing BED [RR: 1.23 (1.16-1.29), $p<0.001$]. Our data showed that obese participants who had three or more snacks per day [RR: 2.17 (1.39-3.37), $p=0.001$] were significantly at a higher risk of developing BED. After controlling for FA scores, obese participants who had a fluid intake of 1-3 cups/day [RR: 1.51 (1.16-2.12), $p=0.017$] were at a significantly increased risk of developing BED.

DISCUSSION

Binge eating disorder can have functional consequences, such as difficulty in adapting to new roles, reduced quality of life, and decreased life satisfaction due to health problems, increased overall morbidity and mortality, increased use of healthcare resources, and weight gain and obesity (Myers & Wiman,

Table 3. Associations between binge eating disorder and selected indicators among study population

Indicators ^a	Relative Risk OR (95% CI)	<i>p</i>
Food addiction scores (FA)	1.23 (1.16-1.29)	<0.001
Smoking	1.17 (0.78-1.77)	0.436
Yes		
No		
Physical activity	1.22 (0.80-1.86)	0.333
Active		
Inactive		
Number of meals	0.98 (0.64-1.48)	0.926
4 meals		
3 meals		
Number of snacks	2.17 (1.39-3.37)	0.001
≥ 3 snacks		
<3 snacks		
Sleeping hours	1.55 (1.14-2.23)	0.017
<6 hours/day		
>6 hours/day		
Fluid Intake	1.51 (1.16-2.12)**	0.019
3 cups/day		
>3 cups/day		

^aLogistic regression test; dependent variable: binge eating disorders

Data presented as RR (odd ratios (OR) + 95% CI). Statistically significance at $p<0.05$

**Adjusted for FA scores

2014). Recently, it has been reported that one in ten individuals suffers from FA. This figure may be doubled among individuals with obesity as shown in a large community sample (Minhas *et al.*, 2021). However, existing research evidence suggested that there is an overlap between BED and the construct of FA (Burrows *et al.*, 2017). In the present study, approximately 86.0% of the total sample of women with obesity had BED, FA, and overlapping BED and FA. The highest frequency was observed in the group that had BED coincident with FA (BED+FA), which accounted for 53.7% of the total sample. Our observations were consistent with previous data, which revealed that 92.0% of individuals with BED met the food addiction criteria (Carter, Van Wijk & Rowsell, 2019). A recent study showed that 61.5% of their sample met both the BED and FA criteria (Fauconnier *et al.*, 2020). Carter *et al.* (2019) reported that high rates of FA symptoms were observed in individuals with BED, which may highlight the overlap between FA symptoms and clinical features of BED. However, our multivariate analysis showed that increased score of FA was significantly associated with increased risk of BED in obese women. The mechanism by which FA is related to BED risk is not fully understood.

In a previous meta-analysis that analysed 25 studies and included a total of 196,211 overweight/obese participants, of which 60.0% were females, the mean prevalence of FA was 19.9%. Furthermore, the mean prevalence of FA was even more pronounced in 14 studies, accounting for 24.9% in overweight/obese individuals (Pursey *et al.*, 2014). However, only 9.0% of obese women met the YFAS 2.0 criteria for FA in the present study. On the other hand, of those with BED, 69.5% of them met the criteria for FA. This variation in

the prevalence rate of FA may be related to cultural theories concerning the effect of exposure to a western diet on the risk of developing eating disorders, which have been focused on eating disorder-specific factors. These factors include media influences, body image ideals, as well as peer and familial pressures on appearance (Myers & Wiman, 2014).

Smoking is a common risk behaviour among individuals with ED, which has been reported as an appetite/weight control strategy (Anzengruber *et al.*, 2006). About one third of our overall sample were current smokers, and the overlapping BED and FA group (BED+FA) reported the highest number of smokers. These findings were consistent with that of Anzengruber and colleagues (2006), who found that women with ED had higher rates of smoking and a greater level of nicotine dependence than controls (Anzengruber *et al.*, 2006). A systematic review revealed that individuals with BED and bulimia nervosa were significantly more likely to be life-long smokers than healthy controls. A possible explanation for these results may be that cigarette smoking is being used by ED individuals as a behavioural strategy to suppress appetite, compensate for overeating, cope with body dissatisfaction, and manage weight or appetite changes due to withdrawal symptoms (Solmi *et al.*, 2016).

As we mentioned previously, the FA group had a significantly lower level of sleeping hours (<6 hours/day) as compared with all other groups. This result matches those observed in earlier studies, which reported that sleep deprivation was associated with increased food intake and appetite. Benedict *et al.* (2012) demonstrated that acute sleep deprivation increases the reward response to food cues, regardless of weight or blood sugar level. The explanation for this result may be

the impact of impulsivity and its effect on insomnia (Benedict *et al.*, 2012). Our data showed that the proportion of obese women who had a daily sleeping time of less than six hours in the BED group was lower than that in the BED and/or FA-free group. However, the likelihood of having BED was significantly higher in obese women who had a daily sleeping time of less than 6 hours ($p < 0.05$). Trace *et al.* (2012) reported that sleep problems were associated with binge eating and obesity in adult Swedish women. A possible explanation for these observations may be related to environmental stressors, depression, or underlying biological mechanisms (Trace *et al.*, 2012).

The present study found that the overlapping BED and FA group (BED+FA) had a significantly higher BMI and WC than that in all other groups. The occurrence of FA with BED could be a sign of more severe BED, associated with factors such as stronger negative affect, more frequent binge eating episodes, and an earlier onset of problematic eating behaviours (Gearhardt *et al.*, 2014).

The current study also found that the BED group was the highest in consuming just two meals and skipping meals, especially breakfast or dinner; whereas the overlapping BED and FA group (BED+FA) was the highest in consuming more than three snacks per day as compared to the BED and/or FA-free group. The BED and/or FA-free group had a tendency to consume no snacks or only one snack per day. This finding confirms that the decreased number of main meals led to an increase in the number of snacks. Our data also showed that obese women who frequently consumed more than or equal to three snacks per day could face more than twice the risk of BED compared to those who consumed less than three snacks per day [RR: 2.17 (1.39-3.37), $p = 0.001$]. Accordingly, it has been reported that

women who were at a high risk of developing ED had a higher frequency of skipping meals and consuming snacks (Gandhi & Battalwar, 2019). Masheb & Grilo (2006) investigated eating habits in overweight patients with BED and reported that patients who ate three meals per day had significantly weighed less and had fewer binge-eating episodes than those who did not regularly eat three meals each day. A possible explanation for this result could be that skipping main meals increases cravings and leads to overeating.

All of the BED and FA groups in this study tended to dine out more frequently than the BED and/or FA-free group, especially the FA and overlapping BED and FA (BED+FA) groups. In line with our results, a large study revealed that FA was positively associated with fast foods (Lemeshow *et al.*, 2018). A cross-sectional study showed that the prevalence of fast food addiction among a sample of adults was high (30.0%) and that fried chicken was the favourite quick food for many of them (49.2%). It seems possible that both personal and socio-cultural factors may increase fast food addiction (Arumugam *et al.*, 2015). Although there is little evidence supporting the fact that fast food has an addictive potential, its high fat and salt contents can trigger addictive-like behavioural or biological reactions due to its unnaturally high rewarding levels (Gearhardt *et al.*, 2014).

In line with previous studies, the current study showed that women with obesity who consumed less amount of water were more likely to exhibit BED and/or FA. Hart *et al.* (2005) reported that only 17.0% of patients with ED had adequate amounts of fluids as recommended. The authors have also observed that fluid intake was inversely related to BMI in patients with ED (Hart *et al.*, 2005). Additionally, a study found

that drinking 17oz. (550ml) of water prior to eating a meal was associated with a lower number of calories consumed by 13.0% of participants as compared with a control group (Davy *et al.*, 2008). One possible explanation could be that increasing water intake may delay gastric emptying, thus increasing sensations of fullness and thermogenesis, which leads to reduced snacking and binge eating (Davy *et al.*, 2008).

The strength of this study is that it was the first study to examine the prevalences of both BED and FA in Jordanian obese women by using paper-based questionnaires filled in by a trained interviewer in a face-to-face setting. Additionally, a descriptive well-designed case series using well-validated assessment tools provided information that allowed researchers to develop hypotheses towards further advanced studies. The present study had the advantage of using a large sample size, and this allowed for more precise estimates of the occurrences of BED and FA. However, the present study had some limitations including the descriptive case series design that had some sources of bias such as selection bias, lack of generalisability, lack of a control group, and inability to show cause and effect associations.

CONCLUSION

This study revealed that the occurrence of binge eating disorder was relatively high among a sample of Jordanian women with obesity. The study demonstrated the overlap between BED and FA in a selected sample of obese women. Although the study was descriptive, it suggested that BED, FA, and the overlapping of BED and FA, in particular, were associated with greater tendencies towards unhealthy pattern of eating practices, fluid intake, and

sleeping habits. The increased risk of BED in this sample of obese women appeared to be associated with FA and other obesity-related risk factors such as unhealthy characteristics of eating patterns and sleeping habits. Therefore, further research is needed to identify the overlapping BED and FA, and to explore its distinctive underlying mechanisms in obese individuals.

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Authors' contributions

Zueter Z, conceptualised the study, conducted the study, performed data collection in the city of Irbid, prepared the draft of the manuscript; Mashal RH, served as an advisor, designed the study, carried out the validation tests for the questionnaires, performed data analysis and interpretation, and reviewed the manuscript.

Conflict of interest

We have no relationships, financial or otherwise, that might lead to a conflict of interest.

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