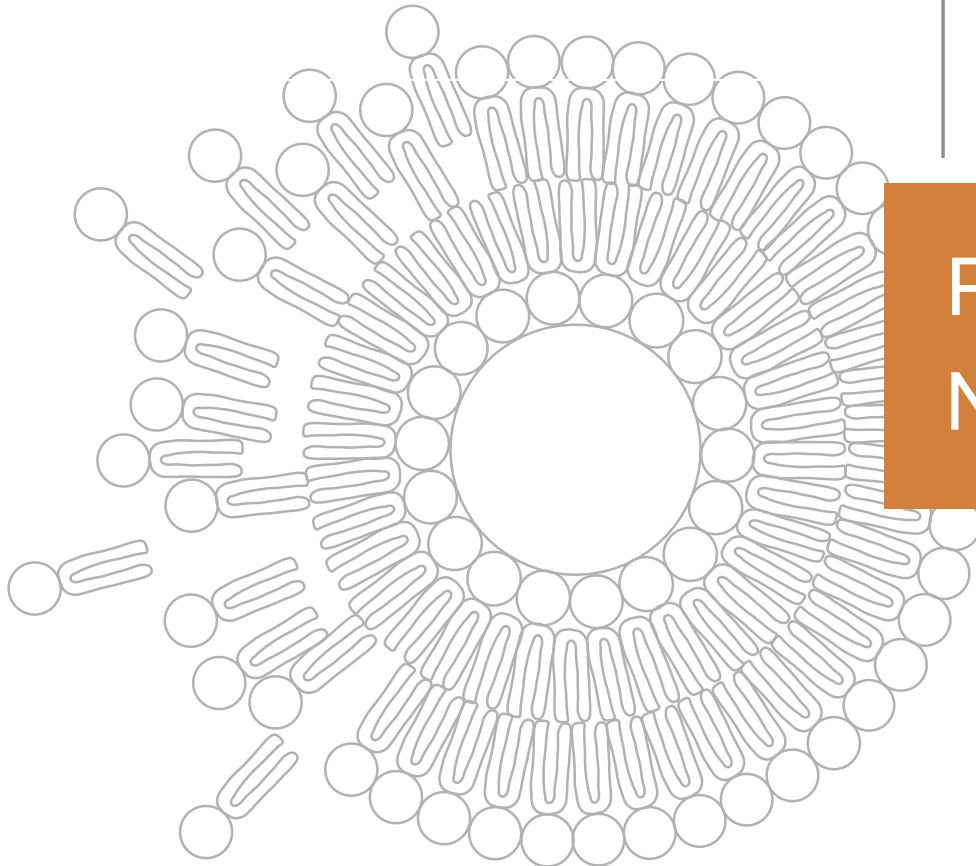


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Lipoid AG



PHOSPHOLIPIDS IN ENTERAL NUTRITION

We Invest in Quality.

LIPOID PRODUCTS IN VARIOUS APPLICATIONS



Pharmaceutical



Health Nutrition/Food Supplements



Cosmetic



LEADING SUPPLIER OF

- › cGMP Phospholipids for the pharmaceutical industry
- › Phospholipids for high-class food supplements
- › Phospholipids & botanical ingredients for superior natural cosmetics

GLOBAL PRESENCE

- › Independent company with over 45 years of experience
- › About 500 employees worldwide
- › Sales offices and representatives in more than 40 countries

What is Enteral Nutrition?

Definition

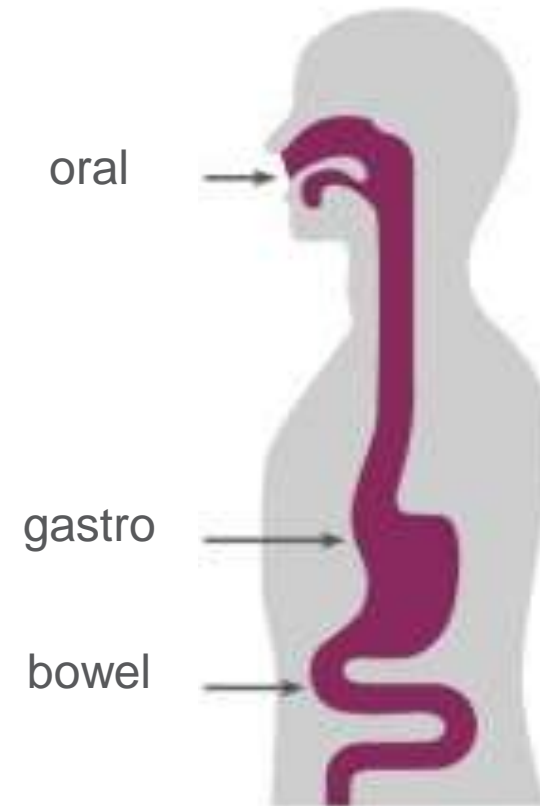
- › Nutrient rich food or supplemental formula
- › Fed into the gastrointestinal tract (greek: *enteron* = intestine)
- › Formula must be pumpable

Supplementation includes

- › Oral or transnasal (nasogastral / nasojejunal)
- › Stomach or intestine tube

Beneficial effects

- › Nutrition “as normal as possible”
- › Maintenance of intestinal integrity
- › Maintenance of mucous membrane
- › Maintenance of lean body mass



PARENTERAL NUTRITION VS ENTERAL NUTRITION

Differences to Parenteral Nutrition

- › For critical ill patients with no possibilities of enteral nutrition
- › Nutrition solely via veins
- › No use of the gastrointestinal tract
- › Contains small molecules such as glucose, amino acids and MCT
- › Listed as medication (nutrition class of drugs)

Why enteral nutrition should (normally) be preferred:

- › Parenteral nutrition causes more complications (e.g. infections)
- › Parenteral nutrition does not preserve the structure and function of the gastrointestinal tract
- › Parenteral nutrition is more expensive.



What ingredients are required for enteral nutrition?

Ingredients

- › ≈ 70 – 80 % water
- › Macronutrients
 - › Carbohydrates (40 – 70 %): Polysaccharides, monosaccharides, maltodextrin
 - › Lipids (15 – 30 %): triglycerides (long chain fatty acids), MCT
 - › Proteins (15 – 20 %): proteins, amino acids
- › Others
 - › Nutrients
 - › Fibers (optional)
 - › **Emulsifiers (soy lecithin)**
 - › **Choline as choline bitartrate**

Energy density

Normal caloric: 1 kcal/mL

High caloric: ≥ 1.2 kcal/mL

Standard polymeric formulas

- › Nutritionally complete (macro- and micronutrients)
 - › Carbohydrates, proteins and lipids (LCT/MCT + ω -3)
- › For patients with intact digestion

Elemental / Semi-elemental formulas

- › Partially or completely hydrolyzed nutrients to maximize absorption
 - › Fructose or maltodextrin, small peptides and MCT
- › For patients with maldigestion and malabsorption

Other formulas

- › Diseases specific, concentrated formulas, ...



What are the benefits of phospholipids?

BENEFITS OF PHOSPHOLIPIDS

Benefits of phospholipids

Hydrophilic head

- › Natural source of choline
- › Strengthening of the intestine barrier
- › Support of liver health

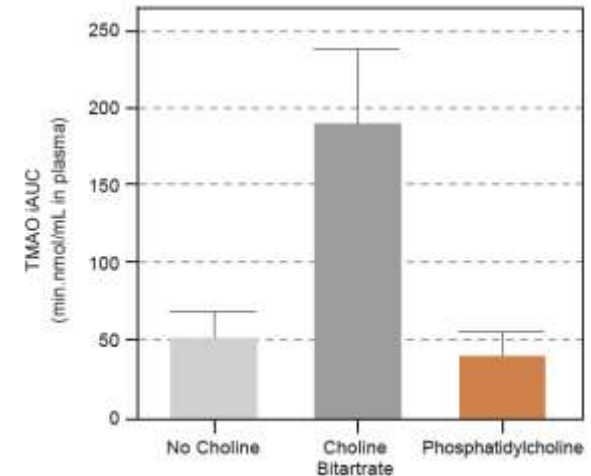


Lipophilic tail

- › Natural source of unsaturated fatty acids
- › Support of liver health

Enteral Nutrition

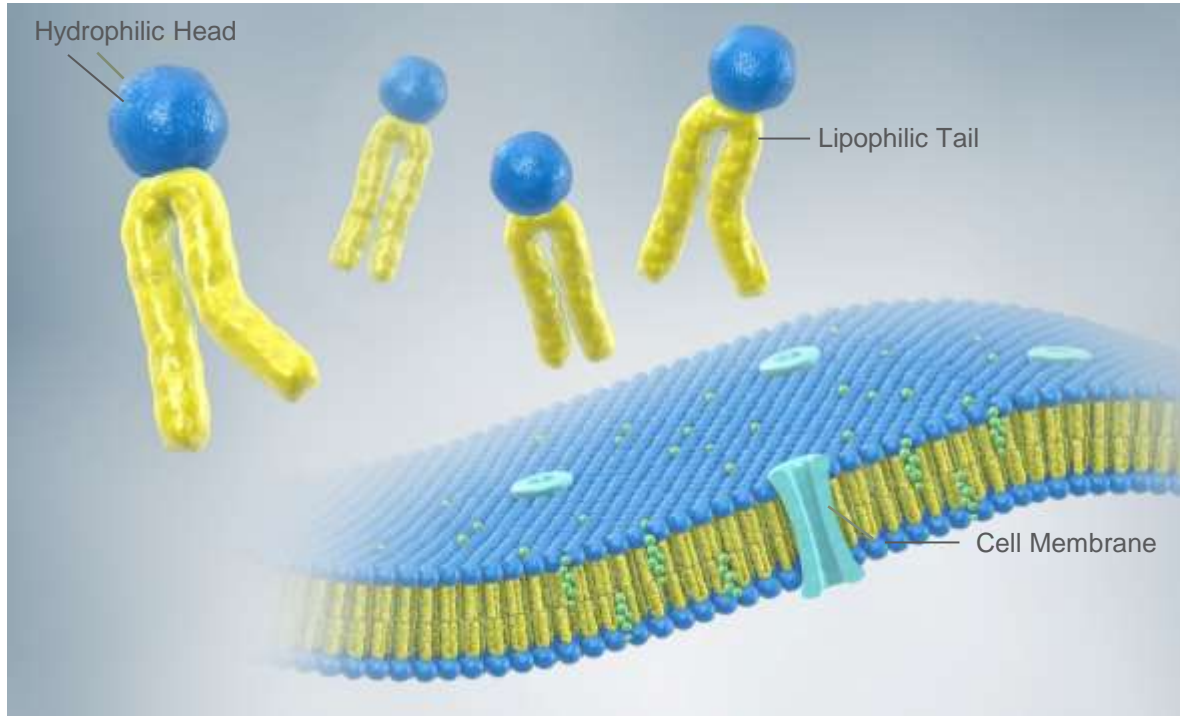
- › Natural emulsifier
- › Improvement of diarrhea
- › No TMAO (Trimethylamine oxide) formation^[1]
 - › Choline bitartrate leads to higher TMAO levels)
 - › High TMAO levels can be associated with increased risk in cardiovascular diseases
 - › Choline as phosphatidylcholine show no alteration in the TMAO level



[1] Cho C.E. et al.; Effect of Choline Forms and Gut Microbiota Composition on Trimethylamine-N-Oxide Response in Healthy Men. Nutrients. 2020 Jul 25;12(8):2220. doi: 10.3390/nu12082220.

BIOLOGICAL FUNCTION

Essential Components of all Organisms



Typical lipid membrane composition of an average mammalian cell membrane – “body-own” material

45 – 55% Phosphatidylcholine	1 – 2% Phosphatidic acid
15 – 25% Phosphatidylethanolamine	10 – 20% Cholesterol
10 – 15% Phosphatidylinositol	5 – 10% Sphingomyelin
5 – 10% Phosphatidylserine	2 – 5% Cardiolipin

Functions in the human body

- › Building block (membranes and organelles)
- › Blood transport (component of lipoproteins)
- › Digestion (formation of micelles in bile)
- › Surfaces (alveoli, tear film)
- › Choline & fatty acid source

Phospholipids are natural emulsifiers.

Common adverse effect of EN

Cause

- › Malabsorption of food ingredients
- › Abnormalities in the motoric activity of the distal colon
- › Diarrhea
- › Small intestinal bacterial overgrowth (“*SIBO*”)
 - › Colon bacteria colonize small intestine and deconjugate bile salts
 - › Micelle formation impaired and malabsorption of lipids

Remedy

- › Addition of fibers
- › Use of MCT-oil
- › Purified lecithin (phospholipids) as emulsifier

Purified lecithin as emulsifier

Clinical study design^[1]

- › 15 ICU patients
- › 5 critical patients with parenteral nutrition before EN
- › However: only short observation time (6 days) and no control group

Aim

- › Convert patients to enteral nutrition (containing egg yolk phospholipids)

Result

- › Increase in EN dosage easily possible
- › No adverse effects (diarrhea, vomiting)
- › Safe usage of egg yolk lecithin in EN formulations with proposed benefits
- › Reduced hospital costs

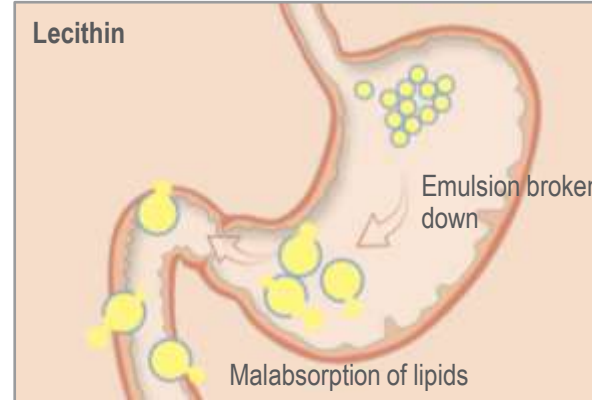


[1] Akashi T, Hashimoto R, Ohno A, Matsumoto K, Nakamura Y. Enteral Nutrition With an Enteral Formula Containing Egg Yolk Lecithin After Percutaneous Endoscopic Gastrostomy: A Case Series. Gastroenterology Res. 2018 Apr;11(2):157-160.

Phospholipids as emulsifier

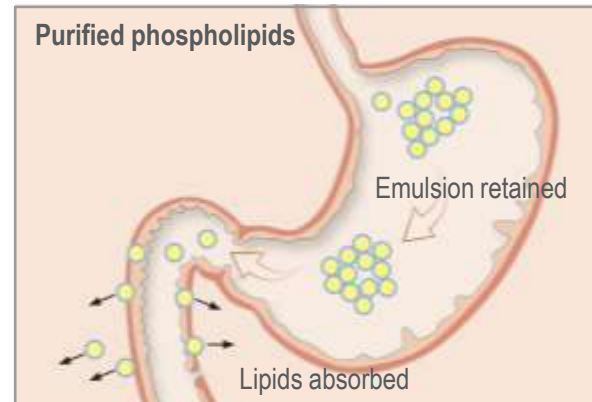
Lecithin

- › Emulsion breakdown at pH 2
- › Big lipid droplets and malabsorption
- › Worsening of diarrhea^[1]



Phospholipids

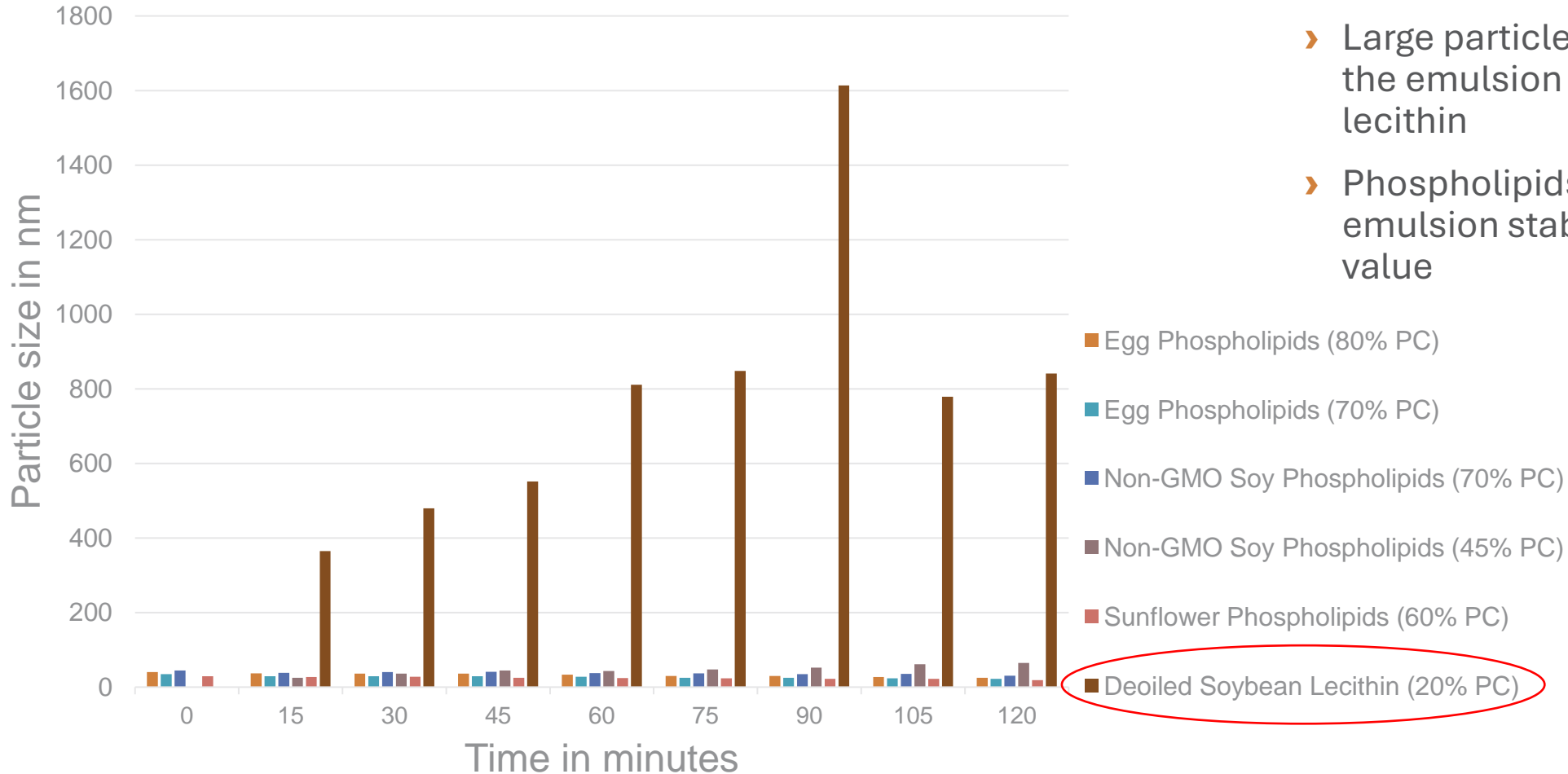
- › Stable emulsion at pH 2 (30 min)
- › Lower triglyceride concentration in serum
- › Lipid-particle size < 1 μm → absorption without digestion
- › High PC concentration support micelle formation
- › Improvement of diarrhea^[1]



[1] Akashi T, Muto A, Takahashi Y, Nishiyama H. Enteral Formula Containing Egg Yolk Lecithin Improves Diarrhea. J Oleo Sci. 2017 Sep 1;66(9):1017-1027.

PHOSPHOLIPIDS AS EMULSIFIER

Particle size of fat emulsion (autoclaved) at pH 1,5 HCl solution (own data):



Results

- › Large particles and breaking of the emulsion with standard lecithin
- › Phospholipids maintain emulsion stability at low pH value

CONCLUSION

By using phospholipids, we see the following benefits:

- › Strengthening of internal barrier
- › Improvement of diarrhea
- › Unsaturated fatty acids source
- › Liver health
- › No TMAO formation
- › Reduced hospital costs

THANK YOU FOR YOUR ATTENTION



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Natural
and
Safe!

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