DIETA CHETOGENICA DOPO CHIRURGIA BARIATRICA: QUANDO PRENDERLA IN CONSIDERAZIONE?

MARIA GRAZIA CARBONELLI

DIR. UO DIETOLOGIA E NUTRIZIONE

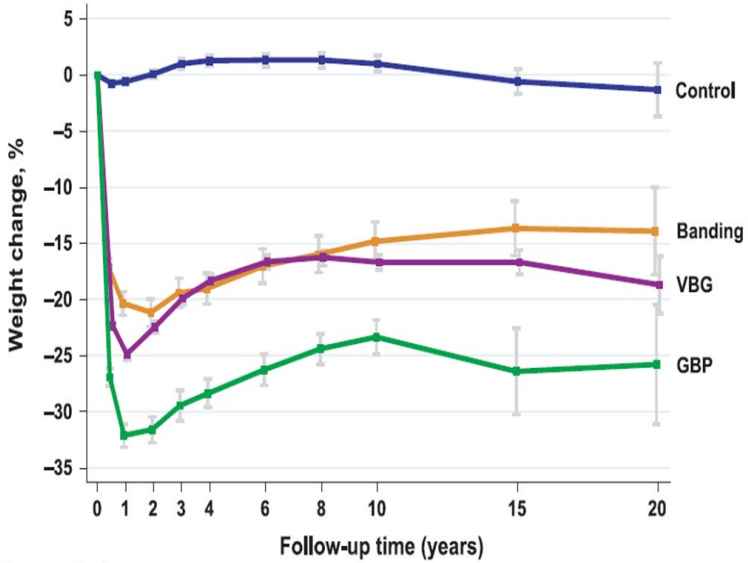
AZIENDA OSPEDALIERA

SAN CAMILLO FORLANINI

ROMA

Bariatric sugery: weight regain

Review of the key results from the Swedish Obese Subjects (SOS) trial – a prospective controlled intervention study of bariatric surgery

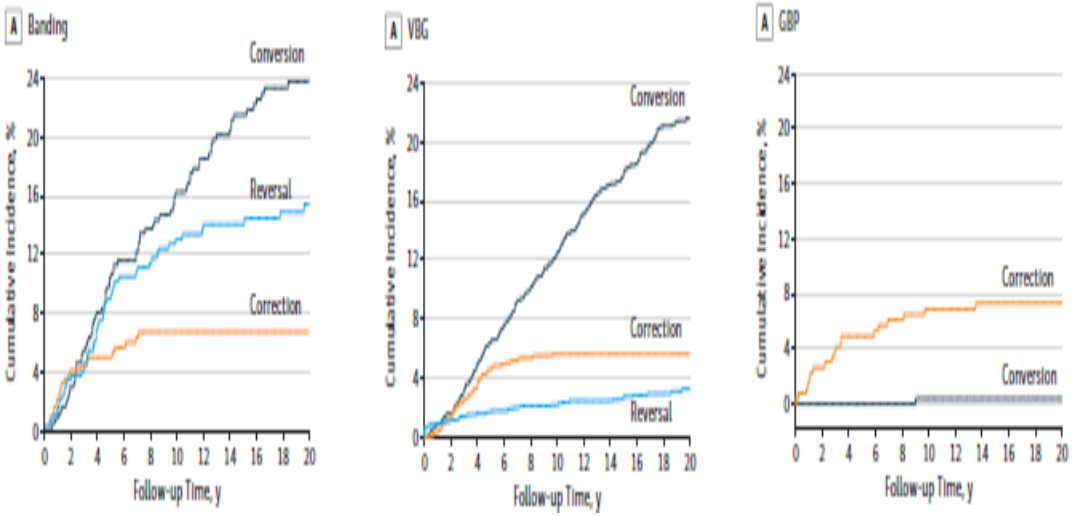


No. examined

Control	2037	1490	1242	1267	556	176
Banding	376	333	284	284	150	50
VBG	1369	1086	987	1007	489	82
GBP	265	209	184	180	37	13

Sjöström L. J Int Med 2013;273:219

Reoperations After Bariatric Surgery in 26 Years of Follow-up of the Swedish Obese Subjects Study



Hjorth S et al. JAMA Surg 2019;154:319

Weight-Loss Maintenance for 10 Years in the National Weight Control Registry

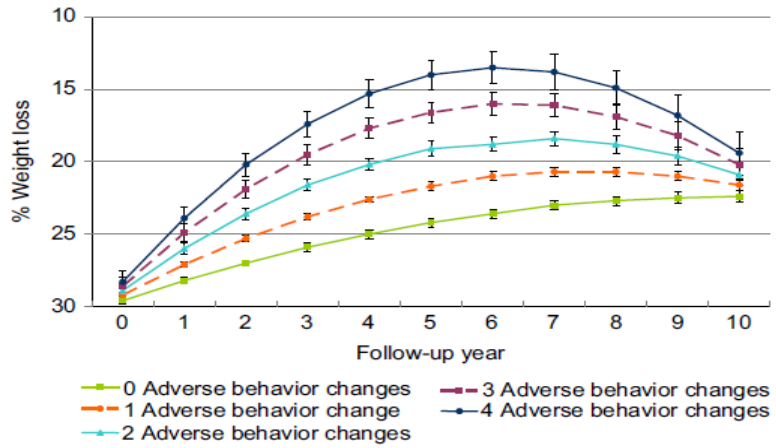


Figure 3. Relationship between behavior change from baseline to 1 year and weight change

- ↓ Dispendio calorico nel tempo libero
- ↓ Moderazione
- ↓ Frequente misurazione del peso
- ↑ Percentuale di grassi alimentari
- ↑ Disinibizione

Thomas JG et al. Am J Prev Med 2014;46:17

DEFINIZIONE RECUPERO PONDERALE o INSUFFICIENTE CALO PONDERALE
> 10 Kg dal nadir
> 10% dal peso corporeo pre-chirurgico
BMI ≥ 5 Kg/m2 rispetto al nadir
BMI > 35 Kg/m2
≥ 25 % EWL
EWL < 50% a 18 mesi
Differenza in Kg o in % tra peso al nadir e all'ultimo controllo
Il pz ricopre ancora i criteri di selezione per la chirurgia bariatrica
Qualsiasi recupero ponderale dopo la remissione del T2DM
QUALSIASI RECUPERO PONDERALE E/O RICOMPARSA DELLE COMPLICANZE

LSG:

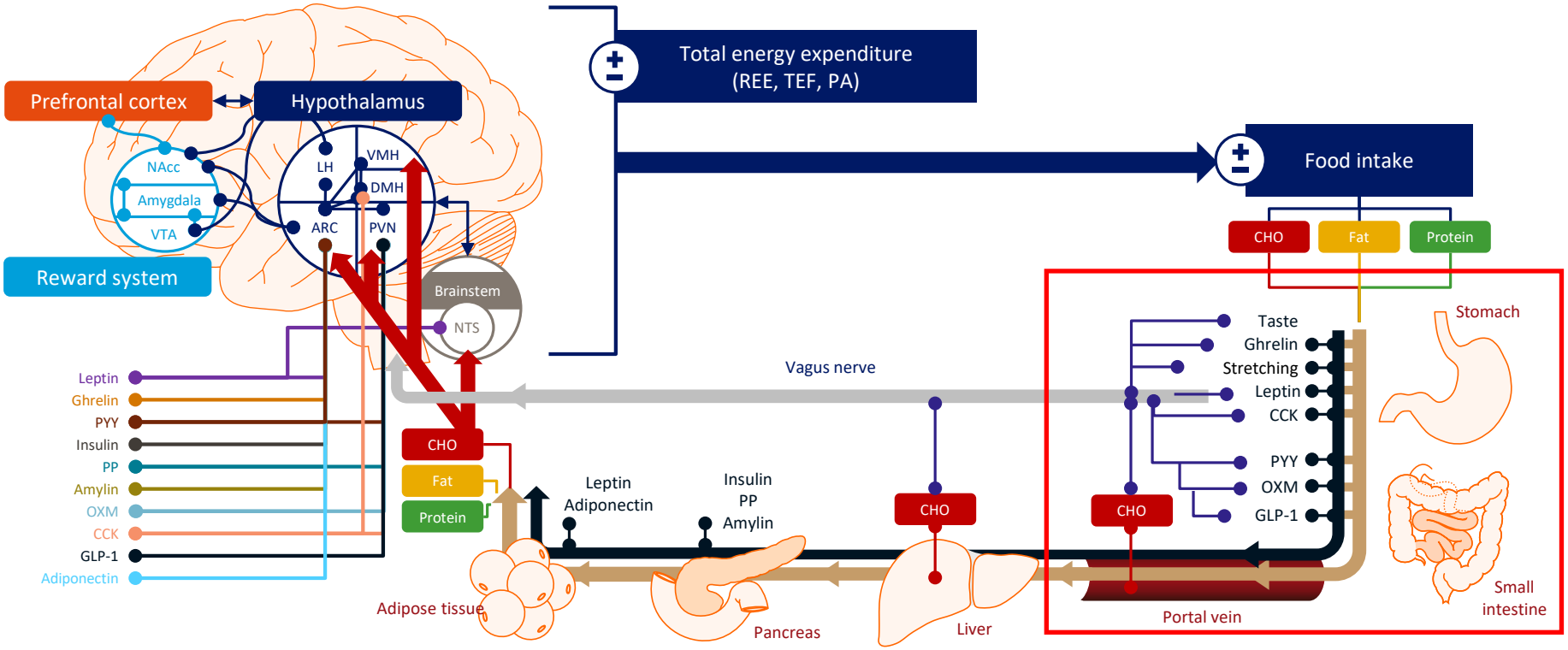
- a 2 anni 5.7 %
- a 6 anni 7.5 %

RYGB:

-a 10 anni 41%

Lauti, M. *et al*. Obesity Surgery, 2016
El Ansari W *et al* Obesity Surgery, 2021
Monaco-Ferreira DV *et al* Obesity Surgery, 2017

Weight Regain is not a simple matter of lack of compliance



ARC, arcuate nucleus; CCK, cholecystokinin; CHO, carbohydrates; DMH, dorsomedial hypothalamic nucleus; GLP-1, glucagon-like peptide 1; LH, lateral hypothalamus; NAcc, nucleus accumbens; NTS, nucleus tractus solitarius; OXM, oxyntomodulin; PA, physical activity; PP, pancreatic polypeptide; PVN, paraventricular nucleus; PYY, peptide YY; REE, resting energy expenditure; TEF, thermic effect of food; VMH, ventromedial hypothalamus; VTA, ventral tegmental area.
Chapelot and Charlot, Metabolism Clinical and Experimental 2019;92:11–25.

MECCANISMI FISIOLOGICI DI RECUPERO PONDERALE

Busetto L et al, EJIM 2021; **Berthoud HR *et al*.** Obesity (Silver Spring) 2021; **Sumithran P, Proietto J.** 2013;

			Risultato
↓ Spesa energetica (↓ termogenesi)	REE misurata < REE predetta		Adattamento Metabolico Energy Gap
Alterato metabolismo substrati energetici	Alterata cellularità e infiammazione		↓ FFM
Pathway ormonali ad azione - Centrale (Ipotalamica) - Periferica (t. adiposo, gastrointestinale, pancreas) ↑Apporto energetico	↓TRH ↓Leptina ↓PYY, CCK, GLP1 ↓POMC, ↓Serotonina ↓Amilina ↓Insulina ↓Neurotensina	↑PP ↑Cortisolo ↑GIP ↑Grelina NPY, Oppioidi, Endocannabinoidi ↑AgRP	↑Appetito ↑Intake alimentare Food Reward
Incremento delle riserve energetiche	↓Ossidazione lipidica		↑Tessuto adiposo Fat Overshooting

MECCANISMI DI RECUPERO PONDERALE IN SEGUITO A CHIRURGIA BARIATRICA

Chirurgici/ Anatomici	Ormonali/ Metabolici/ Neurali	Comportamentali/ Umore
Dimensione tasca gastrica	Segnali Oressigeni /Anoressigeni	Stile di vita (attività fisica e aderenza alla dieta)
Dilatazione tasca gastrica	Livelli Serotonina	Disordini Alimentari
Fondo o antro residuali	Bilancio energetico (Adattamento Metabolico ed Energy Gap)	Disordini mentali/ psichiatrici
Composizione Corporea	Tessuto adiposo (cellularità e infiammazione) Eccesso di massa grassa	Dipendenze
	Neurali (centrali e periferici)	Follow-up e supporto inadeguati

YuY et al. Surg Obes Relat Dis. 2019; **Lauti, M.** et al. Obesity Surgery, 2016; **El Ansari W.** *et al* Obesity Surgery, 2021

Predittori: età (avanzata nella LSG, giovane nel RYGB) , sesso M, elevato BMI preoperatorio, disordini mentali, comorbidità (T2DM, HTN, OSA), carenza marziale, dipendenze .

Modifications of Resting Energy Expenditure After Sleeve Gastrectomy

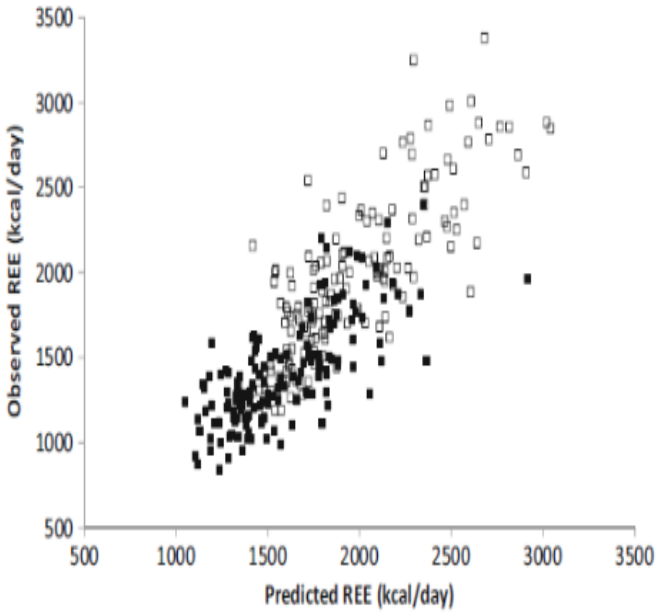
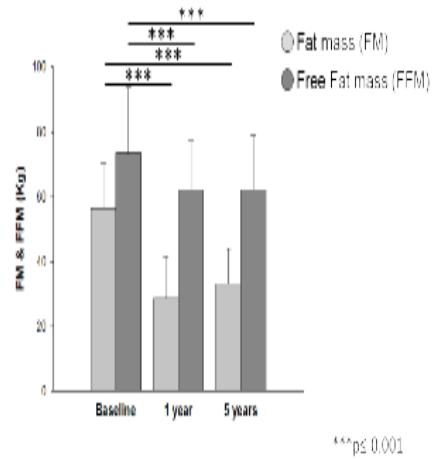


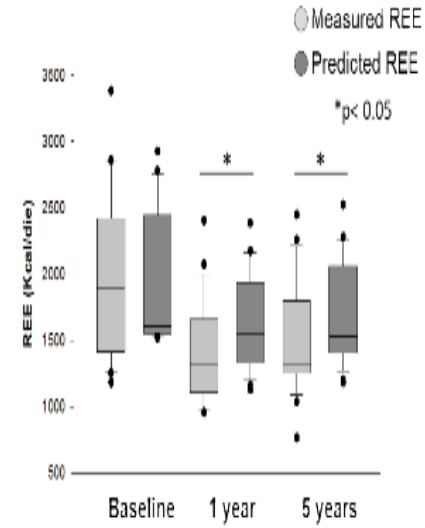
Fig. 1 Distribution of the predicted and observed REE values before (open symbols) and 12 months after sleeve gastrectomy (closed symbols). Most of the observed post-surgery REE values are distributed below the identity line, confirming the existence of a certain degree of metabolic adaptation

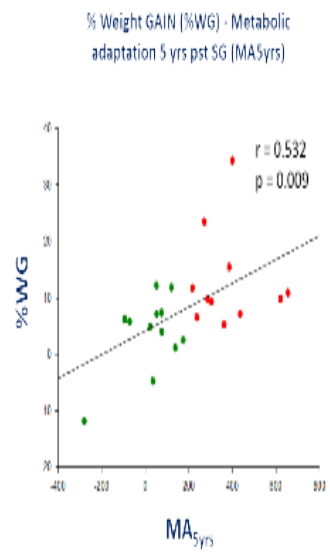
METABOLIC ADAPTATION

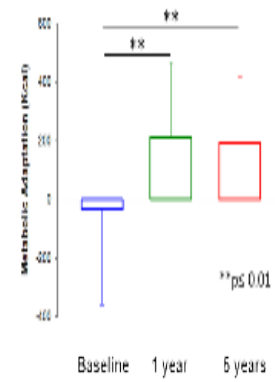
- 199 ± 238 kcal/day

Persistency of metabolic adaptation 5 years after LSG









Bettini et al., Obes Surg. 2018

MANAGEMENT DEL RECUPERO PONDERALE

Obesity Surgery (2021) 31:1755–1766
https://doi.org/10.1007/s11695-020-05160-5

REVIEW

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[1,2,3] · Wahiba Elhag[4]

MANAGEMENT DEL RECUPERO PONDERALE

Practical Recommendations of the Obesity Management Task Force of the European Association for the Study of Obesity for the Post-Bariatric Surgery Medical Management

Luca Busetto[a] Dror Dicker[b] Carmil Azran[c] Rachel L. Batterham[d, e, f]
Nathalie Farpour-Lambert[g] Martin Fried[h] Jøran Hjelmesæth[i] Johann Kinzl[j]
Deborah R. Leitner[k] Janine M. Makaronidis[d, f] Karin Schindler[l]
Hermann Toplak[k] Volkan Yumuk[m]

Obesity Facts
The European Journal of Obesity
Obes Facts 2017;10:597–632

Table 14. List of graded clinical practical recommendations on weight regain prevention and management after bariatric surgery

Recommendations	Level of evidence	Grade of recommendation*
Weight regain after bariatric surgery is a result of hormonal and metabolic alterations, surgical failure, nutritional non-adherence, mental health issues and physical inactivity.	3	D
Enforcing and sustaining healthy lifestyle facilitates weight regain prevention.	3	D
Adding anti-obesity drugs and/or re-do operations may halt weight regain or create further weight loss when applied at optimal timing.	3	D

Comportamentale	Farmacologico	Chirurgico
Follow-up nutrizionale e psicologico	Liraglutide	Revisione chirurgica
Autocontrollo e/o gruppi controllo	Naltrexone-Bupropione	Revisione endoscopica
Gruppi di autoaiuto	Orlistat	
DIETE CHETOGENICHE		

YuY et al. Surg Obes Relat Dis. 2019; **Lauti, M. *et al***. Obesity Surgery, 2016; **El Ansari W *et al*** Obesity Surgery, 2021; **Srivastava G, Buffington C** Obesity Surgery, 2018; **Odom J et al** Obesity Surgery 2010; **Kushner RF, Sorensen KW.** Curr Obes Rep. 2015; Kaouk L ***et al*** *F1000Res*. 2019

VLCKD

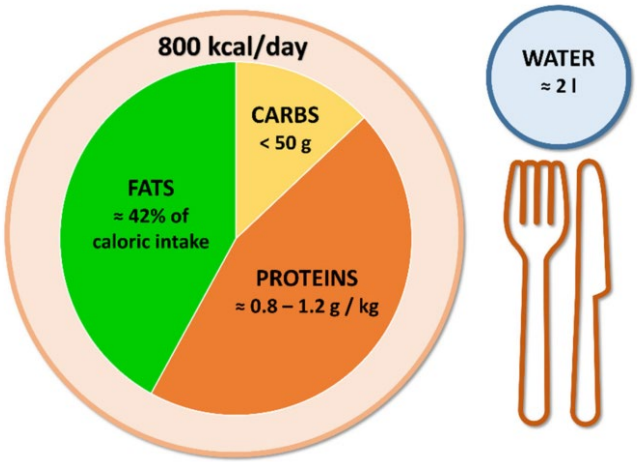
CARATTERISTICHE ED INDICAZIONI

È una dieta ad alto contenuto di grassi, adeguato contenuto di proteine, a basso contenuto di carboidrati
Utilizzata inizialmente per trattare l'epilessia refrattaria nei bambini sin dagli **anni '20**
Successivamente George Blackburn ha introdotto il concetto di "protein-sparing modified fast" (PSMF), un regime dietetico altamente restrittivo basato principalmente sulla **quantità minima di proteine necessarie per preservare la massa corporea magra** e con l'obiettivo di ottenere una rapida perdita di peso, così come potenziali benefici aggiuntivi sullo stato di salute ponendo le basi della **VLCKD**

VLCKD rappresenta un intervento/terapia medica nutrizionale che **imita il digiuno** attraverso una marcata restrizione dell'assunzione giornaliera di carboidrati, in grado di indurre e mantenere uno stato di "chetosi metabolica" cioè una condizione in cui vengono **utilizzati i corpi chetonici come fonte primaria di energia.**

VERY LOW-CALORIE KETOGENIC DIETS (VLCKDS)

STRONG RECOMMENDATIONS	CONTRAINDICATIONS
Severe obesity	Pregnancy and breastfeeding kidney failure
Severe obesity before bariatric surgery	Moderate-to-severe chronic kidney disease
Sarcopenic obesity	Liver failure
Obesity associated with: • T2DM (preserved beta cell function) • Hypertriglyceridemia • Hypertension	Rare disorders: porphyria, carnitine deficiency, carnitine palmitoyltransferase deficiency, carnitine-acylcarnitine translocase deficiency, mitochondrial fatty acid β-oxidation disorders, and pyruvate carboxylase deficiency
Pediatric obesity associated with epilepsy and/or with a high level of insulin resistance and/or comorbidities, not responsive to standardized diet	Respiratory failure unstable angina, hearth failure (NYHA III–IV), recent stroke or myocardial infarction (<12 months), and cardiac arrhythmias
WEAK RECOMMENDATIONS • Obesity associated with dysbiosis; • Obesity associated with dyslipidemia; • Obesity associated with NAFLD; • Obesity associated with heart failure (NYHA I–II);	Eating disorders and other severe mental illnesses, alcohol, and substance abuse Type 1 diabetes mellitus, latent autoimmune diabetes in adults, β-cell failure in T2DM, use of SGLT2 inhibitors
• Obesity associated with atherosclerosis; • Male obesity secondary hypogonadism; • Obesity associated with PCOS; • Menopausal transition-related obesity; • Neurodegenerative disorders.	Active/severe infections and frail elderly patients, 48 h prior to elective surgery or invasive procedures and perioperative period



Nutrients 2022, 14, 3610.

Impact of a Very Low-Calorie Ketogenic Diet (VLCKD) on Changes in Handgrip Strength in Women with Obesity – Nutrients – Barrea L. et al
Ketogenic Diet for Preoperative Weight Reduction in Bariatric Surgery: A Narrative Review – Nutrients – L. Colangeli et al

Muscogiuri et al. J Transl Med (2019) 17:356
https://doi.org/10.1186/s12967-019-2104-z

Journal of Translational Medicine

REVIEW Open Access

The management of very low-calorie ketogenic diet in obesity outpatient clinic: a practical guide

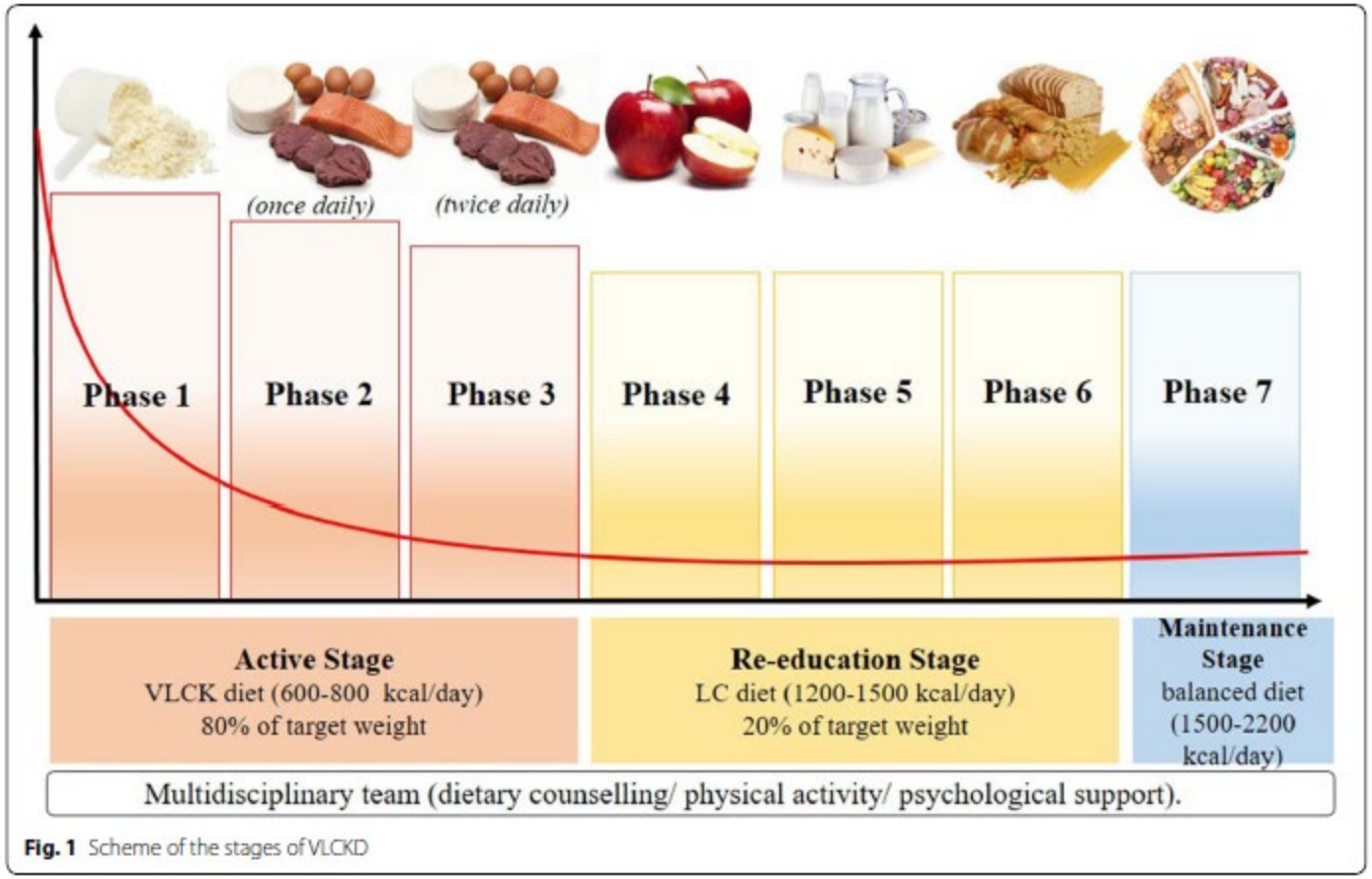


Fig. 1 Scheme of the stages of VLCKD

- Apporto calorico < 800 Kcal/die
- Quota proteica 0.8-1.5/ Kg PcI/die
- Quota glucidica < 30 gr/die e comunque < 1 gr CHO/ kg PcI/die
- Impiego vegetali e ortaggi a BASSO CONTENUTO GLUCIDICO
- Integrazione di vitamine, minerali e fibre

Obesity Facts

Guidelines

Obes Facts
DOI: 10.1159/000515381

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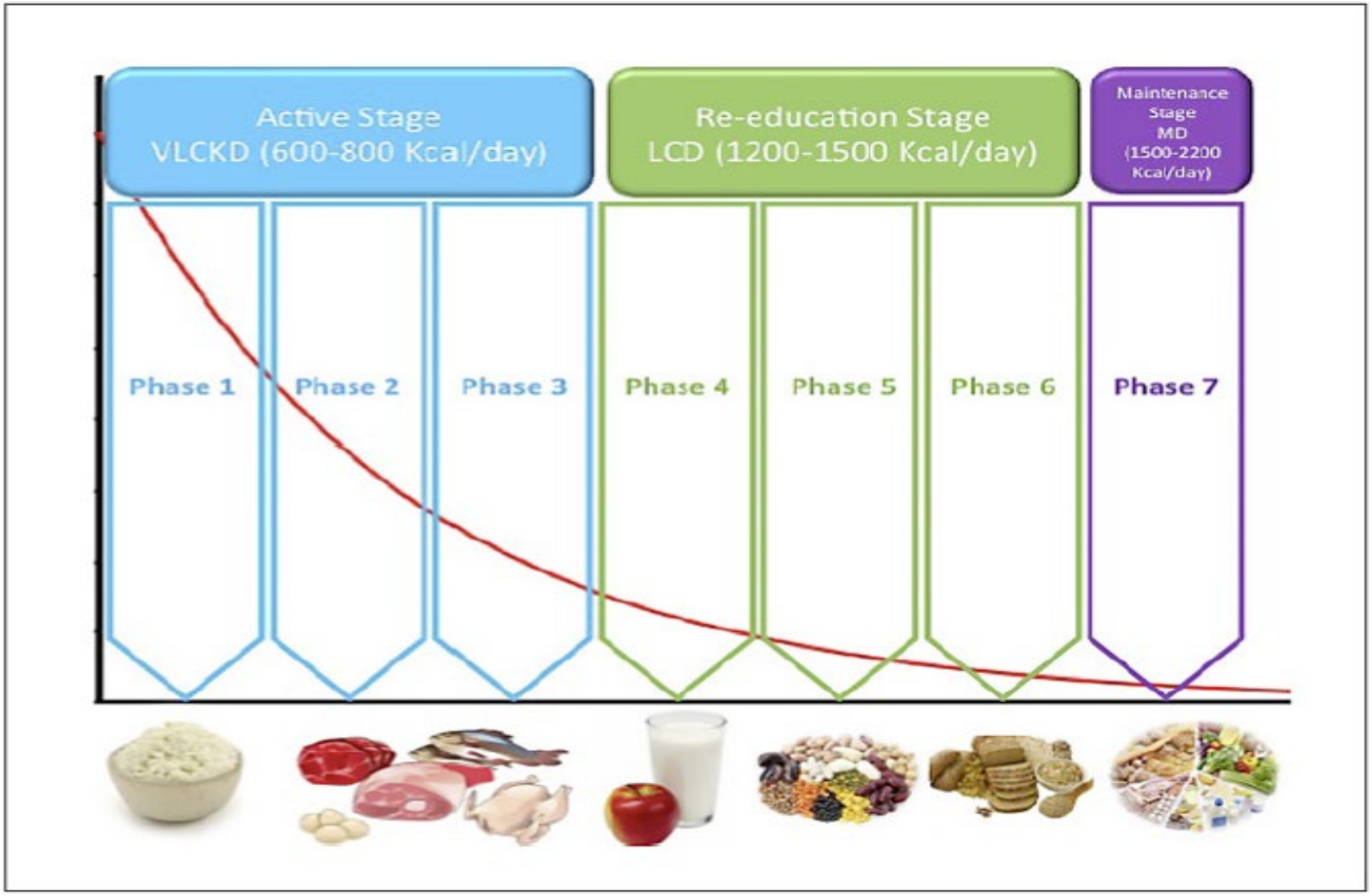
Published online: April 21, 2021

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

Giovanna Muscogiuri[a, b] Marwan El Ghoch[c] Annamaria Colao[a, b] Maria Hassapidou[d] Volkan Yumuk[e] Luca Busetto[f] Obesity Management Task Force (OMTF) of the European Association for the Study of Obesity (EASO)

PROTOCOLLO VLKCD

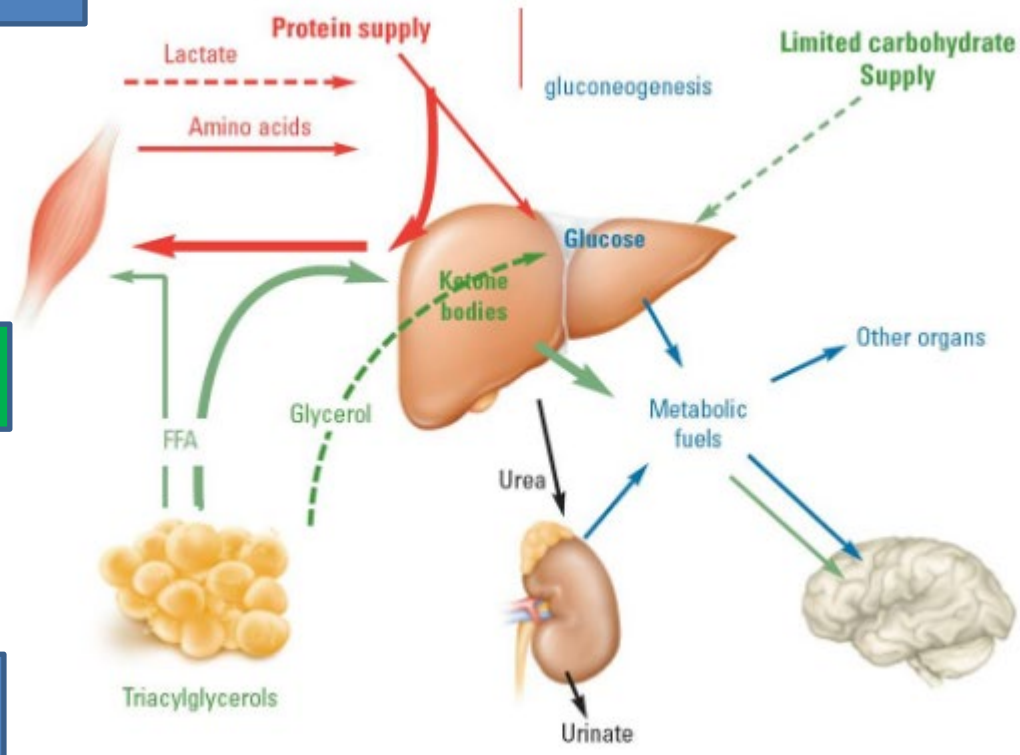


EASO

Chetosi metabolica

Apporto normoproteico

Ridotto apporto glucidico



↓INSULINA
↑GLUCAGONE

KB come carburante energetico

Lipolisi

Ketogenic diets and appetite regulation

Roekenes, Jessica[a]; Martins, Catia[a,b]

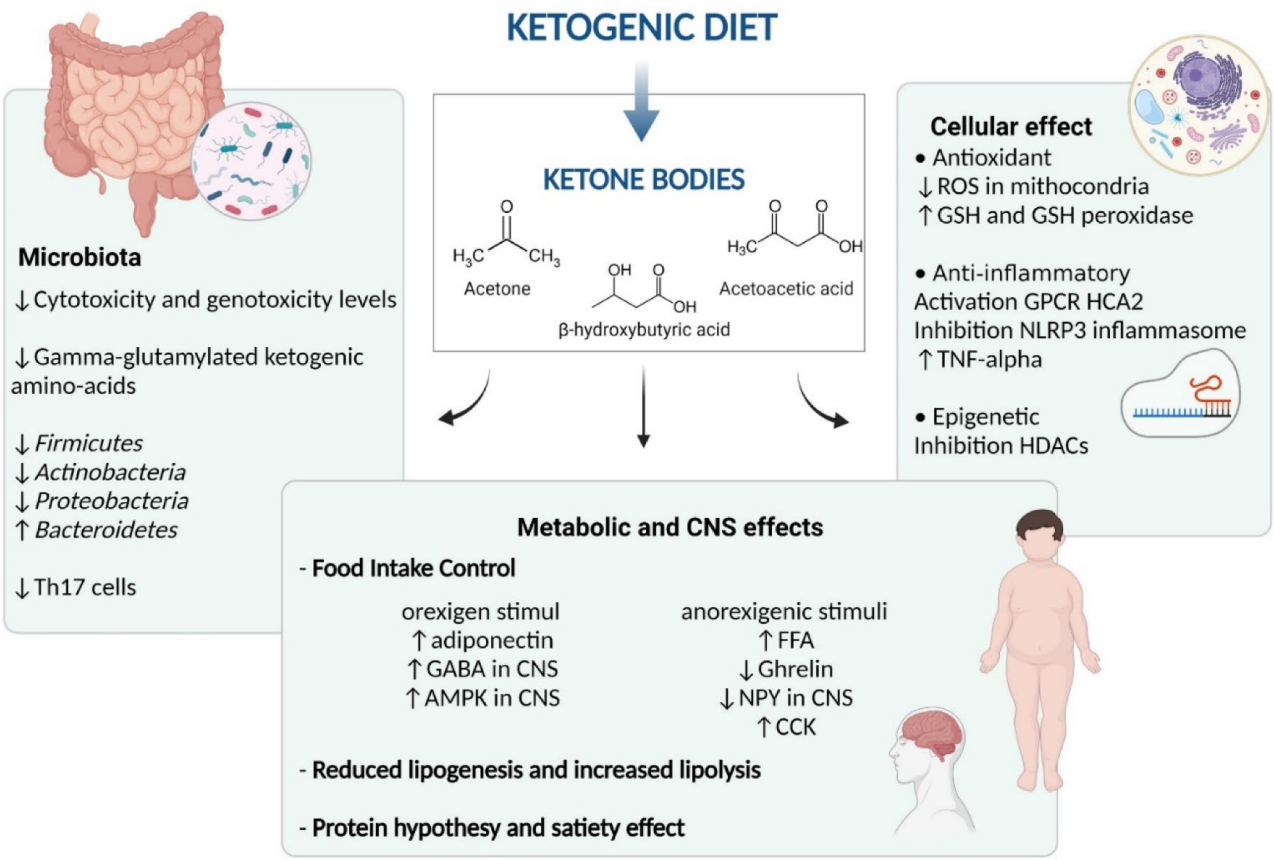
Author Information

Current Opinion in Clinical Nutrition and Metabolic Care

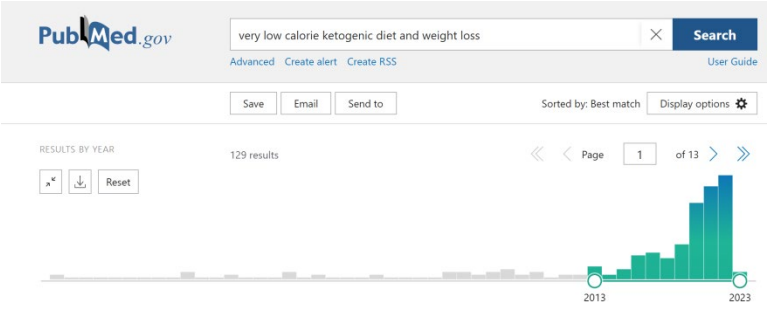
Current Opinion in Clinical Nutrition and Metabolic Care 24(4):p 359-363, July 2021. | *DOI:* 10.1097/MCO.0000000000000760

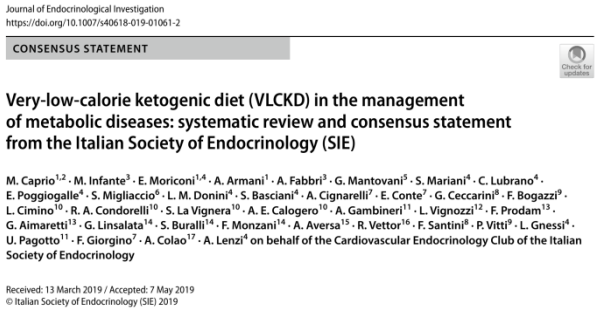
- Diete chetogeniche inducono perdita di peso significativa attenuando l'aumento di secrezione della grelina e la sensazione di fame che accompagna la perdita di peso indotta dalla dieta
- Anche gli studi che utilizzano chetoni esogeni danno risultati simili.
- I meccanismi esatti non sono stati chiariti, ma le prove delle indagini che impiegano chetoni esogeni indicano un effetto diretto dei chetoni sull'appetito.

? bHB modula la secrezione di grelina.

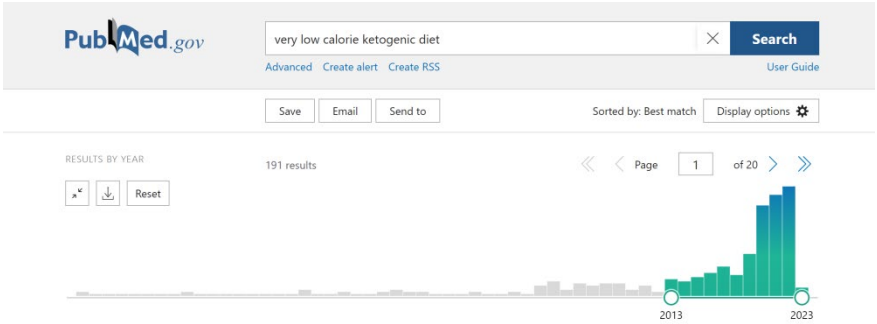


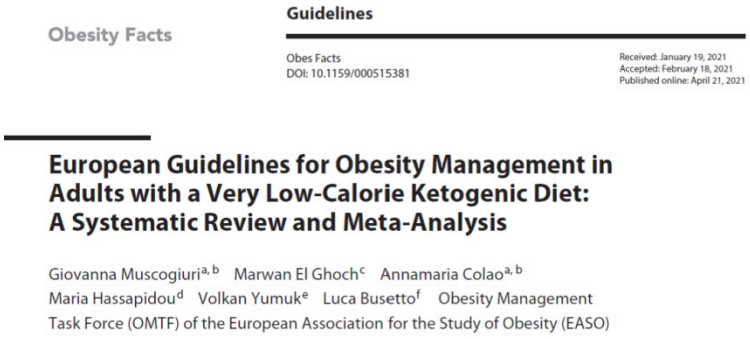
Calcaterra, V.; Verduci, E.; Pascuzzi, M.C.; Magenes, V.C.; Fiore, G.; Di Profio, E.; Tenuta, E.; Bosetti, A.; Todisco, C.F.; D'Auria, E.; Zuccotti, G. Metabolic Derangement in Pediatric Patient with Obesity: The Role of Ketogenic Diet as Therapeutic Tool. *Nutrients* **2021**, *13*, 2805. https://doi.org/10.3390/nu13082805

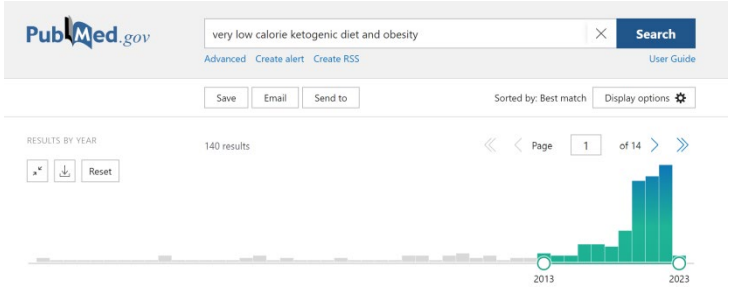




La **VLCKD** ha recentemente suscitato grande interesse nella comunità scientifica per il trattamento dell'obesità e delle sue comorbidità ***[Castellana M et al. Rev Endocr Metab Disord. 2019]***







VERY-LOW CALORIE KETOGENIC DIET (VLCKD)

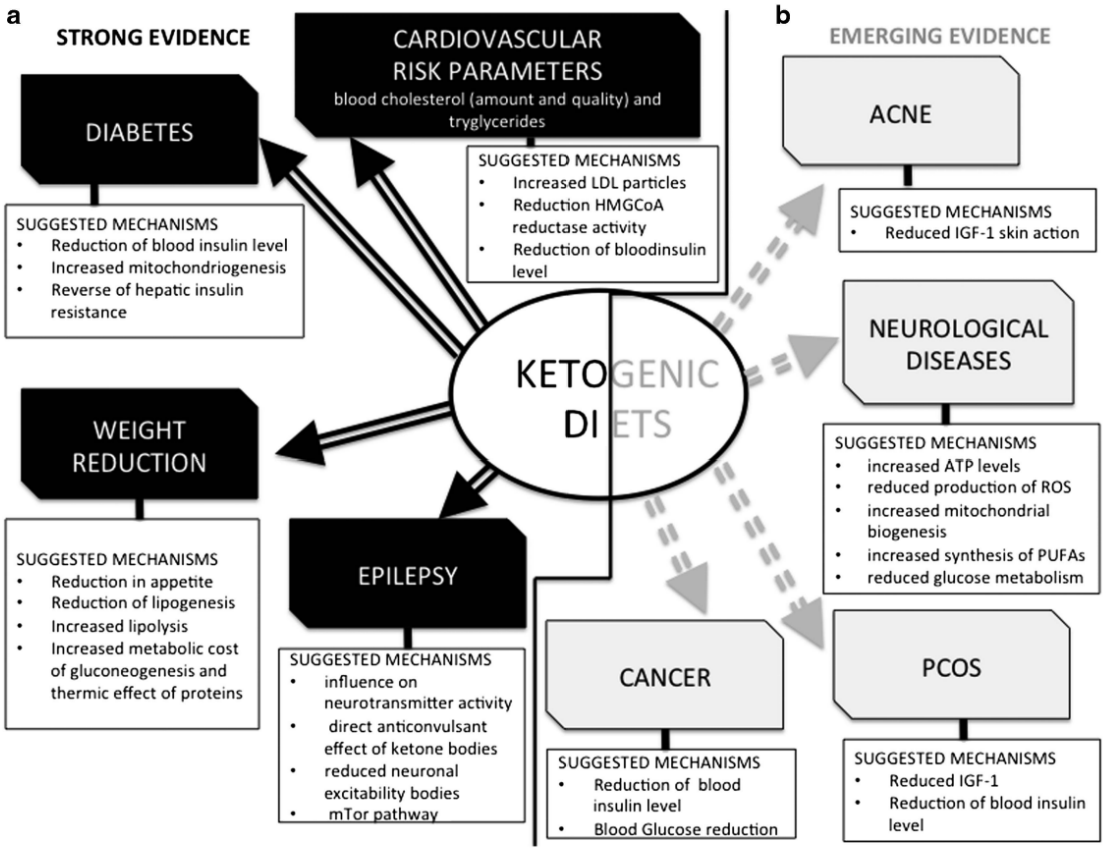


Figure 1. Suggested mechanisms for the therapeutic action of ketogenic diets in pathologies for which there exists strong (**a**) and emerging (**b**) evidence.

OPEN

European Journal of Clinical Nutrition (2013) **67**, 789–796
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www.nature.com/ejcn

REVIEW

Beyond weight loss: a review of the therapeutic uses of very-low-carbohydrate (ketogenic) diets

A Paoli[1], A Rubini[1], JS Volek[2] and KA Grimaldi[3]

2014

Andrea Pezzana[1], Maria Luisa Amerio[2], Giuseppe Fatati[3], Lorenza Caregaro Negrin[4], Fabrizio Muratori[5], Giuseppe M. Rovera[6], Michela Zanardi[1]

FONDAZIONE ADI POSITION PAPER

La dieta chetogenica

Introduzione

Definizione e aspetti biochimici: un punto di vista evoluzionistico

Il position paper (2014) dell'Associazione Italiana di Dietetica e Nutrizione Clinica (ADI) ha proposto la VLCKD come opzione terapeutica in diversi contesti clinici tra cui :

- obesità grave;
- obesità associata a comorbidità;
- steatosi epatica non alcolica (NAFLD);
- Epilessia farmaco resistente;
- strumento utile per dimagrire prima della chirurgia bariatrica

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 termine[5-7] soprattutto nei pazienti super-obesi[8]. 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 palloncino intragastrico[8-14].

Obesity Surgery (2021) 31:5383–5390
https://doi.org/10.1007/s11695-021-05703-4

ORIGINAL CONTRIBUTIONS

Effectiveness and Safety of a Very Low-Calorie Ketogenic Diet on Weight Regain Following Bariatric Surgery

Livia Lugarinho Correa[1] · Adriana Moretti[2] · Priscila Alves Medeiros de Sousa[1] · Leticia Dinis[1] · Mariana Fuganti de Souza[1] · Isabel Tostes[1] · Maitane Nuñez-Garcia[3] · Ignacio Sajoux[3]

EASO

Obesity Facts

Guidelines

Obes Facts
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Received: January 19, 2021
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European Guidelines for Obesity Management in Adults with a Very Low-Calorie Ketogenic Diet: A Systematic Review and Meta-Analysis

Giovanna Muscogiuri[a, b] Marwan El Ghoch[c] Annamaria Colao[a, b] Maria Hassapidou[d] Volkan Yumuk[e] Luca Busetto[f] Obesity Management Task Force (OMTF) of the European Association for the Study of Obesity (EASO)

INDICAZIONI

sie
Società Italiana Endocrinologia

Journal of Endocrinological Investigation
https://doi.org/10.1007/s40618-019-01061-2

CONSENSUS STATEMENT

Very-low-calorie ketogenic diet (VLCKD) in the management of metabolic diseases: systematic review and consensus statement from the Italian Society of Endocrinology (SIE)

M. Caprio[1,2] · M. Infante[3] · E. Moriconi[1,4] · A. Armani[1] · A. Fabbri[3] · G. Mantovani[5] · S. Mariani[4] · C. Lubrano[4] · E. Poggiogalle[6] · S. Migliaccio[6] · L. M. Donini[4] · S. Basciani[4] · A. Cignarelli[7] · E. Conte[7] · G. Ceccarini[8] · F. Bogazzi[9] · L. Cimino[10] · R. A. Condorelli[10] · S. La Vignera[10] · A. E. Calogero[10] · A. Gambineri[11] · L. Vignozzi[12] · F. Prodam[13] · G. Aimaretti[13] · G. Linsalata[14] · S. Buralli[14] · F. Monzani[14] · A. Aversa[15] · R. Vettor[16] · F. Santini[8] · P. Vitti[9] · L. Gnessi[4] · U. Pagotto[11] · F. Giorgino[7] · A. Colao[17] · A. Lenzi[4] on behalf of the Cardiovascular Endocrinology Club of the Italian Society of Endocrinology

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Indicazioni forti	
-	Obesità severa
-	Pre-chirurgia bariatrica
-	Obesità sarcopenica
-	Obesità associata a comorbidità (ipertensione arteriosa, diabete mellito di II tipo, dislipidemia, sindrome delle apnee notturne di tipo ostruttivo, osteopatie)
-	Obesità pediatrica associata a epilessia e\o elevata insulino resistenza o comorbidità, non responsivo a dieta tradizionale
Indicazioni deboli	
-	Obesità associata a: disbiosi, elevati livelli LDL e\o bassi HDL, aterosclerosi, insufficienza cardiaca, NAFLD, PCOS
-	Obesità secondaria a ipogonadismo
-	Malattie neurodegenerative associate a obesità sarcopenica

CONTROINDICAZIONI

-	Gravidanza e allattamento
-	Diabete di tipo 1, LADA, diabete tipo 2 con severa disfunzione beta-cellulare, uso concomitante di SGLT2 inibitori
-	Angina instabile, recente ictus o infarto del miocardio (<12 mesi), aritmia cardiaca; Insufficienza renale moderata-severa, insufficienza epatica, insufficienza cardiaca (NYHA III–IV), insufficienza respiratoria
-	Disturbi del comportamento alimentare, disturbi psichici, abuso di alcol o altre sostanze
-	Malattie rare: porfiria, deficit di carnitina, deficit di palmitoiltransferasi, deficit di carnitina-acetilcarnitina translocasi, disordini della beta-ossidazione mitocondriale degli acidi grassi, deficit di piruvato carbossilasi

Obesity Facts

Guidelines

Obes Facts
DOI: 10.1159/000515381

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

Giovanna Muscogiuri[a, b] Marwan El Ghoch[c] Annamaria Colao[a, b] Maria Hassapidou[d] Volkan Yumuk[e] Luca Busetto[f] Obesity Management Task Force (OMTF) of the European Association for the Study of Obesity (EASO)

Journal of Endocrinological Investigation
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Epilepsia
Official Journal of the International League Against Epilepsy

Free Access

Early- and Late-onset Complications of the Ketogenic Diet for Intractable Epilepsy

Hoon Chul Kang, Da Eun Chung, Dong Wook Kim, Heung Dong Kim

First published: 24 August 2004 | https://doi.org/10.1111/j.0013-9580.2004.10004.x | Citations: 177

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Complicanze

BREVE TERMINE

- Disidratazione
- Ipotensione
- Squilibrio elettrolitico
- Crampi muscolari
- Disturbi del sonno
- Sintomi gastrointestinali
- Iperuricemia

MEDIO E LUNGO TERMINE

- Danno trofismo osseo
- Perdita di capelli
- Calcolosi renale
- Calcolosi biliare
- Deficit di micronutrienti
- Perdita di massa muscolare
- Dislipidemia
- Danno renale

La maggior parte delle complicanze possono essere gestite con successo con un attento follow-up clinico-medico e strategie conservative

VALUTAZIONE CLINICA MEDICA
Iniziale e di follow up

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Table 1 Parameters that need to be monitored before, during and at the end of a VLCKD regimen

Parameters	Frequency of monitoring	Rationale of monitoring
Complete blood count	At baseline and at the end of the VLCKD program	To exclude patients with severe alterations of blood count
Creatinine, BUN, uric acid (serum)	At baseline and during the ketogenic phase	Monitoring of kidney function and potential increase in uric acid
Glucose, total cholesterol, HDL-cholesterol, LDL-cholesterol, triglycerides (serum)	At baseline and at the end of the VLCKD program	Excluding patients with uncontrolled diabetes, monitoring of lipid profile
ALT, AST, γ-GT, total and direct bilirubin (serum)	At baseline, during the ketogenic phase and at the end of the VLCKD program	Monitoring of liver function and cholestatic parameters
Sodium, potassium, calcium, magnesium, inorganic phosphate (serum)	At baseline, during the ketogenic phase and at the end of the VLCKD program	Monitoring for potential dehydration and electrolyte abnormalities
β-Hydroxybutyrate (capillary blood or urine)	During the ketogenic phase	Monitoring of ketosis
TSH, FT4 (serum)	At baseline	To exclude thyroid function abnormalities
25-Hydroxyvitamin D (serum)	At baseline	To treat vitamin D deficiency, if present
Complete urinalysis and microalbuminuria (urine)	At baseline, during the ketogenic phase and at the end of the VLCKD program	To exclude any potential kidney damage
Body composition and hydration status (by bioelectrical impedance analysis)	At baseline, during the ketogenic phase and at the end of the VLCKD program	Monitoring of body composition (fat mass, fat-free mass, body cell mass, total body water, extracellular water)

ALT alanine aminotransferase, *AST* aspartate aminotransferase, *BUN* blood urea nitrogen, *FT4* free thyroxine, *γ-GT* gamma-glutamyl transferase, *HDL-cholesterol* high-density lipoprotein cholesterol, *LDL* cholesterol, low-density lipoprotein cholesterol, *TSH* thyroid-stimulating hormone, *VLCKD* very-low-calorie ketogenic diet

Table 1 Indications and contraindications to VLCKD of ADI (Associazione Italiana di Dietetica e Nutrizione Clinica) and SIE (Società Italiana di Endocrinologia)

	ADI	SIE
Indications	Morbid obesity or complicated (type 2 diabetes, dyslipidemia, hypertension, metabolic syndrome, OSAS, bone diseases or severe arthropathy) Severe obesity with bariatric surgery indication (in the preoperative period) Patients with severe comorbidities needing a rapid weight loss Non-alcoholic fatty liver disease (NAFLD) Drug-resistant epilepsy	Severe obesity Management of severe obesity before bariatric surgery Sarcopenic obesity Obesity associated with type 2 diabetes (preserved beta cell function) Obesity associated with hypertriglyceridemia Obesity associated with hypertension Pediatric obesity associated with epilepsy and/or with a high level of insulin resistance and/or comorbidities, not responsive to standardized diet
Contraindications	Pregnancy and lactation History of mental disorders and behavioral problems, abuse of alcohol and other substances Hepatic or renal failure Type 1 Diabetes Porphyria, unstable angina, recent myocardial infarction	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 for euglycemic diabetic ketoacidosis) Pregnancy and breastfeeding Kidney failure and moderate-to-severe chronic kidney disease Liver failure Hearth failure (NYHA III-IV) Respiratory failure Unstable angina, recent stroke or myocardial infarction (or myocardial infarction (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 elective surgery or invasive procedures and perioperative period Rare disorders: porphyria, carnitine deficiency, carnitine palmitoyltransferase deficiency, carnitine-acylcarnitine translocase deficiency, mitochondrial fatty acid β-oxidation disorders, pyruvate carboxylase deficiency

MICROSUPPLEMENTAZIONE NUTRIZIONALE

NECESSITÀ DI INTEGRAZIONE IN SALI MINERALI E VITAMINE

- Insufficiente apporto di oligoelementi data l'esclusione di alcuni gruppi alimentari
- Consumo di cationi alcalini (Na^+; K^+; Mg^{++}; Ca^{++}) sia perché si legano ai corpi chetonici carichi negativamente(aceto acetato e ß-idrossibutirrato) e vengono eliminati per via renale sia per il loro effetto tampone

CHETOSI NUTRIZIONALE COMPENSATA

Review

Ketogenic Diet for Obesity: Friend or Foe?

Antonio Paoli

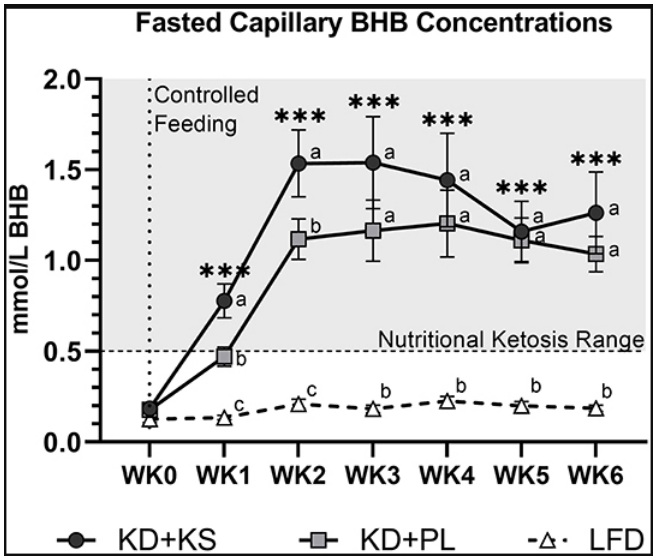

Table 1. Blood levels during a normal diet, ketogenic diet and diabetic ketoacidosis [35]

Blood Levels	Normal Diet	Ketogenic Diet	Diabetic Ketoacidosis
Glucose (mg/dL)	80–120	65–80	>300
Insulin (μU/L)	6–23	6.6–9.4	≈0
KB conc (mmol/L)	0.1	7/8	>25
pH	7.4	7.4	<7.3

nutrients

MDPI

Article

A Ketogenic Low-Carbohydrate High-Fat Diet Increases LDL Cholesterol in Healthy, Young, Normal-Weight Women: A Randomized Controlled Feeding Trial

Jonas Burén [1,2,*], Madelene Ericsson [3,4], Nágila Raquel Teixeira Damasceno [5] and Anna Sjödin [1]

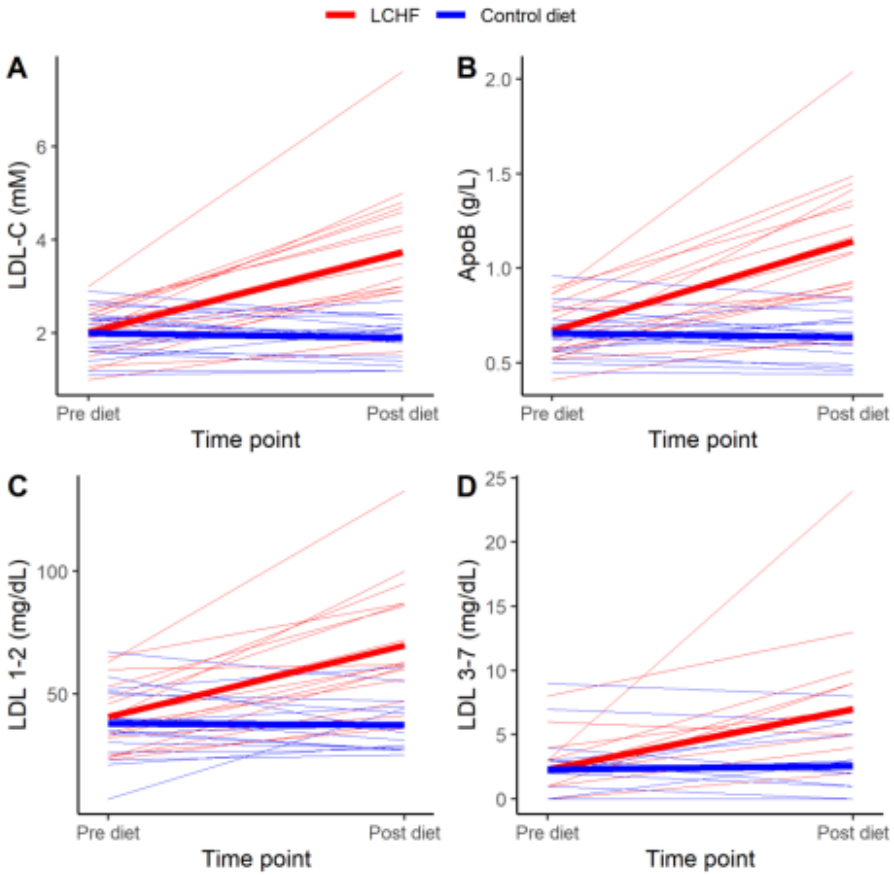

Figure 2. Individual (n = 17) changes of (**A**) low-density lipoprotein cholesterol (LDL-C), (**B**) Apolipoprotein B-100 (ApoB) (**C**) large, buoyant LDL (LDL 1–2), and (**D**) small, dense LDL (LDL 3–7). Pre diet (i.e., immediately before diet intervention

Baseline measures (collected 2 to 5 days before starting the first diet intervention) and treatment effects of a four-week ketogenic LCHF diet [1].

Parameters	Baseline (Mean ± SD)	Treatment Effect (95% CI)	*p* Value
Primary outcome, mM			
LDL cholesterol	2.1 ± 0.6	1.82 [1.24, 2.39]	<0.001
LDL subfractions, mg/dL			
LDL 1–2 (large, buoyant LDL)	42.1 ± 14.6	31.56 [21.60, 41.51]	<0.001
LDL 3–7 (small, dense LDL)	2.7 ± 2.5	4.51 [1.87, 7.16]	<0.01
LDL particle size, nm			
LDL size	270 ± 3	−1.40 [−3.10, 0.30]	0.30
Blood Biochemistry, mM			
Glucose	4.9 ± 0.2	−0.49 [−0.68, −0.29]	<0.001
Insulin	6.3 ± 1.6	−2.94 [−4.00, −1.88]	<0.001
Standard chemical lipids, mM			
TG	0.6 ± 0.3	0.13 [0.05, 0.21]	<0.01
TC	4.1 ± 0.9	2.25 [1.65, 2.84]	<0.001
HDL cholesterol	1.7 ± 0.5	0.32 [0.23, 0.40]	<0.001
Non-HDL cholesterol	2.4 ± 0.6	1.91 [1.34, 2.49]	<0.001
Apolipoproteins, g/L			
ApoB	0.70 ± 0.15	0.50 [0.35, 0.65]	<0.001
ApoA-I	1.56 ± 0.34	0.37 [0.30, 0.44]	<0.001
Ratios			
Total cholesterol/HDL	2.4 ± 0.5	0.82 [0.50, 1.14]	<0.001
ApoB/ApoA-I	0.46 ± 0.12	0.20 [0.12, 0.28]	<0.001
LDL/HDL	1.3 ± 0.4	0.78 [0.47, 1.10]	<0.001

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The utility of weight loss medications after bariatric surgery for weight regain or inadequate weight loss: A multi-center study

Fatima Cody Stanford, M.D., M.P.H., M.P.A.[a,b,c,*], **Nasreen Alfaris, M.D., M.P.H.**[a,c,d], **Gricelda Gomez, B.S.**[c,e], **Elizabeth T. Ricks, M.S.**[f,g,h], **Alpana P. Shukla, M.D.**[f], **Kathleen E. Corey, M.D., M.P.H., M.M.Sc.**[c,i], **Janey S. Pratt, M.D.**[c,j], **Alfons Pomp, M.D.**[k], **Francesco Rubino, M.D.**[l], and **Louis J. Aronne, M.D.**[g]

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SUPPLEMENT ARTICLE

OBESITY Reviews WILEY

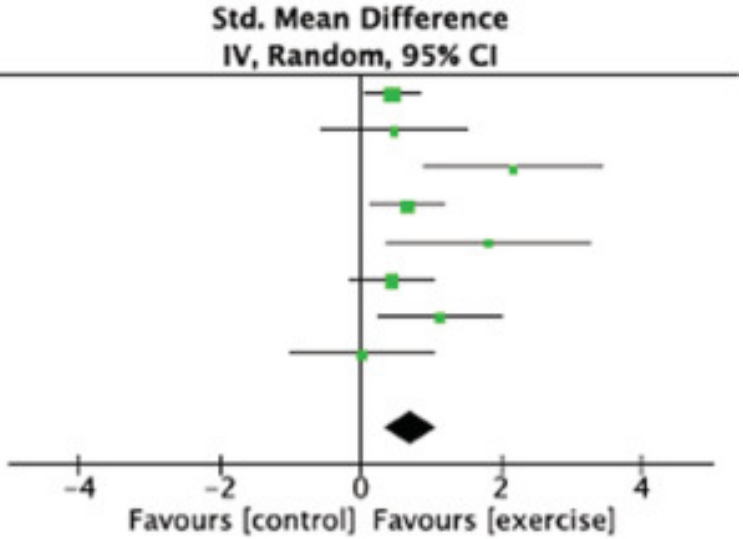
Effect of exercise training before and after bariatric surgery: A systematic review and meta-analysis

(A) Change in VO_2max

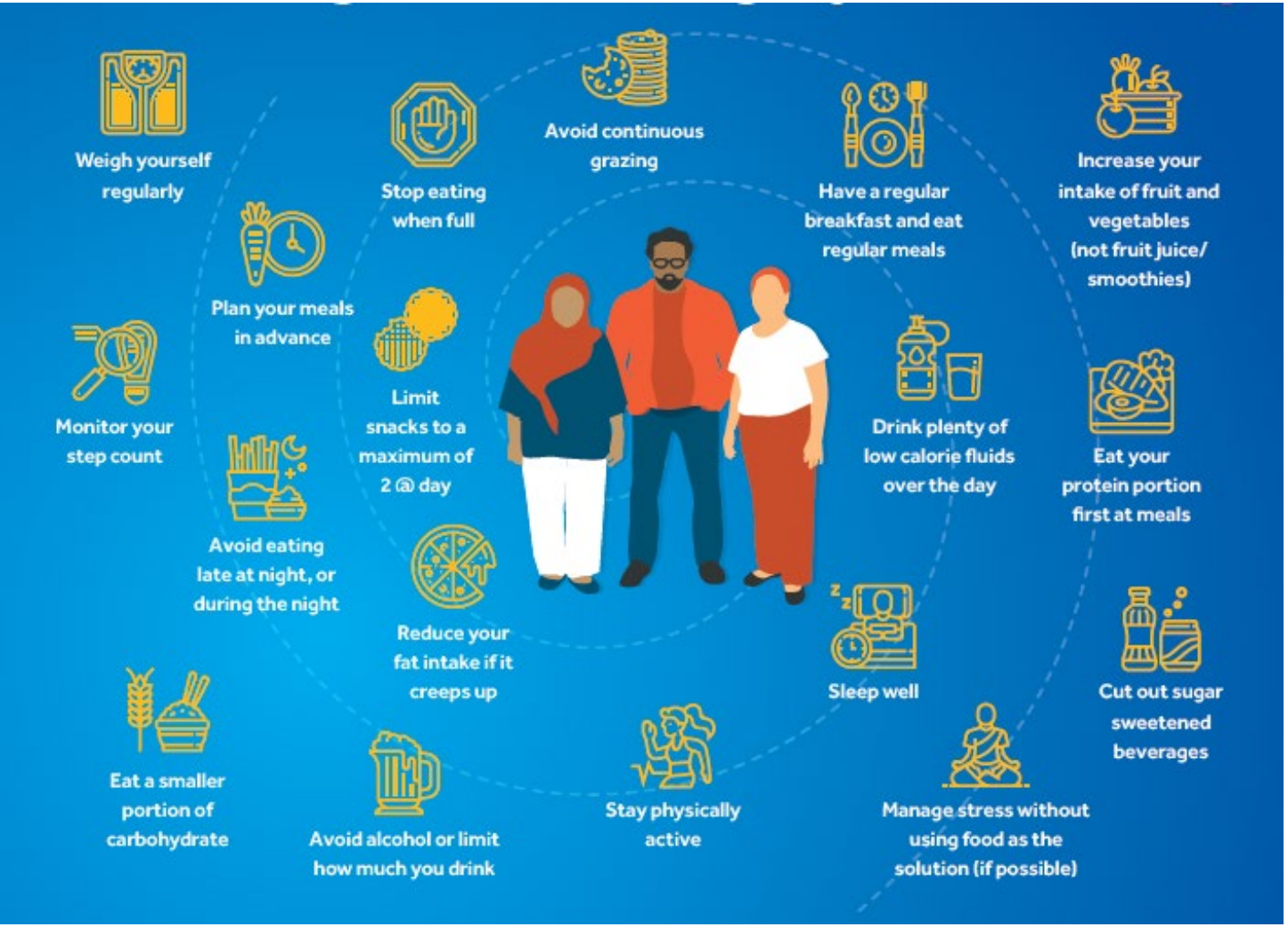
Study or Subgroup	Weight	Std. Mean Difference IV, Random, 95% CI
Coen (b)	23.5%	0.44 [0.05, 0.84]
Huck	8.7%	0.47 [-0.56, 1.50]
Marchesi	6.3%	2.16 [0.89, 3.43]
Mundbjerg (b)	19.3%	0.66 [0.14, 1.18]
Onofre	5.1%	1.82 [0.38, 3.26]
Oppert	17.2%	0.45 [-0.14, 1.04]
Shah	10.9%	1.13 [0.25, 2.01]
Stegen	8.9%	0.02 [-0.99, 1.04]
Total (95% CI)	**100.0%**	**0.70 [0.35, 1.06]**

Heterogeneity: $Tau^2 = 0.10$; $Chi^2 = 12.09$, df = 7 (P = 0.10); $I^2 = 42\%$

Test for overall effect: Z = 3.89 (P < 0.0001)



TIPS per il mantenimento del peso dopo l'intervento di chirurgia bariatrica



- Stile di vita
- Intervento medico/ farmacologico
- Controllo chirurgico

EASO Obesity UK

CONCLUSIONI

1. La DIETA CHETOGENICA è un PROTOCOLLO CLINICO DIETOTERAPICO che può essere prescritto in caso di insuccesso della chirurgia bariatrica SOLO dopo attenta valutazione clinica, nutrizionale e psicologica MIRATA ANCHE ALLA VALUTAZIONE DELLE RAGIONI DEL RECUPERO DEL PESO.
2. La compliance alle VLKCD è difficoltosa se attuata con alimenti naturali ed è costosa se attuata con pasti sostitutivi.
3. PUÒ PRESENTARE DELLE COMPLICANZE a breve, medio e lungo termine che possono essere gestite adeguatamente con un ATTENTO FOLLOW UP EFFETTUATO DA PERSONALE SPECIALIZZATO.
4. Comparato ad altri protocolli presenta un risultato PIÙ RAPIDO, ma studi sul mantenimento dell' obbiettivo a lungo tempo sono scarsi e per lo più comparabili a qualsiasi altro protocollo dietetico personalizzato.
5. La DIETA CHETOGENICA rimane comunque un' opzione per la gestione del recupero del peso dopo chirurgia bariatrica solo se inquadrato in un programma di riabilitazione nutrizionale e modifiche dello stile di vita e se gestito da personale qualificato.

S.I.C.OB.
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SPRING MEETING
18 - 19 MAGGIO 2023
THE NICOLAUS HOTEL
CONDIVIDERE PER CRESCERE
Strategie di integrazione
in Chirurgia Bariatrica
Presidente del Congresso
ANTONIO BRAUN

Grazie

ARRIVEDERCI A SALERNO