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IMMUNONUTRIZIONE O CHETOSI: Quale migliore alleato nel pre-operatorio



UNIVERSITÀ
DI TORINO

FARNAZ RAHIMI

DIRIGENTE MEDICO

RESPONSABILE CENTRO OBESITÀ E

CHIRURGIA BARIATRICA

SC DI DIETETICA E NUTRIZIONE CLINICA

AUO CITTÀ DELLA SALUTE E DELLA SCIENZA DI
TORINO (OSPEDALE MOLINETTE)

ERAS - ASPETTI NUTRIZIONALI

PRE-RICOVERO

VALUTAZIONE
RISCHIO
NUTRIZIONALE

PRE-OPERATORIO

RIDUZIONE
DURATA DEL
DIGIUNO

CARBOHYDRATE
LOADING

POST-OPERATORIO

PRECOCE
RIALIMENTAZIONE O
NUTRIZIONE
ENTERALE

**IMMUNO-
NUTRIZIONE**
PER I PZ

L'immunonutrizione preoperatoria, che prevede la somministrazione di nutrienti specifici, ha dimostrato di:

- ridurre le complicanze postoperatorie, in particolare quelle infettive
- abbreviare la degenza ospedaliera in pazienti sottoposti a chirurgia addominale maggiore.

**CHIRURGIA METABOLICA E
BARIATRICA ?**



SCIENTIFIC REVIEW

Guidelines for Perioperative Care in Bariatric Surgery: Enhanced Recovery After Surgery (ERAS) Society Recommendations

A. Thorell¹ · A. D. MacCormick^{2,3} · S. Awad^{4,5} · N. Reynolds⁴ · D. Roulin⁶ · N. Demartines⁶ · M. Vignaud⁷ · A. Alvarez⁸ · P. M. Singh⁹ · D. N. Lobo¹⁰

SCIENTIFIC REVIEW

Guidelines for Perioperative Care in Bariatric Surgery: Enhanced Recovery After Surgery (ERAS) Society Recommendations: A 2021 Update

Erik Stenberg¹ · Luiz Fernando dos Reis Falcão² · Mary O’Kane³ · Ronald Liem^{4,5} · Dimitri J. Pournaras⁶ · Paulina Salminen^{7,8} · Richard D. Urman⁹ · Anupama Wadhwa¹⁰ · Ulf O. Gustafsson¹¹ · Anders Thorell^{12,13}

Table 1 ERAS recommendations for preadmission care in bariatric surgery

Element	Recommendation	Level of evidence	Recommendation grade
3b. Preoperative weight loss	<i>Preoperative weight loss using very low or low-calorie diet prior to bariatric surgery should be recommended</i>	Postoperative complications: Moderate	Strong

Guidelines for Perioperative Care in Bariatric Surgery: Enhanced Recovery After Surgery (ERAS) Society Recommendations: A 2021 Update

Erik Stenberg¹ · Luiz Fernando dos Reis Falcão² · Mary O’Kane³ · Ronald Liem^{4,5} · Dimitri J. Pournaras⁶ · Paulina Salminen^{7,8} · Richard D. Urman⁹ · Anupama Wadhwa¹⁰ · Ulf O. Gustafsson¹¹ · Anders Thorell^{12,13}

Table 2 ERAS recommendations for preoperative care in bariatric surgery

Element	Recommendation	Level of evidence	Recommendation grade
6. Preoperative fasting	Solids until 6 h before induction and clear liquids until 2 h before induction for elective bariatric surgery assuming no contraindications (e.g., gastroparesis, bowel obstruction)	Low	Strong
7. Carbohydrate loading	There is insufficient evidence to make a recommendation about preoperative carbohydrate loading in bariatric surgery	Low	Weak

Enhanced recovery after bariatric surgery: an Italian consensus statement

Giuseppe Marinari¹  · Mirto Foletto²  · Carlo Nagliati³  · Giuseppe Navarra⁴ · Vincenzo Borrelli⁵ · Vincenzo Bruni⁶ · Giovanni Fantola⁷ · Roberto Moroni⁸  · Luigi Tritapepe⁹  · Roberta Monzani¹⁰  · Daniela Sanna¹¹ · Michele Carron¹²  · Rita Cataldo¹³

Table 4 Effectiveness, safety, and items of Enhanced Recovery after Bariatric Surgery (ERABS) compared to standard approach

	Evidence		Strength of Recommendation	Expert task force statement
	Level	Quality		
Patient optimization	1	A	A	Pre-operative optimization through smoking cessation, weight loss, blood glucose control, and the use of non-invasive ventilation (when indicated) is recommended in ERABS
Fasting	1	A	A	Clear liquids and solid food are recommended up to 2 h and 6 h, respectively, prior to the induction of anesthesia in ERABS
Early re-feeding	1	A	A	Early post-operative resumption of oral feeding is recommended in ERABS

REVIEW



Enhanced Recovery After Surgery (ERAS) protocol in bariatric and metabolic surgery (BMS)—analysis of practices in nutritional aspects from five continents

Carina Rossoni^{1,6}  • Daniéla Oliveira Magro²  • Zélia Coelho Santos³  • Maria Paula Carlini Cambi⁴  •
Luciana Patias⁵  • Rossela Bragança³  • Douglas Pellizzaro⁶  • Chetan Parmar⁷  • Rui Ribeiro³ 

This study aims to understand the prevalent practices on the nutritional aspects of the ERAS worldwide

- Only surgeons, nutritionists, and anesthesiologists (five continents: Africa, America, Asia, Europe, and Oceania) were invited to participate

An electronic questionnaire was provided to evaluate practices about the three nutritional aspects of ERAS protocol:

- ❖ preoperative fasting
- ❖ carbohydrate loading
- ❖ early postoperative nutrition

Editorial

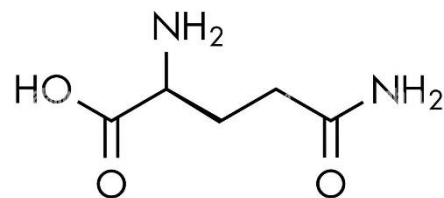
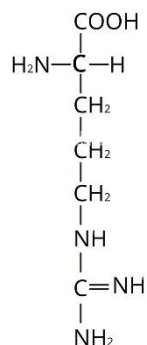
The Role of Immunonutrition in Patients

Marco Cintoni ^{1,*}  and Maria Cristina Mele ^{1,2} 

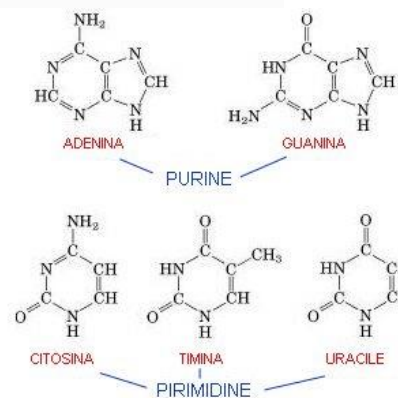
Immunonutrition (IN) is defined as “the use of specific nutritional substrates, called «immunonutrients» having the ability of modulating specific mechanisms involved in several immune and inflammatory pathways”

The most studied immunonutrients are:

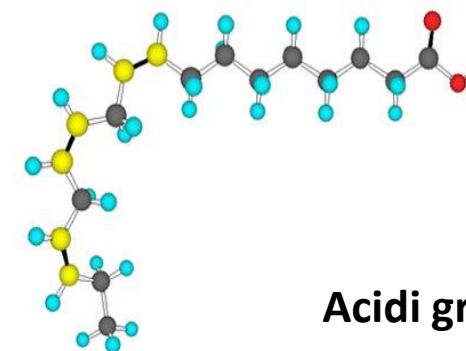
Arginine



glutamine



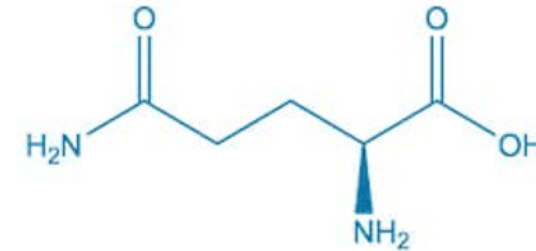
Nucleotidi



Acidi grassi
omega-3

Glutamina

È l'aminoacido più abbondante nell'organismo, la quantità contenuta nei muscoli scheletrici rappresenta più del 60% del pool di aminoacidi liberi. La glutamina è coinvolta in numerose vie metaboliche in vivo ed in vitro¹⁻⁵:



1. è il substrato azotato per la sintesi *de novo* di nucleotidi, amminozuccheri ed è coinvolta nel trasporto ed escrezione di ammoniaca a livello renale
2. è il trasportatore di azoto tra i diversi tessuti, rifornisce gli intermedi del ciclo di Krebs, soprattutto nei tessuti a rapido turnover
3. è coinvolta nella sintesi del glutathione
4. stimola la sintesi delle *heat shock proteins* (HSP)
5. inibisce l'espressione delle citochine pro-infiammatorie
6. promuove l'integrità della mucosa intestinale.

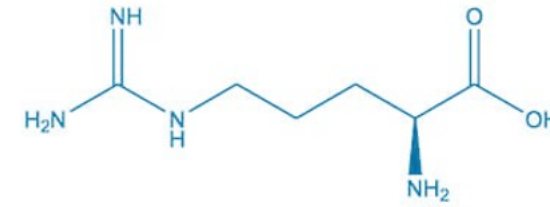
7) Kim H. tYonsei 2011; 8) Wu G et al. 2004; 9) Qu B. et al 2015; 10) Singleton KD. et al. 2007; 11) Ziegler TR. 2005

L-Arginina

Aminoacido polare, basico e condizionatamente essenziale poiché la sua sintesi endogena viene inficiata da peculiari condizioni fisio-patologiche (stress, catabolismo).

È parte integrante di numerosi processi biologici.

Numerose pubblicazioni, in vitro ed in vivo, hanno documentato la sua attività metabolica⁷⁻¹¹:



1. **migliora il bilancio azotato e la sintesi proteica (collagene)**
2. **è il precursore del monossido di azoto (NO) che aumenta permeabilità, dilatazione dei vasi e perfusione dei tessuti**
3. **è precursore delle poliamine → ottimizza l'attività battericida di macrofagi e leucociti**
4. **stimola la proliferazione e l'attività dei linfociti T**
5. **stimola la citotossicità delle cellule Natural Killer attivate dalle linfocine.**

7) Kim H. Yonsei 2011; 8) Wu G et al. 2004; 9) Qu B. et al 2015; 10) Singleton KD. et al. 2007; 11) Ziegler TR. 2005

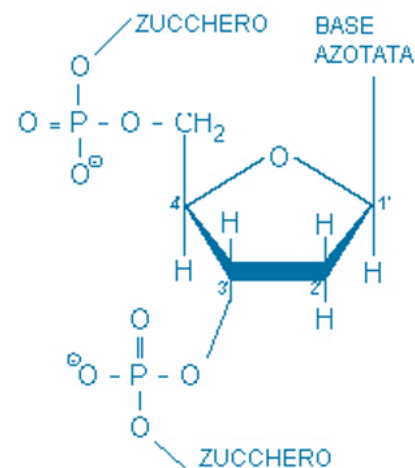
Nucleotidi

Composti chimici costitutivi del DNA e RNA, sono formati da una base azotata e da uno zucchero pentoso unito a 1 o più molecole di acido fosforico.¹ Possono essere sintetizzati *de novo* attraverso processi endogeni oppure assunti per via esogena.¹²

Diventano condizionatamente essenziali in tutte le condizioni fisiopatologiche che richiedono un incremento repentino dell'attività di replicazione cellulare o proliferazione tissutale.⁵

Pubblicazione, in vitro ed in vivo, hanno documentato la loro attività metabolica^{12, 5}:

1. **migliorano numero e attività biologica dei linfociti T e NK**
2. **riducono la produzione di IL-2 che promuove l'attivazione immunitaria**
3. **sono substrati indispensabili per le cellule a rapido turnover (mucose, linfociti e macrofagi)**
4. **sono elementi costitutivi di diversi coenzimi.**

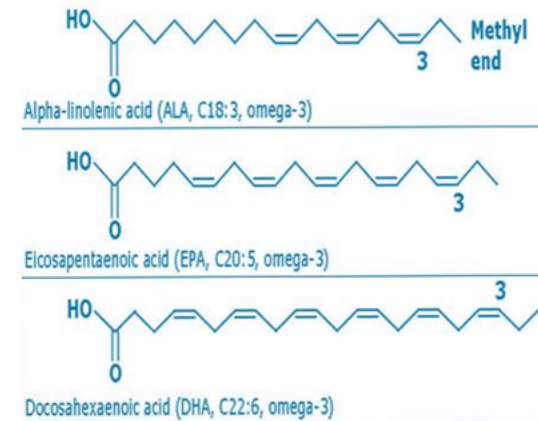


12) Hess JR, Greenberg NA. 2012; 5) Suchner U. et al. 2000.

Acidi Grassi ω -3

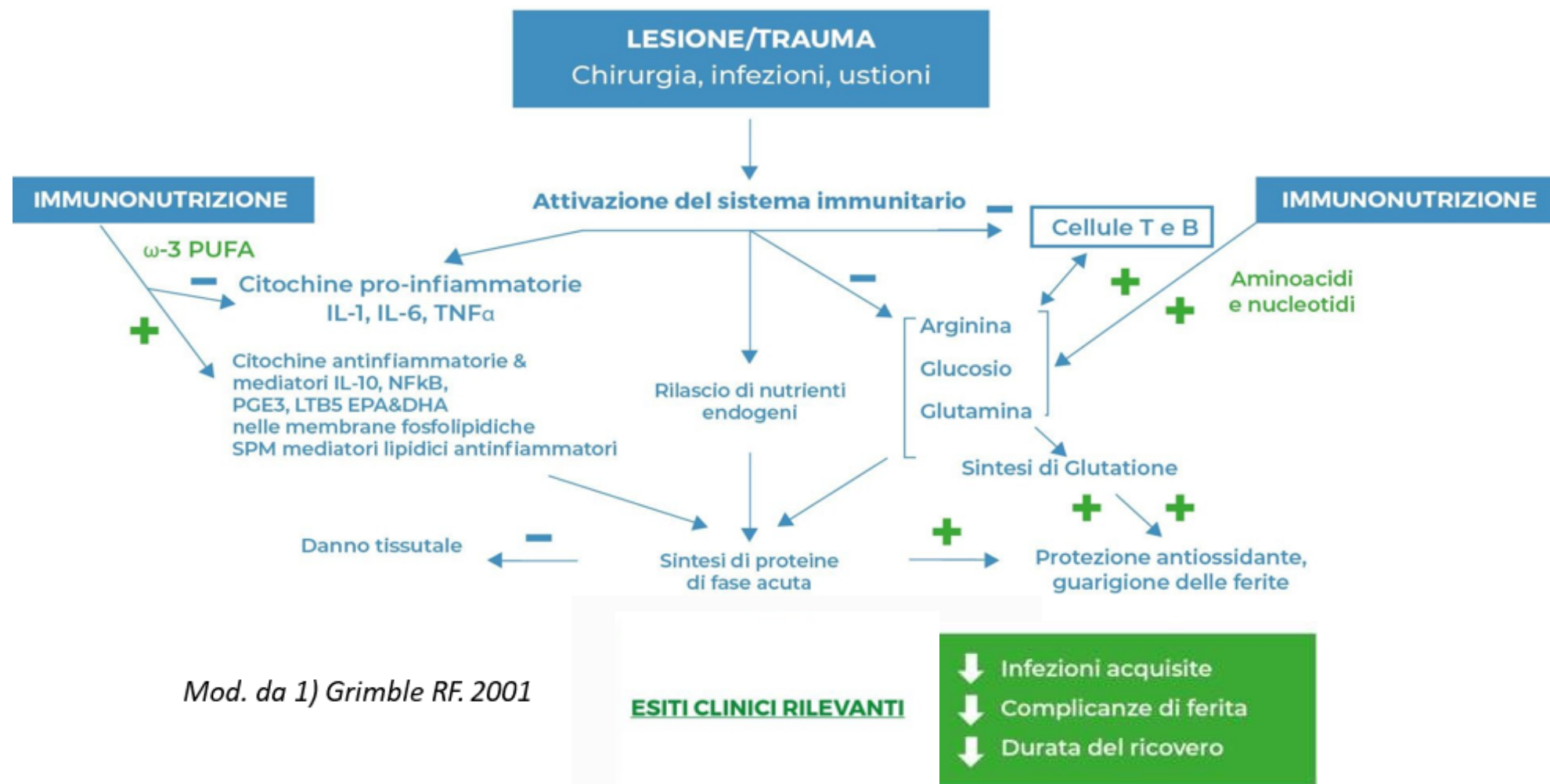
Sono una serie di acidi grassi **polinsaturi (PUFA) a lunga catena (16-24 atomi di C)**. La particolare posizione del doppio legame (ω -3), non sintetizzabile dall'organismo umano, rende essenziale questa classe di nutrienti che, per questa ragione, necessita di essere assunta per via esogena. Sono da tempo ben documentati in letteratura i peculiari effetti metabolici degli acidi grassi ω -3 EPA e DHA di origine marina¹³⁻¹⁵:

1. sono costituenti strutturali delle membrane cellulari. Il rapporto ω 6: ω 3 ne condiziona la fluidità
2. riducono la risposta infiammatoria: modulano la sintesi di eicosanoidi, inibiscono la produzione di IL6, TNF- α , Proteolysis Inducing Factor (PIF) e delle proteine di fase acuta
3. regolano la risposta immunitaria ($\uparrow$ CD4/CD8) e i meccanismi della coagulazione
4. promuovono l'anabolismo proteico.



13) Yi-Qian N. et al. 2008; 14) Wan D. 2013 15) Savino P. 2017

Immunonutrienti: *come agiscono*



Immunonutrienti: *come agiscono*



Gli immunonutrienti sono dei **substrati nutrizionali** che, aggiunti alle miscele per nutrizione enterale in specifici dosaggi, **svolgono un effetto fra loro additivo** e sono in grado di **modulare la risposta immunitaria e infiammatoria**.

Esempi di Immunonutrizione

Linee Guida ESPEN, Società Europea di Nutrizione Enterale e Parenterale)



Impact Oral è un trattamento nutrizionale che serve per migliorare e potenziare le difese immunitarie in generale e, in particolare, in vista di un intervento chirurgico.

Contiene Arginina, Omega 3, RNA e fibra solubile, è privo di **glutine** e contiene **lattosio** anche se in quantità clinicamente irrilevanti.

Numerosi studi clinici hanno dimostrato l'efficacia di Impact Oral: l'utilizzo preoperatorio del prodotto ha i seguenti effetti benefici:

- **riduzione del rischio di complicanze infettive postoperatorie** – Marimuthe K, Ann Surg, 2011
- **riduzione della degenza ospedaliera nella misura di 2,6 giorni** – Ceratola, Br J Surg, 2011

Il dosaggio consigliato, sempre dopo consulto nutrizionale, è il seguente e varia a seconda delle tempistiche pre-intervento:

- 5-7 giorni prima dell'intervento: 3 brik al giorno – **indipendentemente dallo stato nutrizionale del soggetto, raccomandazione di grado A;**
- 15 giorni prima: 2 brik al giorno;
- 30 giorni prima: 1 brik al giorno.

Proteine 22% | Lipidi 25% | Carboidrati 53% | Calorie totali / g N 116 | Calorie NP/g N 91

BMJ Open Pre-admission interventions (prehabilitation) to improve outcome after major elective surgery: a systematic review and meta-analysis

Rachel Perry ¹, Georgia Herbert,¹ Charlotte Atkinson,¹ Clare England,^{1,2} Kate Northstone,³ Sarah Baos,⁴ Tim Brush,⁴ Amanda Chong,¹ Andy Ness,^{1,5} Jessica Harris,⁴ Anne Haase,⁶ Sanjoy Shah,⁷ Maria Pufulete⁴

Table 1 Summary of prehabilitation interventions, main results and GRADE quality of evidence rating

Pre-admission intervention	N studies identified and study characteristics	Surgical populations included	Interventions	Main results
Nutritional interventions				
Immunonutrition ^{36–47 70–75 80}	19 studies published between 2002 and 2020, including 14–244 ppts. 5 Western Europe 4 Japan 2 Turkey 1 Australia 1 USA 1 India 1 Lithuania 1 Mexico 1 New Zealand 2 not stated	2 colorectal cancer 1 upper or lower GI 3 GI cancer 1 total gastrectomy (cancer) 4 pancreatic cancer 2 any abdominal surgery 1 lung cancer 2 cardiac surgery 2 hepatectomy/liver cancer 1 enterocutaneous fistula	Most (15 studies) used combined arginine, omega-3 fatty acids, and RNA; 1 study used alanyl glutamine, 1 used L-glutamine, 1 used arginine + glutamine, and 1 used L-arginine + PUFA), and, where reported, generally ranged from 711 mL/day to 1 L/day, for 3–10 days. Where reported, usually oral consumption at home, hospital, or home and hospital. Comparator: no supplement/usual care/standard diet (17 studies), maltodextrin (1 study), NR (1 study).	Mortality RR 0.55 (95% CI 0.21 to 1.42), p=0.22 GRADE rating: low LoS MD −2.11 (95% CI −3.07 to −1.15), p<0.0001 GRADE rating: very low Total complications (infective and non-infective) RR 0.74 (95% CI 0.54 to 1.02), p=0.07 GRADE rating: very low Total infective complications RR 0.64 (95% CI 0.40 to 1.01), p=0.05 GRADE rating: very low Wound infection RR 0.71 (95% CI 0.51 to 0.99), p=0.05 GRADE rating: very low Pneumonia RR 0.52 (95% CI 0.18 to 1.44), p=0.21 GRADE rating: very low
No Metabolic and Bariatric Surgery				

BMJ Open Pre-admission interventions (prehabilitation) to improve outcome after major elective surgery: a systematic review and meta-analysis

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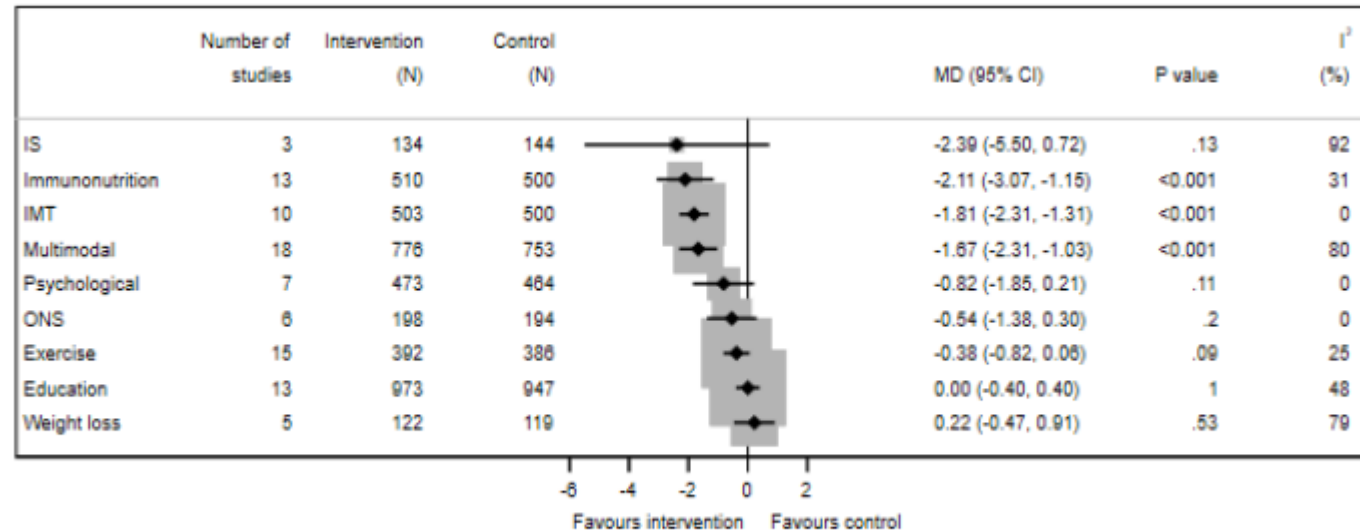


Figure 3 Forest plot of prehabilitation for reducing length of hospital stay. All interventions were tested with usual care as control. IMT, inspiratory muscle training; IS, incentive spirometry; MD, mean difference; ONS, oral nutritional supplements.

Immunonutrition reduces length of hospital stay of 31%

BMJ Open Pre-admission interventions (prehabilitation) to improve outcome after major elective surgery: a systematic review and meta-analysis

Rachel Perry ¹, Georgia Herbert,¹ Charlotte Atkinson,¹ Clare England,^{1,2} Kate Northstone,³ Sarah Baos,⁴ Tim Brush,⁴ Amanda Chong,¹ Andy Ness,^{1,5} Jessica Harris,⁴ Anne Haase,⁶ Sanjoy Shah,⁷ Maria Pufulete⁴

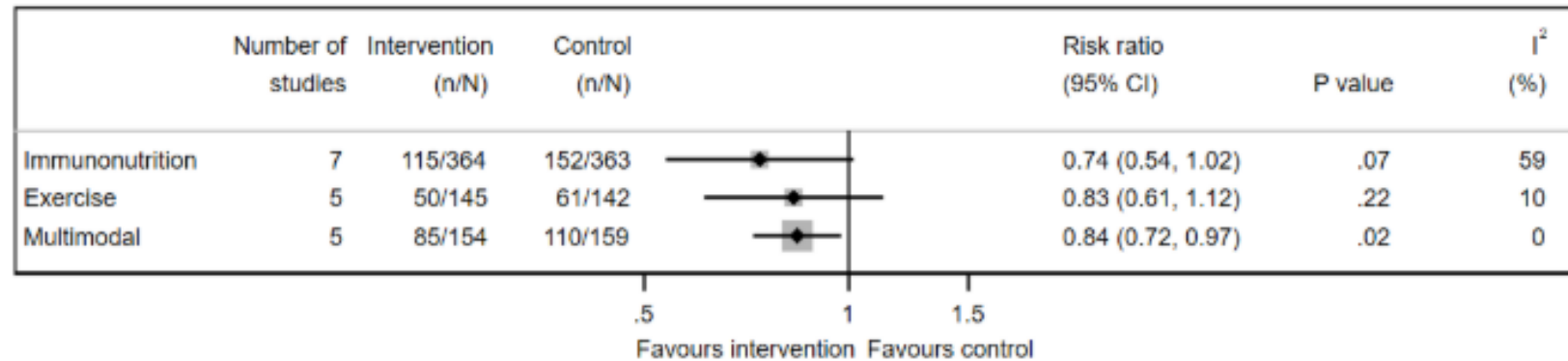


Figure 4 Forest plot of prehabilitation for reducing total postoperative complications. All interventions were tested with usual care as control.

Immunonutrition reduces total postoperative complications (infective and non-infective) of 59%



Review

Perioperative Nutritional Support: A Review of Current Literature

Antonio Jesús Martínez-Ortega , Ana Piñar-Gutiérrez , Pilar Serrano-Aguayo, Irene González-Navarro, Pablo Jesús Remón-Ruiz , José Luís Pereira-Cunill * and Pedro Pablo García-Luna

6.2. Bariatric Surgery

Most centers recommend that immediately prior to surgery, patients follow a low-calorie or low-carbohydrate diet [153] to reduce liver size [154]. This has been associated with surgeons' perceptions of a lower complexity of surgery as well as a lower rate of postoperative complications [155]. In addition, pre-surgery weight loss has been associated with subsequent weight loss, especially the higher the previous body mass index (BMI) [155]. Obesity is a risk pathology for nutritional deficiencies, especially anemia, folic acid, vitamin B12 and vitamin D deficiency. That is why preoperative diets should be supplemented with vitamins and minerals in order to adequate the nutritional status for surgery [153].

Following ERAS protocols, the use of liquids with carbohydrates 2–3 h before surgery and solids up to 6 h before anesthetic induction is also recommended and has been shown to be safe in these patients [155]. After the treatment, it is recommended to start a liquid diet with calcium, iron, vitamins and minerals supplementation after 4 h [155].

**No
Recommendations
concerning the use
of Immunonutrition
before Metabolic
and Bariatric Surgery
was made**

L'utilizzo della immunonutrizione nei protocolli ERAS risulta ancora discussa a causa della eterogeneità delle evidenze cliniche esistenti.

Ciononostante, la somministrazione preoperatoria di miscele contenenti immunomodulanti risulta raccomandata, in particolare nei soggetti malnutriti.

Enhanced recovery after bariatric surgery: an Italian consensus statement

Giuseppe Marinari¹ · Mirto Foletto² · Carlo Nagliati³ · Giuseppe Navarra⁴ · Vincenzo Borrelli⁵ · Vincenzo Bruni⁶ · Giovanni Fantola⁷ · Roberto Moroni⁸ · Luigi Tritapepe⁹ · Roberta Monzani¹⁰ · Daniela Sanna¹¹ · Michele Carron¹² · Rita Cataldo¹³

Table 4 Effectiveness, safety, and items of Enhanced Recovery after Bariatric Surgery (ERABS) compared to standard approach

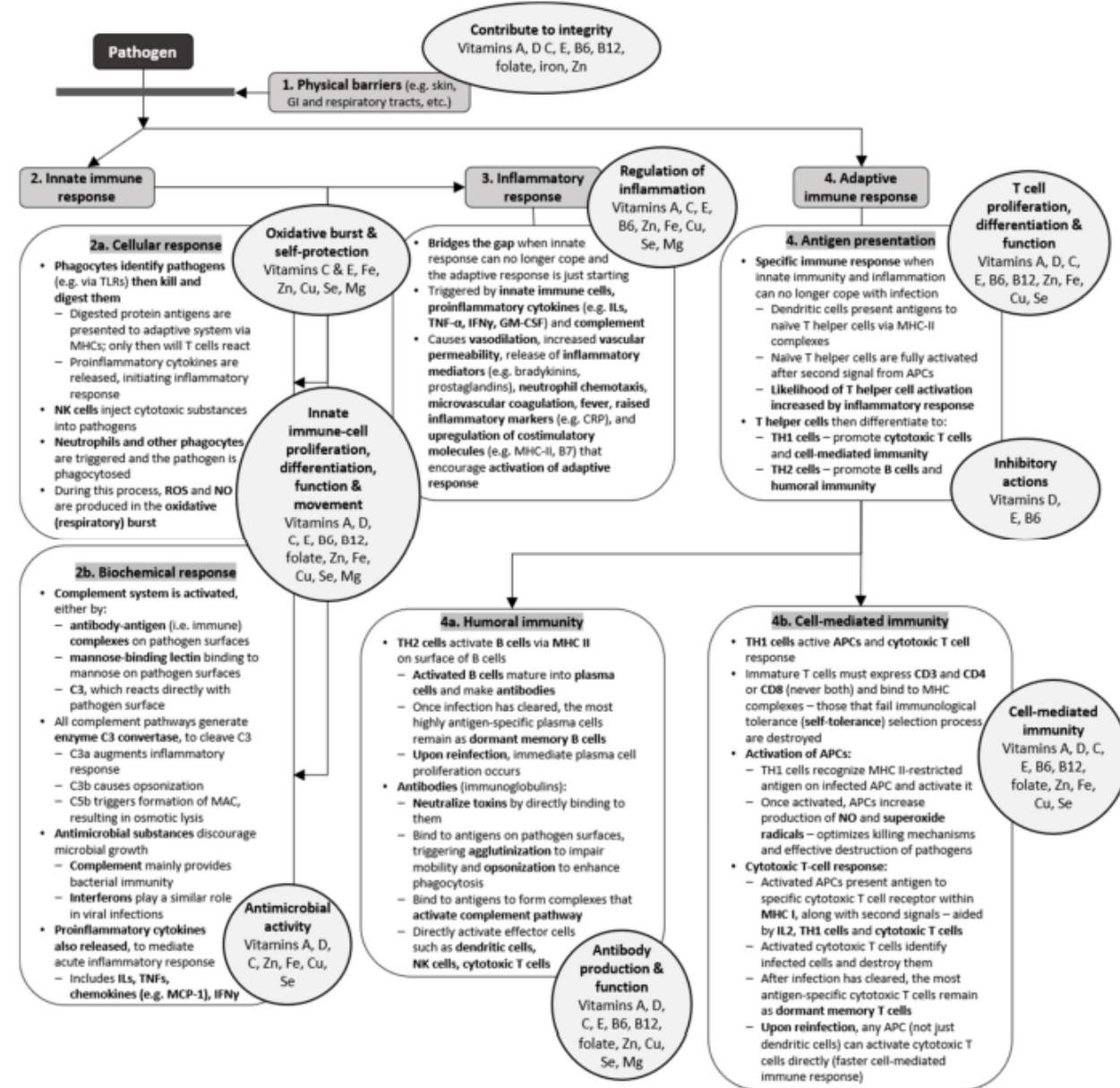
	Evidence		Strength of Recommendation	Expert task force statement
	Level	Quality		
Patient optimization	1	A	A	Pre-operative optimization through smoking cessation, weight loss, blood glucose control, and the use of non-invasive ventilation (when indicated) is recommended in ERABS
Fasting	1	A	A	Clear liquids and solid food are recommended up to 2 h and 6 h, respectively, prior to the induction of anesthesia in ERABS
Early re-feeding	1	A	A	Early post-operative resumption of oral feeding is recommended in ERABS

Conclusions.

- ERABS is an effective and safe approach
- ERABS reduces the length of hospital stay and does not heighten the risk of major post-operative complications, re-operations, and hospital re-admissions, nor does it increase the overall surgical costs

A Review of Micronutrients and the Immune System–Working in Harmony to Reduce the Risk of Infection

Adrian F. Gombart ¹ , Adeline Pierre ² and Silvia Maggini ^{2,*}



**Between 35-80% of bariatric candidates are, *PARADOXALLY*,
in a state of “*HIGH CALORIE MALNUTRITION*” and shows
some dietary deficiency pre-operatively**

Pre-operative micronutrient deficiencies in patients with severe obesity candidates for bariatric surgery

M. Pellegrini¹ · F. Rahimi² · S. Boschetti² · A. Devecchi¹ · A. De Francesco² · M. V. Mancino² · M. Toppino³ · M. Morino³ · G. Fanni¹ · V. Ponzo¹ · E. Marzola⁴ · G. Abbate Daga⁴ · F. Broglio^{1,5} · E. Ghigo^{1,5} · S. Bo^{1,5} 



Review

Preventing and Managing Pre- and Postoperative Micronutrient Deficiencies: A Vital Component of Long-Term Success in Bariatric Surgery

Claudia Reytor-González^{1,†}, Evelyn Frias-Toral^{2,3,†} , Cristina Nuñez-Vásquez¹, Juan Marcos Parise-Vasco¹ , Raynier Zambrano-Villacres⁴ , Daniel Simancas-Racines^{1,*,†}  and Luigi Schiavo^{5,*,†} 

Identify and Correct micronutrient deficiencies in sufficient time before bariatric surgery



Review

Optimizing Nutritional Management Before and After Bariatric Surgery: A Comprehensive Guide for Sustained Weight Loss and Metabolic Health

Evelyn Frias-Toral ^{1,†} , Sebastián Chapela ^{2,3,†}, Victoria Gonzalez ^{4,5} , Andres Martinuzzi ^{6,7} , Julieta Locatelli ⁸ , Natalia Llobera ³, Ezequiel Manrique ^{9,10} , Gerardo Sarno ¹¹ , Monica Mingo ¹², Federica Marchese ¹², Raffaele Cuomo ¹², Ludovica Romaniello ¹², Martina Perna ¹², Annalisa Giordano ¹², Biagio Santella ^{12,13} , and Luigi Schiavo ^{12,13,*} 

Nutritional management prior to surgery is essential to achieve metabolic control and optimize the patient clinical status before surgery to reduce the potential comorbidities associated with the procedure.

CHEOSI PREINTERVENTO

Nutrients 2023, 15, 1907



Patient
eligible for
bariatric
surgery



Very Low Calorie Ketogenic Diet

700–800 kcal/day
30–50 g/day of
carbohydrates,
20–40 g/day of fats,
1.2–1.4 g/day proteins
per kg body weight



reduction of
volume
and fat liver



reduction of
visceral
adipose
tissue



reduction of
perioperative
complications



reduction of
transition to an
open procedure

BENEFICI DELLE VLCKD/VLEKT PRE-CHIRURGIA BARIATRICA *Nutrients 2023, 15, 1907*



Nutrients 2023; 15:1907

Obes Surg 2019; 29:292

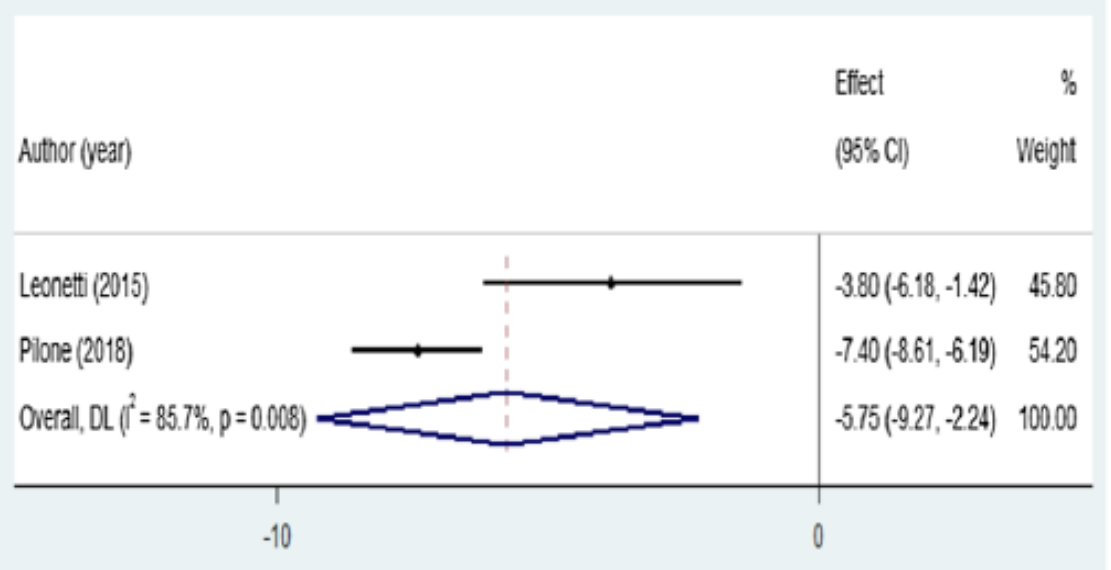
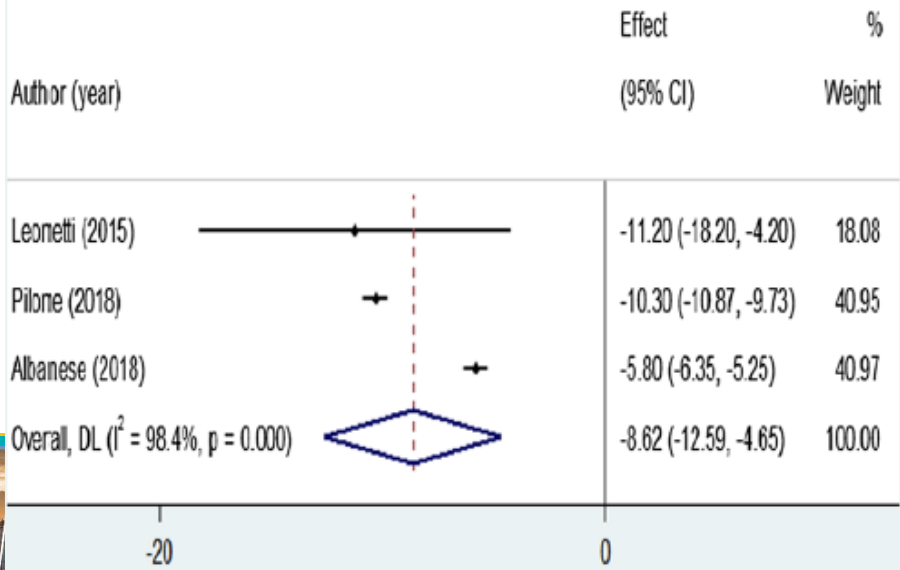
Rev Endocr Metab Disord 2020; 21:297

Nutrients 2022; 14:2610

Evaluate the Effects of Different Types of Preoperative Restricted Calorie Diets on Weight, Body Mass Index, Operation Time and Hospital Stay in Patients Undergoing Bariatric Surgery: a Systematic Review and Meta Analysis Study

Razieh Khalooeifard¹ · Jamal Rahmani² · Seyed Mojtaba Ghoreishy³ · Aryan Tavakoli⁴ · Khosrow Najjari⁵ · Mohammad Talebpour⁵

Previous studies investigated low-calorie diets (LCD), very-low-calorie diets (VLCD), and very-low-calorie ketogenic diets (VLCKD) in relation to weight loss and outcomes for bariatric surgery patients. However, the overall effects of these diets on various outcomes remain unclear. This study aimed to assess the impact of preoperative restricted calorie diets on weight, body mass index (BMI), operation time (OT), and hospital stay (HS) in bariatric surgery patients. Seventeen articles were analyzed, revealing the highest weight loss (-8.62) and BMI reduction (-5.75) with VLCKD. Due to insufficient data, the impact of these diets on OT and HS could not be determined. Further interventional studies are required to determine the ideal preoperative diet that achieves optimal weight loss, patient compliance, tolerance, acceptance, and surgical outcomes.



Intentional weight reduction before surgery – A systematic review

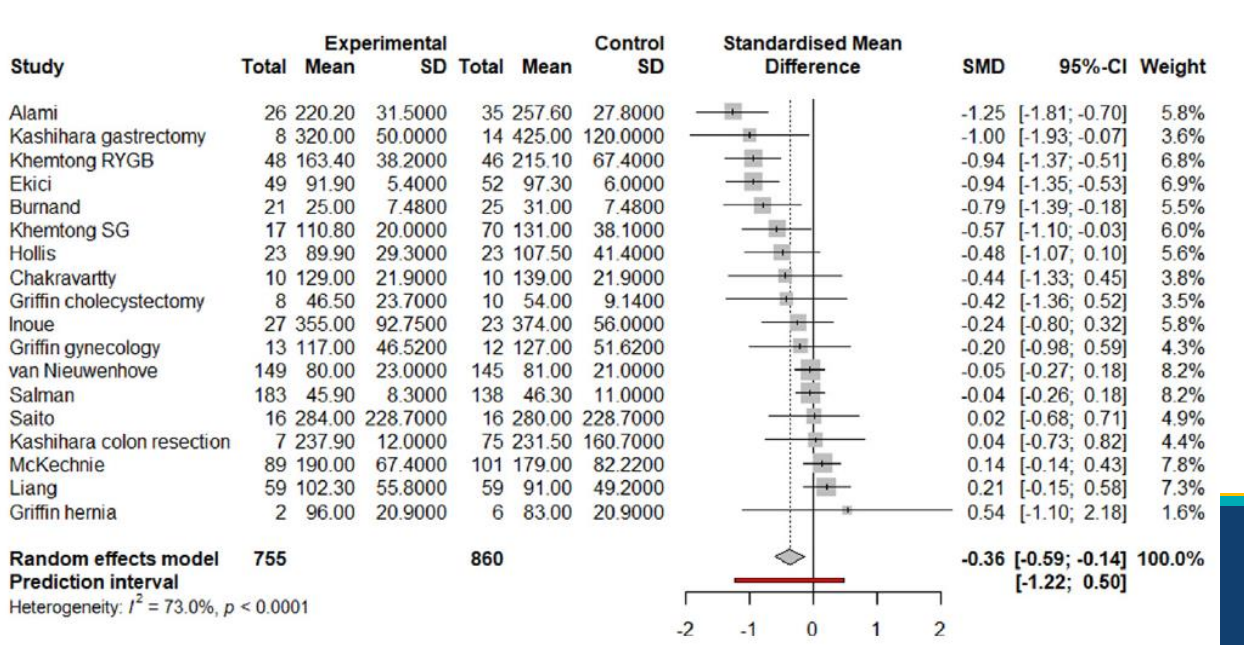
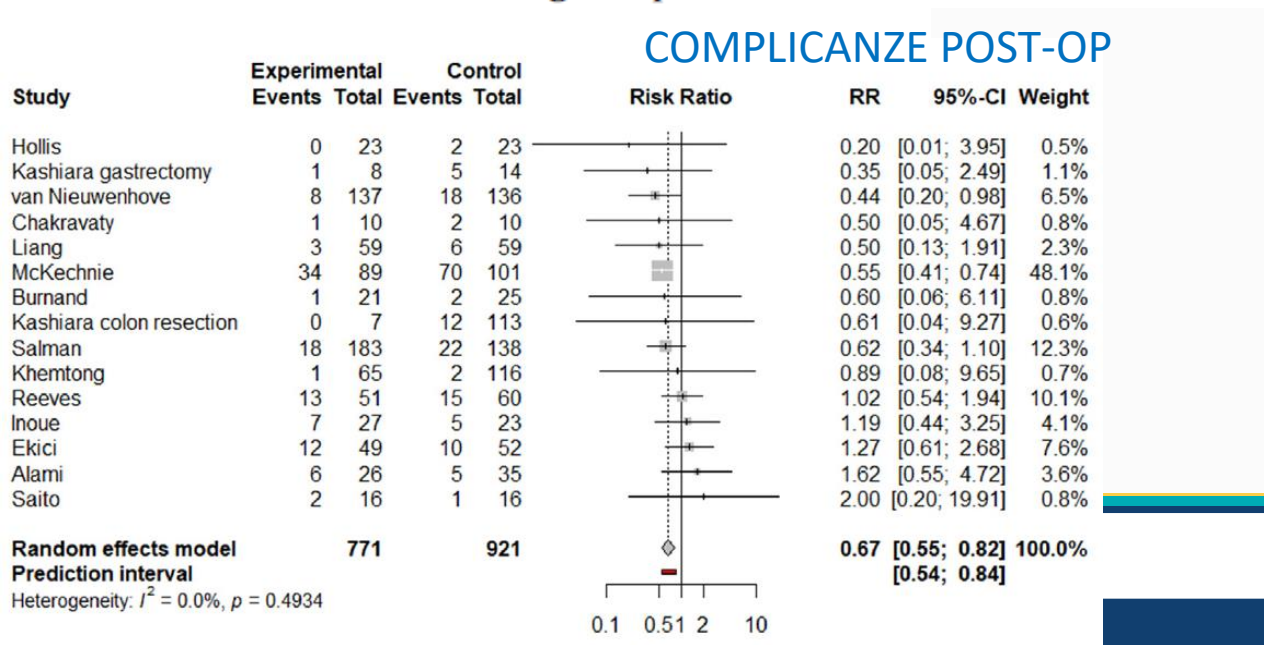
Erik Stenberg^{a,*}, Anna Laurenius^{b,c}, Anders Thorell^{d,e}

Results: A total of 7053 studies were identified. After screening by title and abstract, followed by full text, 18 studies (9 RCTs and 9 observational studies) remained for the analyses including 854 patients who received the intervention and 979 controls. Preoperative LED/VLED resulted in an overall shorter operation time (standard mean difference 0.36, 95 % CI 0.14–0.59, $p = 0.002$), and reduced risk of postoperative complications after bariatric surgery, cholecystectomy, colorectal surgery and hernia repair (pooled RR 0.63, 95%CI 0.51–0.79, $p < 0.001$). Heterogeneity between studies was high for operation time but very low for complications. No difference was seen for intraoperative complications, while the data did not allow further analyses on perceived difficulty of surgery or efficacy outcomes.

Conclusion: The results support the use of LED/VLED for short-term preoperative weight reduction in patients with obesity planned for bariatric surgery and for those undergoing cholecystectomy, colorectal surgery and hernia repair. Further studies including a comparable control group are needed to evaluate its routine use for other surgical procedures.

EVIDENZE PER LED/VLED

TEMPO OPERATORIO



The main indications for the use of VLCKD/VLEKT in obesity are:

- severe obesity,
- treatment of obesity with bariatric indications in the preoperative period before the bariatric procedure,**
- sarcopenic obesity,
- obesity associated with hypertriglyceridemia and/or hypertension and/or type 2 diabetes and/or metabolic syndrome and/or NAFLD and/or obstructive sleep apnea syndrome and/or bone diseases or severe arthropathy

Obes Facts 2021;14:222–245

European Guidelines for Obesity Management in Adults with a Very Low-Calorie Ketogenic Diet: A Systematic Review and Meta-Analysis

Absolute contraindications:

type 1 diabetes mellitus, latent autoimmune diabetes in adults, β -cell failure in type 2 diabetes mellitus,
use of sodium/glucose cotransporter 2 (SGLT2) inhibitors (risk of euglycemic diabetic ketoacidosis),
pregnancy and breastfeeding,
kidney failure and severe chronic kidney disease,
liver failure,
heart failure (NYHA III–IV), respiratory insufficiency, unstable angina, a recent stroke or myocardial infarction (<12 months), cardiac arrhythmias,
eating disorders and other severe mental illnesses, alcohol and substance abuse,
active/severe infections,
frail elderly patients,
48 h prior to an elective surgery or invasive procedures and a perioperative period,
rare disorders such as porphyria, carnitine deficiency, carnitine palmitoyltransferase deficiency, carnitine-acylcarnitine translocase deficiency, mitochondrial fatty acid β -oxidation disorders, and pyruvate carboxylase deficiency



EFFETTI AVVERSI



European Guidelines for Obesity Management in Adults with a Very Low-Calorie Ketogenic Diet: A Systematic Review and Meta-Analysis

Obes Facts 2021;14:222–245

E.29 La riduzione preoperatoria del peso corporeo è consigliata nei pazienti candidati alla chirurgia bariatrica, soprattutto se in presenza di BMI molto elevato o di grave obesità viscerale, anche attraverso la prescrizione di una dieta a basso contenuto calorico/chetogena nel periodo preoperatorio (LIVELLO DI EVIDENZA: 2; GRADO DI RACCOMANDAZIONE: A).

La diminuzione del peso corporeo riduce notevolmente le dimensioni del grasso viscerale e del fegato facilitando l'esecuzione degli interventi laparoscopici^{1,2}, riducendo il tempo di esecuzione e il rischio di conversione^{3,4}, e migliora i risultati a breve e lungo termine⁵⁻⁷ soprattutto nei pazienti super-obesi⁸. Diversi metodi sono stati proposti per favorire la perdita di peso preoperatoria e dalle evidenze in letteratura pare chiaro come l'impiego di una dieta a basso contenuto calorico/chetogena da 15 a 30 giorni prima dell'intervento ottenga risultati soddisfacenti in minor tempo, con un costo minore e meno effetti collaterali rispetto al paloncino intragastrico⁸⁻¹⁴.



LINEE GUIDA DI CHIRURGIA DELL'OBESITÀ

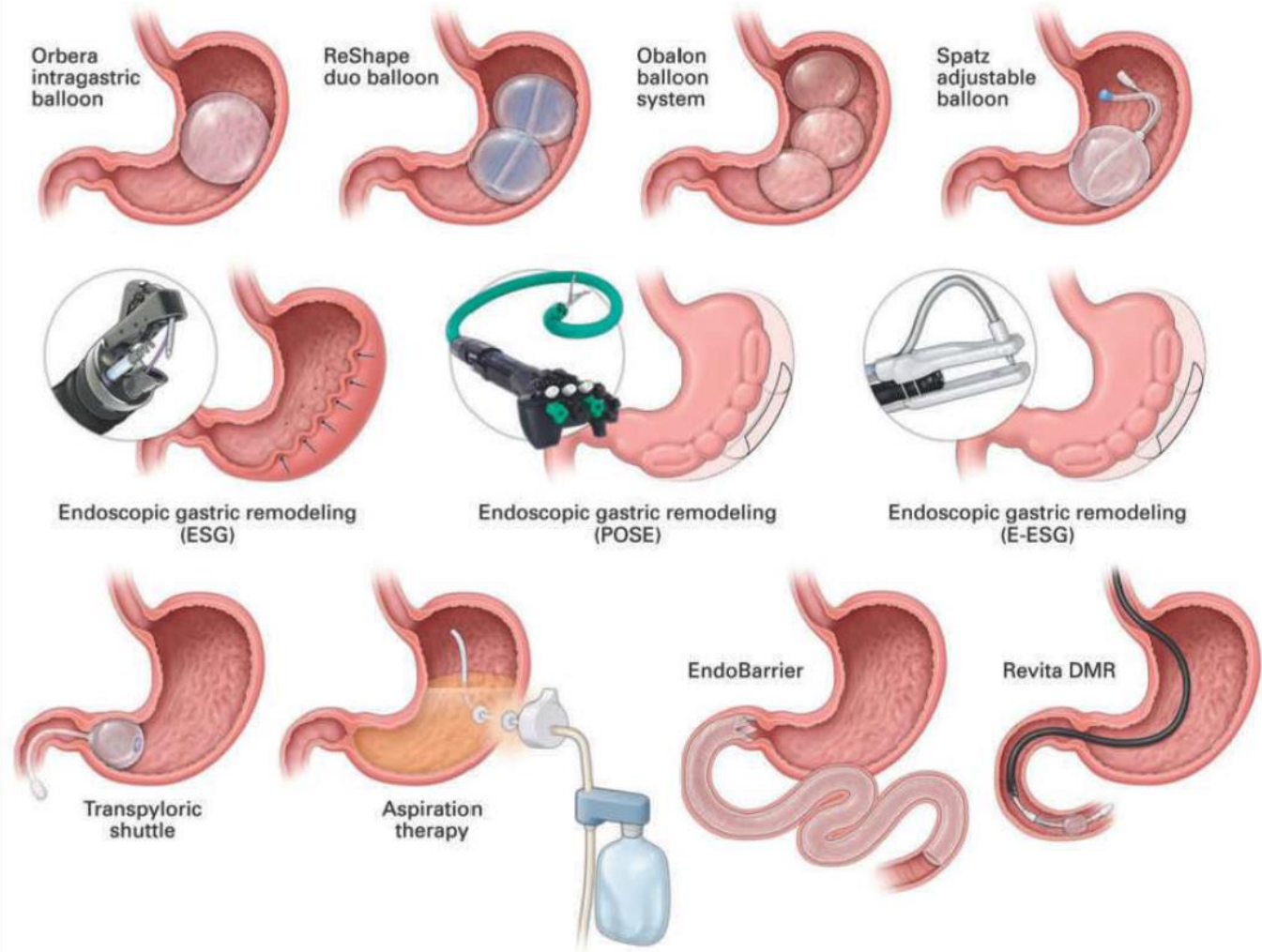
EDIZIONE 2016

EAES rapid guideline: systematic review, network meta-analysis, CINeMA and GRADE assessment, and European consensus on bariatric surgery–extension 2022

Recommendation

We suggest sleeve gastrectomy or laparoscopic Roux-en-Y gastric bypass over adjustable gastric banding, biliopancreatic diversion with duodenal switch and gastric plication for the management of severe obesity and associated metabolic diseases.

One anastomosis gastric bypass and single anastomosis duodeno-ileal bypass with sleeve gastrectomy are suggested as alternatives, although evidence on benefits and harms, and specific selection criteria is limited compared to sleeve gastrectomy and Roux-en-Y gastric bypass.



Remember that your lowest weight post-surgery will occur between 12 to 18 months. After this, there is a natural increase in weight that occurs. If you are gaining excessive amounts of weight, discuss this with your bariatric team or primary care provider

Studies that have been conducted in the bariatric surgery population show that significant weight regain ($\geq 15\%$ gain of initial weight loss post-bariatric surgery) occurs in 25–35% of people who undergo surgery two to five years after their initial surgical date



Bariatric Surgery: Post-Operative Management

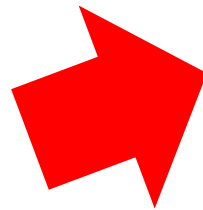
Methods We have conducted an observational, retrospective, and descriptive study with the analysis of medical charts of private offices where patients were examined between 2014 and 2019, totalizing 11 participants who underwent Roux-en-Y gastric bypass (RYGB) without a reduction of 50% in body weight excess or any weight regain after the surgery. The patients followed the first stage of a commercial weight loss program (Pnk® method) which consists of a VLCKD (600–800 kcal/day), low in carbohydrates and lipids.

Results A significant reduction was observed (p -value < 0.05) in weight, body mass index (BMI), abdominal circumference (AC), and glycated hemoglobin (A1C) post-ketogenic diet. Uric acid, transaminases, urea, and creatinine values did not show differences between pre- and post-ketosis. During the course of the study, no serious adverse events were reported.

Conclusion This study has shown that the ketogenic diet can be recommended as an effective and safe treatment for patients who progressed with insufficient weight loss or regain after bariatric surgery.

Key Points

- VLCKD produces significant improvement in weight, BMI, and AC after RYGB.
 - VLCKD produces a significant reduction in A1C levels without changes in kidney and liver functions.
 - VLCKD is effective and safe in case of insufficient weight loss or regain after bariatric surgery.
-



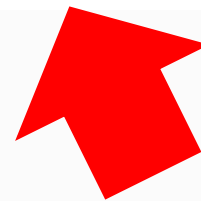
Efficacy, feasibility and tolerability of ketogenic diet for the treatment of poor response to bariatric surgery

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Methods A real-life prospective study was conducted on twenty-two patients who experienced poor response after bariatric surgery and followed a structured VLCKD. Anthropometric parameters, body composition, muscular strength, biochemical analyses, and nutritional behavior questionnaires were evaluated.

Results A significant weight loss (mean $14.1 \pm 4.8\%$), mostly due to fat mass, was observed during VLCKD with the preservation of muscular strength. The weight loss obtained allowed patients with IWL to reach a body weight significantly lower than that obtained at the post-bariatric surgery nadir and to report the body weight of patients with WR at the nadir observed after surgery. The significantly beneficial changes in nutritional behaviors and metabolic profiles were observed without variations in kidney and liver function, vitamins, and iron status. The nutritional regimen was well tolerated, and no significant side effects were detected.

Conclusion Our data demonstrate the efficacy, feasibility, and tolerability of VLCKD in patients with poor response after bariatric surgery.



Impact of a very low-calorie ketogenic diet on metabolic and microbiota outcomes in post-bariatric patients and bariatric-Naïve individuals: A comparative pilot study

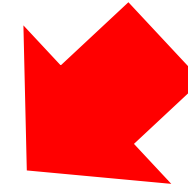
Diabetes Obes Metab. 2025;27:1950–1959.

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Methods: In this prospective, case-control study, 33 patients (15 BS+, 18 BS-) underwent an 8-week-long VLCKD. Outcomes included weight loss, metabolic profile, safety and GM composition.

Results: Both groups achieved significant weight loss (BS+: –6.9%, BS-: –8.3%), but the BS+ group showed slightly less metabolic improvement, particularly in insulin resistance and triglycerides. GM composition differed at baseline, reflecting the lasting effects of BS, and VLCKD led to significant changes in both groups. Microbial diversity and specific taxonomic shifts were more pronounced in BS- patients. Mild renal function changes were noted in BS+ patients, though these remained within clinically acceptable ranges.

Conclusion: VLCKD is effective in both BS+ and BS- patients, though metabolic and microbial responses may be less robust post-surgery, possibly due to anatomical and physiological changes. Tailored approaches may be therefore needed to optimize outcomes in post-bariatric patients.



CONCLUSIONI E PROSPETTIVE FUTURE

- L'immunonutrizione preoperatoria, che prevede la somministrazione di nutrienti specifici come arginina, acidi grassi omega-3 e nucleotidi, ha dimostrato di ridurre le complicanze postoperatorie, in particolare quelle infettive, e di abbreviare la degenza ospedaliera in pazienti sottoposti a chirurgia addominale maggiore.
- Tuttavia, attualmente non esistono studi specifici che valutino l'efficacia dell'immunonutrizione preoperatoria nei pazienti sottoposti a chirurgia bariatrica.
- Pertanto, studi sono necessari per avere evidenze specifiche e scientifiche dell'applicabilità e dell'utilità di tale approccio nel paziente candidato a chirurgia bariatrica e metabolica
- La strategia VLCKD/VLEKT preoperatoria ha delle evidenze/raccomandazioni di grado A: per la rapidità del calo ponderale e riduzione del grasso viscerale ed epatica, riduzione del tempo operatorio e la degenza ospedaliera e riduzione dell'infiammazione e la correzione delle carenze di micro nutrienti, di vitamine e della sarcopenia.
- La terapia chetogenica risulta utile anche dopo la chirurgia bariatrica con minore tasso di weight regain, in termine di BMI e circonferenza addominale.
- Rimane un strumento valido anche in casi di minor successo della chirurgia bariatrica



S.I.C.O.B.

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