Discover Mental Health

Research

Tobacco smoking and the risk of eating behaviors and depression among Palestinian female university students

Basma Damiri[1] · Thabet Zidan[2] · Dalia Hamayel[2] · Motaz Saifi[2]

Received: 20 September 2024 / Accepted: 4 March 2025
Published online: 10 March 2025

Abstract

Background Tobacco smoking and eating disorders are often connected to concerns about body image and can be indicative of underlying mental health conditions, such as depression. In Palestinian society, females have a cultural belief that smoking can aid in weight loss. Societal pressure on body image may drive females to such risky behaviors. However, few studies have examined the link between smoking and eating disorder behaviors. We researched the prevalence of tobacco smoking among Palestinian female university students and its association with binge/purge behaviors and depression.

Method A cross-sectional research study was carried out at An-Najah National University. Female students [N = 642] completed anonymous surveys, sharing information about tobacco smoking and other substance use habits, answering questions from the Eating Attitude Test-26, the Sick (EAT-26), Control, One, Fat, and Food (SCOF) screening tests, and the Beck Depression Inventory.

Results The study reported a high prevalence of waterpipe smoking (24.4%) among Palestinian university female students, which exceeded the prevalence of cigarette smoking (4%). For the SCOF scale, 36.3% scored ≥ 2 points, indicating a screened positive for anorexia or bulimia nervosa; 40% struggled with binge-eating behavior, while only 7.8% had sought treatment for eating disorders. Additionally, 34.7% of the students experienced depression. The adjusted binary logistic regression model of risk factors for cigarette smoking has shown that cigarette smoking is significantly associated with self-induced vomiting (aOR = 6.075, *p*-value = 0.027), history for eating disorder treatment (aOR = 3.438, *p*-value = 0.047), e-cigarettes (aOR = 10.070, *p*-value = 0.001), waterpipe (aOR = 3.299, *p*-value = 0.022), energy drinks (aOR = 5.163, *p*-value = 0.003), moderate depression (aOR = 11.499, *p*-value = 0.010), and mild depression (aOR = 12.963, *p*-value = 0.003).

Conclusion The study revealed concerning results of tobacco smoking linked to depression, binge/purge behaviors, obesity, and various weight-control methods. These findings highlight the urgent need for targeted interventions through awareness campaigns, culturally tailored health education, implementation of mental health support for students, and provide accessible medical and psychological assistance to at-risk Palestinian female students.

Keywords Eating disorders · Depression · Tobacco smoking · Waterpipe smoking · Binge Purge behavior · Female university students

✉ Basma Damiri, bdamiri@najah.edu; ✉ Motaz Saifi, mtzsaifi@gmail.com | [1]Physiology, Pharmacology and Toxicology Division, Faculty of Medicine and Health Sciences, An-Najah National University, New Campus, Building: 19, Office 3226, Box 7, Nablus, Palestine. [2]Department of Medicine, School of Medicine and Health Sciences, An-Najah National University, New Campus, Nablus, Palestine.

1 Introduction

The cultural appreciation for curvy body types in traditional Arab societies, which are majorly located in the Middle East, has been associated with good health and prosperity ideals for a long time [1]. This preference for curvy body types has led to a lower prevalence of eating disorders among Arabs in the past [1]. However, recent studies show a rising incidence of eating disorders within the Arab population, attributed to factors like exposure to Western media and culture influencing body image preferences and leading to a higher desire for thinness [2–5]. Understanding these trends is crucial for developing interventions to promote healthy body image and prevent eating disorders across different cultures. Global media and cultural globalization have significantly influenced body image perceptions among young Arab women, including those in Palestine. The rise of Western ideals of thinness has overshadowed traditional standards that celebrated curvier body types, increasing pressures on women to conform and leading to a rise in eating disorders. This trend highlights the need for localized studies to explore how these influences affect body image perceptions in Palestine.

Eating disorders are severe health conditions that impact both physical and mental health. These conditions involve disturbances in thoughts about food, eating, weight, body shape, and eating behaviors [6, 7]. Females with eating disorders, distorted body image, and weight concerns are more likely to smoke than females who have a healthier relationship with eating. The highest prevalence of smoking was among females with binge/purge subtypes [8]. A misconception lies in the belief that smoking is acceptable for appetite and weight control, especially among females [9–11]. Female patients with eating disorder behaviors used smoking to compensate for overeating or to limit their consumption despite no evidence suggesting smoking as an acceptable weight control method [8, 12]. They were also found to be stricter with their dieting and have an increased risk for depression, panic disorder, substance use, and other physical problems compared to never-smokers and former smokers [13]. Therefore, smoking screening for patients with binge/purge eating was recommended [6]. Moreover, studies have shown that individuals who smoke cigarettes are more likely to be caffeine-dependent [14]. Several studies have also investigated the effect of coffee on adiposity to provide evidence-based recommendations for individuals seeking to manage their weight through dietary changes. Some of these studies have suggested that coffee may have anti-obesity effects [15, 16], and others suggested sex-based effects and lower adiposity, particularly in females [17–19]

Recent studies have shown that tobacco smoking is linked to a higher likelihood of metabolic syndrome, dyslipidemia, and central obesity among adolescents and young adult Palestinians, suggesting the need for greater attention to this issue [20, 21]. Despite the increased prevalence of tobacco smoking and caffeine consumption among Palestinians, along with their association with metabolic abnormalities, there have been few studies investigating their relationship with eating disorder behaviors [20, 22]. A recent study indicated that risk factors associated with self-induced vomiting among Palestinian refugee men were energy drink and alcohol consumption and inversely associated with waterpipe smoking [22]. Additionally, an increased risk of self-induced vomiting behavior among Palestinian male drug users was associated with binge behavior, laxative use, waterpipe smoking, and e-cigarette smoking [23]. These disorders are physically and mentally disabling as they are associated with increased levels of depression and high rates of mortality, among other mental disorders [23].

The prevalence of tobacco smoking among Palestinian females was 7.7% in 2021, a sharp increase from 2.3% in 2010 [24]. Additionally, a high prevalence of waterpipe smoking was reported among Palestinian female students, surpassing the prevalence of cigarette smoking [25]. There is a cultural belief among some Palestinian females that smoking can help with weight loss [26], which often leads women to adopt this behavior in their pursuit of an idealized body image. This cultural norm highlights how societal pressures and traditional beliefs intersect to shape health behaviors among female university students. Moreover, this cultural framework warrants further investigation, as understanding the origins and perpetuation of these beliefs is essential for developing effective interventions. Therefore, the cultural belief among Palestinian women that smoking can aid in weight loss is an important factor that needs to be addressed. Research indicates that females with eating disorders who smoke are more likely to engage in purging and fasting compared to non-smokers with eating disorders [8].

Moreover, smokers with eating disorder behaviors are less concerned about smoking cessation and have poor smoking cessation outcomes [6, 12]. Therefore, there is an essential need to screen these disorders among females, specifically among smokers. Eating disorders among Palestinian females are under-diagnosed and under-treated. While few studies are reporting on the prevalence of eating disorders among Palestinian females [14], the reported prevalence was high, with 38.9% among university students [27] and higher than the worldwide average (5.5–17.9%)

[28, 29]. Given the prevalence of eating disorders such as tobacco smoking and caffeine consumption among Palestinians and their potential association with metabolic abnormalities [30–32], it is crucial to investigate the relationship between these behaviors and eating disorders among Palestinian female students. There is a lack of research on eating disorders among Palestinian women, particularly among female university students. This gap in understanding extends to the relationships between smoking, body image concerns, and eating disorders. It highlights the need to investigate further the culturally specific factors influencing these behaviors. Addressing this knowledge gap is crucial for developing targeted interventions and promoting mental health within this demographic. We aimed to investigate these gaps in the literature and explore the potential association between tobacco smoking, caffeine consumption, and eating disorder behaviors among Palestinian female students, as well as their impact on depression. Specifically, we aimed to investigate whether cigarette smoking is associated with different eating disorder behaviors among Palestinian female university students, especially binge/purge behaviors. The findings are crucial for healthcare providers to understand these behaviors and their prevalence in Palestinian society, leading to earlier diagnosis and improved health outcomes in this population subgroup. Additionally, these findings can guide policymakers in implementing strategies to address this growing issue.

2 Materials and methods

2.1 Study design, setting, population, sample size, and sampling technique

A cross-sectional study was conducted at An-Najah National University (ANNU), a prominent university in the West Bank, Palestine, in 2022. Female students between 18 and 25 were asked to participate in the study through the university portal, social media announcements, and posters. The sample size was estimated to be 171 in a population of 10,000 female students at ANNU, assuming a proportion of tobacco smoking at 12.9% [25], a 95% confidence level, and a precision of 5%. To minimize bias, the students were stratified by their curricular year, with a target sample size of 100 students from each academic year. Therefore, the minimum sample size required for the study was 400. Participants who were taking drugs such as cortisone or had ailments like thyroid problems that could potentially affect the outcomes were excluded from the study.

2.2 Study tool and operational definition

A self-administered questionnaire was utilized anonymously and was divided into three parts. The first part gathered sociodemographic data and general information on tobacco smoking and caffeine product consumption. The second part incorporated the Sick, Control, One, Fat, and Food (SCOFF) questionnaire, while the third part included six behavioral questions from the Eating Attitude Test-26 (EAT-26). Both SCOFF and EAT-26 are effective self-administered questionnaires that are broadly used for screening eating disorders [33, 34]. SCOFF consists of 5 questions with a cutoff point of 2 or more; a score of 2 or more indicates a likely diagnosis of anorexia nervosa (AN) or bulimia nervosa (BN) [33]. The questions were as follows: Q1: Do you make yourself sick because you feel uncomfortably full? Q2: Do you worry you have lost control over how much you eat? Q3: Have you recently lost more than one stone in a 3-month period? Q4: Do you believe yourself to be fat when others say you are too thin?, and Q5: Would you say that food dominates your life? During the assessment, participants were asked behavioral questions (BQ) about the frequency of their eating disorder behaviors. The questions were as follows: QB1: Gone on eating binges where you feel that you may not be able to stop? QB2: Ever made yourself sick (vomited) to control your weight or shape? QB3: Ever used laxatives, diet pills, or diuretics (water pills) to control your weight or shape? QB4: Exercised more than 60 min a day to lose or to control your weight?, QB5: Lost 20 pounds or more in the past 6 months?, and QB6: Have you ever been treated for an eating disorder? The options ranged from never, once a month or less, 2–3 times a month, once a week, 2–6 times a week, and once or more a day. Positive responses to these questions suggest a need for referral. It is important to note that the EAT-26 alone cannot diagnose an eating disorder. Therefore, it is crucial to consider other factors such as weight history, current BMI (body mass index), and percentage of ideal body weight when interpreting the results [34]. Purging behaviors include self-induced vomiting and diuretic or laxative use to control weight. The Arabic-SCOFF and EAT-26 questionnaires were accurate and reliable for the early detection of eating disorders [35, 36]. The EAT-26 has been reproduced with permission [34, 37].

The Beck Depression Inventory (BD-II) Arabic version was employed to measure depression among the participants. This 21-question multiple-choice self-report inventory is widely used to assess the severity of depression. It has proven valid and reliable among undergraduate students in Arabic-speaking countries, with an alpha reliability of 0.83 and test–retest reliability of 0.74 [38]. BD-II categorizes depression into four subtypes: minimal, mild, moderate, and severe. Notably, minimal depression represents individuals without depression. Hence, the overall prevalence of depression includes mild, moderate, and severe cases.

The questionnaire to assess tobacco smoking and caffeine consumption patterns was previously validated and published [39]. Tobacco smoking includes cigarette and waterpipe smoking. A participant in this study who has used tobacco or caffeine products within the past 30 days is considered a current user. The participant's weight was measured to the nearest 0.1 kg using an electronic device, while their height was measured to the nearest 0.1 cm using a wall meter. Body Mass Index (BMI) was calculated using the formula: weight (kg) divided by the square of the height (m^2). Based on their BMI, the participants were categorized as underweight (< 18.5), average weight (18.5–24.9), overweight (25–29.9), or obese (BMI of 30 or greater).

2.3 Ethics approval and consent to participate

The Institutional Review Board "IRB" at An-Najah National University (ANNU) granted ethical approval, with an archived number of (7) Dec. 2019. Prior to participation, informed consent was obtained from every student. Instead of names, codes were used. The research team ensured that all data collected was accessible only to the research team. All the procedures performed in this study were in accordance with the 1964 Helsinki declaration and its later amendments.

2.4 Data analysis

For data analysis, IBM SPSS Statistics for Mac, version 27 (IBM Corp., Armonk, NY, USA). The Shapiro–Wilk test was used to test the normality of the distribution of continuous variables. Continuous variables were described as means with standard deviations (SD). Percentages were used to represent each study variable. Descriptive statistics were calculated for the point-prevalence of reported SCOFF questions, EAT-26 behaviors, depression, tobacco smoking, caffeine consumption, and other substance use. Prior to conducting the adjusted logistic regression analysis, we carried out univariate analyses to assess the individual associations between tobacco smoking and potential risk factors such as eating disorder behaviors and depression levels. This preliminary analysis allowed us to identify significant predictors and understand the relationships between each variable and smoking behavior among Palestinian female university students. The binary logistic regression analysis aimed to determine the relative risk of cigarette smoking and EAT-26 behaviors and depression and was adjusted to other substance use and body mass index. Adjusted odds ratios (OR) and 95% confidence intervals (CI) for risk factors were estimated. A *p*-value of less than 0.05 was considered statistically significant.

3 Results

3.1 General characteristics and anthropometric measurements of participants

The total number of respondents was 661; the incomplete questionnaires were excluded (n = 19), and the final number of participants was 642, with a mean age of 20.0 years. Of all participants, 16.5% were underweight, 14.6% were overweight, 4.1% were obese, and 64.8% had an average weight. Moreover, 53% were city residents, 45.6% were village residents, 1.4% were refugee camp residents, 97.5% of participants were singles, and 5.1% were working (Table 1).

3.2 Tobacco and caffeine products practice, pattern, and motivation of use

Among the study participants, the highest prevalence of smoking was found in waterpipe smoking (22.4%), with 15.3% smoking daily and 29.2% smoking several times weekly. The mean age of initiation for cigarette and waterpipe smoking was similar, with 17.4 for cigarette smoking and 17.7 for waterpipe smoking. Caffeine products were prevalent, with energy drinks at 30.5%, coffee and its derivatives at 83.3%, and tea at 81.0% (Table 2). For the purpose of losing weight, 38.4%, 4.2%, and 37.5% of the students smoked cigarettes, waterpipes, and e-cigarettes, respectively, and 2.6% and 8.4% of students consumed energy drinks and coffee (Table 2).

Table 1 The participants' general characteristics (n = 642)

Residency n (%)	City	340 (53.0)
	Village	293 (45.6)
	Camp	9 (1.4)
Marital Status n (%)	Single	626 (97.5)
	Married	16 (2.5)
Working n (%)	Yes	33 (5.1)
	No	609 (94.9)
Weight category n (%)	Underweight	106 (16.5)
	Normal	416 (64.8)
	Overweight	94 (14.6)
	Obese	26 (4.1)
Age mean (SD)		19.99 (1.64)

SD, Standard deviation

Table 2 The frequency, pattern of use, and initiation age of tobacco and caffeine products

Pattern of Use	Total n (%)	Daily n (%)	Several times weekly n (%)	Several times monthly n (%)	Initiation age in years Mean ± SD
Cigarettes	26 (4.0)	2 (7.7)	3 (11.5)	20 (76.9)	17.44 ± 2.33
Waterpipe	144 (22.4)	22 (15.3)	42 (29.2)	72 (50.0)	17.74 ± 1.89
E-cigarettes	16 (2.5)	2 (12.5)	1 (6.3)	10 (62.5)	18.67 ± 1.03
Energy Drinks	196 (30.5)	15 (7.7)	41 (20.9)	135 (68.9)	16.73 ± 2.62
Coffee	535 (83.3)	251 (46.9)	174 (32.5)	104 (19.4)	14.69 ± 3.65
Tea	520 (81.0)	237 (45.6)	178 (34.2)	102 (19.6)	9.99 ± 4.30
Motivation of use	Cigarettes n (%)	Waterpipe n (%)	E-cigarettes n (%)	Energy Drinks n (%)	Coffee n (%)
Boredom	6 (23.1)	45 (31.2)	3 (18.8)	23 (11.7)	149 (27.9)
Cope with problems	8 (30.1)	29 (20.1)	0 (0.0)	15 (7.7)	83 (15.5)
Addiction	1 (3.8)	17 (11.8)	2 (12.5)	15 (7.7)	120 (22.4)
Anger	10 (38.5)	20 (13.9)	2 (12.5)	30 (15.3)	83 (15.5)
Losing weight	10 (38.4)	6 (4.2)	6 (37.5)	5 (2.6)	45 (8.4)
Seeking pleasure	9 (34.6)	92 (63.9)	6 (37.5)	70 (35.7)	335 (62.3)

SD, Standard deviation.

3.3 Frequencies of SCOFF questions, EAT-26 behaviors, and depression categories based on the Beck scale

For the SCOF scale, 6.4% admitted to making themselves sick due to feeling uncomfortably full, and 5.1% reported losing more than one stone in 3 months. In total, 36.3% scored 2 or more, indicating a likely diagnosis of anorexia nervosa (AN) or bulimia nervosa (BN) 28. For EAT-26 behavioral questions, 39.9% stated that they engaged in binge eating, and 5.5% reported self-induced vomiting as a means to control their weight and shape. In contrast, 4.4% reported using laxatives, diuretics, and diet pills. Furthermore, 36.9% of participants claimed to exercise for more than 60 min daily to manage their weight, 13.6% lost 20 pounds or more in the past six months, and 7.8% had been previously treated for an eating disorder. Moreover, 27.9% felt that food dominates their life, 39.8% worried about losing control over how much they eat, and 36.8% believed they are fat when others say they are too thin. Based on the Beck scale, 3.7% of the participants had severe depression, 9.2% had moderate depression, and 21.8% had mild depression (Table 3).

The univariate analysis results for risk factors associated with cigarette smoking and obesity have shown the following: obesity was significantly associated with SCOF SCORE (≥ 2) (OR = 2.72, *p*-value < 0.001), QB2 (OR = 4.62,

Table 3 The frequency of self-induced vomiting, binging, and weight control methods

SCOFF Questionnaire	Yes n (%)
Q1: Do you make yourself sick because you feel uncomfortably full?	41 (6.4)
Q2: Do you worry you have lost control over how much you eat?	255 (39.8)
Q3: Have you recently lost more than 1 stone in a 3-month period?	33 (5.1)
Q4: Do you believe yourself to be fat when others say you are too thin?	236 (36.8)
Q5: Would you say that food dominates your life?	179 (27.9)
Total SCOF score 2 or more points	232 (36.3)
EAT-26 Behavior Questions	
QB1: Gone on eating binges where you feel that you may not be able to stop?	256 (39.9)
QB2: Ever made yourself sick (vomited) to control your weight or shape?	35 (5.5)
QB3: Ever used laxatives, diet pills or diuretics (water pills) to control your weight or shape?	28 (4.4)
QB4: Exercised more than 60 min a day to lose or to control your weight?	237 (36.9)
QB5: Lost 20 pounds or more in the past 6 months?	87 (13.6)
QB6: Have you ever been treated for an eating disorder?	50 (7.8)
EAT-26 Subscales	
Dieting subscale	
Depression Categories-Based on the Beck Scale	
Sever	24 (3.7)
Moderate	59 (9.2)
Mild	140 (21.8)
Minimum	419 (65.3)

p-value < 0.001), QB3 (OR = 4.11, *p*-value < 0.001), QB4 (OR = 4.44, *p*-value < 0.001), QB5 (OR = 1.82, *p*-value = 0.023), moderate depression (OR = 2.68, *p*-value = 0.045), and waterpipe (OR = 1.66, *p*-value = 0.027). Cigarette smoking was significantly associated with QB2 (OR = 4.89, *p*-value < 0.001), QB6 (OR = 3.17, *p*-value = 0.020), moderate depression (OR = 5.4, *p*-value = 0.018), mild (OR = 7.42, *p*-value = 0.001), and waterpipe (OR = 7.14, *p*-value < 0.001) (Table 4).

3.4 Risk factors associated with cigarette smoking

The adjusted binary logistic regression model of risk factors for cigarette smoking has shown that cigarette smoking is significantly associated with self-induced vomiting (aOR = 6.075, *p*-value = 0.027), history of eating disorder treatment (aOR = 3.44, *p*-value = 0.047), e-cigarettes (aOR = 10.07, *p*-value = 0.001), waterpipe (aOR = 3.299, *p*-value = 0.022), energy drinks (aOR = 5.16, *p*-value = 0.003), moderate depression (aOR = 11.499, *p*-value = 0.010), and mild depression (aOR = 12.96, *p*-value = 0.003) (Table 5).

4 Discussion

Tobacco smoking and eating disorders are often linked to body image concerns and can be a symptom of underlying mental health conditions such as anxiety, depression, or trauma [6, 7]. For Palestinian females, there is a cultural belief that smoking can aid in weight loss. However, few studies examined the relationship between smoking, caffeine consumption, eating disorder behaviors, and depression. In this study, we examined the prevalence of tobacco smoking among university Palestinian females and their association with binge/purge behaviors and depression.

The study found that female students who have increased body mass index are more likely to engage in self-induced vomiting. Moreover, they are more likely to follow a food-centered lifestyle, exercise regularly, and use laxatives, diuretics, and diet pills to lose weight. These findings emphasize the importance of addressing and promoting healthy habits and behaviors amongst obese female students to prevent such harmful practices.

Research has revealed that female smokers with eating disorders are more likely to engage in purging and fasting behaviors than non-smokers with eating disorders [8]. The findings of this study addressed the tobacco smoking problem and its association with the high prevalence of binge/purge behaviors among Palestinian female university students.

Table 4 A univariate analysis of risk factors associated with cigarette smoking and obesity

		Obesity					Cigarette smoking				
		Yes	No	OR	95% CI	*p*-value	Yes	No	OR	95% CI	*p*-value
SCOF SCORE	≥ 2	67	165	2.72	1.81–4.08	< 0.001*	12	220	1.66	0.74–3.695	0.213
	< 2	53	355				13	395			
QB1	Yes	55	201	1.35	0.91–2.02	0.139	13	243	1.67	0.75–3.72	0.207
	No	65	321				12	374			
QB2	Yes	17	18	4.62	2.30–9.27	< 0.001*	5	30	4.89	1.72–13.93	0.001*
	No	103	504				20	587			
QB3	Yes	13	15	4.11	1.90–8.88	< 0.001*	2	26	1.98	0.44–8.84	0.36
	No	107	507				23	591			
QB4	Yes	79	158	4.44	2.91–6.76	< 0.001*	12	225	1.61	0.72–3.59	0.24
	No	41	364				13	392			
QB5	Yes	24	63	1.82	1.08–3.05	0.023*	4	83	1.223	0.41–3.65	0.72
	No	96	458				21	533			
QB6	Yes	8	42	0.82	0.37–1.78	0.608	5	45	3.172	1.14–8.85	0.02*
	No	112	479				20	571			
Beck scale	Severe depression	8	16	2.45	0.83–7.27	0.106	4	20	2.16	0.53–8.86	0.285
	Moderate depression	10	49	2.68	1.02–7.03	0.045*	5	54	5.4	1.34–21.81	0.018*
	Mild depression	22	118	2.12	0.88–5.12	0.096	5	135	7.418	2.17–25.36	0.001*
	Minimum depression	80	339				11	408			
Waterpipe		35	85	1.66	1.06–2.59	0.027*	16	123	7.14	3.08–16.54	< 0.001*

CI, Confidence Interval; OR1, Odds Ratio

*Significance value < 0.05.

Research suggests that individuals with eating disorders may smoke for weight control [7]. Specifically, those who engage in binge eating and purging behaviors have been found to have higher levels of nicotine dependency [40]. Additionally, smoking has been linked to obesity and weight gain, with former smokers reporting higher BMIs than non-smokers and current smokers [41]. In another study, smoking was positively associated with central obesity but not with overall obesity [17], potentially increasing the risk of chronic diseases like cardiovascular disease and type 2 diabetes [42]. Consistent with the literature, a high prevalence of waterpipe smoking was reported among Palestinian female students, and it surpassed the prevalence of cigarette smoking [25]. Similarly in nearby countries [43, 44]. Around one-fourth of the Palestinian female students were waterpipe smokers compared to 4% of cigarette smokers, indicating that non-traditional smoking is an emerging hazard among Palestinian females in general and university students in specific. There is a misperception among Palestinians about the negative health consequences of non-traditional tobacco smoking. There is a mistaken belief that it is less harmful than cigarette smoking, although studies have indicated that it is a risk factor for increased obesity and central obesity [30, 31]. In agreement with these studies, waterpipe smokers were more likely to be obese. Therefore, we recommend educational activities to enhance Palestinian female students' awareness of the health consequences of cigarette and waterpipe smoking, including obesity and eating disorders.

Obesity is associated with an increased risk of developing a purging disorder [45, 46]. These trends may be explained by societal discrimination against those with higher BMIs, which can lead to dissatisfaction with one's body image and an expectation to lose weight [47, 48]. Furthermore, the co-occurrence of eating disorders and obesity may be linked to binge eating as a potential contributor to weight gain [49]. The results of this study revealed that self-induced vomiting is linked to obesity and in smokers more than non-smokers. This could support previous research that shows people with eating disorder behaviors who smoke are at higher risk for obesity than those without eating disorder behaviors [50]. Smokers with eating disorder behaviors reported a misconception about the effectiveness of smoking as a weight control method [9]. Therefore, special measures should be taken to encourage smoking cessation in this population. Metabolic abnormalities are also more common in smokers with eating disorder behaviors than non-smokers with eating disorder behaviors [6]. To address this, screening for binge eating is recommended for female smokers. However, quitting smoking is a difficult challenge for this group as they often believe it helps with weight control and lack interest in quitting. More efforts are needed to encourage smoking cessation among female students which can be through cessation programs.

Table 5 Adjusted binary logistic regression of risk factors associated with cigarette smoking

Cigarette smoking (Yes)		Model 1			
	Variable	Reference group	Odds ratio	95% (CI)	*p*-value
Body Mass Index	Obese	Normal	1.010	0.88–1.15	0.886
Waterpipe	Yes	No	3.299	1.19–9.16	0.022
E-cigarettes	Yes	No	10.070	2.49–40.70	0.001*
Energy Drinks	Yes	No	5.163	1.77–15.10	0.003*
Coffee and its derivatives	Yes	No	1.989	0.27–14.22	0.493
Tea	Yes	No	4.152	0.72–23.95	0.111
QB1-Gone on eating binges where you feel that you may not be able to stop?	Yes	No	0.774	0.29–2.067	0.609
QB2: Ever made yourself sick (vomited) to control your weight or shape?	Yes	No	6.075	1.232–29.965	0.027*
QB3-Ever used laxatives, diet pills, or diuretics (water pills) to control your weight or shape?	Yes	No	0.381	0.046–3.119	0.368
QB4- Exercise more than 60 min daily to lose or control your weight	Yes	No	0.941	0.322–2.750	0.911
QB5: Lost 20 pounds or more in the past 6 months?	Yes	No	0.774	0.180–3.320	0.730
QB6: Have you ever been treated for an eating disorder?	Yes	No	3.438	1.016–11.628	0.047
Beck-Scale	Severe	Minimum	3.189	0.500–20.344	0.220
	Moderate		11.499	1.782–74.215	0.010*
	Mild		12.963	2.395–70.181	0.003*

CI, Confidence Interval; OR1, Odds Ratio

*Significance value < 0.05

Using drugs for weight loss in individuals with eating disorders can increase the risk of receiving an eating disorder diagnosis in the following years, as well as lead to depression and low self-esteem [51, 52]. Excessive exercise is a common trait among people with eating disorders and can lead to a lower quality of life and prognosis [53]. Females with eating disorders often feel guilty when they miss a workout and exercise for reasons related to weight and body shape [53]. In agreement with these studies, obesity was associated with the feeling that food dominates life, which refers to a loss of control over food [54]. These findings suggest that participants' well-being is negatively impacted and that they are more prone to a wide range of health issues, including metabolic abnormalities, dental issues, and nutritional deficiencies.

Mental health issues related to obesity are more common in females than in men [41, 55, 56], and individuals with higher BMIs and central obesity are more likely to experience eating disorders [57, 58]. Palestinian female students often smoke to cope with stress more than men do, as they are more susceptible to depression [59]. The co-occurrence of smoking, depression, eating disorders, and obesity poses complex challenges for overall well-being. Research has shown interconnected links between these conditions, with one often influencing or exacerbating the others [57, 59, 60]. Understanding these connections is critical for developing comprehensive treatment approaches. Addressing mental health, lifestyle factors, and behavioral patterns is essential for promoting comprehensive wellness and recovery. It is important to note that the findings of the study suggest that women with increased obesity are at a higher risk of exhibiting problematic eating behaviors, depression, and other risky behaviors, including smoking. Cigarette smokers were more likely to be depressed and seek treatment for eating disorders compared to non-smokers. The quality of life for these patients is likely jeopardized as a result. It is also concerning that a significant number of female university students, around 40%, were struggling with binge-eating behavior, and 36.3% may be at risk of anorexia nervosa or bulimia nervosa. However, only a small fraction (7.8%) has sought treatment for eating disorders. This highlights a significant gap between the prevalence of the issue and the number of individuals seeking professional help. Additionally, the study highlights the lack of longitudinal studies that investigate the relationships between smoking, eating disorder behaviors, and the impact on mental health over time, which can also be on related populations like males or non-university students to help in further understanding. It also emphasizes the crucial need for greater awareness and assistance for those impacted by these issues. Therefore, it is recommended that female students who experience weight-related difficulties seek assessment from a skilled mental health professional, regardless of screening findings, to ensure early intervention, proper treatment, and better outcomes. Based on the results presented, it is recommended that future studies expand their scope to include the general population of Palestinian women and not just university students. These findings are concerning and highlight the need for programs aimed at identifying and assisting university females who are at increased risk of eating disorder behaviors. Additionally, increasing awareness about the different risk factors associated with these behaviors can help prevent their onset.

The findings of this study highlight significant broader societal implications, particularly regarding how cultural norms can contribute to the prevalence of smoking and eating disorders among women. In many societies, including Palestine, traditional ideals of beauty may conflict with contemporary media portrayals, creating an environment where women feel pressured to conform to unrealistic standards. This pressure can lead to unhealthy behaviors, such as tobacco use as a means of appetite suppression and the development of eating disorders. By engaging with public health frameworks emphasizing the importance of mental health awareness and body positivity, stakeholders can implement community-level interventions to address these issues. Moreover, universities can integrate mental health services into the university healthcare system to support at-risk students. These interventions could include educational campaigns that challenge harmful stereotypes, promote healthy body image, and provide resources for mental health support. Additionally, fostering workshops about body image can address societal and cultural pressures and seek healthier coping mechanisms, ultimately contributing to improved perception about self-image.

This study has some limitations. It is essential to exercise caution when interpreting the results of this study due to certain limitations. First, as the study was conducted in a cross-sectional design, no definitive causality of the associations can be established. Secondly, the usage of self-reported data might have resulted in response bias, in which students' willingness to provide more accurate responses may have been influenced by the cultural norms and stigmas surrounding smoking and eating disorders. Lastly, while the scales used in our study are helpful in screening for eating disorder behaviors and depression, they cannot be used to diagnose depression or eating disorders or specify their subtypes. Despite these limitations, this study is among the few that examine the prevalence of binge/purge behaviors among Palestinian females, in particular, female university students in Palestine. Moreover, previous studies have not reported a distinct association between these behaviors and certain risk factors, such as tobacco smoking and depression.

5 Conclusion

This study highlights the high prevalence of risky behaviors among female university students, including smoking, binge eating, and the use of diet pills, which were strongly linked to depression. The findings of the study highlight the need for greater awareness and support for female university students struggling with binge eating, as only a small percentage have sought treatment for eating disorders. This emphasizes the importance of providing accessible resources and promoting a healthier approach to wellness among this demographic of university students and addresses their association with tobacco smoking. Targeted interventions should include making smoking restriction policies, starting anti-smoking campaigns, culturally tailored health education, implementing mental health support for students who are struggling with these behaviors, and promoting a healthy lifestyle. Moreover, further studies should be conducted to explore the relationship between smoking, caffeine consumption, and eating disorder behaviors in a broader population in Palestine. It is essential to have early assessment and intervention for those facing weight-related issues. Addressing these interconnected factors is vital for preventing the onset of eating disorders and promoting overall wellness among Palestinian women.

Acknowledgements The authors would like to thank the students who responded for their participation in filling out the questionnaires and facilitating this study.

Author contributions Conceptualization: Damiri B. Study conception and design: Damiri B. Data curation: Damiri B. Formal analysis: Damiri B. Methodology: Damiri B, Zidan T, Hamayel D. Writing-original draft: Damiri B, Zidan T, Hamayel D., Saifi M Writing, review & editing: Damiri B, Zidan T, Hamayel D, Saifi M. All authors read and approved the final version of the manuscript and is accountable for aspects of the work.

Funding This research received no specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing interests The authors declare no competing interests.

References

1. Melisse B, de Beurs E, van Furth EF. Eating disorders in the Arab world: a literature review. J Eat Disord. 2020;8:1–19.
2. Alsheweir A, Goyder E, Alnooh G, Caton SJ. Prevalence of eating disorders and disordered eating behaviours amongst adolescents and young adults in Saudi Arabia: a systematic review. Nutrients. 2023;15:4643.
3. Azzeh M, Peachey G, Loney T. Prevalence of high-risk disordered eating amongst adolescents and young adults in the Middle East: a scoping review. Int J Environ Res Public Health. 2022;19:5234.
4. Ford KA, Dolan BM, Evans C. Cultural factors in the eating disorders: a study of body shape preferences of Arab students. J Psychosom Res. 1990;34:501–7.
5. Thomas J, Khan S, Abdulrahman AA. Eating attitudes and body image concerns among female university students in the United Arab Emirates. Appetite. 2010;54:595–8.
6. Udo T, White MA, Barnes RD, Ivezaj V, Morgan P, Masheb RM, et al. Psychosocial and metabolic function by smoking status in individuals with binge eating disorder and obesity. Addict Behav. 2016;53:46–52.
7. White MA, Grilo CM. Symptom severity in obese women with binge eating disorder as a function of smoking history. Int J Eat Disord. 2007;40:77–81.
8. Fairweather-Schmidt K, Wade TD. The relationship between disordered eating and cigarette smoking among adult female twins. Int J Eat Disord. 2015;48:708–14.

9. Jennings KM, Wolfe BE, Kelly-Weeder S. Gender differences in binge eating and behavioral correlates among college students. Eat Weight Disord. 2012;17:e200–2.
10. White MA. Smoking for weight control and its associations with eating disorder symptomatology. Compr Psychiatry. 2011;53:403.
11. Mason TB, Martinez C, Dunton GF, Belcher BR, Pang RD. Understanding daily life experiences of women who smoke: The role of smoking-related weight control expectancies. Addict Behav. 2022;134: 107413.
12. White MA. Smoking for weight control and its associations with eating disorder symptomatology. Compr Psychiatry. 2012;53:403–7.
13. Torres OV, O'Dell LE. Stress is a principal factor that promotes tobacco use in females. Prog Neuropsychopharmacol Biol Psychiatry. 2016;65:260.
14. Badrasawi MM, Zidan SJ, Natour N, Sharif I, Atrash S, Abueid G, et al. Binge eating symptoms are associated with the severity of premenstrual symptoms among university students, cross sectional study from Palestine. J Eat Disord. 2021;9:1–9.
15. Hosseinabadi S, Rafraf M, Asghari S, Asghari-Jafarabadi M, Vojouhi S. Effect of green coffee extract supplementation on serum adiponectin concentration and lipid profile in patients with non-alcoholic fatty liver disease: a randomized, controlled trial. Complement Ther Med. 2020;49: 102290.
16. Koyama T, Maekawa M, Ozaki E, Kuriyama N, Uehara R. Daily consumption of coffee and eating bread at breakfast time is associated with lower visceral adipose tissue and with lower prevalence of both visceral obesity and metabolic syndrome in Japanese populations: a cross-sectional study. Nutrients. 2020;12:1–10.
17. Kim Y, Jeong SM, Yoo B, Oh B, Kang HC. Associations of smoking with overall obesity, and central obesity: a cross-sectional study from the Korea National Health and Nutrition Examination Survey (2010–2013). Epidemiol Health. 2016;38: e2016020.
18. Lu MY, Cheng HY, Lai JCY, Chen SJ. The relationship between habitual coffee drinking and the prevalence of metabolic syndrome in Taiwanese adults: evidence from the Taiwan biobank database. Nutrients. 2022;44(12):1371–8.
19. Shin S, Lim J, Lee HW, Kim CE, Kim SA, Lee JK, et al. Association between the prevalence of metabolic syndrome and coffee consumption among Korean adults: results from the Health Examinees study. Appl Physiol Nutr Metab. 2019;44:1371–8.
20. Damiri B, Khatib O, Nazzal Z, Sanduka D, Igbaria S, Thabaleh A, et al. Metabolic syndrome associated with tobacco and caffeine products use among refugee adolescents: risk of dyslipidemia. Diabetes Metab Syndr Obes. 2021;14:4121–33.
21. Mohammed Ali M, Helou M, Al-Sayed Ahmad M, Al Ali R, Damiri B. Risk of tobacco smoking and consumption of energy drinks on obesity and central obesity among male university students. Cureus. 2022;14: e21842.
22. Damiri B, Hamayel D, Wael M. Energy drinks and waterpipe smoking associated with disordered eating habits among male Palestinian refugees. J Ethn Subst Abuse. 2023. https://doi.org/10.1080/15332640.2023.2283767.
23. Khelfeh NA, Mousa AM, Shakhshir AI, AbuAlrub IA, Hamad AH, Hunjul MM, et al. Substance use associated with eating attitudes and behaviors, neglected health issues among Palestinian refugees. J Subst Use. 2023. https://doi.org/10.1080/14659891.2023.2250851.
24. PCBS | Announces the preliminary results of the Smoking and Tobacco Consumption Survey, 2021. Available from: https://www.pcbs.gov.ps/site/512/default.aspx?lang=en&ItemID=4246
25. Tucktuck M, Ghandour R, Abu-Rmeileh NME. Waterpipe and cigarette tobacco smoking among Palestinian university students: a cross-sectional study. BMC Public Health. 2017;18:1–12.
26. An-Najah Staff. 2024. Available from: https://staff.najah.edu/en/publications/12206/
27. Damiri B, Safarini OA, Nazzal Z, Abuhassan A, Farhoud A, Ghanim N, et al. Eating disorders and the use of cognitive enhancers and psychostimulants among university students: a cross-sectional study. Neuropsychiatr Dis Treat. 2021;17:1633–45.
28. Musaiger AO, Al-Mannai M, Tayyem R, Al-Lalla O, Ali EYA, Kalam F, et al. Risk of disordered eating attitudes among adolescents in seven Arab countries by gender and obesity: a cross-cultural study. Appetite. 2013;60:162–7.
29. Silén Y, Keski-Rahkonen A. Worldwide prevalence of DSM-5 eating disorders among young people. Curr Opin Psychiatry. 2022;35:362–71.
30. Jaber ME, Nouri L, Hamed A, Jarrar N, MohammedAli M, Saifi M, et al. The epidemiology of electronic cigarette smoking among university students in the West Bank: practice, motivation, and dependence of a new emerging hazard. Popul Med. 2023;5:1–8.
31. Mohammed Ali M, Helou M, Al-Sayed Ahmad M, Al Ali R, Damiri B. Risk of tobacco smoking and consumption of energy drinks on obesity and central obesity among male university students. Cureus. 2022. https://doi.org/10.7759/cureus.21842.
32. Saifi M, Damiri B. Non-traditional tobacco smoking: An emerging risk in the West Bank among male Palestinians. Popul Med. 2024;6:1–8.
33. Morgan JF, Reid F, Lacey JH. The SCOFF questionnaire: assessment of a new screening tool for eating disorders. BMJ. 1999;319:1467–8.
34. Garner DM, Garfinkel PE. The Eating Attitudes Test: an index of the symptoms of anorexia nervosa. Psychol Med. 1979;9:273–9.
35. Aoun A, Azzam J, El Jabbour F, Hlais S, Daham D, El Amm C, et al. Validation of the Arabic version of the SCOFF questionnaire for the screening of eating disorders. East Mediterr Health J. 2015;21:326–31.
36. Al-Subaie A, Al-Shammari S, Bamgboye E, Al-Sabhan K, Al-Shehri S, Bannah AR. Validity of the Arabic version of the eating attitude test. Int J Eat Disord. 1996;20:321–4.
37. Garner DM, Bohr Y, Garfinkel PE. The eating attitudes test: psychometric features and clinical correlates. Psychol Med. 1982;12:871–8.
38. Alansari BM. Beck Depression Inventory (BDI-II) items characteristics among undergraduate students of nineteen islamic countries. Soc Behav Pers. 2005;33:675–84.
39. Damiri B, Sandouka HN, Janini EH, Yaish ON. Prevalence and associated factors of psychoactive substance use among university students in the West Bank, Palestine. Drugs Educ Prev Policy. 2020;27:173–82.
40. Anzengruber D, Klump KL, Thornton L, Brandt H, Crawford S, Fichter MM, et al. Smoking in eating disorders. Eat Behav. 2006;7:291–9.
41. Al Sabbah H, Assaf EA, Dabeet E. Prevalence of smoking (cigarette and waterpipe) and its association with obesity/overweight in UAE and Palestine. Front Public Health. 2022;10: 963760.
42. Fahed G, Aoun L, Zerdan MB, Allam S, Zerdan MB, Bouferraa Y, et al. Metabolic syndrome: updates on pathophysiology and management in 2021. Int J Mol Sci. 2022;23(2):786.
43. Hamadeh RR, Lee J, Abu-Rmeileh NME, Darawad M, Mostafa A, Kheirallah KA, et al. Gender differences in waterpipe tobacco smoking among university students in four Eastern Mediterranean countries. Tobacco Induct Dis. 2020;18:100.
44. Khabour OF, Alzoubi KH, Eissenberg T, Mehrotra P, Azab M, Carroll MV, et al. Waterpipe tobacco and cigarette smoking among university students in Jordan. Int J Tuberc Lung Dis. 2012;16:986.
45. Keel PK. Purging disorder: recent advances and future challenges. Curr Opin Psychiatry. 2019;32:518–24.

46. Balantekin KN, Grammer AC, Fitzsimmons-Craft EE, Eichen DE, Graham AK, Monterubio GE, et al. Overweight and obesity are associated with increased eating disorder correlates and general psychopathology in university women with eating disorders. Eat Behav. 2021.
47. Fairburn C, Cooper Z, Shafran R. Behavior therapy for eating disorders (" CBT-E "): Cogn Behav Ther Eat Disord. 2008;36(6):713–22.
48. Da Luz FQ, Sainsbury A, Mannan H, Touyz S, Mitchison D, Hay P. Prevalence of obesity and comorbid eating disorder behaviors in South Australia from 1995 to 2015. Int J Obes (Lond). 2017;41:1148–53.
49. Fairburn CG, Doll HA, Welch SL, Hay PJ, Davies BA, O'Connor ME. Risk factors for binge eating disorder: a community-based, case-control study. Arch Gen Psychiatry. 1998;55:425–32.
50. Howe LJ, Trela-Larsen L, Taylor M, Heron J, Munafò MR, Taylor AE. Body mass index, body dissatisfaction and adolescent smoking initiation. Drug Alcohol Depend. 2017;178:143–9.
51. Hazzard VM, Simone M, Austin SB, Larson N, Neumark-Sztainer D. Diet pill and laxative use for weight control predicts first-time receipt of an eating disorder diagnosis within the next 5 years among female adolescents and young adults. Int J Eat Disord. 2021;54:1289–94.
52. Kovacs D, Palmer RL. The associations between laxative abuse and other symptoms among adults with anorexia nervosa. Int J Eat Disord. 2004;36:224–8.
53. Young S, Touyz S, Meyer C, Arcelus J, Rhodes P, Madden S, et al. Relationships between compulsive exercise, quality of life, psychological distress and motivation to change in adults with anorexia nervosa. J Eat Disord. 2018;6:1–8.
54. Bazzazian S, Ozgoli G, Kariman N, Nasiri M, Mokhtaryan-Gilani T, Hajiesmaello M. The translation and psychometric assessment of the SCOFF eating disorder screening questionnaire: the Persian version. J Eat Disord. 2022. https://doi.org/10.1186/s40337-022-00564-3.
55. Lonergan C, Millar SR, Kabir Z. Associations between adiposity measures and depression and well-being scores: a cross-sectional analysis of middle- to older-aged adults. PLoS ONE. 2024;19: e0299029.
56. Sutin AR, Zonderman AB. Depressive symptoms are associated with weight gain among women. Psychol Med. 2012;42:2351–60.
57. da Luz FQ, Hay P, Touyz S, Sainsbury A. Obesity with comorbid eating disorders: associated health risks and treatment approaches. Nutrients. 2018.
58. Succurro E, Segura-Garcia C, Ruffo M, Caroleo M, Rania M, Aloi M, et al. Obese patients with a binge eating disorder have an unfavorable metabolic and inflammatory profile. Medicine (Baltimore). 2015;94(52):e2098.
59. Safarini OA, Taya H, Elhija YA, Qadous M, Farhoud A, Thabaleh A, et al. Assessment of the Relationship of Depression With Tobacco and Caffeine Use Among University Students: A Cross-Sectional Study. Cureus. 2021;13.
60. McIntyre RS. The co-occurrence of depression and obesity: implications for clinical practice and the discovery of targeted and precise mechanistically informed therapeutics. J Clin Psychiatry. 2024;85:55135.