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Review

Lipids in the intensive care unit: Recommendations from the ESPEN Expert Group☆

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Introduction

- RFE / travaux présentés au congrès l'ESPEN Avril 2014
- Rationnel de l'étude: Rôle important des lipides dans le soutien nutritionnel: apport d'AG (calories) et composant des membranes cellulaires.
- Pratiques actuelles: huiles végétales riches en acide linoléique.
- Recommandations en 2014:
  - Situation hypercatabolisme
  - NE > NP (NP ssi CI de le NE)
  - Dans les 72 H pour tout patient de SC et réanimation
- Apparition de nouveau composant lipidiques avec TG à chaine légères, enrichies en huile de poisson.
- Propriété AI et immunomodulateurs.

Question évaluée

- Quel est l'apport de la nutrition enrichie en **huile d'olive (OO)** et **huile de poisson (FO**) versus huile de soja (SO) sur le plan clinique .

Type d’étude

- Revue de la littérature
- Evaluation des différentes émulsions lipidiques dans chaque contexte (chirurgie, sepsis, traumat…)
  - utrition entérale
  - Nutition parentérale
- Contrôlé versus emulsion à base d’huile de soja

Population étudiée

- Patients hospitalisés dans des unité de réanimation et de SC.
- chirurgicaux essentiellement mais aussi non chirurgicaux
- Adultes et enfants

Objectif principal

- Variable selon études.
- Durée de ventilation
- Durée de séjour en réanimation
- Mortalité (à J28, J60)

Objectif secondaire

- Complication infectieuses
- Paramètres biochimiques:

Bilan hépatique

Propriétés spécifique de chaque AG sans effet « famille » : Quelles est l'apport en terme clinique de l'enrichissement spécifique en omega 3 de type EPA (a. eicosapentaénoïque) et en DHA (a. docosahexaenoïque).

→ Taux sanguin d'omega 3 et omega 6

Les lipides dans la nutrition parenterale

- diminuent la quantité de glucides qui doit être fournie dans le cadre du soutien nutritionnel
- Elements constitutifs des membranes
- Apport d'AGE
- Facilite l'absorption des vitamines liposolubles

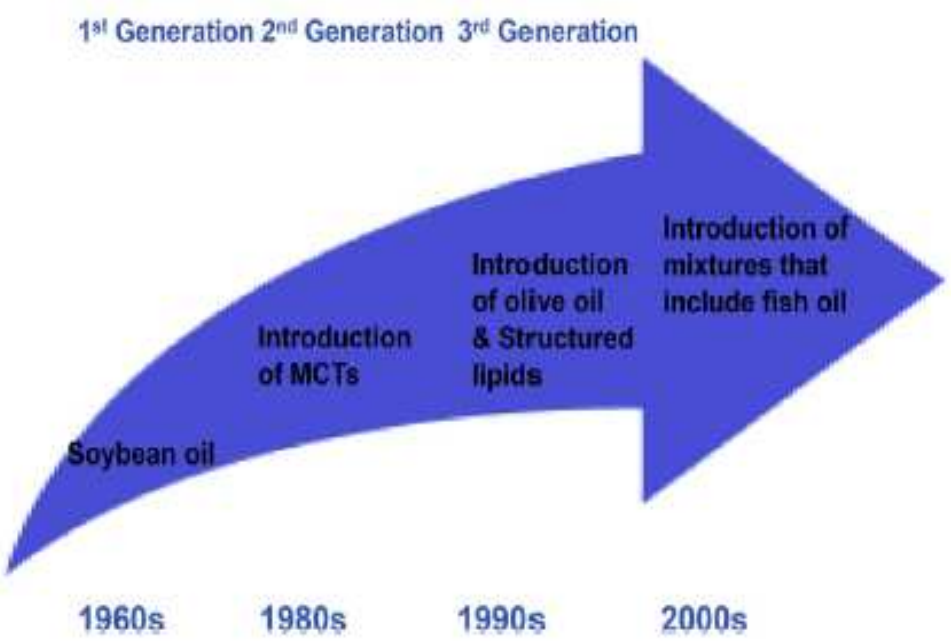

Fig. 1. Evolution of lipid emulsions for use in parenteral nutrition.

Nutrition Entérale

Table 1
Macronutrient composition of EN formulas commonly used in research studies.

	Oxepa[1]	Pulmocare[1]	Ensure Plus HN[2]	Impact[3]	Reconvan[4]
Protein (g/l)	63	63	63	56	55
Carbohydrate (g/l)	105	105	204	132	120
Fat (g/l)	93 (MCT, canola oil, fish oil, borage oil)	93 (MCT, canola oil, corn oil, high oleic safflower oil)	49 (MCT, canola oil, corn oil)	28 (Palm kernel oil, high oleic sunflower oil, high oleic safflower oil, fish oil)	33 (MCT, safflower oil, flaxseed oil, fish oil)
Omega-6 PUFAs (g/l)	18.4	18.4	7.7	5.8	6.9
Of which GLA (g/l)	4.3	0	0	0	0
Omega-3 PUFAs (g/l)	10	4.8	1.5	3.3	3.4
Of which EPA + DHA (g/l)	6.5	0	0	1.7	2.5
Also contains	Taurine, carnitine, vitamin C, α-tocopherol, β-carotene	Taurine, carnitine, vitamin C, α-tocopherol, β-carotene	Vitamin C, α-tocopherol	Arginine, nucleotides, vitamin C, α-tocopherol, β-carotene	Arginine, glutamine, vitamin C, α-tocopherol, β-carotene

Source: [1]Abbott Nutrition company website; [2]Taken from [68]; [3]Taken from [202] and Nestlé Health Science company website; [4]Fresenius Kabi company website.

Nu te

Table 4
Clinically relevant outcomes of studies using fish oil-enriched EN in critically ill patients.

Study	Population (Number enrolled/included in analysis)	Intervention	EPA (g/d)	DHA (g/d)	GLA (g/d)	Control	Outcome in intervention group
Braga et al. 2002 [69]	Major abdominal surgery for GI malignancy (196/150)	Peri- & post-operative IMPACT®	~2.9 EPA + DHA		0	Post-operative standard EN	↓ Number of complications ↓ Hospital length of stay
Elamin et al. 2012 [59]	ARDS (22/17)	Oxepa®	N/A	N/A	N/A	Pulmocare®	↑ Oxygenation ↓ Lung injury ↓ Organ dysfunction ↓ ICU stay
Gadek et al. 1999 [56]	ARDS (146/98)	Oxepa®	6.9	2.9	5.8	Pulmocare®	↑ Oxygenation ↓ Ventilator days ↓ New organ failure ↓ ICU stay
Grau-Carmona et al. 2011 [60]	Septic patients with ALI/ARDS (160/132)	Oxepa®	5.4	2.3	4.9	Ensure Plus HN®	↑ Oxygenation ↓ New organ failure ↓ ICU stay
Kagan et al. 2015 [71]	Severe trauma (120/99)	Oxepa®	5.5	2.3	4.7	Pulmocare®	No effect on oxygenation, incidence of ARDS/ALI, length of ventilation time, length of ICU stay or 28-day mortality
Klek et al. 2011 [70]	Major abdominal surgery for GI malignancy (341/303)	Post-operative Reconvan®	~5 EPA + DHA		0	Post-operative Peptisorb®	↓ Hospital stay ↓ Infectious complications ↓ Overall morbidity ↓ Overall mortality
Pontes-Arruda et al. 2006 [58]	ARDS secondary to sepsis/septic shock (165/103)	Oxepa®	4.9	2.2	4.6	Pulmocare®	↑ Oxygenation ↓ New organ failure ↓ Ventilator days ↓ ICU stay ↓ Mortality
Pontes-Arruda et al. 2011 [68]	Early stage sepsis (115/106)	Oxepa®	4.6	2.0	4.4	Ensure Plus HN®	↓ Progression of sepsis ↓ Respiratory and cardiac failure ↓ ICU stay
Rice et al. 2011 [61]	ARDS/ALI (272/272)	Bolus FO + GLA	6.8	3.4	5.9	Equivalent with no FO or GLA	No clinical benefit. Trial stopped early due to fewer ventilator-free and ICU-free days, and greater 60-day mortality in FO group
Singer et al. 2006 [57]	ALI (100/95)	Oxepa®	5.4	2.5	5.1	Pulmocare®	↑ Oxygenation ↓ Ventilator duration
Stapleton et al. 2011 [62]	ALI (90/85)	Bolus FO	9.8	6.8	0	Equivalent with no FO	No effect on SOFA, ventilator free days or mortality
Van Zanten et al. 2014 [73]	Medical/surgical trauma ICU patients (301/301)	Experimental high protein feed enriched with glutamine, omega-3 fatty acids & antioxidants	~4.5 EPA + DHA		0	Protison (high protein feed)	No effect on infections, mortality, organ failure, duration of mechanical ventilation or length of stay. Increased 6-month mortality rate reported in medical sub-group.

SOFA, Sequential Organ Failure Assessment score.

⇒ PAS de Recommandation pour les ALI et SDRA

Nutrition Parentérale

Table 3
Oil and typical fatty acid compositions (% of total) of commercially available lipid emulsions for use in parenteral nutrition.

	Intralipid®	Lipofundin® MCT/LCT	Structolipid®	Omegaven®	ClinOleic®	Lipoplus® (also known as Lipidem®)	SMOFlipid®
Oil source	100% soybean	50% MCT + 50% soybean	36% MCT + 64% soybean	100% fish[c]	80% olive + 20% soybean	50% MCT + 40% soybean + 10% fish[c]	30% MCT + 30% soybean + 25% olive + 15% fish[c]
SFA	15	58	46	21	14	49	37
MUFA[a]	24	11	14	23	64	14	33
PUFA	61	31	40	56	22	37	30
n-3 PUFA	8	4	5	48	3	10	7
ALA	8	4	5	1	3	4	2
EPA	–	–	–	20	–	3.5	3
DHA	–	–	–	19	–	2.5	2
n-6 PUFA[b]	53	27	35	5	19	27	23

Information taken from [203–205].
SFA, saturated fatty acid; MUFA, monounsaturated fatty acid; PUFA, polyunsaturated fatty acid; ALA, α-linolenic acid; EPA, eicosapentaenoic acid; DHA, docosahexaenoic acid.
[a] Mainly oleic acid.
[b] Mainly linoleic acid.
[c] The fatty acid composition of fish oil is more variable than that of vegetable oils so that the precise contribution of different fatty acids may differ in different batches. Note that the fish oil used in Lipolus® is more concentrated in EPA and DHA than that used in SMOFLipid® so that 10% fish oil in Lipoplus® provides more EPA and DHA than 15% fish oil in SMOFLipid®.

Table 5
Clinically relevant outcomes from including different lipid emulsions in PN in surgical patients.

Study	Population	Intervention	Duration	Control	Outcome in intervention group
Badia-Tahull et al. 2010 [85]	Gastrointestinal surgery	OO/SO + FO (ClinOleic® + Omegaven®) (n = 13)	5 d	OO/SO (ClinOleic®) (n = 14)	↓ Number of infections. Trend toward lower mortality and fewer incidences of sepsis. No effect on length of hospital stay
Berger et al. 2008 [206]	Abdominal aorta aneurysm surgery	SO/MCT/FO (Lipoplus®) (n = 12)	4 d	SO/MCT (Lipofundin®) (n = 12)	Trend toward shorter ICU and hospital stay
Berger et al. 2013 [89]	Cardiac surgery	FO (Omegaven®) (n = 14)	3 infusions; 12 h and 2 h before surgery and immediately after surgery	Saline (n = 14)	Trend toward shorter length of mechanical ventilation and shorter ICU stay
Grimm et al. 2006 [97]	Gastrointestinal surgery	SO/MCT/OO/FO (SMOFlipid®) (n = 19)	5 d	SO (Lipovenoes®) (n = 14)	↓ Length of hospital stay
Han et al. 2012 [105]	Major surgery	SO/MCT + FO (Lipofundin® + Omegaven®) (n = 18)	7 d post-surgery	SO/MCT (Lipofundin®) (n = 12)	Trend toward less liver dysfunction and fewer infections
Heidt et al. 2009 [99]	Coronary artery bypass surgery	FO (Omegaven®) (n = 52)	~12 h prior to surgery until ward transfer	SO (Lipovenoes®) (n = 50)	↓ Post-operative atrial fibrillation ↓ ICU stay
Heller et al. 2004 [106]	Gastrointestinal surgery	SO + FO (Lipovenoes® + Omegaven®) (n = 24)	5 d post-surgery	SO (Lipovenoes®) (n = 20)	↓ Markers of liver dysfunction
Jiang et al. 2010 [91]	Gastrointestinal surgery	SO + FO (Intralipid® + Omegaven®) (n = 100)	7 d post-surgery	SO (Intralipid®) (n = 103)	↓ SIRS ↓ Length of hospital stay Trend toward fewer infectious complications.
Klek et al. 2005 [94]	Gastrointestinal surgery	Post-operative FO (Omegaven®) (n = 30)	Mean duration 9 d	SO/MCT (Lipofundin®) (n = 30) SO/MCT + glutamine (Lipofundin® + Dipeptiven®) (n = 30)	↓ Infectious complications ↓ Hospital stay
Ma et al. 2012 [108]	Gastrointestinal surgery	SO/MCT/OO/FO (SMOFlipid®) (n = 20)	5 d post-surgery	SO/MCT (Lipovenoes®) (n = 20)	No difference in post-operative complications, infections or duration of hospital stay
Mateu-de Antonio et al. 2008 [85]	Surgery patients	OO/SO (ClinOleic®) (n = 23)	Mean duration 19 d	SO (Intralipid®) (n = 16)	No difference in number and type of infections, ICU stay, hospital stay or mortality.
Metry et al. 2014 [109]	Gastrointestinal surgery	SO/MCT/OO/FO (SMOFlipid®) (n = 41)	7 d post-surgery	SO (Intralipid®) (n = 42)	No difference in ventilation, duration of ICU or hospital stay or mortality
Piper et al. 2009 [107]	Surgery	SO/MCT/OO/FO (SMOFlipid®) (n = 22)	5 d post-surgery	OO/SO (ClinOleic®) (n = 22)	↓ Markers of liver dysfunction
de Miranda Torrinhas et al. 2013 [92]	Gastrointestinal surgery	Pre-operative FO (Omegaven®) (n = 31)	3 d pre-surgery	SO/MCT (Lipovenoes®) (n = 32)	No effect on post-operative infections, length of ICU or hospital stay.
Tsekos et al. 2004 [100]	Gastrointestinal surgery	Peri-operative SO/MCT + FO (Omegaven®) (n = 53) vs Post-operative SO/MCT + FO (Omegaven®) (n = 86)	2–3 d pre-surgery followed by 5 d post-surgery	SO/MCT (brand un-disclosed) (n = 110)	Perioperative: ↓ Mortality ↓ Number of patients requiring ventilation ↓ Hospital stay No change in length of ICU stay
Umpierrez et al. 2012 [84]	Surgery	OO/SO (ClinOleic®) (n = 51)	28 d post-surgery	SO (Intralipid®) (n = 49)	No difference in mortality, infections or length of stay
Wachtler et al. 1997 [207]	Gastrointestinal surgery	SO/MCT/FO (Prototype of Lipoplus®) (n = 19)	5 d post-surgery	SO/MCT (brand un-disclosed) (n = 21)	Trend toward fewer infections and shorter ICU stay. No effect on length of hospital stay
Wang et al. 2012 [104]	Gastrointestinal surgery	SO/MCT/FO (Lipoplus®) (n = 32)	5 d post-surgery	SO/MCT (Lipofundin®) (n = 31)	↓ Total bilirubin
Weiss et al. 2002 [90]	Surgery	Peri-operative FO (Omegaven®) (n = 12)	d-1 to d 5	SO (Lipovenoes®) (n = 12)	↓ Length of hospital stay. No effect on infection rate or mortality.
Wichmann et al. 2007 [96]	Gastrointestinal surgery	SO/MCT/FO (Lipoplus®) (n = 127)	5 d post-surgery	SO (Intralipid®) (n = 129)	↓ Length of hospital stay. Trend toward fewer infections and decreased length of ICU stay. No effect on mortality
Wu et al. 2014 [110]	Gastrointestinal surgery	SO/MCT/OO/FO (SMOFlipid®) (n = 20)	5 d post surgery	MCT/SO (Lipovenoes®) (n = 15)	No difference in infections, duration of hospital stay or mortality
Zhu et al. 2012 [93]	Elderly gastrointestinal surgery	SO + FO (Intralipid® + Omegaven®) (n = 29)	7 d post-surgery	SO (Intralipid®) (n = 28)	↓ Infectious complications ↓ SIRS ↓ Length of hospital stay

NP /

Table 6
Clinically relevant outcomes from including different lipid emulsions in PN in critically ill medical patients.

Study	Population	Intervention	Duration	Control	Outcome
Barbosa et al. 2010 [119]	Critically ill with sepsis/SIRS	SO/MCT/FO (Lipoplus®) (n = 13)	5 d	SO/MCT (part of LipidSpecial®) (n = 10)	↑ PO_2/FiO_2 ratio ↓ Length of hospital stay for surviving patient sub-group. No difference in ventilation days, length of ICU stay or mortality
Barros et al. 2013, 2014 [208,209]	Elderly ICU patients on EN	Supplementary FO (Omegaven®) (n = 15)	6 h infusions/d for 3 d	No supplementary PN (n = 25)	↑ Gas exchange Trend toward shorter length of mechanical ventilation and decreased mortality. No effect on liver function
Burkhart et al. 2014 [120]	Sepsis	FO (Omegaven®) (n = 25)	7 d	Standard care (n = 25)	No difference in duration of ICU stay or mortality
Edmunds et al. 2014 [115]	Mechanically ventilated critically ill	FO-enriched lipids (SMOFlipid®, Lipoplus® or Omegaven®) (n = 19) OO/SO (ClinOleic®) (n = 74)	≥5 d	SO-based lipids (various brands) (n = 223) Lipid-free (n = 70) SO/MCT (various brands) (n = 65)	For FO-enriched lipids: ↓ Duration of mechanical ventilation ↓ Length of ICU stay ↓ Mortality
Friesecke et al. 2008 [126]	Medical ICU	SO/MCT + FO (Lipofundin® + Omegaven®) (n = 63)	≥6 d	SO/MCT (Lipofundin®) (n = 60)	No effect on infection, duration of mechanical ventilation, length of ICU stay or 28-day mortality
García-de-Lorenzo et al. 2005 [210]	Severe burns	OO/SO (ClinOleic®) (n = 11)	6 d	SO/MCT (Lipofundin®) (n = 11)	No effect on organ dysfunction, requirement for ventilation, number of infections, length of ICU or hospital stay or mortality
Grau-Carmona et al. 2015 [123]	Medical and surgical ICU	SO/MCT/FO (Lipoplus®) (n = 58)	≥5 d	SO/MCT (Lipofundin®) (n = 59)	↓ Nosocomial infections No difference in duration of ventilation, length of ICU or hospital stay or 6-month mortality
Gupta et al. 2011 [211]	ARDS on EN	Supplemental FO (Omegaven®) (n = 31)	14 d	Standard EN (n = 30)	No difference in duration of ventilation, ICU stay or hospital stay or mortality
Hall et al. 2014 [118]	Critically ill with sepsis	FO (Omegaven®) (n = 30)	14 d or to discharge	Standard care (N = 30)	↓ SOFA ↓ Mortality in less severe sepsis subgroup No effect on length of stay
Khor et al. 2011 [121]	Severe sepsis	FO (Omegaven®) (n = 14)	5 d	Saline (n = 13)	No effect on length of ICU or hospital stay
Mayer et al. 2003 [122]	Septic shock	FO (Omegaven®) (n = 10)	5 d	SO (Lipoven®) (n = 11)	No effect on mortality or length of mechanical ventilation
Mayer et al. 2003 [117]	Septic shock	FO (Omegaven®) (n = 5)	10 d	SO (Lipoven®) (n = 5)	Trend toward shorter ventilation time. No mortality in either group
Sabater et al. 2008 [212]	ARDS	SO/MCT/FO (Lipoplus®) (n = 8)	12 h	SO (Intralipid®) (n = 8)	No effect on gas exchange or mortality
Wang et al. 2008 [116]	Acute pancreatitis	SO + FO (Lipovenoes® + Omegaven®) (n = 20)	5 d	SO (Lipovenoes®) (n = 20)	↓ Requirement for renal replacement therapy ↑ Oxygenation index Trend toward fewer infections and shorter length of ICU and hospital stay
Zhu et al. 2012 [98]	Liver transplantation	FO (Omegaven®) (n = 33)	7 d post-surgery	SO/MCT (20% emulsion with a 1:1 ratio) (n = 33)	↓ Length of hospital stay

SOFA, Sequential Organ Failure Assessment.

Huile de soja (SO) – omega 6

- Pro-inflammatoire
- suppression de la fonction immunitaire en raison de sa teneur élevée en AL et tendance à la peroxydation.
- Risque d'exacerber la réponse inflammatoire post-chirurgicale
- effet immunosuppresseur chez les patients traumatisés sévères → une plus longue durée de ventilation mécanique et à un séjour plus long en soins intensifs et à l'hôpital

Huile d’olive(OO)

- effets physiologiques neutres, par exemple sur la fonction immunitaire, l'inflammation et la coagulation sanguine
- forte teneur en acides gras mono-insaturés → plus résistant à la peroxydation et au stress oxydatif que le SO.
- préserve la fonction hépatobiliaire.
- **patients chirurgicaux adultes** : amélioration de l'état des acides gras, une augmentation de la concentration de vitamine E dans le sang, une diminution de la peroxydation lipidique des paramètres inflammatoires

Mais Aucune différence significative sur les CJP

Huile de poisson (FO) – omega 3

- immunonutrition
- source d'EPA et de DHA
- enrichie en arginine, nucléotides et acides gras oméga-3
- anti-inflammatoire
- Facilite le fonction immunitaire et améliorer le métabolisme hépatique et la fonction hépatique.

Huile de poisson (FO) en pratique

- Chirurgie digestive, traumatisés sévères
- SEPSIS: Aucun bénéfice

Pé

Table 7
Clinical and biochemical outcomes from including different lipid emulsions in PN in pediatric patients.

Study	Population	Intervention	Duration	Control	Outcome in intervention group
Beken et al. 2014 [159]	Very low birth weight preterm infants	SO/MCT/OO/FO (SMOFlipid®) (n = 40)	Mean: 14 d	SO (Intralipid®) (n = 40)	↓ Retinopathy of prematurity No difference in morbidity or mortality outcomes
D'Ascenzo et al. 2014 [160]	Very low birth weight preterm infants	SO/MCT/OO/FO (SMOFlipid®) (n = 30)	7 d following birth	SO (Intralipid®) (n = 32)	↑ Plasma EPA and DHA ↓ Plasma ARA ↑ Serum triglycerides, plasma phospholipids, free cholesterol No difference in weight.
Deshpande et al. 2014 [161]	Preterm neonates	SO/MCT/OO/FO (SMOFlipid®) (n = 17)	7 d	OO/SO (ClinOleic®) (n = 17)	↑ RBC EPA ↑ Vitamin E ↓ F_2 isoprostanes
Larsen et al. 2012 [166]	Infants undergoing open heart surgery	SO/MCT/FO (Lipoplus®) (n = 16)	1-4 d before and 10 d post-surgery	SO (Intralipid®) (n = 16)	↓ TNF-α No difference in clinical outcomes
Larsen et al. 2015 [165]	Infants undergoing open heart surgery	SO/MCT/FO (Lipoplus®) (n = 16)	3 d pre-op and 5 d post-op	SO (Intralipid®) (n = 16)	↑ Plasma phospholipid EPA ↓ Plasma LTB_4 and lymphocytes
Pawlik et al. 2013 [162]	Very low birthweight preterm infants	OO/SO + FO (ClinOleic® + Omegaven®) (n = 60)	28 d	OO/SO (ClinOleic®) (n = 70)	↑ Plasma DHA ↓ Cholestasis
Savini et al. 2013 [163]	Very low birthweight preterm infants	SO (Intralipid®) (n = 30) vs SO/MCT (Lipofundin®) (n = 30) vs SO/MCT/FO (Lipidem®) (n = 27) vs OO/SO (ClinOleic®) (n = 29) vs SO/MCT/OO/FO (SMOFlipid®) (n = 28)	21 d	–	Lowest plasma phytosterols in SMOFlipid® group No difference in liver function
Vlaardingerbroek et al. 2014 [158], Roelands et al. 2016 [134]	Very low birth weight infants	SO/MCT/OO/FO (SMOFlipid®) (n = 48)	Median: 11 d	SO (Intralipid®) (n = 48)	↑ Plasma EPA and DHA ↑ Weight gain No difference in ARA. No differences in morbidity, mortality or other biochemical outcomes No difference in neurodevelopmental outcome
Wang et al. 2016 [164]	Preterm infants	OO/SO (ClinOleic®) (n = 50)	14 d	SO (Intralipid®) (n = 50)	↓Direct bilirubin Differences in bile acid composition No difference in clinical outcome

Résultats principaux - RFE

- La nutrition parentérale postopératoire incluant les acides gras oméga-3 ne doit être instaurée que chez les patients malnutris qui ne peuvent pas être nourris de manière adéquate.
- Soja: **suspendre** les LE à base de SO au cours de la première semaine suivant le début du traitement chez le patient gravement malade ou limiter à 100 g / semaine (souvent divisé en 2 doses / semaine) en cas de carence en acides gras essentiels.
- Poisson: En cas de complication chirurgicale l'huile de poisson est recommandée .
- l'ajout d'EPA et de DHA aux émulsions lipidiques a des effets significatifs sur les membranes cellulaires et les processus inflammatoires.
- RFE: les formulations entéro-immunodémulatrices (arginine, oméga-3, …)
  - Bénéfices sur les patients chirurgicaux et plus value d'une administration précoce
  - Pas d'utilisation systémique pour les patients médicaux . Formulations réservées aux lésions cérébrales traumatiques et aux patients périopératoires.

Points forts

- Revue élargie de la littérature.
- Obtention de RFE mises à jours

Points faibles

- Pas un essai clinique
- Comparaison d'études de taille et de design très différents.
- Beaucoup d'études non contributives

Implications et conclusions

- Les lipides = essentiels au support nutritionnel
- Alors que la nutrition entérale et parentérale à base d'huile végétale riche en LA est encore largement utilisée, les nouveaux composants lipidiques tels que les MCT et OO semblent être plus sûrs et mieux tolérés que le SO pur.

Implications et conclusions

- **Huile de poisson**: avantages cliniques supplémentaires, en chez les **patients chirurgicaux**, et traumatisés sévères en raison de ses effets anti-inflammatoires et immunomodulateurs.
- Patients non chirurgicaux : pas de recommandation, nécessité d'essai clinique sur une plus grande population.
- Economie: gain en lien avec la diminution de la durée d'hospitalisation compense la majoration du prix.

Perspectives

- Neurologie: DHA
  - Lésions spinales: réduit la taille des lésions et de ,réduit les pertes neuronales, réduit le recrutement et l'activation des macrophages et diminue la mort apoptotique.
  - Lésion cérébrale traumatique.
  - AVC ischémique
- Sepsis
- Lésions pulmonaire

Remerciements