Maternal intake of fish oil during pregnancy and blood pressure in the 19 year old offspring

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The Power of Programming
Background

N-3 Polyunsaturated fatty acids (PUFA)

- Essential fatty acids
- Long chain n-3 PUFA mainly found in fatty fish
  - Docosahexaenoic acid (DHA)
  - Eicosapentaenoic acid (EPA)
Background
Fetal Programming and N-3 PUFA

• Important constituent of cell membranes
  • Development of different tissues
  • Function of membrane bound receptors and channels
• Precursor of hormones/secondary messengers.
• Energy reserve (adipose tissue)
Programming of blood pressure and N-3 PUFA

DEF=PUFA deficient diet
CON=PUFA containing diet

FIG. 1. Effect of dietary fatty acid supply on mean arterial blood pressure. Groups are labeled according to the diets consumed before and after 9 wk of age. Diets were semisynthetic premixtures, either supplemented (CON) or deficient (DEF) in n-3 polyunsaturated fatty acids (see Table 1 for details). *Significantly higher than all other groups (P < 0.05); †significantly higher than CON-CON (P < 0.05).


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Programming of blood pressure and N-3 PUFA

Table 5  Blood pressure (mm Hg) at age 6 years in children who as infants had been randomised to be fed with formula supplemented with long chain polyunsaturated fatty acids or with formula without supplementation

<table>
<thead>
<tr>
<th>Blood pressure</th>
<th>Supplemented formula (n=65)</th>
<th>Formula without supplementation (n=71)</th>
<th>Mean difference (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>74.8</td>
<td>77.8</td>
<td>-3.0 (-5.4 to -0.5)</td>
<td>0.02</td>
</tr>
<tr>
<td>Diastolic</td>
<td>57.3</td>
<td>60.9</td>
<td>-3.6 (-6.5 to -0.6)</td>
<td>0.018</td>
</tr>
<tr>
<td>Systolic</td>
<td>92.4</td>
<td>94.7</td>
<td>-2.3 (-5.3 to 0.7)</td>
<td>0.132</td>
</tr>
</tbody>
</table>

Hypotheses

Fish oil supplementation during pregnancy decreases blood pressure in the 19-20 year old offspring.
Randomized controlled trial from Aarhus 1990

- 533 healthy women in third trimester
- Randomised to fish oil (2.7 g n-3 LCPUFA/day), olive oil or no oil (2:1:1)
- Dietary interview before and after delivery
Follow-up

• 18-19 year old offspring from the randomized controlled trial (n=517)
  - Web-based questionnaire
    • Health
    • lifestyle
  - Physical examination
    • Anthropometry
    • Blood pressure and HRV
    • Blood and urin sampling
Blood pressure measurements

• 7 minutes rest
• Measured with automatic blood pressure device 3 times (2 minutes in between)
• Mean of the last two measurements used in the analysis
Participation

- Invited to fill out questionnaire: 517
- Filled out questionnaire: 382
- Invited to physical examination: 360
- Participated in physical examination: 243
## Results

### RCT: Systolic blood pressure

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Mean Systolic blood pressure (mmHg) (SD)</th>
<th>*Difference in systolic blood pressure (mmHg) (SE)</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish oil (n=108)</td>
<td>108.71 (9.64)</td>
<td>-0.48 (1.47)</td>
<td>-3.38-2.41</td>
</tr>
<tr>
<td>Olive oil (n=72)</td>
<td>109.19 (9.63)</td>
<td>ref</td>
<td>-</td>
</tr>
<tr>
<td>No oil (n=63)</td>
<td>109.02 (10.49)</td>
<td>-0.17 (1.73)</td>
<td>-3.60-3.25</td>
</tr>
</tbody>
</table>

*Crude difference in blood pressure compared to olive oil*
## Results

### RCT: Diastolic blood pressure

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Mean Diastolic blood pressure (mmHg) (SD)</th>
<th>*Difference in diastolic blood pressure (mmHg) (SE)</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish oil</td>
<td>63.69 (5.75)</td>
<td>1.12 (0.87)</td>
<td>-0.60-2.84</td>
</tr>
<tr>
<td>Olive oil</td>
<td>62.56 (5.70)</td>
<td>ref</td>
<td>-</td>
</tr>
<tr>
<td>No oil</td>
<td>64.21 (6.28)</td>
<td>1.64 (1.03)</td>
<td>-0.40-3.68</td>
</tr>
</tbody>
</table>

*Crude difference in blood pressure compared to olive oil
Conclusion

Fish-oil supplementation during third trimester of pregnancy does not influence offspring blood pressure in adolescence.
Co-Workers

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