WEIGHT REGAIN: FATTORI DETERMINANTI LA RIPRESA DEL PESO

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Weight Regain and Insufficient Weight Loss After Bariatric Surgery

Characteristic	Summary
Causes	
Hormonal/metabolic	Increase in ghrelin, decrease in peptide YY and GLP-1, post-bariatric hypoglycemia, role of leptin is unclear [24, 40–49]
Dietary non-adherence	Increase caloric intake with time, dietary non-adherence/food indiscretion, grazing, lack of nutritional follow-up [13, 32, 50–56]
Physical inactivity	Non-compliance, sedentary behavior, presence of barriers to exercise [51, 57–61]
Mental health	Depression, multiple psychiatric conditions, binge eating disorder, loss of control over eating [54, 62–68]
Anatomic surgical failure	
LAGB	Pouch distension [69]
LSG	Dilatation of gastric pouch [70–77]
RYGB	Dilatation of gastric pouch, dilatation of gastrojejunostomy stoma outlet, gastrogastric fistula [73–75]
Predictors	Older age, male gender, higher preoperative BMI, mental health issues, presence of comorbidities (T2DM, hypertension, OSA) [34, 36, 76–86]

GLP-1 glucagon-like protein-1, LAGB laparoscopic adjustable gastric banding, LSG laparoscopic sleeve gastrectomy, RYGB Roux-en-Y gastric bypass, BPD/DS biliopancreatic diversion with duodenal switch, DRYGB distal RYGB

El Ansariet W et al., Obesity Surgery 2021

Physiological factors determining the steady state of weight maintenance

Homeostatic

Orexigen (driving weight gain)

- Central
  - NPY
  - AgRP
- Perfipheral
  - Ghrelin
  - GIP

Anorexigen (driving weight lost)

- Central
  - POMC
  - CART
- Perfipheral
  - GLP-1 - CCK
  - PP - PYY
  - Amylin - Leptin
  - Insulin

Energy Intake

- Hunger
- Satiety
- Nutrient absorption

Energy expenditure

- Metabolic rate (REE)
- Thermogenesis
- Activity (NREE)

STEADY STATE

Enviroment

Lifestyle

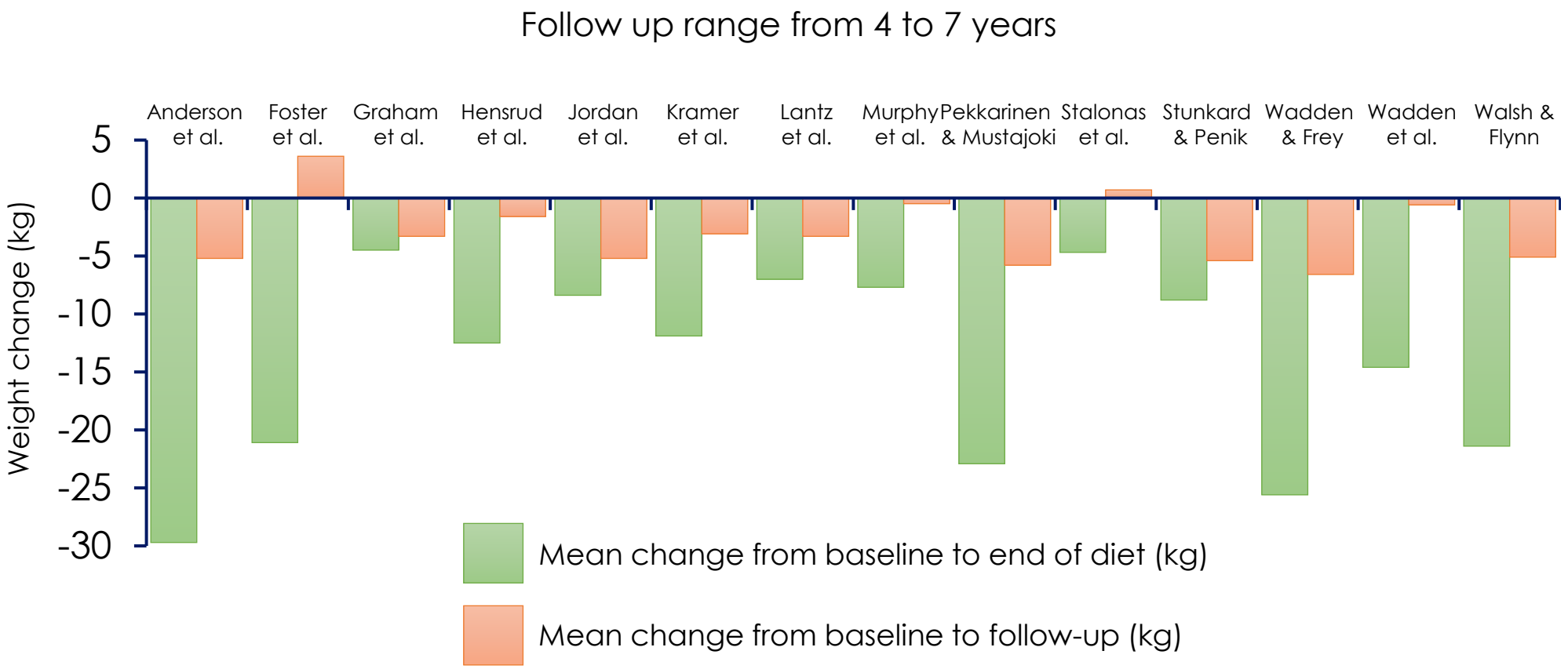
Choice, motivation, stress

Hedonic reward system

Behavioural

Adapted from Greenway FL International Journal of Obesity, 2015

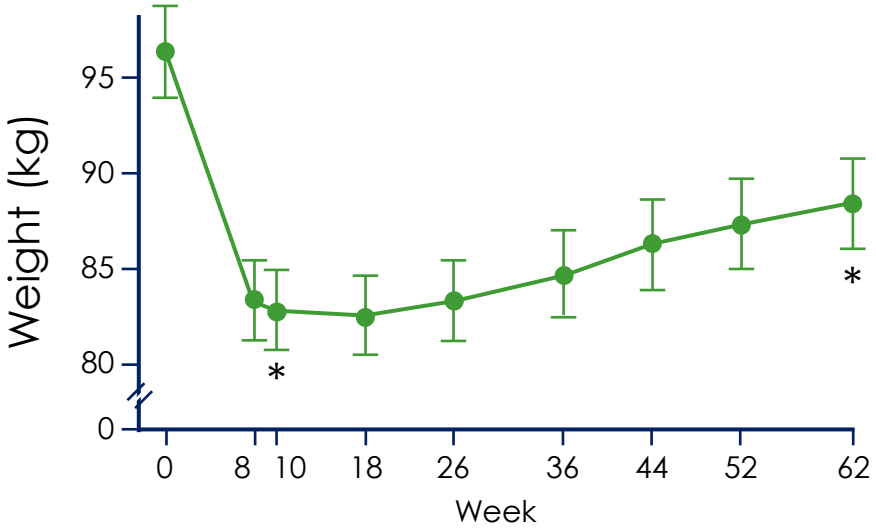
Maintenance of weight loss is challenging



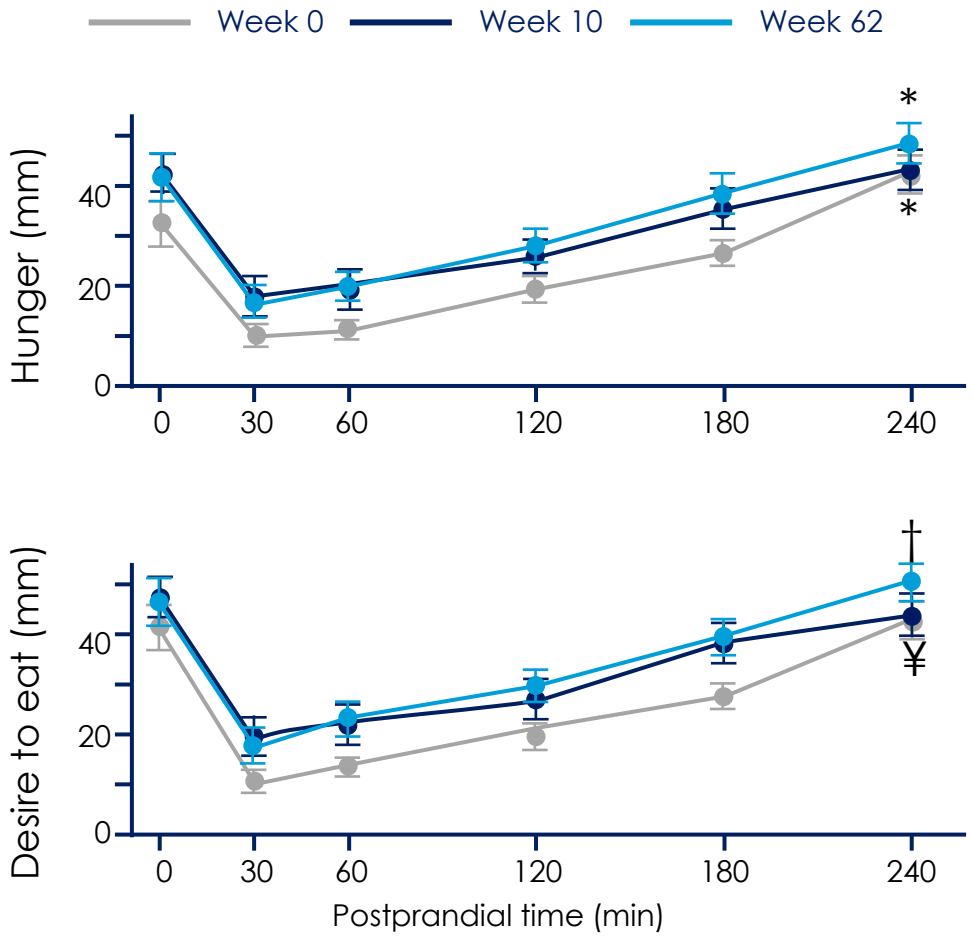
Mann et al. Am Psychol 2007;62:220–33

Hunger increases in response to weight loss

- 50 individuals with overweight/obesity lost weight on a 10-week VLCD
- Appetite was measured using VAS scores at 0, 10 and 62 weeks



*p<0.001, ¥p=0.008, †p=0.09 vs mean at baseline (week 0)



Sumithran et al. N Engl J Med 2011;365:1597–604

Physiological factors driving weight regain after weight loss

Homeostatic

Orexigen (driving weight gain)

- Central
  - NPY
  - AgRP
- Perfipheral
  - ↑ Ghrelin
  - GIP

Anorexigen (driving weight lost)

- Central
  - POMC
  - CART
- Perfipheral
  - ↓ GLP-1
  - PP
  - ↓ Amylin
  - ↓ Insulin
  - ↓ CCK
  - ↓ PYY
  - ↓ Leptin

Energy Intake

- ↑ All Aspects of appetite

Energy expenditure

- ↓ Metabolic rate (REE)
- ↓ Activity (NREE)

Weight Regain

STEADY STATE

Enviroment

Lifestyle

Choice, motivation, stress

↑Hedonic reward system

Behavioural

Changes in specific parameters that drive weight regain are indicated in red

Adapted from Greenway FL International Journal of Obesity, 2015

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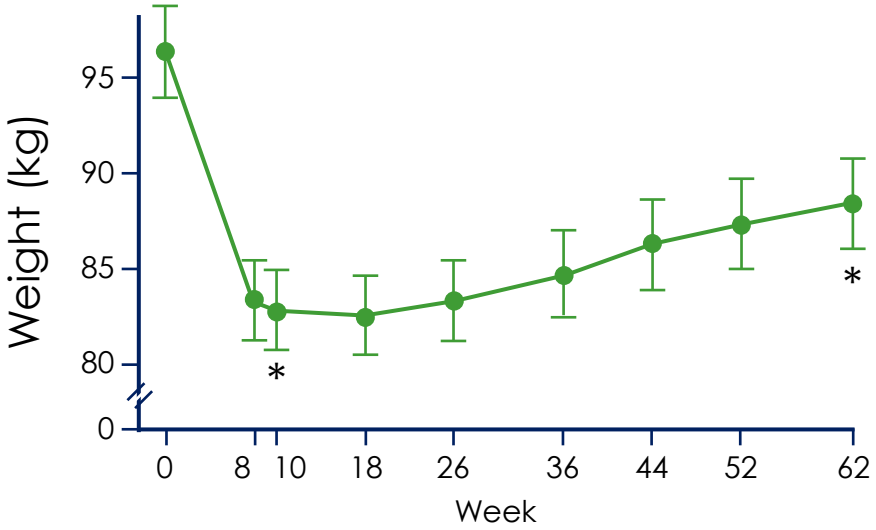

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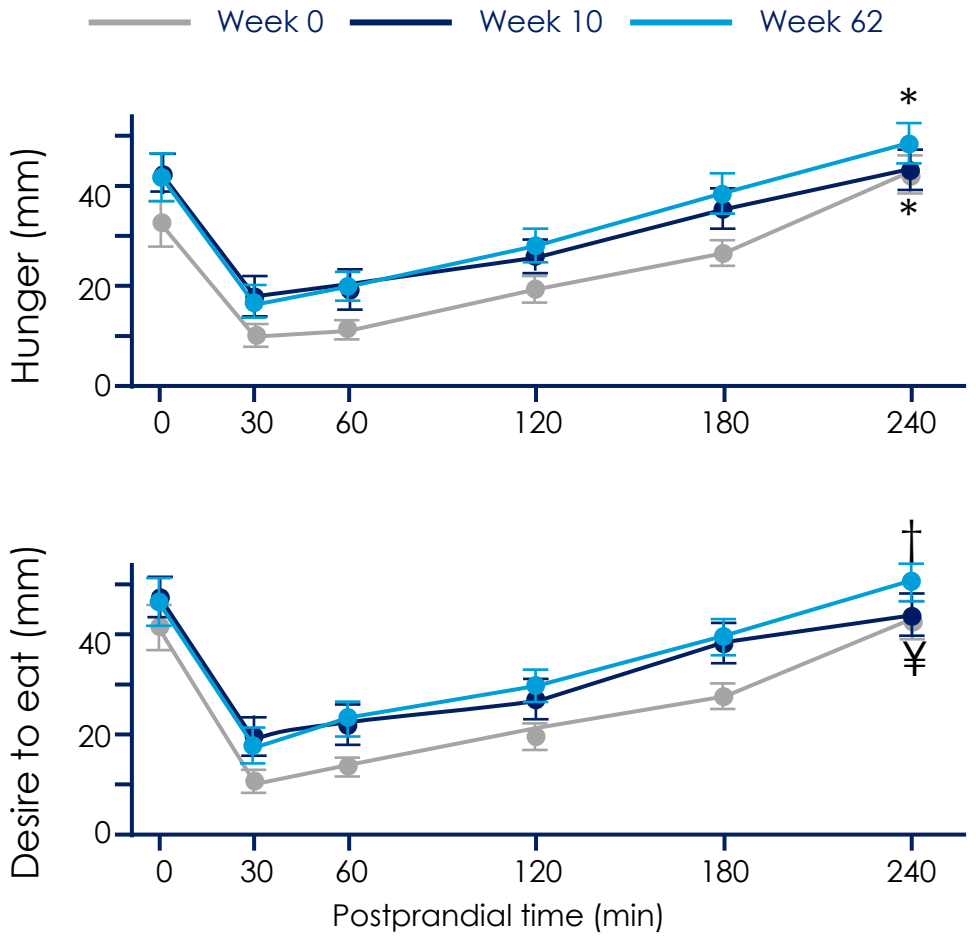


Sumithran et al. N Engl J Med 2011;365:1597–604

Diet control and nutrition restriction affect the achievement of target weight loss in patients undergoing bariatric surgery

Changes in percentage of excess weight loss excess weight loss (%EWL) between two groups.

Variable	Total (n = 189)	Achievement of Weight Loss			Operative Method			Comorbidity		
		Success (n = 127)	Failure (n = 62)	p-Value	LRYGB (n = 146)	SG (n = 43)	p-Value	Yes (n = 43)	No (n = 146)	p-Value
Postop 1 month	24.69 ± 9.23	25.85 ± 10.00	22.50 ± 6.52	0.005	24.52 ± 9.66	25.24 ± 7.64	0.615	24.59 ± 7.82	25.25 ± 13.39	0.695
Postop 3 months	41.66 ± 11.57	45.38 ± 10.87	34.03 ± 8.96	<0.001	42.18 ± 12.91	41.50 ± 11.19	0.736	45.35 ± 16.06	48.71 ± 17.57	0.258
Postop 6 months	46.42 ± 17.27	52.76 ± 17.12	33.48 ± 7.78	<0.001	50.05 ± 18.66	46.67 ± 16.75	0.289	41.98 ± 10.87	42.24 ± 13.58	0.900
Postop 12 months	53.05 ± 15.90	61.71 ± 7.90	37.46 ± 10.21	<0.001	54.40 ± 16.38	53.57 ± 13.75	0.762	53.15 ± 14.80	54.81 ± 13.81	0.511

LRYGB, Roux-en-Y gastric bypass; SG, sleeve gastrectomy. Data are reported as mean ± SD and p-values were calculated with Wilcoxon's rank-sum test.

Lim HS et al., Nutrients 2020

Diet control and nutrition restriction affect the achievement of target weight loss in patients undergoing bariatric surgery

Comparison of nutrition intakes between two groups

Variable	Calorie (kcal)			Carbohydrate (g)			Protein (g)			Fat (g)		
	Success (n = 127)	Failure (n = 62)	p-Value	Success (n = 127)	Failure (n = 62)	p-Value	Success (n = 127)	Failure (n = 62)	p-Value	Success (n = 127)	Failure (n = 62)	p-Value
Preop	2282.97 ± 626.93	2234.31 ± 609.10	0.610	293.31 ± 90.00 (53.5%)	311.18 ± 113.16 (56.4%)	0.280	92.06 ± 32.42 (16.8%)	84.02 ± 28.75 (15.1%)	0.086	74.24 ± 32.67 (29.9%)	70.77 ± 31.61 (28.5%)	0.485
Postop 1 month	769.33 ± 217.88	765.73 ± 178.30	0.904	70.48 ± 34.82 (36.7%)	70.56 ± 35.47 (39.6%) [a]	0.987	58.02 ± 21.95 (30.1%)	50.55 ± 23.74 (28.9%)	0.040	30.04 ± 14.53 (33.2%)	27.59 ± 14.25 (31.5%)	0.272
Postop 6 months	999.82 ± 259.30	1120.81 ± 272.43	0.004	97.58 ± 44.1 (40.6%)	133.98 ± 54.96 (46.4%)	<0.001	57.87 ± 20.91 (25.4%)	53.79 ± 18.06 (20.2%) [b]	0.169	34.71 ± 11.53 (34.0%)	38.98 ± 12.10 (33.4%)	0.022
Postop 12 months	1336.75 ± 229.03	1646.21 ± 315.55	<0.001	139.13 ± 49.04 (48.4%)	198.60 ± 81.10 (53.1%) [A]	<0.001	79.19 ± 24.09 (28.0%)	70.43 ± 25.04 (20.4%) [B]	0.023	47.87 ± 12.32 (23.6%)	59.42 ± 17.53 (26.5%) [C]	<0.001

Lim HS et al., Nutrients 2020

Postoperative Nutritional Management

Protein

46 g/d—women
56 g/d—men
Protein needs:
- Should constitute 10%-35% of daily caloric intake
- Weight maintenance: 0.8-1.2 g/kg body weight per day

Carbohydrates

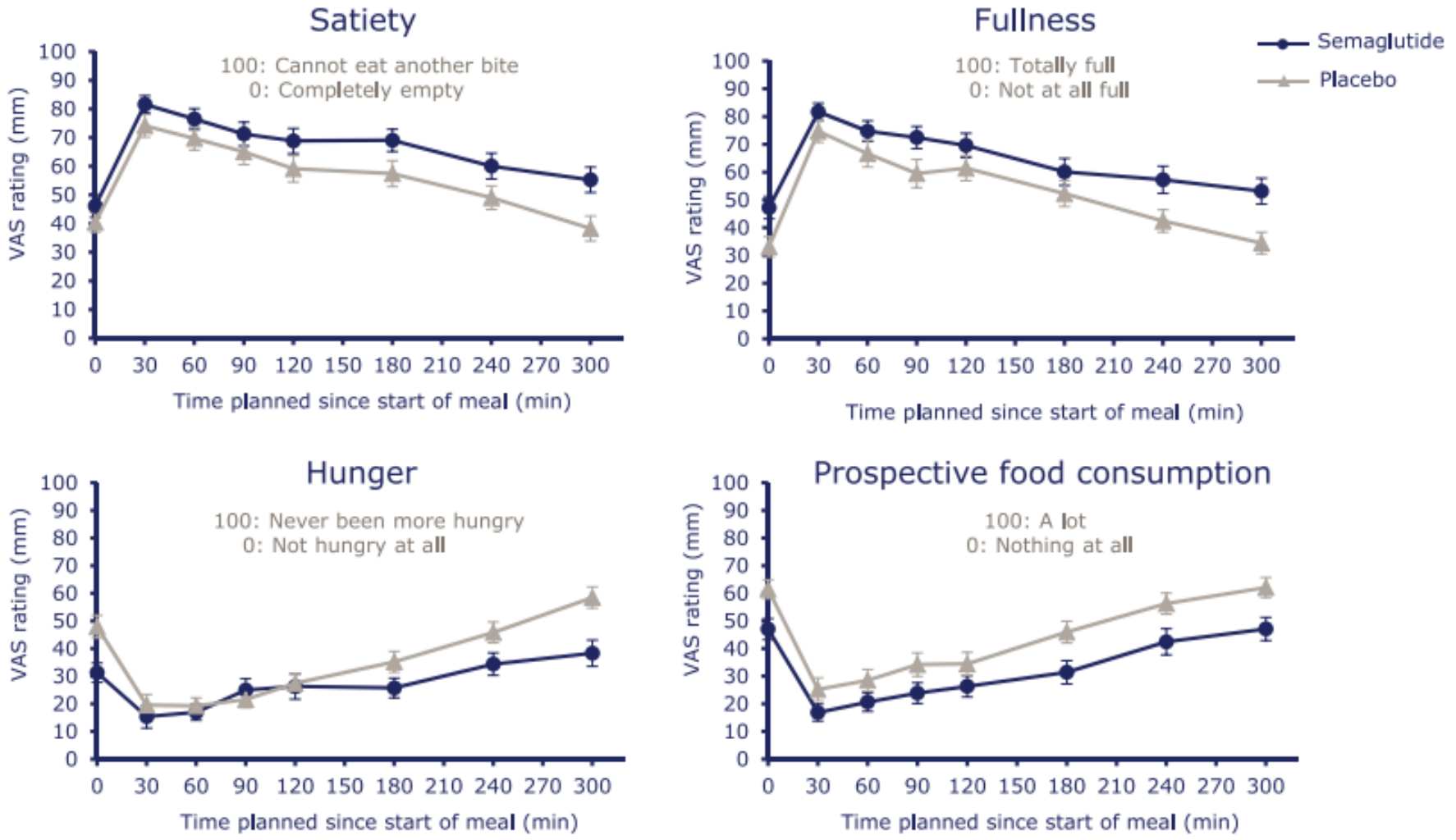
- Early postop—50 g/d
- As diet intake increases—130 g/d

Fat

- 20%-35% of the daily caloric intake; bulk of the fat intake should be unsaturated fat

Mechanick JI al., Nutrients 2020

Effects of once-weekly semaglutide on appetite, energy intake, control of eating, food preference and body weight in subjects with obesity



Blundell J et al., Diabetes Obesity Metabolism, 2017

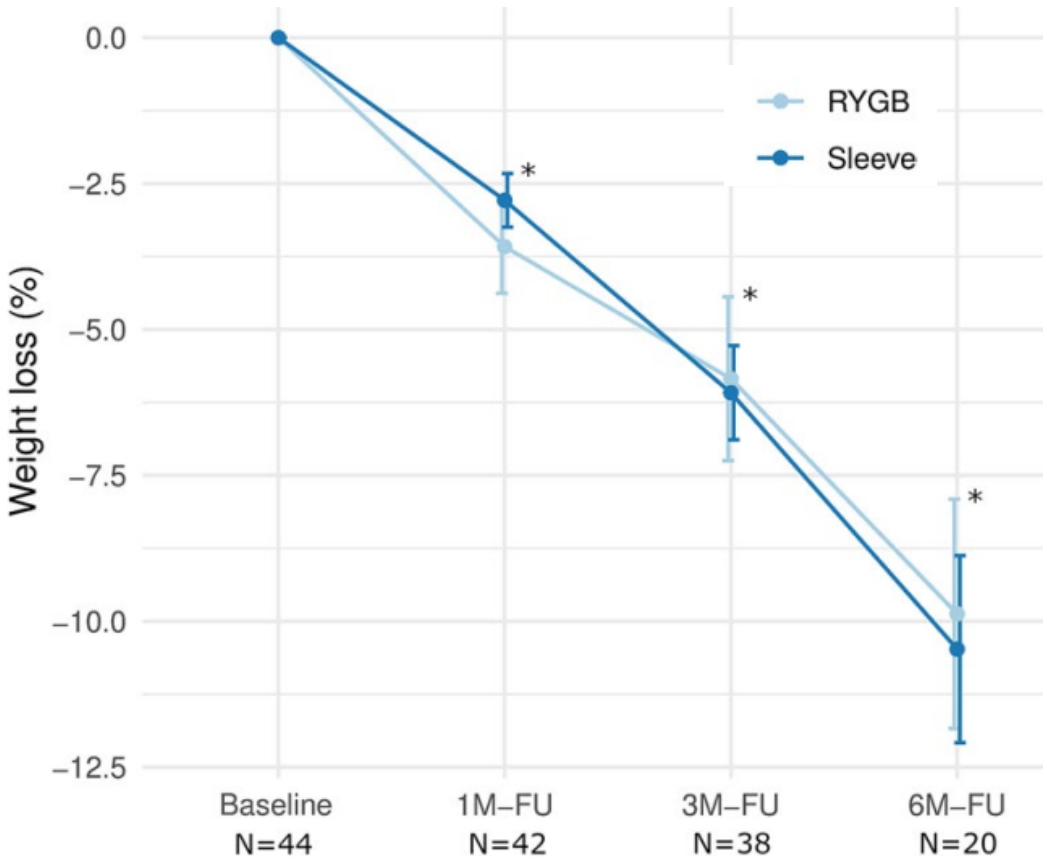
The Potential of Semaglutide Once-Weekly in Patients Without Type 2 Diabetes with Weight Regain or Insuficient Weight Loss after Bariatric Surgery

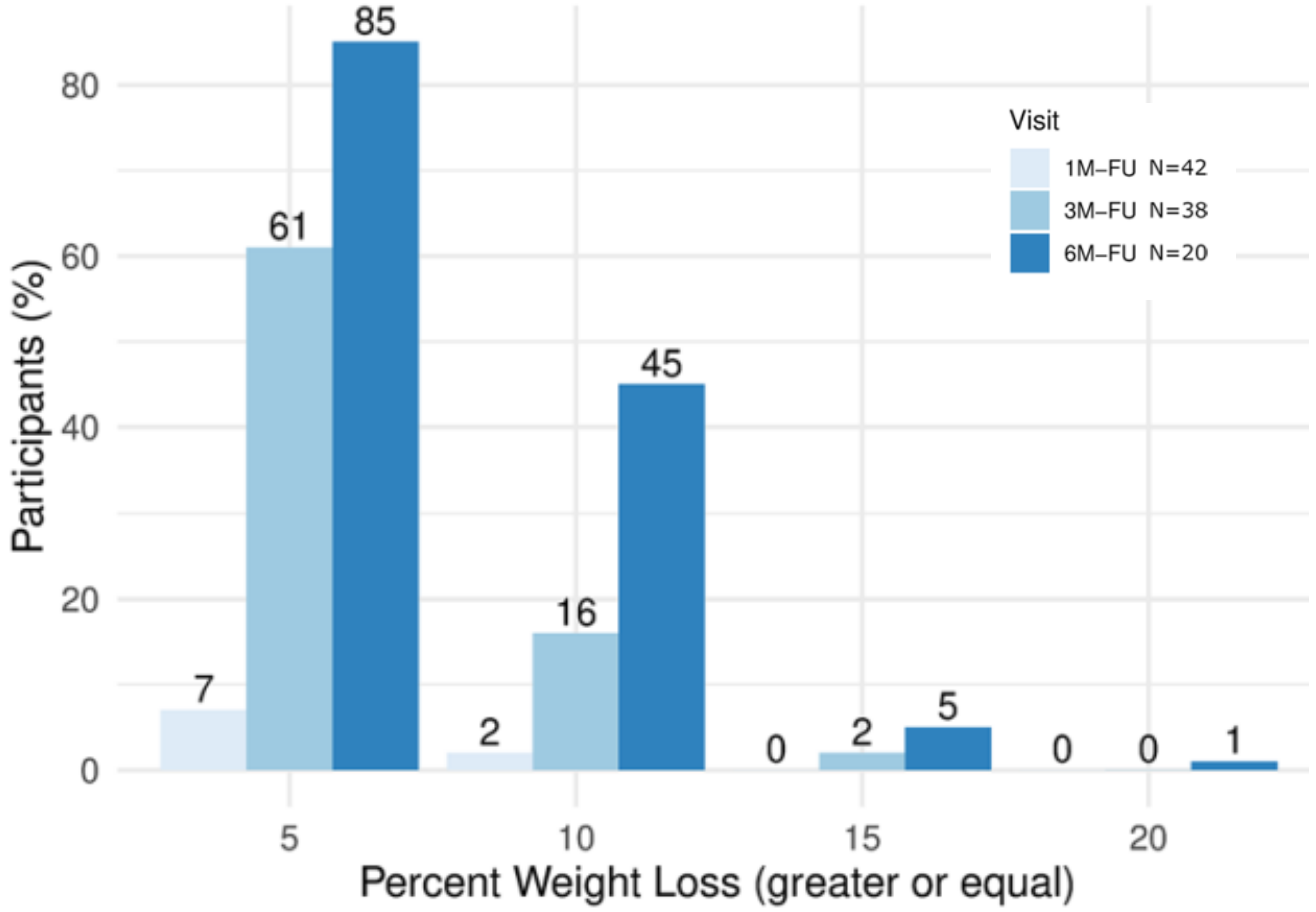
Anthropometric and biochemical characteristics at baseline by type of surgery

	RYGB ($N=15$)	SG ($N=29$)	Total ($N=44$)	p value
Age [year]	46.8 (7.3)	46.3 (9.6)	46.4 (8.8)	0.859
Sex (females)	12 (80%)	20 (69%)	32 (73%)	0.436
Body weight before BS [kg]	136.3 (17.5)	150.5 (38.7)	145.7 (33.5)	0.185
BMI before BS [kg/m^2]	48.0 (5.9)	50.1 (10.1)	49.4 (8.9)	0.467
Body weight nadir post BS [kg]	92.5 (18.9)	107.9 (27.2)	102.9 (25.6)	0.065
BMI nadir post BS [kg/m^2]	32.5 (6.0)	35.8 (6.5)	34.7 (6.5)	0.118
Time from BS to weight loss nadir [months]	27.8 (20.1)	28.2 (45.9)	28.0 (39.1)	0.973
Time from BS to initiation of semaglutide treatment [months]	78.8 (37.8)	57.4 (51.1)	64.7 (47.6)	0.160
Time from weight nadir to initiation of semaglutide treatment [months]	50.8 (32.5)	29.2 (32.7)	36.2 (33.8)	0.048
Total weight loss from BS to nadir [%]	−32.7 (10.3)	−27.4 (12.4)	−29.1 (11.9)	0.172
Weight regain from nadir to initiation of semaglutide treatment [%]	17.4 (15.8)	9.8 (13.2)	12.3 (14.4)	0.103
Weight prior to initiation of semaglutide treatment [kg]	106.5 (18.2)	117.1 (27.7)	113.5 (25.2)	0.187
BMI prior to initiation of semaglutide treatment [kg/m^2]	37.3 (6.4)	38.9 (6.5)	38.3 (6.4)	0.465
Hb prior to initiation of semaglutide treatment [g/dL]	12.9 (1.2)	13.7 (1.3)	13.4 (1.3)	0.066

Lautenbach A. et al., Obesity Surgery, 2022

The Potential of Semaglutide Once-Weekly in Patients Without Type 2 Diabetes with Weight Regain or Insuficient Weight Loss after Bariatric Surgery





Lautenbach A. et al., Obesity Surgery, 2022

Hallmarks

- Regular follow-ups with a clinical dietitian are important for preventing malnutrition and facilitating adequate eating behaviour to the surgical procedure.

- Bariatric surgery has profound effects on type 2 diabetes and can lead to prompt modifications and adjustments of medical therapy.

- Use of GLP-1ra as an adjunctive treatment in patients who have inadequate resolution of type 2 diabetes or insufficient weight loss after bariatric surgery may halt weight regain or create further weight loss when applied at optimal timing.