Evidence tabel voor voeding

Auteurs, jaartal	Mate van bewijs	Studie type Follow-up	Populatie (incl. steekproef-grootte)	Patienten kenmerken	Interventie	Controle	Resultaten	Conclusie	Opmerkingen, commentaar
Voedingsstatus, vitaminen en mineralen									
Kang, 2007 Korea minerals	B	Prospective cohort study	20 patients who had a gastrectomy due to gastric cancer pre- and postoperative levels of minerals were measured	Mean age 53.6 yrs (range 27-67); 70% males	Patients with subtotal gastrectomy (n=15)	Patients with total gastrectomy (n=5)	Only sodium levels were postoperative significantly decreased (p=0.047). Cobalt, molybdenum, cadmium, lead were increased postoperatively (p=0.058, p=0.016, p=0.005, p=0.02). Other minerals did not change. In subgroup analysis, subtotal gastrectomy decreased sodium (p=0.065) and potassium (ns) and significantly increased molybdenum (p=0.010). Total gastrectomy decreased sodium (p=0.065) and significantly increased cobalt (p=0.040).	Gastrectomy does not seem to affect the levels of most minerals in the body. However, changes in sodium levels indicate that gastrectomy affects sodium absorbency in gastric cancer patients.	
Sakuta, 2005 Japan Vit B12	B	Prospective cohort study	31 male patients who had undergone gastrectomy plasma total homocysteine, vitamin B12 and folate were measured	Mean age 53 yrs; 100% males	Patients who had undergone gastrectomy (n=31)	Healthy controls (n=31)	Vitamin B12 of patients was lower (p=0.010) than that of controls, whereas plasma folate of patients and that of controls were comparable. Plasma tHcy was higher in patients than in controls (p=0.009). Of 31 patients six (19.4%) showed low vitamin B12 (<233 pg/ ml), four (12.9%) low folate (<3.0 ng/ml) and seven (22.6%) hyperhomocysteinemia (>14 µmol/l), whereas they were found in one (3.2%), none (0%) and one (3.2%) of 31 controls, respectively. Patients who had undergone gastrectomy because of cancer showed higher total homocysteine compared to patients who had undergone it because of peptic ulcer. Type of surgery did not correlate with total homocysteine.	Hyperhomocysteinemia is a relatively common clinical feature of gastrectomized male patients, especially in those who had undergone gastrectomy for stomach cancer.	
Iwase, 2002 Japan Vit B1	B	Prospective cohort study	Patients undergoing gastrectomy for gastric cancer Serum vit B1 was measured pre- or / and postoperatively in different populations	Mean age 62 yrs; 56% males	Patients with gastric cancer (n=25)	Patients with colorectal cancer (n=21)	Preoperatively, none of the patients had serum Vit B1 levels below the normal range	Vit B1 levels may be reduced in gastrectomized patients, especially within 6 months after operation even after their return to normal daily activity without nutrition support.	3 deel studies, 3 verschillende populaties
					3 groups of patients: - distal gastrectomy for gastric cancer (n=54) - total gastrectomy for gastric cancer (n=32) - radical surgery for colorectal cancer (n=30)		Decreased serum vit B1 were found in 13% of the patients with distal gastrectomy, 16% of total gastrectomy and none of patients with surgery for colorectal cancer		
					Patients with gastrectomy for gastric cancer (n=25)	Patients with radical surgery for colorectal cancer (n=26)	Postoperative serum vitamin B1 levels were lower than those before operation in patients with gastrectomies ($p<0.05$) , whereas there was no difference in B1 levels before and after the surgeries in patients operated for colorectal cancer		
Bae, 1998 Korea Nutritional status	B	Prospective cohort study	20 gastric cancer patients who had undergone total gastrectomy	Mean age 51.9 (±10.4 SD) yrs; 55% males	Assessment of nutritional status of gastric cancer patients	Assessment of nutritional status of normal controls (n=6)	Average daily calorie intake was 1586.2 kcal, which is lower than the normal intake of Korean adults (1838 kcal). Malnutrition of skeletal and visceral protein was not found. There was no significant malabsorption of carbohydrates. There was, however, severe fat malnutrition and a deficit of	These results suggest that poor oral intake and fat malabsorption following total	Small study, only 6 controls

					(n=20)		body fat. Postoperatively the body mass index was considerably lower than that preoperatively (22.2 6 0.4 vs. 18.9 6 0.4 kg/m_2; preoperatively vs. postoperatively). With malabsorption tests, the daily excreted amount of fecal fat was 28.6 6 3.4 g (mean 6 SD) in patients and 6.9 6 0.2 g in controls. In 64.3% (9/14) of patients, vitamin B_{12} absorption was abnormal; and the serum concentration of vitamin B_{12}, which was significantly related to malabsorption of this vitamin, was lower than normal in 73.7% (14/19). Bacterial overgrowth was not found, and there were no abnormal histologic findings in the jejunal mucosa.	gastrectomy cause malnutrition and that fat malabsorption may be related to relative pancreatic insufficiency.	
Type voeding									
Ziegler, 1998 France enteral	B	RCT (cross-over trial)	11 patients having undergone esophagectomy (n=6) or gastrectomy (n=5) for cancer (NB 1 pt had peptic ulcer)	Age range 41-69 yrs; 82% males	Enteral OPD (oligopeptide-based diet) (n=11)	Enteral WPD (whole protein-based diet) (n=11)	Amino acid peripheral bioavailability was higher (leucine: 54%, P < 0.01; essential amino acids: 48%, P < 0.01; total amino acids: 53%, P < 0.02) and peripheral appearance of amino acids was more homogeneous (variation around the calculated plateau of plasma leucine was 39% for OPD and 78% for WPD, P < 0.001) with the OPD than with the WPD. With the OPD, insulin stimulation was faster and plasma concentrations of leucine and insulin were correlated (r = 0.77, P < 0.01). The OPD led to a higher amino acid peripheral bioavailability than the corresponding WPD.	These results could be useful for a better definition of clinical indications of semi-elemental diets. Such an OPD should be indicated in clinical situations in which digestive capacities are markedly compromised.	
Chen, 2005 China enteral	B	RCT	40 patients with gastric carcinoma who had undergone major surgery	Mean age of 59.0 yrs (SD 12.6); 70% males	Immunonutrition group (Stresson) Enteral formula enriched with glutamine, arginine and omega-3 fatty acids for 7 days	Standard nutrition group (Nutrison) Standard enteral formula	The two formulas were tolerated well and the postoperative process was uneventful. On Day 9, serum levels of prealbumin (p<0.05) and transferrin (P<0.01) were higher in the immunonutrition group than in the standard nutrition group. After 7 days' nutritional support, patients in the immunonutrition group had higher levels of immunoglobulin, CD4 cell counts, CD4/CD8 ratio and IL-2 than those in the control group, whereas IL-6 and TNF-alpha levels were significantly lower in the immunonutrition group.	Compared with standard enteral nutrition, enteral immunonutrition can improve defence mechanisms and modulate inflammatory action after major elective surgery for gastric carcinoma.	
Lobo, 2006 UK enteral	A2	RCT	120 patients undergoing resection for cancers of the pancreas, esophagus and stomach. 29/108 had gastric cancer	Mean age 66 yrs; 77% males	Group A: Jejunostomy feeding with immune modulating diet (Stresson) (n=60) (analysed 54)	Group B Jejunostomy feeding with Nutrison high protein (n=60) (analysed 54)	Feed delivery, although less than targeted, was similar in both groups. There were 6 (11%) deaths in each group. Median (IQR) postoperative hospital stay was 14.5 (12-23) days in Group A and 17.5 (13-23) days in Group B (P=0.48). A total of 24 (44%) patients in each group had infective complications (P=1.0). A total of 21 (39%) patients in Group A and 28 (52%) in Group B had non-infective complications (P=0.18). Jejunostomy-related complications occurred in 26 (48%) patients in Group A and 30 (56%) in Group B (P=0.3).	Early postoperative feeding with an immune modulating diet conferred no outcome advantage when compared with a standard feed.	

Farreras, 2005 Spain enteral	B	RCT	66 patients with gastric cancer, scheduled for surgery	Mean age 68 yrs (SD 11); 53% males	Early postoperative enteral immunonutrition (Impact) (30 analysed)	Isocaloric-isonitrogenous control (Isosource Protein) (30 analysed)	Patients fed with immunonutrition showed higher local hydroxyproline levels (59.7 vs. 28.0 nmol, P=0.0018) and lower episodes of surgical wound healing complications (0 vs. 8 (26.7%) P=0.005) when compared to patients fed with the control formula. Hematogical and biochemical parameters were different between groups for lymphocytes (p=0.026) and total proteins (p=0.014). Symptoms related to intolerance of the formula were significantly less frequent in the study group (5 cases) than in the control group (12 cases), (16% vs. 40%, P= 0.045).	Early postoperative enteral nutrition with a formula supplemented with arginine, omega 3 fatty acids and RNA increased hydroxyproline synthesis and improved surgical wound healing in patients undergoing gastrectomy for gastric cancer.	
Heslin, 1997 US enteral	A2	RCT	195 patients with a preoperative diagnosis of esophageal (n=23), gastric (n=75), peripancreatic (n=86) or bile duct (n=11) cancer who underwent resection	Median age 65 yrs; 60% males	IEF via jejunostomy tube: supplemented with arginine, RNA and omega 3 fatty acids (Impact) (n=97)	Control: intravenous crystalloid solutions (n=98)	Caloric intake was 61% and 22% of goal for the IEF and control groups, respectively. The IEF group received significantly more protein, carbohydrate, lipids and immune-enhancing nutrients than did the control group. There were no significant differences in the number of minor, major, or infectious wound complications between the groups. Hospital mortality was 2.5% and median length of hospital stay was 11 days, which was not different between the groups.	Early enteral feeding with an IEF was not beneficial and should not be used in a routine fashion after surgery for upper GI malignancies.	
Senkal, 1995 Germany enteral	B	RCT	42 patients with upper gastrointestinal cancer who underwent major abdominal operation	Mean age 68 yrs; 61% males	Enteral immuno-nutrition with arginine, RNA, omega-3 fatty acids (n=21)	Placebo diet: enteral feeding, isocaloric and isonitrogenous (n=21)	Tolerance of both formulas was excellent with no differences between the groups. Among those receiving the placebo diet (after spontaneous stimulations) IL-6 concentrations were significantly higher on days 3 and 7 ($p<0.05$) and TNF-α concentrations on day 7. In contrast (after stimulation with phytohaemagglutinin) mean concentrations of IL-2 receptor were significantly higher on day 3 and 7, and of IL-1 β and IL-2 on day 16 ($p<0.05$) in the group receiving the supplemented diet.	Supplementation improved recovery from immune depression induced by cancer and operation.	
Bragelmann, 1999 The Netherlands Oral enzymes	B	RCT	52 in-patients of rehabilitation centres with a faecal fat output > or = 14 g/day, operated on for malignant gastric disease a median of 198 days previously, and free from recurrence and/or metastasis.	Median age 57 yrs; 73% males	Nine sachets of pancreatic enzymes per day (each containing lipase 36,000, amylase 27,000, protease 2400 FIP (Federation International Pharmaceutique)) (n=27)	identical-looking placebo were given for 14 days (n=25)	During the intervention, the median kilojoule intake per kilogram body weight was 9% higher in the placebo group (170.8 (IQR 146.9-202.6)) than in the enzyme-treated group (157.0 (IQR 134.8-170.4)) (P = 0.03). Enzyme treatment did not result in a difference between the placebo and the enzyme-treated group regarding bowel habits or fat malassimilation. Patients who had been on enzyme therapy reported an improvement of overall well-being more often than patients on placebo (p=0.006). The total symptom scores before and after the intervention period did not differ between study groups. The intervention was prematurely ended in 6 patients (1 placebo, 5 enzyme-treated)	Enzyme supplementation at the high dosage applied did not lead to an increased energy intake and did not significantly alter fat malabsorption and does not justify its routine use.	

Gianotti 1997 Type ENT vs TPN	B	RCT	260 candidates for pancreaticoduodenectomy or gastrectomy for cancer.	Mean age 64 yrs; 56% males Pancreaticoduodenectomy=54% Gastrectomy=46 %	3 regimens delivering the same amount of calories and nitrogen 7 POD's. 1: standard enteral formula (n=87) 2: enteral formula enriched with arginine, omega 3-fatty acids and RNA (immunonutrition) (n=87) 3: total parenteral nutrition (n=86)		Both formulas were similarly tolerated; in total 114 patients (65.5%) complained of adverse effects. The immunonutrition group had a significantly better recovery of the immune parameters on postoperative day 8 compared with the other groups. Only 11 patients (6.3%) in both enteral groups did not reach the nutritional goal. Postoperative infection rate was 14.9% (13/87) in the immunonutrition group, 22.9% (20/87) in the standard group, and 27.9% (24/86) in the parenteral group (P = .06). Mean +/-SD length of hospital stay was 16.1 +/- 6.2, 19.2 +/- 7.9, and 21.6 +/- 8.9 days in the immunonutrition, standard, and parenteral groups, respectively (P = .01 vs standard group; P = .004 vs parenteral group).	Early postoperative enteral feeding is a valid alternative to parenteral feeding in patients undergoing major surgery. Immunonutrition enhances the host response, induces a switch from acute-phase to constitutive proteins, and reduces the severity of postoperative infections and length of hospital stay.	
Route of delivery									
Braga, 2001 Italy ENT vs TPN	A2	RCT	257 patients with cancer of the stomach (n=121), pancreas (n=110) or esophagus (n=26), suitable for curative surgery	Mean age 63.5 yrs; 54% males	EEN: Enteral nutrition using jejunostomy or nasojejunal tube (n=126)	TPN: Total parenteral nutrition (n=131)	Duration of artificial feeding was 13.2+/-4.9 days and 12.8+/-5.5 days in TPN and EEN groups, respectively. The nutritional goal was reached in 100/126 (79.3%) patients in the EEN group and in 128/131 (97.7%) patients in the TPN group (p <.001). No differences were found in nutritional, immunologic, and inflammatory variables between the two groups. The overall complication rate was similar (40.4% for TPN vs. 35.7%, for EEN; p =.52). No difference was detected for either infectious or noninfectious complications, length of hospital stay, and mortality. EEN was four-fold less expensive than TPN ($25 vs. $90.60/day, p<0.001).	EEN represents a rational alternative to TPN in patients who undergo upper gastrointestinal tract surgery for cancer and who clinically require postoperative artificial nutrition.	
Kamei, 2005 Japan ENT vs TPN	B	RCT	52 patients who underwent total gastrectomy for gastric cancer	Median age 62 yrs (range 36-84); 71% males	Enteral nutrition beginning on post-operative day 3 with peripheral supplements (n=27)	Total parental nutrition beginning on post-operative day 3 (n=21)	Albumin and RBP concentrations changed little in either group. DAO activity decreased in both groups and recovered within 1 week in the EN group but not in the TPN group. Serum DAO on day 7 was higher in EN group (8.1+/- 2.3 vs 5.8+/-2.3, p=0.008) Complications were similar in the 2 groups. Hospital stay was shorter in the EN group (23.1+/-7.2 vs 27.6 +/-4.7 days, p=0.03) and mean treatment costs of EN group were less ($1,195+/-51 vs $1,368+/-78, p<0.0001)	EN is an efficient way to provide nutrition to patients. Compared to TPN, EN reduces treatment cost and hospital length-of-stay.	
Reynolds 1997 ENT vs TPN	B	RCT	67 patients undergoing major upper gastrointestinal surgery for esophageal, gastric, or pancreatic malignancy	Mean age 68 yrs; 79% males 21% underwent radical gastrectomy	TEN (n=33) fed postoperatively for 7 days	TPN (n=34) fed postoperatively for 7 days	The mean caloric intake was 1800 $\pm$ 100 ($\pm$SEM) kcal/d in the TPN group for the first 7 days after operative procedure compared with 1300 $\pm$ 300 kcal/d in the TEN group (p=ns). The mean nitrogen intake per day over this time was 10 $\pm$ 1 g in the TPN group compared with 8$\pm$3 in the TEN group (p=ns). There was no difference in the incidence of major infective and non-infective complications.	No clinical benefit was found for TEN feeding, compared to TPN. No basis was found to support the thesis that enteral feeding reduces	

			malignancy		TPN (n=15) with a needle catheter jejenostomy	TEN (n=15) with a needle catheter jejenostomy	Postoperative permeability studies Serum albumin and CRP did not change in either group from day 1 to 7. All other parameters changed, with the percentage changes in median values for enteral vs. parenterally fed groups as follows: L/M ratio. 64% vs. 64% increase; serum IgG EndoCAb, 120% vs. 110% increase; and serum IgM EndoCAb, 100% vs. 120% increase.	reduces endogenous sepsis and preserves gut barrier function compared to TPN.	
Sand, 1997 Finland ENT vs TPN	B	RCT	29 patients undergoing curative total gastrectomy for gastric cancer.	Median age 63 yrs (range 46-82); 38% males	Enteral feeding by nasojejunal tube (n=13)	Parenteral nutrition by central venous catheter (n=16)	Postoperative complications developed in 5 (38%) enteral fed patients and 8 (50%) parenteral fed patients (p=0.7). Patients were discharged from the hospital a median of 11 days (range 7-45) with no difference between the groups. Serum CRP concentration on day six was lower in the enteral feeding group than in the parenteral feeding group (32 (16) g/L compared with 61 (41) g/L; p = 0.02 Enteral feeding was well tolerated. Diarrhoea developed earlier in the enteral than in the parenteral group (days 3-5 compared with 5-7, respectively) but there was a tendency to an increased risk of diarrhoea in the parenteral group. Parenteral feeding was more than four times as expensive as enteral feeding (405 vs 95 USD).	Enteral nasojejunal feeding is safe and well tolerated after total gastrectomy and less expensive than parenteral feeding.	
Gianotti 1997 Type ENT vs TPN	B	RCT	260 candidates for pancreaticoduodenectomy or gastrectomy for cancer.	Mean age 64 yrs; 56% males Pancreaticoduodenectomy=54% Gastrectomy=46 %	3 regimens delivering the same amount of calories and nitrogen 7 POD's. 1: standard enteral formula (n=87) 2: enteral formula enriched with arginine, omega 3-fatty acids and RNA (immunonutrition) (n=87) 3: total parenteral nutrition (n=86)		Both formulas were similarly tolerated; in total 114 patients (65.5%) complained of adverse effects. The immunonutrition group had a significantly better recovery of the immune parameters on postoperative day 8 compared with the other groups. Only 11 patients (6.3%) in both enteral groups did not reach the nutritional goal. Postoperative infection rate was 14.9% (13/87) in the immunonutrition group, 22.9% (20/87) in the standard group, and 27.9% (24/86) in the parenteral group (P = .06). Mean +/-SD length of hospital stay was 16.1 +/- 6.2, 19.2 +/- 7.9, and 21.6 +/- 8.9 days in the immunonutrition, standard, and parenteral groups, respectively (P = .01 vs standard group; P = .004 vs parenteral group).	Early postoperative enteral feeding is a valid alternative to parenteral feeding in patients undergoing major surgery. Immunonutrition enhances the host response, induces a switch from acute-phase to constitutive proteins, and reduces the severity of postoperative infections and length of hospital stay.	