Research Paper

Explaining the Relationship Between Perfectionism and Binge Eating Disorder in Female College Students: The Mediating Role of Cognitive Emotion Regulation

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ABSTRACT

Objective: Binge eating disorder is a type of eating behavior disorder that occurs with voluntary limitations in eating food. It has a psychological and social origin and is one of the concerns of the World Health Organization. The present study explains the relationship between perfectionism and binge eating disorder in female college students and the mediating role of cognitive emotion regulation.

Methods: In this descriptive-correlation study, data were analyzed using the structural equation modeling (SEM) method. The statistical population of this research consisted of all the female college students of Isfahan City, Iran, in October and November 2022. A total of 214 students were selected by the available sampling method. The participants answered the perfectionism inventory (PI, 2004), the cognitive emotion regulation questionnaire (CERQ, 2001), and the binge eating severity (BES, 1982). The data were analyzed using EMOS 22 software and SEM.

Results: The results showed that adaptive cognitive regulation strategies could negatively mediate the relationship between adaptive perfectionism and eating disorder ($P<0.01$, $\beta=-0.113$) while positively and significantly mediating the relationship between maladaptive perfectionism and eating disorder ($P<0.01$, $\beta=0.124$).

Conclusion: Based on the results, physicians and therapists can incorporate cognitive regulation techniques into eating disorder treatments and help individuals manage perfectionism and negative thoughts. Additionally, educational programs can be developed in counseling centers, schools, and universities to empower individuals to recognize signs and seek help promptly.

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Highlights

• The relationship between maladaptive perfectionism and binge eating disorder of female college students is positive.

• The relationship between adaptive perfectionism and binge eating disorder female college students is negative.

• Adaptive emotion regulation strategy mediates the relationship between adaptive perfectionism and binge eating disorder in female college students.

• Adaptive emotion regulation strategy mediates the relationship between maladaptive perfectionism and binge eating disorder in female college students.

• Maladaptive emotion regulation strategy mediates the relationship between maladaptive perfectionism and binge eating disorder in female college students.

Plain Language Summary

This study assessed how perfectionism is linked to binge eating disorders in female college students, focusing on the mediating role of cognitive emotion regulation. The findings revealed important insights into the relationships among cognitive regulation strategies, perfectionism, and eating disorders. When it comes to adaptive perfectionism, which involves setting high standards without being overly critical, the study showed mixed connections with eating disorders based on cognitive regulation strategies. Importantly, the study found significant indirect pathways between maladaptive perfectionism (setting unrealistic standards and being overly self-critical) and binge eating. Adaptive cognitive regulation strategies negatively mediated the relationship between adaptive perfectionism and eating disorders (a protective factor). On the other hand, maladaptive cognitive regulation strategies positively mediated the relationship between maladaptive perfectionism and eating disorders (a risk factor). In other words, how females regulate their emotions seems to play a crucial role in whether perfectionism leads to unhealthy eating habits in them or not. Understanding these connections can contribute to developing more effective strategies for promoting mental health and preventing eating disorders among young women.

Introduction

A considerable proportion of female students (38.9%) experience non-clinical indicators of eating disorders, which encompasses attitudinal factors such as an obsession with eating, fitness, and weight, as well as behavioral factors such as restricting food intake and engaging in excessive exercise (Stevenson et al., 2018). Given the psychological and physiological impacts associated with this condition, understanding the underlying factors contributing to the development of eating disorders offers the opportunity to develop different interventions. This knowledge further enables the identification and potential advancement of subthreshold symptoms toward threshold symptoms (Baranauskas et al., 2022).

Since perfectionism is a heightened risk factor observed across various mental disorders (Egan et al., 2022), certain indications propose that perfectionism alone cannot account for individual discrepancies in eating disorder symptoms (Dahlenburg et al., 2019) or clinical eating disorders among young women (Brewerton, 2019). This highlights the significance of exploring other underlying factors that may amplify the impact of perfectionism, thereby increasing the risk of experiencing symptoms related to eating disorders (Alfalahi et al., 2022).

A review of the research background reveals that perfectionism is significantly associated with eating disorder symptoms and can exacerbate such symptoms (Johnston et al., 2018; Vanzhula et al., 2021). In other words, individuals with eating disorders tend to worry excessively about making mistakes, which is a component of perfectionism. Perfectionism is also identified as a precursor to anorexia, nervous disorders, and disordered eating habits. The combination of high personal standards and concern about making errors and being evaluated, as the two dimensions of perfectionism, is linked to eating disorder symptoms (Kiani-Sheikhabadi et al., 2019; Sadaty, 2008).

However, other studies indicated that negative emotion regulation strategies, such as rumination, suppression, and emotional avoidance were strongly associated with anorexia nervosa and bulimia nervosa (Prefit et al., 2019). Additionally, it was found that binge eating and various types of eating disorders were linked to difficulties in different dimensions of emotion regulation, including impulse control, purposeful behavior, and access to effective emotion regulation strategies (Weinbach et al., 2018). This suggests that a lack of access to effective emotion regulation strategies at the trait level is associated with subsequent eating disorder symptoms. Furthermore, the increased use of maladaptive strategies and attentional focus, along with the reduced use of adaptive strategies, were associated with a higher likelihood of eating disorders (Mikhail & Kring, 2019).

In contrast to some studies (Malivoire et al., 2019; Vois & Damian, 2020) indicating that perfectionism is influenced by emotion regulation strategies, the findings support the research hypothesis that an indirect and mediated relationship can exist between perfectionism and eating disorders. Other variables, such as the cognitive regulation of emotion, may play a role in this relationship.

To achieve this objective, cognitive-behavioral approaches (FusarPoli et al., 2019) and socio-emotional strategies (Nechita et al., 2021) for eating disorders place particular emphasis on addressing issues related to negative emotional states. These approaches involve activities such as monitoring, evaluating, and modifying emotional responses (Tng & Yang, 2021). When facing difficulties and challenges, individuals employ cognitive regulatory strategies to either diminish or intensify their emotional experiences (Mcree & Gross, 2020). The process of emotion regulation involves determining what emotions to feel, when to experience them, and how to manage them (Kraaij & Garnefski, 2019).

In simpler terms, cognitive regulation of emotions refers to the cognitive techniques employed by people to enhance, diminish, or maintain their emotional experiences. These strategies can be classified into two categories: Positive cognitive regulatory strategies and negative regulatory strategies (Lasa-Aristu et al., 2019). Cognitive regulation encompasses both positive and negative strategies (Kraaij & Garnefski, 2019). Regulatory strategies are actions that individuals undertake to cope with stressful situations and unfortunate events. Essentially, a person's cognitive regulation involves how they mentally process and deal with challenging circumstances (Bailly et al., 2022; Garnefski et al., 2004).

Negative cognitive regulation strategies include being self-centered, focusing on others' faults, ruminating, catastrophizing, and trivializing, while positive regulatory strategies include shifting focus to positive aspects, re-evaluating positively, accepting, and refocusing on planning. Generally, an individual's well-being is influenced by a two-way interaction between employing specific types of positive and negative or consistent and incompatible strategies, as well as adequately assessing their level of stress (Habibzadeh et al., 2021).

The literature indicates that increasing the utilization of positive emotional cognitive regulatory strategies leads to a reduction in negative emotional experiences. Furthermore, a growing body of evidence supports the notion that young women exhibiting symptoms of eating disorders are linked to particular strategies for regulating excitement. For instance, cognitive processes alter the significance of negative situations, such as regulating the intensity or nature of unfavorable emotional encounters (Araujo et al., 2020; Garnefski et al., 2001).

Specifically, there is substantial evidence indicating that symptoms of eating disorders are linked to the utilization of incompatible strategies, including rumination, catastrophizing, and self-criticism, which involve persistent thoughts or self-blame (Meule et al., 2021; Prefit et al., 2019). For instance, multiple meta-analyses have demonstrated that individuals displaying eating disorder symptoms employ cognitive emotion regulation strategies, such as self-reliance, rumination, and catastrophic thinking, more frequently than individuals without such symptoms (Meule et al., 2021; Palmieri et al., 2021).

Consequently, it can be concluded that individuals with high levels of perfectionism and a tendency to regulate negative emotions are at an increased risk of experiencing symptoms associated with eating disorders (Donahue et al., 2018). Hence, based on cognitive-behavioral theories of eating disorders, this study primarily examines how specific dimensions of perfectionism and cognitive regulatory strategies interact with one another in predicting symptoms associated with eating disorders.

However, only a limited number of studies have investigated the connection between perfectionism, emotion regulation strategies, and different aspects of eating disorders. To begin with, research indicates that both adaptive and maladaptive forms of perfectionism serve as risk factors for symptoms of eating disorders in female students (Downey & Chang, 2007, Mohorić et al., 2022).

While cognitive dysregulation of excitement is proposed as a risk factor for symptoms related to eating disorders, specific regulatory strategies that may exacerbate these symptoms in non-clinical samples have not yet been identified. Previous studies examining cognitive emotion regulation and symptoms of eating disorders have primarily framed emotional dysregulation as a broader issue encompassing difficulties in emotional experiences, utilization of flexible strategies, and negative emotions (Gratz & Roemer, 2004, Hallion et al., 2018).

For instance, Haynos et al. (2018) claim that individuals with anorexia, even among healthy students, exhibit heightened challenges in cognitive regulation, including limited access to adaptive emotional regulatory skills. Lastly, prior research suggests that relying solely on evident variables with potential measurement errors can obscure genuine interactive relationships. For instance, conflicting findings regarding the association between perfectionism and symptoms of eating disorders could result from random measurement errors in observable variables (Mohorić et al., 2022). These errors might have similarly influenced the actual effects of perfectionism and cognitive emotion regulation on symptoms of eating disorders. Despite the research conducted on the subject of the present study, it can be noted that some studies have solely focused on a limited sample of non-student girls (Konopa, 2019), potentially limiting the generalizability of their results to student populations.

Therefore, there is a need for appropriate sampling and samples that align with the objectives of the current research. Additionally, more research should consider the influences of gender and culture on this relationship. The relationship between perfectionism, emotion regulation, and eating disorders in Iranian girls might differ from that in girls of other cultures or compared to boys (Macedo et al., 2017). Most studies have been conducted in the United States or Canada, which may constrain the generalization of our results. Perfectionism results might be influenced by social-cultural factors; thus, it is necessary to conduct research within the cultural and social context of Iran.

The significance of investigating the mediating role in research design has been emphasized in previous studies, which often focused solely on establishing direct variable associations. By examining the mediating role of a variable, such as emotion regulation, we gain insight into the causal mechanisms between perfectionism and eating disorders. This approach unveils how perfectionism can influence eating disorders through its impact on emotion regulation, and vice versa, how emotion regulation might mitigate the effects of perfectionism and eating disorders. The recognition of emotion regulation's mediating role also highlights its potential as an intervention strategy in the prevention and treatment of these disorders. Enhancing emotion regulation skills can empower individuals to effectively manage perfectionism and eating disorders through optimal strategies. Moreover, as eating disorders and perfectionism share symptomatic and causal factors, understanding emotion regulation's mediating role aids in accurate diagnosis and differentiation between the two conditions.

It is worth noting that some previous studies employed distinct measurement tools for variable assessment, leading to potentially disparate outcomes compared to the present study. Likewise, differences in data analysis methods across studies can yield divergent results, underlining the need for further research to address these limitations. Additionally, existing research often focused on trait perfectionism, while the current study explored two dimensions: Adaptive and maladaptive perfectionism.

In conclusion, investigating the relationship between perfectionism, eating disorders, and emotion regulation in girls holds paramount importance for understanding these issues and promoting their mental well-being. The potentially adverse effects of these matters on girls' psychological health underscore the need for comprehensive research. Exploring the associations between perfectionism, eating disorders, and emotion regulation can offer valuable insights into causative factors and lead to effective strategies, including prevention and therapeutic programs. This understanding is crucial for mental health professionals and psychologists seeking to support girls' psychological well-being. Thus, the employment of precise methodologies, like structural equation modeling (SEM), is imperative to analyze latent and mediating variables. In light of these considerations, the research question posed here uncovers the significant relationship between perfectionism and binge-eating disorder among female college students, with cognitive emotion regulation as a mediator.

Materials and Methods

This study employed a descriptive-correlational design to analyze data using SEM. The target population for this research comprised all female college students of Isfahan City, Iran, in October and November 2022. A total of 214 female students were selected by the available sampling method. The sample size was determined using the recommended Kline approach (Brosof et al., 2019), suggesting that a minimum of 20 participants per parameter should be included in the study. Considering

potential data loss and questionnaire incompatibilities, a sample size of 180 individuals was deemed appropriate. Participants were provided with clear instructions regarding the questionnaires and were assured that their information would be strictly used for research purposes, with no mention of personal identity details. Upon elucidating the research objectives and obtaining informed consent from the participants, data were collected utilizing the perfectionism scale, cognitive emotion regulation questionnaire, and excessive eating scale.

Implementation of research

The research commenced after obtaining the necessary permissions from the Ethics Committee at Isfahan University of Medical Sciences (ethics code: IR.ARI.MUI.REC.1401.032). It employed an online approach for data collection, using designed online questionnaires shared via Isfahan City's university network pages. Participants voluntarily answered these questionnaires, and responses were stored in the researcher's Google form account for analysis. Ethical considerations were upheld, ensuring participants' informed consent and addressing potential concerns. The research adhered to scientific protocols, with a commitment to participants' well-being and data confidentiality.

Binge eating scale (BES)

The binge eating scale was designed by Gormally et al. (1982) in the United States including 16 items that measure 2 components of feeling/cognition. A 4-point Likert scale evaluates the questionnaire's items from 0 to 3. The minimum score in this tool is 0 and the maximum score is 48. On this scale, a higher score means less overeating, and the cutting line of the scale is 17, which means that a score higher than 17 indicates the absence of a binge eating disorder. A score of 0 to 17 means high BES and 18 to 48 means low binge eating (Gormally et al., 1982). In the research of Duarte et al. (2015), the construct validity was determined by the convergent validity method. The validity of the "overeating" scale on a sample of 1008 women in Portugal with the emotional eating scale was 0.55 and reliability by internal consistency method using the Cronbach alpha coefficient was 0.88. Escriva-Martinez et al. (2019) established the construct validity of the questionnaire using the convergent validity method on a sample of 428 Spanish students with a body mass index equal to 0.2. The reliability of BES using the internal consistency method calculating the Cronbach alpha coefficient was 0.86. In the research of Mouloudi et al., (2010), the construct validity of the overeating scale was investigated by confirmatory factor analysis on 120 ordinary people of Tehran, and the results of 2 factors were confirmed. Reliability was 0.85 by the internal consistency method calculating the Cronbach alpha coefficient. Niko Sarasht and Samali Eskoi (2021) reported the construct validity of the BES at 0.21 using the convergent validity method on a sample of 370 students of the Azad University of Roudhen with the measure of perceived stress.

Cognitive emotion regulation questionnaire (CERQ)

The questionnaire developed by Garnefski et al. (2001) is a multidimensional questionnaire employed to assess individual cognitive coping strategies following negative events or situations. CERQ is a multidimensional questionnaire used to identify cognitive coping strategies used by individuals after experiencing negative events or distressing situations. Unlike other coping questionnaires that do not distinguish between an individual's thoughts and actual behaviors, the CERQ evaluates an individual's thoughts following exposure to negative experiences or harmful events. This self-report questionnaire consists of 36 items and is easy to administer, suitable for individuals aged 12 and above (both normal individuals and clinical populations). Each component of CERQ has 4 items. The four cognitive adjustment components measure maladaptive emotion, including self-blame (items 19, 28, 1, 10), other-blame (items 9, 18, 27, 36) catastrophizing (items 8, 17, 26, 35), and rumination (items 3, 12, 21, 30, and 5). These four components measure the cognitive regulation components of adaptive emotion including the acceptance of expressions (items 29, 2, 11, 20), refocusing on positive phrases (items 5,14, 23, 32), refocusing on planning phrases (items 34, 7, 16, 25), positive reappraisal phrases (items 6, 15, 24, 33), and putting into perspective phrases (items 7, 16, 25, 34). This tool can be used for adults and adolescents over 12 years old. This questionnaire is on a 5-point Likert scale in the range of 1 (almost never) up to 5 (almost always). The total score of each component is obtained by summing the scores of the statements, so the score range of each component is between 4 and 20 and the total score is between 36 and 180 The total score of adaptive cognitive regulation is between 20 and 100 and the total score of maladaptive cognitive regulation of emotion is between 16 and 80.

The scale's response is on a 5-point Likert scale ranging from 1 (almost never) to 5 (almost always). There is no reverse scoring and high scores in each component indicate the extent of more use of adaptive or non-adaptive cognitive regulation of emotion in dealing with stressful and negative life events. Garnefski and Kraaij estab-

lished the construct validity of CERQ by confirmatory factor analysis on 611 adults from the general population in the Netherlands. The study confirmed the structure of 9 factors to check the convergent validity of the CREQ and obtain its correlation coefficient with the depression anxiety stress scale, which was significant at 0.48. The internal consistency reliability by calculating the Cronbach alpha coefficient in the above sample was between 0.78 and 0.94 for the components (Garnefski & Kraaij, 2007). Tuna and Bozo (2012) measured the psychometric properties of the CERQ in 311 students in Turkey. Confirmatory factor analysis showed the 9-factor structure of the questionnaire and the acceptable fit of the model. The reliability was 0.74 by the internal consistency method calculating the Cronbach alpha coefficient in the above sample (Tuna & Bozo, 2012). In the study of Tajik, and Lotfi Kashani (2019), the convergent validity of the "excitement cognitive regulation questionnaire" has been confirmed in 478 men and women in Tehran by simultaneously implementing the "depression, anxiety and tension scale obtaining a correlation coefficient between 0.51 and 0.62 for the components. The reliability index was obtained between 0.78 and 0.93 using internal homogeneity by calculating the Cronbach alpha coefficient for each component. Hasani (2010) in a study on 420 students in Tehran measured the construct validity of CERQ using confirmatory factor analysis indicating 9 factors for this questionnaire. Reliability by the internal consistency method was obtained from 0.68 to 0.82 by calculating the Cronbach alpha coefficient in the above sample for the components.

Perfectionism inventory (PI)

The PI was prepared by Hill et al. (2004) containing 59 items. Participants must specify the amount of each item describing them in a range of five options from agree to disagree (Hill et al., 2004). The subscales of the instrument are concern over mistakes (range of scores: 8-40), high standards for others (range of scores: 7-35), need for approval (range of scores: 8-40), organization (range of scores: 8-40), perceived parenting pressure (range of scores: 8-40), planfulness (range of scores: 7-35), rumination (range of scores: 7-35), and struggle for excellence (range of scores: 6-30) (Hill et al., 2004). Gratz, et al. (2017) calculated the correlations of the subscales of this instrument with those of the multidimensional perfectionism scale (MPS). The results confirmed the validity of the instrument (the Cronbach alpha coefficients of the subscales ranged between 0.81 and 0.95). In a similar study conducted in Iran, the calculated Cronbach alpha coefficient was satisfactory (α=0.92), which shows proper internal consistency for the instrument (Sharifi, et al., 2015). Also, Sharifi et al. (2015) reported the construct validity of the scale as 0.913. Convergent validity with the Weisman and Beck's dysfunctional attitude scale was reported as 0.38 in the research of Talai and Jafari Roshan (2021). The convergent validity of this instrument was measured by calculating its correlation coefficient with the frost perfectionism questionnaire, with a satisfactory result of 0.741 (Taghavizade Ardakani et al., 2019).

After an initial description and hypothesis verification, the data from the current study were analyzed using EMOS 22 software and SEM.

Results

In this study, there were 167 single female students (77.3 %) and 49 married female students (22.7 %). The age mean and standard deviation of the participants were 23.61 and 4.75, respectively. Among the participants, 31 (14.4%) were studying for an associate degree, 131 (60.6%) bachelor's degree, 42 (19.4%) master's degree, and 12 (5.6 %) for PhD. All these students were actively engaged in their studies. Table 1 displays the mean, standard deviation, and correlation coefficients illustrating the relationships between adaptive perfectionism, non-adaptive perfectionism, adaptive strategies, non-adaptive strategies, cognitive regulation of emotion, and an excessive eating disorder.

Table 1 indicates a positive correlation between adaptive perfectionism and adaptive cognitive regulation strategies, as well as between maladaptive perfectionism and maladaptive cognitive emotion regulation strategies, with an excessive eating disorder at a significance level of 0.01. The research also examined the skewness and kurtosis of the variables to assess the assumption of normality in the distribution of univariate data. Additionally, the study investigated the variance inflation (VIF) and tolerance coefficient to evaluate the presence or absence of collinearity assumptions. The findings of these evaluations are presented in Table 2.

Table 2 displays that the skewness and kurtosis values of all variables fall within the range of ±2, which confirms the assumption of normality in data distribution. Furthermore, Table 2 reveals that the predictor variables have tolerance coefficient values exceeding 0.1 and VIF values below 10. This suggests that the assumption of collinearity is also preserved in the current research data. It is worth noting that the establishment or non-establishment of the assumption of normality in multivariate data distribution was assessed using the "Mahalanobis

Table 1. The mean, standard deviation, and correlation matrix between variables

Research Variables	Mean±SD	1	2	3	4
1. Adaptive perfectionism	81.86±13.27	-			
2. Non-adaptive perfectionism	83.25±14.66	0.21**	-		
3. Adaptive strategies of cognitive regulation	61.76±11.49	0.28**	-0.26**	-	
4. Non-adaptive strategies of cognitive regulation	41.93±9.52	-0.11	0.47**	-0.25**	-
5. Binge eating disorder	8.56±7.87	0.32**	0.23**	-0.47**	0.36**

**P<0.01 and *P<0.05

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Table 2. Assumptions of normality and collinearity

Variables	Normality		Co-linearity	
	Kurtosis	Skewness	Tolerance Coefficient	Variance Inflation Factor (VIF)
1. Adaptive perfectionism	-0.66	0.78	0.83	1.21
2. Non-adaptive perfectionism	-0.16	-0.73	0.68	1.47
3. Adaptive strategies of cognitive regulation	0.09	-0.54	0.80	1.25
4. Non-adaptive strategies of cognitive regulation	0.51	-0.33	0.76	1.32
5. Binge eating disorder	1.45	1.54	-	-

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distance" evaluation. The results indicate that the skewness and kurtosis values are 0.83 and 0.05, respectively. These values, along with the histogram chart depicted in Figure 1, confirm the validity of the assumption of normality in multivariate data distribution. Additionally, the scatter diagram evaluation of the standardized variances of errors (Figure 2) demonstrates that the assumption of homogeneity of variances is maintained across the data.

Once the assumptions were confirmed within the data, the model fit was evaluated using the path analysis technique with AMOS software, version 24. The fit indices of the path model are depicted in Table 3.

Table 3. Fit indices of the measurement model and the structural model

Fit Indicators	Structural Model	Cut Point
Chi-square	2.26	-
The degree of freedom of the model	1	-
df/χ^2	2.26	<3
GFI	0.995	<0.090
AGFI	0.925	<0.850
CFI	0.991	<0.90
RMSEA	0.076	>0.80

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Abbreviations: GFI: Goodness of fit index; AGFI: Adjusted goodness of fit index; RMSEA: Root mean square error of approximation.

Table 4. Total, direct, and indirect path coefficients between research variables in the research model

Paths	Variables	b	S.E	β	p
Direct	Maladaptive perfectionism → maladaptive emotion regulation strategies	0.310	0.040	0.496	0.001
	Non-adaptive perfectionism → adaptive strategies of emotion regulation	-0.292	0.047	-0.339	0.001
	Adaptive perfectionism → maladaptive emotion regulation strategies	-0.082	0.056	-0.104	0.136
	Adaptive perfectionism → adaptive emotion regulation strategies	0.386	0.073	0.354	0.001
	Maladaptive emotion regulation strategies → over-eating disorder	0.186	0.051	0.250	0.003
	Adaptive strategies of emotion regulation → over-eating disorder	-0.172	0.030	-0.320	0.001
	Maladaptive perfectionism → over-eating disorder	0.036	0.038	0.078	0.352
	Adaptive perfectionism → over-eating disorder	-0.148	0.045	-0.252	0.001
Indirect	Maladaptive perfectionism → over-eating disorder	0.108	0.021	0.232	0.001
	Adaptive perfectionism → over-eating disorder	-0.082	0.020	-0.139	0.001
Total	Maladaptive perfectionism → over-eating disorder	0.144	0.031	0.310	0.001
	Adaptive perfectionism → over-eating disorder	-0.230	0.045	-0.391	0.001

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Table 3 displays the fit indices (including df/χ^2= 2.26, CFI=0.991, GFI=0.995, GFI=0.925, AGFI=0, and RMSEA=0.076) obtained from the analysis, indicating that the model fits well with the collected data. Table 4 illustrates the path coefficients for the variables in the research model.

The findings in Table 4 indicate a negative relationship between adaptive perfectionism and excessive eating disorder (P<0.01, β=-0.391), meaning that as adaptive perfectionism increases, excessive eating disorder tends to decrease. On the other hand, there is a positive and significant relationship between maladaptive perfectionism and excessive eating disorder (P<0.01, β=0.310) at the 0.01 significance level, suggesting that as maladaptive perfectionism increases, excessive eating disorder also tends to increase.

Moreover, a negative path coefficient is observed between cognitive regulation of emotion as an adaptive strategy and excessive eating disorder (P<0.01, β=0.320), implying that an increase in adaptive cognitive regulation of emotion is associated with a decrease in an excessive eating disorder. Conversely, there is a positive and significant path coefficient between the cognitive regulation of emotion as a maladaptive strategy and excessive eating disorder (P<0.01, β=0) at the 0.01 significance level, indicating that an increase in maladaptive cognitive regulation of emotion is linked to an increase in the excessive eating disorder.

Table 4 provides a negative indirect path between adaptive perfectionism and excessive eating disorder (P<0.01, β=0.139), indicating that cognitive emotion regulation plays a mediating role in the relationship be-

Table 5. Baron a–nd Kenny's test results in investigating the indirect relationship between perfectionism and excessive eating disorder

Relations	b_{ab}	SE_{ab}	$_{ab}\beta$	t
Adaptive perfectionismà Adaptive strategiesà Cognitive regulation of excessive eating	-0.066	0.021	0.113	-3.14
Adaptive perfectionism à maladaptive strategies of cognitive regulation à excessive eating	-0.015	0.028	-0.026	-0.54
Maladaptive perfectionism à adaptive strategies à cognitive regulation of excessive eating	0.050	0.024	0.108	2.08
Maladaptive perfectionism à maladaptive cognitive regulation strategies à excessive eating	0.058	0.041	0.124	3.05

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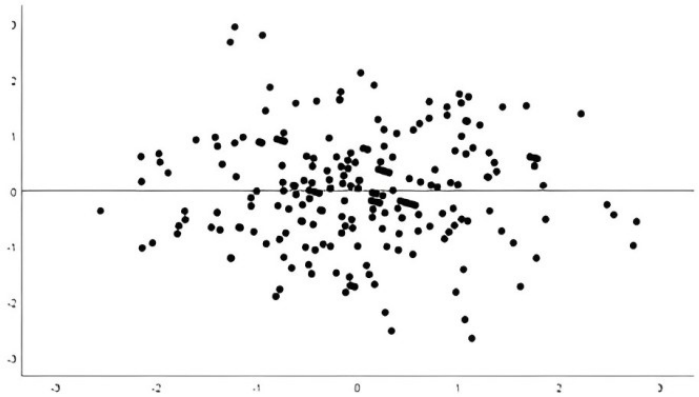

Figure 1. The histogram diagram for the distribution of Mahlen-Bays interval data

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tween these two variables. Additionally, it shows a positive and significant indirect path between maladaptive perfectionism and excessive eating disorder (P<0.01, β=0.232) at the 0.01 level. However, the specific contribution of each mediating variable (adaptive and non-adaptive strategies of cognitive emotion regulation) was not determined to the link between dimensions of perfectionism and excessive eating disorder.

The significance or non-significance of the mediator role played by each mediator variable was assessed using Baron and Kenny's formula (1986, as cited by Mallinckrodt et al., 2006). The outcomes of this analysis are presented in Table 5.

Table 5 displays the findings regarding the relationship between adaptive perfectionism, binge eating, and cognitive regulation strategies. It shows a negative and statistically significant coefficient of the indirect path from adaptive perfectionism to binge eating through adaptive cognitive regulation strategies at a level of 0.01 (P<0.01, β=-0.113). Conversely, the path coefficient between these variables through non-adaptive cognitive regulation strategies was not statistically significant at a level of 0.05.

Furthermore, there are positive and statistically significant indirect path coefficients between maladaptive perfectionism and binge eating through both adaptive and maladaptive cognitive regulation strategies. Specifically, the coefficients for the indirect and indirect paths through adaptive strategies are significant at the levels of 0.05 (P<0.05, β=0.108) and 0.01 (P<0.01, β=0.124), respectively. These results indicate that adaptive cognitive regulation strategies negatively mediate the relationship between adaptive perfectionism and eating disorders, whereas maladaptive cognitive regulation strategies positively and significantly mediate the relationship between maladaptive perfectionism and eating disorders. Additionally, non-adaptive cognitive emotion regulation strategies only positively and significantly mediate the relationship between non-adaptive perfectionism and binge eating disorder. Figure 3 illustrates the research

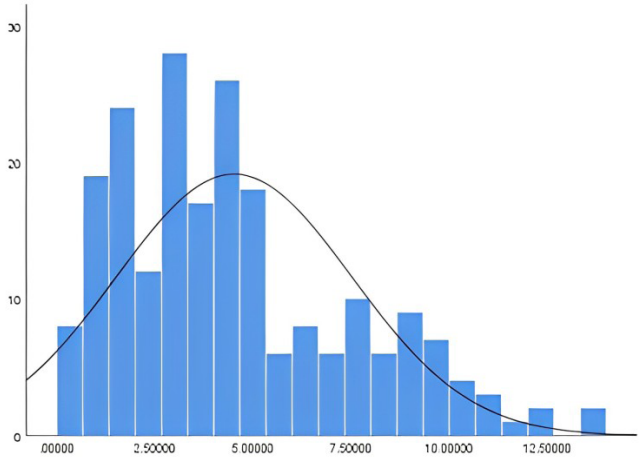

Figure 2. The scatter diagram for standardized error variance

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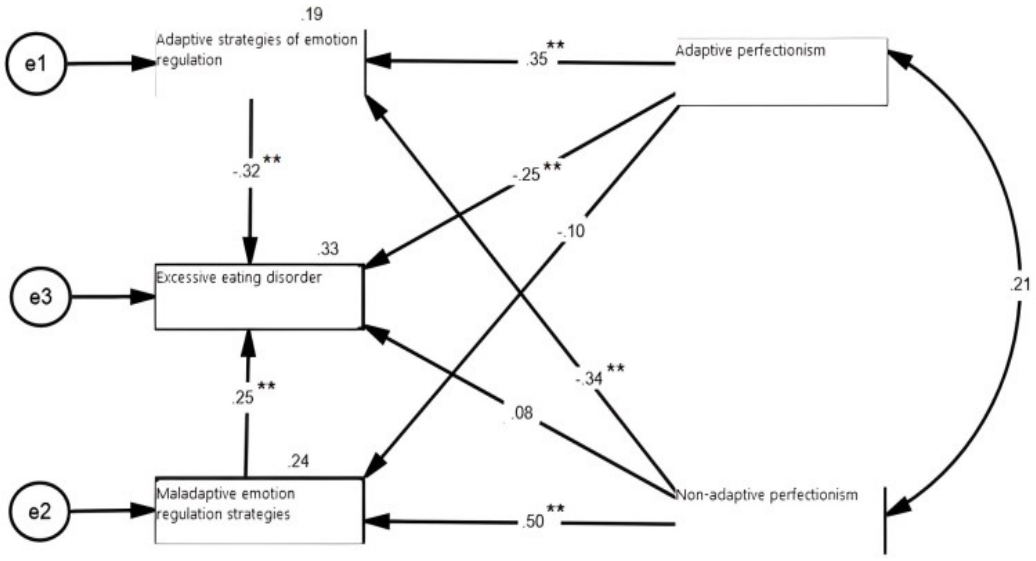

Figure 3. The research model using standard data

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model depicting the relationship between perfectionism, binge eating disorder, and cognitive emotion regulation strategies as mediators in students.

Figure 3 illustrates the squared multiple correlations (R^2) of 0.33 for the Binge eating disorder variable. This suggests that the combination of cognitive regulation strategies related to emotion and perfectionism explains approximately 32% of the variability in binge eating disorders.

Discussion

This study explained the relationship between perfectionism and binge eating disorder in female college students and considered the mediating role of cognitive emotion regulation. The study's findings shed light on the connections between cognitive regulation strategies, perfectionism, and eating disorders. Adaptive cognitive regulation strategies demonstrated mixed associations with eating disorders within the context of adaptive perfectionism.

Related to this research finding, Egan et al. (2022) and Shafran et al. (2002) emphasized the influence of maladaptive cognitive emotion regulation strategies on the link between perfectionism and eating disorder symptoms. These insights support cognitive-behavioral models that identify perfectionism as a key risk factor. Notably, the study discovered that maladaptive strategies amplify the positive association between perfectionism and eating disorder symptoms, aligning with Prefit et al. (2019) and Smith et al. (2018). In essence, employing non-adaptive cognitive emotion regulation strategies correlates with the manifestation of eating disorder symptoms. Earlier research, like Donahue et al. (2018), utilizing Gratz and Roemer's (2004) cognitive emotion regulation difficulties model, highlighted the moderating role of cognitive emotion regulation disorders, particularly the limited access to adaptive strategies, in the perfectionism-eating disorder symptoms link. Thus, this study extends prior work by pinpointing cognitive emotion regulation strategies as mediators interacting with perfectionism to account for eating disorder symptoms. It also advances cognitive-behavioral models by proposing that maladaptive strategies reinforce eating disorder symptoms, such as weight-related concerns and food restriction, stemming from a failure to meet societal standards (Fairburn et al., 2003).

In explaining this research finding, it can be said the "mediating role" of cognitive emotion regulation refers to the idea that cognitive strategies used to manage emotions may act as intermediaries between perfectionism and binge eating disorder. In other words, these cognitive strategies could influence the strength or nature of the relationship between perfectionism and binge eating disorder symptoms (Smith et al., 2020). For instance, if a female college student with perfectionistic tendencies faces stress or negative emotions, her cognitive emotion regulation strategies could determine how she copes with these emotions. If she tends to use maladaptive strategies like avoidance or rumination, this might increase her vulnerability to engaging in binge eating episodes as a way to cope with distress. On the other hand, if she employs adaptive strategies such as seeking support or reframing thoughts positively, she might be

better equipped to manage her emotions and not resort to binge eating. In other words, perfectionism, characterized by the pursuit of exceptionally high standards and an intense fear of making mistakes or falling short, can significantly impact how individuals regulate their emotions (Macedo et al., 2017)

Perfectionists often engage in self-criticism and self-blame when they perceive themselves as failing to meet their unrealistic standards (Hewitt & Flett, 1991). This self-criticism can lead to increased negative emotions and decreased self-esteem. Individuals who struggle with self-criticism often experience intense negative emotions such as shame, guilt, and low self-esteem. These emotions can be overwhelming and difficult to manage. Binge eating might serve as a maladaptive coping mechanism to temporarily alleviate these distressing emotions (Fairburn et al,2003; Munsch et al,2012). Engaging in binge eating can create a short-lived distraction from self-critical thoughts and emotions, providing momentary relief (Wonderlich et al, 2015).

The research's implications lie in understanding the psychological processes affecting binge eating disorder symptoms. As perfectionism may entail tying self-worth to external standards (Holden & Jeanfreau, 2021), this study suggests that inadequacy related to eating disorder symptoms might result from pursuing external standards of thinness and restraint, rather than personal ones. Maladaptive cognitive emotion regulation strategies further perpetuate thoughts and emotions centered on seeking acceptance from others, reinforcing eating disorder symptoms. The study underscores how perfectionism and maladaptive strategies interact to predict weight and dietary restriction concerns, reflecting efforts to regain control in the face of heightened perfectionism (Gibson & Mehler, 2019). Importantly, the results highlight the necessity of addressing maladaptive cognitive emotion regulation strategies, especially in individuals with high perfectionism levels.

In summary, this study reveals a significant link between perfectionism and eating disorder symptoms but acknowledges that it might not solely explain eating disorders when considering other factors like maladaptive cognitive emotion regulation. This finding resonates with Brewerton et al. (2019), emphasizing the reciprocal dynamics between perfectionism and emotion dysregulation. It calls for examining distinct dimensions of perfectionism alongside various underlying factors to comprehensively understand eating disorder symptoms. Notably, the study aligns with Brockmeyer et al. (2022), showcasing the association between maladaptive cognitive emotion regulation and a broader spectrum of eating disorder symptoms. This resonance reflects the recognition of eating disorder symptoms as a maladaptive response to emotional distress (Sala et al., 2018).

Conclusion

This study explored the causal relationship between perfectionism and binge eating disorder in female students, considering the mediating role of cognitive emotion regulation. The findings of this study reveal interesting insights into the relationship between cognitive regulation strategies, perfectionism, and eating disorders. The study revealed that adaptive cognitive regulation strategies showed both negative and positive associations with eating disorders in the context of adaptive perfectionism. This suggests that certain adaptive cognitive strategies might be protective against the development of eating disorders, while others could potentially contribute to their manifestation. Furthermore, the study highlights the significant mediating role of adaptive cognitive regulation strategies in the relationship between maladaptive perfectionism and eating disorders. This suggests that the way individuals cope with their perfectionistic tendencies through cognitive regulation strategies plays a crucial role in determining whether maladaptive perfectionism leads to eating disorders. The findings imply that interventions targeting these cognitive regulation strategies may be effective in mitigating the impact of maladaptive perfectionism on eating disorders. Another noteworthy finding is the positive and significant mediating role of non-adaptive cognitive emotion regulation strategies in the relationship between non-adaptive perfectionism and binge eating disorder. This suggests that individuals who display non-adaptive perfectionistic tendencies might resort to maladaptive cognitive strategies to cope with negative emotions, which in turn could contribute to the development of binge eating disorder. This highlights the importance of addressing both non-adaptive perfectionism and cognitive emotion regulation strategies in the prevention and treatment of binge eating disorder. Overall, the study underscores the complex interplay between cognitive regulation strategies, perfectionism, and eating disorders. It provides valuable information for understanding the mechanisms through which perfectionism can influence the development of eating disorders and the potential pathways through which cognitive strategies can either exacerbate or ameliorate these effects. The implications of these findings could contribute to the development of targeted interventions that focus on promoting adaptive cognitive regulation strategies and addressing maladaptive cogni-

tive emotion regulation strategies in individuals at risk of eating disorders. However, further research is needed to better comprehend the specific mechanisms underlying these relationships and to develop more effective and tailored interventions for individuals with eating disorders.

Study limitations

To elaborate on the research findings, it can be stated that the utilization of non-adaptive cognitive emotion regulation strategies represents an ongoing cognitive process that perpetuates concerns about weight, shape, and eating. This cognitive process likely contributes to the development of eating disorder symptoms as a means of escaping from negative thoughts and emotions while seeking a sense of comfort or security. This research had certain limitations, notably the utilization of a cross-sectional design, which restricts the ability to gain a comprehensive understanding of causal relationships between variables and assess how these evolved relationships can only be achieved through the implementation of a longitudinal design. Additionally, this study solely relied on self-report questionnaires for data collection. Future studies are recommended to incorporate multiple sources of data collection (such as observer reports, behavioral measures, or interviews) to enhance the evaluation process. One of the limitations of the present study was the lack of control of variables related to body mass index and economic status, so it is suggested that researchers consider this matter in future studies.

Ethical Considerations

Compliance with ethical guidelines

This study has obtained approval from the Isfahan University of Medical Sciences as a project, identified by the ethics code IR.ARI.MUI.REC.1401.032.

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Authors' contributions

All authors contributed equally to preparing this article.

Conflict of interest

The authors declare no conflict of interest.

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