L'OBESITÀ NEL 2024: NUOVI MODELLI E TRAGUARDI DI CURA

L'OBESITÀ: MALATTIA SISTEMICA E RUOLO DELLA TERAPIA CHIRURGICA

Moderatori: Anna Pia, Roberto Polastri, Marco Quercio

Aspetti endocrino-metabolici: il distiroidismo, l'ipovitaminosi D e la sarcopenia

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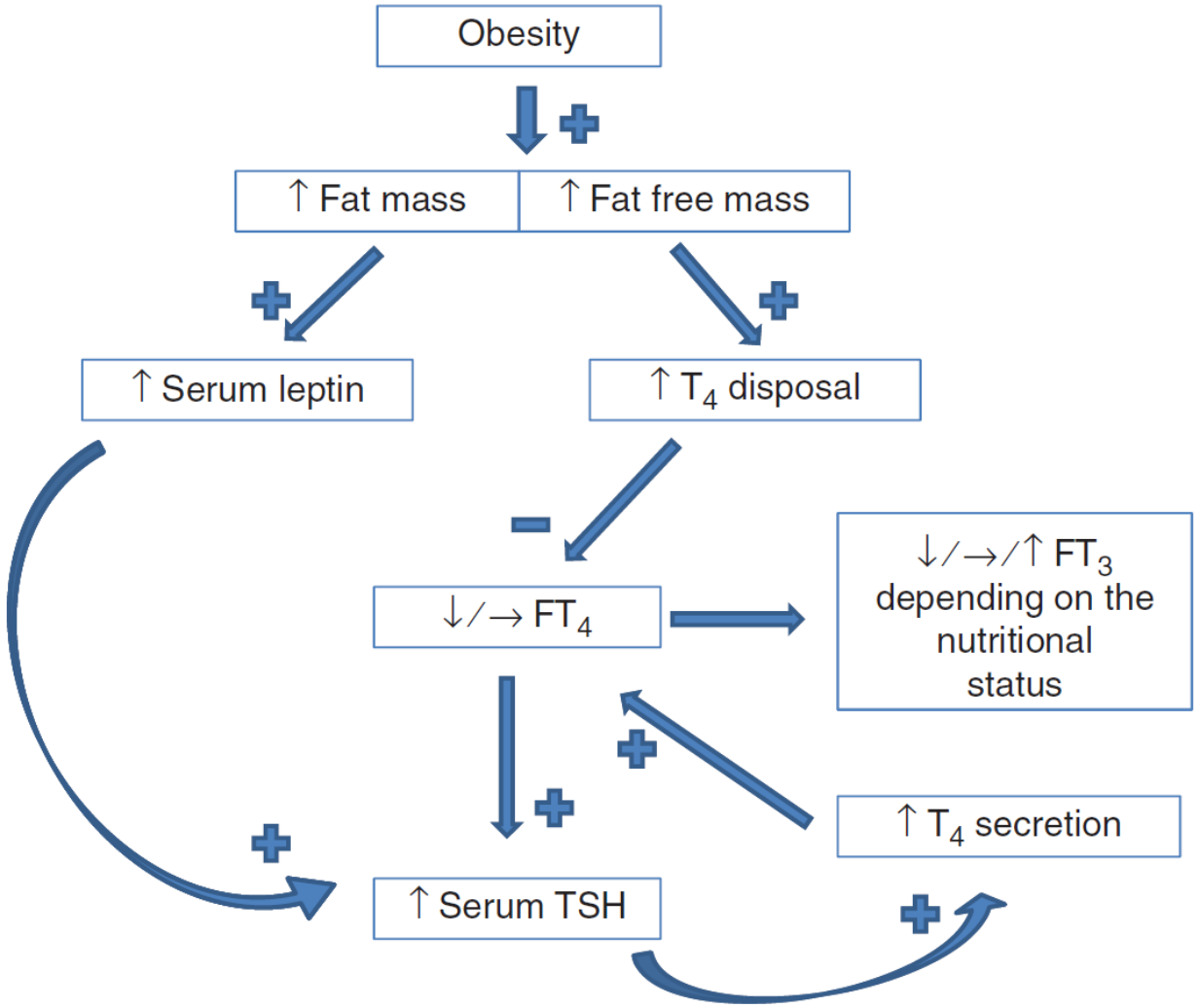
DISCLOSURES

Abiogen; Amryt/Chiesi; Astra Zeneca; Boheringer; Difass International; Caelus Health; Menarini; Novartis; Novo Nordisk; Probiotical , Sanofi; Therascience


15
min

HPT in OBESITY



Santini F et al, EJE 2014

HPT in OBESITY

In morbid obese patients, TSH is moderately increased

The slightly elevated TSH encountered in obese patients is reversible with weight loss and due to the increased adiposity

Morbid obesity is characterized by a slight **pituitary resistance to thyroid hormones** that is reversible with BS-induced weight loss

Cordido M et al, J Clin Med 2022

HPT in OBESITY after BS

TSH

Study or Subgroup	Before surgery Mean	SD	Total	After surgery Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Abu-Ghanem 2015	2.45	0.17	38	1.82	0.18	38	3.4%	3.56 [2.83, 4.30]
Alagna (1) 2003	1.55	0.693	12	1.4	0.294	12	3.3%	0.27 [-0.53, 1.08]
Alagna (2) 2003	1.5	0.91	26	1.65	0.59	26	3.7%	-0.19 [-0.74, 0.35]
Bawahab 2017	3.369	0.62	50	2.39	0.4	50	3.8%	1.86 [1.39, 2.33]
Buscemi 1997	1.14	0.32	10	1.28	0.74	10	3.2%	-0.24 [-1.12, 0.65]
Butte 2015	3.05	1.36	11	1.65	0.94	11	3.1%	1.15 [0.24, 2.07]
Camastra 2009	1.94	0.22	7	1.49	0.18	7	2.3%	2.10 [0.70, 3.49]
Dall' Asta 2010	1.9	0.07	258	1.93	0.12	220	4.1%	-0.31 [-0.49, -0.13]
Dittmar 2003	1.38	0.76	26	1.27	0.52	26	3.7%	0.17 [-0.38, 0.71]
Fallahi (1) 2017	2.21	0.91	13	3.8	1.83	13	3.2%	-1.07 [-1.90, -0.23]
Fallahi (2) 2017	2.65	0.86	4	3.12	1.33	4	2.3%	-0.36 [-1.77, 1.04]
Fierabracci 2016	1.56	1.47	93	0.84	1.03	93	4.0%	0.56 [0.27, 0.86]
Gkotsina (1) 2013	2.56	1.14	10	2.37	1.17	10	3.2%	0.16 [-0.72, 1.04]
Gkotsina (2) 2013	1.88	0.94	7	2.02	0.95	7	2.9%	-0.14 [-1.19, 0.91]
Gkotsina (3) 2013	2.57	1.01	15	3.07	1.26	15	3.4%	-0.43 [-1.15, 0.30]
Gniuli 2010	2.96	4.11	45	4.59	9.05	45	3.9%	-0.23 [-0.64, 0.18]
Hasani 2015	2.47	1	21	2.25	1.09	21	3.6%	0.21 [-0.40, 0.81]
Janssen 2015	5.82	2.05	61	2.78	1.31	61	3.9%	1.76 [1.34, 2.18]
Lips 2013	3.4	1.7	31	2	1.1	31	3.7%	0.97 [0.44, 1.49]
MacCuish 2012	2	0.14	55	2.02	0.22	55	3.9%	-0.11 [-0.48, 0.27]
Michalaki 2014	2.02	0.97	35	2.4	1.06	35	3.8%	-0.37 [-0.84, 0.10]
Moulin (1) 2005	2.28	0.88	54	1.74	0.97	54	3.9%	0.58 [0.19, 0.96]
Moulin (2) 2005	5.27	1.22	18	2.68	0.89	18	3.2%	2.37 [1.50, 3.25]
Nannipieri (1) 2009	1.4	0.52	14	1.1	0.74	14	3.4%	0.46 [-0.30, 1.21]
Nannipieri (2) 2009	2	0.67	13	0.9	0.74	13	3.1%	1.51 [0.62, 2.40]
Sundaram 2013	2.64	1.83	74	2	1.43	74	4.0%	0.39 [0.06, 0.71]
Vettor 2003	1.76	0.22	10	2	0.21	10	3.0%	-1.07 [-2.02, -0.12]
Xing 2017	3.13	1.3	10	1.62	0.4	10	2.9%	1.50 [0.48, 2.52]
Zendel 2017	3.9	2.8	93	3	2.6	93	4.0%	0.33 [0.04, 0.62]
Total (95% CI)			**1114**			**1076**	**100.0%**	**0.52 [0.20, 0.83]**

Heterogeneity: Tau² = 0.62; Chi² = 310.49, df = 28 (P < 0.00001); I² = 91%
Test for overall effect: Z = 3.19 (P = 0.001)

Std. Mean Difference IV, Random, 95% CI
-4 -2 0 2 4
Increase in value Decrease in value

T3

Study or Subgroup	Before surgery Mean	SD	Total	After surgery Mean	SD	Total	Weight	Std. Mean Difference IV, Fixed, 95% CI
Buscemi 1997	1.37	0.21	10	1.27	0.14	10	5.1%	0.54 [-0.36, 1.43]
Butte 2015	115	30.7	11	77.7	17.9	11	4.4%	1.43 [0.47, 2.38]
Gkotsina (1) 2013	1.29	0.16	10	1.05	0.11	10	3.7%	1.67 [0.62, 2.72]
Gkotsina (2) 2013	1.44	0.28	7	1.18	0.21	7	3.2%	0.98 [-0.15, 2.12]
Gkotsina (3) 2013	1.4	0.12	15	1.15	0.12	15	5.0%	2.03 [1.12, 2.93]
Hasani 2015	1.52	0.63	21	1.21	0.41	21	10.6%	0.57 [-0.05, 1.19]
Lips 2013	1.9	0.3	31	1.6	0.2	31	13.9%	1.16 [0.62, 1.70]
Michalaki 2014	1.36	0.28	35	1.16	0.2	35	17.0%	0.81 [0.32, 1.30]
Moulin (1) 2005	133	24.5	54	112.1	16.5	54	25.3%	0.99 [0.59, 1.39]
Moulin (2) 2005	129.1	22.1	18	104.3	16.7	18	7.8%	1.24 [0.52, 1.96]
Xing 2017	1.7	0.2	10	1.4	0.2	10	4.0%	1.44 [0.43, 2.44]
Total (95% CI)			**222**			**222**	**100.0%**	**1.05 [0.85, 1.25]**

Heterogeneity: Chi² = 12.00, df = 10 (P = 0.29); I² = 17%
Test for overall effect: Z = 10.22 (P < 0.00001)

Std. Mean Difference IV, Fixed, 95% CI
-2 -1 0 1 2
Increase in value Decrease in value

fT4

Study or Subgroup	Before surgery Mean	SD	Total	After surgery Mean	SD	Total	Weight	Std. Mean Difference IV, Fixed, 95% CI
Bawahab 2017	15.34	1.66	50	15.08	0.65	50	30.1%	0.20 [-0.19, 0.60]
Buscemi 1997	8.84	1.33	10	8.04	0.81	10	5.6%	0.70 [-0.21, 1.60]
Butte 2015	7.77	1.65	11	7.32	1.23	11	6.6%	0.30 [-0.54, 1.14]
Gkotsina (1) 2013	7.71	0.83	10	8.32	1.24	10	5.8%	-0.55 [-1.45, 0.34]
Gkotsina (2) 2013	9.38	1.15	7	8.65	1.43	7	4.0%	0.53 [-0.55, 1.60]
Gkotsina (3) 2013	9.19	1.36	15	8.87	1	15	9.0%	0.26 [-0.46, 0.98]
Hasani 2015	8.1	1.45	21	9.04	1.33	21	12.0%	-0.66 [-1.29, -0.04]
Michalaki 2014	8.93	1.57	35	8.38	1.51	35	20.8%	0.35 [-0.12, 0.83]
Xing 2017	87	11.3	10	88.8	16	10	6.0%	-0.12 [-1.00, 0.75]
Total (95% CI)			**169**			**169**	**100.0%**	**0.12 [-0.10, 0.34]**

Heterogeneity: Chi² = 12.06, df = 8 (P = 0.15); I² = 34%
Test for overall effect: Z = 1.09 (P = 0.28)

Std. Mean Difference IV, Fixed, 95% CI
-2 -1 0 1 2
Increase in value Decrease in value

T4

Study or Subgroup	Before surgery Mean	SD	Total	After surgery Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Abu-Ghanem 2015	13.27	0.45	38	12.96	0.42	38	4.7%	0.70 [0.24, 1.17]
Alagna (1) 2003	12.8	2.61	12	12.1	3.54	12	4.5%	0.22 [-0.59, 1.02]
Alagna (2) 2003	14	2.78	26	12.8	3.25	26	4.7%	0.39 [-0.16, 0.94]
Buscemi 1997	1.3	0.24	10	1.39	0.24	10	4.5%	-0.36 [-1.24, 0.53]
Butte 2015	1.31	0.18	11	1.26	0.25	11	4.5%	0.22 [-0.62, 1.06]
Camastra 2009	11.7	0.9	7	10.4	0.3	7	4.1%	1.81 [0.50, 3.13]
Dall' Asta 2010	1.17	0.01	258	1.23	0.02	220	4.8%	-3.88 [-4.19, -3.58]
Fallahi (1) 2017	1.27	0.31	13	1.18	0.37	13	4.5%	0.26 [-0.52, 1.03]
Fallahi (2) 2017	1.31	0.28	4	1.2	0.36	4	4.0%	0.30 [-1.10, 1.70]
Fierabracci 2016	12	2.5	93	12.1	2.8	93	4.8%	-0.04 [-0.32, 0.25]
Gniuli 2010	12.32	2.59	45	11.85	2.04	45	4.8%	0.20 [-0.21, 0.61]
Janssen 2015	15	2	61	14	2	61	4.8%	0.50 [0.14, 0.86]
Lips 2013	15.3	2.8	31	14.6	2.3	31	4.7%	0.27 [-0.23, 0.77]
MacCuish 2012	13.46	0.28	55	15.14	0.55	55	4.6%	-3.82 [-4.46, -3.19]
Moulin (1) 2005	1.04	0.17	54	1.04	0.16	54	4.8%	0.00 [-0.38, 0.38]
Moulin (2) 2005	1.04	0.13	18	1.09	0.14	18	4.6%	-0.36 [-1.02, 0.30]
Nannipieri (1) 2009	10.9	2.96	14	14.5	5.11	14	4.5%	-0.84 [-1.61, -0.06]
Nannipieri (2) 2009	10.3	2.89	13	12.6	3.33	13	4.5%	-0.71 [-1.51, 0.08]
Vettor 2003	13.35	0.58	10	10.99	0.55	10	3.7%	4.00 [2.36, 5.64]
Xing 2017	13.5	1	10	12.8	1.9	10	4.4%	0.44 [-0.45, 1.33]
Yashkov 2000	15.6	3.4	33	16.8	4.7	20	4.7%	-0.30 [-0.86, 0.26]
Zendel 2017	13.7	3.1	93	14.9	4.9	93	4.8%	-0.29 [-0.58, -0.00]
Total (95% CI)			**909**			**858**	**100.0%**	**-0.11 [-0.77, 0.55]**

Heterogeneity: Tau² = 2.33; Chi² = 737.25, df = 21 (P < 0.00001); I² = 97%
Test for overall effect: Z = 0.34 (P = 0.74)

Std. Mean Difference IV, Random, 95% CI
-4 -2 0 2 4
Increae in value Decrease in value

Guan B et al, Obes Surg 2017

Thyroid hormone treatment after BS

Thyroid Hormone Treatment in Obese Patients with Hypothyroidism and the Effects of Bariatric Surgery
- In hypothyroid severe obese patients following BS-induced weight loss, the total levothyroxine dose decreased, the levothyroxine dose/kg of IBW did not change and the levothyroxine dose/kg of actual BW increased.
- In hypothyroid severe obese patients, after BS, the weight lost was inversely correlated with the levothyroxine dose/body surface and levothyroxine dose/kg of actual BW. The absolute levothyroxine dose and the levothyroxine dose/kg of IBW was not related with weight loss
- The levothyroxine needs and its change after BS was similar for SG and RYGB
- Thyroid hormone replacement in patients with obesity and hypothyroidism can be more adequately adjusted if it is based on IBW.

Cordido M et al, J Clin Med 2022

Thyroid hormone treatment after BS

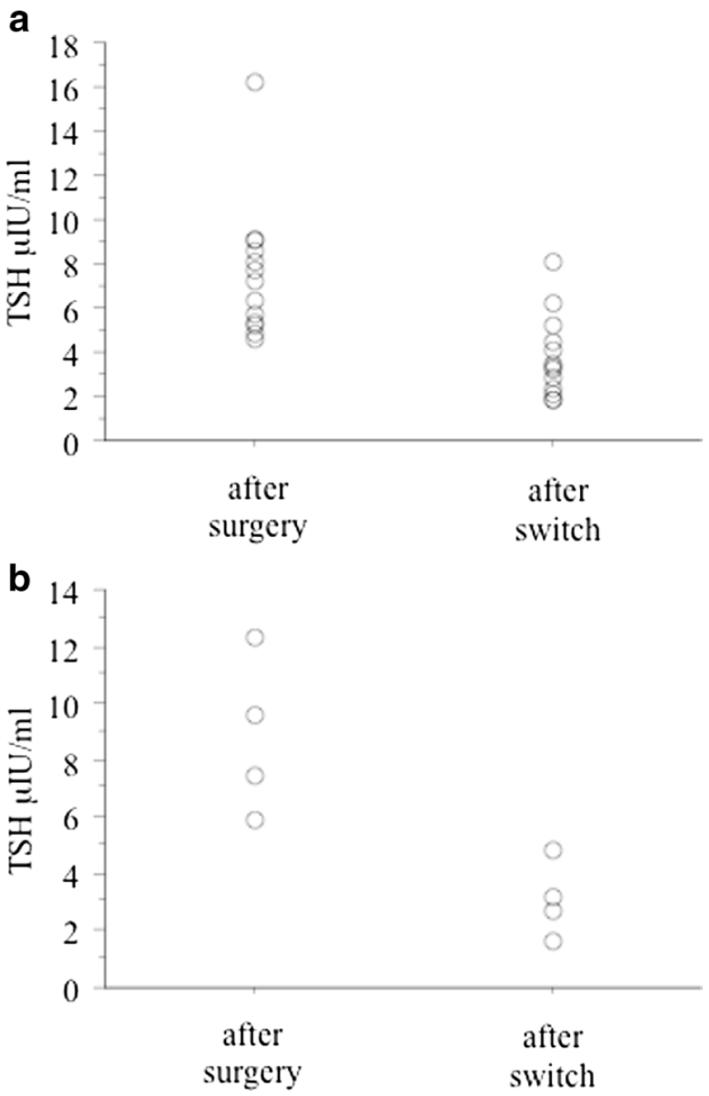
MALABSORPTION?

- ✓ Drug **dissolution and solubility** may be potentially altered in **restrictive procedures** that increase gastric pH in the newly stomach
- ✓ Highly **lipophilic drugs** are more likely to be affected because they are often dependent upon the availability of **bile acids** to enhance solubility
- ✓ Lipophilic agents also undergo **enterohepatic recirculation**
- ✓ Bypass of the upper small intestine **limits the mixing of such drugs with bile acids** to the common (post-anastamotic) limbs of the distal small intestine
- ✓ Jejunoileal bypass may also result in bile acid wasting
- ✓ As **microbiota** can modulate both the absorption and the metabolism of drugs, they may constitute a missing link in the assessment of pharmacokinetic changes after BS (understudied area)

Fallahi P et al, Front Endocrinol 2021

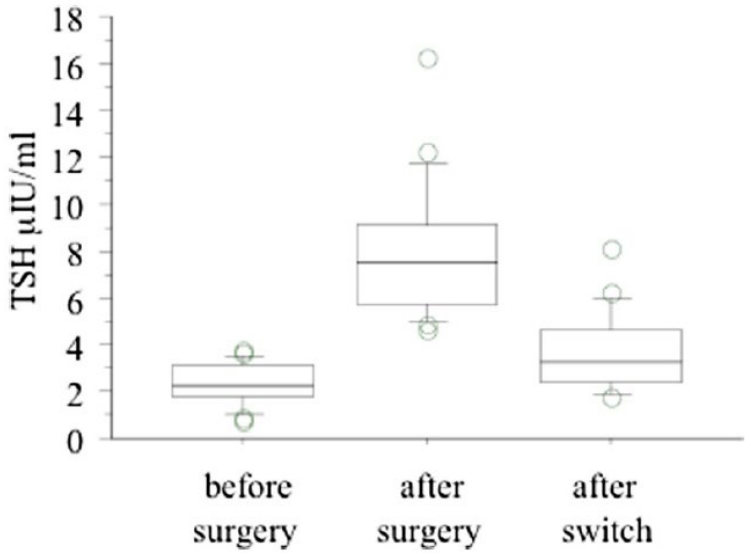
TSH Normalization in Bariatric Surgery Patients After the Switch from L-Thyroxine in Tablet to an Oral Liquid Formulation

SOFT GEL TABLETS ?



RYGB

BPD



Fallahi P et al, Obes Surg 2017

Patient to be treated with THYROXINE

Tablet T_4 treatment

TSH not on target

Check patient compliance and ingestion habits

improved

TSH on target

TSH not on target

amended

"THE DIFFICULT PATIENT"
Patients' personal preference
Polypharmacy
Diagnosed gastrointestinal disorders
Intolerant to excipients

ALTERNATIVE T_4 PREPARATIONS

Check for gastrointestinal disorders or drug interference

TSH not on target

LIQUID
Infants
Unconscious
Impaired gastric acidity
Unable to swallow
Enterally fed
Pregnant ?

SOFTGEL
Impaired gastric acidity

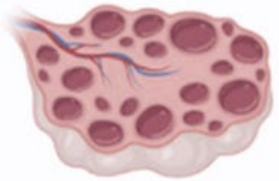
Virili C et al, Endocrine 2016

VD in OBESITY

↓Function β cell
↓Insulin sensivity (PPAR-δ)
Modulation Calcium fluxes
Chronic Inflamation
Regulation Calbindin

Type 2 Diabetes

↓SHB
↑Antimüllerian Hormone
Hyperandrogenism
Distubance VDR gene polymorphisms



Polycystic ovarian syndrome

Vitamin D | **Insulin Resistance**

Obesity

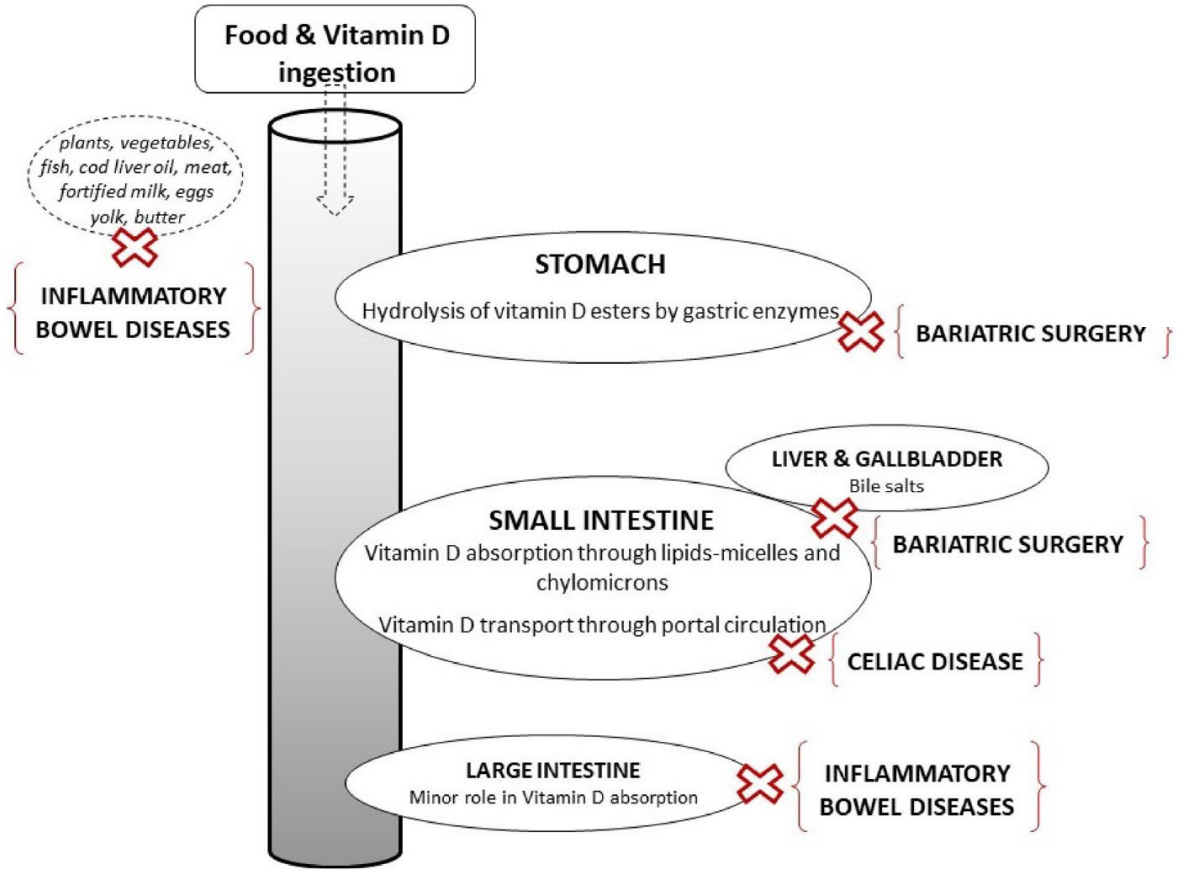
Fat-soluble storage
Volumetric dilution
↑Vitamin-D receptor expression

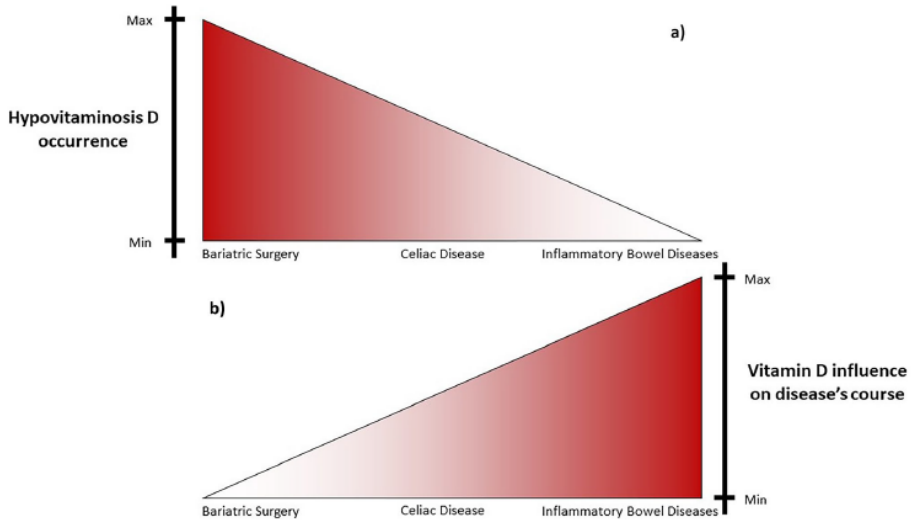
Metabolic Syndrome

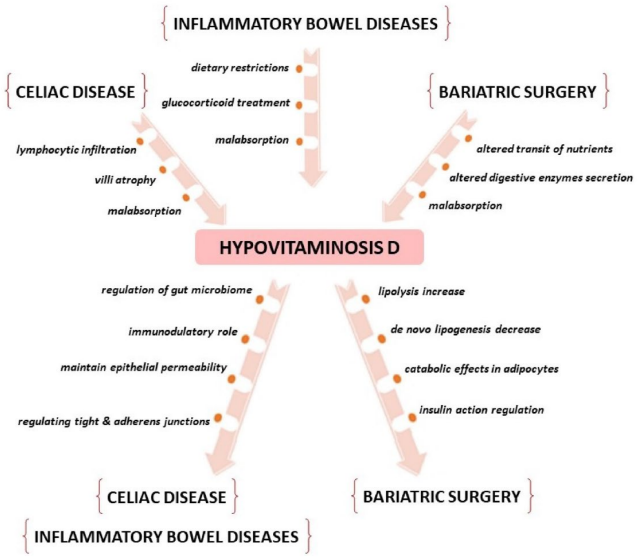
Apoptosis
Impaired hepatic 25-hydroxylation
↑Renin-Angiotensin System
↑Cardiovascular Risk

Contreras-Bolivar V et al, Nutrients 2021

VD in OBESITY after BS







Giustina A et al, Rev Endocr Metab Disord 2023

Vitamin D status and supplementation before and after Bariatric Surgery: Recommendations based on a systematic review and meta-analysis

PREVALENCE

The statement proposed by Consensus group regarding key clinical question #1 was: "25(OH)D levels should be evaluated preoperatively in all patients who undergo bariatric surgery".
Recommendation D; Low quality evidence.

The statement proposed by Consensus group regarding key clinical question #2 was: "25(OH)D levels should be routinely evaluated in all patients who have undergone bariatric surgery. Without specific postoperative supplementation, high rates of vitamin D insufficiency are observed".
Recommendation D; Low quality evidence.

The statement proposed by Consensus group regarding key clinical question #3 was: "Patients undergoing malabsorptive bariatric surgery have higher rates of 25(OH)D <30 ng/mL than those undergoing restrictive bariatric surgery".
Recommendation C; Low quality evidence.

Giustina A et al, Rev Endocr Metab Disord 2023

Vitamin D status and supplementation before and after Bariatric Surgery: Recommendations based on a systematic review and meta-analysis

The statement proposed by the Consensus group regarding key clinical questions #1 and #2 was: "Post-operative doses of vitamin D supplementation ≥2,000 IU/daily result in lower rates of vitamin D insufficiency (only as defined by 30 ng/mL threshold) compared to doses <2,000 IU/daily, regardless of the type of intervention and timepoints".
Recommendation D; low quality evidence.

The statement proposed by the group regarding clinical question #3 was: "In patients undergoing malabsorptive surgery, use of intramuscular supplementation may be considered an alternative to oral supplementation, as it results in higher 25(OH)D levels and lower rates of vitamin D insufficiency, especially at high-dose".
Recommendation D; low quality evidence.

Quality of evidence and publication bias for clinical question #3: given lack of data and low number of studies, descriptive statistics were used, and quality of evidence was rated very low, relying mainly on expert opinion.

TREATMENT

Giustina A et al, Rev Endocr Metab Disord 2023

SARCOBESITY

	Sarcopenia	Sarcopenic obesity
Definition	SCREENING	ASO (2022)
Pathological factors	DIAGNOSIS	diposity + mass/function
Diagnosis	STAGING	esity
		uscle strength ed fat mass nuscle mass

SCREENING

- High **BMI or WC** (based on ethnic cut-points)
- **Surrogate parameters for sarcopenia** [clinical symptoms, clinical suspicion or questionnaires (e.g. SARC-F in older subjects)]

***Both conditions** must be present to proceed with the diagnostic process.*

DIAGNOSIS

*It will be performed in **two steps:***

1. ALTERED SKELETAL MUSCLE FUNCTIONAL PARAMETERS considering **strength** (HGS, chair stand test)

If muscle functional parameters suggest the presence of SO, the diagnostic process will continue considering body composition.

2. ALTERED BODY COMPOSITION: increased FM (FM%) and **reduced muscle mass** assessed as ALM/W by DXA or as SMM/W by BIA

*Both **altered body composition** and **altered skeletal muscle functional parameters** should be present to assess the presence of SO.*

STAGING

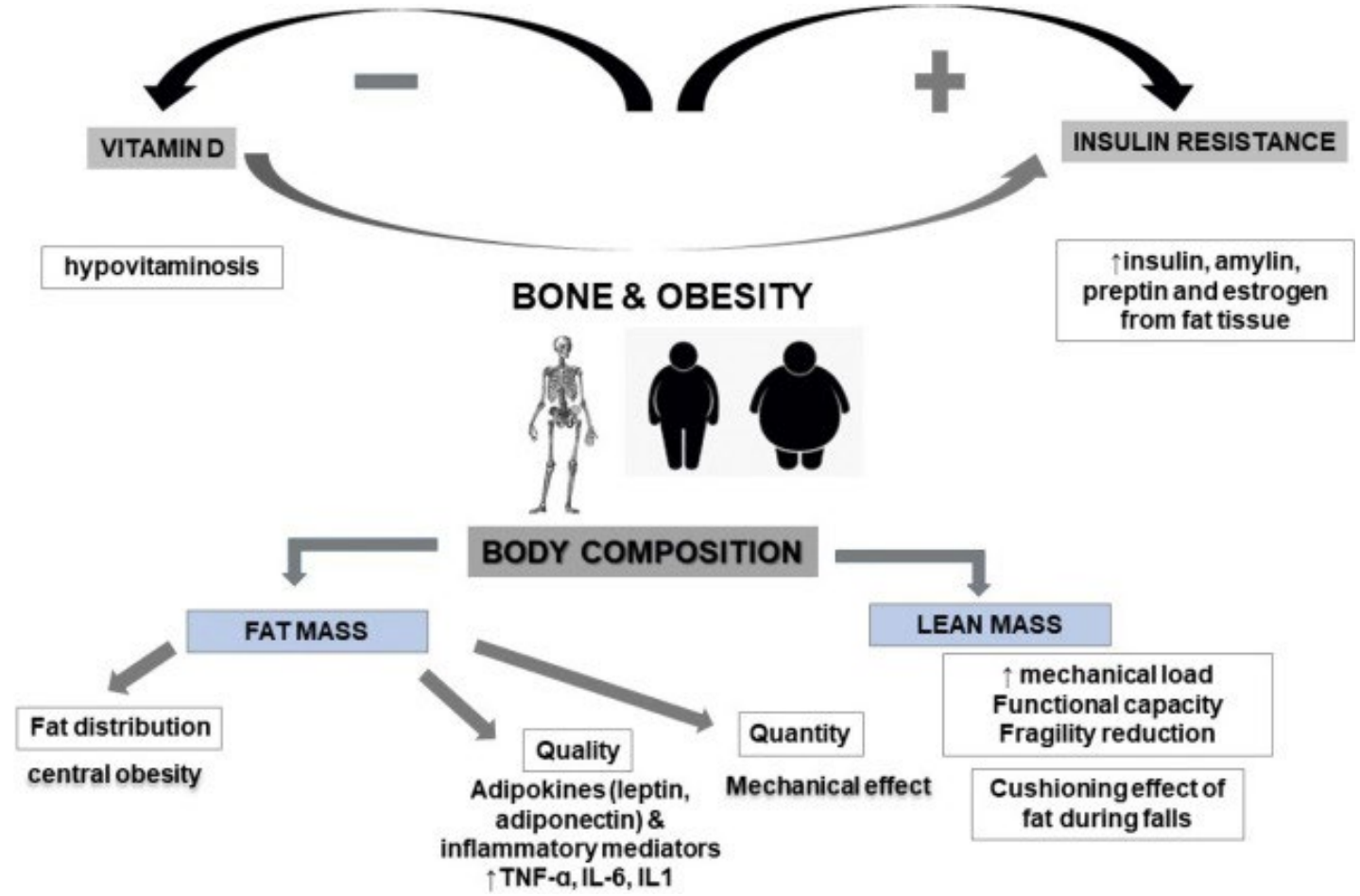
A two-level STAGING should be performed, based on the presence of complications **resulting from high FM and low ASMM,** to better mirror the progression/severity of SO:

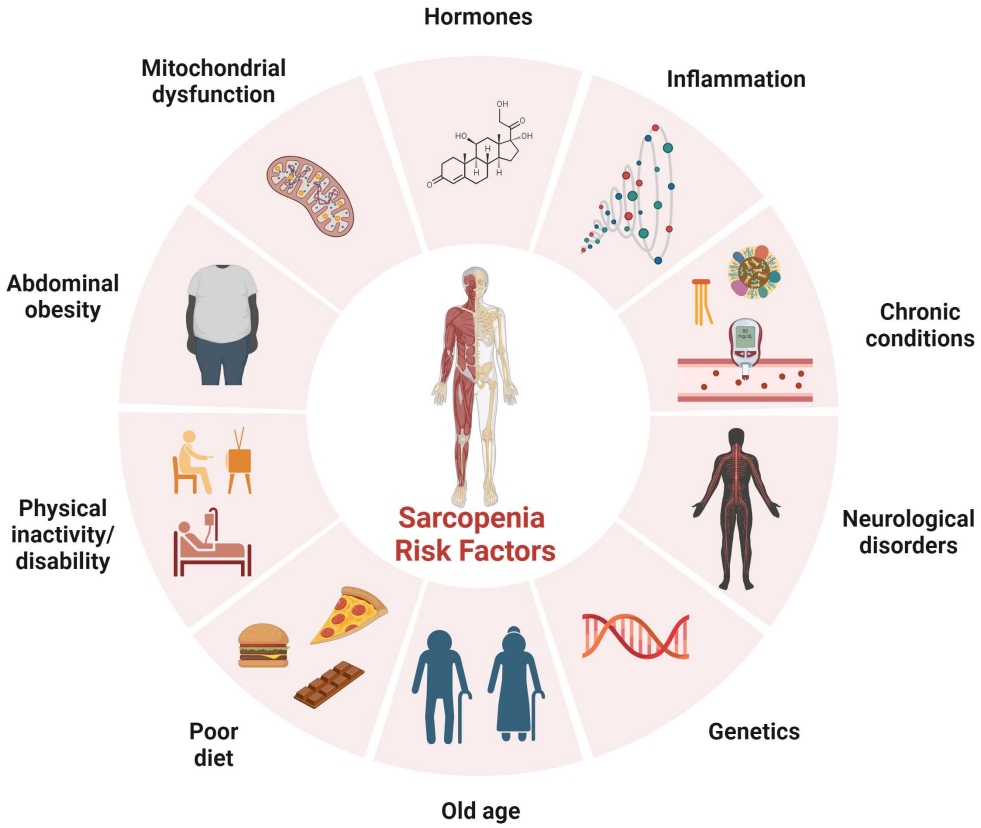
- **STAGE I: NO complications**
- **STAGE II: presence of at least one complication attributable to SO** (e.g. metabolic diseases, functional disabilities, cardiovascular and respiratory diseases).

Donini LM et al, Clin Nutr 2022

Seo E et al, Rev Endocr Metab Disord 2023

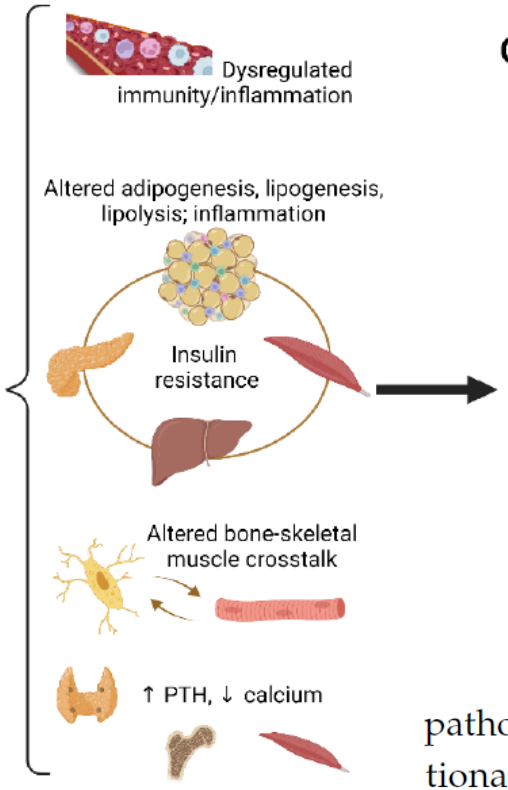
SARCOBESITY



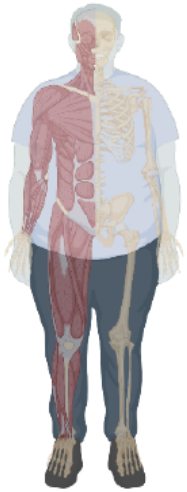


VD in SARCOBESITY

VITAMIN D DEFICIENCY



OSTEOSARCOPENIC OBESITY



pathogenesis and treatment of the condition. We found that, although evidence from large observational studies and pre-clinical experiments strongly supports a role of vitamin D deficiency in the pathogenesis of osteosarcopenic obesity, the common belief that vitamin D improves musculoskeletal health lacks solid clinical evidence, as trials specifically aimed at assessing the effects of vitamin D supplementation in patients with osteosarcopenic obesity are not available, and trials that investigated the role of vitamin D on muscle and bone health in other patient populations either showed no or even detrimental effects. We conclude that large observational and interventional studies including individuals with osteosarcopenic obesity representative of different sex, age and race are needed to better define the role of vitamin D in the pathogenesis and treatment of this condition.

D Filippo L et al, Nutrients 2022

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DOI: 10.1111/apha.13269

REGULAR PAPER

ACTA PHYSIOLOGICA

Opposing effects of 25-hydroxy- and 1α,25-dihydroxy-vitamin D_3 on pro-cachectic cytokine-and cancer conditioned medium-induced atrophy in C2C12 myotubes

Hana Sustova[1,2] | Marilisa De Feudis[1,2] | Simone Reano[1,2] | Maraiza Alves Teixeira[1,2] | Ilaria Valle[1] | Ivan Zaggia[1] | Emanuela Agosti[1,2] | Flavia Prodam[3] | Nicoletta Filigheddu[1,2]

www.aging-us.com AGING 2021, Vol. 13, Advance

Research Paper

Cholecalciferol (vitamin D_3) has a direct protective activity against interleukin 6-induced atrophy in C2C12 myotubes

Maraiza Alves Teixeira[1,2], Marilisa De Feudis[1], Simone Reano[1], Tommaso Raiteri[1], Andrea Scircoli[1], Ivan Zaggia[1], Sara Ruga[1], Laura Salvadori[1,2], Flavia Prodam[3], Paolo Marzullo[1,4], Claudio Molinari[1], Davide Corà[1,5], Nicoletta Filigheddu[1,2]

antioxidants MDPI

Article

The atrophic effect of 1,25(OH)2 vitamin D3 (calcitriol) on C2C12 myotubes depends on oxidative stress

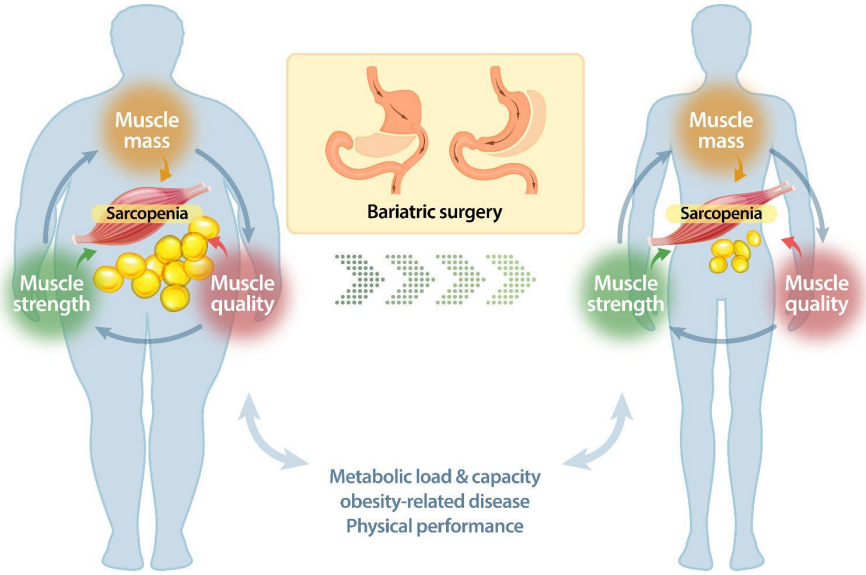
Tommaso Raiteri [1], Ivan Zaggia [1], Simone Reano [1], Andrea Scircoli [1], Laura Salvadori [1], Flavia Prodam [2], Nicoletta Filigheddu [1*]

Pro-atrophic Effect of Vitamin D Binding Protein in Skeletal Muscle and Its Involvement in Cancer-Induced Muscle Wasting

Filigheddu N, Raiteri, Reano S, Scircoli A, Antonioli A, Prodam F

SARCOBESITY in BS

- ✓ There is currently no consensus or definition regarding the research and clinical use of sarcopenia in patients undergoing BS
- ✓ The current consensus on the diagnosis of sarcopenia in the general population recommends sequential assessment of muscle strength and mass
- ✓ It seems thar that in patients undergoing BS, the assessment of muscle mass should take precedence over the evaluation of muscle strength.
- ✓ detailed evaluation of muscle quality should be conducted.
- ✓ Tracking changes muscle mass, quality, and function before and after bariatric surgery offers valuable clinical insights for identifying patients who would benefit from enhanced lifestyle guidance or more intensive treatment.
- ✓ Further evaluation of potential postsurgical complications will enable the assessment of the effectiveness and validity of surgical interventions.



Seo E et al, Rev Endocr Metab Disord 2023

SARCOBESITY in BS

ESPEN
The European Society for Clinical Nutrition and Metabolism

Prot: 60-90 g/die or 1.2-1.5 Kg/IBW Supplements

Management before and after weight loss

Before bariatric surgery

72) All patients undergoing bariatric surgery, including those with chronic gastrointestinal diseases, should be evaluated for nutritional deficiencies and sarcopenia before intervention. (R72, GPP, 97%)

73) In patients with inflammatory bowel disease, gastric endoscopy and coloscopy should be performed before surgery. (R73, GPP, 97%)

74) In patients with CD, a complete gastrointestinal tract assessment should be performed before bariatric surgery. (R74, GPP, 100%)

75) In patients with CLD, the presence of decompensated cirrhosis should be excluded before bariatric surgery, because of the increased risk following surgery. (R75, GPP, 100%)

76) A psycho-social evaluation can be performed by a behavioral healthcare specialist before bariatric surgery. (R76, 0, 96%)

77) Esophagogastroscopy can be performed as a routine diagnostic test before bariatric surgery to rule out Barret esophagus or esophageal and gastric malignancies. (R95, 0, 100%)

After bariatric sugery

78) All patients undergoing bariatric surgery, including those with chronic gastrointestinal diseases should be monitored for nutritional deficiencies after bariatric surgery. (R77, B, 100%)

79) Post-bariatric surgery patients should ingest adequate amounts of protein to preserve muscle mass and thus prevent sarcopenia. (R78, GPP, 97%)

80) All patients undergoing bariatric surgery, including those with chronic gastrointestinal diseases should be given nutritional supplements to avoid deficiencies after bariatric surgery. (R79, B, 96%)

81) Patients with gastrointestinal disease undergoing bariatric surgery should undergo immediate follow-up programs specifically designed for post-bariatric patients along with a follow-up of their primary disease. (R80, GPP, 100%)

82) Supplementary medical nutritional therapy should be provided to patients with chronic gastrointestinal diseases (IBS, IBD, CLD) if they develop nutritional deficiencies after surgically-induced weight loss. (R81, GPP, 100%)

83) Post-bariatric surgery patients who develop a nutritional insufficiency and specifically fat-soluble vitamin deficiencies despite adequate supplementation should undergo investigation for pancreatic insufficiency. (R89, GPP, 97%)

84) Post-bariatric surgery patients developing fat-soluble vitamin deficiencies despite adequate vitamin supplementation should be screened for pancreatic enzyme treatment even if fecal elastase is normal. (R90, GPP, 100%)

85) A structured long-term follow-up program should be defined and put into place after successful weight loss therapy is achieved by lifestyle intervention or bariatric surgical procedure. The follow-up program should comprise nutritional screening and assessment, diet recommendations, routine metabolic and nutritional monitoring as well as vitamin, nutrient, and micronutrient supplementation regularly. (R82, B, 100%)

Bischodd SC et al, Clin Nutr 2023

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