Supplementary Table 1. Characteristics and Findings of Studies Evaluating Preoperative Nutritional Counseling or Dietary Regimens

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| **Author and year** | **Country** | **Study design** | **Number of sites** | **Cancer site** | **Sample size** | **Intervention** | **Outcomes** | **Study findings** |
| Awad 2011 | UK | Narrative review | N/A | Multiple | N/A | N/A | N/A | In patients with cancer undergoing neoadjuvant therapy, intensive dietary counseling is recommended. |
| Barrett-Bernstein 2019 | Canada | RCT | Single | Colorectal | 183 | Multicomponent perioperative prehabilitation program including dietitian assessment, personalized dietary program, whey protein supplementation. | Improvement in functional capacity, measured by 6MWT | Functional capacity improved with intervention |
| Chen 2016 | China | RCT | Single | Esophageal | 260 | Multicomponent perioperative ERAS protocol including nutritional education by specialized nurse consultant. | Hospital LOS, incisional pain, postoperative complications | Reduced LOS with intervention, no difference in postoperative complications |
| Gillis 2014 | Canada | RCT | Single | Colorectal | 77 | Multicomponent preoperative prehabilitation program including personalized dietary counseling and whey protein supplementation. | Functional status at 8 weeks after surgery measured by 6MWT | Improved 6MWT with intervention |
| Gillis 2019 | Canada | Pooled analysis of RCTs | Single | Colorectal | 139 | Multicomponent preoperative prehabilitation program including personalized dietary counseling and whey protein supplementation. | Change in lean body mass at 8 weeks after surgery | Reduced loss of lean body mass with intervention |
| Li 2013 | Canada | Prospective observational study | Single | Colorectal | 87 | Multicomponent preoperative prehabilitation program including nutritionist counseling and protein supplementation. | Functional capacity at 8 weeks after surgery measured by 6MWT, postoperative complications, self-reported physical activity, health-related quality of life | Improved 6MWT and self-reported physical activity with intervention, no difference in complication rates or health-related quality of life |
| Ligthart-Melis 2013 | Netherlands | Retrospective observational study | Single | Esophageal | 65 | Preoperative dietitian counseling with recommended calorie and protein goals and enteral feeding if goals were not met | Postoperative complications, ICU LOS, hospital LOS | Fewer complications, reduced ICU and hospital LOS with intervention |
| Minnella 2017 | Canada | Pooled analysis of observational studies | Single | Colorectal | 185 | Multicomponent preoperative prehabilitation regimen including nutritional assessment, dietary changes, and protein supplementation | Functional status at 8 weeks after surgery measured by 6MWT, hospital LOS, postoperative complications | Functional status improved among intervention group, no differences in hospital LOS or postoperative complications |
| Shida 2015 | Japan | Retrospective observational study | Single | Colorectal | 352 | Multicomponent perioperative ERAS protocol including nutritional counseling and reduced preoperative fasting time | Hospital LOS, postoperative complications | Reduced LOS with intervention, no difference in postoperative complications |
| Trepanier 2019 | Canada | Pooled analysis of observational studies | Single | Colorectal | 202 | Multicomponent preoperative prehabilitation protocol including nutritional counseling and whey protein supplement | Overall survival, disease-free survival, receipt of systemic therapy, time to systemic therapy | Improved disease-free survival with intervention. No difference in overall survival and receipt or timing of adjuvant therapy. |
| van Rooijen 2019 | Netherlands | Prospective observational study | Single | Colorectal | 50 | Multicomponent preoperative prehabilitation regimen including tailored dietary advice and protein supplementation. | Functional status at 4 weeks after surgery measured by 6MWT, muscle strength | No difference |
| Wang 2015 | China | RCT | Single | Esophageal | 180 | Multicomponent perioperative fast-track surgery program including reduced fasting duration and parenteral or enteral nutrition for malnourished patients | Time to return of bowel function, time to chest tube removal, hospital LOS, postoperative complications | Time to return of bowel function, time to chest tube removal, hospital LOS, postoperative complications improved with intervention, |

RCT, randomized clinical trial; 6MWT, 6-minute walk test; ERAS, enhanced recovery after surgery; LOS, length of stay; CCI, Charlson Comorbidity Index; PRS, preoperative risk score in Estimation of Physiologic Ability and Surgical Stress

Supplementary Table 2. Characteristics and Findings of Studies Evaluating Preoperative Protein and Calorie Supplementation

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| **Author and year** | **Country** | **Study design** | **Number of sites** | **Cancer site** | **Sample size** | **Intervention** | **Outcomes** | **Study findings** |
| Awad 2011 | UK | Narrative review | N/A | Multiple | N/A | N/A | N/A | In patients with cancer undergoing neoadjuvant therapy, oral or enteral nutritional support is recommended if necessary. |
| Barrett-Bernstein 2019 | Canada | RCT | Single | Colorectal | 183 | Multicomponent perioperative prehabilitation program including dietitian assessment, personalized dietary program, whey protein supplementation. | Improvement in functional capacity, measured by 6MWT | Functional capacity improved with intervention |
| Barth 2019 | USA | RCT | 2 | Hepatic | 60 | Low-calorie, low-fat diet for 14 days before surgery with protein supplementation | Postoperative complications | No difference |
| Bruns 2018 | Netherlands | Systematic review with meta-analysis | N/A | Colorectal | N/A | Oral preoperative or perioperative nutritional supplementation | Postoperative complications, surgical site infections | No difference |
| Burden 2011 | UK | RCT | Not specified | Colorectal | 116 | Preoperative oral protein-calorie supplementation from enrollment until surgery | Postoperative complications, surgical site infections, chest infections, urinary tract infections | No difference |
| Burden 2017 | UK | RCT | 6 | Colorectal | 100 | Preoperative oral protein-calorie supplementation for 7 days | Chest or surgical site infection, postoperative complications | Reduced chest or surgical site infection with intervention. No difference in postoperative complications. |
| Fukuda 2015 | Japan | Retrospective observational study | Single | Gastric | 152 | Preoperative oral nutritional supplementation for 0, 1-9, 10-13 or ≥14 days | Surgical site infections | Fewer surgical site infections for with longer duration of preoperative nutritional support |
| Gillis 2014 | Canada | RCT | Single | Colorectal | 77 | Multicomponent preoperative prehabilitation program including personalized dietary counseling and whey protein supplementation. | Functional status at 8 weeks after surgery measured by 6MWT | Improved 6MWT with intervention |
| Gillis 2016 | Canada | RCT | Single | Colorectal | 43 | Perioperative oral whey protein supplement for 4 weeks before and 4 weeks after surgery | Functional capacity measured by 6MWT, self-reported physical activity, health-related quality of life | No difference |
| Gillis 2019 | Canada | Pooled analysis of RCTs | Single | Colorectal | 139 | Multicomponent preoperative prehabilitation program including personalized dietary counseling and whey protein supplementation. | Change in lean body mass at 8 weeks after surgery | Reduced loss of lean body mass with intervention |
| Ichikawa 2013 | Japan | RCT | Single | Hepatic | 56 | Preoperative oral branched-chain amino acid supplementation for 2 weeks before and 6 months after surgery | Disease recurrence | Reduced early disease recurrence with intervention |
| Kabata 2015 | Poland | RCT | Single | Multiple | 102 | Preoperative oral protein supplementation for 14 days | Postoperative complications | Fewer postoperative complications with intervention |
| Kikuchi 2016 | Japan | RCT | Single | Hepatic | 77 | Perioperative branched-chain amino acid supplementation for 1 month before and 1 year after surgery | Presence of ascites 4 weeks after surgery, postoperative complications, LOS | No difference |
| Li 2013 | Canada | Prospective observational study | Single | Colorectal | 87 | Multicomponent preoperative pulmonary rehabilitation program including dietary recommendations and protein supplementation | Postoperative complications | No difference |
| Liu 2020 | China | RCT | Single | Esophageal | 50 | Preoperative and postoperative oral nutritional supplementation extended to all patients versus malnourished patients only | Weight loss at 30 days after surgery, postoperative complications, health-related quality of life | No difference in weight loss or postoperative complications, improved quality of life with intervention |
| Mudarra García 2020 | Spain | Prospective observational study | Single | Multiple | 85 | Preoperative oral protein-calorie supplementation for 15 days before surgery | Wound complications, LOS | Reduced wound complications, shorter LOS with intervention |
| Tang 2020 | China | RCT | Single | Colorectal | 200 | Multicomponent fast-track surgery protocol including oral nutritional supplement. | Time to return of bowel function | Reduced time until return of bowel function with intervention |
| Trepanier 2019 | Canada | Pooled analysis of observational studies | Single | Colorectal | 202 | Multicomponent preoperative prehabilitation protocol including nutritional counseling and whey protein supplement | Overall survival, disease-free survival, receipt of systemic therapy, time to systemic therapy | Improved disease-free survival with intervention. No difference in overall survival and receipt or timing of adjuvant therapy. |
| van Rooijen 2019 | Netherlands | Prospective observational study | Single | Colorectal | 50 | Multicomponent preoperative prehabilitation regimen including tailored dietary advice and protein supplementation. | Functional status at 4 weeks after surgery measured by 6MWT, muscle strength | No difference |
| Wang 2018 | China | Prospective observational study | Single | Esophageal | 104 | Preoperative oral protein-calorie supplementation for 3 days | Postoperative complications, LOS | No difference |
| Yao 2015 | China | Retrospective observational study | Single | Hepatic | 79 | Preoperative oral protein-calorie supplementation for 3 days | Postoperative complications, infectious complications, major complications | No difference |
| Zhao 2018 | China | RCT | Single | Esophagogastric junctional | 66 | Preoperative oral protein-calorie supplementation for 7 days | Postoperative complications, time to return of bowel function, LOS | Fewer postoperative complications, shorter LOS and time until return of bowel function with intervention |

RCT, randomized clinical trial; 6MWT, 6-minute walk test; LOS, length of stay; CCI, Charlson Comorbidity Index; PRS, preoperative risk score in Estimation of Physiologic Ability and Surgical Stress

Supplementary Table 3.Characteristics and Findings of Studies Evaluating Preoperative Immunonutrition Supplementation

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author and year** | **Country** | **Study design** | **Number of sites** | **Cancer site** | **Sample size** | **Intervention** | **Outcomes** | **Study findings** |
| Aida 2014 | Japan | RCT | Single | Pancreatic | 50 | Preoperative immunonutrition supplementation for 5 days | Infectious and non-infectious complications | Fewer infectious complications, no difference in non-infectious complications |
| Barker 2013 | Australia | RCT | Single | Multiple | 95 | Preoperative immunonutrition supplementation for 5 days | Hospital LOS, infectious and non-infectious complications, antibiotic use, ICU admission, mortality | No difference |
| Cerantola 2011 | Switzerland | Systematic review with meta-analysis | N/A | Multiple | N/A | Preoperative and perioperative immunonutrition supplementation | Postoperative complications, infections, hospital LOS | Postoperative complications, infections, and hospital LOS improved with intervention |
| Dias Rodrigues 2017 | Brazil | Prospective observational study | Single | Gastric | 37 | Preoperative immunonutrition supplementation for 6 days | Postoperative complications, mortality | No difference |
| Doganay 2019 | UK | Narrative review | N/A | Esophageal | N/A | N/A | N/A | Inadequate evidence for immunonutrition supplementation for patients undergoing surgery for esophageal cancer |
| Fujitani 2012 | Japan | RCT | Multicenter, number not specified | Gastric | 231 | Preoperative immunonutrition supplementation for 5 days | Surgical site infection, infectious complications, postoperative complications | No difference |
| Gade 2016 | Denmark | RCT | Single | Pancreatic | 35 | Preoperative immunonutrition supplementation for 7 days | Postoperative complications, hospital LOS | No difference |
| Giger-Pabst 2013 | Switzerland | RCT | 6 | Multiple | 108 | Preoperative immunonutrition supplementation for 3 days | Postoperative complications, infectious and non-infectious complications, ICU LOS, hospital LOS, antibiotic duration | No difference |
| Guan 2019 | China | Systematic review with meta-analysis | N/A | Pancreatic | N/A | Preoperative immunonutrition supplementation | Postoperative complications, infectious complications, non-infectious complications, mortality, hospital LOS | No difference in overall postoperative complications, non-infectious complications, mortality. Improved infectious complications and hospital LOS with intervention |
| Hamza 2015 | UK | RCT | 3 | Pancreatic | 30 | Preoperative immunonutrition supplementation for 14 days | Performance status, sequential organ failure assessment, infection probability score, high-acuity unit LOS, hospital LOS, postoperative complications | No difference |
| Healy 2017 | Ireland | RCT | 2 | Esophageal | 191 | Preoperative and postoperative immunonutritional supplement | Lean body mass at 1 month after discharge, body mass index, postoperative complications | No difference |
| Kanekiyo 2019 | Japan | RCT | Single | Esophageal | 40 | Perioperative immunonutrition supplementation for 7 days before and 7 days after surgery | Infectious complications, overall survival, antibiotic duration, and changes to therapeutic antibiotic regimen | Fewer infectious complications, fewer changes to therapeutic antibiotic regimen, and shorter duration of antibiotic use with intervention |
| Kitagawa 2017 | Japan | RCT | Single | Esophageal | 29 | Perioperative immunonutrition supplementation for 5 days | Infectious complications, hospital LOS | No difference |
| Kubota 2014 | Japan | Retrospective observational study | Single | Esophageal | 55 | Preoperative immunonutrition supplementation for 5 days | Infectious complications, non-infectious complications, in-hospital mortality, 6-month survival, hospital LOS | Fewer infectious complications and in-hospital deaths, improved 6-month survival, shorter hospital LOS |
| Ma 2018 | Taiwan | RCT | Single | Gastric | 34 | Preoperative immunonutrition supplementation for 3-5 days | Postoperative complications | No difference |
| Martin 2017 | USA | RCT\* | Single | Pancreatic | 69 | Preoperative immunonutrititon supplementation for 5 days | Postoperative complications, hospital LOS | Fewer postoperative complications, shorter hospital LOS with intervention |
| Martin 2018 | Switzerland | Retrospective observational study | Single | Esophageal | 76 | Preoperative immunonutrition supplementation for 7 days | In-hospital postoperative complications, hospital LOS | Longer hospital LOS with intervention, no difference in complications |
| Mikagi 2011 | Japan | RCT | Single | Hepatic | 26 | Preoperative immunonutrition supplementation for 5 days | Postoperative complications, hospital LOS | No difference |
| Mudge 2011 | Australia | Narrative review | N/A | Esophageal | N/A | N/A | N/A | Current evidence is insufficient to recommend routine immunonutrition for patients undergoing surgery for esophageal cancer |
| Mudge 2018 | Australia | RCT | 11 | Esophageal | 276 | Preoperative immunonutrition supplementation for 7 days | Mortality, ICU LOS, hospital LOS, infectious and non-infectious complications, quality of life at 42 days after surgery | No difference |
| Nagano 2013 | Japan | RCT | Single | Esophageal | 20 | Perioperative immunonutrition supplementation for 5 days before and 7 days after surgery | Postoperative complications, hospital LOS | No difference |
| Okamoto 2009 | Japan | RCT | 2 | Gastric | 60 | Preoperative immunonutrition supplementation for 7 days | Infectious and non-infectious complications, hospital LOS, administration of therapeutic antibiotics | Fewer infectious complications and fewer patients requiring therapeutic antibiotics with intervention, no difference in non-infectious complications or hospital LOS |
| Osland 2014 | Australia | Systematic review with meta-analysis | N/A | Multiple | N/A | Preoperative and perioperative arginine-dominant pharmaconutrition supplementation | Mortality, infectious complications, non-infectious complications, hospital LOS | No difference for preoperative administration alone. Fewer infectious and non-infectious complications and shorter hospital LOS with perioperative administration, no difference in mortality. |
| Russell 2019 | UK | RCT | Single | Hepatic | 32 | Preoperative immunonutrition supplementation for 5 days | Postoperative complications, infectious and non-infectious complications | No difference |
| Shirakawa 2012 | Japan | Retrospective observational study | Single | Pancreatic | 31 | Preoperative immunonutrition supplementation for 5 days | Hospital LOS, pancreatic fistula, delayed gastric emptying, cholangitis, surgical site infection, mortality | Reduced rate of surgical site infection with intervention, no difference in hospital LOS, pancreatic fistula, delayed gastric emptying, cholangitis, or mortality |
| Song 2015 | China | Systematic review with meta-analysis | N/A | Multiple | N/A | Preoperative and perioperative immunonutrition supplementation | Infectious and non-infectious complications, hospital LOS | Reduced infectious complications, no difference in non-infectious complications and hospital LOS with preoperative intervention |
| Tumas 2020 | Lithuania | RCT | Single | Pancreatic | 70 | Preoperative immunonutrition supplementation for 5 days | Postoperative complication severity | Reduced complication severity with intervention |
| Yamagata 2019 | Japan | Narrative review | N/A | Gastric | N/A | N/A | N/A | Insufficient evidence to recommend pharmaconutrition for patients undergoing surgery for gastric cancer. |
| Yildiz 2016 | Turkey | RCT | Single | Multiple | 41 | Perioperative immunonutrition supplementation for 7 days before and 7 days after surgery | Infectious complications, overall morbidity, mortality, hospital LOS | Reduced rate of infectious complications and shorter hospital LOS with intervention. No difference in overall morbidity or mortality. |
| Zhang 2012 | China | Systematic review with meta-analysis | N/A | Multiple | N/A | Preoperative or perioperative immunonutrition supplementation | Postoperative complications, hospital LOS | Fewer infectious complications and shorter hospital LOS, no difference in non-infectious complications with preoperative intervention. Fewer infectious and non-infectious complications and shorter LOS with peripoerative intervention. |

\*Although reported as a randomized clinical trial, a true randomization schema was not employed

RCT, randomized clinical trial; LOS, length of stay

Supplementary Table 4.Characteristics and Findings of Studies Evaluating Preoperative Supplementation with Synbiotics

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author and year** | **Country** | **Study design** | **Number of sites** | **Cancer site** | **Sample size** | **Intervention** | **Outcomes** | **Study findings** |
| Peitsidou 2012 | Greece | Narrative review | N/A | Colorectal | N/A | N/A | N/A | Several studies have demonstrated reduced rates of postoperative infections with preoperative synbiotic administration |
| Polakowski 2019 | Brazil | RCT | Single | Colorectal | 73 | Preoperative synbiotic (fructooligosaccharide, *L. acidophilus, L. rhamnosus, L. casei*, and *B. lactis*) for 7 days | Infectious and non-infectious complications, duration of antibiotic administration, mortality, hospital LOS | Fewer infectious complications, shorter duration of antibiotics, and shorter hospital LOS with intervention. No difference in mortality. |
| Tan 2016 | Malaysia | RCT | Single | Colorectal | 40 | Preoperative probiotics (*L. acidophilus, L. casei, L. lactis, B. bifidum, B. longum,* and *B. infantis*) for 7 days | Time to return of bowel function, hospital LOS | Shorter time to return of bowel function and hospital LOS with intervention |
| Tanaka 2012 | Japan | RCT | Single | Esophageal | 64 | Perioperative probiotic (galacto-oligosaccharides, *B. breve*, and *L. casei*) administration. Preoperative duration unspecified, postoperative duration 21 days | Postoperative infectious complications, ICU LOS, hospital LOS, interruption of postoperative nutrition, time until return of bowel function, duration of antibiotic administration | No difference in infectious complications, ICU LOS and duration of antibiotic administration. Shorter hospital LOS, time until return of bowel function, and fewer interruptions in nutrition with intervention |
| Zhang 2012 | China | RCT | Single | Colorectal | 60 | Preoperative probiotic (*B. longum, L. acidophilus,* and *E. faecalis*) administration for 3 days | Infectious complications | Fewer infectious complications with intervention |
| Zhi-Hua 2013 | China | RCT | 2 | Colorectal | 150 | Perioperative probiotics (*L. plantarum, L. acidophilus,* and *B. longum)* for 6 days before and 10 days after surgery | Postoperative septicemia, central line infection, pneumonia, urinary tract infection, diarrhea, duration of postoperative pyrexia, duration of antibiotic therapy | Reduced rate of all complications with intervention. Shorter duration of pyrexia and antibiotic therapy with intervention. |

RCT, randomized clinical trial; LOS, length of stay

Supplementary Table 5. Characteristics and Findings of Studies Evaluating Preoperative Enteral and Parenteral Supplementation

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| **Author and year** | **Country** | **Study design** | **Number of sites** | **Cancer site** | **Sample size** | **Intervention** | **Outcomes** | **Study findings** |
| Awad 2011 | UK | Narrative review | N/A | Multiple | N/A | N/A | N/A | In patients with cancer undergoing neoadjuvant therapy oral or enteral nutritional support is recommended if necessary. |
| Chen 2011 | China | Retrospective observational study | Single | Colorectal | 202 | Preoperative total parenteral nutrition | Postoperative complications, hospital LOS | No difference |
| Chen 2018 | Taiwan | Narrative review | N/A | Esophageal | N/A | N/A | N/A | Recommend at least 7-10 days of preoperative tube feeding for patients at severe nutritional risk |
| de Miranda Torrinhas 2013 | Brazil | RCT | Single | Multiple | 63 | Preoperative parenteral administration of fish oil lipid emulsion for 3 days | Infectious complications, ICU LOS, hospital LOS | No difference |
| Gianotti 2009 | Italy | RCT | 11 | Multiple | 428 | Perioperative parenteral administration of L-alanine-L glutamine dipeptide for 1 day before and 5 or more days after surgery | Postoperative complications, hospital LOS, need for artificial nutrition support | No difference |
| Huddy 2018 | UK | Narrative review | N/A | Esophageal | N/A | N/A | N/A | No clear evidence to recommend esophageal stenting vs. jejunostomy vs. gastrostomy for patients undergoing surgery for esophageal cancer |
| Jankowski 2018 | Poland | Narrative review | N/A | Multiple | N/A | N/A | N/A | Preoperative enteral nutrition is preferred to preoperative parenteral nutrition for malnourished patients. Parenteral nutrition is, however, effective among malnourished patients. |
| Ligthart-Melis 2013 | Netherlands | Retrospective observational study | Single | Esophageal | 65 | Dietary counseling from specialized dietitians with recommended calorie and protein goals, and enteral feeding provided if goals were not met | Postoperative complications, ICU LOS, hospital LOS | Fewer complications and shorter ICU and hospital LOS among with intervention |
| Wang 2015 | China | RCT | Single | Esophageal | 180 | Multicomponent fast-track surgery model. Nutritional components include reduced fasting duration, and parenteral or enteral nutrition for malnourished patients | Time to flatus, defecation, and chest tube removal, length of stay, postoperative complications | Time to flatus, defecation, chest tube removal, length of stay, and postoperative complications improved with intervention, |
| Yamagata 2019 | Japan | Narrative review | N/A | Gastric | N/A | N/A | N/A | Routine preoperative artificial nutrition is not warranted, but malnourished patients should be optimized with supplements or enteral nutrition. |

RCT, randomized clinical trial; LOS, length of stay