

Absorption of Essential Fatty Acids in Wax Ester Rich Oil from the Marine Crustacean, *Calanus finmarchicus*, in Healthy Men and Women

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Background

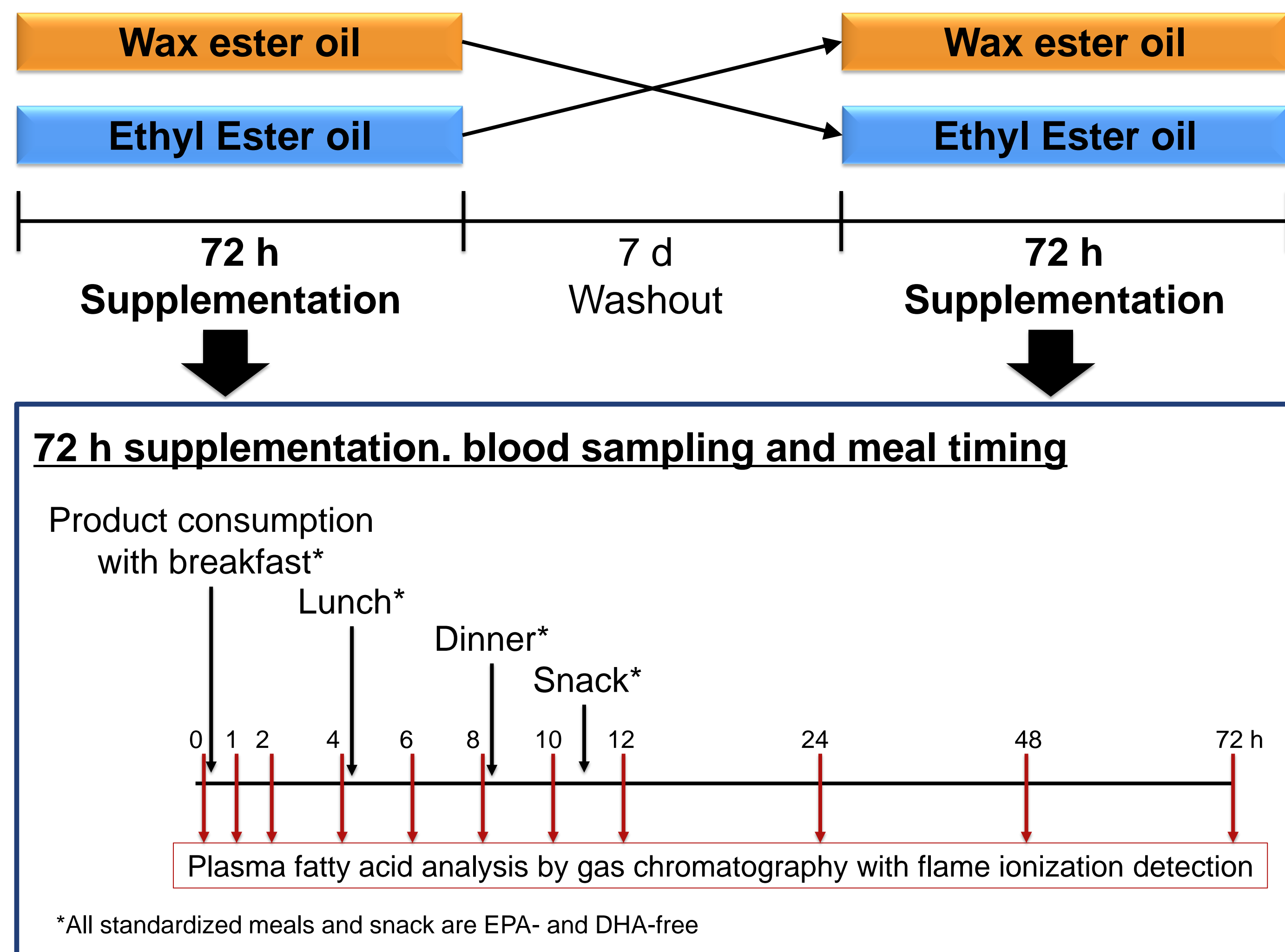
- Absorption of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) depends on the source and chemical composition of the fatty acids (e.g., bound as triacylglycerols [TAG], ethyl esters, or phospholipids).¹⁻⁴
- EPA and DHA derived from the marine copepod *Calanus finmarchicus*, contains >85% of the fatty acids present as wax esters bound predominantly to aliphatic long-chain monounsaturated alcohols [mostly 20:1(n-9) and 22:1(n-11) alcohols], with minor amounts of TAG and other neutral lipids (<10%) and polar lipids (<5%).⁵
- The bioavailability of essential fatty acids from wax ester rich oil remains to be determined in humans.

Objective

The primary objective of this randomized, two-period crossover study was to assess the absorption of EPA and DHA wax esters from *C. finmarchicus* extracted oil as an encapsulated dietary supplement in generally healthy adults.

Methods

Figure 1. Study Design and Procedures



Study Products

- Wax ester oil (Calanus® oil; Calanus AS, Tromsø, Norway) providing 260 mg EPA and 156 mg/day DHA primarily as primarily wax esters.
- Ethyl ester oil (Lovaza®, GlaxoSmithKline, Research Triangle Park, NC) providing 465 mg EPA and 375 mg DHA as primarily ethyl esters.

Statistical Analyses

- Statistical analyses were performed using SAS v9.4.
- All tests of significance were performed at $\alpha = 0.05$, two-sided.

Results

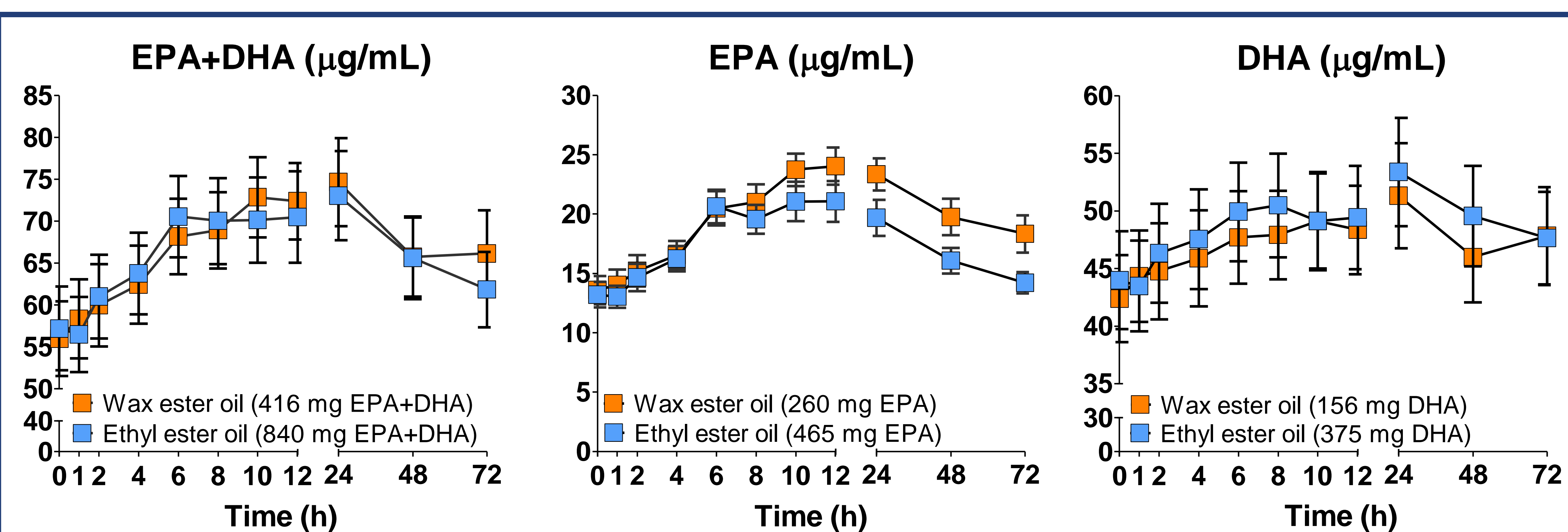
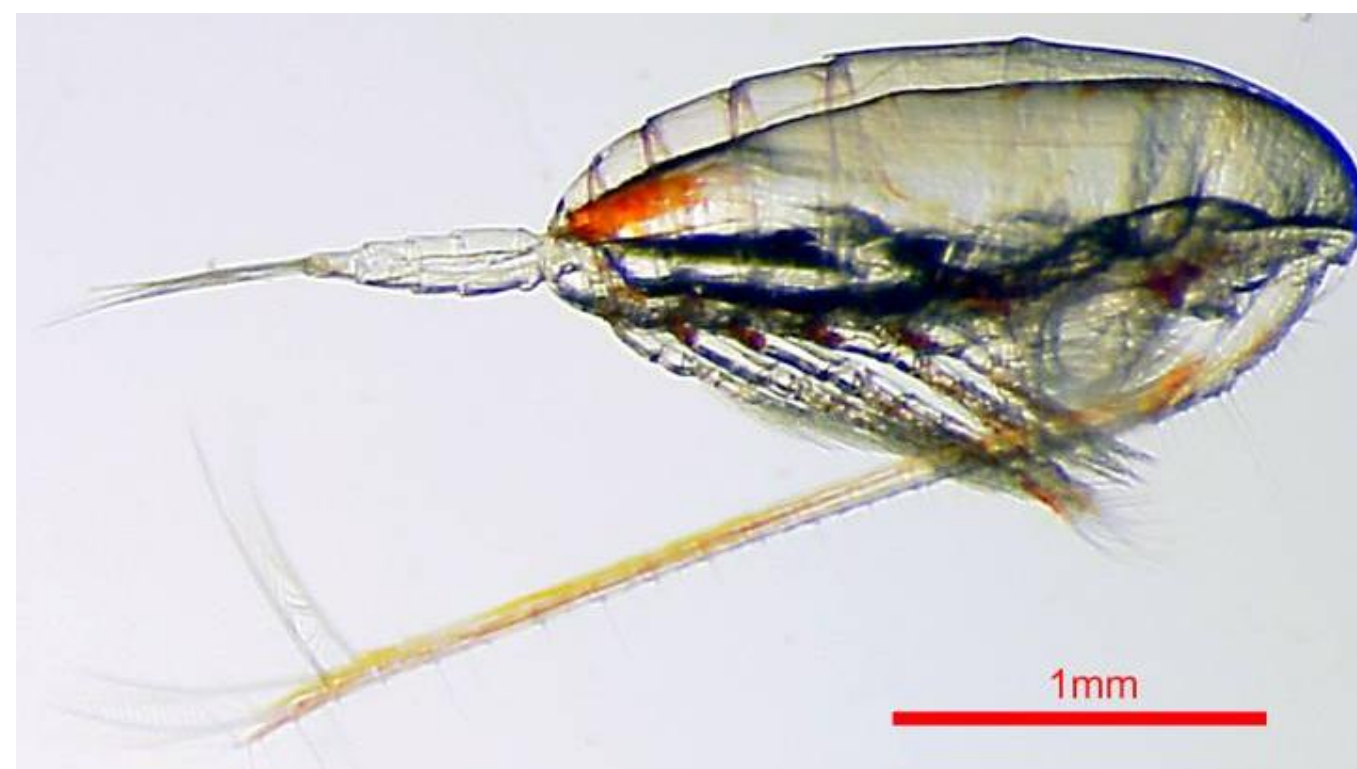


Figure 2. The 72 h time course of plasma EPA+DHA, EPA, and DHA in response to a single serving of wax ester oil or ethyl ester comparator oil. Data presented as mean \pm SEM.

Table 1. Fatty acid profile of wax ester oil.

Fatty Acid (Common Name)	g/100 g
C14:0 (myristic acid)	10.7
C16:0 (palmitic acid)	5.0
C15:0	0.5
C16:1	1.5
C16:3	0.1
C17:0	0.2
C18:0 (oleic acid)	0.4
C18:4 n-9	1.4
C18:1	0.3
C18:2 n-6	0.5
C18:3	0.7
C18:4 n-3 (stearidonic acid; SDA)	7.3
C20:1 n-9	1.5
C20:4	0.2
C22:1 n-11	3.0
C20:5 n-3 (EPA)	6.5
C24:1 n-9	0.4
C22:5 n-3	0.3
C22:6 n-3 (DHA)	3.9



Calanus finmarchicus



Table 2. Baseline characteristics.

	n (%)
Sex	
Male	9 (50.0)
Female	9 (50.0)
Race	
White	13 (72.2)
Black / African American	1 (5.6)
Asian / Pacific Islander	3 (16.7)
Other	1 (5.6)
	Mean \pm SEM
Age, years	38.3 \pm 2.5
Weight, kg	73.1 \pm 3.1
Body BMI, kg/m ²	25.1 \pm 0.6

Table 3. Kinetic parameters for plasma EPA+DHA, EPA, and DHA in response to a single serving of wax ester oil and ethyl ester comparator oil.

Parameter	Ethyl ester oil	Wax ester oil
	Mean \pm SEM	
EPA+DHA		
iAUC _{0-72 h} , $\mu\text{g}\cdot\text{h}/\text{mL}$	764 \pm 93	931 \pm 92
iAUC _{0-48 h} , $\mu\text{g}\cdot\text{h}/\text{mL}$	585 \pm 63	681 \pm 61
iAUC _{0-24 h} , $\mu\text{g}\cdot\text{h}/\text{mL}$	291 \pm 32	335 \pm 30
C _{max} ($\mu\text{g}/\text{mL}$)	77 \pm 5	80 \pm 5
T _{max} (h)	16.4 \pm 2.7	20.3 \pm 3.9
EPA		
iAUC _{0-72 h} , $\mu\text{g}\cdot\text{h}/\text{mL}$	313 \pm 49	514 \pm 47*
iAUC _{0-48 h} , $\mu\text{g}\cdot\text{h}/\text{mL}$	259 \pm 39	381 \pm 31*
iAUC _{0-24 h} , $\mu\text{g}\cdot\text{h}/\text{mL}$	146 \pm 20	190 \pm 14
C _{max} ($\mu\text{g}/\text{mL}$)	23 \pm 2	26 \pm 2
T _{max} (h)	17.3 \pm 4.1	16.9 \pm 3.5
DHA		
iAUC _{0-72 h} , $\mu\text{g}\cdot\text{h}/\text{mL}$	460 \pm 66	438 \pm 75
iAUC _{0-48 h} , $\mu\text{g}\cdot\text{h}/\text{mL}$	327 \pm 41	308 \pm 46
iAUC _{0-24 h} , $\mu\text{g}\cdot\text{h}/\text{mL}$	146 \pm 18	150 \pm 21
C _{max} ($\mu\text{g}/\text{mL}$)	55 \pm 5	55 \pm 5
T _{max} (h)	27.4 \pm 5.5	27.4 \pm 5.4

*Significant difference ($p < 0.05$) compared to ethyl ester oil

Abbreviations: BMI, body mass index; C_{max}, maximal concentration; iAUC, incremental area under the curve; SEM, standard error of the mean; T_{max}, time to maximal concentration

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Oil from the marine crustacean, *Calanus finmarchicus*, appears to be a suitable alternative source of EPA and DHA to help meet daily intake recommendations of these fatty acids.