

Shifts in the Enjoyment of Healthy and Unhealthy Behaviors Affect Short- and Long-Term Postbariatric Weight Loss[†]

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Objective: To investigate whether bariatric patients experience changes in the enjoyment of health-promoting behaviors, and how those changes relate to weight loss success.

Materials and Methods: Online lifestyle survey for bariatric patients ≥ 18 years old who had undergone gastric bypass or sleeve gastrectomy ≥ 1 year earlier. Changes in the enjoyment of eating behaviors and exercise were surveyed, and associations with weight loss success were analyzed. The role of obtaining external support since surgery was investigated.

Results: Of 877 respondents, 475 were eligible (95% women, 53.3 ± 9.0 years, body mass index 34.2 ± 8.0 kg/m²), of whom 21%, 36%, and 43% had had surgery 12–24, 24–60, and >60 months earlier, respectively. Postsurgery, patients enjoyed eating healthy foods more (63%), exercise more (46%), eating junk food less (66%), and overeating less (95%). Increased enjoyment of healthy foods and exercise were only associated with weight loss success among patients with surgery ≥ 24 months previously. While obtaining external support was associated with successful weight loss overall, external support correlated with enjoying healthy food and exercise more in patients who had had their surgery at least 60 months previously.

Discussion: Learning to enjoy health-promoting behaviors after bariatric surgery may not coincide with improved weight loss outcomes before 2 years have passed.

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Introduction

BARIATRIC SURGERY IS CONSIDERED the most effective means of treating severe obesity, in terms of weight loss magnitude, duration, and decreases in weight-associated comorbidities.^{1,2}

The majority of patients who undergo bariatric surgery lose a significant amount of their excess weight, with the percentage of excess weight loss (%EWL) reaching 57% to 67%.¹ Even after 10 years, the percent of total weight loss varies from 13% to 25% depending on the type of the surgery.³ However, weight loss maintenance after bariatric surgery remains a challenge, mostly due to poor adherence with postsurgery diet, maladaptive eating behaviors,^{4,5} and lack of exercise.⁶ Typically, weight regain starts between 18–24 months after surgery and ~ 30 –64% of patients experience weight regain after 2 years.^{7,8}

Bariatric surgery is not a low-effort means of losing weight and maintaining weight loss. Individuals undergo invasive surgery and are required to comply with rigorous dietary changes to ensure sustained weight loss and to prevent complications such as vomiting and gastric dumping.⁹ To reinforce the adoption of these new dietary habits as well as increased physical activity, physicians recommend that patients obtain support. Such support involves attending annual postoperative surgical follow-up visits, which can include dietary/nutritional counseling, as well as attending bariatric support groups, using pedometers to track exercise, and—if needed—making use of psychological counseling. Compliance with surgical follow-up visits has been associated with improved eating habits¹⁰ and higher levels of physical activity,¹¹ whereas inadequate follow-up attendance has been associated with lower %EWL.^{6,12}

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It is evident that healthy behaviors, including those affecting eating, exercise, and obtaining support that reinforce healthy behaviors, can help patients achieve long-term weight loss maintenance. A factor that plays a major role in adhering to new behaviors is enjoyment; pleasure is one of the most influential determinants behind our dietary choices.¹³ Yet, little is known about experiencing enjoyment in health-promoting behaviors in bariatric patients and how that affects weight loss maintenance. Therefore, the purpose of the current study is to investigate weight loss and weight regain over time, changes in enjoyment of healthy and unhealthy behaviors, and how these are associated with long-term weight loss success among bariatric patients. More specifically, we study whether enjoyment of eating and exercise change after bariatric surgery and whether these shifts correlate with both short- and long-term weight loss success. We also assess the role of obtaining support in experiencing increased enjoyment in health-promoting behaviors.

Materials and Methods

Participants

Participants were recruited from the general membership of an online bariatric support group via an advertisement link. Professional members of the website (e.g., surgeons, bariatric support group leaders) were also encouraged to forward the link to their patients. The cross-sectional online survey consisted of 89 questions about participants' lifestyles and behaviors. To be eligible, a participant had to (1) be at least 18 years old, (2) have had bariatric surgery at least 1 year before participation, and (3) have undergone a Roux-en-Y gastric bypass or sleeve gastrectomy procedure. Those who completed the survey were offered a free e-copy of a bariatric surgery cookbook, which provides recipes designed for postbariatric patients.

Ethical approval

The study was approved by the Internal Review Board of Stanford University. All participants provided informed consent.

Measures

Weight change. The primary outcome was percentage of excess body mass index (BMI) loss (%EBL) calculated using the following formula: $(\text{presurgery BMI [kg/m}^2] - \text{current BMI [kg/m}^2]) / (\text{presurgery BMI [kg/m}^2] - 25) \times 100$. Weight loss success was defined as losing $\geq 50\%$ of excess BMI, that is, %EBL ≥ 50 .¹⁴⁻¹⁶ Weight regain was defined as a percentage increase from nadir weight that was surveyed as part of a lifestyle survey. Participants were categorized according to the amount of weight regained using a 15% threshold.¹⁷ Weight measures were asked as a part of the lifestyle survey and were thus self-reported.

Changes in enjoyment of healthy and unhealthy behaviors. The participants were surveyed about experiencing enjoyment of healthy and unhealthy behaviors, to investigate whether perceived enjoyment changed postsurgery. Shifts in the enjoyment of behaviors related to healthy and unhealthy eating and exercise were evaluated using the following statements: "I enjoy eating healthy foods *more/the same/less*

now than I did before surgery," "I enjoy eating junk food *more/the same/less* now than I did before surgery," "I enjoy overeating *more/the same/less* now than I did before surgery," and "I enjoy exercise *more/the same/less* now than I did before surgery."

Obtaining external support to reinforce diet and exercise. The following questions were asked to measure participants' current engagement with postsurgery support or having obtained it at some point since having had surgery: "Do you regularly meet with a nutritionist?," "Do you regularly see a therapist or counselor to deal with weight- or eating-related issues?," "Have you enlisted the help of a bariatric or life coach to help with your weight- or eating-related issues?," or "Have you enlisted the help of a fitness coach or personal trainer?." Participants who responded "yes" to at least one of the preceding questions were categorized as obtaining external support at some point since having surgery.

Analysis

As a first step, participants were divided into three groups based on the time that had elapsed since their surgery. The three follow-up groups were as follows: 12–24 months since surgery; 24–60 months since surgery; and >60 months since surgery. The reason for dividing patients into groups based on their follow-up time was based on patients' tendency to regain weight over time.^{6,18} These particular time-since-surgery groups were chosen using these same classifications.⁶ Sociodemographic variables, weight-related variables, and obtaining external support were described across the follow-up groups using means (standard deviations) or frequencies (percentages) and further compared using ANOVA and a chi-squared test. The association between enjoyment of healthy behaviors and weight loss success and obtaining external support and enjoyment of healthy behaviors were analyzed using logistic regression models. Odds ratios (OR), 95% confidence intervals (CIs) and the corresponding *p*-values were reported. Crude associations (OR) and adjusted associations (OR_{adj}) were reported by controlling the sex, age, type of surgery, and presurgery BMI for weight change models. Presurgery BMI and type of surgery are known to correlate with weight loss outcomes.^{19,20} The analyses were carried out separately for each of the follow-up groups.

Analyses were conducted with SPSS 21 (IBM 2012).

Results

Participant characteristics

In total, 877 individuals responded to the online lifestyle survey. Of these, 281 were excluded due to having had surgery less than 1 year previously, which would have left insufficient time to achieve postsurgical outcome success. Seventy subjects were excluded due to having had surgery other than gastric bypass or sleeve gastrectomy. A further 41 were excluded for failing to provide information necessary to calculate % EBL, failing to answer questions assessing relevant environmental factors, or failing to provide a date of surgery, and 10 subjects were further excluded due to their low presurgery BMIs (<35 kg/m²).

The final sample consisted of 475 participants, of whom 95% were female, age was 53.3 ± 9.0 years, current BMI was 34.2 ± 8.0 kg/m², a preoperative BMI was 49.3 ± 8.8 kg/m², and the highest BMI before surgery was 52.6 ± 9.2 kg/m². In total, 106 (22%) and 369 (78%) had undergone sleeve gastrectomy and gastric bypass procedures, respectively. Some 403 (85%) identified themselves as Caucasian, 31 (7%) as African American, and 17 (4%) as Hispanic. The remaining 4% were categorized into "other ethnic group" or the information was missing. Education levels were as follows: 70 (15%) were finished secondary school or had less than that, 153 (32%) had some university education, 175 (37%) were university graduates, and 76 (16%) were participants with graduate degrees. Some 345 (73%) participants were married or were in a committed relationship. The average number of months since surgery was 66 ± 52 ; for 101 (21%), 172 (36%), and 202 (43%) participants, there had been 12–24, 24–60, or >60 months since their surgery, respectively.

Weight loss, weight regain, and follow-up time since surgery

The mean %EBL was 65.0 ± 25.9 with 334 (70%) participants having lost $\geq 50\%$ of their excess weight. The nadir BMI postsurgery was 30.0 ± 6.7 kg/m². Weight regain was $14.5 \pm 14.9\%$ from the nadir weight. In total, 198 (42%) participants regained 15% or more of their weight, and 321 (68%) participants regained more than 5% from their nadir weight.

Table 1 shows sociodemographic background and weight-related variables across participants who had had 12–24, 24–60, or >60 months since their surgery. Of sociodemographic characteristics, age differed between the groups

($F=6.94, p=0.001$). Participants who had the longest follow-up time were 2 and 3 years older than participants who had 24–60 and 12–24 months since their surgery, respectively. The percentage of patients with gastric bypass surgery increased across the follow-up groups ($\chi^2=93.65, p<0.001$): of participants who had 12–24, 24–60, and >60 months since surgery, 50%, 72%, and 97% had undergone a gastric bypass, respectively.

The presurgery BMI was highest among participants who had had the longest time since their surgery (>60 months) when compared with participants who had 24–60 (Fisher's LSD correction, $p<0.001$) and 12–24 (Fisher's LSD correction, $p=0.013$) months since their surgeries. The presurgery BMI levels were 48.4, 47.8, and 51.0 kg/m² for the three follow-up groups (12–24, 24–60, and >60 months, respectively). Similarly the %EBL was significantly different across the follow-up groups ($F=8.6, p<0.001$). Participants who had had their surgery >60 months before had the lowest %EBL of 59.6%, which was significantly lower than among participants with 12–24 (Fisher's LSD correction, $p=0.033$) or 24–60 (Fisher's LSD correction, $p<0.001$) months since their surgery. Correspondingly, the percentage of participants who had lost $\geq 50\%$ of their excess weight differed by follow-up time since surgery ($\chi^2=6.1, p=0.046$). The percentage of weight regainers ($\chi^2=147.6, p<0.001$) and the mean weight regain ($F=112.3, p<0.001$) were significantly different across the follow-up groups: an increase of $\geq 15\%$ was experienced by 2 (2%), 52 (30%), and 144 (71%) participants in the three follow-up groups, and the groups' means were 2.8%, 10.6%, and 23.8%, respectively. Despite the largest weight regain among participants with >60 months since their surgery, the majority (64%) of them had lost at least 50% of their excess weight.

TABLE 1. SOCIODEMOGRAPHIC BACKGROUND AND WEIGHT-RELATED VARIABLES OF PATIENTS WITH 12–24, 24–60, AND >60 MONTHS SINCE THEIR SURGERY

	12–24 months since surgery, n = 101	24–60 months since surgery, n = 172	>60 months since surgery, n = 202	p-value for group differences
Gender, female, n (%)	95 (94%)	162 (94%)	196 (97%)	$\chi^2=2.19, p=0.333$
Age, years, ^a mean (SD)	51.3 (10.4)	52.4 (9.2)	55.0 (7.9)	$F=6.94, p=0.001$
Race, n (%)				$\chi^2=5.186, p=0.520$
Caucasian	88 (92%)	143 (87%)	172 (88%)	
African American	5 (5%)	10 (6%)	16 (8%)	
Hispanic	2 (2%)	10 (6%)	5 (3%)	
Other	1 (1%)	2 (1%)	3 (1%)	
Married or in a committed relationship, n (%)	75 (75%)	116 (67%)	154 (76%)	$\chi^2=3.94, p=0.139$
Education, n (%)				$\chi^2=9.52, p=0.146$
High school or less	17 (17%)	33 (19%)	20 (10%)	
Some college	26 (26%)	55 (32%)	72 (36%)	
College graduate	42 (42%)	59 (34%)	74 (36%)	
Graduate degree	15 (15%)	25 (15%)	36 (18%)	
Type of surgery, n (%)				$\chi^2=93.65, p<0.001$
Gastric bypass	50 (50%)	123 (72%)	196 (97%)	
Presurgery BMI, kg/m ²	48.4 (8.4)	47.8 (7.6)	51.0 (9.6)	$F=7.11, p=0.001$
Current BMI, kg/m ² , mean (SD)	33.6 (7.7)	32.3 (6.8)	36.2 (8.6)	$F=12.3, p<0.001$
Percentage excess BMI loss, %, mean (SD)	66.3 (25.6)	70.5 (25.4)	59.6 (25.5)	$F=8.60, p<0.001$
Excess BMI loss $\geq 50\%$, n (%)	74 (73%)	130 (76%)	130 (64%)	$\chi^2=6.14, p=0.046$
Weight regain from nadir weight, %, mean (SD)	2.8 (5.6)	10.6 (10.4)	23.8 (15.7)	$F=112.29, p<0.001$
Regained 15% or more from nadir weight, n (%)	2 (2%)	52 (30%)	144 (71%)	$\chi^2=147.6, p<0.001$

^adata missing from seven participants.

BMI, body mass index; SD, standard deviation.

Change in enjoyment of healthy behaviors

Of the 475 participants, 299 (63%), 162 (34%), and 14 (3%) reported that they enjoyed healthy foods *more/the same/less*, respectively. Some 217 (46%), 223 (47%), and 34 (7%) participants reported that they enjoyed exercising *more/the same/less*. Two (0.5%), 22 (4.5%), and 450 (95%) participants reported that they enjoyed overeating *more/the same/less*. Nineteen (4%), 140 (30%), and 315 (66%) reported that they enjoyed junk food *more/the same/less*. Participants who responded “more” to questions related to healthy foods and exercising were compared to the participants who responded “the same” or “less.” Correspondingly, participants who responded “less” to questions related to overeating and junk food were compared to participants who responded “the same” or “more” due to the small sample sizes in the latter categories.

Follow-up time since surgery was not related to shifts in enjoyment of eating behaviors, that is, increased enjoyment of eating healthy foods ($\chi^2=0.298$, $p=0.861$) or reduced enjoyment of eating junk food ($\chi^2=1.09$, $p=0.580$) or overeating ($\chi^2=4.76$, $p=0.093$). Participants with a longer follow-up period since surgery were less likely to report increased enjoyment of exercise ($\chi^2=13.3$, $p=0.001$). Of participants who had had their surgery >60 months previously, 73 (36%) reported they enjoyed exercise more, whereas participants with 24–60 and 12–24 months since their surgeries, 94 (55%) and 50 (50%) enjoyed exercising more, respectively.

Weight loss success and change in enjoyment of healthy behaviors

Increased enjoyment of eating healthy foods ($\chi^2=20.5$, $p<0.001$) and exercise ($\chi^2=21.8$, $p<0.001$) and decreased enjoyment of eating junk food ($\chi^2=12.6$, $p<0.001$) were associated with %EBL $\geq 50\%$. Of the participants who experienced successful and unsuccessful weight loss, 232 (70%) and 67 (48%) experienced an increase in their enjoyment of eating healthy foods, 176 (53%) and 41 (29%) enjoyed exercising more, 238 (72%) and 77 (55%) enjoyed eating junk food less, and 320 (96%) and 130 (93%) had decreased enjoyment of overeating. There was no difference in the shift in enjoyment of overeating among participants who experienced successful and unsuccessful weight loss ($\chi^2=1.8$, $p=0.181$).

Table 2 shows shifts in enjoyment of eating behaviors and exercise among participants who experienced successful versus unsuccessful weight loss across the different follow-up groups. Among participants who were 12–24 months since surgery, experiencing increased enjoyment of eating healthy foods did not differ between those with successful versus unsuccessful weight loss outcomes (OR_{adj}=1.33, 95% CI: 0.45–3.90). However, among participants whose surgery had taken place 24 months or more previously, those who reported increased enjoyment of eating healthy foods showed significantly increased odds for weight loss success. Specifically, for the 24–60-month follow-up group, the OR_{adj} was 2.81 (95% CI: 1.33–5.96), and for the >60-month follow-up group, the OR_{adj} was 3.02 (95% CI: 1.61–5.65).

Similarly, increased enjoyment of exercise was associated with weight loss success in participants who had 24–60 months (OR_{adj}=2.270, 95% CI: 1.070–4.817) or >60 months

(OR_{adj}=3.22, 95% CI: 1.58–6.58) since surgery, but not among participants who had had their surgery 12–24 months previously (OR_{adj}=2.60, 95% CI: 0.88–7.66).

Weight loss success was associated with decreased enjoyment of eating junk food only among participants who had 24–60 months since their surgery, OR_{adj}=2.33 (95% CI: 1.11–4.90). Among participants who had the least amount of time since surgery (12–24 months), the unadjusted OR indicated significant association; however, the OR decreased markedly after adjusting for sex, age, type of surgery, and BMI before surgery, such that the 95% CI and corresponding p -values indicated a nonsignificant association between weight loss success and consumption of junk food (OR_{adj}=2.07, 95% CI: 0.71–6.05).

Decreased enjoyment of overeating was not associated with weight loss success in any of the follow-up groups: the OR_{adj} were 5.17 (95% CI: 0.27–98.82), 0.48 (95% CI: 0.05–4.27), 1.64 (95% CI: 0.54–4.93) for the 12–24, 24–60 and >60 months follow-up groups, respectively. It is notable that only a few participants reported enjoying overeating the same/more, which resulted in wide CIs.

Obtaining external support and change in enjoyment of healthy behaviors

One hundred seventy-eight (38%) participants reported obtaining postbariatric support at some point since surgery, including meetings with at least one of the following: a nutritionist, a therapist/counselor, a bariatric coach, or a fitness coach/personal trainer. Seventy-eight participants (16%) met with a fitness coach or personal trainer, 66 (14%) met with a nutritionist, 58 (12%) met with a bariatric coach, and 53 (11%) met with a therapist or counselor to deal with weight- or eating-related issues. Follow-up time since surgery was not associated with the rate of obtaining support ($\chi^2=2.13$, $p=0.345$). Of participants with 12–24, 24–60, and >60 months since their surgery, 43 (43%), 66 (38%), and 69 (34%), respectively, obtained support.

Table 3 shows the association between obtaining support and enjoyment of healthy behaviors across the three follow-up groups. Among participants who had had their surgery 12–24 months previously, obtaining support was not associated with enjoying healthy food more (OR=1.03, 95% CI: 0.46–2.33), enjoying exercise more (OR=1.32, 95% CI: 0.60–2.91), or enjoying overeating less (43% vs. 0%). The only significant association in this follow-up group was between obtaining support and reduced enjoyment of eating junk food (OR=4.82, 95% CI: 1.76–13.21). Among participants who had had their surgery 24–60 months earlier, obtaining support was associated with increased enjoyment of exercise (OR=2.24, 95% CI: 1.18–4.24). Among participants who had 60 or more months since the surgery, obtaining support was associated with increased enjoyment of eating healthy foods (OR=3.99, 95% CI: 2.00–7.99), exercise (OR=3.75, 95% CI: 2.03–6.93), and reduced enjoyment of eating junk food (OR=2.23, 95% CI: 1.17–4.25).

Regardless of time since surgery, obtaining support was associated with a greater likelihood of successful weight loss; OR=1.96 (95% CI: 1.27–3.01, $p=0.002$). Of the participants who had successful or unsuccessful weight loss outcomes, 140 (42%) and 38 (27%) reported obtaining support.

TABLE 2. ASSOCIATIONS BETWEEN WEIGHT LOSS SUCCESS AND CHANGES IN ENJOYMENT OF EATING BEHAVIORS AND EXERCISE ACROSS FOLLOW-UP TIMES SINCE SURGERY

	12-24 Months since surgery			24-60 Months since surgery			>60 Months since surgery				
	Successful weight loss ^a , n=74	OR (95% CI) p	OR _{adj} ^c (95% CI) p	Successful weight loss ^a , n=130	Unsuccessful weight loss ^b , n=42	OR (95% CI) p	OR _{adj} ^c (95% CI) p	Successful weight loss ^a , n=130	Unsuccessful weight loss ^b , n=72	OR (95% CI) p	OR _{adj} ^c (95% CI) p
Enjoy eating healthy foods											
More	47 (64%)	OR = 1.20 (0.49-2.95) p = 0.696	OR _{adj} = 1.33 (0.45-3.90) p = 0.608	92 (71%)	19 (45%)	OR = 2.93 (1.43-5.99) p = 0.003	OR _{adj} = 2.81 (1.33-5.96) p = 0.007	93 (72%)	32 (44%)	OR = 3.14 (1.72-5.73) p < 0.001	OR _{adj} = 3.02 (1.61-5.65) p < 0.001
The same/less	27 (36%)			38 (29%)	23 (55%)			37 (28%)	40 (56%)		
Enjoy exercise											
More	40 (54%)	OR = 2.00 (0.81-4.94) p = 0.133	OR _{adj} = 2.60 (0.88-7.66) p = 0.083	76 (59%)	18 (43%)	OR = 1.88 (0.93-3.79) p = 0.080	OR _{adj} = 2.27 (1.07-4.82) p = 0.033	60 (46%)	13 (18%)	OR = 3.82 (1.91-7.65) p < 0.001	OR _{adj} = 3.22 (1.58-6.58) p = 0.001
The same/less	34 (46%)			54 (41%)	24 (57%)			70 (54%)	58 (82%)		
Enjoy eating junk food											
Less	55 (75%)	OR = 2.84 (1.13-7.15) p = 0.027	OR _{adj} = 2.07 (0.71-6.05) p = 0.183	95 (73%)	22 (52%)	OR = 2.47 (1.20-5.06) p = 0.014	OR _{adj} = 2.33 (1.11-4.90) p = 0.025	88 (68%)	41 (57%)	OR = 1.58, (0.88-2.87) p = 0.129	OR _{adj} = 1.52 (0.82-2.81) p = 0.187
The same/more	18 (25%)			35 (27%)	20 (48%)			42 (32%)	31 (43%)		
Enjoy overeating											
Less	73 (99%)	OR = 2.81 (0.17-46.53) p = 0.471	OR _{adj} = 5.17 (0.27-98.82) p = 0.275	124 (95%)	41 (98%)	OR = 0.504 (0.06-4.31) p = 0.532	OR _{adj} = 0.48 (0.05-4.27) p = 0.510	123 (95%)	63 (89%)	OR = 2.23, (0.77-6.43) p = 0.137	OR _{adj} = 1.64 (0.54-4.93) p = 0.381
The same/more	1 (1%)			6 (5%)	1 (2%)			7 (5%)	8 (11%)		

^a%EBL ≥50.

^b%EBL <50.

^cAdjusted for sex, age, presurgery BMI, and type of the surgery.

CI, confidence interval; %EBL, percentage of excess BMI loss; OR, odds ratio.

TABLE 3. ASSOCIATIONS BETWEEN ENJOYMENT OF EATING BEHAVIORS AND EXERCISE AND OBTAINING EXTERNAL SUPPORT ACROSS THREE FOLLOW-UP TIMES SINCE SURGERY

	Enjoy eating healthy foods			Enjoy exercise			Enjoy eating junk food			Enjoy overeating		
	More	The same/less	OR (95% CI) p	More	The same/less	OR (95% CI) p	Less	The same/more	OR (95% CI) p	Less	The same/more	OR (95% CI) p
12–24 Months since surgery	27 (43%)	16 (42%)	OR=1.03 (0.46–2.33) p=0.941	23 (46%)	20 (39%)	OR=1.32 (0.60–2.91) p=0.491	37 (54%)	6 (19%)	OR=4.82 (1.76–13.21) p=0.002	43 (43%)	0	**
Obtaining external support	47 (42%)	19 (31%)	OR=1.62 (0.84–3.14) p=0.150	44 (47%)	22 (28%)	OR=2.24 (1.18–4.24) p=0.013	46 (39%)	20 (36%)	OR=1.13 (0.58–2.20) p=0.710	64 (39%)	2 (29%)	OR=1.58 (0.30–8.41) p=0.589
24–60 Months since surgery	56 (45%)	13 (17%)	OR=3.99 (2.00–7.99) p<0.001	39 (53%)	30 (23%)	OR=3.75 (2.03–6.93) p<0.001	52 (40%)	17 (23%)	OR=2.23 (1.17–4.25) p=0.015	65 (35%)	4 (27%)	OR=1.48 (0.45–4.82) p=0.518
Obtaining external support												

**indeterminate odds ratio (zero cases in one group).

Discussion

This research investigated whether bariatric patients experience changes in their enjoyment of healthy behaviors after having bariatric surgery, and whether these changes correlate with weight loss success. Enjoyment of healthy behaviors (e.g., enjoying eating healthy foods or junk food, and enjoying exercising) was associated with weight loss success only after participants were at least 24 months past their surgery. Although participants who had surgery less than 24 months previously did lose significant amounts of weight, increased enjoyment of eating healthy foods, exercising, and reduced enjoyment of eating junk food were associated only with longer term weight loss success (i.e., found in participants whose surgery had taken place at least 2 years beforehand). Furthermore, those who obtained external support were significantly more likely to report increased enjoyment of engaging in healthy behaviors when they had undergone surgery at least 2 years and especially at least 5 years beforehand.

The percentage of participants who experienced significant weight regain ($\geq 15\%$) were 2%, 30%, and 71% in the three follow-up groups (12–24, 24–60, >60 months since their surgeries). However, despite the regain, the current BMI levels remained clearly lower than before the surgery. While the presurgery BMI for the entire sample was 49.3 kg/m², participants >60 months from surgery had the highest post-surgery BMIs, 36.2 kg/m², participants with the least amount of time since surgery (12–24 months) had BMIs of 33.6 kg/m², and participants 24–60 months since surgery had BMIs of 32.3 kg/m². Such findings demonstrate that while bariatric patients do show increasing weight trends over time, weight losses remain substantial, even after 5 years.

Perhaps unsurprisingly, the majority of the participants, regardless of follow-up time since surgery, reported that they enjoyed healthy behaviors more than they did before surgery. However, it was only after 2 years that greater enjoyment of healthy behaviors appeared to be associated with weight loss success. Among participants whose follow-up time since surgery was the shortest (12–24 months), changes in enjoyment of healthy behaviors did not show correlation with weight loss success. In other words, although these participants had lost a significant amount of weight, it may be that experiencing greater enjoyment in health-promoting behaviors that further promote weight loss did not play a role in achieving the weight loss. It is likely that participants soon after surgery do not need to enjoy their new behavioral patterns to adhere to them, since returning to old eating patterns is much more anatomically difficult and painful. Research confirms that almost all participants who undergo bariatric surgery experience rapid weight loss during the first 2 years.^{8,21}

Consistent with findings on weight loss success, seeking external support did not correlate with increased enjoyment of healthy behaviors among patients who had less than 2 years since their surgeries. In fact, the effect was strongest only among patients who had 5 or more years since their surgery. This is in line with previous findings highlighting the importance of external support in promoting dietary changes and compliance to them.^{12,22} External support, in the form of individual support from therapists, nutritionists, and personal trainers, appears to provide an especially important channel for patients by reinforcing their healthier habits and

providing tools for sustained behavioral changes. In this study, those who sought external support were almost two times more likely to achieve successful weight loss outcomes. The findings imply that external support over the longer term could play a role in helping one learn to experience increased enjoyment from health-promoting behaviors.

Besides caloric malabsorption and the reduced volume of their stomachs, bariatric patients experience alterations in taste perceptions that may promote the adoption and adherence to healthy behaviors. However, somewhat surprisingly, postbariatric changes in taste perceptions and eating behaviors have not been found to correlate with weight loss.^{23,24} The findings from the present study may help to explain this. For example, the studies that lacked correlations between changes in taste perception and weight loss success included patients with relatively short postsurgery follow-up times, such as 6 and 15 months postsurgery,^{23,24} a period wherein the majority of bariatric patients experience substantial weight loss. Just as the current study only demonstrated correlation between increased enjoyment of healthy behavior and weight loss at least 2 or more years after surgery, the effect of taste alteration might only become evident when examining its effect on longer term weight loss. Indeed, Schultes *et al.*²⁵ did show a correlation, although a very small one, between excess BMI loss and an individual's motivation to consume palatable foods among patients whose average time since surgery was 23 months.

Limitations

Our findings should be interpreted within the context of certain limitations. First, the study is cross-sectional, which prevents drawing any causal conclusions about the effect of perceived enjoyment of healthy behaviors on weight loss success. For instance, the observed association between enjoyment of eating healthy foods and exercise may indicate that those who learn to enjoy healthy behaviors are more likely to adhere to their new lifestyle and succeed in long-term weight loss maintenance. On the contrary, the findings could also indicate that individuals who are successful at weight loss find healthy behaviors more reinforcing because they experience the results of weight loss and maintenance—thus influencing their enjoyment of healthy behaviors. Second the enjoyment questions were created for this study and hence no information is available regarding their psychometric properties. Single-item questions are known, however, for low reliability. At the time the survey was developed, we were not aware of any validated instrument assessing changes in enjoyment within a bariatric population. Furthermore, shifts in enjoyment were asked after surgery, rather than being assessed before and after surgery, hence, increasing the risk for recall bias. Third, all measures were self-reported. Self-reported measures are subject to positive bias due to the tendency to provide socially desirable answers. They also increase the likelihood that weight losses were overestimated. However, the overall rates of weight loss and weight regain found in this study were similar to those reported in other studies. Fourth, the population was a self-selected group and was thus unlikely to be representative of the entire bariatric patient population. For example, the majority of participants in this study were Caucasian women,

which limits the study's generalizability to the general population undergoing bariatric surgery.

Conclusions

In the bariatric population, learning and adopting new healthy behaviors, especially learning to enjoy them, may not coincide with improved weight loss outcomes before 2 years have passed since surgery. Experiencing increased enjoyment of eating healthy foods and exercising seems to play a major role in long-term weight loss maintenance, and the role of enjoying healthy behaviors should not be underestimated. This is not surprising, as pleasure is one of the most influential determinants behind our dietary choices. Our results also demonstrate the potentially important role of obtaining external support in reinforcing healthy behavioral changes, as those who reported obtaining support at least 2 years and especially 5 years after surgery were more likely to report increased enjoyment of healthy foods and exercise.

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Author Disclosure Statements

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