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Understanding Emotional Eating in Obesity: Demographic Associations, Gender Differences, and BMI-Based Prediction

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ABSTRACT

The term emotional eating refers to eating behavior due to emotional state and not physiological hunger. In many cases, obesity patients tend to indulge in emotional eating. This cross-sectional study investigates whether body mass index is a predictor of emotional eating in obese individuals, if there are any differences between male and female participants in relation to their emotional eating behavior, and also assesses the relative effect of gender, age, and body mass index on the emotional eating behavior through a neural network. Purposive sampling was used to select 250 obese participants (125 male and 125 females) with a body mass index above 30 kg/m2. BMI significantly and positively predicted emotional eating, $B = 0.339$, $\beta = .176$, $t = 2.81$, $p = .005$, but explained only 3.1% of the variance, $F(1, 248) = 7.90$, $p = .005$. Women ($M = 27.02$, $SD = 2.45$) reported significantly higher emotional eating than men ($M = 23.06$, $SD = 5.45$), $t(172.39) = -7.43$, $p < .001$, 95% CI [−5.02, −2.91], a large difference ($d \approx 0.94$). In the neural network, gender was the most important predictor (normalized importance = 100%), followed by BMI (24.1%) and age (4.7%), although predictive accuracy was modest (relative error = .818 for training and .827 for testing). Findings suggest that, within an obese sample, gender distinguishes emotional eating more strongly than BMI does. Weight-management programs may therefore benefit from gender-sensitive screening and support for emotional eating.

1. Introduction

Emotional eating (EE) is commonly described as eating in response to negative emotions or stress rather than in response to physiological hunger (Frayn & Knäuper, 2018; van Strien, 2018). Because food can temporarily relieve distress, EE may become a habitual coping strategy, and it has attracted growing attention in research on weight regulation and obesity treatment (Smith et al., 2023). According to the World Health Organization (2026), adults with a body mass index (BMI) of 30 kg/m^2 or above are classified as having obesity, and this threshold was used in the present study to define the target population. Emotional eating matters for obesity for at least two reasons. First, reviews have linked EE with weight gain over time and with difficulty in losing weight and maintaining weight loss (Frayn & Knäuper, 2018). Second, EE has been proposed as an explanatory factor for the weight regain commonly seen among dieters (van Strien, 2018). A meta-analysis of studies using validated

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questionnaires found that degree of EE was greater among adults with a BMI above the healthy range than among adults with a healthy BMI, and that this difference was driven by adults with obesity rather than adults with overweight (Vasileiou & Abbott, 2023). At the same time, the relationship between BMI and EE is unlikely to be simple (Carneiro et al., 2016). Qualitative evidence shows that EE is endorsed by people of normal weight as well as by people with overweight or obesity, and that some emotional eaters manage to maintain their weight through compensatory behaviors such as physical activity and controlling their eating (Frayn et al., 2018). This suggests that BMI may be only one of several correlates of EE, and that psychological and demographic factors deserve attention alongside it (Kim et al., 2014). Gender is one such factor. Studies of treatment-seeking adults have reported that women score higher than men on EE, particularly for depression- and anger-related emotional triggers (Guerrero-Hreins et al., 2022), and that women with binge eating disorder are more likely than men to report eating in response to negative emotions (Tanofsky et al., 1997). However, little is known about whether gender differences remain when the sample is restricted to adults who are all obese and when EE is measured with an instrument developed specifically for obesity, such as the Emotional Eater Questionnaire (EEQ; Garaulet et al., 2012). The present study therefore examined the role of BMI and gender in EE among 250 obese adults.

2. Literature Review

2.1 Emotional Eating: Concept and Measurement

Various self-administered instruments have been developed to assess emotional eating. The Dutch Eating Behavior Questionnaire (DEBQ) was developed to check restrained, emotional, and external eating (van Strien et al., 1986), and the Emotional Eating Scale (EES) was developed to measure coping with negative affect by eating (Arnow et al., 1995). Frayn and Knäuper (2018) noted that the DEBQ, the Three-Factor Eating Questionnaire, and the EES are among the most frequently used measures in studies of EE and weight in adults. The Emotional Eater scale was developed by Garaulet et al. (2012) specifically for use in obesity and for easy application in clinical practice. The ten-item questionnaire was administered to 354 participants in a weight-reduction program (mean BMI = 31, *SD* = 5; mean age = 39 years, *SD* = 12). Principal components analysis indicated three dimensions, namely disinhibition, type of food, and guilt, which together explained 60% of the total variance (Garaulet et al., 2012). Because the EEQ was designed for people with obesity, it is well suited to samples such as the one in the present study.

2.2 Emotional Eating and Body Mass Index

The relationship between emotional eating and body mass index has been examined extensively. In a review and meta-analysis article of 11 studies with 7,207 participants, Vasileiou and Abbott (2023) reported that EE was greater in adults with a BMI above the healthy range than in adults with a healthy BMI (standardized mean difference). Subgroup analysis showed that the difference was present for adults with obesity, but not for adults with overweight, which suggests that the link between EE and weight is most evident at higher BMI levels. In a narrative review, Frayn and Knäuper (2018) similarly described a relationship between emotional eating and weight related outcomes, including weight increase in the longitudinal studies and further, problems with weight decrease and weight-decrease maintenance in intervention studies. Van Strien (2018) reviewed recent findings on EE as a mediator between depression and body mass index and weight increase, and noted that dieting is considered a risk factor for an enhanced tendency toward EE. Together, these findings imply that BMI is related to EE but that the relationship operates alongside other psychological variables, so that BMI alone would be expected to account for only part of the variation in EE.

2.3 Gender Differences in Emotional Eating

Gender differences in EE have been reported in clinical samples. Guerrero-Hreins et al. (2022) studied 387 adults (71% women) attending a hospital obesity management service and found that women had higher total EES scores, higher scores on the depression and anger subscales, and higher scores on the individual feelings of being blue, sad, and upset. Earlier, Tanofsky et al. (1997) compared 21 men and women with binge eating issues and reported that women with negative emotions show increase in eating response, predominantly with the emotions of anxiety, anger and frustration, and depression. These studies suggest that women may use food to regulate negative emotions more often than men do, although the studies differ in sample, measure, and clinical context.

2.4 Summary and Rationale

In summary, the literature indicates that EE is positively associated with elevated BMI, particularly at the level of obesity (Vasileiou & Abbott, 2023), that the association is neither deterministic nor unique to people with obesity (Frayn et al., 2018), and that women tend to report more EE than men (Guerrero-Hreins et al., 2022; Tanofsky et al., 1997). What remains less clear is how much BMI contributes to EE once the sample is restricted to adults with obesity, and how BMI compares with gender

and age as a predictor. The present study addresses this question using the EEQ, a measure developed for obesity (Garaulet et al., 2012), and complements linear methods with a neural network analysis.

2.5 Importance of the Study

The study has theoretical, practical, and methodological significance. Theoretically, it clarifies how much of the variation in EE among obese adults can be attributed to BMI and how much to gender, which helps to refine models that treat EE as a simple consequence of higher body weight. Practically, because EE has been linked to difficulty in losing weight (Frayn & Knäuper, 2018), identifying who is most likely to report EE can inform screening in weight-management settings; findings on gender may support more personalized lifestyle interventions, as suggested by Guerrero-Hreins et al. (2022).

2.6 Objectives

The objectives of the study were:

(1) to examine whether BMI predicts emotional eating among obese adults;

(2) to compare emotional eating between obese men and women; and

(3) to determine the relative importance of gender, age, and BMI in predicting emotional eating using a neural network.

2.7 Hypotheses

- **(H1)** BMI would positively predict emotional eating
- **(H2)** women would report significantly higher emotional eating than men.

3.Research Methodology

3.1 Research Design

The study used a cross-sectional research design for data collection. The aim was to determine whether BMI predicted emotional eating among obese adults and to examine gender differences in emotional eating.

3.2 Participants

A sample of 250 obese adults (125 men and 125 women) was selected from a population of general and health-care workers using purposive sampling. All participants met the inclusion and exclusion criteria described below.

Participants were included if they were 18 years of age or older, obese (BMI of 30 kg/m^2 or higher; World Health Organization, 2026), able to read and respond to the research questionnaires, and willing to provide informed consent. Participants were excluded if they were younger than 18 years, not obese (BMI below 30 kg/m^2), unable to read and respond to the questionnaires, or suffering from a serious medical or mental health problem that would substantially affect their ability to complete the measures.

3.3 Measures

Demographic information: A demographic questionnaire was used to collect information such as gender and age.

Body Mass Index: Participants with a BMI of 30 kg/m^2 or above were classified as obese and taken in the study.

Emotional Eating (Garaulet et al., 2012): Emotional eating was assessed with the self-report Emotional Eater Questionnaire (EEQ; Garaulet et al., 2012). The EEQ comprises 10 items that evaluate the emotional and behavioral components of eating and lack of control over eating, and it was developed specifically for use with people who are obese. Higher total scores indicate gre ater emotional eating.

3.4 Procedure

After approval was obtained from the academic department data collection began. Eligible candidates were approached and informed about the purpose and nature of the study, and written informed consent was obtained before data collection. Participants were told that participation was voluntary and that they could withdraw at any time without consequences. After consent, participants completed the demographic questionnaire, and their height and weight were measured to calculate BMI. They then completed the EEQ in a comfortable environment with adequate time.

3.5 Ethical Considerations

Participants were informed of the nature and aim of the study before consent was obtained, and they were assured of anonymity and confidentiality. They were told that they could withdraw at any time without giving a reason and that the information obtained would be used only for academic purposes and would not be shared with unauthorized persons. Permission to use the standardized instrument was obtained where applicable.

3.6 Data Analysis

Data were analyzed using SPSS. A simple linear regression was conducted to test whether BMI predicted EEQ total scores. An independent-samples *t* test compared EEQ scores between men and women. Levene's test was used to test equality of variances, and Welch's unequal-variances *t* test was reported when this assumption was violated, in line with recommendations to favor Welch's test when variances differ (Delacre et al., 2017). Cohen's (1988) conventions were used to describe effect sizes, and Cohen's *d* for the gender difference was computed from the reported means and standard deviations using the pooled standard deviation. Finally, a multilayer perceptron neural network (Goodfellow et al., 2016) was fitted with gender, age, and BMI as inputs and EEQ total score as the dependent variable. Cases were partitioned into training and testing samples, and the importance of each predictor was examined. The significance level was set at .05.

4. Results

4.1 Regression Analysis: BMI Predicting Emotional Eating

Table-1: Simple Linear Regression Predicting Emotional Eating from Body Mass Index (BMI) (N=250)

Predictor	*B*	*SE B*	β	*t*	*p*
Constant	13.054	4.273	—	3.055	.002
BMI	0.339	0.121	.176	2.811	.005

Note. Dependent variable = Emotional Eater Questionnaire total score (EEQTOTAL). *B* = unstandardized regression coefficient; *SE B* = standard error of *B*; β = standardized regression coefficient.

Table-2: Model Summary for the Regression Model

R	R^2	Adjusted R^2	*SE* of the estimate
.176	.031	.027	4.597

Table-3: ANOVA for the Regression Model

Source	SS	Df	MS	F	*p*
Regression	167.003	1	167.003	7.903	.005
Residual	5240.597	248	21.131	-	-
Total	5407.600	249	-	-	-

Note. SS = sum of squares; *MS* = mean square.

The regression model was statistically significant, $F(1, 248) = 7.90$, $p = .005$. BMI explained 3.1% of the variance in emotional eating ($R^2 = .031$; adjusted $R^2 = .027$). BMI was a significant positive predictor of emotional eating, $B = 0.339$, $SE = 0.121$, $\beta = .176$, $t = 2.81$, $p = .005$. Each one-unit increase in BMI was associated with an estimated 0.339-point increase in EEQ scores, so that, for example, a difference of 10 BMI units corresponds to an estimated difference of about 3.4 points. According to Cohen's (1988) conventions, a correlation of this size ($r = .176$) is small. H1 was therefore supported, although the practical contribution of BMI was limited.

4.2 Independent-Samples t Test: Gender Differences in Emotional Eating

Table-4: Independent-Samples t Test Comparing Emotional Eater Questionnaire (EEQ) Total Scores by Gender (N=250)

Gender	n	M	SD	*t*	*df*	*p*	95% CI for mean difference
Male	125	23.06	5.45	−7.43	172.39	< .001	[−5.02, −2.91]
Female	125	27.02	2.45				

Note. EEQ = Emotional Eater Questionnaire. Mean difference was calculated as male minus female. Welch's *t* test is reported because Levene's test indicated unequal variances, $F = 44.27$, $p < .001$.

An independent-samples *t* test was conducted to compare emotional eating between men and women. Levene's test was significant, $F = 44.27$, $p < .001$, indicating that the assumption of equal variances was violated; therefore, Welch's *t* test was used. The difference between men ($M = 23.06$, $SD = 5.45$) and women ($M = 27.02$, $SD = 2.45$) was statistically significant, $t(172.39) = -7.43$, $p < .001$, 95% CI [−5.02, −2.91]. Women scored almost 4 points more than men in their EEQ (difference mean ≈ 3.97). The negative value of t-statistic and of the confidence interval can be attributed to the order of calculation (male - female) and since the interval does not contain zero, we can see that there is a reliable difference between groups. In order to calculate Cohen's d using the reported statistics (means and standard deviations), it was found to be ≈ 0.94, which is a large effect according to Cohen (1988). Thus, hypothesis H2 is supported. The groups also showed great differences in variability, as women scored much more similarly (SD = 2.45) compared to men (SD = 5.45). It implies that, typically, a woman reports very consistent levels of emotional eating, whereas the scores of men are more varied, hence the need for Welch correction. The significance test does not show why such variation exists, so the result should be interpreted carefully.

4.3 Neural Network Analysis

Of the 250 valid cases, 169 (67.6%) were assigned to the training sample and 81 (32.4%) to the testing sample, and no cases were excluded.

Table-5: Training and Testing Performance of the Neural Network Model (N=250)

Sample	Sum of squares error	Relative error
Training	68.692	.818
Testing	29.744	.827

Note. Relative error is the error of the network relative to a model that predicts the mean.

The relative error was .818 for the training sample and .827 for the testing sample, a difference of only .009. The similar values suggest that the model did not overfit the training data, but both values are high: a relative error close to 1 means that the network performed only slightly better than simply predicting the mean EEQ score, and a relative error of about .82 corresponds to roughly 18% of the variance being explained. Sum-of-squares errors should not be compared across samples because the training and testing samples differ in size.

Table-6: Importance of Gender, Age, and BMI in Predicting Emotional Eating (N=250)

Predictor	Importance	Normalized importance (%)	Rank
Gender	.776	100.0	1
BMI	.187	24.1	2
Age	.036	4.7	3

Note. The most important predictor was assigned a normalized importance of 100%.

Gender had the highest importance (.776; 100%), followed by BMI (.187; 24.1%) and age (.036; 4.7%). Gender therefore contributed most strongly to the network's predictions, and BMI contributed more than age. Importance values describe the relative contribution of each predictor within the fitted network; they do not indicate the direction of an association, statistical significance, or causation.

5. Discussion

This study examined BMI and gender as predictors of emotional eating among 250 obese adults. Three main findings emerged. First, BMI was a statistically significant but weak positive predictor of EE, explaining 3.1% of the variance. Second, women reported significantly and substantially higher EE than men. Third, in the neural network model gender was by far the most important predictor, BMI was second, and age contributed little, while overall predictive accuracy remained modest. The positive relationship between BMI and EE is consistent with meta-analytic evidence that EE is higher among adults with obesity than among adults with a healthy BMI (Vasileiou & Abbott, 2023) and with reviews that link EE to weight outcomes (Frayn & Knäuper, 2018). The small size of the effect is also understandable. All participants in the present study were obese, so the range of BMI was restricted, and a restricted range tends to limit how much any single variable can explain. In addition, EE is endorsed by people across weight categories (Frayn et al., 2018) and has been linked to psychological factors such as depression (van Strien, 2018), none of which were measured here. The finding therefore suggests that, among people who are already obese, higher BMI is accompanied by somewhat more EE , but that BMI is far from a sufficient explanation. The large gender difference agrees with earlier studies reporting higher EE among women in treatment-seeking samples of people with obesity (Guerrero-Hreins et al., 2022) and among women with binge eating disorder (Tanofsky et al., 1997). The present study extends this work by showing the difference in a sample of 125 men and 125 women, all of whom were obese, using an instrument developed for obesity (Garaulet et al., 2012). The considerably lower standard deviation among women implies that high EE scores were rather homogenous within this category; this may either indicate a real homogeneity of the EE experience among women or be related to sampling issues or response styles; however, the current data cannot discriminate between these two alternatives. The neural network analysis is consistent with regression analysis and t-test analysis. Gender was the predictor of the highest importance, as seen from the substantial effect of t test, whereas the predictor of BMI showed importance of the lower but still non-zero level, which can be explained by the low regression effect of BMI. For example, a standardized mean difference of $d \approx 0.94$ corresponds to approximately 18% of the common variance between gender and EE, which is also approximately 18% of the error reduction achieved through the neural network; hence, BMI and age made virtually no contribution after gender. This approximation is based on the given numbers and cannot be used as a formal test. In any case, the neural network analysis was not superior to the traditional analyses, and the only use of neural network analysis here is the convergence of the predictor ranking.

5.1 Implications

It can thus be concluded that the screening of EE in obesity management should not depend only on BMI, since BMI could not account for much variance in EE among obese individuals. Gender-specific approaches may also work well: since women had higher EE compared to men, the intervention targeting the emotional factors causing people to eat may be particularly effective for women, as was proposed by Guerrero-Hreins et al. (2022).

5.2 Limitations and Future Research

There are several limitations that need to be addressed. First, this study used a cross-sectional design; hence, it cannot establish any causation or time sequence in relation to EE and BMI. Second, the sampling technique was purposive, using general and health care workers and, therefore, limiting generalizability; moreover, EE was assessed through self-reports, which may be biased with social desirability or recall problems. Third, the sample comprised only obese adults, and therefore, the findings cannot be generalized to individuals who have a lower BMI. Fourth, the study did not measure any psychological factors such as depression, anxiety, or stress that can possibly correlate with EE, and the discrepancy in variance between the two groups requires some cautious interpretation. Finally, neural network used a small network size and a small sample size, had high relative error, and does not point at direction or significance of effects.

6.Conclusion

Among 250 obese adults, BMI significantly but only weakly predicted emotional eating, whereas gender was associated with a large difference, with women reporting higher emotional eating than men. A neural network analysis ranked gender as the most important predictor, followed by BMI and age. Emotional eating in obesity therefore appears to be shaped more by who the person is than by how high their BMI is, and weight-management programs may benefit from gender-sensitive assessment and support for emotional eating.

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