Prehabilitation and Nutritional Support

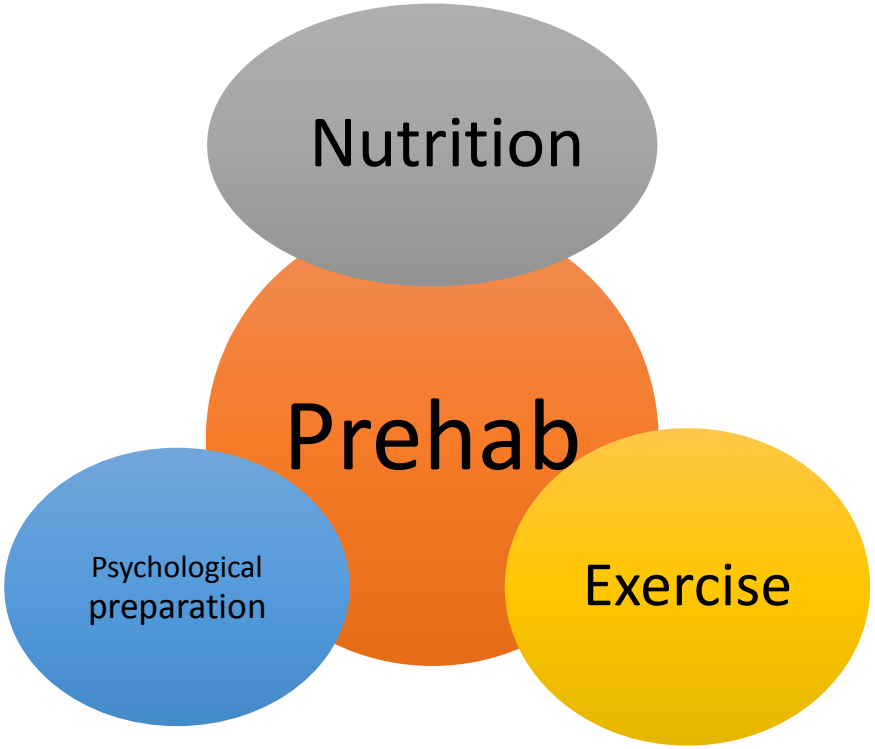
Dr Anastasios Papalazarou, MSc, PhD

Dietitian - Nutritionist

Scientific Associate, Department of Nutrition and Dietetics, Harokopio University

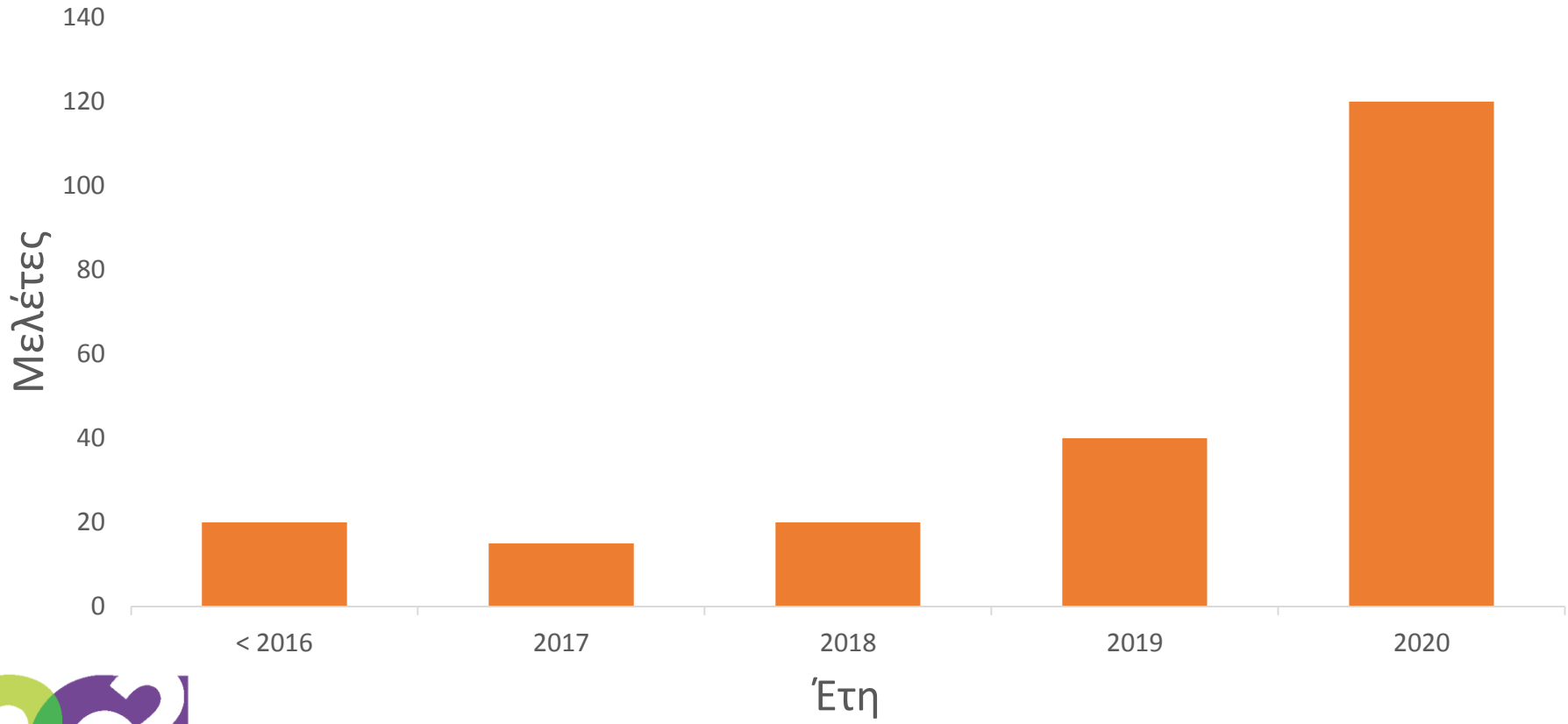
Prehabilitation

"The process of enhancing the functional capacity of the individual to enable him or her to withstand a stressful event."

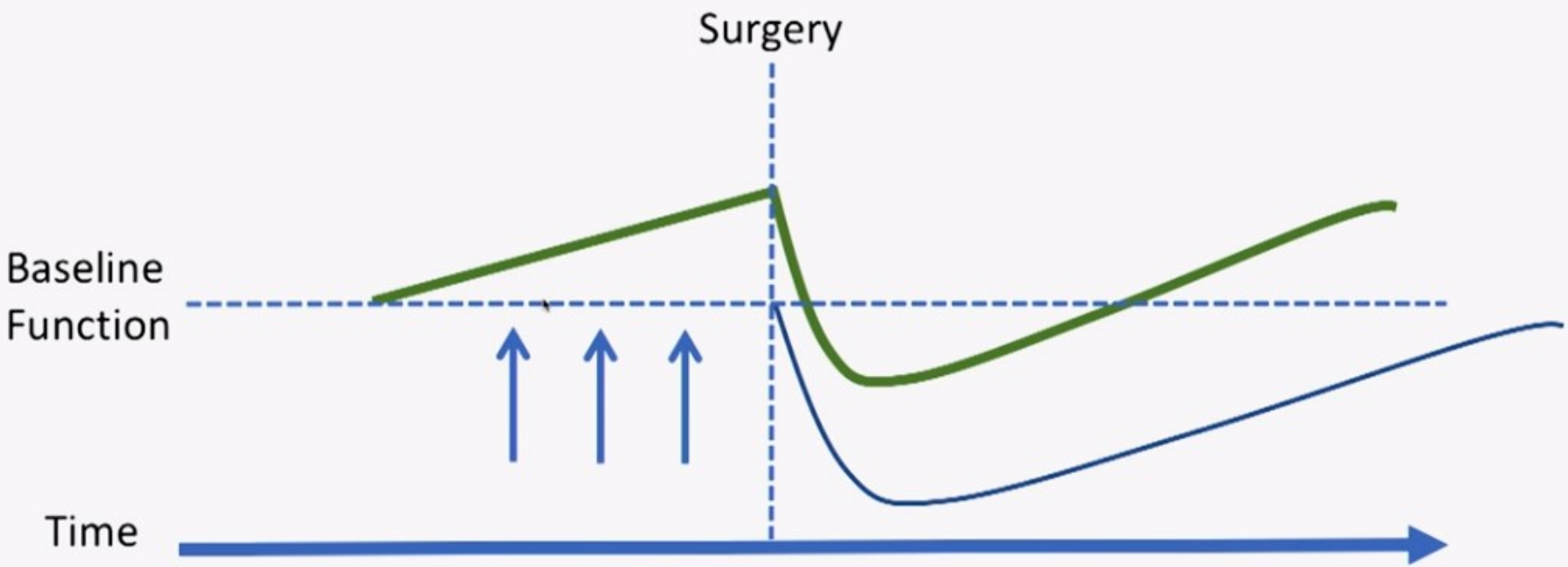


Gillis C et al. Anaesthesia Jan;74 Suppl 1:27-35 2019

Studies in pubmed with «Prehabilitation and Nutrition»



Focusing on Recovery Before Surgery



University of California, 2018

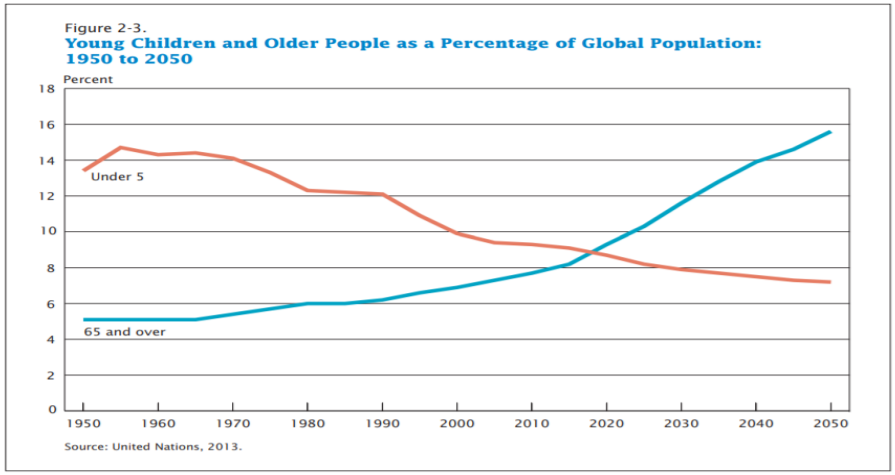
Why is there so much interest?

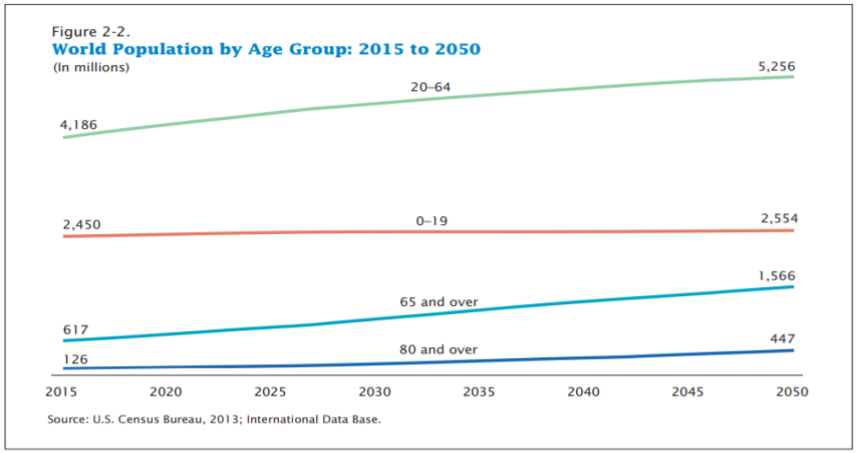
About 50% of patients are either undernourished or under the risk of becoming undernourished.

- **High mortality rates**
- **Problematic functionality**
- Reduced immune function
- Delay in wound healing
- **Increased period of hospital stay**
- Increased costs
- More frequent repeated hospitals imports
- Dysfunctional of human organs

Gillis C et al. Anaesthesia Jan;74 Suppl 1:27-35 2019

Operations are getting increased





An Aging World: 2015, International Population Reports

- ✓ About 53% of all operations occur at patients >65 years old
- ✓ Forecasts reveals that 1 out of 2 individuals >65 years old is going to make at least 1 surgery.

Yang R et al, Geriatr Orthop Surg Rehabil. 2011

Asia Pac J Clin Nutr 2021;30(3):349-357 349

Review Article

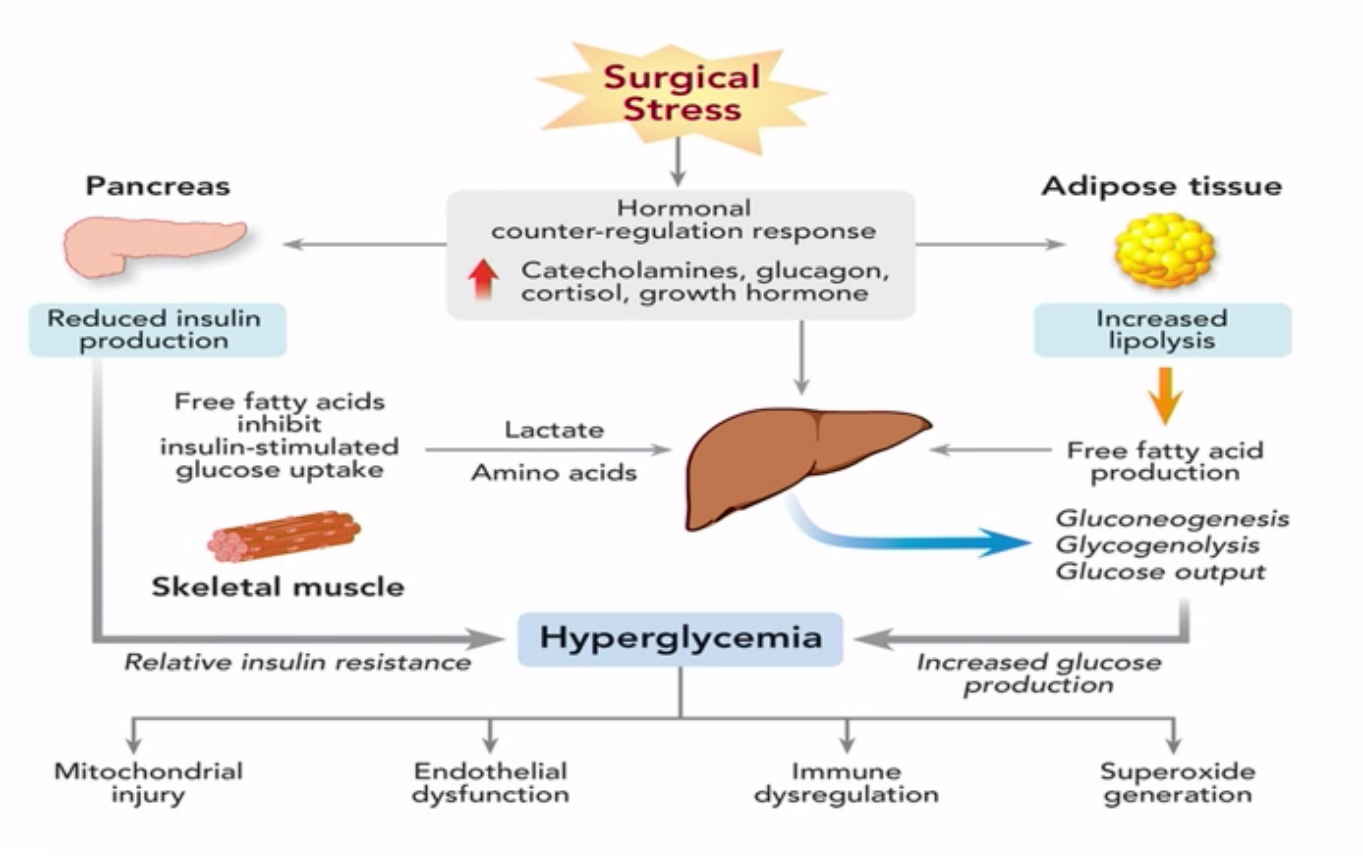
Nutrition and exercise prehabilitation in elderly patients undergoing cancer surgery

Yanni Zhang MD†, Shanjun Tan MD, PhD†, Junjie Wang MD, Zhige Zhang MD, Guohao Wu MD, PhD

Surgical resection is the primary and most effective treatment for cancer patients. While such a traumatic intervention often accompanies different degrees of postoperative risk largely depending on the patient's health status. Due to the high prevalence of malnutrition or low cardiorespiratory fitness in elderly cancer patients, prehabilitation is an optimal program to reduce postoperative complications and enhance recovery from surgical trauma. An increasing body of evidence suggests that improving nutrition and taking aerobic exercise or strength training prior to major surgery can help reduce postoperative morbidity, mortality, or length of stay. However, there are still controversies regarding the manner, intensity, or duration of preoperative nutrition and exercise training in elderly patients, as well as the impact on delaying cancer treatment. This article reviews the impact of prehabilitation on improving postoperative outcomes in the multi-modal or single-modal pathway, aiming to maximize its effectiveness and increase medical practitioners' attention on enhancing the physical condition of the elderly cancer patients preoperatively.

Key Words: prehabilitation, preoperative support, enhanced recovery, cancer treatment, nutrition

Metabolic response to surgical stress



Carli F, et al. Br J Anaesth. Oct;87(4):531-3, 2001

Prehab Focus Points

Careful **evaluation** of the patient's nutritional status.

Based on the nutritional status, immediate initiation of the **nutritional therapy**, if necessary, for best outcome.

Maintaining lean mass via adequate protein consumption & resistance exercise.

Fasting before surgery?

Reducing insulin resistance and succeeding better **glycemic control**

Carbohydrate Loading

Enhanced Recovery After Surgery (ERAS) protocol

Evaluation of Nutritional Status (NRS 2002)

Table 1 Initial screening

		Yes	No
1	Is BMI < 20.5?		
2	Has the patient lost weight within the last 3 months?		
3	Has the patient had a reduced dietary intake in the last week?		
4	Is the patient severely ill ? (e.g. in intensive therapy)		

Yes: If the answer is 'Yes' to any question, the screening in Table 2 is performed.
No: If the answer is 'No' to all questions, the patient is re-screened at weekly intervals. If the patient e.g. is scheduled for a major operation,

Table 2 Final screening

	Impaired nutritional status		Severity of disease (≈ increase in requirements)
Absent **Score 0**	Normal nutritional status	Absent **Score 0**	Normal nutritional requirements
Mild **Score 1**	Wt loss > 5% in 3 mths or Food intake below 50–75% of normal requirement in preceding week	Mild **Score 1**	Hip fracture* Chronic patients, in particular with acute complications: cirrhosis*, COPD*. *Chronic hemodialysis, diabetes, oncology*
Moderate **Score 2**	Wt loss > 5% in 2 mths or BMI 18.5 – 20.5 + impaired general condition or Food intake 25–60% of normal requirement in preceding week	Moderate **Score 2**	Major abdominal surgery* Stroke* *Severe pneumonia, hematologic malignancy*
Severe **Score 3**	Wt loss > 5% in 1 mth (> 15% in 3 mths) or BMI < 18.5 + impaired general condition or Food intake 0-25% of normal requirement in preceding week in preceding week.	Severe **Score 3**	Head injury* Bone marrow transplantation* *Intensive care patients (APACHE > 10).*
Score:	+	**Score:**	= **Total score**
Age	if ≥ 70 years: add 1 to total score above	= **age-adjusted total score**	

Score ≥ 3: the patient is nutritionally at-risk and a nutritional care plan is initiated
Score < 3: weekly rescreening of the patient. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.

ESPEN Guidelines for Nutrition Screening, 2002, Clinical Nutrition, 2003

Maintaining Fat Free Mass (FFM)

Maintaning FFM is crucial for

- Patient functionality
- Wound healing,
- Autonomy and function of the immune system

FFM loss is related to

- Decreased response to surgical stress
- Increased chance of complications
- Increased hospital stay
- Reduced survival rates

- Obese patients with reduced muscle mass have increased morbidity and mortality

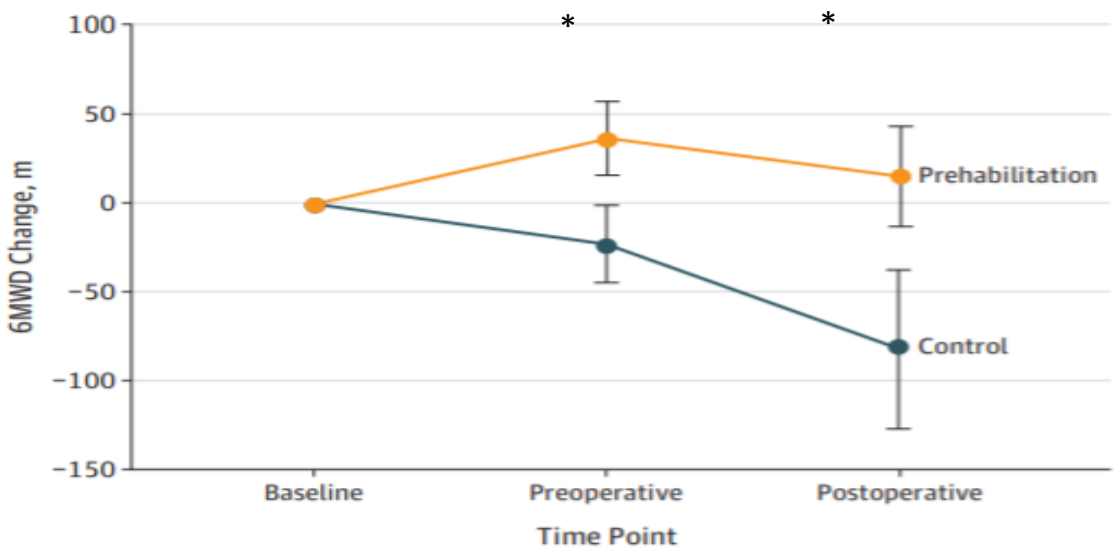
Gıllis C et al. Anaesthesia Jan;74 Suppl 1:27-35 2019

JAMA Surgery | Original Investigation

Effect of Exercise and Nutrition Prehabilitation on Functional Capacity in Esophagogastric Cancer Surgery
A Randomized Clinical Trial

Enrico M. Minnella, MD; Rashami Awasthi, MSc; Sarah-Eve Loiselle, PDt; Ramanakumar V. Agnihotram, PhD; Lorenzo E. Ferri, MD, PhD; Francesco Carli, MD, MPhil

Figure 2. Trajectory of Change in Functional Capacity in the Perioperative Period



Data are means (95% CIs). 6MWD indicates 6-minute walking distance.

* p<0.001

Minella E.M. et al JAMA 2018

Nutritional Prehabilitation impact on both patient's functionality and length of stay at hospital

Bitterli et al,[49] 2011	THA	80	65.3	Exercise (unsupervised minimal intervention strategy focused on awareness of hip joint movement)	2–6 wk	Less pain and better mean balance ability before surgery, no postoperative impact of the program
Huang et al,[51] 2012	TKA	243	70.5	Exercise (unsupervised strength), education	2–4 wk	Significantly decreased LOS and medical costs
Matassi et al,[43] 2014	TKA	122	66	Exercise (supervised and unsupervised strength and flexibility)	6 wk	Significantly decreased LOS and improved knee mobility in early postoperative period
Villadsen et al,[48] 2014	THA and TKA	165	66.9	Exercise (supervised strength, functional)	8 wk	Improvement with ADLs and pain 6 wk after surgery
Biau et al,[87] 2015	THA	207	66	Education (supervised functional postoperative exercises, pain management)	1 class	Time to reach complete functional independence after surgery was not improved
Skoffer et al,[42] 2016	TKA	59	70.7	Exercise (supervised strength, flexibility)	4 wk	Improved functionality and strength 6 wk after surgery. Patient-reported outcomes (QoL, pain) unchanged

Author, Year	Type of Surgery	Subjects (N)	Mean Age (y)	Prehabilitation (Intervention Group) Program Features	Duration	Impact of Prehabilitation
Abdominal and Colorectal Surgeries						
Jensen et al,[21] 2015	Radical cystectomy	107	69	Exercise (unsupervised aerobic, strength) Behavioral	2 wk	Improved walking capacity after surgery and ability to perform ADLs
Gillis et al,[44] 2014	Elective colorectal resection	77	65.7	Exercise (unsupervised aerobic, strength) Nutrition Behavior	4 wk	Improved walking capacity after surgery
Minnella et al,[22] 2017	Elective colorectal resection	185	68.5	Exercise (supervised or unsupervised aerobic, strength, flexibility), nutrition, behavioral	4 wk	Improved perioperative walking capacity
Barberan-Garcia et al,[36] 2018	Elective major abdominal surgery	125	71	Exercise (supervised high-intensity aerobic, unsupervised aerobic, functional) Behavioral	6 wk (±2 wk)	Increased aerobic capacity, decreased postoperative complications
Bousquet-Dion et al,[23] 2018	Colon surgery	63	71	Exercise (supervised and unsupervised aerobic and strength) Nutrition	4 wk	No significant impact, but determined that sedentary patients more likely to benefit from prehabilitation than active

Vega et al Anesthesiology Clin 37,437–452, 2019

Maintaining FFL Recommendations

- Protein intake should be at the level of 1.2-1.5g / Kg / day
- Protein intake in combination with both aerobic and resistance exercises offer a significant effect.

Eur. Society Clin Nutrition and Metabolism 2009
Gıllis C et al. Anaesthesia Jan;74 Suppl 1:27-35 2019

- Protein intake of 20-30 g in liquid form (whey) immediately after resistance exercises, maximizes protein synthesis in healthy individuals.
- Intake of Alanine and BCAA (Leu Isoleu Val) brings the best results.

Burke et al American Society for Nutrition. Adv Nutr 2017;8:511–9

Pre- surgery CHO loading

- It is recommended to take 800 ml of CHO drink (mainly a mixture of maltodextrins) the night before and 400 ml 2 hours before the operation, density 12.5%

(ERAS protocol)

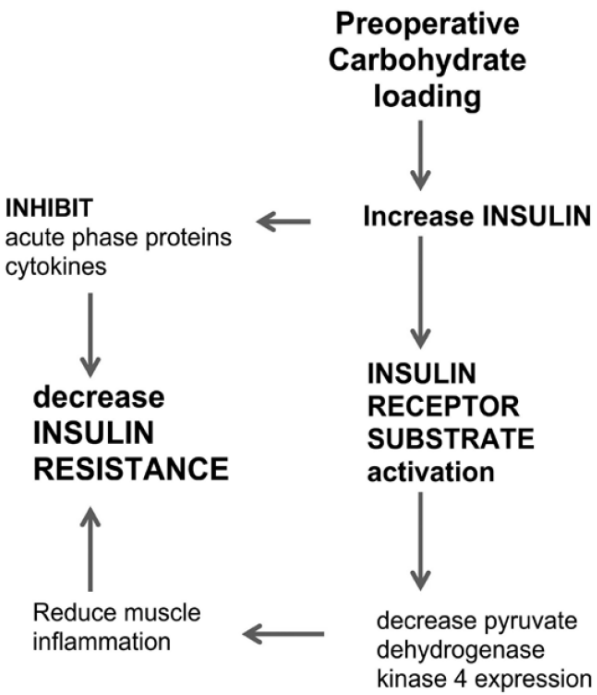


Figure 3: Effects of preoperative carbohydrate loading on insulin resistance.

Pillinger et al, Anaesth Intensive Care, 46:5, 2018
ESPEN guideline: Clinical nutrition in surgery, 2017

CHO loading and insulin resistance

Author	Surgery type	N	Intervention	Effect on insulin resistance
Fujikuni et al[48] 2016	Gastrectomy	80	Oral CHO ERAS vs standard care	Reduced $P < 0.014$
Okabayashi et al[49] 2010	Liver resection	26	Oral CHO + amino acids	Reduced $P < 0.039$
Faria et al[26] 2009	Laparoscopic cholecystectomy	21	Oral CHO vs fasting overnight	Reduced $P < 0.03$
Svanfeldt et al[50] 2007	Colorectal	12	Oral high CHO vs oral low CHO	No significant difference
Nygren et al[51] 1999	Colorectal Total hip replacement	14 16	Oral CHO vs placebo	Reduced 24% Reduced 37%
Ljungqvist et al[52] 1994	Open cholecystectomy	12	IV glucose vs fasting	Reduced $P < 0.01$

CHO, carbohydrate loading; ERAS, enhanced recovery after surgery; N, number of subjects.

Pillinger et al, Anaesth Intensive Care, 46:5 2018

CHO loading and clinical results

Author	N	Clinical effects
Li et al[4] 2012	22 trials N=1905	No effect on length of hospital stay or ICU stay No effect on nausea or vomiting Reduced thirst compared with fasting
Awad et al[2] 2013	21 trials N=1685	No effect on length of stay overall Reduced length of stay in major open abdominal surgery 1.08 days (95% CI 1.87–0.29) No effect on pulmonary or surgical complications
Smith et al[3] 2014	27 trials N=1976	Reduced length of hospital stay by 0.3 days (95% CI 0.56–0.04) Shortened time to passage of flatus 0.39 days (95% CI 0.7–0.07) No effect on postoperative complications
Amer et al[8] 2017	43 trials N=3110	Small reduction in length of hospital stay compared with fasting alone Low dose CHO 0.4 days (95% CI 0.03–0.7) High dose CHO 0.2 days (95% CI 0.04–0.4) No effect on length of stay compared with water or placebo No effective on postoperative complications

CHO, carbohydrate loading; N, number of subjects; ICU, intensive care unit; CI, confidence intervals.

Pillinger et al, Anaesth Intensive Care, 46:52018

ImmuneNutrition

(Immune Modulating Nutrition IMN)

Recent studies have shown that irrespective of the patients baseline nutritional status supplementation of preoperative oral nutritional formulations with specific immune modulating substrates improves surgical outcomes.

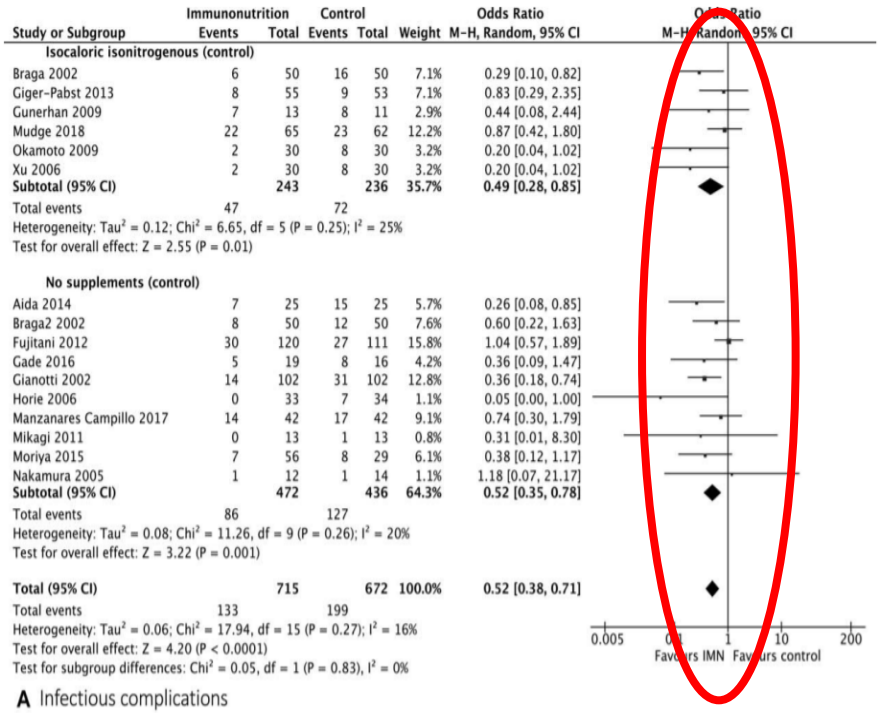
- Glutamine
  - Source of metabolic fuel
  - Aid in the preservation of small bowel function
  - Aid in the preservation of T-lymphocyte responsiveness during major surgery
  - Participating in wound healing
  - Promotes protein synthesis
- Arginine
  - Also stimulates T-cell function
  - Promote wound healing
  - Improves microcirculation via the formation of nitric oxide
- Omega-3 fatty acids
  - Modulation of the inflammatory response
  - May play a role in protein anabolic response
- Vitamin D
  - May play a role in protein anabolic response

However there is currently no clear evidence for the use of formulas enriched with immunonutrients vs. standard oral nutritional supplementation, exclusively in the preoperative period.

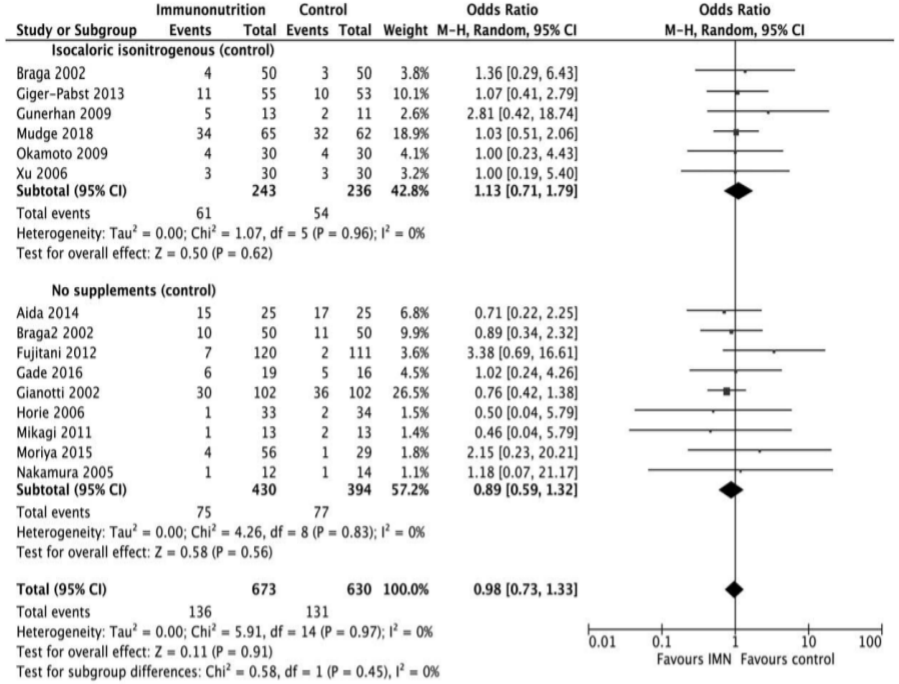
Perioperative Nutrition, Z. Torgersen, Sur Clin N Am, 2015

ESPEN guideline: Clinical nutrition in surgery, 2017

Immune Nutrition and Infectious and non infectious complications



A Infectious complications

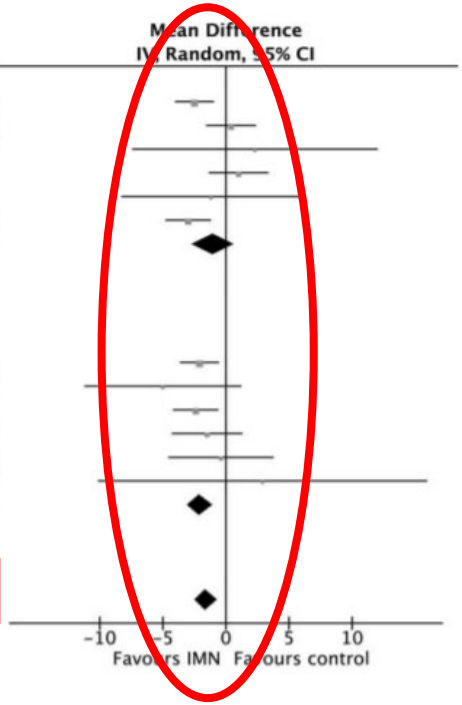


B Non-infectious complications

Adiamah A et al , Metanalysis, Ann Surg 2019;270:247–256)

Immune nutrition and length of stay

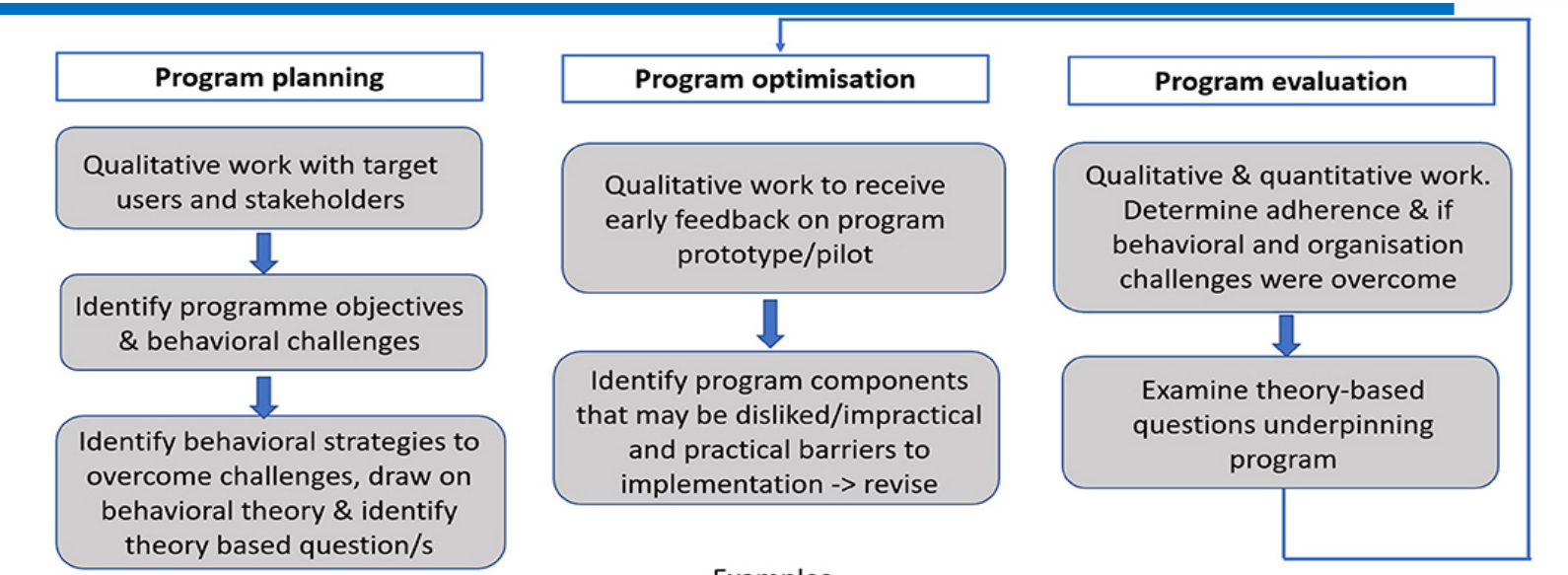
Study or Subgroup	Immunonutrition Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Isocaloric isonitrogenous (control)								
Braga 2002	9.5	2.9	50	12	4.5	50	16.3%	-2.50 [-3.98, -1.02]
Giger-Pabst 2013	12	4.9	55	11.6	5.3	53	12.6%	0.40 [-1.53, 2.33]
Gunerhan 2009	16.5	14.8	13	14.2	9.1	11	0.9%	2.30 [-7.38, 11.98]
Mudge 2018	14	6.8	65	13	6.5	62	10.1%	1.00 [-1.31, 3.31]
Okamoto 2009	23.8	16.6	30	25	10.6	30	1.6%	-1.20 [-8.25, 5.85]
Xu 2006	9	3.2	30	12	3.7	30	13.9%	-3.00 [-4.75, -1.25]
Subtotal (95% CI)			**243**			**236**	**55.3%**	**-1.06 [-2.76, 0.63]**
Heterogeneity: $Tau^2 = 2.33$; $Chi^2 = 13.37$, df = 5 (P = 0.02); $I^2 = 63\%$								
Test for overall effect: Z = 1.23 (P = 0.22)								
No supplements (control)								
Braga2 2002	13.2	3.5	50	15.3	4.1	50	16.2%	-2.10 [-3.59, -0.61]
Gade 2016	11	9	19	16	9.5	16	2.0%	-5.00 [-11.17, 1.17]
Gianotti 2002	11.6	4.7	102	14	7.7	102	13.9%	-2.40 [-4.15, -0.65]
Horie 2006	12.5	3.8	33	14	7.2	34	7.9%	-1.50 [-4.25, 1.25]
Manzanares Campillo 2017	12.7	8.3	42	13.1	10.8	42	4.2%	-0.40 [-4.52, 3.72]
Nakamura 2005	49	18.3	12	46.1	15	14	0.5%	2.90 [-10.10, 15.90]
Subtotal (95% CI)			**258**			**258**	**44.7%**	**-2.06 [-3.07, -1.06]**
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 2.36$, df = 5 (P = 0.80); $I^2 = 0\%$								
Test for overall effect: Z = 4.04 (P < 0.0001)								
Total (95% CI)			**501**			**494**	**100.0%**	**-1.57 [-2.48, -0.66]**
Heterogeneity: $Tau^2 = 0.75$; $Chi^2 = 16.58$, df = 11 (P = 0.12); $I^2 = 34\%$								
Test for overall effect: Z = 3.38 (P = 0.0007)								
Test for subgroup differences: $Chi^2 = 1.00$, df = 1 (P = 0.32), $I^2 = 0\%$								



A Length of stay

Adiamah A et al , Metanalysis, Ann Surg 2019;270:247–256)

Behavior and Prehabilitation (Grimmett C et al Fron Psych 2021)



Examples

Patient: "I don't want to exercise as I experience pain when I do"

Strategy: Enhance self-efficacy to exercise by explaining gradual, graded exercise can improve pain & provide patients stories modelling overcoming this barrier.

If developing written materials or web-based resource use think-aloud interviews to elicit immediate user reactions to content and navigation and identify modifications required e.g. are patient stories to enhance self-efficacy salient?

If increasing self-efficacy to exercise was a target of the program, review quantitative data evaluating this concept and explore in interviews with users at the end of the program.

CONCLUSIONS

- Protein intake at levels of 1.2-1.5 gr / kg BW in combination with both aerobic and resistance exercise seems to contribute to the improvement of the peri- and postoperative condition.
- "Carbohydrate loading" seems to improve insulin resistance.
- Immunnutrition seems to improve hospital stay, and possibly have a positive effect on reducing postoperative complications.

Fig. 1 The Prehabilitation Puzzle: components of a comprehensive patient assessment

THANK YOU…..

…LOOKING FORWARD TO SEE YOU!