Can seal oil contribute to better human health?

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Historical background

- Old food lore of seafood
- It makes you smart
- It makes you stay healthy
- Has obtained some support in science
- Dietary habits have changed
- Last 200 years
- Relative total fat, saturated fat and n-6 increased
- Relative n-3 decreased
- Incidents of CHD increased

Adapted from Leaf et al., Am J Clin Nutr, 1987
Greenland Eskimos, on their traditional diet - lower incidence of CHD

(Dyerberg et al., 1978)

- Omega-3 protects against atherosclerosis and thrombosis
  - Marine mammals and Fish
  - Visceral organs (liver, kidney, heart)
  - Raw or minimal processed food
Functional “molecules” from seafood

n-3 (omega-3) Fatty Acids:
  eicosapentaenoic (EPA, 20:5), docosahexenoic acid (DHA, 22:6)

Peptides/ Proteins:
  Fish protein hydrolysates
  Angiotensin converting enzyme (ACE) inhibitors
  Serine protease inhibitors

Amino acids:
  taurine, lysine, histidine, glutamine

Vitamins:  A, D, E and K ...Ubiquinone CoQ10....niacin, B6, B12

Minerals and trace elements:
  potassium, calcium, magnesium, zinc, selenium, iodine

..be aware of the risk of overfocusing single aspects..

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Different types of cholesterol

-HDL-cholesterol: the **good** cholesterol

-LDL-cholesterol: the **bad** cholesterol

Therefore we want to increase HDL-cholesterol and reduce LDL-cholesterol

**HDL-cholesterol is enhanced by:**

- Physical exercise
- Alcohol (red wine is recommended)
- Omega-3 fatty acids (specially in seal-and whale oil

**LDL-cholesterol is reduced by:**

- Intake of fish
- Less intake of saturated fatty acids (bacon, lamb, etc)
- More intake of white meat
- Increased intake of vegetables
Intake of food that contains cholesterol may be beneficial:

Those who don’t have inherited hypercholesterolemi can eat egg and other products which contains cholesterol with a positive effect

Why? The cholesterol in the diet will reduce the production of cholesterol in the liver!
Mechanism of atherogenesis
-a short review
Atherogenesis

Arterial wall

Site of lesion development
Differences in death of chronical diseases between Greenland's eskimos and Danes

<table>
<thead>
<tr>
<th>Disease</th>
<th>Eskimos/Danes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>2/1</td>
</tr>
<tr>
<td>Acute myocardial infarction</td>
<td>1/10</td>
</tr>
<tr>
<td>Psoriasis</td>
<td>1/20</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Rare</td>
</tr>
<tr>
<td>Asthma</td>
<td>1/25</td>
</tr>
<tr>
<td>Thyrotoxicosis</td>
<td>Rare</td>
</tr>
<tr>
<td>Multiple Sclerosis</td>
<td>0</td>
</tr>
<tr>
<td>Epilepsia</td>
<td>2/1</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>Low</td>
</tr>
</tbody>
</table>

LDL trapping in arterial intima

- Binding of LDL to PG in arterial intima:
  - Long LDL residence time (weeks versus min for other tissue)
  - High LDL conc (10-fold higher than in other tissue)
**LDL oxidation**

Oxidation of trapped LDL:
- Minimally modified LDL (MM-LDL)
- Oxidized LDL (OX-LDL)

The oxidation may occur at low speed.
Effects of minimally modified LDL

Monocyte and endothelial release of
- chemoattractant (MCP-1)
- monocyte growth factor (M-CSF)

Smooth muscle cell release of
- chemoattractant (MCP-1)
Effects of minimally modified LDL

- Adhesion of monocytes and T cells to endothelium.
- Migration of monocytes and T cells into intima.
Effects of foam cells

Continued influx of activated inflammatory cells leads to more advanced lesions.
Advanced lesion

Lipid core formation

AHA lesion type IV

Atheroma

Extracellular lipid core

cholesterol

cholesterol ester
Advanced lesions

Intimal smooth muscles cause marked expansion of the intimal lesion due to
- proliferation
- collagen synthesis
- fibrous cap formation

AHA lesion type Va
Rupture of plaque

Fig. 3 Diagrammatic representation of superficial and deep intimal injury.
Effects of marine oils associated with reduction in

- inflammatory reactions
- atherogenesis (development of atherosclerosis)
- thrombus formation
- depression
- psoriasis
- inflammatory bowel disease (IBD)
- ADHD
Platelet activity

• Intake of marine oils reduces the activity of platelets (reduce platelet aggregation, adhesion to vessel wall, generation of pro-inflammatory products)

• Important: Platelets are important in thrombosis, atherosclerosis, myocardial infarcts (MI), brain infarcts (stroke)
Oxidation rate of fatty acids depends largely on number of double bonds

<table>
<thead>
<tr>
<th>Fatty acid</th>
<th>Number of double bonds</th>
<th>Induction period (h) 25°C</th>
<th>Rel. rate of oxidation</th>
</tr>
</thead>
<tbody>
<tr>
<td>18:0</td>
<td>-</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td>18:1</td>
<td>1</td>
<td>82</td>
<td>100</td>
</tr>
<tr>
<td>18:2</td>
<td>2</td>
<td>19</td>
<td>1200</td>
</tr>
<tr>
<td>18:3</td>
<td>3</td>
<td>1.3</td>
<td>2500</td>
</tr>
<tr>
<td>20:5 EPA</td>
<td>5</td>
<td>--</td>
<td>?</td>
</tr>
<tr>
<td>22:6 DHA</td>
<td>6</td>
<td>--</td>
<td>?</td>
</tr>
</tbody>
</table>
Adverse effects of omega-3 fatty acids?

- omega-3 fatty acids are also incorporated in LDL-particles
- particles are thereby more susceptible for oxidation
- increased lesion (atherosclerosis) formation in the vessel wall?
History of clinical studies with marine oils in our laboratory

9 clinical studies

1986   Cod liver oil (CLO)

1987   Concentrate of EPA + DHA (85%, K85=Omacore)

1992   Cold pressed whale oil, refined seal oil, CLO, seal oil/CLO,

1994   Cold pressed and refined whale oils, CLO, seal oil/CLO, olive oil/CLO

1999   Smoked salmon, salmon filet, cod filet, CLO

1999   CLO products from various stages of refinement

2000   Cold pressed and refined whale oil, seal oil, and CLO

2003   Seal oil, CLO, Salmon pate, OliVita

2004   Salmon pate, CLO capsules
In our clinical studies on marine oils (9 studies) we had several interesting observations:
- The beneficial effect of e.g. cold pressed whale oil was superior to cod liver oil despite only half of the omega-3 fatty acids content
- Refinement of marine oils removed a large part of the beneficial effects

**WHY:** Removal of antioxidants and quite possibly other unknown products
### Administration of marine oils; 10 weeks

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control</th>
<th>Seal</th>
<th>Cod liver</th>
<th>Seal+CL</th>
<th>Whale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum: triacylglycerol (TG)</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>total cholesterol</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>HDL cholesterol</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>Coagulation factors:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prothrombin F1 + 2</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>Lipopolysaccharide stimulated(LPS) whole blood:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tumor necrosis factor - α TNFα (monocytes)</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>tissue factor activity (TF) (monocytes)</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>thromboxane B2 (TXB2)</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

- no significance, L lower, H higher, * p< 0.05, ** p< 0.01, *** p< 0.005

Østerud et al., 1995 Lipids, 30 (12): 1111 - 1118.
Seal oil studies
We have performed 4 clinical studies where intake of seal oil was one of the test substances

Results: Similar effects as fish oil except that HDL-cholesterol (the positive cholesterol) is more enhanced with seal oil compared to fish oil and uptake of omega-3 fatty acids from seal oil is better compared to fish oil
Seal oil study in Canada i 1999 (Conquer et al. 96: 239-50)

20 g seal oil per day in capsules for 6 weeks

Results: 2.7 to 4.3 times increase in EPA, and DHA increased between 1.5 to 2.4 times.

DPA increased 0.5 to 0.7 times

Pro-inflammatory fatty acid arachidonic acids was reduced by 26%

Fibrinogen- a protein associated with risk of coronary heart disease was reduced by 18%
Murphy et al 1999; (Lipids 34: 115-24)

Another study from Canada showed that Guinea pigs had a higher rise in omega-3 fatty acids with seal oil compared to fish oil.

Reduced production of thromboxane A$_2$, a product that makes the platelets more sticky, with both marine oils.

10 capsules seal oil per day in 10 persons for 6.

5 capsules seal oil per day in 5 persons for 6 weeks.

Positive changes in fatty acid composition regarding ratio between n-6 and n-3 fatty acids.

Positive effects on an inflammatory product in lymphocytes.
Studies from Bergen:


“Effects of short-term oral administration of dietary marine oils in patients with inflammatory bowel disease and joint pain: A pilot study comparing seal oil and cod liver oil”

CONCLUSION: No significant differences in the two treatment groups were seen; in both groups, the changes in several joint pain parameters, leukotriene B(4) level of plasma, and serum fatty acid profile were putatively favorable.
Development of a new oil mixture
A combination of seal oil and cold pressed olive oil (OliVita)
OliVita has all the positive effects of omega-3 fatty acids; but even more important, excessive antioxidants/anti-inflammatory products that together with the omega-3 fatty acids, prevent inflammatory reactions
Designed to have similar effects as cold pressed whale oil!
The stability of various oils when heated to 70 °C and exposed to oxidation

<table>
<thead>
<tr>
<th>Oil</th>
<th>Hours before start</th>
<th>”Second”</th>
</tr>
</thead>
<tbody>
<tr>
<td>reaction</td>
<td>of oxidation</td>
<td></td>
</tr>
<tr>
<td>Seal oil + olive oil</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Fish oil + olive oil</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Olive oil</td>
<td>&gt; 60</td>
<td></td>
</tr>
<tr>
<td>Soya oil</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Cod liver oil (CLO)</td>
<td>0.5</td>
<td>9.6</td>
</tr>
<tr>
<td>Seal oil</td>
<td>2.1</td>
<td>12.5</td>
</tr>
<tr>
<td>Conc. EPA+DHA</td>
<td>&lt; 5 min</td>
<td></td>
</tr>
</tbody>
</table>
Diet added 15 ml cod liver oil (CLO), OliVita or nothing (Control), % changes in parameters related to coronary heart disease (CHD) before and after intake.

<table>
<thead>
<tr>
<th>Groups</th>
<th>HDL--chol</th>
<th>hsCRP</th>
<th>MCP-1</th>
<th>TxB2</th>
<th>LTB4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0</td>
<td>+5.1</td>
<td>+8.5</td>
<td>0</td>
<td>+36.6</td>
</tr>
<tr>
<td>CLO</td>
<td>+1.4 (i.s.)</td>
<td>+12.5 (n.s.)</td>
<td>-5.2 (0.05)</td>
<td>-14.3 (0.05)</td>
<td>+8.6 (0.001)</td>
</tr>
<tr>
<td>OliVita</td>
<td>+8.3 (0.05)</td>
<td>-24.0 (0.001)</td>
<td>-14.3 (0.005)</td>
<td>-17.6 (0.05)</td>
<td>+8.8 (0.001)</td>
</tr>
</tbody>
</table>
Studies on transgenic mice

Knock out mice (transgenic), who acquire rapidly atherosclerosis were used to detect the effects of dietary oils.

By supplying the diet with various oils we can measure the effect by the quantification of the fatty plaques formed on the vessel wall in these animals.

This gives us a final proof whether the oils may have a beneficial effect on the development of atherosclerosis.
Female control
Female treated with olivita
Female treated with Corn oil
Plaque burden – aortic arch

<table>
<thead>
<tr>
<th></th>
<th>Females</th>
<th>Males</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seal-Oliv</td>
<td>10.46</td>
<td>11.86</td>
</tr>
<tr>
<td>Corn</td>
<td>12.50</td>
<td>10.99</td>
</tr>
<tr>
<td>No oil</td>
<td>4.40</td>
<td>15.01</td>
</tr>
</tbody>
</table>

* indicates a significant difference.
Eskimo advice - for obvious reasons this may not be perceived as an alternative.

"Every day you should eat something from each of the five basic food groups; fried blubber, boiled blubber, stewed blubber, baked blubber and raw blubber."

Copyright 1988 S. Flann
Conclusion:

Eat more seafood and supplement it with a combination of seal oil and olive oil that will provide sufficient antioxidants to prevent inflammatory reactions in your body.
Thank you for your attention!
What causes cardiovascular diseases?

- Inheritance
- High LDL-cholesterol and low HDL-cholesterol
- Diabetes
- High blood pressure
- Lack of physical activity
- Smoking
- Overweight

Amplifying factors:
- milieu-social status
- bacteria
- unhealthy diet