



**CORSO SICOB III EDIZIONE  
MILANO 11-12 APRILE 2024**

# **IL MANAGEMENT DELL'OBESITÀ**

DIRETTORI DEL CORSO: MAURIZIO DE LUCA, GIUSEPPE NAVARRA

Corso sul management nutrizionale, psicologico-psichiatrico, motorio, farmacologico, endoscopico e chirurgico per i pazienti affetti da obesità.

PROVIDER SICOB  
EVENTO ACCREDITATO ECM 401500  
15 CREDITI FORMATIVI

# **IPOVITAMINOSI E DEFICIT DI MICRONUTRIENTI DOPO CHIRURGIA BARIATRICA**

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UNIVERSITÀ DEGLI STUDI DI SALERNO**

**RESPONSABILE AMBULATORIO DIETETICA E NUTRIZIONE  
UOC CLINICA MEDICA ED EPATOLOGICA, AOU SAN GIOVANNI  
DI DIO E RUGGI D'ARAGONA, SALERNO**

***Delegato Campano Soci Affini SICOB***



## Weight Regain and Insufficient Weight Loss After Bariatric Surgery: Definitions, Prevalence, Mechanisms, Predictors, Prevention and Management Strategies, and Knowledge Gaps—a Scoping Review

Walid El Ansari<sup>1,2,3</sup> · Wahiba Elhag<sup>4</sup>

**2021: SG and Roux-en-Y gastric bypass (RYGB) constitutes 95% of the total MBS performed in the World**

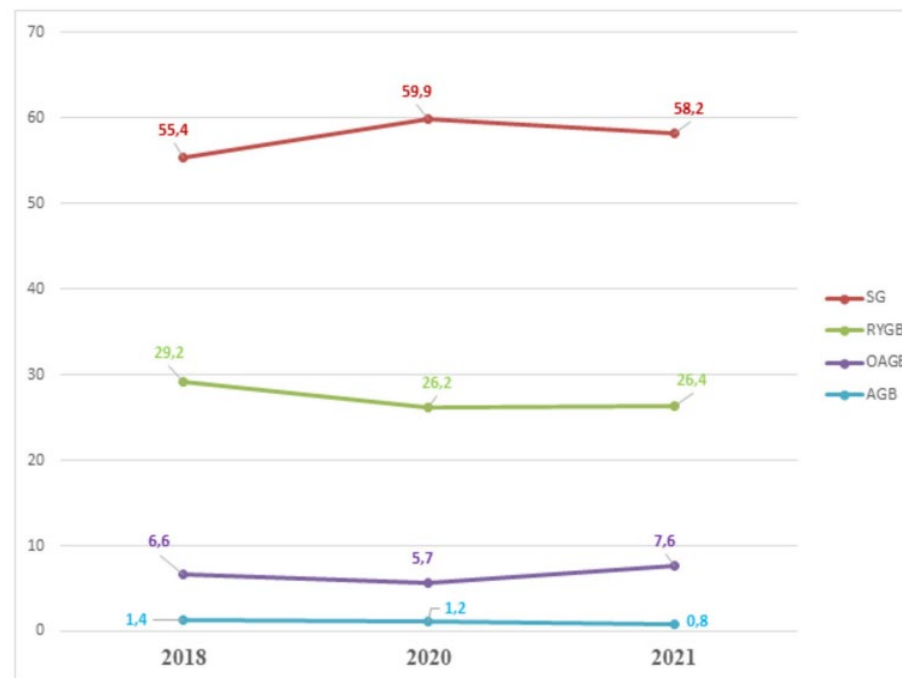


### ORIGINAL CONTRIBUTIONS

## IFSO Worldwide Survey 2020–2021: Current Trends for Bariatric and Metabolic Procedures

Luigi Angrisani<sup>1</sup> · Antonella Santonicola<sup>2</sup> · Paola Iovino<sup>2</sup> · Rossella Palma<sup>3</sup> · Lilian Kow<sup>4</sup> · Gerhard Prager<sup>5</sup> · Almino Ramos<sup>6</sup> · Scott Shikora<sup>7</sup> · the Collaborative Study Group for the IFSO Worldwide Survey

%



Worldwide trend in the percentage of the main surgical metabolic and bariatric (MBS) from 2018 to 2021 confirmed that the **sleeve gastrectomy (SG) was the most performed MBS in the world**

# Micronutrient Deficiencies (MD) after MBS



SURGERY FOR OBESITY  
AND RELATED DISEASES

Surgery for Obesity and Related Diseases 13 (2017) 727–741

Review article

## American Society for Metabolic and Bariatric Surgery Integrated Health Nutritional Guidelines for the Surgical Weight Loss Patient 2016 Update: Micronutrients

Julie Parrott, M.S., R.D.N.<sup>a,\*</sup>, Laura Frank, Ph.D., M.P.H., R.D.N., C.D.<sup>b</sup>,  
Rebecca Rabena, R.D.N., L.D.N.<sup>c</sup>, Lillian Craggs-Dino, D.H.A., R.D.N., L.D.N.<sup>d</sup>,  
Kellene A. Isom, M.S., R.D.N., L.D.N.<sup>e</sup>, Laura Greiman, M.P.H., R.D.N.<sup>f</sup>

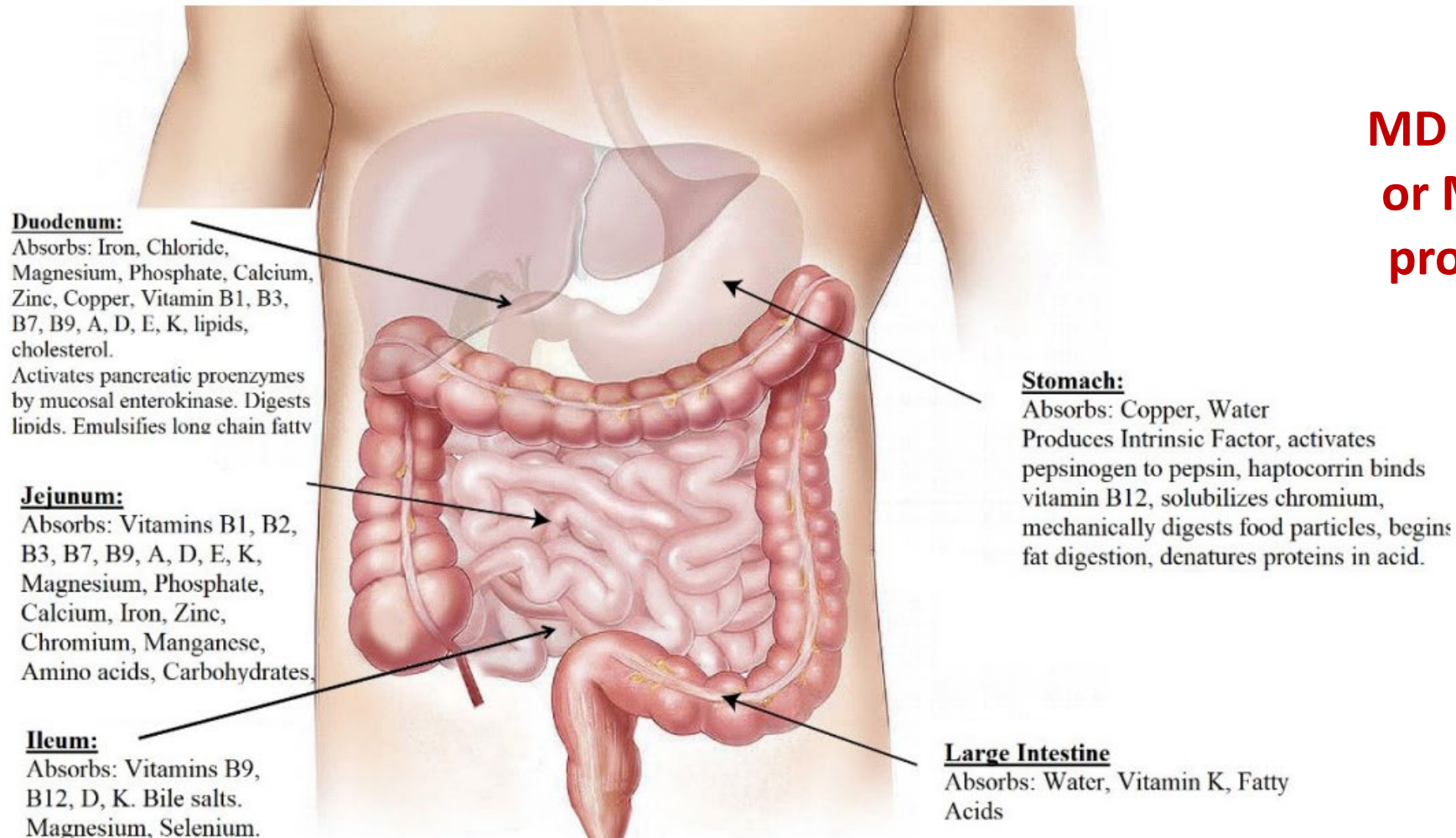
**Table. Complications of Bariatric Surgery**

Early Complications (Within 30 Days of Surgery)	Late Complications (More Than 30 Days After Surgery)
Bowel obstruction	Anastomotic stricture
Deep venous thrombosis	Bowel obstruction
Gastrointestinal or intra-abdominal bleeding	Cholelithiasis
Leaks	Dehiscence/fistulization
Pulmonary embolism	Gastrointestinal or abdominal bleeding
Wound infection	Incisional hernia
	Marginal ulceration
	Nutritional deficiencies

**MD**, is an important complication associated with MBS with 50% of cases of vitamin deficiency (VD) being observed at the end of the first postoperative year



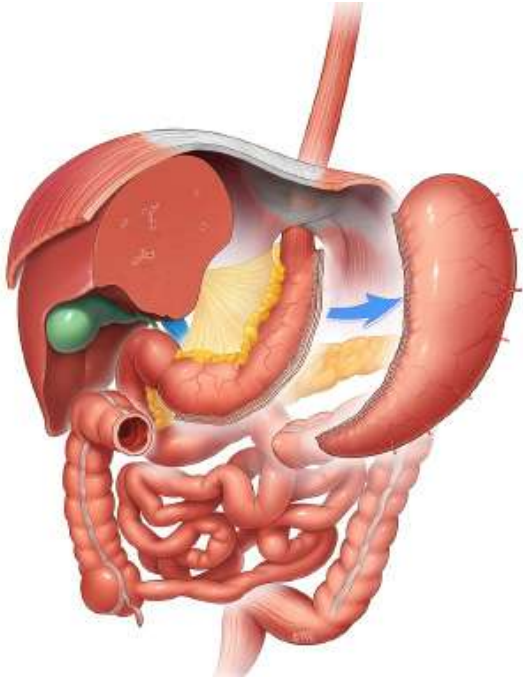
# Micronutrient Absorption in the Gastro Intestinal Tract (GIT): Physiology



**MD secondary to RESTRICTIVE or MALABSORPTIVE bariatric procedures are explained by different factors.**

Figure 1. Different parts of the GI tract and their corresponding nutritional absorption.

## Sleeve Gastrectomy



a type of weight-loss surgery that **involves removing part of the stomach to make it smaller**

OBES SURG (2011) 21:207–211  
DOI 10.1007/s11695-010-0316-7

CLINICAL RESEARCH

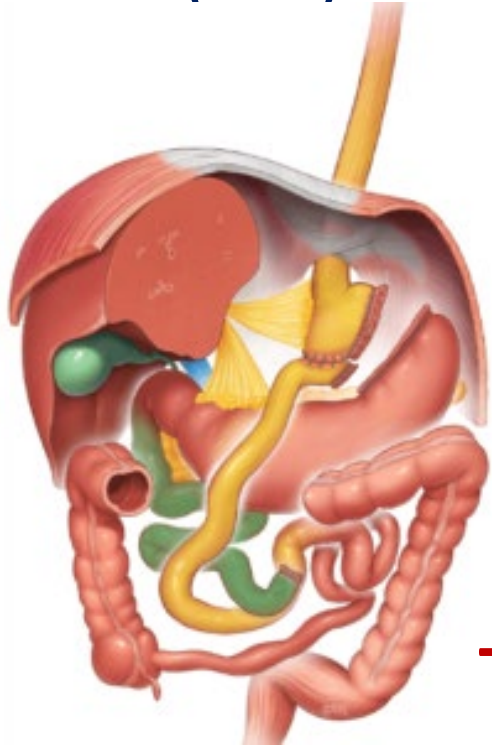
### The Gastric Sleeve: Losing Weight as Fast as Micronutrients?

Edo O. Aarts · Ignace M. C. Janssen · Frits J. Berends

**SG affects the MICRONUTRIENTS status by changing:**

- **Gastrointestinal motility**
- **Gastric emptying**
- **Gastro-duodenal transit time**
- **HCL secretion**
- **IF secretion**

## Roux-en-Y gastric bypass (RYGB)



Obesity Facts

Research Article

Obes Facts 2021;14:197–204  
DOI: 10.1159/000514847

### Prevalence of Micronutrient Deficiency after Bariatric Surgery

Eva-Christina Krzizek<sup>a,b</sup> Johanna Maria Brix<sup>a,b</sup> Alexander Stöckl<sup>a,b</sup>  
Verena Parzer<sup>a,b</sup> Bernhard Ludvik<sup>a,b</sup>

**Roux-en-Y gastric bypass (RYGB) affects the MICRONUTRIENT status by:**

- Changing the size of the stomach
- Changing the gastrointestinal transit time
- Bypassing the duodenum

**The main cause of MD after RYGB is bypassing the main sites where the absorption of micronutrient occurs**

Basishvili et al. *Mini-invasive Surg* 2022;6:29  
DOI: 10.20517/2574-1225.2021.130

Mini-invasive Surgery

Perspective

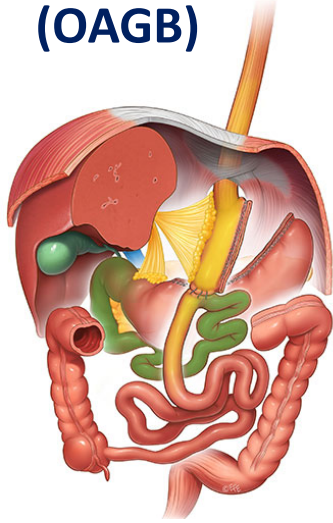
Open Access

Check for updates

### Nutritional deficiencies following metabolic surgery

Givi Basishvili, Aurora Pryor

## One Anastomosis gastric bypass (OAGB)



Article

### Nutritional Outcomes One Year after One Anastomosis Gastric Bypass Compared to Sleeve Gastrectomy

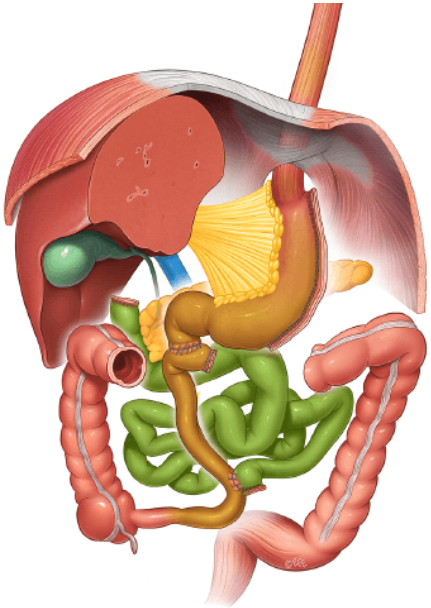
Naama Shirazi <sup>1,2,\*</sup>, Nahum Beglaibter <sup>2</sup>, Ronit Grinbaum <sup>2</sup>, Wiessam Abu Ahmad <sup>3</sup> and Anna Aronis <sup>1</sup>

**One-Anastomosis Gastric Bypass (OAGB) affects the MICRONUTRIENT status by:**

- Changing the size of the stomach
- Bypassing part of the small bowel (duodenum and part of the jejunum).

**The main cause of MD after OAGB is bypassing the main sites where the absorption of micronutrients occurs**

## Biliopancreatic diversion with duodenal switch (BPD-DS)



**Biliopancreatic diversion with duodenal switch (BPD-DS) affects the MICRONUTRIENT status by:**

- **Exclusion of the jejunum from the alimentary tract**
- **The short common channel of the BPD-DS deteriorates the absorption of fat-soluble vitamin (A, D, E, and K).**

**The main mechanism contributing to fat-soluble vitamin deficiencies is delayed mixing of dietary fat with pancreatic enzymes and bile salts, creating fat malabsorption.**



# Vitamin B<sub>12</sub> (Cobalamin)

Intrinsic factor (IF), synthesized by the parietal cells of the stomach, plays a major role in cobalamin absorption

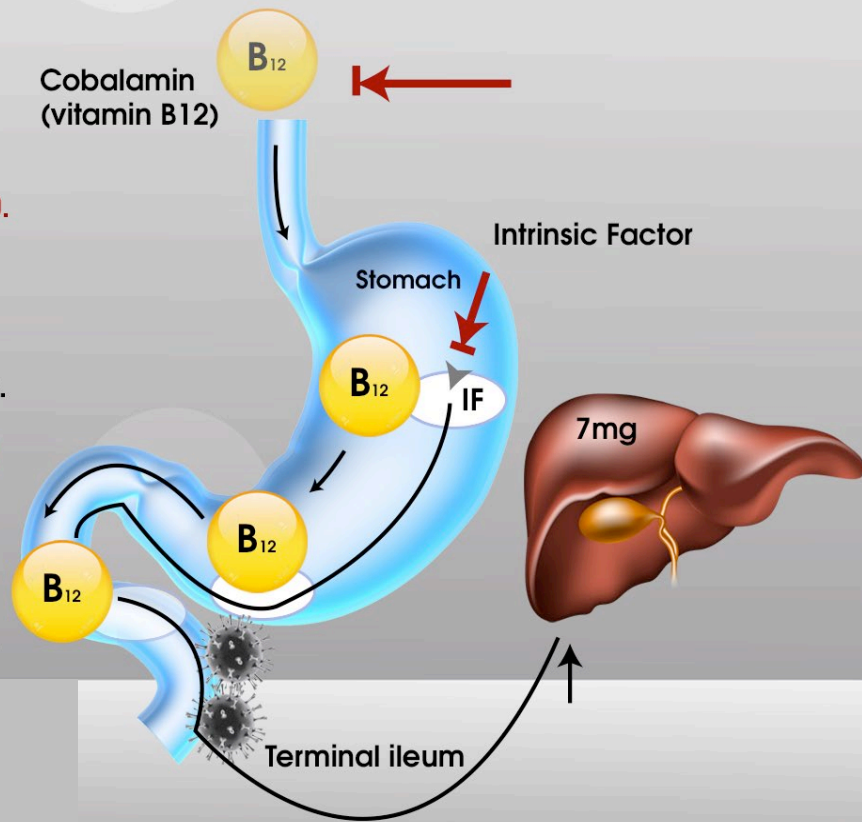
## Absorption of Vitamin B<sub>12</sub>

Intrinsic factor is a glycoprotein of M.W. 4500.

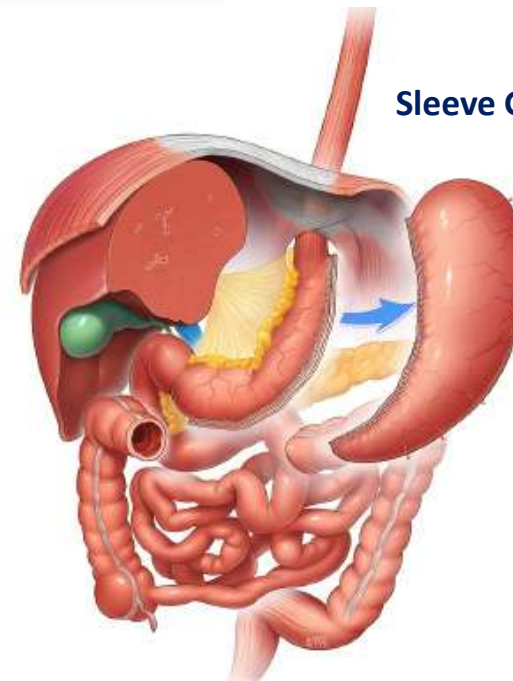
Vit. B<sub>12</sub> combine with intrinsic factor forming a complex that resist digestion by GIT enzymes.

This complex is absorbed at terminal ileum by pinocytosis.

Vit. B<sub>12</sub> is transported to the liver where it is stored.



deficiency is reported in 10–20% of SG patients



Sleeve Gastrectomy (SG)

- After SG, gastric fundus resection result in decreased secretion of IF
- Decreased IF secretion is currently considered the main driver of the post-surgical B<sub>12</sub> deficiency

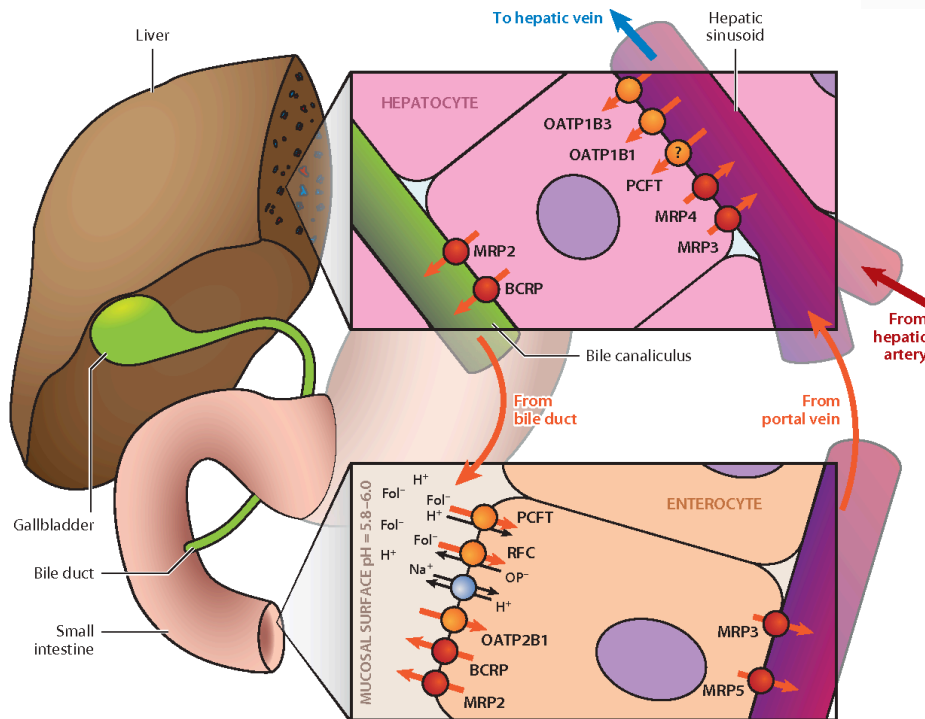
Administration of high doses of B<sub>12</sub> is recommended to be initiated right after BMS

350–500 mcg daily (sublingual/liquid) or 1000 mcg monthly (parenteral)

- **Obeid, R et al.** Vitamin B<sub>12</sub> Intake From Animal Foods, Biomarkers, and Health Aspects. *Front Nutr.* 2019, 6, 93.
- **Parrott, J et al.** ASMBS Integrated Health Nutritional Guidelines for the Surgical Weight Loss Patient 2016 Update: Micronutrients. *Surg. Obes. Relat. Dis.* 2017, 13, 727–741.

# Folate

Folate absorption occurs primarily in the upper small intestine (proximal jejunum)



**Folate deficiency ranges between 9% and 39% following both malabsorptive and restrictive procedures and is mostly due to:**

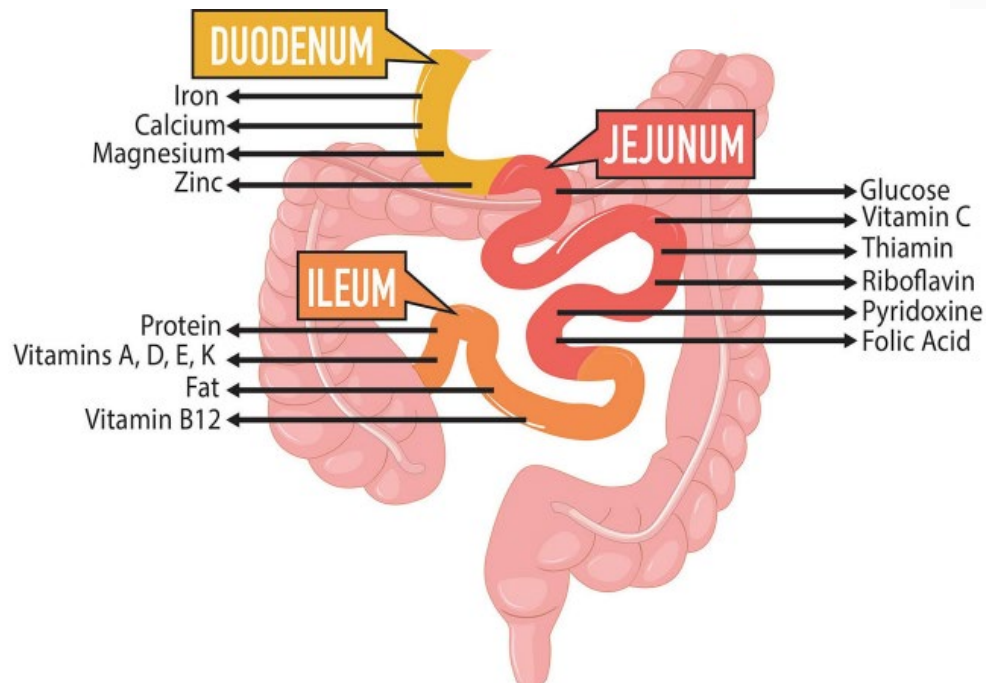
- the depletion of tissue stores as a result of inadequate dietary intake
- an impaired absorption due to the decrease of HCl secretion
- an altered intestinal pH

Postoperative supplementation following RYGB with physiologic doses (400 mcg) is generally sufficient to prevent or correct the folate deficiency

Parrott, J et al. ASMBS Integrated Health Nutritional Guidelines for the Surgical Weight Loss Patient 2016 Update: Micronutrients. Surg. Obes. Relat. Dis. 2017, 13, 727-741.

# Vitamin B<sub>1</sub> (Thiamine)

Thiamine absorption occurs primarily in the jejunum.



**27% of patients who underwent BS experience vitamin B1 deficiency within 6 months following surgery, mostly due to hyperemesis.**

- Intractable vomiting impairs absorption of thiamine and so deficiency can occur despite oral supplementation.
- Therefore, early diagnosis of thiamine deficiency is crucial to prevent permanent sequelae, such as Wernicke Encephalopathy (WE)

**12 mg daily/50 mg dose from B-complex supplement/multivitamin twice daily**

**Parrott, J et al.** ASMBS Integrated Health Nutritional Guidelines for the Surgical Weight Loss Patient 2016 Update: Micronutrients.  
*Surg. Obes. Relat. Dis.* 2017, 13, 727–741

# Vitamin D

Absorption of vitamin D occurs mostly in the jejunum and ileum through passive diffusion, a mechanism which rather requires the presence of bile salts

Bone Reports 8 (2018) 57–63



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Contents lists available at ScienceDirect

Bone Reports

journal homepage: [www.elsevier.com/locate/bonr](http://www.elsevier.com/locate/bonr)

Thin bones: Vitamin D and calcium handling after bariatric surgery

Katrien Corbeels<sup>a,\*</sup>, Lieve Verlinden<sup>a</sup>, Matthias Lannoo<sup>a</sup>, Caroline Simoens<sup>a,b</sup>,  
Christophe Matthys<sup>a</sup>, Annemieke Verstuyf<sup>a</sup>, Ann Meulemans<sup>a</sup>, Geert Carmeliet<sup>a</sup>,  
Bart Van der Schueren<sup>a</sup>

**Vitamin D deficiency is common following bariatric surgery  
and has been reported to occur in 50-80% of patients**

3000 IU daily until plasma concentration  
exceeds 30 ng/mol

**Parrott, J et al.** ASMBS Integrated Health Nutritional Guidelines for the Surgical Weight Loss Patient 2016 Update: Micronutrients. Surg. Obes. Relat. Dis. 2017, 13, 727–741.



# Vitamin A, E, and K

The frequency of these nutritional deficiencies following BS is generally low.



Review

## Bariatric Surgery in Obesity: Effects on Gut Microbiota and Micronutrient Status

Daniela Ciobârca<sup>1</sup>, Adriana Florinela Cătoi<sup>2,\*</sup>, Cătălin Copăescu<sup>3</sup>, Doina Miere<sup>1</sup>  
Gianina Crișan<sup>4</sup>

- Vitamin A deficiency following RYGB ranges between 8% and 11%
- Vitamin E deficiency is present in 8.7% of patients 1 year following RYGB
- Vitamin K deficiency is rare

Vitamin A, 5000–10,000 IU/day  
Vitamin E, 15 mg/day  
Vitamin K, 90–120 ug/day

Parrott, J et al. ASMBS Integrated Health Nutritional Guidelines for the Surgical Weight Loss Patient 2016 Update: Micronutrients. Surg. Obes. Relat. Dis. 2017, 13, 727–741.

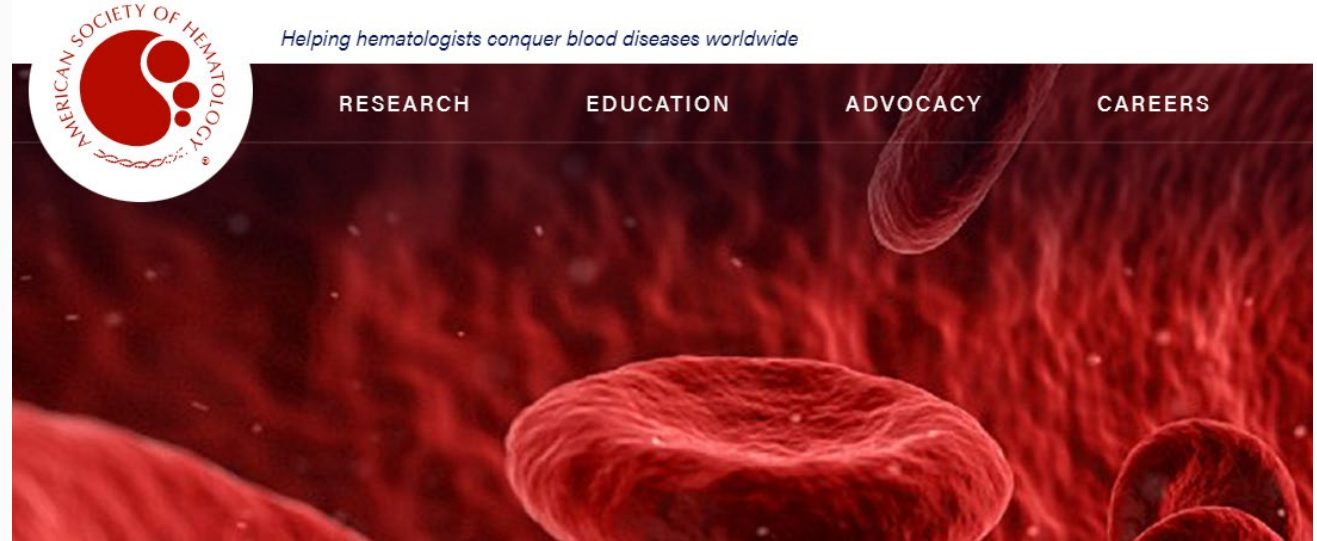
# Post-MBS Anemia

American Society of Hematology: **33%-49% of operated patients presenting anemia within 2 years after surgery.**

As expected, the average prevalence of anemia is lower following **LSG (17%)** and reaches **45%-50% after RYGB and BPD**

## Post-bariatric anemia is in most cases due to:

- the bypassing of the duodenum and proximal jejunum (which are the main sites of iron absorption) are the primary mechanisms that lead to iron deficiency.
- Reduced iron absorption due to hypochloridria
- Post-operative reduction in food intake
- Changes in food preferences such as intolerance for meat and dairy products, are important contributory factors.



However, for the correction of iron deficiency (when iron deficiency sets in), oral supplementation is not sufficient, and intravenous iron administration is required.

**Parrott, J et al.** ASMBS Integrated Health Nutritional Guidelines for the Surgical Weight Loss Patient 2016 Update: Micronutrients. *Surg. Obes. Relat. Dis.* 2017, 13, 727–741.

## Bariatric surgery and long-term nutritional issues

Roberta Lupoli, Erminia Lembo, Gennaro Saldalamacchia, Claudia Kesia Avola, Luigi Angrisani, Brunella Capaldo

The best practices guidelines highly recommend regular metabolic and nutritional monitoring after MBS, which frequency varies according to the type of procedure.

Table 1 Schedule of biochemical and nutritional assessments for the different bariatric procedures

Assessments	Pre-operative	1 mo	3 mo	6 mo	12 mo	18 mo	24 mo	Annually
MOC DEXA							AGB, SG, RYGB, BPD <sup>1</sup>	AGB <sup>3</sup> , SG, RYGB, BPD <sup>1</sup>
Calcium	AGB, SG, RYGB, BPD <sup>2</sup>	AGB, SG, RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>1</sup>
Magnesium	AGB, SG, RYGB, BPD <sup>1</sup>		AGB, SG, RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>1</sup>	RYGB, BPD <sup>1</sup>		RYGB, BPD <sup>1</sup>	RYGB, BPD <sup>1</sup>
Phosphorus	AGB, SG, RYGB, BPD <sup>1</sup>				AGB, SG, RYGB, BPD <sup>1</sup>		AGB, SG, RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>1</sup>
Zinc	AGB, SG, RYGB, BPD <sup>2</sup>		RYGB, BPD <sup>1</sup>	RYGB, BPD <sup>2</sup>	AGB, SG, RYGB, BPD <sup>2</sup>		AGB, SG, RYGB, BPD <sup>2</sup>	AGB, SG, RYGB, BPD <sup>2</sup>
Iron	AGB, SG, RYGB, BPD <sup>2</sup>		RYGB, BPD <sup>1</sup>	RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>2</sup>	RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>2</sup>	AGB, SG, RYGB, BPD <sup>2</sup>
Transferrin	AGB, SG, RYGB, BPD <sup>2</sup>		AGB, SG, RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>1</sup>		AGB, SG, RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>1</sup>
Ferritin	AGB, SG, RYGB, BPD <sup>2</sup>		AGB, SG, RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>1</sup>		AGB, SG, RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>1</sup>
Vitamin A	AGB, SG, RYGB, BPD <sup>2</sup>		RYGB, BPD <sup>1</sup>	RYGB, BPD <sup>1</sup>	RYGB, BPD <sup>1</sup>		RYGB, BPD <sup>1</sup>	RYGB, BPD <sup>1</sup>
Vitamin E	AGB, SG, RYGB, BPD <sup>1</sup>				AGB, SG, RYGB, BPD <sup>1</sup>			
Vitamin D	AGB, SG, RYGB, BPD <sup>2</sup>		RYGB, BPD <sup>2</sup>	RYGB, BPD <sup>2</sup>	AGB, SG, RYGB, BPD <sup>2</sup>		AGB, SG, RYGB, BPD <sup>2</sup>	AGB, SG, RYGB, BPD <sup>2</sup>
Vitamin B1	AGB, SG, RYGB, BPD <sup>2</sup>	AGB, SG, RYGB, BPD <sup>2</sup>	AGB, SG, RYGB, BPD <sup>1</sup>		AGB, SG, RYGB, BPD <sup>1</sup>		AGB, SG, RYGB, BPD <sup>1</sup>	AGB, SG, RYGB, BPD <sup>1</sup>
Vitamin B6	AGB, SG, RYGB, BPD <sup>2</sup>				AGB, SG, RYGB, BPD <sup>1</sup>			AGB <sup>3</sup> , SG <sup>3</sup> , RYGB <sup>3</sup> , BPD <sup>1,3</sup>
Vitamin B12	AGB, SG, RYGB, BPD <sup>1</sup>			AGB, SG, RYGB, BPD <sup>2</sup>	AGB, SG, RYGB, BPD <sup>2</sup>	AGB, SG, RYGB, BPD <sup>2</sup>	AGB, SG, RYGB, BPD <sup>2</sup>	AGB, SG, RYGB, BPD <sup>2</sup>
Parathormone	AGB, SG, RYGB, BPD <sup>2</sup>			AGB, SG, RYGB, BPD <sup>2</sup>	AGB, SG, RYGB, BPD <sup>2</sup>		AGB, SG, RYGB, BPD <sup>2</sup>	AGB, SG, RYGB, BPD <sup>2</sup>

<sup>1</sup>Useful, including all contents in the space; <sup>2</sup>Recommended, including all contents in the space; <sup>3</sup>Every 2-5 years. AGB: Laparoscopic adjustable gastric banding; SG: Sleeve gastrectomy; RYGB: Roux-en-Y gastric bypass; BPD: Biliopancreatic diversion.

Considering the high prevalence of nutrient deficiencies even prior to surgery, the current Guidelines also underscore the need for a complete pre-surgery nutritional assessment in all candidates for bariatric surgery.





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## **CONCLUSIONS AND TAKE HOME MESSAGE**

- BS may increase the risk of MD as a result of modifications to the gastrointestinal anatomy and physiology; however, confounders including preoperative deficiency, eating behavior, supplementation and inflammation are also to be considered
- The best practices guidelines highly recommend regular metabolic and nutritional monitoring after BS, which frequency varies according to the type of procedure to identify MD earlier and allows for intervention before development of clinical symptoms.
- A more individualized, person-centred approach may be safe and efficacious, within a supportive nutritionist with expertise in BS and the administration of multivitamins especially formulated for BS patients

**Grazie**



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