Lipid structure matters!

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Normal fish oil

- 100% Triglycerides
- > 30% saturated fatty acids
- Un-concentrated Omega-3
- Limited uptake
- Fishy taste
- Reflux
Goals for an improved Omega-3

✓ Better taste
✓ Reduced reflux
✓ Better uptake
✓ More concentrated

but:

✓ Natural processing only
✓ No side products allowed
✓ Natural omega-3 position
- Enzyme treated and ultra clean -
Enzymatic production of Marinol

Refined fish-oil

Enzyme treatment

Enzyme

Washing Distillation Refining Deodorizing

Marinol

* No reflux
* Better uptake
* Low in saturated fats
* Clean taste
* No side products
Production of Marinol:
A pre-metabolized and ultra-refined Omega-3 source

Low temperature processing prevents oxidation.
Distillation helps remove saturates and volatile contaminants.
Omega-3 glyceride-mixture has 135% bioavailability!

(Dyerberg, 2010)
Structure of lipids
Unstructured Lipids

free fatty acid

saturated

unsaturated

omega 3

ALA (18:3)

EPA (20:5)

DHA (22:6)

omega-6

omega-9

ethyl-ester
Triglycerides: How are those formed?

Glycerol + 3 Fatty Acids → Triglyceride + 3 water molecules

condensation reaction
Structured Lipids.....

- Fatty acid on "sn1"
- Fatty acid on "sn2"
- Fatty acid on "sn3"

OR

- Phosphate
- Choline

Tri-glyceride

Phospho-lipid metabolite
Lipid Structure Matters to *Nature*

- 60% of Omega-3 in breast milk is on sn-2 position
- 95% of all Omega-3 in breast milk is in TG form
- 99% of Omega-3 in brain is on sn-2 position
- DAG, MAG and FFA are signaling molecules
Lipid Structure Matters to *Nature*

1) Uptake
2) Metabolism
3) Distribution
4) Stability

*Scientific references are available upon request*
DHA at sn-2 Promotes Uptake

* Dyerberg, 2010: Glyceride mix as in Marinol has 135% bioavailability of pure TG’s in humans!
Brain Uptake of DHA from TG

60% DHA on sn-2 of TG of breast milk
  ✔ Lipase specific for sn-1/3
  ✔ Transport as mono-glyceride

DHA maintained on sn-2

✔ PL-synthesis using DG with DHA on sn-2

Brain uptake of Lysophosphatidylcholine DHA:
  ✔ Endothelial Lipase specificity for FFA at sn-1

99% of DHA on sn-2
Fate of DHA from PL, FFA or EE

PL: Up to 80% DHA on sn-2
  ✓ Role PLA2?
  ✓ Incomplete breakdown of EE?

Position DHA mixed...
  ✓ Random re-acetylation?

Brain: 99% DHA is on sn-2
Effect on Metabolism

DHA from TG prefers incorporation into PL.

Dyerberg et al, 2010
Effect on LDL/HDL Distribution

**LDL-Phospholipids**

- **Control**
- **TF-TG**
- **E-PL**

- 20:4 (n=6)
- 22:6 (n=3)

**HDL-Phospholipids**

- **Control**
- **TF-TG**
- **E-PL**

- 20:4 (n=6)
- 22:6 (n=3)

Amate et al, 2001

**DHA from TG favors LDL.**
Oxidative stability of DHA is better at sn-2.
Marinol D-40: Omega-3 for infant formulas

1) Mimics breast milk
   • Structured regarding DHA (60% on sn-2)
   • TG form
   • DHA / EPA close to 5
   • Very clean taste

2) Pre-metabolized, well-absorbed

3) Biologically concentrated
1. For sensitive digestive systems
2. Better bioavailability
3. Purely natural
4. Neutral taste
Questions?

Thank you for attending!

Questions? E-mail to hkeizer@stepan.com

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