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Long-term Nutritional Deficiencies Persist Regardless of Recurrent Weight Gain after Roux-en-Y Gastric Bypass

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The Future of Obesity Management:
From Weight Loss to Health Gain

On behalf of: Ferran Torres, Adriana Pane, Ainitze Ibarzabal, Ana de Hollanda, Amanda Jimenez, Alba Andreu, Judit Molero, Lilliam Flores, Josep Vidal, Violeta Moizé.

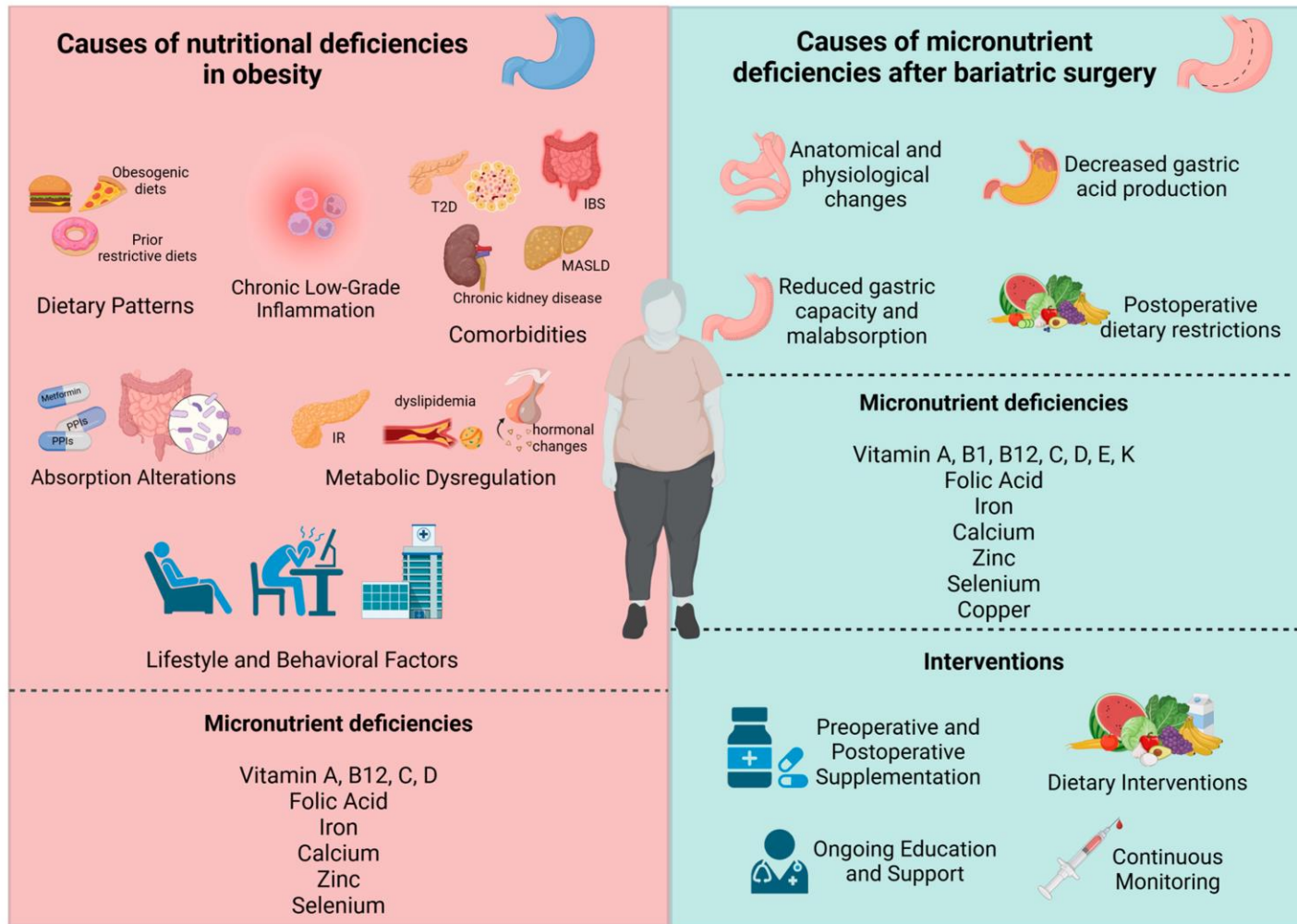


Conflicts of interest

☒	No, nothing to disclose
☐	Yes, please specify:



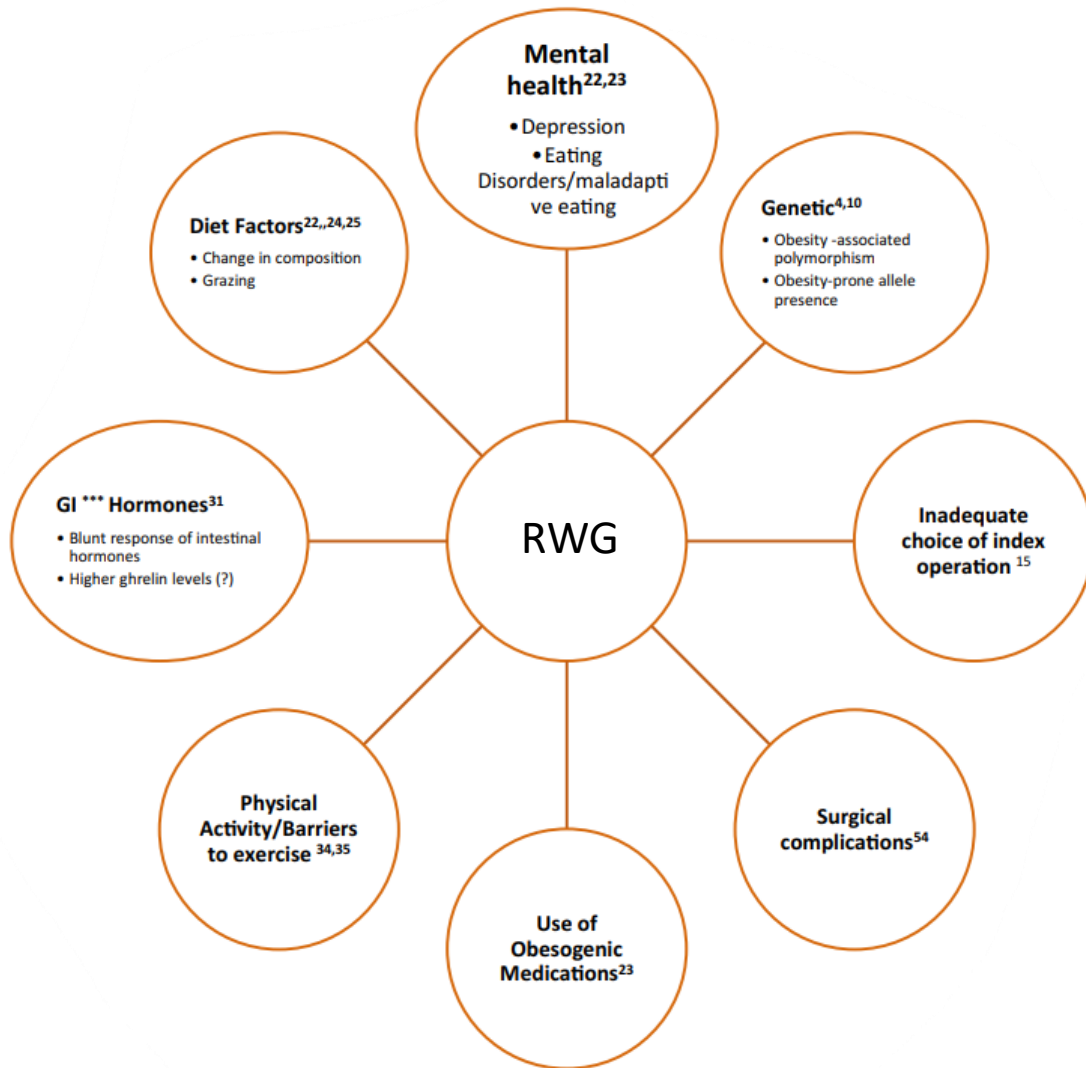
Nutritional deficiencies before & after MBS



Patients are at high risk of developing nutritional deficiencies before and after surgery, even with supplementation.



Factors contributing to RWG



(RWG) Recurrent Weight Gain = gaining >30% of the initial weight loss or worsening of an obesity complication.

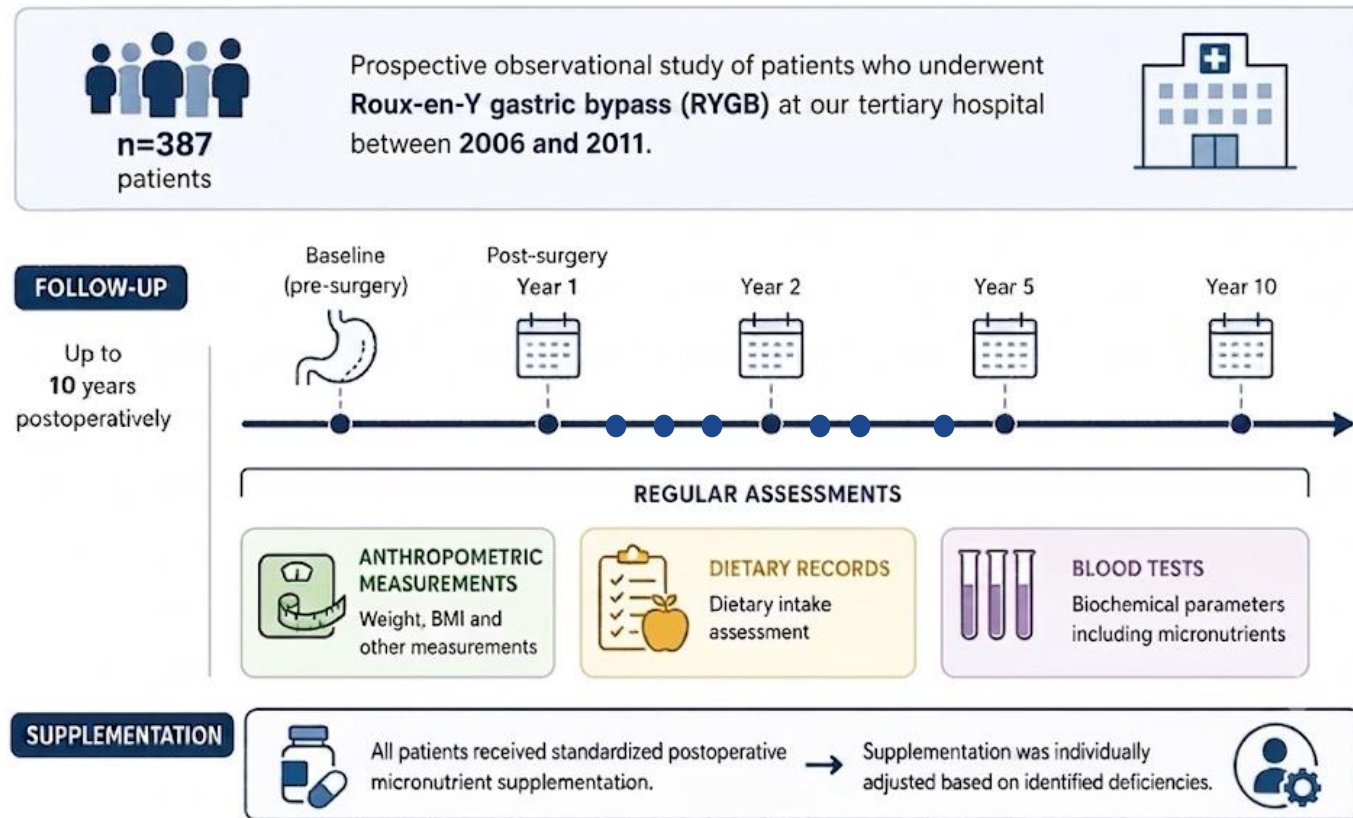
Salminen P, et al. *Obesity Surgery* (2024) 34:30–42
<https://doi.org/10.1007/s11695-023-06913-8>



Objective & Study design

To evaluate the prevalence of nutritional deficiencies in patients experiencing significant RWG ($\geq 30\%$ of total weight lost) 10 years after Roux-en-Y gastric bypass (RYGB).

STUDY DESIGN



Results-RWG

Patients who developed RWG reached their nadir weight significantly earlier than those who did not experience RWG. Both groups exhibited a similar pattern of rapid weight loss during the first postoperative year. However, after reaching nadir weight, patients with RWG showed a progressive increase in body weight over time, whereas those without RWG maintained a more stable weight trajectory throughout follow-up.

Table 1. Baseline demographic and clinical characteristics of the study population.

Variable	GBP (n=387)
	n(%)
Sex (female)	305 (78.8%)
Age (years)	43.34 (10.25)
Weight (kg)	121.73 (17.65)
BMI (Kg/m ²)	45.82 (4.96)
Hypertension	182 (47.0%)
Follow up (years)	8.41 (2.14)
RWG 5 years FU	65 (16,8)
RWG 10 years FU	191(49,3)

Descriptive statistics are n(%) and mean (SD), as appropriate

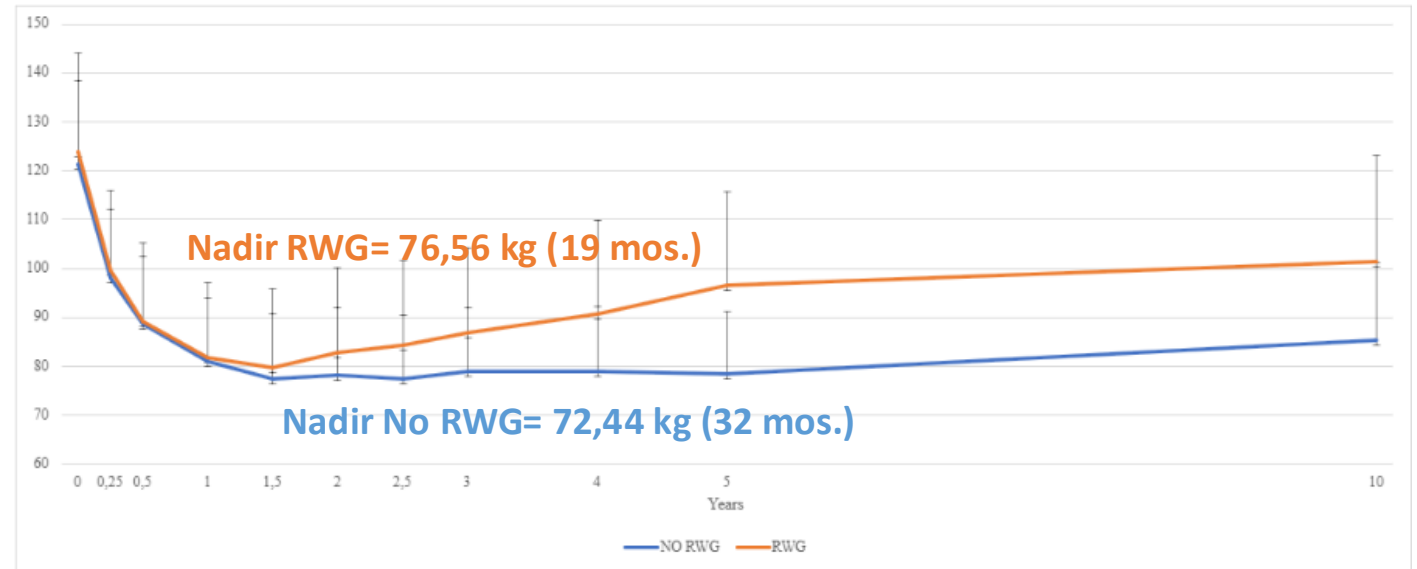


Figure 1. Weight trajectories in patients with and without RWG.



Results-Dietary Intake

No significant differences were observed in baseline energy intake, macronutrient distribution, or protein intake (g/kg body weight/day) between patients who did and did not develop RWG at 5 years (Table 2). Similarly, dietary intake remained comparable between groups at the 5-year follow-up, with no significant differences in total energy intake or macronutrient composition.

Table 2. Dietary intake at baseline and 5 years according to RWG status at 5 years.

	Baseline			5 years		
	No RWG n=322	RWG n=65	p-value	No RWG n=322	RWG n=65	p-value
Kcal	2133.04 (818.51)	2092.59 (847.39)	0,4096	1631.92 (1146.10)	1454.24 (749.25)	0,1466
Prot	91.82 (35.84)	89.96 (34.01)	0,4298	64.29 (20.00)	64.00 (18.76)	0,6024
Prot %	18.19 (5.52)	18.34 (5.54)	0,5507	18.32 (4.84)	19.57 (5.27)	0,0548
CHO	207.43 (96.48)	207.79 (92.33)	0,583	148.23 (61.75)	137.83 (53.93)	0,1902
CHO%	39.89 (9.71)	40.90 (9.53)	0,347	41.68 (9.44)	41.10 (9.63)	0,5646
Fat	98.79 (46.12)	95.82 (50.22)	0,5163	66.81 (36.95)	61.44 (31.35)	0,3103
Fat%	41.88 (9.46)	40.47 (9.45)	0,3219	40.20 (10.08)	39.45 (10.60)	0,4633

RWG: 30% recurrent weight gain at 5 years

Descriptive statistics are mean (SD)

Dietary intake was estimated using 3-day food records supplemented with a 24-hour dietary recall.

Protein (Prot), carbohydrate (CHO), and fat (Fat) intake are expressed as g/day, whereas Prot%, CHO%, and Fat% represent the percentage of total energy intake.



Results-Nutritional Deficiencies

Overall, the prevalence of at least one micronutrient deficiency remained consistently high throughout the follow-up period in both groups. No statistically significant differences in the overall prevalence of micronutrient deficiencies were observed between patients with and without RWG.

Table 3. Prevalence of micronutrient deficiencies in patients with and without $\geq 30\%$ RWG at 5 and 10 years after RYGB.

	Baseline			5 years			10 years		
	No RWG n=322	RWG n=65	p-value	No RWG n=322	RWG n=65	p-value	No RWG n=322	RWG n=65	p-value
Any deficiency	310 (96.3%)	63 (97.5%)	0,2869	295 (91.6%)	54 (83.5%)	0,0219*	308 (95.8%)	62 (95.5%)	0,2513
At least 4 deficiencies	113 (35.0%)	18 (28.1%)	0,0606	90 (27.9%)	17 (25.5%)	0,1171	84 (26.0%)	18 (27.8%)	0,1168

RWG: 30% recurrent weight gain at 5 years

Descriptive statistics are n (%)



Results-Nutritional Deficiencies

Table 4. Prevalence of specific nutritional deficiencies in patients with and without $\geq 30\%$ RWG at baseline, 5, and 10 years after MBS.

	Reference range	5 years			10 years		
		No RWG (n=322)	RWG (n=65)	<i>p-value</i>	No RWG (n=322)	RWG (n=65)	<i>p-value</i>
Total Protein	63-80 g/L	8 (2.5%)	1 (2.2%)	<i>0,0424*</i>	19 (6.0%)	4 (6.0%)	<i>0,221</i>
Albumin	34-48 g/L	-	-	-	2 (0.7%)	1 (1.6%)	<i>0,143</i>
Prealbumin	0.200-0.400 g/L	50 (15.5%)	8 (11.6%)	<i>0,0161*</i>	98 (30.4%)	17 (25.6%)	<i>0,0788</i>
Calcium	8.5-10.5 mg/dL	2 (0.6%)	1 (1.4%)	<i>0,0486*</i>	5 (1.6%)	2 (2.6%)	<i>0,0845</i>
Magnesium	1.8-2.6 mg/dL	13 (4.0%)	2 (2.3%)	<i>0,0361*</i>	12 (3.8%)	2 (2.8%)	<i>0,1011</i>
Iron	50-170 μ g/dL	87 (26.9%)	17 (25.7%)	<i>0,047*</i>	43 (13.4%)	8 (11.6%)	<i>0,0641*</i>
Ferritin	15-200 ng/mL	99 (30.7%)	17 (26.4%)	<i>0,0155*</i>	83 (25.8%)	11 (17.4%)	<i>0,006**</i>
Transferrin	2.5-3.8 g/L	101 (31.5%)	15 (22.9%)	<i>0,0048**</i>	64 (19.7%)	14 (21.7%)	<i>0,0261*</i>
VitB12	250-1,050 pg/mL	98 (30.4%)	18 (28.3%)	<i>0,1089</i>	103 (31.9%)	18 (27.6%)	<i>0,0946</i>
VitD	≤ 30 ng/mL	209 (84.6%)	39 (86.3%)	<i>0,1743</i>	236 (87.3%)	45 (82.0%)	<i>0,0884</i>
Hemoglobin	137 men/ 122 women g/L	78 (24.1%)	12 (17.9%)	<i>0,0231*</i>	48 (14.8%)	7 (11.1%)	<i>0,034*</i>
Intraerythrocyte folic acid	250-1,050 ng/mL	16 (6.2%)	4 (7.8%)	<i>0,2125</i>	22 (6.7%)	5 (7.9%)	<i>0,0548</i>

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RWG: 30% recurrent weight gain at 5 years

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Conclusions

Persistence beyond weight: Nutritional deficiencies persist for many years after RYGB regardless of RWG, challenging the assumption that weight gain reflects nutritional recovery.

Weight stigma and patient dropout: RWG-related stigma often causes patients to disengage from follow-up, challenging the management of nutritional deficiencies.

Lifelong surveillance: Lifelong nutritional monitoring, individualized supplementation, and patient education remain fundamental components of postoperative care beyond weight trajectories.





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