

Author, year, reference	Country	Design	Patient type	No. of patients (treat./control)	Dose of fish oil (Duration)	Intervention		Clinical outcomes	Laboratory outcomes
						Experimental (Brand)	Control (Brand)		
Badia-Tahull 2010 [23]	Spain	RCT, DB	Major gastrointestinal surgery	27(13/14)	0.13-0.16 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1-5)	OO/FO (Clinoleic <sup>®</sup> /Omegaven <sup>®</sup> )	OO (Clinoleic <sup>®</sup> )	Infection, HLOS	ALT*, GGT*, CRP
Berger 2008[15]	Switzerland	RCT, DB	Abdominal aortic aneurysm surgery	24(12/12)	0.15 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1-4)	LCT/MCT/FO (Lipoplus <sup>®</sup> )	LCT/MCT(L ipofundin <sup>®</sup> )	HLOS, ICULOS	ALT*, AST*, GGT*, TG, TC, CRP, AA, EPA, DHA
**Heller 2004[24]	Germany	RCT, DB	Major abd. or pancreas surgery due to cancer	44(24/20)	0.16 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1) 0.2 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 2-5)	LCT/FO (Lipovenoes <sup>®</sup> / Omegaven <sup>®</sup> )	LCT (Lipovenoes <sup>®</sup> )	HLOS, ICULOS	ALT*, AST*, WBC, CRP, IL-6*
**Heller 2002[33]	Germany	RCT, DB	Major abd. or pancreas surgery due to cancer	44(24/20)	0.16 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1) 0.2 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 2-5)	LCT/FO (Lipovenoes <sup>®</sup> / Omegaven <sup>®</sup> )	LCT (Lipovenoes <sup>®</sup> )		PLT, aPTT
Jiang 2010[26]	China	RCT, DB	Gastrointestinal or colonic cancer surgery	206(100/103)	0.2 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1-7)	LCT/FO (Intralipid <sup>®</sup> / Omegaven <sup>®</sup> )	LCT (Intralipid <sup>®</sup> )	Infection, HLOS	ALT*, GGT*, TBIL*, TC*, TG*, CD4 <sup>+</sup> *, CD8 <sup>+</sup> *, CD4 <sup>+</sup> /CD8 <sup>+</sup> *, IL-6*, TNF-α*
Liang 2008[12]	China	RCT, DB	Radical colorectal cancer resection	41(20/21)	0.1 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1) 0.2 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 2-7)	LCT/FO (Intralipid <sup>®</sup> / Omegaven <sup>®</sup> )	LCT (Intralipid <sup>®</sup> )	Infection, HLOS	GGT, CD4 <sup>+</sup> , CD8 <sup>+</sup> , CD4 <sup>+</sup> /CD8 <sup>+</sup> , WBC, IL-6, TNF-α, PLT
Long 2013[25]	China	RCT	Esophageal cancer surgery	60(30/30)	0.17 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1-7)	LCT/FO (-)	LCT (-)		CD4 <sup>+</sup> /CD8 <sup>+</sup> *
Makay 2011[27]	Turkey	RCT, DB	Gastric cancer surgery	26(14/12)	0.2 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1-5)	LCT/FO (Lipovenoes <sup>®</sup> / Omegaven <sup>®</sup> )	LCT (Lipovenoes <sup>®</sup> )	Infection, HLOS	ALT, AST

Morlion 1996[10]	Germany	RCT	Major abdominal surgery	20(10/10)	0.15 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1-5)	LCT/FO (Lipovenos <sup>®</sup> /Omegavenos <sup>®</sup> )	LCT (Lipovenos <sup>®</sup> )		AA, EPA, DHA
Roulet 1997[28]	Switzerland	RCT	Total esophagectomy	19(10/9)	0.15 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1-8)	LCT/FO (Lipovenos <sup>®</sup> /Omegavenos <sup>®</sup> )	LCT (Lipovenos <sup>®</sup> )		AA*, EPA*, DHA*
Schauder 2002 [16]	Germany	RCT, DB	Large bowel surgery	39(19/20)	0.1 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1) 0.2 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 2-5)	LCT/FO (Lipovenos <sup>®</sup> /Omegavenos <sup>®</sup> )	LCT (Lipovenos <sup>®</sup> )		CD <sub>4</sub> /CD <sub>8</sub> , TNF- $\alpha$
Senkal 2007[29]	Germany	RCT, DB	Elective colorectal surgery	40(19/21)	0.14 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1-2) 0.28 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 3-5)	LCT/MCT/FO (Lipoplus <sup>®</sup> )	LCT/MCT (Lipofundin <sup>®</sup> )	Infection	AA, EPA, DHA
Wachtler 1997[11]	Germany	RCT, DB	Major intestinal surgery due cancer	40(19/21)	0.07 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1-2) 0.14 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 3-5)	LCT/MCT/FO (Lipoplus <sup>®</sup> )	LCT/MCT (Lipofundin <sup>®</sup> )	Infection, HLOS, ICULOS	IL-6*, TNF- $\alpha$ *
Wang 2012[30]	China	RCT	Gastrointestinal surgery	64(32/32)	0.04 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1) 0.08 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 2-5)	LCT/MCT/FO (Lipoplus <sup>®</sup> )	LCT/MCT (Lipofundin <sup>®</sup> )	Infection	ALT, AST, GGT, TBIL, TG, TC, CD4 <sup>+</sup> , CD8 <sup>+</sup> , CD4 <sup>+</sup> /CD8 <sup>+</sup> , CRP, IL-6, TNF- $\alpha$ , PLT, aPTT,
Wei 2014[31]	China	RCT	Surgical resection of gastric tumors	46(26/20)	0.2 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1-6)	LCT/FO(Intralipid <sup>®</sup> /Omegaven <sup>®</sup> )	LCT (Intralipid <sup>®</sup> )	Infection	ALT*, AST*, TBIL*, TC, CD4 <sup>+</sup> , CD8 <sup>+</sup> , CD4 <sup>+</sup> /CD8 <sup>+</sup> , CRP, IL-6, TNF- $\alpha$
**Wendel 2007[2]	Germany	RCT, DB	Major abd. or pancreas surgery due cancer	44(24/20)	0.16 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1) 0.2 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 2-5)	LCT/FO (Lipovenoes <sup>®</sup> /Omegaven <sup>®</sup> )	LCT (Lipovenoes <sup>®</sup> )		TG*, TC*

Zhu 2012[32]	China	RCT, DB	Colorectal cancer surgery	57(29/28)	0.2 g·kg <sup>-1</sup> ·d <sup>-1</sup> (POD 1-6)	LCT/FO(Intralipid <sup>®</sup> / Omegaven <sup>®</sup> )	LCT (Intralipid <sup>®</sup> )	Infection, HLOS	CD4 <sup>+</sup> , CD8 <sup>+</sup> , CD4 <sup>+</sup> /CD8 <sup>+</sup> , IL-6, TNF- $\alpha$
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Table 2: Demographic and characteristics of the included studies.

\*Data not reported mean and standard deviation. \*\*Same study, but different outcomes. AA: arachidonic acid; ALT: alanine aminotransferase; aPTT: activated partial thromboplastin time; AST: aspartate transaminase; CRP: C-reactive protein; DB: double blind; DHA: docosahexaenoic acid; EPA: eicosapentaenoic acid; FO: fish oil; GGT: gamma glutamyl transferase; HLOS: length of hospital stay; ICULOS: length of intensive care unit stay; IL: interleukin; LCT: long-chain triglycerides; MCT: medium-chain triglycerides; OO: olive oil; PLT: platelets; POD: postoperative day; RCT: randomized controlled trials; SO: soybean oil; TBIL: total bilirubin; TC: total cholesterol; TG: triglycerides; TNF- $\alpha$ : tumor necrosis factor-alpha; WBC: white blood cells.

Table 3: Statistical results of included studies.

Outcomes	Studies (no./reference)	Statistical method	Effect estimate (95% CI)	P value	I <sup>2</sup> value %
Clinical outcomes					
Infection rate	9 [11, 12, 23, 26, 27, 29-32]	RR (fixed)	0.43[0.28, 0.67]	0.0001	0
HLOS (d)	8 [11, 12, 15, 23, 24, 26, 27, 32]	MD (fixed)	-1.69 [-2.72, -0.66]	0.001	0
ICULOS (d)	3 [11, 15, 24]	MD (fixed)	-0.33 [-0.51, -0.14]	0.0005	0
Laboratory outcomes					
Liver Function					
ALT (U/l)	2 [27, 30]	MD (random)	0.98 [-23.36, 25.33]	0.94	81
AST (U/l)	2 [27, 30]	MD (fixed)	-18.25 [-30.10, -6.41]	0.003	0
GGT(U/l)	2 [12, 30]	MD (fixed)	-11.17 [-24.21, 1.88]	0.09	0
TBIL (mg/dl)	2 [15, 30]	MD (random)	-1.81 [-6.61, 2.99]	0.46	84
Lipid profile					
TG (mmol/l)	2 [15, 30]	MD (fixed)	0.10 [-0.18, 0.39]	0.47	0
TC (mmol/l)	3 [15, 30, 31]	MD (random)	0.11 [-0.48, 0.69]	0.72	71
Immune function					
CD4 <sup>+</sup> (%)	4 [12, 30-32]	MD (random)	-0.70 [-6.49, 5.09]	0.81	81
CD8 <sup>+</sup> (%)	4 [12, 30-32]	MD (random)	-2.38 [-5.58, 0.83]	0.15	66
CD4 <sup>+</sup> / CD8 <sup>+</sup>	5 [12, 16, 30-32]	MD (fixed)	0.16 [0.01, 0.31]	0.04	15
Inflammatory markers					
WBC (10 <sup>9</sup> /l)	2 [12, 24]	MD (random)	0.63 [-1.89, 3.15]	0.62	57
CRP (mg/l)	5 [15, 23, 24, 30, 31]	MD (fixed)	1.33 [-8.48, 11.15]	0.79	0
IL-6 (ng/l)	4 [12, 30-32]	MD (fixed)	-7.03 [-11.10, -2.97]	0.0007	49
TNF- $\alpha$ (ng/l)	5 [12, 16, 30-32]	MD (fixed)	-1.18 [-1.71, -0.66]	<0.0001	9
Coagulation					
PLT (10 <sup>9</sup> /l)	3 [12, 30, 33]	MD (fixed)	-6.82 [-30.98, 17.35]	0.58	0
aPTT(s)	2 [30, 33]	MD (random)	0.03 [-4.35, 4.41]	0.99	57
Lipid fatty acid					
AA (mg/l)	3 [10, 15, 29]	SMD (random)	0.06 [-0.87, 0.99]	0.90	69
EPA (mg/l)	3 [10, 15, 29]	SMD (random)	5.41 [2.47, 8.34]	0.0003	88
DHA(mg/l)	3 [10, 15, 29]	SMD (random)	3.20 [1.27, 5.14]	0.001	87

AA: arachidonic acid; ALT: alanine aminotransferase; aPTT: activated partial thromboplastin time; AST: aspartate transaminase; CI: Confidence Interval; CRP: C-reactive protein; DHA: docosahexaenoic acid; EPA: eicosapentaenoic acid; GGT: gamma glutamyl transferase; HLOS: length of hospital stay; ICULOS: length of intensive care unit stay; IL: interleukin; MD: mean difference; PLT: platelets; RR: risk ratio; SMD: standard mean difference; TBIL: total bilirubin; TC: total cholesterol; TG: triglycerides; TNF- $\alpha$ : tumor necrosis factor-alpha; WBC: white blood cells.