The importance of Omega-3 fatty acids in children's diets

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Abstract
The 3 main types of fat in our diet are saturated fat, monounsaturated fat and polyunsaturated fat. Saturated fatty acids do not contain any carbon double bonds, as the fatty acid is fully saturated with hydrogens. Monounsaturated fatty acids, as the name suggests contain fatty acids with one carbon double bond (i.e. mono meaning one) and likewise polyunsaturated fatty acids contain two or more carbon double bonds.

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Omega-3 polyunsaturated fatty acids, especially the long chain omega-3s docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), are essential nutrients throughout life, particularly during the growing years. They are important for the proper functioning of every cell in the body especially the brain, eye and heart. Evidence suggests that deficiencies may contribute to behaviour and learning disorders such as ADHD, dyslexia and autism. The best sources of long chain omega-3 fats are fish and seafood, foods enriched with omega-3s and red meat. Children may not be getting enough DHA and EPA if they do not eat enough of the foods rich in these nutrients particularly fish—fresh or canned (salmon, tuna, sardines, gemfish). Health professionals need to encourage parents and carers to serve fish/seafood twice a week.

In this issue of HeinzSight, Dr Barbara Meyer discusses the importance of omega-3 fatty acids in children’s diets. She raises the question that the current dietary recommendations may be set too low.

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Dr Barbara Meyer is Associate Professor in the School of Health Sciences at the University of Wollongong, teaching nutrition and pathophysiology. Her expertise in cardiovascular disease research, particularly the role of omega-3 fatty acids is recognised nationally and internationally. Her research in collaboration with Professor Peter Howe was used in the development of the National Health and Medical Research Council (NHMRC) recently released Nutrient Reference Values (NRV) for omega-3 polyunsaturated fatty acids.

The importance of Omega-3 fatty acids in children’s diets

What are omega-3 fatty acids?

The 3 main types of fat in our diet are saturated fat, monounsaturated fat and polyunsaturated fat. Saturated fatty acids do not contain any carbon double bonds, as the fatty acid is fully saturated with hydrogens. Monounsaturated fatty acids, as the name suggests contain fatty acids with one carbon double bond (i.e. mono meaning one) and likewise polyunsaturated fatty acids contain two or more carbon double bonds.

Polyunsaturated fats can be further classified as either omega-6 or omega-3 polyunsaturated fatty acids. The difference between these two types of fats is the location of the first double bond - either on carbon number 3 (omega-3) or carbon number 6 (omega-6).

While polyunsaturated fats as a group are healthy, there is more scientific evidence suggesting that omega-3 polyunsaturated fatty acids are associated with more health benefits than omega-6 polyunsaturated fatty acids. Our diet provides us with four main types of omega-3 fatty acids. Their chemical names and frequently used abbreviated names are shown in Table 1.

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Abbreviated Name</th>
<th>Main Food Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha-linolenic acid</td>
<td>ALA or LNA</td>
<td>Flaxseeds, canola, walnuts</td>
</tr>
<tr>
<td>Eicosapentaenoic acid</td>
<td>EPA</td>
<td>Fish and seafood, meat, eggs</td>
</tr>
<tr>
<td>Docosapentaenoic acid</td>
<td>DPA</td>
<td>Meat, fish and seafood, eggs</td>
</tr>
<tr>
<td>Docosahexaenoic acid</td>
<td>DHA</td>
<td>Fish and seafood, meat, eggs</td>
</tr>
</tbody>
</table>

Why are omega-3 fatty acids important?

Alpha-linolenic acid (ALA) is an essential nutrient because it can't be synthesised by the body but must be consumed in our diet. ALA once consumed can be converted to eicosapentaenoic acid (EPA), docosapentaenoic acid (DPA) and docosahexaenoic acid (DHA) which are collectively known as the long chain omega-3 polyunsaturated fatty acids (LC n-3 PUFA). Figure 1. However as the amount we are able to synthesise is minimal, the physiological relevance of this is questionable. Hence it is probably better that we consume preformed LC n-3 PUFA.
Figure 1: Conversion of Polynsaturated Fatty Acids to LCPUFA of the Omega-3 and Omega-6 series.

A great number of health benefits have been attributed to omega-3 fatty acids. ALA has been linked to a potential 40% risk reduction in sudden cardiac death and also aids in bone resorption thus maintaining healthy bones.

DHA is particularly important for neurological development and organs like the brain, eyes and heart muscle accumulate a great amount of DHA. It is particularly important during the third trimester of pregnancy when the growing foetus accretes the bulk of its brain matter.

Apart from these organs already mentioned, every cell in our body contains omega-3 fatty acids, as part of the cell membrane phospholipids. A balance between the omega-3 and omega-6 fatty acids in cells must be maintained.

Consuming too much omega-6 and/or not enough omega-3 fatty acids, will put cells out of balance and may result in a potentially pro-thrombogenic and pro-inflammatory state.

The health benefits of LC n-3 PUFA are significant. These include:

- reduction in the risk of blood clotting
- improvements in high blood pressure
- reductions in blood triglycerides
- improvements of arterial compliance (elasticity of blood vessels) and heartbeat disturbances

How much omega-3 fatty acids are children eating?

The intakes of omega-3 fatty acids are shown in Table 2. The current average level of ALA consumption would not lead to ALA deficiency. The National Health & Medical Research Council (NHMRC) used this data to derive the Adequate Intake (AI) recommendations for Australians (NHMRC NRV 2006). Other organisations are recommending higher intakes for adults. The British Nutrition Foundation, European Academy of Nutritional Sciences and the International Society for the Study of Fatty Acids and Lipids (ISSFAL) recommend 2g (2000mg) per day of ALA and 0.21-1.0g (210-1000mg) per day for LC n-3 PUFAs.

How much omega-3 fatty acids do children need?

It is difficult to determine exactly how much children need as little research has been done. The NHMRC used the published data in Table 2 and released Adequate Intakes (AI) for children, adolescents and adults. ‘Adequate Intake’ is defined as ‘the average daily nutrient intake level that is based on observed or experimentally-determined approximations or estimates of nutrient intake by a group (or groups) of apparently healthy people that are assumed to be adequate’.

However, the prevalence of diseases linked to LC n-3 PUFA deficiency such as Attention Deficit Hyperactivity Disorder (ADHD) and asthma are high. The incidence of ADHD is 11% while the parent rating prevalence of asthma has been reported to be 11-15%. Clinical trials suggest a beneficial effect of supplementing children with ADHD with LC n-3 PUFA. Doses of 560mg to 732mg LC n-3 PUFA for 12 to 16 weeks have been effective in improving behavioural outcomes. Given these high incidence rates, Australian children may not be consuming enough LC n-3 PUFA in their diets and the suggested AI for LC n-3 PUFA may be too low.

Table 2: Intakes of omega-3 fatty acids (mg per day)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>ALA</th>
<th>EPA</th>
<th>DPA</th>
<th>DHA</th>
<th>Total LC n-3 PUFA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-3</td>
<td>680</td>
<td>10</td>
<td>5</td>
<td>24</td>
<td>40</td>
</tr>
<tr>
<td>4-7</td>
<td>810</td>
<td>19</td>
<td>10</td>
<td>47</td>
<td>76</td>
</tr>
<tr>
<td>8-11</td>
<td>1080</td>
<td>30</td>
<td>17</td>
<td>60</td>
<td>106</td>
</tr>
<tr>
<td>12-15</td>
<td>1220</td>
<td>32</td>
<td>22</td>
<td>63</td>
<td>117</td>
</tr>
<tr>
<td>16-18</td>
<td>1290</td>
<td>41</td>
<td>20</td>
<td>77</td>
<td>138</td>
</tr>
<tr>
<td>19+</td>
<td>1170</td>
<td>56</td>
<td>26</td>
<td>106</td>
<td>189</td>
</tr>
</tbody>
</table>

Table 3: Current Australian intakes of omega-3 fatty acids versus NHMRC recommendations

<table>
<thead>
<tr>
<th>Age (yr)</th>
<th>Approx ALA Intake (median)</th>
<th>Approx LC n-3 PUFA Intake (median)</th>
<th>Age (yr)</th>
<th>NHMRC Recommended ALA Intake (AI)</th>
<th>NHMRC Recommended LC n-3 PUFA Intake (AI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-3</td>
<td>544</td>
<td>32</td>
<td>1-3</td>
<td>500</td>
<td>40</td>
</tr>
<tr>
<td>4-7</td>
<td>648</td>
<td>61</td>
<td>4-8</td>
<td>800</td>
<td>55</td>
</tr>
<tr>
<td>8-11</td>
<td>864</td>
<td>85</td>
<td>9-13</td>
<td>1000 (boys), 800 (girls)</td>
<td>70</td>
</tr>
<tr>
<td>12-15</td>
<td>976</td>
<td>94</td>
<td>14-18</td>
<td>1200 (boys), 800 (girls)</td>
<td>125 (boys), 85 (girls)</td>
</tr>
<tr>
<td>16-18</td>
<td>1032</td>
<td>110</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3 shows that children 4-8 years and boys 9-18 years may not reach the AI for ALA while children 2-3 years and boys 14-18 years may not reach the AI for LC n-3 PUFA. Given the high rates of ADHD and asthma, questions are being raised as to whether the AIs suggested by the NHMRC are adequate.

As mentioned previously, the synthesis of DHA from ALA in the body is extremely limited. One classic study, conducted in children suffering from amino acid metabolism disorders demonstrates this very elegantly. These children need to restrict their dietary intake of protein rich foods such as fish, seafood, meat and eggs as these foods contain amino acids. Restricting these foods also limits their intake of LC n-3 PUFA as these foods are important sources. Vegetable based foods are primarily consumed, those being generally rich in the shorter chain omega-6 LA and omega-3 ALA, precursors of the LCPUFA. Compared to a control group of healthy children, intakes of AA were lower, 2.2mg vs 17 mg. However the blood levels of AA were similar in both groups suggesting that the conversion of LA to AA in the body is sufficient.

Table 2: Intakes of omega-3 fatty acids (mg per day)
Intakes of DHA were also lower — 1 mg versus 36 mg, but the blood levels of DHA were 30% lower than those in the healthy children. This suggests that DHA should be consumed directly from foods rich in DHA, as the conversion from ALA to DHA is ineffective.

A Scientific Consensus Workshop held recently by the Omega-3 Centre suggested an intake of 500 mg per day of the LC n-3 PUFA for children aged 14 years and over.17

**Foods sources of omega-3 fatty acids**

The best food sources of ALA are:

- flaxseed oil
- canola products (spreads and oils)
- soybean oil
- walnuts
- pecan nuts and 
- vegetables like broccoli.

Children, like adults consume 5-6 times more meat than fish/seafood (Figure 2) and yet fish/seafood, especially fatty fish is still the largest contributor to LC n-3 PUFA intakes (Figure 3). Meat contributes a similar amount of LC n-3 PUFA as lean fish (Figure 3).19

Some children do not like or are allergic to fish/seafood. For these children foods enriched with LC n-3 PUFA provide an alternative source of LC n-3 PUFA. Some of these fortified foods include breads, muffins, orange juice, spreads, milk, dips, yoghurt and spaghetti.

![Figure 2. Children's Daily intake of Fish, Meat and Egg](image)

**Summary**

- Omega-3 fatty acids are essential nutrients for health (brain, eyes, heart, and joints) and are important in children's diets.
- The long chain omega-3 polyunsaturated fatty acid DHA is particularly important for children's brain development. It may also have positive effects on behaviour and asthma.
- The conversion of the shorter chain omega-3 fatty acid ALA to LC n-3 PUFA, DHA and EPA is not efficient in the body. It is important that children consume foods containing LC n-3 PUFA in their diet such as fish/seafood, red meat, eggs and foods enriched with them.
- Children may not be getting their required intake of LC n-3 PUFA and the current NH&MRC Nutrient Reference Values may not be high enough.

**Editors Note:** LC omega-3 PUFA are found in all Heinz® Nurture GOLD infant formulas and GOLD Toddler Milk. One 230 ml serve of Heinz® Nurture Gold Toddler Milk, and one 100g serve of Heinz® Little Kids Tuna Mini Meals each provide at least 40 mg of LC omega-3 PUFA, the daily Adequate Intake (AI) for a 1-3 year-old. One 95 g can of Greensseas® tuna provides 210 mg of LC omega-3 PUFA.

**References**