



Perceived weight stigma and disordered eating behaviors among postpartum women: The mediating role of weight bias internalization and postpartum depression

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ABSTRACT

Background: Weight stigma is linked to adverse effects, but whether it directly heightens the risk of disordered eating behaviors or psychological factors mediate this connection among postpartum women is uncertain.

Objectives: To investigate the relationship between perceived weight stigma and disordered eating behaviors (restrained eating, emotional eating, and external eating) and identify the mediating role of weight bias internalization and postpartum depression (PPD).

Methods: This cross-sectional study involved 507 postpartum women. Data were collected anonymously using self-reported questionnaires, including the Perceived Weight Stigma Questionnaire, Weight Bias Internalization Scale, Edinburgh Postpartum Depression Scale, and Dutch Eating Behavior Questionnaire. Data were analyzed using descriptive statistics, Pearson's correlation analysis, hierarchical linear regression, and mediation analysis.

Results: The results showed that the relationship between perceived weight stigma and disordered eating behaviors was fully mediated by weight bias internalization and PPD. Specifically, perceived weight stigma was associated with greater weight bias internalization, which was associated with greater PPD, and greater PPD was associated with greater disordered eating behaviors.

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Conclusion: This may be the first study to propose a chain mediation model exploring the roles of weight bias internalization and PPD in the relationship between perceived weight stigma and disordered eating behaviors among postpartum women. The findings enhance the understanding of the psychological impacts of perinatal weight stigma and underscore the importance of addressing weight stigma in postpartum care. Comprehensive interventions should be developed to enhance postpartum health and reduce the risk of disordered eating behaviors.

Abbreviations

BMI	Body mass index
PPD	Postpartum depression
PWSQ	Perceived Weight Stigma Questionnaire
WBIS	Weight Bias Internalization Scale
EPDS	Edinburgh Postpartum Depression Scale
DEBQ	Dutch Eating Behavior Questionnaire

Contribution of the Paper

What is already known about the topic?

- Weight stigma is associated with a range of negative psychological, behavioral, and physical health outcomes.
- Postpartum women, however, are underrepresented in weight stigma research, despite being at a critical stage for issues related to weight, body image, eating behaviors, and depression.

What this paper adds?

- This might be the first study to explore the mediating role of weight bias internalization and postpartum depression in the relationship between perceived weight stigma and disordered eating behaviors among postpartum women.
- The relationship between perceived weight stigma and disordered eating behaviors was fully mediated by weight bias internalization and PPD.
- Health is multidimensional. A holistic focus must be maintained, shift emphasis from weight to the overall health and well-being of postpartum women, while being inclusive of health at every size.

1. Introduction

The dramatic increase in obesity rates has been accompanied by a rise in weight-based prejudice, discriminatory behavior, and stereotyping, known as weight stigma (Brewis et al., 2018). For example, a study conducted by Rodriguez et al. (2020), which involved a sample of 501 pregnant and postpartum women, found that nearly two-thirds of the participants reported experiencing weight stigma during pregnancy and postpartum periods. Women across all weight categories are at risk of being stigmatized, and the higher the body mass index (BMI) is, the higher the reported rate of weight stigma is (Rodriguez and Nagpal, 2021).

Weight stigma is associated with a range of negative psychological, behavioral, and physical health outcomes, including overeating, depression, and weight gain (Rodriguez et al., 2019b; Romano et al., 2021; Schvey et al., 2019). It has also been linked to increased risk of suicide and death (Daly et al., 2020; Sutin et al., 2015). These observed relationships may be unique and particularly harmful in the postpartum period. During this stage of life, women experience inherent weight fluctuations and are particularly sensitive to issues related to weight and body image (Jensen et al., 2022). Additionally, unrealistic portrayals and expectations about the 'ideal' postpartum body image exist in society, emphasizing the rapid 'return' to pre-pregnancy weight after delivery (Nippert et al., 2021) can exacerbate these concerns.

The postpartum period is a high-risk time for the occurrence and progression of disordered eating behaviors. After delivery, women have increased concerns about their body's changes. A study showed that weight and body image concerns are significantly higher in the postpartum period than in the pre-pregnancy period (Nunes et al., 2014). This body dissatisfaction can increase the risk of developing disordered eating behaviors (Pearson et al., 2015). Furthermore, women may be less motivated to maintain healthy practices and are less inclined to seek monitoring by health care professionals as frequently than they were during pregnancy (Tierney et al., 2011; Nunes et al., 2014). Meanwhile, the transition to motherhood is challenging, and disruptions in routine and sleep can make maintaining regular eating patterns difficult for postpartum women (Park et al., 2003). The lack of motivation for healthy behaviors, the absence of regular monitoring by healthcare professionals, and stress from identity transitions can distort cognitive functioning and coping strategies among postpartum women, leading to maladaptive eating behaviors (Baskin et al., 2020; Beck and Haigh, 2014). Consequently, postpartum women are especially susceptible to disordered eating behaviors, which can have serious health implications for both the mother and child, including postpartum weight retention (Yu et al., 2022), postpartum depression (PPD) (das Neves

et al., 2022), and an increased risk of unhealthy eating patterns in the child (Rodriguez and Nagpal, 2021). Additionally, there is a significant link between disordered eating and suicidal ideation (Lipson and Sonnevile, 2020).

Weight stigma is a predictor of disordered eating behaviors. Tomiyama (2014) proposed the Cyclic Obesity/Weight-Based Stigma (COBWEBS) model to explain the association between weight stigma and disordered eating behaviors. This model suggests that weight stigma induces stress, which results in physiological (such as depression), cognitive, and behavioral changes that promote emotional eating and weight gain. This process in turn increases vulnerability to weight stigma. Empirical research supports this model. A cross-sectional study involving 601 adults in Taiwan found that the relationship between perceived weight stigma and food addiction is mediated by weight bias internalization and psychological distress (i.e., depression, anxiety, and stress) (Huang et al., 2024). Additionally, Huang et al. (2022) reported that perceived weight stigma triggers psychological distress (i.e., depression, anxiety, and stress) in Taiwanese undergraduates, which in turn has been linked to food addiction.

The COBWEBS model broadly conceptualizes different forms of weight stigma. A systematic review and meta-analysis (Alimoradi et al., 2020) have demonstrated that perceived weight stigma—defined as awareness of stereotypes, prejudice, and discrimination related to one’s weight—and weight bias internalization—defined as the acceptance and endorsement of these stereotypes, prejudice, and discrimination—are distinct constructs. Given this distinction, they should be considered separately. Furthermore, weight bias internalization may be a critical mechanism in understanding the relationship between perceived weight stigma and disordered eating behaviors. A theoretical model proposed by Tylka et al. (2014) suggests that weight bias internalization mediates the relationship between perceived/experienced weight stigma and adverse health outcomes. Specifically, perceived/experienced weight stigma is positively associated with weight bias internalization, which in turn is related to adverse biopsychosocial outcomes (e.g., disordered eating behaviors and depression). Preliminary evidence supports this theoretical model. Bidstrup et al. (2022a) reported that weight bias internalization mediates the relationship between perceived weight stigma and disordered eating behaviors and depression. The results from a systematic evaluation show that the relationship between perceived/experienced weight stigma and depression is mediated by weight bias internalization (Bidstrup et al., 2022b).

Empirical studies have been conducted to assess the association and explanatory mechanisms between perceived weight stigma and disordered eating behaviors in the general population (O’Brien et al., 2016; Huang et al., 2022). For example, a study that surveyed 968 undergraduate students in Taiwan reported that weight bias internalization and psychological distress sequentially mediated the relationship between perceived weight stigma and food addiction (Huang et al., 2022). Specifically, perceived weight stigma was positively associated with weight bias internalization, which was linked to greater psychological distress, and greater psychological distress was associated with greater disordered eating behaviors.

Although these findings have been demonstrated in the general population, additional empirical research focusing specifically on postpartum women is crucial. The Lancet editorial (Treasure and Ambwani, 2021) emphasizes the need for healthcare professionals to address weight stigma within broader social populations, especially those with multiple marginalized identities (e.g., women, sexual minorities, and individuals with higher body weights). Failing to consider the unique challenges faced by these groups in public health initiatives may expose them to increased victimization. Postpartum women, who are already at high risk for depressive symptoms and distress (Wang et al., 2021), may experience exacerbated effects due to weight stigma and disordered eating behaviors. Understanding the association between weight stigma and disordered eating behaviors during the postpartum period is a critical step toward developing targeted interventions aimed at reducing the risk of PPD and disordered eating behaviors. A study in the United States involving 501 pregnant ($n = 143$) and postpartum women ($n = 358$) found that weight stigma was positively associated with depression, emotional eating, and dieting behaviors (Rodriguez et al., 2019a). However, this study did not explore the cumulative outcomes or the interactions between these variables in a comprehensive model.

Furthermore, to date, no study has explored the association of weight stigma with PPD and disordered eating behaviors among Chinese postpartum women. In traditional Chinese culture, the practice of "sitting the month" during the first month postpartum is considered essential (Tsai and Wang, 2019). This practice encourages increased intake of food and supplements to restore energy and support breastfeeding (Wong and Fisher, 2009). While this may result in postpartum weight gain, it is often overlooked, viewed as

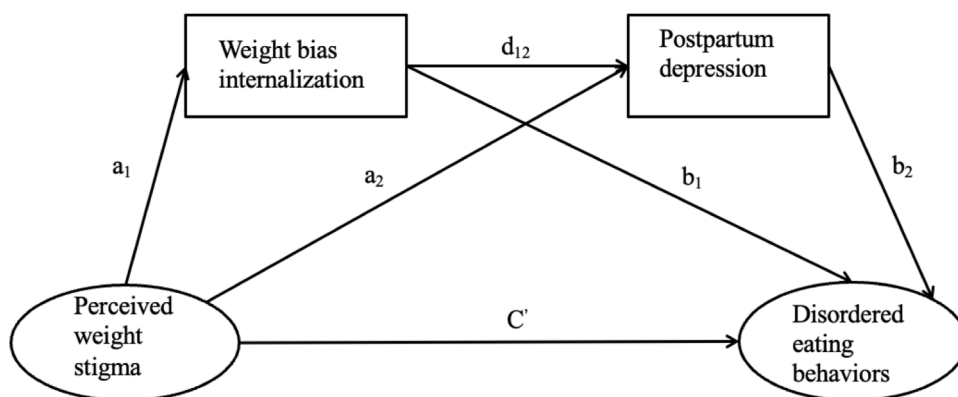


Fig. 1. Hypothesized serial mediation effects of weight bias internalization and PPD between perceived weight stigma and disordered eating behaviors.

acceptable, or even beneficial within this cultural framework. However, the growing prevalence of the "thin ideal" in China has led to increased weight-related prejudice and discrimination (Stojcic et al., 2020). The intersection of traditional practices and modern societal values may foster a unique form of weight stigma among Chinese postpartum women.

Therefore, this study aimed to fill an important gap in the weight stigma literature concerning postpartum women, a high-risk population, by examining the relationship between perceived weight stigma, weight bias internalization, PPD, and disordered eating behaviors. Based on two models' hypothesized mechanisms (Tylka et al., 2014; Tomiyama, 2014) and previous research, we tested two hypotheses: (1) Variation in perceived weight stigma, weight bias internalization, and PPD predicts disordered eating behaviors. (2) Weight bias internalization and PPD mediate the relationship between perceived weight stigma and disordered eating behaviors (as shown in Fig. 1).

2. Methods

2.1. Participants

This cross-sectional study was conducted between December 2021 and March 2022 in the postnatal follow-up clinics of a maternal and child health hospital and four community health centers located in Changsha, China. A convenience sampling method was used to recruit postpartum women in the waiting room. Paper questionnaires were distributed to all the participants who met the inclusion criteria and were willing to participate in this study. Trained research staff guided the participants in completing the questionnaires in a demonstration room, and they collected the questionnaires after completion on site. The questionnaire could be completed in 10–15 mins.

The inclusion criteria for participants were as follows: (a) at least 18 years of age, (b) within one year of childbirth, and (c) voluntary participation in this study. Individuals who with a history of significant mental or physical health disorders such as developmental delay, or cognitive disorders were excluded.

Based on a confidence level ($1-\alpha = 0.95$), permissible error ($\delta = 1.2$), and response rate of the survey (95%), the required sample size was calculated to be 477 cases using PASS 11.0. A total of 530 postpartum women participated in the survey, of which 23 questionnaires were excluded because they were incomplete (>20% of the entire questionnaire was not completed) and/or missing important information (e.g., weight). Finally, 507 valid questionnaires were obtained.

2.2. Measures

2.2.1. Demographic characteristics

The age and the monthly income were self-reported. A portable height and weight metre was used to measure the participants' height (meters) and weight (kilograms). The BMI (kg/m^2) was calculated using the standard formula of weight divided by height squared.

2.2.2. Perceived weight stigma questionnaire (PWSQ)

The PWSQ (Gan et al., 2022), a self-reported questionnaire, was used to assess perceptions of weight-based stigmatization experiences. The scale uses 10 dichotomous items, and participants answer 'yes' or 'no' (yes core = 1, no score = 0) to report whether they have related experiences and feelings. Higher PWSQ scores indicate higher levels of perceived weight stigma. The Chinese version of PWSQ had acceptable psychometric properties among adolescents (CFI = 0.996, NNFI = 0.994, RMSEA = 0.022, and SRMR = 0.031) (Ahorsu et al., 2024). In the current sample, the PWSQ showed good internal consistency (Cronbach's alpha = 0.80). The validity analysis showed a Kaiser-Meyer-Olkin (KMO) value of 0.811 and a Bartlett's test p -value < 0.001, indicating good construct validity of the scale.

2.2.3. Weight bias internalization scale (WBIS)

The WBIS consists of 11 items that are scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). After reverse coding two item scores (items 1 and 9), the total points for the items represent the degree of weight bias internalization. Higher scores indicate a greater internalization of weight bias. A sample item for the WBIS is "I hate my overweight". The English version of the WBIS has shown high internal consistency both in pregnancy and postpartum individuals, with Cronbach alpha equaling 0.808 and 0.814, respectively (Dieterich et al., 2021). Through careful back-translation, the original English version of the WBIS was translated into Chinese, with the term "weight" substituted for "overweight." For instance, the sample item above is "I hate my weight" in the Chinese WBIS. The Chinese version demonstrated satisfactory psychometric properties among woman population (CFI = 1.000, RMSEA = < 0.001, and SRMR = 0.051) (Rozzell-Voss et al., 2024). In this study, the WBIS showed high internal consistency with a Cronbach's alpha of 0.90. The validity analysis showed a KMO value of 0.951 and a Bartlett's test p -value < 0.001, indicating good construct validity of the scale.

2.2.4. Edinburgh postpartum depression scale (EPDS)

The EPDS is a widely used self-rating scale for the screening of PPD. The scale employs a 4-point Likert scale (0–3) and was developed by Cox et al. (1987). A higher score indicates a higher degree of PPD. We used the Chinese version of the EPDS that has been validated on Chinese postpartum women with good internal consistency (Cronbach's alpha = 0.78), sensitivity (81.25%), and specificity (80.67%) (Lau et al., 2010). In this study, the EPDS showed high internal consistency (Cronbach's alpha = 0.90). The

validity analysis showed a KMO value of 0.908 and a Bartlett's test p -value < 0.001 , indicating good construct validity of the scale.

2.2.5. Dutch eating behavior questionnaire (DEBQ)

The DEBQ was used to assess eating behaviors. This questionnaire is a self-report 33-item questionnaire, which was published in 1986 by van Strien et al. (1986), contains three subscales that assess restrained eating (i.e., conscious restriction of food intake), emotional eating (i.e., eating in response to negative emotions), and external eating (i.e., eating in response to food-related stimuli regardless of the internal states of hunger and satiety). The scale showed high internal consistency in postpartum women, with Cronbach's α being 0.89, 0.95, and 0.88 for restrained, emotional, and external eating, respectively (Singh et al., 2023). The items are scored on a 5-point scale (1 = never to 5 = very often), with high scores indicating greater disordered eating behaviors. The Chinese version of the DEBQ was validated in a sample of Taiwanese parents and showed good internal consistency (Cronbach's α ranging from 0.81 to 0.94) (Wang et al., 2018). In this study, the internal consistency for restrained, emotional, and external eating is 0.95, 0.96, and 0.89, respectively. The validity analysis showed a KMO value of 0.924 and a Bartlett's test p -value < 0.001 , indicating good construct validity of the scale.

2.3. Analysis

The SPSS 26.0 software (IBM SPSS Inc., Chicago, IL, USA) was used for data analysis. Mann-Whitney U tests and chi-square test were conducted to examine the differences between the underweight/normal weight (BMI < 24) and overweight/obesity (BMI ≥ 24) groups on the variables of interest. Pearson's correlation analysis was used to examine the correlations between variables. Then, hierarchical linear regression models were used to examine how basic demographics (age, BMI, and monthly income), and scores on the PWSQ, WBIS, and EPDS were associated with restrained, emotional, and external eating. Demographic characteristics were entered in the first step. The score of PWSQ, WBIS, and EPDS were entered in the second, third, and fourth steps, respectively. Statistical significance was set at $p < 0.05$ (two-tailed). Residual normality was examined in the hierarchical regression model to confirm that the residuals followed a normal distribution. Additionally, the variance inflation factor (VIF) was computed to ensure that there were no substantial issues with collinearity.

Finally, PROCESS v.3.4 was used to examine a chain mediation model (Model 6) with two potential mediators (i.e., weight bias internalization and PPD) and three covariates (age, BMI, and monthly income) in the relationship between perceived weight stigma and disordered eating behaviors. The effect was considered statistically significant if the 95 % CI did not include zero (Hayes, 2022).

2.4. Ethical considerations

This study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethics Committee of the School of Nursing, Central South University, on July 29, 2021 (Approval No. E2021108). Signed informed consent was obtained from all participants. The data collected were kept confidential, and only the researchers had access to the encrypted data in the database.

3. Result

3.1. Demographic characteristics and group differences

Table 1 shows that the mean age of the participants was 30.92 years (SD = 4.67), with 68 % of participants reporting a moderate to

Table 1
Descriptive statistics [M \pm SD or n (%)] for study variables of interest (N = 507).

Variables	Whole sample (N = 507)	Underweight/Normal weight (N = 334)	Overweight/Obesity (N = 173)	p
Age	30.92 \pm 4.67	30.51 \pm 4.57	31.71 \pm 4.76	0.014
BMI	22.94 \pm 3.00	23.94 \pm 21.28	26.15 \pm 2.07	< 0.001
Monthly income (yuan)				0.062
<3000	44 (8.7)	27 (8.1)	17 (9.8)	–
3000~5000	119 (23.5)	89 (26.6)	30 (17.4)	–
>5000	344 (67.8)	218 (65.3)	126 (72.8)	–
PWSQ	0.46 \pm 1.23	0.41 \pm 1.04	0.55 \pm 1.53	0.738
*PWSQ scores ≥ 1	107 (21.1)	73 (21.9)	34 (19.7)	–
WBIS	25.50 \pm 9.26	22.76 \pm 8.18	30.79 \pm 8.93	< 0.001
EPDS	8.26 \pm 5.91	8.36 \pm 5.86	8.06 \pm 6.01	0.492
Restrained eating	24.07 \pm 8.73	22.93 \pm 9.01	26.26 \pm 7.72	< 0.001
Emotional eating	26.61 \pm 10.89	25.57 \pm 10.62	28.61 \pm 11.14	0.002
External eating	29.93 \pm 7.14	29.84 \pm 7.25	30.12 \pm 6.92	0.730

Note: P values are for the difference between non-overweight and overweight/obese participants. Abbreviations: BMI, Body Mass Index; PWSQ, Perceived Weight Stigma Questionnaire; WBIS, Weight Bias Internalization Scale; EPDS, Edinburgh Postpartum Depression Scale.

Scores range: PWSQ (0–10), WBIS (11–55), EPDS (0–30), Restrained eating (10–50), Emotional eating (13–65), external eating (10–50).

* PWSQ scores ≥ 1 indicating that at least one weight-based stigma incident was reported.

high income (> 5000 RMB). According to the Chinese BMI categories established by the [Revision Committee of the Chinese Guidelines for the Prevention and Control of Overweight and Obesity in Adults \(2021\)](#), the following classifications were observed: 4.7 % of individuals were underweight (BMI < 18.5), 61.1 % had a normal weight (18.5 ≤ BMI < 24.0), 27.8 % were classified as overweight (24.0 ≤ BMI < 28.0), and 6.3 % were categorized as obesity (BMI ≥ 28). The participants with overweight /obesity reported significantly higher levels of weight bias internalization (WBIS) compared to those with underweight/normal weight, while no significant difference was found in perceived weight stigma (PWSQ).

3.2. Correlations between perceived weight stigma, weight bias internalization, PPD and disordered eating behaviors

Pearson’s correlation analysis revealed several significant correlations between the predictor variables and disordered eating behaviors (see [Table 2](#)). Restrained eating and emotional eating were positively correlated with the PWSQ score, WBIS score, and EPDS score ($r = 0.090$ to 0.380). External eating was positively correlated with the EPDS score ($r = 0.249$).

3.3. Regression models of restrained, emotional, and external eating

[Table 3](#) shows the results of the hierarchical regression analysis. For restrained and emotional eating, all models were statistically significant ($p < 0.000$), with significant changes in R^2 ($p < 0.05$). For external eating, only Model 4 was significant ($p < 0.000$). The relationship between the PWSQ score and eating behaviors decreased when WBIS and EPDS scores were added to the models.

For restrained eating, the initial model (age, income, and BMI) explained 7.4 % of the variance. In Model 2, PWSQ explained 0.8 %, but it was no longer significant after adding WBIS (8.5 %) and EPDS (1.9 %). The final model identified income, BMI, WBIS, and EPDS as significant predictors. For emotional eating, age, monthly income, and BMI accounted for 2.7 % of the variance. PWSQ explained an additional 2.9 %, but after adding WBIS, PWSQ became insignificant, and WBIS explained 2.9 % of the variance. The final model showed that EPDS explained 3.9 % and was a significant predictor. For external eating, the EPDS score explained 6 % of the variance.

3.4. Testing the chain mediation model

After controlling for covariates (age, monthly income, and BMI), chain mediation analysis was conducted with WBIS and EPDS scores as mediators. The unstandardized and standardized path coefficients are summarized in [Table 4](#). In all models, the direct effect of PWSQ on disordered eating behaviors was not significant (restrained eating: $\beta = -0.06, p = 0.222$; emotional eating: $\beta = 0.05, p = 0.243$; external eating: $\beta = -0.02, p = 0.738$). Weight bias internalization and PPD fully mediate the association between perceived weight stigma and disordered eating behaviors.

For restrained and emotional eating, higher weight bias internalization (restrained eating: $\beta = 0.30, p < 0.001$; emotional eating: $\beta = 0.13, p < 0.050$) and PPD (restrained eating: $\beta = 0.15, p < 0.001$; emotional eating: $\beta = 0.22, p < 0.001$) were significantly associated with greater disordered eating behaviors. For external eating, a higher PPD was associated with greater external eating ($\beta = 0.28, p < 0.001$).

[Table 5](#) presents the unstandardized indirect effects in the model. The indirect effects of PWSQ scores via the score of WBIS and EPDS on restrained, emotional, and external eating were 0.11 (95 % CI = 0.04, 0.20), 0.20 (95 % CI = 0.10, 0.33), and 0.17 (95 % CI = 0.09, 0.26), respectively. The indirect effects of PWSQ scores via the WBIS score on restrained and emotional eating were 0.65 (95 % CI = 0.39, 0.93) and 0.35 (95 % CI = 0.05, 0.68), respectively. The indirect effects of the PWSQ score via the EPDS score were significant for all three outcomes: restrained (0.28, 95 % CI = 0.10, 0.51), emotional (0.50, 95 % CI = 0.23, 0.86), and external eating (0.41, 95 % CI = 0.21, 0.66).

4. Discussion

The present study used a chain-mediated model to test the underlying mechanism between perceived weight stigma and disordered eating behaviors among postpartum women for the first time. The results showed that the association between perceived weight stigma and disordered eating behaviors (restrained eating, emotional eating, and external eating) was fully sequentially mediated by weight bias internalization and PPD ([Zhao et al., 2010](#)). Specifically, weight stigma, as a stressor, was perceived and internalized as self-stigma by postpartum women, which was associated with higher levels of PPD, and in turn, greater disordered eating behaviors. This study

Table 2
Correlations between perceived weight stigma, weight bias internalization, PPD, and disordered eating behaviors (N = 507).

	1	2	3	4	5	6
1.PWSQ	1.000					
2.WBIS	0.330**	1.000				
3.EPDS	0.352**	0.338**	1.000			
4.Restrictd Eating	0.090*	0.380**	0.226**	1.000		
5.Emotional Eating	0.166**	0.260**	0.279**	0.314**	1.000	
6.External Eating	0.050	0.043	0.249**	0.259**	0.414**	1.000

Note: * $p < 0.05$, ** $p < 0.01$. Abbreviations: PWSQ, Perceived Weight Stigma Questionnaire; WBIS, Weight Bias Internalization Scale; EPDS, Edinburgh Postpartum Depression Scale.

Table 3
Regression models for predictors of the respective eating behaviors (N = 507).

Variables	Model 1			Model 2			Model 3			Model 4		
	B	SE	β	B	SE	β	B	SE	β	B	SE	β
Restrained Eating												
Age	0.11	0.08	0.06	0.09	0.08	0.05	0.09	0.08	0.05	0.11	0.08	0.06
Monthly income	1.14	0.59	0.08	1.35	0.59	0.10*	1.45	0.57	0.11*	1.42	0.56	0.11*
BMI	0.69	0.13	0.24**	0.68	0.13	0.23**	0.22	0.14	0.08	0.30	0.14	0.10*
PWSQ				0.65	0.31	0.09*	-0.11	0.31	-0.02	-0.39	0.32	-0.06
WBIS							0.33	0.05	0.35**	0.28	0.05	0.30**
EPDS										0.23	0.07	0.15**
R ²			0.074**			0.082**			0.168**			0.186**
Emotional Eating												
Age	-0.01	0.11	-0.01	-0.05	0.10	-0.02	-0.04	0.10	-0.02	-0.01	0.10	-0.01
Monthly income	0.93	0.75	0.06	1.44	0.75	0.09	1.52	0.74	0.09*	1.45	0.72	0.09*
BMI	0.55	0.16	0.15**	0.52	0.16	0.14**	0.19	0.18	0.05	0.33	0.18	0.09
PWSQ				1.54	0.39	0.17**	0.99	0.41	0.11*	0.48	0.42	0.06
WBIS							0.24	0.06	0.20**	0.15	0.06	0.13*
EPDS										0.41	0.09	0.22**
R ²			0.027**			0.056**			0.085**			0.124**
External Eating												
Age	-0.06	0.07	-0.04	-0.07	0.07	-0.04	-0.07	0.07	-0.04	-0.04	0.07	-0.03
Monthly income	0.82	0.50	0.07	0.94	0.50	0.09	0.95	0.50	0.09	0.90	0.49	0.08
BMI	-0.00	0.11	-0.00	-0.01	0.11	-0.00	-0.06	0.12	-0.02	0.06	0.12	0.03
PWSQ				0.39	0.26	0.07	0.31	0.28	0.05	-0.09	0.28	-0.02
WBIS							0.03	0.04	0.04	-0.04	0.04	-0.05
EPDS										0.33	0.06	0.28**
R ²			0.006			0.011			0.012			0.072**

Note: **p* < 0.05, ***p* < 0.001. Abbreviations: BMI, Body Mass Index; PWSQ, Perceived Weight Stigma Questionnaire; WBIS, Weight Bias Internalization Scale; EPDS, Edinburgh Postpartum Depression Scale.

Table 4
Unstandardized and standardized path coefficients for all pathways for the model presented in Fig. 1 (N = 507).

Antecedent	Consequent	WBIS				EPDS				Restrained Eating					
		B	β	SE	p	B	β	SE	p	B	β	SE	p		
PWSQ	a ₁	2.30	0.31	0.28	< 0.001	a ₂	1.22	0.25	0.21	< 0.001	c'	-0.39	-0.06	0.32	0.222
WBIS						d ₁₂	0.22	0.34	0.03	< 0.001	b ₁	0.28	0.30	0.05	< 0.001
EPDS											b ₂	0.23	0.15	0.07	< 0.001
Antecedent	WBIS					EPDS					Emotional Eating				
		B	β	SE	p		B	β	SE	p	B	β	SE	p	
PWSQ	a ₁	2.30	0.31	0.28	< 0.001	a ₂	1.22	0.25	0.21	< 0.001	c'	0.48	0.05	0.41	0.243
WBIS						d ₁₂	0.22	0.34	0.03	< 0.001	b ₁	0.15	0.13	0.06	< 0.050
EPDS											b ₂	0.41	0.22	0.09	< 0.001
Antecedent	WBIS					EPDS					External Eating				
		B	β	SE	p		B	β	SE	p	B	β	SE	p	
PWSQ	a ₁	2.30	0.31	0.28	< 0.001	a ₂	1.22	0.25	0.21	< 0.001	c'	-0.09	-0.02	0.28	0.738
WBIS						d ₁₂	0.22	0.34	0.03	< 0.001	b ₁	-0.04	-0.05	0.04	0.351
EPDS											b ₂	0.33	0.28	0.06	< 0.001

Note: Abbreviations: PWSQ, Perceived Weight Stigma Questionnaire; WBIS, Weight Bias Internalization Scale; EPDS, Edinburgh Postpartum Depression Scale.

adds to the extant literature by giving an explicit psychosocial process of the development of disordered eating behaviors among postpartum women, providing theoretical support to future intervention studies on alleviating disordered eating behaviors.

Aligned with previous studies (Prunty et al., 2020; O'Brien et al., 2016), the results of this study indicated that postpartum women with overweight/obesity reported higher levels of weight bias internalization compared to those with underweight/normal weight. However, no significant differences were found in perceived weight stigma between the two groups. This suggests that postpartum women who are not classified as having overweight or obesity based on BMI criteria can still perceive weight stigma and experience its associated negative effects. This may be explained by the fact that, in line with pregnancy work (Rodriguez et al., 2020), how a pregnant or postpartum woman perceives her own weight may be a more important factor than actual weight in whether she will also perceive weight stigma.

Furthermore, it is important to note that in this study, perceived weight stigma was not directly related to disordered eating behaviors; instead, it is connected indirectly through mediating variables. This suggests that individuals experience differently to weight stigma, and the experiences likely influence the outcomes. For example, individuals who internalize negative weight-based stereotypes

Table 5

Unstandardized indirect and total indirect effects in the model of the PWSQ score and eating behaviors, mediated the score of WBIS and EPDS ($N = 507$).

	Effect	SE	95% CI	
			Lower	Upper
Restrained eating				
Indirect effects				
PWSQ → WBIS → Restrained Eating(a_1b_1)	0.65	0.14	0.39	0.93
PWSQ → EPDS → Restrained Eating(a_2b_2)	0.28	0.11	0.10	0.51
PWSQ → WBIS → EPDS → Restrained Eating($a_1d_1b_2$)	0.11	0.04	0.04	0.20
Total indirect effect	1.03	0.16	0.73	1.37
Emotional eating				
Indirect effects				
PWSQ → WBIS → Emotional Eating(a_1b_1)	0.35	0.16	0.05	0.68
PWSQ → EPDS → Emotional Eating(a_2b_2)	0.50	0.16	0.23	0.86
PWSQ → WBIS → EPDS → Emotional Eating($a_1d_1b_2$)	0.20	0.06	0.10	0.33
Total indirect effect	1.05	0.22	0.66	1.52
External eating				
Indirect effects				
PWSQ → WBIS → External Eating(a_1b_1)	-0.09	0.11	-0.30	0.12
PWSQ → EPDS → External Eating(a_2b_2)	0.41	0.11	0.21	0.66
PWSQ → WBIS → EPDS → External Eating($a_1d_1b_2$)	0.17	0.05	0.09	0.26
Total indirect effect	0.48	0.14	0.21	0.79

Note: The effect was considered statistically significant, if 95 % CI did not include zero. Abbreviations: PWSQ, Perceived Weight Stigma Questionnaire; WBIS, Weight Bias Internalization Scale; EPDS, Edinburgh Postpartum Depression Scale.

may suffer more from perceived weight stigma (Pudney et al., 2020). This difference in experiences can be further understood through self-control theory. According to a state-based theory of binge eating (Pearson et al., 2015) that is based on self-control theory, when individuals face risk factors for disordered eating behaviors—such as internalizing a thin ideal, having negative self-evaluations, and experiencing negative emotions—they need to expend more self-control resources. This increased demand for self-control to manage and inhibit stress can elevate the risk of engaging in disordered eating behaviors.

However, previous studies in general populations showed a significant direct effect between perceived weight stigma and disordered eating behaviors (Huang et al., 2024, 2022; O'Brien et al., 2016). This discrepancy may reflect the unique challenges of the postpartum period, where weight-related concerns are intertwined with other postpartum stressors, such as identity changes and caregiving responsibilities, thereby complicating the relationship between perceived weight stigma and disordered eating behaviors. Future research should further explore these differences in mediating mechanisms between general populations and postpartum women to better understand the specific risks postpartum women face within the context of weight stigma.

This study also investigated the mediating role of weight bias internalization in the relationship between perceived weight stigma and disordered eating behaviors. Consistent with recent research, perceived weight stigma was positively associated with weight bias internalization (Huang et al., 2024). According to the weight-based social identity threat model (Hunger et al., 2015), when individuals regularly perceived weight stigma and believe that others view them as overweight, they will endorse negative weight-based stereotypes and internalize the belief that obese people are socially devalued, leading to self-defeating attitudes. In this study, weight bias internalization was positively associated with restrained and emotional eating. This suggests that weight bias internalization leads postpartum women to two extreme eating behaviors, namely, controlling intake (restrained eating) and overeating (emotional eating). The positive association between weight bias internalization and emotional eating was supported by a study involving a military sample (Morse et al., 2023). One possible explanation is that while the WBIS effectively measures weight bias internalization, it also reflects elements of psychological distress (such as feelings of emotional upset when thinking about one's weight). According to emotion regulation theory (Agras and Telch, 1998), women who frequently experience high levels of negative emotions are at risk of overeating to alleviate these feelings.

Furthermore, the positive association between weight bias internalization and restrained eating has also been observed in the general population (Wagner et al., 2020). The restraint model proposes that women who internalize weight bias tend to experience body dissatisfaction, due to the unrealistic nature of the ideal weight. Then, increase the risk of excessively reducing their food intake (in an effort to meet the ideal) (Pearson et al., 2015; Polivy and Herman, 1985). This association is more apparent in postpartum women than in the general women population. Previous research shows that concerns about weight and body image are significantly higher in postpartum women compared to their pre-pregnancy levels. (Nunes et al., 2014). Interestingly, the present study found no direct effect between weight bias internalization and external eating. This may be due to the fact that, although emotional and external eating can occur simultaneously, the level of psychological distress captured by the WBIS was not intense enough to heighten postpartum women's sensitivity to food cues.

As expected, this study found that PPD plays a significant role in the relationship between perceived weight stigma and disordered eating behaviors. Our results are consistent with a longitudinal study indicating that higher levels of perceived weight stigma are linked to increased psychological distress, including depression, anxiety, and stress (Mohsen et al., 2024). Additionally, a longitudinal study involving 214 postpartum women in the United States found that weight-related discrimination experienced over pregnancy through the first month postpartum was not only associated with greater postpartum depressive symptoms but also prospectively

predicted greater postpartum depressive symptoms at 1 year postpartum (Rodriguez et al., 2019b). Symptoms of depression have also been identified as a risk factor for disordered eating behaviors (Emerson et al., 2017; Yu et al., 2022). According to the COBWEBS model, weight stigma functions as a psychological stressor that can trigger a series of behavioral, emotional, and physiological responses (Tomiyama, 2014).

In China, the relationship between perceived weight stigma, PPD, and disordered eating behaviors is further complicated in the cultural context. The 'thin ideal' has become increasingly popular in China in recent years (Stojic et al., 2020). The socio-cultural environment is characterized by a low tolerance for deviation from the 'thin ideal'. Meanwhile, a deep-rooted collectivist culture in China emphasizes close ties and consistency between individuals and groups. Heightened sensitivity to collective values amplifies the stress of deviating from societal expectations (Jackson and Chen, 2011). This pressure can potentially intensify the effects of weight stigma on mental health. Moreover, mental health conditions, including PPD, are often stigmatized in traditional Chinese cultural, with beliefs that such conditions are indicative of weakness or over-sensitivity. This stigma can lead postpartum women to adopt passive coping strategies, rather than actively seeking professional help (Zhang, 2023). As a result, psychological distress goes unaddressed, exacerbating the risk for the development of disordered eating behaviors.

Finally, this study observed a serial mediating effect of weight bias internalization and PPD between perceived weight stigma and disordered eating behaviors. Consistent with the results of a meta-analysis, greater weight bias internalization was strongly associated with higher levels of depression (Romano et al., 2023). A study in the United States that included 251 women between 6 and 12 months after delivery has confirmed the relationship between weight bias internalization and depression symptoms, showing that weight bias internalization increased, and depression symptom severity increased (Sharp et al., 2023). However, the reported relationship between weight bias internalization and psychological factors may be bidirectional. A prospective study in Chinese adolescents shows that higher psychological distress at baseline predicted higher WBI at 6 months later (Barnhart et al., 2023). Further research is needed to more extensively explore the complex mechanisms linking perceived weight stigma to disordered eating behaviors among postpartum women.

5. Implications

Our study has extended the scope of previous research by revealing the associations and mechanisms of perceived weight stigma and disordered eating behaviors among postpartum women. These findings can inform the tailoring of interventions for postpartum women. Firstly, a key point that can be highlighted is that perceived weight stigma and weight bias internalization are two important factors to consider in postpartum care. It is essential to shift the focus from weight to the overall health and well-being of postpartum women, ensuring an inclusive approach to health for individuals of all sizes. According to the Health at Every Size (HAES) principle (Tylka et al., 2014), this involves maintaining a holistic focus on health, rather than solely focusing on weight loss. It also emphasizes working with families and communities to provide safe physical activity resources and ways to improve access to nutrient-dense foods.

At the same time, measures to reduce weight bias internalization are important to reduce the risk of developing and sustaining PPD and disordered eating behaviors in the postpartum period. Preliminary evidence demonstrates that cognitive-behavioral interventions (Pearl et al., 2018) and mindfulness-based interventions (O'Reilly et al., 2014) can reduce weight bias internalization. At the same time, screening efforts seeking to identify postpartum women susceptible to experiencing adverse consequences of weight stigma should not be limited to those with high BMIs. Secondly, in postpartum care, health interventions should prioritize the early identification and intervention of postpartum depression to minimize its negative effects on eating behaviors.

Finally, interventions for postpartum women in China must consider the cultural dimensions. In a collectivist culture, peer support can be particularly effective, as sharing experiences within a group helps alleviate isolation and provides emotional support. Framing mental health care as a communal responsibility aligns with cultural values and encourages women to seek help for their own well-being and the well-being of their families. Involving family members in the intervention process, through education or counseling, may reduce the stigma of seeking psychological help and foster a more supportive environment for postpartum women. In conclusion, the results of this study may draw the attention of obstetricians to perinatal weight stigma by highlighting perceived weight stigma, weight bias internalization, and PPD as risk factors for disordered eating behaviors in the postpartum period.

6. Limitations

There are limitations to this study. First, our sample was drawn exclusively from China, and future research should include more diverse geographical regions to gain a broader understanding of the relationship and potential mechanisms between perceived weight stigma and disordered eating behaviors among postpartum women globally. Second, while the pattern of relationships tested in our model were hypothesized according to theoretical analysis and existing studies, the cross-sectional design of this study does not allow for causal inferences to be made. To further investigate the issue, a prospective design should be made. Third, the psychometric properties of the Chinese versions of the PWSQ, WBIS, and DEBQ have not been previously assessed among postpartum individuals. However, these Chinese versions have demonstrated good internal consistency in both prior research conducted with general populations and the present study.

7. Conclusions

The present study initially explored the psychological mechanisms of the association between perceived weight stigma and disordered eating behaviors among postpartum women, a high-risk group. Specifically, it reveals the mediating roles of weight bias

internalization and PPD, as well as the serial mediating effects between these variables. The findings underscore the potential risks associated with perinatal weight stigma and offer a clearer understanding of the psychosocial processes that may contribute to the development of disordered eating behaviors among postpartum women. Longitudinal studies are needed to further investigate the mechanisms linking perceived weight stigma to disordered eating behaviors. Future mental health nursing and interventions for postpartum women should consider these psychosocial factors to foster a healthier environment, which may help prevent or mitigate negative emotional outcomes and disordered eating behaviors associated with weight stigma.

CRedit authorship contribution statement

Jiayuan Peng: Writing – review & editing, Writing – original draft, Visualization, Investigation, Formal analysis, Data curation, Conceptualization. **Xiangmin Tan:** Writing – review & editing, Validation. **Ni Ning:** Writing – review & editing, Validation. **James Wiley:** Writing – review & editing, Validation. **Nan Hua:** Writing – review & editing, Validation. **Yuan Zeng:** Writing – review & editing, Visualization, Supervision, Investigation, Conceptualization. **Mei Sun:** Writing – review & editing, Visualization, Supervision, Investigation, Funding acquisition, Conceptualization.

Declaration of competing interest

None.

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Data availability

The data that support the findings of this study are not openly available due to reasons of protect study participant privacy and are available from the corresponding author upon reasonable request.

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