Examining Intuitive Eating Behavior Across Metabolic and Bariatric Surgery and Non-Surgical Patients

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ABSTRACT

BACKGROUND: Intuitive Eating (IE) scales assess eating behaviors by capturing individuals' tendencies to rely on internal cues – such as hunger and satiety – rather than external influences like emotional factors or dieting mentality. IE data within the context of metabolic and bariatric surgery (MBS) patients seeking obesity management treatment remain limited.

OBJECTIVE: This study aimed to explore changes in Intuitive Eating Assessment Scale-2 (IEAS-2) scores among MBS and non-MBS patients and examine how individual-level factors, including obesity management medication (OMM), may influence these changes.

METHODS: We retrospectively analyzed 168 IEAS-2 responses from 84 patients at an obesity medicine clinic, including four subscales: (1) Unconditional Permission to Eat, (2) Eating for Physical Rather Than Emotional Reasons, (3) Reliance on Internal Cues, and (4) Body-Food Choice Congruence. Linear mixed-effects models assessed changes from baseline to follow-up and associations with OMM use, MBS status, depression, sleep duration, and physical activity.

RESULTS: Thirty-five non-MBS and 49 MBS patients (25 gastric bypass, 24 sleeve gastrectomy) were included, with a mean age of 47±11.5 years and BMI of 41.5±8.3 kg/m². Total IEAS-2 scores improved marginally over time ($p = .054$), irrespective of MBS status. OMM use ($p < .001$), physical activity ($p = .019$), and sleep ($p = .065$) were associated with better IE scores, while depression ($p < .001$) predicted worse outcomes.

CONCLUSIONS: Improvements in IE may be influenced more by individual-level factors – such as OMM use, lifestyle behaviors, and mental health – than by treatment modality alone, supporting the importance of interdisciplinary obesity care, integrating medical, psychological, and behavioral support.

KEYWORDS: Metabolic and Bariatric Surgery, Obesity Management Medication, Intuitive Eating, Eating Behavior, Obesity Treatment

INTRODUCTION

Obesity is a chronic, complex disease associated with an increased risk of developing severe health conditions,[1] currently affecting 41.9% of the United States population.[2] Treatment strategies typically include lifestyle interventions (e.g., dietary changes, sleep health, stress reduction, and physical activity), pharmacological therapies (i.e., obesity management medications; OMM, oral and injectables), and metabolic and bariatric surgery (MBS).[3] While behavioral interventions can lead to modest (5–10%) but clinically meaningful weight loss and health improvements,[4,5] sustaining these outcomes over the long-term remains a clinical challenge,[6,7] with most individuals (80%) experiencing weight recurrence after the intervention concludes.[8–10]

MBS is an effective and durable treatment for obesity and its comorbidities,[11] with about 70% of patients achieving a ≥50% loss of excess weight. However, 20–30% may still experience suboptimal weight loss or weight recurrence.[12] More recently, pharmacological options – such as the injectables glucagon-like peptide-1 (GLP-1) and glucose-dependent insulinotropic polypeptide (GIP) receptor agonists – have demonstrated efficacy in modulating appetite and satiety,[13] resulting in 15–21% mean body weight reduction and a lower risk of obesity-related diseases.[14,15] However, they also pose challenges including limited accessibility, regimen adherence, and potential side effects.[16]

A comprehensive, multidisciplinary approach to obesity management – including nutrition, physical activity, pharmacotherapy, surgical, and psychological support – is increasingly recommended to support positive health outcomes.[18,19] Psychological factors, such as stress and depression, are linked to emotional eating and obesity,[18,20] while insufficient or poor quality of sleep has also been associates with increased obesity risk and disordered eating patterns.[21,22]

Each treatment – behavioral, surgical, and pharmacological – offer distinct benefits and challenges, particularly in terms of long-term adherence and weight recurrence. As these modalities increasingly overlap in clinical care,[11,19] there is growing interest in understanding how they intersect with eating behavior patterns, and Intuitive Eating (IE), an evidence-based concept, may facilitate this understanding.

Intuitive Eating

IE promotes eating in response to physiological cues, such as hunger and satiety, rather than emotional cues, encouraging flexibility and self-compassion over restrictive dieting and rigid food rules.[23] Unlike traditional weight-centric models, IE and other health-centric approaches emphasize engagement in health-promoting behaviors and have been associated with favorable health outcomes.[24] Systematic review of non-weight-centric approaches has shown that IE and mindful eating are associated with reduced depressive symptoms, lower disordered eating, improved body image, greater fruit and vegetable intake, higher dietary fiber consumption, better quality of sleep, and increased physical activity.[24–26]

The IE Assessment Scale-2 (IEAS-2) measures IE through four dimensions, which are described in more detail in the Methods section.[23] Counseling based on this assessment may support individuals by measuring their tendency to follow their hunger and satiety cues, thereby helping individuals make food-related decisions aligned with their physiological needs.[27]

The present study integrates behavioral, psychological, and physiological variables related to obesity to emphasize the importance of comprehensive care. It investigates the intersection of MBS, pharmacological intervention, particularly OMM, intuitive eating, and lifestyle factors, such as physical activity, sleep duration, and experiences of depression. To our knowledge, this is the first study to examine these factors collectively, providing insight into how surgical and pharmacological treatments may relate to intuitive eating behaviors while considering lifestyle and psychological factors. Specifically, the study 1) explored the changes from baseline to follow-up in Intuitive Eating Assessment Scale-2 scores across non-MBS and MBS patients, and 2) examined how other variables, including OMM, may influence these scores.

METHODS

Study Design

This study employed a retrospective longitudinal design to compare the change in IEAS-2 scores overtime (i.e., baseline and follow-up) and across non-MBS and MBS patients. Data were collected at an obesity medicine clinic in the state of Rhode Island and received approval from the responsible Institutional Review Board.

Participants

Participants included non-MBS and MBS patients who visited the obesity medicine clinic between January 2021 and July 2023. Eligibility criteria included: all patients who (a) are 18 years of age or older, and (b) had completed the IEAS-2 at baseline and at follow-up as part of the clinic's standard of care. MBS patients in this sample likely represent a specific subgroup of bariatric surgery patients – those experiencing either inadequate weight loss or weight regain – since patients with sustained success would be less likely to present to the clinic for further obesity management.

Data Collection

The following data were retrieved from electronic medical records using Research Electronic Data Capture (REDCap): (a) demographics of all participants, including age, date of birth, legal gender, marital status, employment status, race, and ethnicity, (b) the use or no use of OMM, (c) anthropometrics including weight, height, and body mass index (BMI), (d) the type of MBS and day of surgery, when applicable, (e) baseline and follow-up IEAS-2 completed by each patient, and (f) a brief health questionnaire about experiencing depression, sleep duration, and physical activity level.

Measures

The study examined IE responses across non-MBS and MBS patients, utilizing the IEAS-2. The scale is composed of 23 items distributed across four domains that indicate the core characteristics of intuitive eaters: (1) unconditional permission to eat, (2) eating for physical rather than emotional reasons, (3) reliance on hunger and satiety cues to decide when and how much to eat, and (4) body-food choice congruence.[28] Patients were instructed to answer 'yes' or 'no' for each statement, and when in between answers, they were instructed to pick the answer that most often applies to them.[29] For domains 1 and 2, each 'yes' is added up, and it represents an IE area that the individual may need to work on more. For domains 3 and 4, all 'no' answers are added and indicate the areas for improvement; thus, higher scores correspond to more negative IE outcomes. For easier analysis and interpretation, we standardized the scoring across the subscales so that lower IEAS-2 scores indicate better outcomes, as the individual has fewer areas to improve. Scores were not replaced if missed but the following criteria were applied: For subscales 1–3, if at least 50% of the questions were answered (i.e., 3 out 6, 4 out of 8, and 3 out of 6 for subscales 1,2, and 3, respectively), they were accounted for and added to the IEAS-2 subscales' total and overall scores. For subscale 4, the answers were accounted for if at least 2 out of 3 items were answered. The IEAS-2 subscales were calculated by counting the number of "yes" responses to items in subscales 1 and 2 and the number of "no" responses to items in subscales 3 and 4. Total scores were the sum of all subscales items.

Subscales

Unconditional Permission to Eat (UPE)

This subscale assesses individuals' permission – or lack of permission – to consume food when experiencing hunger without attempting to suppress it (e.g., "I don't allow myself to eat what food I desire at the moment"), categorize specific foods as off-limits (e.g., "I have forbidden foods that

I don't allow myself to eat") or as healthy/unhealthy (e.g., "I get mad at myself for eating something unhealthy"), and without rules that dictate what, when, and how to eat.[28,29]

Eating for Physical Rather than Emotional Reasons (EPR)

This subscale represents whether individuals' eating decisions are in response to physical hunger or driven by emotional distress, such as anxiety, loneliness, or boredom. For example, "I find myself eating when I'm feeling emotional (i.e., anxious, sad, depressed), even when I'm not physically hungry."[28]

Reliance on Hunger and Satiety Cues (RHSC)

This subscale assesses individuals' confidence in their internal hunger and satiety signals and their capacity to utilize these cues to regulate their eating behavior. For example, "I trust my body to tell me *when* to eat."[28]

Body-food Choice Congruence (B-FCC)

The B-FCC subscale assesses individuals' reliance on making food choices that honor health and taste preferences, while maintaining a flexible nutrition approach, listening to how food makes one feel, without a rigid focus on healthy foods and perfection – "gentle nutrition."[23,28]

Table1. Participant Demographics

Frequencies Descriptives	Total, n (%) Mean ± SD	Non-MBS	MBS	Significance
Sample	84 (100)	35 (41.6/100)	49 (58.4/100)	>0.05
Type of Surgery Gastric Bypass, n Vertical Sleeve			25 (52) 24 (48)	
Initial Body Mass Index (kg/m²) Mean ± SD	41.54 ± 8.3	42.64 ± 7.87	40.75 ± 8.6	.307
Age, years Mean ± SD	47.29 ± 11.5	46.74 ± 12.55	47.67 ± 10.81	.717
Gender Men Women	12 (14.3) 72 (85.7)	10 (28.6) 25 (71.4)	2 (4.1) 47 (95.9)	.002
Ethnicity Not Hispanic/Latino Hispanic/Latino Prefer not to answer	71 (84.5) 11 (13.1) 2 (2.4)	27 (77.1) 6 (17.1) 2 (5.7)	44 (89.8) 5 (10.2) 0	.140
Race Black White Other/Multiracial Prefer not to answer	12 (14.3) 62 (73.8) 8 (9.5) 2 (2.4)	3 (8.6) 27 (77.1) 3 (8.6) 2 (5.7)	9 (18.4) 35 (71.4) 5 (10.2) 0	.229
Obesity Management Medication (OMM) Use Initial Visit No use Yes use	68 (81.0) 16 (19)	27 (77.1) 8 (22.9)	41 (83.7) 8 (16.3)	.575
Time Elapsed Since Bariatric Surgery, years Median (Min-Max)			6.17 ± 6.59 5.3 (.18-40)	
Time Elapsed Initial to Follow-up Visit, days	129.6 ± 82.74	131.2 ± 92.73	128.4 ± 75.78	.881
Total Weight Loss Pounds	5.59 ± 12.4	7.22 ± 11.23	4.43 ± 13.18	.314

Statistical Analysis

Descriptive analysis was used for all participants' characteristics and separated by surgical status (non-MBS and MBS). In Statistical Package for the Social Sciences (SPSS; IBM version 28.0.1.1), a linear mixed-effects model was selected to examine changes in intuitive eating total scores and subscales 1-4 across two time points (baseline and follow-up), comparing non-MBS and MBS groups. The model included variables: age, gender, marital status, race, ethnicity, employment, BMI, exercise level, depression, sleep duration, weight loss, and OMM status (coded as medication use: yes/no). A Confidence interval of 95% was employed, and statistical significance was determined at the $p < 0.005$ level.

RESULTS

A total of 168 IEAS-2 surveys from 84 patients were included in the analyses. The only demographic variable that differed between non-MBS and MBS patients was gender [**Table 1**]. Of the 12 males who participated, two (16.7%) were in the MBS group whereas 47 (65.3%) of the 72 females were in the MBS group.

Changes in IEAS-2 total scores across time and between MBS and Non-MBS

We found a marginally significant main effect of time, $F(1, 102.82) = 3.79$, $p = .054$, suggesting that IE scores improved from baseline ($M = 9.48$, $SE = 0.55$) to follow-up ($M = 8.10$, $SE = 0.56$; see **Figure 1**). The main effect of bariatric status was not significant, $F(1, 72.03) = 1.68$, $p = .199$, nor was the Time × Bariatric Status interaction, $F(1, 78.05) = 0.17$, $p = .682$, indicating that IE change over time did not significantly differ between the MBS and non-MBS groups.

Examination of the variables revealed several significant predictors of intuitive eating. Medication use was significantly associated with lower (i.e. better) IE scores, $B = -3.11$,

Figure 1. Changes in IEAS-2 total scores across time between Non-MBS and MBS.

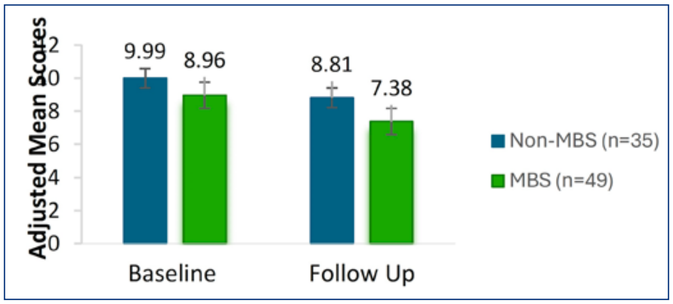
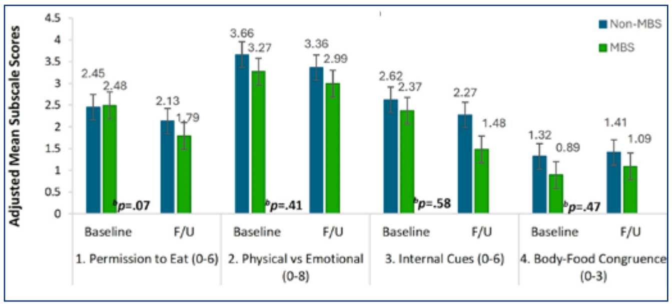


Figure 2. Changes in IEAS-2 Subscale Scores Across Time Between Non-MBS and MBS Adults[a].



a. Interaction between Time and Bariatric Status
b. P values indicate an effect of Time.
Note: Lower IEAS-2 scores = better outcomes

SE = 0.83, *t*(128.63) = -3.77, *p* < .001. Greater physical activity also predicted better IE outcomes, *B* = –1.24, *SE* = 0.52, *t*(143.88) = -2.37, *p* = .019. In contrast, depression was associated with higher (i.e., worse) IE scores, *B* = 1.40, *SE* = 0.32, *t*(134.13) = 4.44, *p* < .001, indicating poorer intuitive eating. There was a marginal effect of sleep, with longer sleep duration associated with better IE outcomes, *B* = –1.09, *SE* = 0.59, *t*(133.34) = –1.86, *p* = .065.

Changes in IEAS-2 subscale scores across time and between MBS and Non-MBS adults

Subscale 1: Unconditional Permission to Eat

There was a marginally significant main effect of Time, *F*(1, 109.64) = 3.32, *p* = .071, suggesting that Subscale 1 scores somewhat decreased (i.e., improved) from baseline (*M* = 2.47, *SE* = 0.21) to follow-up (*M* = 1.96, *SE* = 0.20). Although MBS had slightly better scores at follow-up, the main effect of Bariatric Status was not significant, *F*(1, 73.18) = 0.20, *p* = .653, with non-MBS participants (*M* = 2.29, *SE* = 0.25) showing similar Subscale 1 scores to MBS (*M* = 2.14, *SE* = .20). The interaction between Time and Bariatric Status was also not significant, *F*(1, 79.31) = 1.00, *p* = .321 (see **Figure 2** for adjusted mean score changes from baseline to follow-up separated per group).

Among all variables, OMM status was the only significant predictor, *B* = –0.67, *SE* = .32, *t*(138.08) = –2.12, *p* = .036. This indicates that OMM use was associated with lower (i.e., better) unconditional permission to eat scores, controlling for other variables.

Subscale 2: Eating for Physical Rather than Emotional Reasons

IEAS-2 subscale 2 scores improved from baseline (*M* = 3.47, *SE* = 0.29) to follow-up (*M* = 3.18, *SE* = 0.29). However, the main effect of Time did not achieve statistical significance, *F*(1, 94.56) = 0.68, *p* = .411. The main effect of Bariatric Surgery Status was also not significant, *F*(1, 70.71) = 0.53, *p* = .469, with non-MBS participants (*M* = 3.52, *SE* = 0.38) not differing from MBS participants (*M* = 3.14, *SE* = 0.32). Additionally, the Time × Bariatric Surgery Status interaction was not significant, *F*(1, 73.70) = 0.003, *p* = .958, suggesting no differential change in Subscale 2 scores over time by surgery status [**Figure 2**].

Among the obesity-related variables, depression was a significant predictor of Subscale 2 scores, *B* = .474, SE = .16, *t*(124.9) = 2.98, *p* = .003, such that depression was associated with a greater likelihood of eating for emotional rather than physical reasons. OMM use was also a significant predictor, *B* = –.818, *SE* = .41, *t* (115.3) = –1.99, *p* = .048, with OMM use being associated with lower (better) Subscale 2 scores. No other covariates reached statistical significance (*p* > .05).

Subscale 3: Reliance on Internal Hunger/Satiety Cues

There was a marginally significant main effect of Time, *F*(1, 102.19) = 3.66, *p* = .058, with mean Subscale 3 scores decreasing (i.e., improving) from Baseline (*M* = 2.50, *SE* = 0.25) to Follow-up (*M* = 1.88, *SE* = 0.24). The main effect of Bariatric Surgery Status was not significant, *F*(1, 71.61) = 1.60, *p* = .211, with non-MBS participants (*M* = 2.45, *SE* = 0.30) not differing from MBS participants (*M* = 1.93, *SE* = 0.25), nor was the Time × Bariatric Status interaction, *F*(1, 75.25) = 1.41, *p* = .238, suggesting no differential change in reliance on internal cues scores over time by surgery status [**Figure 2**].

Among all variables, less reliance on hunger and satiety cues was associated with marital status (*B* = 0.066, *SE* = 0.030, *t*(113.35) = 2.22, *p* = .028) and depression (*B* = 0.522, *SE* = 0.142, *t*(137.89) = 3.67, *p* < .001). On the contrary, exercise level (*B* = -0.526, *SE* = 0.232, *t*(144.32) = –2.26, *p* = .025) and OMM use (*B* = –0.830, *SE* = 0.375, *t*(132.98) = –2.21, *p* = .029) were associated with better outcomes.

Subscale 4: Body-Food-Choice Congruence

The main effect of Time was not significant, *F*(1, 104.93) = 0.53, *p* = .469, indicating no major change in Subscale 4 scores from Baseline (*M* = 1.11, *SE* = 0.16) to Follow-Up (*M* = 1.26, *SE* = 0.14). The main effect of Bariatric Surgery Status was also non-significant, *F*(1, 72.71) = 2.37, *p* = .128, with non-MBS participants (*M* = 1.37, SE = 0.18) not differing from MBS (*M* = .99, *SE* = 0.15). Time × Bariatric Status interaction was non-significant, *F*(1, 76.90) = 0.16, *p* = .687, suggesting no differential change in body-food-congruence scores over time by surgery status [**Figure 2**].

Regarding all variables, exercise level was associated with lower (i.e., better) body-food-congruence, $B = -0.35$, $SE = 0.14$, $t(143.36) = -2.51$, $p = .013$. Sleep duration and OMM use also predicted lower scores ($B = -0.32$, $SE = 0.16$, $t(137.67) = -2.01$, $p = .047$, and $B = -.66$, $SE = 0.23$, $t(136.36) = -2.89$, $p = .004$, respectively). Depression was linked to higher (i.e., worse) scores, B = 0.35, SE = 0.09, $t(141.19) = 3.99$, $p < .001$. All other covariates were non-significant ($p > .05$).

DISCUSSION

This study examined changes in intuitive eating behaviors among patients in an obesity management clinic, comparing those who had undergone MBS to those who had not. Overall, IEAS-2 scores showed marginal improvement over time, irrespective of MBS status, suggesting some progression in participants' intuitive eating. However, no significant bariatric status or Time × Bariatric Status interaction was observed, indicating that surgery status alone did not significantly influence IE outcomes.

Modest improvement in IE over time

The modest improvement observed in intuitive eating may reflect the gradual and non-linear nature of behavior change and habit formation.[30] Improvements may be related to the care and information provided at the clinical, but more research is needed to elucidate this relationship. The marginal effect of time could be partially explained by the relatively short interval between baseline and follow up (mean of 130 days), as behavioral change typically evolves gradually and unfolds overtime.[31,32] Additionally, adopting IE may present challenges in weight management context, as IE is not inherently designed for weight loss.[23] Furthermore, the variability in follow-up timing may have diluted potential time-related effects, as participants had differing durations in which potential change could occur. These factors should be considered when interpreting the observed time effects and in planning future longitudinal assessments.

MBS and IE

MBS participants showed numerically greater improvements than their non-MBS counterparts, though this difference was not statistically significant. This trend may reflect patterns observed in prior research, which suggests that initial behavioral changes following MBS diminishes over time without structured follow-up.[33] While individuals who undergo MBS typically receive nutrition education during their pre- and post-operative process, their eating behaviors may be similar to those of non-MBS patients over time, potentially mirroring pre-surgery dieting behaviors.[34] This underscores the importance of sustained support, and IE may offer an opportunity for patients to reconnect with the skills they learned around time of surgery. This will ensure more meaningful, lasting changes, especially when combined with other therapeutical strategies, such as OMM, and lifestyle interventions.[35]

OMM and IE

A beneficial relationship was observed between the use of OMM and the IEAS-2 scores, both in the total score and across all four subscales. This may suggest a potential link between OMM and a healthier relationship with food and eating behaviors. OMM use emerged as a consistent predictor of improved IE scores, potentially due to its role in modulating physiological pathways that regulate appetite and satiety signaling,[14] thereby supporting engagement with eating behavior changes.[30]

Part of this effect may be explained by OMM's ability to regulate reward-seeking behaviors,[36] which may reduce what has been colloquially referred to as "food noise" – a constant preoccupation with food.[36] In the absence of persistent food thoughts and hunger, it is plausible to think that individuals may be less inclined to consciously engage in restrictive eating patterns (Subscale 1), fostering a more intuitive relationship with food that relies less on externally imposed rules. Furthermore, OMM may also support more attuned decisions regarding food, mind, and body (Subscales 2–4). Individuals may become more likely to eat in response to physical hunger rather than emotional cues, to consider how certain foods feel in their body and mind, and to choose foods that align with their body's needs. These findings suggest OMM may exert physiological and psychological influence on eating behaviors.[36]

Lifestyle (physical activity and sleep duration) and IE

Physical activity level and sleep duration were also associated with improved IE outcomes, particularly in subscales related to eating in response to internal cues (Subscale 3) and body-food congruence (Subscale 4). These findings align with existing literature suggesting that physical activity and eating behaviors are interconnected, with greater physical activity supporting more autonomous and regulated eating patterns. For example, Fernandes et al (2023) found that higher levels of physical activity are associated with more self-determined eating regulation, characterized by reduced reliance on external rules or emotional cues.[37] Our results also align with the literature that supports that sleep duration is associated with better eating patterns.[22,38] This may be due to the role that adequate sleep has in supporting regulation of appetite hormones, food intake, high-energy intake, and emotional eating.[22,39]

Depression and IE

Depressive symptoms were consistently associated with poorer IEAS-2 outcomes, especially in domains related to emotional eating. This underscores the connection between depressive symptoms and eating behavior as supported by current literature. Research has shown that depressive symptoms are closely associated to disordered eating patterns, including loss of appetite, overeating, binge eating, and weight gain in response to emotions, as individuals with depressive symptoms are more likely to rely on food as a coping mechanism.[40,41] These findings emphasize obesity as a somatic comorbidity in mental health,[42,43] reinforcing the importance of addressing psychological health within obesity management care.[44] The integration of holistic strategies – such as mindfulness-based interventions like intuitive eating – may support emotional well-being and reduce emotional eating among individuals undergoing weight management.[35,44]

Considering these findings collectively, weight management interventions may depend not only on the treatment format itself but also on the interplay of psychological, behavioral, and physiological factors. Addressing modifiable variables such as physical activity, sleep, and depressive symptoms, along with pharmacological treatment and surgery may enhance the effectiveness of obesity management treatment.

CONCLUSION

This study offers novel insights into the role of intuitive eating within an obesity management context, particularly in relation to MBS and pharmacological treatment. While MBS status did not significantly predict changes in IE behaviors, individual-level variables – most notably OMM use, physical activity, sleep duration, and depressive symptoms – were consistently associated with IE outcomes. These findings suggest that treatment modality alone may not be sufficient to drive meaningful behavior change; rather, IE appears to hinge on a broader set of modifiable factors.

Importantly, the observed links between IE, lifestyle behaviors, and psychological factors reinforce the value of a multidimensional, patient-centered model of obesity care. Interventions that combine physiological support (e.g., OMM, MBS) with behavioral and psychological strategies (e.g., promoting physical activity, improving sleep, and addressing mental health) may enhance long-term outcomes.

Future research should explore intuitive eating trajectories over extended follow-up periods and assess the impact of tailored interventions – such as medication-assisted, surgical, and IE counseling programs – on more diverse populations across gender, race, ethnicity, and geographical location. As obesity care continues to evolve toward personalized, holistic treatment models, understanding the dynamic interplay between pharmacological, surgical, behavioral, and psychological influences will be essential to improving outcomes and eating behaviors.

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