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Vaping and eating disorders association: A systematic review

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Summary

Background: *Electronic cigarette (e-cigarette) use has risen rapidly, particularly among adolescents and young adults. Concurrently, the prevalence of eating disorders has increased in these populations. Given the shared demographic and psychological risk factors, this systematic review aims to explore the association between e-cigarette use and eating disorders, examining potential links.*

Subjects and Methods: *The review was carried out following the PRISMA guidelines. A comprehensive search strategy was applied across PubMed, Web of Science, and Embase up to September 5, 2024, to locate studies investigating the link between eating disorders and e-cigarette use. Studies were included if they focused on adolescents, young adults, or the general adult population, with outcomes relating to diagnosed eating disorders or self-reported disordered eating behaviors. Data were collected and synthesized in a narrative format, and quality evaluations were conducted using the Newcastle-Ottawa Scale.*

Results: *Out of 903 records identified, 13 studies met the inclusion criteria. Most studies were cross-sectional and predominantly conducted in the USA. Findings consistently indicated a positive association between e-cigarette use and different disorders of eating, including, binge eating disorder, bulimia nervosa, and anorexia nervosa. E-cigarette use was also linked to eating disorders such as purging and fasting. Gender-specific differences were observed, with female users at higher risk. However, mixed or non-significant results were reported in some studies, indicating potential variations due to cultural or demographic factors.*

Conclusion: *Then current evidence points towards a significant association between e-cigarette use and eating disorder behaviors, including binge eating, bulimia nervosa, anorexia nervosa, and unhealthy weight control behaviors such as purging and fasting. However, as most included studies were cross-sectional, the direction of this relationship remains unclear. E-cigarette use may be linked to eating disorders, but further longitudinal studies are necessary to establish causality and understand the dynamics of this relationship. These findings indicate the need for targeted public health interventions to address these co-occurring behaviors.*

Keywords: *Electronic cigarette, eating disorders, vape*

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INTRODUCTION

Over the last decade, the landscape of nicotine consumption has been transformed by the advent of electronic cigarettes (e-cigarettes), also known as vapes. Initially marketed as a less harmful alternative to traditional cigarettes, e-cigarettes were promoted for their potential to reduce smoking-related harms (Bozier et al., 2020). These

List of abbreviations:

EDs:	Eating disorders
BED:	Binge-eating disorder
BN:	Bulimia nervosa
AN:	Anorexia nervosa
PROSPERO:	Is an international systematic review registry database
PRISMA:	Preferred reporting items for systematic reviews and meta-analyses
OR:	Odds ratio

devices provide nicotine in an aerosolized form, avoiding the harmful combustion products present in traditional tobacco smoke, such as tar and carbon monoxide (Hartmann-Boyce et al., 2023; Russell et al., 2020). As such, e-cigarettes were seen by some as a harm reduction tool, especially for adults seeking to quit smoking. However, their growing popularity, particularly among adolescents and young adults who had not previously used nicotine products, has raised substantial public health concerns. The rapid increase in e-cigarette use, especially among younger populations, has been alarming (Gardner et al., 2023; Jane Ling et al., 2023). The majority of these users had never smoked traditional cigarettes, reflecting that e-cigarettes may serve as a gateway to nicotine addiction rather than as a cessation tool (Chan et al., 2021; Goel et al., 2024). Adolescents are particularly vulnerable to the addictive potential of nicotine, which can impact brain development and increase the risk of substance use disorders (Castro et al., 2023).

At the same time, the prevalence of eating disorders (EDs) has also escalated, particularly among adolescents and young adults (Juli et al., 2023a; Juli et al., 2023b). The most common eating disorders—binge-eating disorder (BED), bulimia nervosa (BN), and anorexia nervosa (AN)—are characterized by severe disruptions in eating behaviors. While anorexia nervosa typically involves an intense fear of gaining weight and a distorted body image, binge-eating disorder is marked by recurrent episodes of overeating without compensatory behaviors, and bulimia nervosa includes episodes of binge eating followed by compensatory actions such as purging (Qian et al., 2021). These conditions are associated with significant morbidity and mortality, as well as a host of psychiatric comorbidities, including depression, anxiety, and substance abuse (Barakat et al., 2023). Given the shared demographic and psychological characteristics between e-cigarette users and individuals with eating disorders, researchers have begun to explore the possible links between these two behaviors. Understanding the potential association between e-cigarette use and eating disorders requires a multidisciplinary approach, drawing from theories in psychology, addiction science, and public health. Both e-cigarette use and eating disorders may be viewed through the lens of maladaptive coping strategies used to manage underlying psychological distress. For instance, young people who are struggling with anxiety, depression, or low self-esteem may turn to e-cigarettes as a form of self-medication (Kang & Malvaso, 2024). Similarly, disordered eating behaviors often develop as a way to cope with overwhelming emotions or to exert control over one's body in the context of feelings of inadequacy (Henderson et al., 2019).

Body image dissatisfaction, a well-established risk factor for eating disorders may also play a role in the association between these conditions. E-cigarettes have been marketed in ways that emphasize weight control and appetite suppression, particularly among female users (Mantey et al., 2018; Singh et al., 2018). Nicotine itself has long been known to have appetite-suppressing properties, and traditional cigarette smoking has been associated with lower body weight in some populations (Schwartz & Bellissimo, 2021). Consequently, young people who are preoccupied with weight loss or body image concerns may be more likely to initiate e-cigarette use, viewing nicotine as a means to control their appetite and weight. This aligns with the broader literature that links cigarette smoking with eating disorder pathology, particularly among individuals with a heightened concern about body weight (Anzengruber et al., 2006).

While research on the specific connection between e-cigarette use and eating disorders is still in its early stages, a growing body of evidence points to a potential association between these behaviors. Several cross-sectional studies have found that adolescents and young adults who use e-cigarettes are more likely to report symptoms of disordered eating compared to non-users (Ganson & Nagata, 2021; Qeadan et al., 2023; Smith, Mason, Wright, et al., 2024). This systematic review seeks to compile and analyze the existing evidence on the relationship between e-cigarette use and eating disorders. This review will provide a comprehensive overview of the potential links between these behaviors and highlight areas where further research is needed.

SUBJECTS AND METHODS

To ensure methodological rigor and transparency, this systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Table S1). The review protocol was also registered in advance with the International Prospective Register of Systematic Reviews (PROSPERO) to outline the research approach and objectives before beginning the review process.

Database Search

A comprehensive search strategy was developed and applied to multiple databases to identify relevant studies. The databases included Embase, Web of Science, and PubMed from inception to September 5 2024. The search

terms were carefully selected to capture both e-cigarettes use and eating disorder-related terminology. Boolean operators (AND, OR) were applied to refine the search and ensure all relevant studies were captured. The complete search strategy used for each database has been presented in Table S2.

ELIGIBILITY CRITERIA

Included studies met the following criteria: the population consisted of adolescents, young adults, or the general adult population; the exposure involved the use of e-cigarettes, vaping behavior, or nicotine consumption via e-cigarettes; and the outcome was either diagnosed eating disorders (such as anorexia nervosa, bulimia nervosa, or binge-eating disorder) or self-reported disordered eating behaviors, including fasting, purging, or severe calorie restriction. The review included cross-sectional studies, cohort studies, case-control studies, randomized controlled trials, as well as systematic reviews and meta-analyses. Only studies published in English were eligible for inclusion. Studies were excluded if they focused solely on traditional cigarette use or smokeless tobacco products without addressing e-cigarette use, did not include data on eating disorders or disordered eating behaviors, or were based on animal models or in vitro research.

Screening of studies

The initial search results from the databases were exported to a semi-automatic web software (Nested-Knowledge, MN USA) to organize the references and remove duplicates. Two independent reviewers assessed the titles and abstracts of all identified studies for relevance, applying the specified inclusion and exclusion criteria. Studies that appeared relevant after the initial screening underwent a full-text review to confirm their eligibility for inclusion. Any discrepancies between the reviewers during the screening process were resolved through discussion or consultation with a third reviewer.

Data extraction and quality assessment

A structured data extraction sheet was developed and piloted to standardize the process of collecting information from each study. The extracted data included study characteristics such as frequency of e-cigarette use, author(s), publication year, study design, age, gender, and sample size. Outcome variables were also recorded, including types of diagnosed eating disorders, self-reported disordered eating behaviors, or body image concerns, along with the main findings related to the association between e-cigarette use and eating disorders, incorporating statistical measures such as odds ratios, relative risks, and confidence intervals. The quality of the included studies was evaluated using validated tools suited to each specific study design. For cross-sectional and cohort studies, the Newcastle-Ottawa Scale (NOS) was used to assess methodological quality, focusing on factors such as sample selection, comparability, and the evaluation of exposure and outcomes.

Synthesis of results

The findings from the included studies were synthesized narratively, focusing on the association between EDs or disordered eating behaviors and e-cigarette use. The synthesis aimed to identify patterns and trends across the studies, taking into account variations in population characteristics, exposure definitions, and outcome measures. Meta-analyses were not performed due to heterogeneity among the data. The results were presented in tables summarizing the characteristics of associations.

RESULTS

Database search result

The database search identified a total of 903 records, with 78 from PubMed, 492 from Embase, and 333 from Web of Science. To ensure the integrity of the review, duplicate records were identified and removed, resulting in the exclusion of 115 duplicate entries. This resulted in 788 unique records, which were then subjected to an initial screening of their titles and abstracts. During the screening phase, 320 records were deemed not relevant to the research question and were excluded. Following this, 468 reports were sought for full-text retrieval. The next phase involved a detailed assessment of the 468 full-text articles to determine their eligibility based on predefined inclusion criteria. After this in-depth evaluation, 456 articles were excluded for various reasons: 111 articles did not report the outcome of interest (e.g., eating disorders or disordered eating behaviours), 91 articles did not focus on the exposure of interest (e-cigarette use), and 254 articles were not relevant to the research question. Finally, 13 (Dunn et al., 2022; Ganson & Nagata, 2021;

Hennigan et al., 2022; Khelfeh et al., 2023; Lanza et al., 2024; Lee & Lee, 2019; Naveed et al., 2021; Qeadan et al., 2023; Smith, Mason, Kechter, et al., 2024; Smith, Mason, Wright, et al., 2024; Tavolacci et al., 2016; Wang et al., 2020; Zickgraf & Barrada, 2021) studies met all the inclusion criteria and were included in the systematic review. These studies serve as the foundation for the synthesis and analysis, offering valuable insights into the link between e-cigarette use and eating disorders.

Characteristics of included studies

A total of 13 studies (Dunn et al., 2022; Ganson & Nagata, 2021; Hennigan et al., 2022; Khelfeh et al., 2023; Lanza et al., 2024; Lee & Lee, 2019; Naveed et al., 2021; Qeadan et al., 2023; Smith, Mason, Kechter, et al., 2024; Smith, Mason, Wright, et al., 2024; Tavolacci et al., 2016; Wang et al., 2020; Zickgraf & Barrada, 2021) were included in this review, with the majority (9 out of 13) conducted in the USA. One study was conducted in Korea, one in France, one in China, and one among Palestinian refugees, indicating some geographical diversity but an overall concentration in Western contexts. The study designs were predominantly cross-sectional (12 studies). Only one study employed a longitudinal design, providing insight into the potential predictive relationship between e-cigarette use and susceptibility to external and emotional eating over time. The populations studied varied, including young adults, college students, adolescents, female adolescents, yoga practitioners, and Palestinian refugees. The total sample sizes of the studies ranged widely, from small-scale studies with 299 participants (Naveed 2021) to large-scale studies with over 400,000 college students (Qeadan et al., 2023). Age groups also differed across studies, with several focusing on adolescents (as young as 13 years) and young adults (up to 35-55 years in the case of yoga practitioners). The proportion of male participants in the included studies ranged from 16% to almost 50%, with some studies focusing exclusively on female adolescents (Dunn et al., 2022; Naveed et al., 2021). The quality assessment of the studies is given in Table S3.

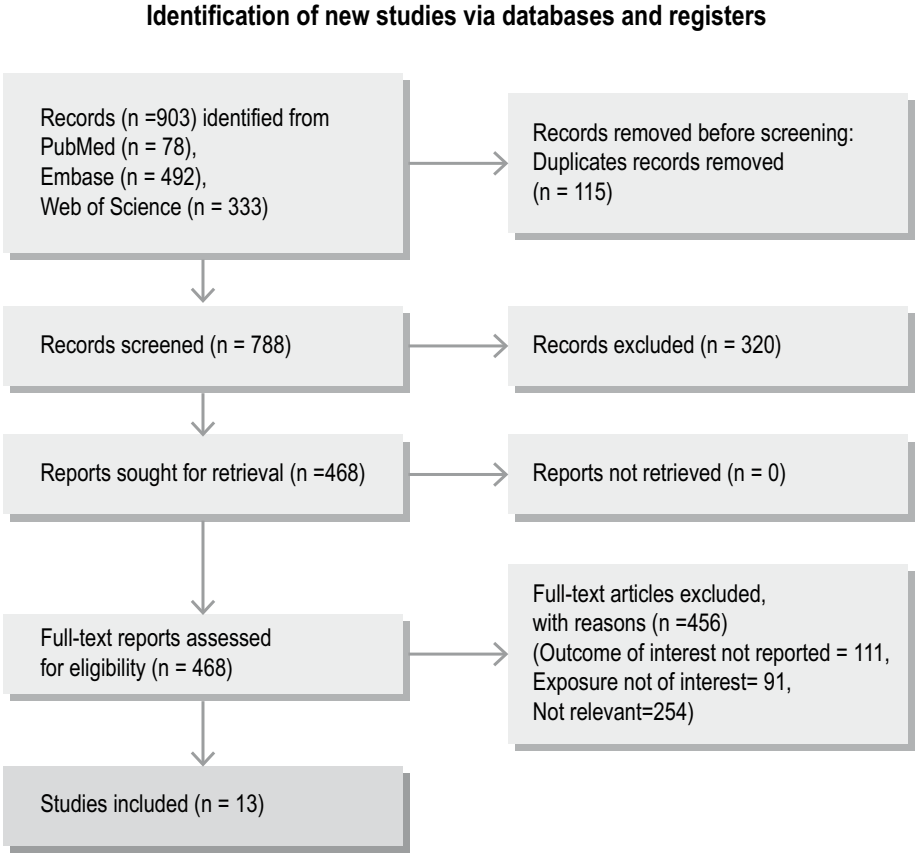


Figure 1: PRISMA flow diagram depicting article screening and selection process

Table 1: Characteristics of included studies

Author	Country	Study design	Population	Total sample	Age	Male	Key findings
Dunn 2022 (Dunn et al., 2022)	USA	Cross-sectional study	Female adolescents	915	14.4 (2.0) years	NA	E-Cigarette use experimentation in past 30 days was associated with disordered eating behaviours (p=<0.001)
Ganson 2021 (Ganson & Nagata, 2021)	USA	Cross-sectional study	college students	51,231	23.4 (7.5) years	41.90%	Vaping or e-cigarette use was associated with higher odds of all eating disorder measures, including the self-reported lifetime eating disorder diagnosis items (any diagnosis, anorexia nervosa, bulimia nervosa, binge-eating disorder) and elevated eating disorder risk, while adjusting for demographic and confounding variables.
Hennigan 2022 (Hennigan et al., 2022)	USA	Cross-sectional study	Students aged ≥18 years old	716	19.23 (1.65) years	39%	No significant correlations between eating disorder symptoms (body dissatisfaction, binge eating) and vaping motives emerged
Khelfeh 2023 (Khelfeh et al., 2023)	Palestine	Cross-sectional study	Palestinian refugees	566	NA	100%	Vape smoking is not significantly associated with eating disorders or binge eating but is linked to self-induced vomiting.
Lanza 2024 (Lanza et al., 2024)	USA	Longitudinal study	young adults	1303	20.52 (2.29) years	34.80%	Nicotine vaping predicted both susceptibility to external, and emotional eating.
Lee 2019 (Lee & Lee, 2019)	Korea	Cross-sectional study	Adolescents	27284	13-18 years	39.6%	Prevalence of Unhealthily weight control behaviours tended to increase as electronic cigarette use (P <0.001) increased
Naveed 2021 (Naveed et al., 2021)	USA	Cross-sectional study	Female adolescents	299	13-17 years	NA	Electronic Cigarette Dependence Index (ECDI) scores were correlated with weight preoccupation, binge eating and compensatory behaviour, but no body dissatisfaction. E-cigarette use is associated with behavioural and attitudinal symptoms related to eating disorders in adolescent girls
Qeadan 2023 (Qeadan et al., 2023)	USA	Cross-sectional study	College students	414299	NA	30.55%	E cigarette misuse has been associated with Eating disorders, Anorexia, and bulimia
Smith 2024-A (Smith, Mason, Wright, et al., 2024)	USA	Cross-sectional study	Young adult	1875	20.87 (1.94) years	31%	Higher SWEET-EC scores were observed associated with daily e-cigarette use, JUUL use, self-reported vaping for weight control, older age, higher body mass index, and problematic eating behaviours.
Smith 2024-B (Smith, Mason, Kechter, et al., 2024)	USA	Cross-sectional study	Young adults	2500	18-24 years	30.10%	Individuals with Anorexia Nervosa were more likely to be dual users, while those with Atypical Anorexia Nervosa and Binge Eating Disorder/ Night Eating Syndrome were more likely to be exclusive e-cigarette or dual users compared to those without an eating disorder.
Tavolacci 2016 (Tavolacci et al., 2016)	France	Cross-sectional study	College students	1134	20.8 (2.3) years	30.90%	Eating disorders are not associated with current or ever E-cigarette use
Wang 2020 (Wang et al., 2020)	China	Cross-sectional study	Middle and high school students	17359	NA	49.60%	Eating less food, taking laxatives, using diet pills, and going without eating for more than 24 hours are associated with current e-cigarette use
Zickgraf 2022 (Zickgraf & Barrada, 2021)	USA	Cross-sectional study	Yoga practitioners	469	35–55 years	16%	Orthorexia nervosa was related to higher scores on measures of being a vape user

Table 2: Summary of associations between e-cigarette use and eating disorders with odds ratios reported by studies

Study	Predictor	Outcome Variable	Odds Ratio (OR)	Confidence Interval (CI)
Smith 2024-B (Smith, Mason, Kechter, et al., 2024)	Broad spectrum eating disorders	Exclusive e-cigarette users	1.77	1.18, 2.67
	Atypical anorexia nervosa	Exclusive e-cigarette users	2.08	1.16, 3.76
	Night eating syndrome	Exclusive e-cigarette users	1.62	1.04, 2.55
Qaedan 2023 (Qeadan et al., 2023)	E-cigarette misuse	Anorexia	2.29	2.14–2.46
		Bulimia	2.83	2.62-3.06
		Eating disorders	1.81	1.74–1.88
		Self-reported eating disorder	1.5	1.27-1.77
Ganson 2021 (Ganson & Nagata, 2021)	E-cigarette use (past 30 days)	Anorexia nervosa	1.39	1.12 to 1.73
		Bulimia nervosa	1.49	1.14 to 1.94
		Binge eating	1.72	1.23 to 2.39
		Elevated eating disorder risk	1.11	1.01 to 1.22
		One food diet	1.05	0.74 to 1.49
	Male: Ever E-cigarette use	Diet pill use	1.52	0.94 to 2.45
		Purging	1.37	0.89 to 2.11
		One food diet	2.2	1.52 to 3.18
	Male: Current E-cigarette use	Diet pill use	3.3	1.80 to 6.05
Lee 2019 (Lee & Lee, 2019)		Purging	3.18	1.97 to 5.15
		One food diet	1.87	1.41 to 2.48
	Female: Ever E-cigarette use	Diet pill use	2.21	1.42 to 3.45
		Purging	2.04	1.37 to 3.04
		One food diet	2.32	1.47 to 3.65
	Female: Current E-cigarette use	Diet pill use	3.76	2.04 to 6.92
		Purging	3.25	1.87 to 5.62
Tavolacci 2016 (Tavolacci et al., 2016)	Eating disorders	Ever E-cigarette use	1.39	0.95 to 2.01
		Current E-cigarette use	0.67	0.30 to 1.48
Wang 2020 (Wang et al., 2020)	Eating less food, fewer calories	Current E-cigarette use	1.74	1.33-2.27
	Taking laxatives		3.34	2.11-5.27
	Taking diet pills		2.63	1.72-4.02
	Going without eating more than 24 hrs		2.74	1.86-4.04
Khelfeh 2023 (Khelfeh et al., 2023)	Vape use	Binge episode behaviour	1.57	0.454-5.44
		Self-induced vomiting	10.373	1.033 -104.124
		Eating disorders	1.147	0.581–2.26

E-CIGARETTE USE AND BROAD SPECTRUM EATING DISORDERS

Several studies in this review explored the association between e-cigarette use and a broad range of eating disorders (**Table 2**). A study that specifically assessed the link between e-cigarette use and eating disorders in young adults revealed that individuals who exclusively used e-cigarettes had significantly higher odds of displaying a wide range of eating disorders (OR = 1.77, 95% CI: 1.18–2.67) (Smith 2024-B). This study also identified that individuals with atypical anorexia nervosa were more likely to be exclusive e-cigarette users (OR = 2.08, 95% CI: 1.16–3.76). Additionally, exclusive e-cigarette use was associated with night eating syndrome (OR = 1.62, 95% CI: 1.04–2.55), suggesting that e-cigarette use may correlate with specific patterns of disordered eating behaviors. Another study (Qeadan et al., 2023) further supported the link between e-cigarette misuse and eating disorders. This study explored a strong association between e-cigarette misuse and specific eating disorder diagnoses, with the odds of anorexia being 2.29 times higher (95% CI: 2.14–2.46) and the odds of bulimia being 2.83 times higher (95% CI: 2.62–3.06) among e-cigarette misusers. The study also reported a general association between e-cigarette misuse and eating disorders, with an odds ra-

tio of 1.81 (95% CI: 1.74–1.88). These findings emphasize that e-cigarette use, especially when misused, may be linked to a broad spectrum of disordered eating behaviors.

SELF-REPORTED EATING DISORDERS AND SPECIFIC DIAGNOSES

Several studies focused on the relationship between e-cigarette use and self-reported eating disorders. Literature has shown that individuals who reported e-cigarette use in the past 30 days had significantly higher odds of self-reporting an eating disorder (OR = 1.50, 95% CI: 1.27–1.77) (Ganson & Nagata, 2021). This association extended to specific eating disorders, including anorexia nervosa (OR = 1.39, 95% CI: 1.12–1.73) and bulimia nervosa (OR = 1.49, 95% CI: 1.14–1.94). The study further identified a significant association between e-cigarette use and binge eating behaviors (OR = 1.72, 95% CI: 1.23–2.39). Additionally, it found that e-cigarette use was linked to a higher risk of developing eating disorders (OR = 1.11, 95% CI: 1.01–1.22), suggesting that vaping behaviors may contribute to an increased susceptibility to eating disorders over time.

E-cigarette use and unhealthy weight control behaviors

The review included several studies that specifically examined the relationship between e-cigarette use and unhealthy weight control practices. A study (Lee & Lee, 2019) conducted a detailed analysis of both male and female adolescents, finding that current e-cigarette use was significantly associated with various unhealthy weight control behaviors. Among males, current e-cigarette use was linked to adopting a one-food diet (OR = 2.20, 95% CI: 1.52–3.18), using diet pills (OR = 3.30, 95% CI: 1.80–6.05), and engaging in purging behaviors (OR = 3.18, 95% CI: 1.97–5.15). Female adolescents also exhibited strong associations between current e-cigarette use and unhealthy weight control practices, including a one-food diet (OR = 2.32, 95% CI: 1.47–3.65), diet pill use (OR = 3.76, 95% CI: 2.04–6.92), and purging (OR = 3.25, 95% CI: 1.87–5.62). These findings indicate that e-cigarette use may be intertwined with various maladaptive weight control behaviors in adolescents, with female users particularly at risk. Another study (Wang et al., 2020) extended these findings by focusing on middle and high school students, showing that Current e-cigarette use was found to be associated with behaviors such as eating less (OR = 1.74, 95% CI: 1.33–2.27), using laxatives (OR = 3.34, 95% CI: 2.11–5.27), taking diet pills (OR = 2.63, 95% CI: 1.72–4.02), and fasting for more than 24 hours (OR = 2.74, 95% CI: 1.86–4.04). These results provide further evidence that e-cigarette use may be linked to extreme and unhealthy weight control measures among adolescents.

MIXED AND NON-SIGNIFICANT ASSOCIATIONS

While a majority of the studies found significant associations between e-cigarette use and eating disorder behaviors, a few reported non-significant or mixed results. A relationship was investigated between eating disorders and e-cigarette use among French college students (Tavolacci et al., 2016). Although they observed a positive association between ever using e-cigarettes and eating disorders (OR = 1.39, 95% CI: 0.95–2.01), the result was not statistically significant. Similarly, they reported an inverse, non-significant association for current e-cigarette use and eating disorders (OR = 0.67, 95% CI: 0.30–1.48). This study suggests that the relationship between e-cigarette use and eating disorders might vary across different populations and usage patterns. A study (Khelfeh et al., 2023), focusing on Palestinian refugees, found no significant association between vape use and eating disorders (OR = 1.147, 95% CI: 0.581–2.26) or binge episode behavior (OR = 1.57, 95% CI: 0.454–5.44). However, the study did identify a significant link between vape use and self-induced vomiting (OR = 10.373, 95% CI: 1.033–104.124). This highlights that while general associations may not always be present, specific disordered behaviors like self-induced vomiting can still be linked to vaping in certain subpopulations.

GENDER-SPECIFIC DIFFERENCES IN E-CIGARETTE USE AND EATING BEHAVIORS

Another study (Lee & Lee, 2019) also provided insight into gender-specific differences in the association between e-cigarette use and disordered eating behaviors. The study found that both males and females who

engaged in current e-cigarette use exhibited significantly higher odds of engaging in unhealthy weight control behaviors, such as diet pill use and purging. However, the odds were generally higher for female users. For example, current e-cigarette use was associated with a one-food diet in males (OR = 2.20) but showed an even stronger association in females (OR = 2.32). Similar patterns were observed for diet pill use and purging, with females exhibiting a more pronounced association. This gender difference indicates the potential for e-cigarette use to interact with gender-specific risk factors for eating disorders.

Disordered eating behaviors and e-cigarette use

Several studies included in this review have explored the relationship between disordered eating behaviors as a predictor and subsequent e-cigarette use as an outcome. The underlying premise is that individuals exhibiting specific eating behaviors may be more susceptible to engaging in e-cigarette use, possibly as a means of weight control, appetite suppression, or coping with emotional distress. One study (Wang et al., 2020) found that adolescents who practiced unhealthy weight control behaviors, including eating less, using laxatives, taking diet pills, or fasting for over 24 hours, were significantly more likely to report current e-cigarette use. This suggests that individuals who are already using extreme measures to control their weight may turn to e-cigarettes as an additional strategy, possibly due to nicotine's appetite-suppressing effects. Similarly it has been (Lee & Lee, 2019) demonstrated that adolescents, particularly females, who engaged in unhealthy weight control practices like one-food diets, diet pill use, and purging were at a significantly higher risk of e-cigarette use. This pattern indicates that problematic eating behaviors may serve as an early risk factor for vaping, highlighting the need for interventions targeting eating disorder symptoms as a potential means to prevent e-cigarette use initiation. These findings emphasize the bidirectional nature of the relationship between eating behaviors and e-cigarette use, where disordered eating may not only result from vaping but also act as a predictor for its onset.

DISCUSSION

This systematic review sought to compile and analyze existing research on the relationship between e-cigarette use and eating disorders across diverse populations. The findings provide a comprehensive overview of the potential links between these behaviours, with particular attention to adolescents and young adults. While many studies support a positive association between e-cigarette use and eating disorder symptoms, the relationship appears to be heterogeneous, involving various eating behaviours and sub-populations

The review revealed a consistent link between e-cigarette use and disordered eating behaviors across various populations. Multiple cross-sectional studies indicated that e-cigarette users had increased odds of exhibiting eating disorder symptoms, including anorexia nervosa (AN), bulimia nervosa (BN), binge eating, and other unhealthy weight control behaviors. Notably, a study has (Qeadan et al., 2023) highlighted that exclusive e-cigarette users had increased odds of presenting with broad-spectrum eating disorders, particularly atypical anorexia nervosa and night eating syndrome. The findings of a study (Ganson & Nagata, 2021) further indicated that individuals who reported recent e-cigarette use were more likely to self-report eating disorder symptoms, including specific diagnoses such as AN and BN. This suggests that vaping behaviors might contribute to the development or exacerbation of eating disorders over time.

The association between e-cigarette use and unhealthy weight control practices, such as diet pill use, fasting, purging, and restrictive dieting, was also strongly supported in this review. Studies (Lee & Lee, 2019; Wang et al., 2020) have underscored that adolescents engaging in such behaviors had higher odds of using e-cigarettes, with female adolescents demonstrating particularly strong associations. This connection aligns with the idea that individuals with body image concerns may turn to e-cigarettes, potentially viewing nicotine as a means of appetite suppression and weight control (Singh et al., 2018). The findings echo existing research on traditional cigarette use, which has also been linked to eating disorder pathology, especially in individuals preoccupied with body weight (Anzengruber et al., 2006). However, it is worth noting that not all studies found significant associations and reported mixed or non-significant results, suggesting that cultural, geographical, and population-specific factors may influence the strength and nature of these associations (Tavolacci et al., 2016 ; Khelfeh et al., 2023).

The observed link between e-cigarette use and eating disorders may be underpinned by several psychological, behavioral, and biological mechanisms. One key factor is the role of nicotine, the primary psychoactive substance in e-cigarettes. Nicotine is known to have appetite-suppressing properties, which may lead individuals, particularly those concerned with body image and weight, to

use e-cigarettes as a weight control method (Schwartz & Bellissimo, 2021). This is further supported by marketing strategies that sometimes emphasize vaping as a means of weight management, thereby reinforcing the use of e-cigarettes among individuals with body image dissatisfaction or eating disorder symptoms (Singh et al., 2018).

Psychological distress, such as anxiety, depression, and low self-esteem, is another potential link between e-cigarette use and eating disorders. Adolescents and young adults often use e-cigarettes as a coping mechanism for psychological distress, paralleling how disordered eating behaviors can develop as maladaptive strategies to exert control or manage overwhelming emotions. Thus, individuals struggling with mental health issues may simultaneously adopt both e-cigarette use and disordered eating behaviors, leading to a bidirectional relationship where each behavior reinforces the other. The findings from studies (Wang et al., 2020; Lee & Lee, 2019) suggest that those already engaged in extreme weight control behaviors might be particularly prone to initiating e-cigarette use, possibly due to nicotine's potential to aid in controlling appetite and weight.

The studies reviewed (Lee & Lee, 2019), suggest that female adolescents show a stronger association between e-cigarette use and disordered eating behaviors compared to males. This gender disparity could be influenced by societal pressures regarding body image and the higher occurrence of eating disorders among females. Females are more likely to engage in dieting and other unhealthy weight control behaviors, which might make them more susceptible to adopting e-cigarette use as a perceived weight management strategy. Additionally, the marketing of e-cigarettes has often targeted young females, promoting vaping as a lifestyle choice associated with weight control and social desirability. Future research should explore these gender differences further to understand how marketing and societal pressures uniquely impact the e-cigarette use and eating disorder association among males and females.

Despite the overall positive associations reported, some studies in this review (Tavolacci et al., 2016; Khelfeh et al., 2023), found non-significant relationships between e-cigarette use and eating disorders. These mixed results could be attributed to variations in study populations, cultural contexts, and definitions of exposure and outcomes. For example, one study (Khelfeh et al., 2023) focussed on Palestinian refugees may suggest that cultural factors and socioeconomic status could modulate the relationship between vaping and eating disorders. Similarly, findings from French college students highlight the potential influence of regional and cultural differences in health behaviors and attitudes toward e-cigarettes (Tavolacci et al., 2016). These discrepancies underscore the importance of considering contextual factors in future research to unravel the complexities of this association.

The findings of this review carry significant public health implications, indicating that e-cigarette use should be regarded as a potential risk factor for the onset or worsening of eating disorders, especially in adolescents and young adults. Public health interventions aimed at reducing e-cigarette use might benefit from integrating strategies that also address body image concerns and unhealthy weight control behaviors. Moreover, healthcare providers working with individuals presenting with eating disorder symptoms should be vigilant in assessing for e-cigarette use, as it may be indicative of co-occurring risk behaviors that require comprehensive intervention. Future research should focus on longitudinal studies to explore the causality and directionality of the relationship between e-cigarette use and eating disorders. Investigating the underlying mechanisms, including psychological, biological, and sociocultural factors, is crucial for developing targeted prevention and intervention strategies. Additionally, examining the impact of e-cigarette marketing on young people's perceptions of vaping and its association with body image and weight control could provide insights into how public health campaigns can counteract potentially harmful messaging.

Our study has some limitations. A significant limitation is that most of the included studies employed cross-sectional designs, which do not establish causality or the directionality of the relationship between e-cigarette use and eating disorders. Only one study used a longitudinal design, highlighting the need for more research to explore temporal sequences. There was also considerable heterogeneity in the study populations, ranging from adolescents and young adults to yoga practitioners and refugees, which complicated result synthesis and limited generalizability to specific subgroups. The studies varied in how they defined and measured eating disorders, using both clinical diagnoses and self-reported behaviors like fasting and purging, potentially introducing inconsistencies and reporting bias. Additionally, the review only included studies published in English, which may introduce language bias and exclude relevant data from non-English-speaking regions, while publication bias may have led to an overrepresentation of studies with significant findings. Due to these factors, a meta-analysis was not feasible, further limiting the ability to quantify the overall effect size and formally assess publication bias across the included studies. Future research should focus on longitudinal designs, standardized definitions of eating disorders, and more homogeneous populations to better understand this complex association.

CONCLUSION

E-cigarette use has been closely linked to a variety of eating disorder behaviors, a connection that appears to be particularly significant in adolescents and young adults. Nicotine's appetite-suppressing effects, combined with factors like body image concerns, may drive this relationship, suggesting it can be both a predictor and a consequence of disordered eating. However, the predominance of cross-sectional studies limits causal inferences, highlighting the need for longitudinal research. Public health interventions should address both vaping and eating disorders, especially in high-risk groups, to develop more comprehensive prevention strategies.

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