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Review article

Does weight loss immediately before bariatric surgery improve outcomes: a systematic review

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Abstract

Background: Preoperative weight loss before bariatric surgery has been proposed as a predictive factor for improved patient compliance and the degree of excess weight loss achieved after surgery. In the present study, we sought to determine the effect of preoperative weight loss on postoperative outcomes.

Methods: A search of MEDLINE was completed to identify the patient factors associated with weight loss after bariatric surgery. Of the 909 screened reports, 15 had reported on preoperative weight loss and the degree of postoperative weight loss achieved. A meta-analysis was performed that compared the postoperative weight loss and perioperative outcomes in patients who had lost weight preoperatively compared to those who had not.

Results: Of the 15 articles (n = 3404 patients) identified, 5 found a positive effect of preoperative weight loss on postoperative weight loss, 2 found a positive short-term effect that was not sustained long term, 5 did not find an effect difference, and 1 found a negative effect. A meta-analysis revealed a significant increase in the 1-year postoperative weight loss (mean difference of 5% EWL, 95% confidence interval 2.68–7.32) for patients who had lost weight preoperatively. A meta-analysis of other outcomes revealed a decreased operative time for patients who had lost weight preoperatively (mean difference 23.3 minutes, 95% confidence interval 13.8–32.8).

Conclusion: Preoperative weight loss before bariatric surgery appears to be associated with greater weight loss postoperatively and might help to identify patients who would have better compliance after surgery. (Surg Obes Relat Dis 2009;5:713–721.)

Keywords: Bariatric surgery; Predictors; Weight loss; Preoperative weight loss; Outcomes

Obesity has increased rapidly in the United States, with a current estimate of >30% of adults with a body mass index (BMI) >30 kg/m^2 [1]. Morbid obesity, generally defined as a BMI >40 kg/m^2, is associated with increased mortality [2]. Surgical intervention has emerged as the most effective method of ensuring significant and sustained weight loss for the morbidly obese, with the added benefits of improving co-morbidities and quality of life [3].

The mortality after bariatric surgery has been quite low, with a <1% incidence of perioperative death [4]. As with any surgical procedure, patient selection is critical for minimizing risks and to optimize outcomes. The risk factors for death include male gender, super obesity (BMI ≥50 kg/m^2), and diabetes [5,6]. The failure of weight loss after surgery is likely multifactorial and involves psychological differences, eating disorders, and support systems [7,8].

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Preoperative weight loss is postulated to help assess patient compliance and assist with patient selection. Requiring preoperative weight loss might identify patients who will comply better with the dietary restrictions after surgery and might decrease the operative risks. Insurance companies have been requiring documentation of previous weight loss efforts within the past year as an eligibility criterion for surgery. However, the present review studied the 10–20-lb weight loss that some surgeons have mandated or requested of patients before proceeding with surgery. Losing weight in the weeks before surgery appears to decrease liver size, which in turn might lead to shorter operative times, less blood loss, a lower rate of conversion from laparoscopic to open procedures, and fewer perioperative complications [9]. Because a preoperative weight loss requirement in the period immediately preceding surgery might potentially exclude some patients who would or refuse to lose weight, it is critical to evaluate the evidence on whether preoperative weight loss leads to improved outcomes.

The present systematic review has analyzed the evidence of whether preoperative weight loss in bariatric patients in the weeks preceding surgery is associated with the degree of postoperative weight loss. Additional perioperative outcomes regarding operative complexity and morbidity were also analyzed (i.e., blood loss, operative time, length of stay, and complications).

Methods

Study identification and selection

The present study was a part of a larger systematic review examining the patient factors related to postoperative weight loss after bariatric surgery. A MEDLINE search to identify studies of preoperative weight loss (January 1, 1988 to January 9, 2009) was conducted using the search terms "bariatric surgery" [Mesh:NoExp] or "weight loss surgery" or "obesity surgery" or "weight reduction surgery" or "biliopancreatic diversion" [Mesh] or "laparoscopic band" or "lap and" or "gastric band" or "gastric bypass" [Mesh] or "Gastroplasty"[Mesh] or "gastric sleeve" or "sleeve gastrectomy") and "Obesity" [Mesh] and ("preoperative weight loss" or "pre-operative weight loss" or "preoperative weight" or "pre-operative weight").

Each report was evaluated with a standardized screener. The selection criteria included studies published in English with patients >18 years old (studies with patients both >18 and <18 years old were accepted) who had undergone bariatric surgery (i.e., open or laparoscopic gastric bypass, laparoscopic gastric banding, biliopancreatic diversion, vertical banded gastroplasty, or gastric sleeve). We manually searched the reference lists of the screened studies to identify additional publications. Accepted study designs included case series/cohort, case control, and randomized control trials; studies with a sample size of <10 patients were excluded. Studies that did not report the preoperative and postoperative weight loss were excluded.

Data extraction

The data abstracted from each study included the study design, type of operation, baseline patient demographics, number of patients, criteria for preoperative weight loss, and postoperative outcomes (i.e., weight loss, operative time, estimated blood loss, length of stay, and complications).

Quality rating

The methodologic quality of the included studies was evaluated by rating the major sources of potential bias in the prognostic reviews. These consisted of study participation and attrition, prognostic factor and outcome measurement, accounting for confounders, and analysis [10]. Each criterion had multiple components, and compliance was rated as yes, partly, no, or unsure. For each major category, we identified the components most relevant to bariatric surgery research and assessed whether each was met for the individual study. For study participation, we required an adequate description of patient sampling and recruitment, sufficient participation by the eligible patients, and a description of the inclusion and exclusion criteria. In the study attrition category, a 50% response rate at 12 months was required. The prognostic factor measurement was fulfilled if the patients' preoperative weight had been assessed through an office visit rather than by self-report or if the method was not stated. Studies receiving a "no" for ≥2 criteria were considered low quality. Studies receiving a "no" for ≤1 criteria were rated as high quality. We use only the studies rated as high for the meta-analysis and took this quality assessment into account when drawing our overall conclusions.

Meta-analysis

A meta-analysis was performed to assess the combined effect of preoperative weight loss on the 12-month postoperative percentage of excess weight loss (%EWL) for the high-quality studies. Similarly, meta-analyses for preoperative weight loss with the other outcomes of interest (e.g., length of stay and operative time) were performed. The mean difference method in Revman, version 5.0.17 (The Nordic Cochrane Centre TCC, Copenhagen, Denmark), was used [11]. A random effects model was used to calculate the mean differences, 95% confidence intervals (CIs) for each comparison, the combined overall effect with P value, and the P value for testing heterogeneity ($P < .1$ was considered significant). When the standard deviation was not available, which was the case for 3 preoperative weight loss studies, it was estimated using the mean standard deviation from the other studies.

Results

Description of selected studies

A total of 909 studies were identified that had assessed the relationship of ≥1 patient factors with the degree of postoperative weight loss (Appendix 1). Of these, 15 studies reported on the preoperative weight loss in the period immediately preceding surgery and included 3403 patients, with a mean age of 33–50 years and a mean follow-up time of 6–48 months. All studies had mostly female patients, except for the Veterans Affairs study [12]. The baseline body mass index (BMI) was 43–58 kg/m^2 (Table 1).

One study was a randomized control trial comparing patients with a 10% preoperative total body weight loss with those with no weight loss requirement [13]. Four studies were prospective cohorts, one compared patients who had lost ≥7.5 kg preoperatively with those who had no preoperative weight loss [14]. Another study, by Ray et al. [15], evaluated patients who had previously achieved a certain weight loss cutoff by any preoperative dieting attempt compared with a no-weight loss group. Still et al. [16] and Alger-Mayer et al. [17] separated patients into multiple categories according to the degree of the percentage of preoperative weight loss or gain. The remaining 10 studies were retrospective studies that compared a weight loss group defined by a certain amount or percentage of preoperative weight loss with a no-weight loss group [12,18] or a weight gain group [19,20]. Several studies separated patients into ≥3 groups according to the amount of preoperative weight loss [21,22]. Jantz et al. [23] studied the number of previous weight loss attempts for a correlation with postoperative weight loss. Taylor et al. [24] examined patients who had gained ≥2.5% of their body weight preoperatively versus those who had either stayed at the same weight or had lost weight, and Alvarado et al. [25] and Carlin et al. [26] did not separate patients into groups.

Postoperative weight loss: systematic review

All identified studies had postoperative weight loss as their primary outcome. About one third of the studies specified that the weight was measured at office visits [13,19,21,24]. Ray et al. [15] relied on self-reporting, and the rest did not specify the method of measurement. The length of follow-up varied from 6 to 48 months. Weight loss was generally reported as the %EWL, with 3 studies using the weight at the initial presentation as the baseline, and the remainder using the immediate preoperative weight.

Several studies found a short-term benefit for preoperative weight loss in bariatric surgery patients (Table 2). Mrad et al. [22] found that preoperative weight loss correlated with postoperative weight loss in men but not in women. A significant short-term correlation was found at 3 months ($r = -.18$, $P = .04$), but this effect had disappeared by 12 months. Alami et al. [13] also found significantly greater weight loss in the preoperative weight loss group at 3

Table 1
Baseline characteristics of studies included in review

Investigator	Study design	Operation type	Patients	Mean age (yr)	Women (%)	Baseline BMI
Alvarado et al. [25], 2005	Retrospective cohort	LRYGB	90	42	90	48.1
Alami et al. [13], 2007	Randomized control trial	LRYGB	35	44.9 ± 7.8	83.6	49.3 ± 6.4
			26	42.4 ± 10.5		48.7 ± 6.6
Ali et al. [21], 2007	Retrospective cohort	LRYGB	351	42.7	92	46.7
Harnisch et al. [19], 2008	Retrospective cohort	LRYGB	115	41.4	84.7	NA*
			88	44		
Carlin et al. [26], 2008	Retrospective cohort	LRYGB	295	45 ± 10	89.0	51 ± 7
Jantz et al. [23], 2008	Retrospective cohort	LRYGB	384	43.3 ± 9.3	82.6	48.0 ± 5.9
Riess et al. [18], 2008	Retrospective cohort	LRYGB	279	42.7 ± 9.5	70	47.0 ± 5.7
			74	43.3 ± 9.2		54.2 ± 6.7
Martin et al. [14], 1995	Prospective cohort	ORYGB	53	38.8 ± 9.2	84	53.0 ± 7.2
			47	40.2 ± 8.3		58.4 ± 11.6
Huerta et al. [12], 2008	Retrospective cohort	ORYGB	25	50 ± 1.3	30	49 ± 1.0
			15			
Still et al. [16], 2007	Prospective cohort	ORYGB and LRYGB	884	45 ± 10	78	51.3 ± 8
Fujioka et al. [20], 2008	Retrospective cohort	ORYGB and LRYGB	121	48	83.0	49.2
Ray et al. [15], 2003	Prospective cohort	RYGB†	149	39 ± 10	81	52 ± 10
Alger-Mayer [17], 2008	Prospective cohort	RYGB†	150	45.3 ± 8.9	80	52.2 ± 9.8
Taylor et al. [24], 1995	Retrospective cohort	VBG	17	37	88.2	43.5 ± 5.18
			59	33		46.2 ± 5.53
Mrad et al. [22], 2008	Retrospective cohort	VBG, RYGB, LAGB	146	39.5	84.2	52.6

BMI = body mass index; LRYGB = laparoscopic Roux-en-Y gastric bypass; ORYGB = open RYGB; VBG = vertical banded gastroplasty.
Data presented as mean ± standard deviation.
Columns with 2 rows of data include data for no-weight loss group and weight loss group, respectively.
* No baseline BMI recorded, baseline weight (lb) for weight gain and weight loss groups was 321.4 and 312.2, respectively.
† Not stated whether laparoscopic or open technique used.

Table 2
Effect of preoperative weight loss on postoperative weight loss

Investigator	Follow-up (mo)	Group	Weight loss as %EWL or %TWL		Effect	Quality rating
			From initial presentation	From immediately preoperative		
Alvarado et al. [25], 2005	12	All patients	—	74.4% EWL	Positive	High
Still et al. [16], 2007	12	>5% EBMIG	—	28%*	Positive	High
		0–5% EBMIG		38%		
		0–5% EBMIL		38%		
		5–10% EBMIL		40%		
		>10% EBMIL		59%†		
Alger-Mayer et al. [17], 2008	36	WG or no WL	—	49.4% ± 23.9% EWL	Positive	High
		0–5% TWL		47.6% ± 22.1%		
		5–10% TWL		56.2% ± 19.0%		
		10–15% TWL		54.8% ± 22.6%		
		15–25% TWL		60.4% ± 14.3%		
		≥25% TWL		61.4% ± 16.6%		
Harnisch et al. [19], 2008	12	WG ≥10 lb (5.45%)‡	60% EWL	63.5% EWL	Positive	High
		WL ≥10 lb (5.41%)	67.2†	63.9%		
Mrad et al. [22], 2008	12	>2% TWL	F 36%; male 38% TWL§	—	Positive	High
		No weight change	F 34%; M 29%			
		>2% total WG	F 36%; M 13%‖			
Alami et al. [13], 2007	3	No WL	—	50.9% EWL	Positive/ Negative	High
		10% EWL		53.9%		
Ali et al. [16], 2007	6	No weight change	57.9% EWL	—	Positive/ Negative	High
		<5% EWL	60.2%			
		5–10% EWL	61.2%			
		>10% EWL	69.5%¶			
Martin et al. [14], 1995	48	No WL	—	"No difference"	Inconclusive	High
		≥7.5-kg WL				
Carlin et al. [26], 2008	12	BMI <50 (5–lb WL)	73 ± 15 vs 71 ± 17 %EWL¶	70 ± 16 vs 70 ± 17¶	Inconclusive	High
		BMI 50–60 (5% WL‡)	67 ± 11 vs 64 ± 13	63 ± 1 vs 61 ± 3		
		BMI ≥60 (10% WL)	65 ± 14 vs 53 ± 9	58 ± 17 vs 47 ± 9		
Fujioka et al. [20], 2008	12	WG >0 lb (mean 2.6%‡)	—	60% EWL§	Inconclusive	Low
		WL >0 lb (mean 3.9%)		58		
Huerta et al. [12], 2008	24	No TWL	—	57% EWL	Inconclusive	Low
		TWL (mean 8.3%)		62		
Taylor et al. [24], 1995	12	>2.5% EBMIG	—	32.8% ± 5.64% EBMIL	Inconclusive	Low
		<2.5% EBMIG		30.7% ± 5.21%		
Riess et al. [18], 2008	12	No WL (≤4.54 kg)	—	74% ± 15% EWL	Negative	Low
		WL (>4.54 kg)		66% ± 15%†		

%EWL = percentage of excess weight loss; %TWL = percentage of total weight loss; WL = weight loss; WG = weight gain; EBMIL = excess body mass index loss; EBMIG = excess body mass index gain.
* Patients who achieved 70% EWL.
† P <.001.
‡ %TWL.
§ Abstracted from graph.
¶ Weight loss goal met vs not met.
‖ Male (M), P <0.05; female (F), P = NS.

months (%EWL 33.1% versus 44.1%, P <.05), with a trend sustaining this effect at 6 months (Table 2).

A positive effect of preoperative weight loss was shown in several studies. Harnisch et al. [19] found significantly greater weight loss at 12 months in patients who had lost weight preoperatively, starting from the weight at initial presentation, although by 24 months, this was only a trend (%EWL 63.4% versus 67.7%, P = .25). Still et al. [16] reported that patients with >10% preoperative weight loss were more likely to achieve 70% EWL at 12 months than were those with 0–5% preoperative weight loss (hazard ratio 2.12, 95% CI 1.5–3.01). Ray et al. [15] reported that patients with better success at weight loss attempts before surgery showed a trend toward improved results at 12 months (58% versus 63% EWL, P = .20). Alvarado et al. [25] showed that an increase of 1% in preoperative weight loss correlated with increase of 1.8% in the postoperative %EWL at 1 year (P <.05). Carlin et al. [26] found no correlation between the preoperative and postoperative %EWL at 12 months, controlling for initial BMI. In contrast, Riess et al. [18] found greater postoperative %EWL at 12 months in patients who had not lost weight preoperatively.

Several studies assessed the long-term weight loss outcomes past 12 months. Alger-Mayer et al. [17] found a positive correlation between the preoperative EWL and postoperative EWL at 3 years (r = .225, P = .006). Jantz et al. [23] also found no correlation at 1, 2, or 4 years (R^2 = .005), and Martin et al. [14] found no correlation at 48 months.

Quality assessment

Most of the studies were rated as high quality. Four studies failed to meet the minimal requirements in ≥2 criteria and were therefore categorized as low quality. Huerta et al. [12], Fujioka et al. [20], and Riess et al. [18] did not describe the method of weight assessment, and Taylor et al. [24] relied on self-reporting to determine the preoperative weight. Huerta et al. [12] also had a low response rate, and the other 3 studies had inadequately described the study attrition. The remaining 11 studies failed to meet only 1 quality criteria, because most either inadequately described how the weight loss was measured or had a poor/unclear response rate. These 11 studies were rated as high quality and were used for the meta-analyses.

Postoperative weight loss: meta-analysis

A meta-analysis of postoperative weight loss at 12 months assessed the effect of preoperative weight loss versus no weight loss (Fig. 1A). Low-quality studies and studies reporting the number of previous weight loss attempts rather than preoperative weight loss were excluded. The included studies reported postoperative weight loss measured from the initial encounter (not from surgery). Three studies included laparoscopic Roux-en-Y gastric bypass, and the fourth included open and laparoscopic Roux-en-Y gastric bypass, vertical banded gastroplasty, and laparoscopic adjustable gastric banding. The preoperative weight loss group overall had had a mean of 5% greater EWL (95% CI 2.7–7.3%). No significant heterogeneity was present (P = .46).

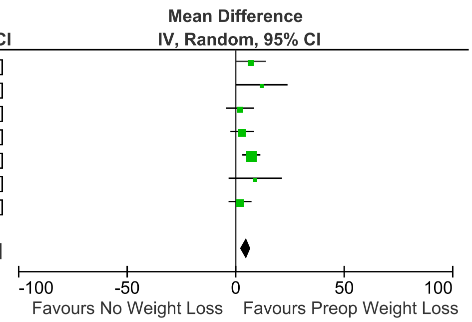
Operative outcomes and postoperative complications: systematic review and meta-analysis

Several studies reported the outcomes relating to operative complexity and complications (Table 3). Alami et al

A

Study or Subgroup	Preop Weight Loss Mean	SD	Total	No Preop Weight Loss Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Ali 2007	84	15	23	77	15	91	11.5%	7.00 [0.14, 13.86]
Carlin 2008	65	14	20	53	9	3	3.8%	12.00 [0.11, 23.89]
Carlin 2008	73	15	120	71	17	32	12.9%	2.00 [-4.47, 8.47]
Carlin 2008	67	11	94	64	13	26	18.0%	3.00 [-2.47, 8.47]
Harnisch 2008	67.2	15	88	60	15	115	31.1%	7.20 [3.04, 11.36]
Mrad 2008	38	15	12	29	15	11	3.6%	9.00 [-3.27, 21.27]
Mrad 2008	36	15	61	34	15	62	19.2%	2.00 [-3.30, 7.30]
Total (95% CI)			**418**			**340**	**100.0%**	**5.00 [2.68, 7.32]**

Heterogeneity: Tau² = 0.00; Chi² = 5.71, df = 6 (P = 0.46); I² = 0%
Test for overall effect: Z = 4.22 (P < 0.0001)



B

Study or Subgroup	Preop Weight Loss Mean	SD	Total	No Preop Weight Loss Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Alami 2007	220.2	31.5	26	257.6	27.8	35	22.6%	-37.40 [-52.61, -22.19]
Harnisch 2008	104.9	39.1	88	119.7	48.4	115	28.8%	-14.80 [-26.84, -2.76]
Huerta 2008	161.1	5.7	15	182.9	7.6	25	48.6%	-21.80 [-25.95, -17.65]
Total (95% CI)			**129**			**175**	**100.0%**	**-23.31 [-32.81, -13.80]**

Heterogeneity: Tau² = 43.91; Chi² = 5.32, df = 2 (P = 0.07); I² = 62%
Test for overall effect: Z = 4.81 (P < 0.00001)

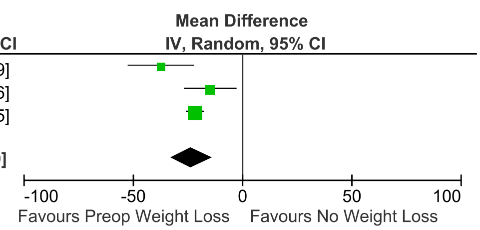


Fig. 1. (A) Meta-analyses of postoperative weight loss at 12 months for preoperative weight loss versus no preoperative weight loss groups. Forest plots of random effects meta-analyses of %EWL at 12 months, separately for preoperative weight loss versus no preoperative weight loss groups. Studies that reported EWL for separate groups (i.e., Carlin et al. [26] had 3 different groups according to initial BMI and Mrad et al. [22] had 2 different groups for men and women) were included separately with their respective weight loss and patient numbers. (B) Meta-analyses of operative time for preoperative weight loss versus no preoperative weight loss groups. Forest plots of random effects meta-analyses of operative time in minutes, separately for preoperative weight loss versus no preoperative weight loss groups.

Table 3
Effect of preoperative weight loss on other surgical outcomes

Investigator	Weight loss groups	Operative time (min)	LOS (d)	Overall complications (%)
Alami et al. [13], 2007	No WL	257.6 ± 27.8	3.1 ± 1.1	14.3%
	10% EWL	220.2 ± 31.5*	3.4 ± 1.6	23.1%
Harnisch et al. [19], 2008	WG ≥10 lb (5.45%)	119.7	—	11.3%
	WL ≥10 lb (5.41%)	104.9*		12.5%
Martin et al. [14], 1995	No WL	—	—	50.9%
	≥7.5-kg WL			40.4%
Alvarado [25], 2005	All patients	†	—	"No correlation"
Still et al. [16], 2007	>5% EBMIG	—	1.19‡	—
	0–5% EBMIG		1.06	
	0–5% EBMIL		1	
	5–10% EBMIL		0.44	
	>10% EBMIL		0.48*	
Huerta et al. [12], 2008	No TWL	182.9 (7.6)	5 (0.2)	16%
	TWL (mean 8.3%)	161.1 (5.7)*	4.3 (0.2)	20%
Fujioka et al. [20], 2008	WL >0 lb (mean 3.9%)	—	—	7%
	WG >0 lb (mean 2.6%)			10%
Riess et al. [18], 2008	No WL (≤4.54 kg)	137 (31)	2.3 (1.3)	—
	WL (>4.54 kg)	147 (32)*	2.2 (0.5)	

LOS = length of stay; other abbreviations as in Table 2.
* P <.05.
† Preoperative %EWL ≥5% correlated with decrease in operative time of 36.2 minutes (no P value reported).
‡ Adjusted odds ratio of LOS ≥4 days.

[13], Harnisch et al. [19], and Huerta et al. [12] all reported an operative time that was shorter by 15–35 minutes in the preoperative weight loss group, and Riess et al. [18] reported that patients in the weight loss group had a mean operative time that was longer by 10 minutes. Alvarado et al. [25] reported that a preoperative %EWL ≥5% correlated with an operative time that was shorter by 36.2 minutes. A meta-analysis of the operative times comparing the weight loss and no-weight loss groups was conducted using the only 3 high-quality studies that reported this finding, resulting in significant heterogeneity (P = .07; Fig. 1B). Overall, the mean operative time was 23 minutes (95% CI 13.8–2.8) shorter in the preoperative weight loss group.

A few studies reported on the length of stay after the initial bariatric procedure (Table 3). Only 2 high-quality studies reported this outcome, and neither found significant differences between the preoperative weight loss and no-weight loss groups. Therefore, pooling was not performed.

Several studies reported on the number or percentage of complications, but the definition and types of complications varied such that comparisons were difficult. The categories included bleeding, wound infection, anastomotic leak, need for reoperation during the initial hospitalization, and thromboembolic complications. Some studies also included late complications such as incisional hernia and marginal ulcers. None of the studies found significant differences between the groups, although several (Alami et al. [13], Harnisch et al. [19], and Huerta et al. [12]) reported trends indicating a greater number of complications in the patients who had lost weight preoperatively (Table 3).

Discussion

The topic of preoperative weight loss before bariatric surgery has garnered increasing attention. The present review examined the effect of acute weight loss immediately before surgery, rather than the insurance-mandated requirement for documenting previous weight loss attempts. This concept is controversial, in part because of questions of the safety of relatively rapid weight loss in an obese population before undergoing major surgery. The efficacy and justification of mandating patients to lose weight before bariatric surgery has also been challenged. The findings from the present review suggest that obese patients can lose 10% of their excess body weight in the weeks before undergoing surgery without significant perioperative risk. Several studies demonstrated a decreased operative time for patients who had lost weight preoperatively, although mostly this did not translate to a decreased length of stay or complication rate.

Overall, it appears that preoperative weight loss results in greater total postoperative weight loss, when studies of low quality were excluded. The study by Riess et al. [18] was the only study to demonstrate a negative effect of preoperative weight loss, although it was a lower quality study. One possible reason is that the patients in the study by Riess et al. [18] were directed into the weight loss or no-weight loss group according to the surgeon's perception of their amount of visceral and subcutaneous fat. This resulted in patients in the preoperative weight loss group who had had a greater initial BMI. As noted by Riess et al. [18], patients with greater excess weight will exhibit a lower %EWL. The study by Alami et al. [13] was the only study to randomize patients to a weight loss or no-weight loss group. They found a positive short-term effect for preoperative weight loss. Although randomized trials are generally of higher quality than cohort studies, an advantage might exist for recommending preoperative weight loss to all patients. This would result in a preoperative weight loss group that was self-selected and potentially more motivated and compliant, a strategy more relevant to real-life practice.

The recommendation of preoperative weight loss is of interest to surgeons owing to the potential of decreasing perioperative complications in such a high-risk patient group. Even a modest decrease of 10% of excess body weight will improve obstructive sleep apnea and decrease cardiovascular and thromboembolic complications, inflammation, and serum glucose concentrations [27,28]. In addition to the potential to improve global patient risk factors, preoperative weight loss also decreases intra-abdominal fat stores. The proposed mechanism involves shrinkage of visceral adiposity and intrahepatic fat [29]. Liu et al. [30] reported that patients who lost weight preoperatively were less likely to have an enlarged liver.

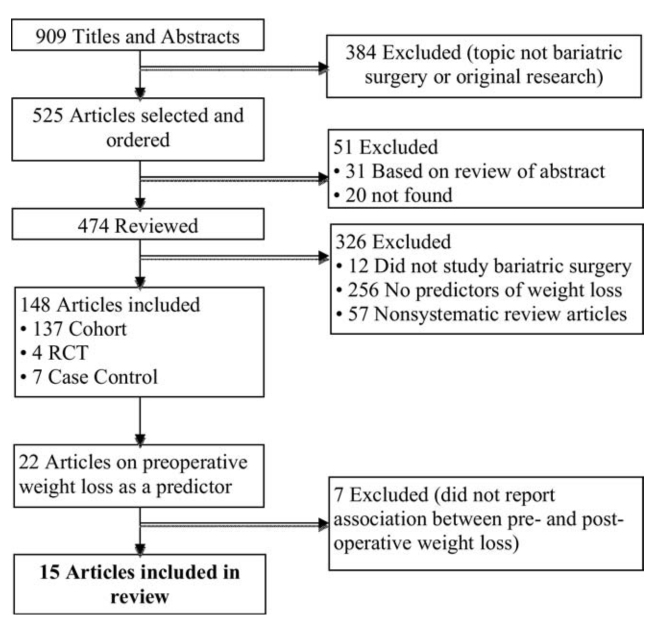
The methods of preoperative weight loss differed among the studies but generally included a nutritional component under the direction of a registered dietician and an exercise plan (Appendix 2). Several studies specified a low-calorie liquid diet, and most included dietary logs and nutritional education. Of the 5 studies demonstrating a positive effect of preoperative weight loss, 2 included an exercise component, 2 specified a calorie-restricted diet, and 1 mandated counseling from a registered dietician. A very-low-energy-diet instituted for 2–6 weeks before bariatric surgery has been shown to decrease the liver volume and visceral and subcutaneous adipose tissue in proportion to the reduction in body weight [31,32]. A successful program will likely contain both an exercise and nutritional component, with the latter providing specific dietary instructions and specialized counseling.

Our review had some limitations in large part because of the heterogeneity of the studies. Variations were present in how weight loss was defined, whether by the %EWL or percentage of the total weight or by the change in pounds or BMI, along with the methods to achieve the preoperative weight loss and whether this was mandatory. One challenge in pooling data was the difference in the preoperative weight value reported. Some studies defined it from the time of surgery, and others included weight loss after the initial consultation. The results were less likely to be positive if weight loss was calculated from the time of surgery. Although this might be a more precise measure, it could be misleading. If patients lose weight preoperatively and sustain that extra weight loss after surgery, in addition to the surgically induced component, that would be a significant benefit. Furthermore, the extra head start of losing 15 lb can motivate and enhance postoperative weight loss. The disparity in reporting complications (i.e., how they were defined and which ones were included) made it difficult to compare results.

The implications of our findings go beyond weight loss surgery to other abdominal operations. Longer operative times have been reported for obese patients undergoing cholecystectomy, unilateral mastectomy, and colectomy [33]. Patients undergoing laparoscopic colectomy for sigmoid colon cancer who have greater visceral fat as assessed by computed tomography have had longer operatives time and lengths of stay, as well as greater wound infection and overall complication rates [34]. Obese patients (BMI >31 kg/m^2) undergoing orthotopic liver transplant also have had a greater incidence of postoperative infectious and pulmonary and cardiovascular complications [35]. Additional studies are necessary to determine whether obese noncancer patients, who might be malnourished even if overweight, can safely lose weight before elective procedures and whether this benefits the surgical outcomes.

Preoperative weight loss immediately before bariatric surgery appears to improve the total postoperative weight loss and decrease the operative time. Mandating 10% EWL might enhance patient selection to identify those who will be most compliant with postoperative guidelines and those who might be less compliant and who need additional education or early interventions to assist with weight loss.

Appendix 1. Flow diagram of included and excluded studies for review.



Appendix 2
Preoperative weight loss methods

Investigator	Diet	Exercise	Other counseling
Alvarado et al. [25]	Nutritional counseling available if desired; patients advised to concentrate on diets that worked in the past	None	Patients allowed to use any means to lose weight
Still et al. [16]	Diet of low-fat marcronutrient compostion, in addition to 500 Kcal deficit from estimated calories; patients encouraged to avoid caloric beverages and to drink >1.92 L of water daily; if patients following diet had not reached weight loss goal by month 4, told to follow a 1000–1500-Kcal liquid diet	Patients encouraged to use pedometer and walk >8000 steps/d	None
Alger-Mayer et al. [17]	Patients given dietary "advice"	Patients given exercise "advice"	None
Harnisch et al. [19]	Patients received nutritional evaluation and counseling from registered dietician	None	None
Martin et al. [14]	Patients started on protein-sparing modified fast (liquid diet of 420 Kcal, 70 g protein/d); patients asked to use diet for >1 mo	None	None
Alami et al. [13]	Patients advised to concentrate on diets that worked well in the past;access to a nutritionist available for extra support	None	Patients were allowed to use any means to lose weight
Ali et al. [21]	Patients educated about postgastric bypass nutrition (caloric intake, protein requirements, and micronutrient supplementation); patients required to perform calculations of caloric and protein content of food; patients required to attend seminar focusing on nutrition and to keep food journal for 2 weeks after seminar; patients who required additional guidance referred to bariatric surgery dietician for individual education	Patients advised of principles of physical activity and safe exercise and encouraged to create and begin physical activity regimen of their choice to follow after surgery; patients required to attend seminar focusing on physical activity	None
Carlin et al. [26]	Patients received counseling from registered dietician who advised preferred nutritional guidelines	Individually tailored exercise programs created with exercise physiologist	None
Fujioka et al. [20]	Patients advised to work with dietician to create 1100–1200-calorie meal plan with micronutrient breakdown of 48% carb, 27% protein, 25% fat	General exercise guidelines of 30–60 min, 5 d/wk	None
Riess et al. [18]	Patients required to use dietary logs and follow nutrition program	Patients required to follow exercise program	None
Jantz et al. [23]	Patients encouraged to make lifestyle changes under guidance of registered dietician	None	Guidance of bariatric team (physician assistant, psychologist, and surgeon)
Mrad et al. [22]	Patients received counseling from registered dieticians		Multidisciplinary approach

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