



# Analysis of Interpretation Bias Related to Overeating in Obese Individuals with Weight Loss Surgery: A Qualitative Study

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## ABSTRACT

This study aimed to analyze interpretation bias related to overeating in obese individuals following weight loss surgery. The research type was qualitative and utilized the thematic analysis method of Clarke and Braun (2006). The research environment included all individuals with a history of obesity and weight loss surgery. Participants were ten individuals selected purposefully. The criterion for the number of participants was data saturation. The research tool was a semi-structured interview with questions related to interpretation bias in this group. Data were analyzed using Clarke and Braun's (2006) six-step method. The results showed that interpretation bias among these individuals consisted of three overarching categories: 1) Interpretative bias facilitating overeating (with organizing codes of interpreting situations based on incompatible beliefs about overeating, normalizing overeating, and confusing interpretations of overeating), 2) Catastrophic interpretative bias (with organizing categories of interpretative bias based on inability and interpretative bias based on the futility of dieting), and 3) Interpretative bias inhibiting eating (with organizing categories of interpretative bias based on external issues and interpretative bias based on internal issues). Based on the results of this study, it can be said that to prevent overeating or maintain weight loss, individuals prone to or suffering from overeating need to manage their cognitive biases and receive training in this area.

**Keywords:** Interpretation Bias, Obesity, Weight Loss.

## 1. Introduction

Today, obesity is one of the fundamental problems facing human societies (1). The Body Mass Index (BMI), which is used as a measure to determine the level of obesity in individuals, is increasingly associated with chronic

diseases (diabetes, hyperlipidemia, hypertension, etc.) that increase the risk of mortality. For example, in individuals with a BMI over 30, known as obese individuals, the risk of developing cardiovascular and cerebrovascular diseases is four times higher than in individuals with normal weight and BMI (2). Obesity, in addition to causing physical and

medical problems for affected individuals, is often accompanied by some behavioral and psychological-emotional and cognitive issues (3). Since the etiology of obesity is highly complex and multifactorial, encompassing a range of biological, psychological, social, and behavioral factors such as genetic structure, socioeconomic status, and cultural influences (4), bariatric surgery is considered one of the most effective treatment methods for significant weight loss in individuals with morbid obesity (5).

One type of bariatric surgery is bariatric surgery itself. This surgery, by making alterations to the digestive system (stomach or intestines), leads to weight loss (6). These changes often include reducing the absorption surface area or shrinking the stomach volume, which can be achieved through various laparoscopic obesity surgery methods, including adjustable gastric banding, gastric bypass, and sleeve gastrectomy (7). Among these, the choice of the appropriate type of obesity surgery for patients is mainly based on individual goals, patient preferences, personalized goals, classification of comorbidities risk, surgeon's opinion, and their experience (8). Therefore, any patient intending to undergo obesity surgery must be evaluated medically, behaviorally, and nutritionally by a multidisciplinary team to assess their eligibility for surgery (9). Eligibility criteria for surgery primarily depend on the BMI and obesity-related diseases of the individual. Accurate selection of eligible patients significantly increases the likelihood of successful surgery (10).

However, although bariatric surgery has gained considerable popularity in recent decades, particularly as a treatment for morbid obesity and its metabolic complications, only a few individuals achieve the therapeutic goals of attaining a 50% reduction in excess weight, along with improvement in comorbidities. Additionally, some individuals who lost part or all of their weight regain it within a few years post-surgery. Studies indicate that impulsivity in weight gain and failure in maintaining achieved weight are more related to cognitive-emotional impacts and behavior management in response to food cues (11, 12).

In this context, cognitive theories suggest that one of the causes of obesity is maladaptive cognitive structures or schemas regarding concepts such as eating, body weight, and shape, which underlie the concerns of obese individuals.

Cognitive processing bias theories related to obesity suggest that bias in processing food-related stimuli may play a role in the persistence of obesity and eating disorders. For example, readiness/sensitivity to cognitive bias can act as a marker/trigger for eating disorders (13). Thus, it appears that for sustained weight maintenance, surgery alone as a physical intervention to eliminate or block access to food is insufficient; there is also a need for change in individuals' cognition regarding the nature of food/eating. It seems that individuals who have successfully maintained their weight post-surgery have managed to adjust their attitudes and adopt a new lifestyle. Indeed, maintaining weight seems more crucial than merely losing it (14). Cognitive theories thus propose that obese individuals and those with eating disorders have a type of interpretive bias regarding body shape, weight, and food cues. Research results by Zhou et al. (2022) showed that BMI positively predicts response delay and duration bias in high-calorie foods, with body weight dissatisfaction positively predicting response delay and duration bias in high-calorie foods. These findings demonstrate a positive relationship between BMI and attention bias to food, with body weight dissatisfaction fully mediating this relationship in women (15).

Therefore, it is necessary first to examine and study the cognitive biases of these individuals to develop appropriate psychological training based on that. Correcting cognitive biases, including interpretive bias in these individuals, can primarily reduce sensitivity to stimuli related to weight, shape, and food. This way, one can change the individual's attitude and behavior towards weight-regaining stimuli post-surgery. Moreover, as of the writing of this article, the content of interpretive biases in this group had not been studied according to the review of information databases. Thus, this study addressed the question: What is the content of interpretive bias in obese individuals before and after weight loss surgery?

## 2. Methods and Materials

### 2.1. Study Design and Participants

This study, given the depth of investigation into the cognitive biases of obese individuals with sleeve gastrectomy surgery, was qualitative and used the thematic analysis method of Braun and Clarke (2006).

The research environment in the qualitative phase included all obese individuals who had undergone sleeve gastrectomy surgery a year and a half prior. After obtaining the necessary permissions and coordination, based on inclusion and exclusion criteria, obese individuals who had undergone surgery were purposefully selected. To find these individuals, medical and surgical centers were visited, and the individuals referred by these centers were interviewed. The selection of participants was based on data saturation. The inclusion criteria were sleeve gastrectomy surgery, at least 18 months post-obesity surgery, and re-engagement in thoughts related to weight gain and obesity; the exclusion criteria were bulimia nervosa and eating disorders, participation in other training courses simultaneously, and withdrawal from continuing the study.

## 2.2. Measures

### 2.2.1. Semi-Structured Interview

In this study, semi-structured interviews were used in the qualitative section to extract the content of cognitive biases. The semi-structured interview process was such that questions about discovering the nature of cognitive bias were developed based on the research literature and theory and through consultation with advisors and consultants before conducting the interviews. After reaching a consensus, the final general interview form was prepared, and interview sessions were arranged based on the formulated questions. This interview contained questions on important topics such as eating management before and after surgery, the role of memories, focus and attention on or distraction from eating before and after surgery, and exploratory questions like "Could you explain more?" or "Is there anything else you would like to add?". At the end of the interview, participants were asked to mention any additional information they deemed necessary to ensure no critical point was missed. However, the questions were not mandatory, and participants could choose not to answer any questions they did not wish to. All interviews were recorded during the process. In addition to voice recording, note-taking was also done, sometimes during the interview and immediately after it. To accurately understand the participants' statements, their words were often summarized, and they were asked to

confirm the accuracy of the understanding. The duration of the interviews ranged between 35 and 50 minutes. Semi-structured interviews began by focusing on the main topics covering the research subject.

### 2.3. Data Analysis

For data analysis, considering the researchers aimed to identify the underlying constructs of cognitive biases in obese individuals with sleeve gastrectomy surgery, the six-phase thematic analysis method by Braun and Clarke (2006) was used as follows:

**Familiarization with Data:** This began with reading all interviews to get a general overview of them.

**Generating Initial Codes:** In the second reading, a line-by-line coding was performed, where each sentence in the interview received a code derived from the researcher's and advisor's understanding. Thus, it is not claimed that the codes were exclusively data-driven. In Braun and Clarke's (2006) suggested approach for thematic analysis, all data are coded, and the codes are compiled into increasingly abstract codes until they represent a category or pattern.

**Searching for Themes:** After initial coding, codes were integrated into larger units with similar semantic content. This process of merging codes into larger units continued until only a few remained. The next step in the analysis was integrating the codes into themes or patterns. In this study, a theme was defined as the smallest unit that could meaningfully represent the included codes. For example, a theme could represent an underlying concept, with the included codes being manifestations of it, or it could provide a unified meaning to "similar" codes with divergent content not directly related. In the end, the main themes were formed.

## 3. Findings and Results

Table 1 presents the results of the thematic analysis, which consisted of 120 initial codes. After eliminating irrelevant sentences, 17 basic codes were derived from the initial codes, and from these basic codes, seven organizing themes and three overarching themes related to interpretation bias in obese individuals were extracted.

**Table 1**

*Comprehensive, Organizing, and Basic Themes of Interpretation Bias*

Comprehensive Theme	Organizing Theme	Basic Theme
Interpretation Bias Facilitating Overeating	Interpretation of Situations Based on Incompatible Beliefs about Overeating	- "Eating won't kill you" - "You should eat your fill" - "Weakness is solved by overeating" - "Some foods make you happy"
	Confusing Interpretation of Overeating	- Inappropriate food substitution - Inappropriate calorie substitution - Inappropriate meal replacement
Catastrophic Interpretative Bias	Normalizing Overeating Interpretation	- "Everyone has a problem" - "Abundant provision"
	Interpretation Based on Inability	- Belief in lack of willpower - Belief that obesity is a disease
Interpretative Bias Preventing Eating Post-Surgery	Interpretation Based on the Futility of Dieting	- Belief in low metabolism - Seeking quick weight loss methods - Belief in the futility of dieting
	Interpretation Based on External Factors	- Physical fitness leads to proper communication - Physical fitness enables social participation - Physical fitness leads to a neat appearance
	Interpretation Based on Internal Factors	- Physical fitness leads to higher self-confidence - Physical fitness leads to better health - Physical fitness leads to satisfaction

As shown in Table 1, the interpretative bias in obese individuals comprises three overarching themes: 1) Interpretation Bias Facilitating Overeating, 2) Catastrophic Interpretative Bias, and 3) Interpretative Bias Preventing Eating. Each of these overarching themes includes organizing themes and basic themes, which will be elaborated upon below.

### 3.1. Interpretation Bias Facilitating Overeating

Interpretation Bias Facilitating Overeating is one of the overarching themes indicating that before surgery, these individuals interpreted eating-related situations in a way that encouraged eating. This comprehensive code includes three organizing themes: 1) Interpretation of Situations Based on Incompatible Beliefs about Overeating, 2) Confusing Interpretation of Overeating, and 3) Normalizing Overeating Interpretation. Each of these organizing themes is explained in detail below.

#### 3.1.1. Interpretation of Situations Based on Incompatible Beliefs about Overeating

One of the organizing themes leading to the overarching theme of Interpretation Bias Facilitating Overeating was the interpretation of eating situations based on incompatible beliefs about overeating. This theme showed that eating is not only an instinctual activity but also a cognitive one, with cognitive biases facilitating overeating. This organizing theme included the following basic themes:

"Eating won't kill you": "My grandfather ate everything and lived to be 90 years old. He always said there's nothing deadly in eating."

"Eating is a pleasure": "Well, if I'm being honest, I always loved the pleasure of eating, and I still do."

"Weakness is solved by overeating": "I learned that eating can solve my problems, especially when I felt physically weak."

"Some foods make you happy": "Ice cream makes you happy; research has shown this too."

#### 3.1.2. Confusing Interpretation of Overeating

Another organizing theme forming the overarching theme of Interpretation Bias Facilitating Overeating was the confusing interpretation of overeating, showing that the mind shapes cognitive interpretations of overeating to create opportunities for it. This organizing theme included the following basic themes:

Inappropriate food substitution: "I tried to eat less so I could eat sweets and chocolates."

Inappropriate calorie substitution: "I reduced fruits and instead ate chocolates, trying to swap the calories."

Inappropriate meal replacement: "I skipped breakfast and instead had a big dinner."

#### 3.1.3. Normalizing Overeating Interpretation

Another organizing theme forming the overarching theme of Interpretation Bias Facilitating Overeating was the normalization of overeating interpretation, showing that the mind shapes cognitive interpretations of overeating to

reduce psychological distress caused by overeating. This organizing theme included the following basic themes:

"Everyone has a problem": "When I saw my obesity, I would say to myself, well, everyone has a problem, and this is mine."

"Abundant provision": "I would tell myself that I have abundant provision and that God wants me to have plenty."

### 3.2. *Catastrophic Interpretative Bias*

Another overarching theme in the interpretative bias of individuals with sleeve gastrectomy surgery was the catastrophic interpretative bias of obesity, indicating that with increasing weight gain, obesity was perceived as an insurmountable disaster in the minds of these individuals, with eating being the only solace. This comprehensive code includes the organizing themes 1) Interpretation Based on Inability and 2) Interpretation Based on the Futility of Dieting. Each of these organizing themes is explained in detail below.

#### 3.2.1. *Interpretation Based on Inability*

One of the organizing themes leading to the overarching theme of Catastrophic Interpretative Bias was the interpretation based on inability, which led to despair about eating less or dieting and resulted in overeating. This organizing theme included the following basic themes:

Belief in lack of willpower: "I would say I'm not the type to diet; I don't have the willpower."

Belief that obesity is a disease: "I would say obesity is a disease, and I am a patient. This disease causes eating."

#### 3.2.2. *Interpretation Based on the Futility of Dieting*

Another organizing theme leading to the overarching theme of Catastrophic Interpretative Bias was the interpretation based on the futility of dieting, which led to despair about dieting and resulted in overeating. This organizing theme included the following basic themes:

Belief in low metabolism: "I dieted several times, but my metabolism was very low, and each time I lost only a little weight."

Seeking quick weight loss methods: "I wanted to eat something and lose weight quickly, like something herbal or weight loss earrings."

Belief in the futility of dieting: "I dieted so many times and failed that I concluded dieting is useless."

### 3.3. *Interpretative Bias Preventing Eating Post-Surgery*

Another overarching theme in the interpretative bias of individuals with sleeve gastrectomy surgery was the interpretative bias preventing eating post-surgery, indicating that after surgery, these individuals attempted to stabilize their weight. This comprehensive code includes the organizing themes 1) Interpretation Based on External Factors and 2) Interpretation Based on Internal Factors. Each of these organizing themes is explained in detail below.

#### 3.3.1. *Interpretation Based on External Factors*

One of the organizing themes leading to the overarching theme of Interpretative Bias Preventing Eating Post-Surgery was the interpretation based on external factors related to obesity or weight loss, which helped maintain weight loss. This organizing theme included the following basic themes:

Physical fitness leads to proper communication: "When you are fit, you are comfortable and happy in your interactions, so you can have good relationships with others."

Physical fitness enables social participation: "I can easily go to the gym, interact with others, attend parties, and be satisfied."

Physical fitness leads to a neat appearance: "When you have a good figure, you can easily choose and coordinate clothes, but when you are obese, nothing fits you, and you can't wear anything, making you impressive to others."

#### 3.3.2. *Interpretation Based on Internal Factors*

Another organizing theme leading to the overarching theme of Interpretative Bias Preventing Eating Post-Surgery was the interpretation based on internal factors related to obesity or weight loss, helping maintain weight loss. This organizing theme included the following basic themes:

Physical fitness leads to higher self-confidence: "Unlike before when I didn't want to participate in gatherings, now I have the confidence that gives me the courage to be in social settings."

Physical fitness leads to better health: "Now, I don't get out of breath; my health has improved."



Physical fitness leads to satisfaction: "I experience a lot of satisfaction, which makes me happy. I can't eat a lot now, whereas before, I couldn't eat a little."

#### 4. Discussion and Conclusion

This study aimed to analyze the interpretative bias in obese individuals with sleeve gastrectomy surgery. The results showed that their interpretative bias comprises three overarching themes: 1) Interpretation Bias Facilitating Overeating, 2) Catastrophic Interpretative Bias, and 3) Interpretative Bias Preventing Eating.

No previous research has addressed such a study, so it is not possible to compare these findings with other research results. However, studies have investigated cognition in obese individuals. For instance, Prickett et al. (2015) showed that obese individuals have impairments in visual memory, complex attention, verbal memory, and decision-making. Ciro et al. (2011) demonstrated that weight loss does not improve executive brain function; Copy et al. (2018) showed that obesity impairs cognitive abilities; Kim and Park (2016) indicated that obesity contributes to cognitive decline; Loken et al. (2010) showed that the intelligence of individuals with sleeve gastrectomy surgery does not differ from others, but their executive function in problem-solving is slightly lower; Lavender et al. (2014) demonstrated that surgery does not improve executive brain function in individuals with sleeve gastrectomy surgery; and Vreeken et al. (2023) showed that among those who underwent sleeve gastrectomy surgery, individuals with lower depression had better cognitive performance (16). Dardano et al. (2022) showed that performance is affected by obesity. Nonetheless, these studies suggest that cognitive functions are somewhat influenced by obesity (17).

To explain the Interpretation Bias Facilitating Overeating, indicating that before surgery, these individuals interpreted eating-related situations in a way that encouraged eating, it can be said that this comprehensive code includes two organizing themes: 1) Interpretation of Situations Based on Incompatible Beliefs about Overeating and 2) Confusing Interpretation of Overeating. These findings can indicate that due to external feedback and individual problems, these individuals know that obesity is troublesome, so they try to direct their thoughts in a way that reduces cognitive dissonance and guilt (18).

To explain another organizing theme, the Confusing Interpretation of Overeating, it can be said that to facilitate overeating, confusing interpretation of overeating occurs, showing that the mind shapes cognitive interpretations of overeating to create opportunities for it. Here, the confusing interpretation also serves as a defense mechanism, where the individual tries to alleviate guilt by inappropriate food substitution, such as "I tried to eat less so I could eat sweets and chocolates," or inappropriate calorie substitution, such as "I reduced fruits and instead ate chocolates, trying to swap the calories," or inappropriate meal replacement, such as "I skipped breakfast and instead had a big dinner." This interpretative bias also helps reduce the psychological distress caused by cognitive dissonance related to overeating (19).

To explain the Normalizing Overeating Interpretation, it can be said that this organizing theme indicates that individuals try to reduce the anxiety caused by overeating through justifications, such as: "Everyone has a problem," "When I saw my obesity, I would say to myself, well, everyone has a problem, and this is mine," and "Abundant provision: I would tell myself that I have abundant provision and that God wants me to have plenty." This organizing theme is also a defense mechanism against overeating to reduce cognitive dissonance (20).

To explain the comprehensive code Catastrophic Interpretative Bias, it can be said that this code indicated that with increasing weight gain in the minds of these individuals, obesity was perceived as an insurmountable disaster, with eating being the only solace. Fear and anxiety from the inability to lose weight led to increased overeating. It seems that the hidden mechanism of this phenomenon is the rumination of disabling thoughts that make the situation appear unchangeable, activating negative interpretative biases. These led to the Interpretation Based on Inability (21) and Interpretation Based on the Futility of Dieting, which resulted in beliefs in lack of willpower, beliefs that obesity is a disease, beliefs in low metabolism, and seeking quick weight loss methods.

To explain the comprehensive code Interpretative Bias Preventing Eating Post-Surgery, it can be said that after surgery, these individuals attempt to direct their thoughts and biases in a way that prevents eating. Thus, they either try to have an Interpretation Based on External Factors,

meaning they maintain their weight based on external reasons related to obesity or weight loss, which is more about the impact of obesity on personal interactions, or they try to have an Interpretation Based on Internal Factors, meaning they maintain their weight for entirely personal reasons, such as higher self-confidence, better health, and greater inner satisfaction.

Given these results, it can be said that to maintain weight loss among obese individuals, their interpretative biases need to be managed, and they should receive appropriate training. This can increase the likelihood of weight control and also has implications for obesity prevention, such as directing the cognitive interpretations of individuals prone to obesity to help them better maintain a healthy weight.

This study, like other research, has limitations, such as the possibility that these findings might not be validated by close relatives of these individuals. Finally, it is suggested that dietitians and psychologists in the field of overeating treatment use these findings to improve the condition of obese individuals.

### Authors' Contributions

S.T.K. conceptualized the study, designed the research methodology, and supervised the data collection process. H.T., the corresponding author, conducted the semi-structured interviews, performed the thematic analysis using NVivo software, interpreted the results, and led the drafting and revising of the manuscript. Z.Y. assisted with participant recruitment, supported data collection, and contributed to the literature review. All authors participated in discussing the findings, critically reviewed the manuscript for important intellectual content, and approved the final version for publication.

### Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

### Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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### Declaration of Interest

The authors report no conflict of interest.

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### Ethics Considerations

The study placed a high emphasis on ethical considerations. Informed consent obtained from all participants, ensuring they are fully aware of the nature of the study and their role in it. Confidentiality strictly maintained, with data anonymized to protect individual privacy. The study adhered to the ethical guidelines for research with human subjects as outlined in the Declaration of Helsinki.

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