

# The role of fats in the lifecycle stages

## Pregnancy and the first year of life

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THE HIGH BIRTHWEIGHTS and long duration of pregnancies observed in the fish-eating community of the Faroe Islands in the North Atlantic led to the suggestion that fatty acids from marine food could delay spontaneous delivery and increase birthweight.<sup>1</sup> Likewise, the low incidence of pre-eclampsia observed in Greenland Inuit<sup>2</sup> provided a basis for the first suggestion that fish oil could prevent this condition. The plausibility of these hypotheses was strengthened by the fact that fish oil (omega-3) fatty acids such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) may alter eicosanoid/cytokine balance to modulate vasoconstriction and endothelial damage associated with gestational hypertension, delay the initiation of labour and cervical ripening, and relax the myometrium.

Based on this evidence, a number of randomised trials of fish oil supplementation during pregnancy have been undertaken to prevent pre-eclampsia, prevent preterm birth and to increase birthweight. The review of the 10 available trials indicates that fish oil supplementation during pregnancy has a small effect on prolonging gestation, with the effect being greatest in women at high risk of preterm birth, although not apparent in women with twin pregnancies.<sup>3,4</sup> There appears to be no benefit of fish oil supplementation on preventing pre-eclampsia or increasing birth weight.<sup>3,4</sup> Collectively, these data do not support routine fish-oil supplementation for the primary prevention of pre-eclampsia, preterm birth and low birthweight, but the role of fish-oil treatment in preventing recurrent preterm delivery is worthy of further investigation.<sup>3,4</sup>

Until 2001, there were no published trials that followed infants beyond the neonatal period to determine if fish-oil supplementation in pregnancy influences the growth or development of the child. The only available study used the Fagan test as an indicator of cognitive function and growth to one year of age. This study shows neither harmful nor beneficial effects of maternal fish oil supplementation on cognitive development or growth.<sup>5</sup>

All the pregnancy intervention studies supplemented women with high doses of fish oil that had much higher contents of EPA than DHA.<sup>3-5</sup> However, it is DHA that has

### Summary

- Fish oil supplementation during pregnancy has been tested in several trials, with small positive effects on length of gestation; there have been no beneficial or harmful effects on cognitive development or growth of infants as a result of fish oil supplementation in pregnancy.
- The strongest evidence for good developmental outcomes for infants supports breastfeeding for at least six months.
- Preterm infants are at the greatest risk of DHA deficiency and there is strong evidence for the positive effects of DHA on visual and cognitive outcomes that has resulted in all Australian preterm formulas being supplemented with DHA.
- Debate continues about the importance of DHA supplementation for term infants; the current consensus is that the benefits of DHA supplementation in term infants are smaller than for preterm infants.

been postulated to be important for the neurobiological development of infants. High levels of DHA are found in the grey matter of the cerebral cortex and in the retina. The fetus and the newborn are dependent on a high supply of DHA from their mothers, either via the placenta or via breast milk.

### Preterm infants

DHA is most actively accreted into the brain during the last trimester of pregnancy. Preterm infants who are denied this flow of DHA from the placenta are born with reduced fat stores and have a low capacity to synthesise DHA from precursor fatty acids.<sup>6</sup> Collectively, this makes them vulnerable to disturbed fatty acid accretion and at risk of deficiency.

The focus of research attention has been the effect of dietary DHA on measures of development. Twelve trials designed to test the effect of dietary DHA on the growth or development of preterm infants have been reported. All randomly assigned infants to either a DHA-supplemented or DHA-unsupplemented formula.<sup>7</sup> All trials that assessed visual acuity development reported a beneficial effect of DHA supplementation. However, only three trials included more global measures of neurodevelopment. While two of these trials were small and reported little or no effect of diet,<sup>7</sup> the remaining, largest trial to date reported, in separate subgroups, eight-point advantages in both Bayley psychomotor development at 12 months corrected age, and language development at 14 months corrected age, to infants fed formulas with DHA compared with controls.<sup>8</sup>

Although trials involving preterm infants have almost universally shown some improvement in developmental indices of preterm infants supplemented with DHA, some

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early studies that supplemented infants with fish oil containing both DHA and EPA showed poorer weight and length gain in supplemented versus unsupplemented infants. It was suggested that the poorer growth rates were associated with the reduction in plasma levels of the omega-6 long-chain fatty acid arachidonic acid (AA) caused by these fish oils.<sup>7</sup> Subsequent studies have avoided high EPA oils, have added AA and have shown no growth differences between supplemented and unsupplemented infants.<sup>7</sup>

Based on these findings supplementation of preterm infant formulas with both DHA and AA has been recommended,<sup>9,10</sup> and, in Australia, all available preterm formulas are supplemented. Further work is needed to determine the effect of supplementation on long term neurodevelopmental outcomes in children.

### The breastfed and the formula-fed term infant

DHA is never completely absent from breast milk, but its level is largely determined by the mother's diet. For example, vegan women who consume no animal products have the lowest levels of DHA in their breast milk compared with women on omnivorous diets, while women who regularly eat fish have the highest levels of DHA in their milk.<sup>3</sup>

Developmental outcomes in breastfed infants are consistently reported to be better than formula-fed infants, and it has been hypothesised that one contributing factor may be DHA in breast milk. For this reason, randomised trials of supplementing formula with DHA at levels equivalent to those found in breast milk have been undertaken. These trials have shown either a small statistically significant positive benefit or no effect of DHA supplementation on developmental indices.<sup>7</sup> No trials have consistently shown a negative effect on either growth or development.<sup>7</sup> That the effect of supplementation is positive or neutral implies that any benefit is likely to be small, and this is no surprise, as term infants have had the benefit of a full in-utero supply of DHA as well as other nutrients.

To ensure the best developmental outcomes for their infants, women are encouraged to breastfeed to at least 6 months of age, and preferably longer. If this is not possible, some committees have recommended the use of long-chain polyunsaturated fatty acid (PUFA) supplemented formulas.<sup>9,10</sup> These recommendations are, however, not unanimously supported or universally implemented. In Australia, there are a number of formulas supplemented with long-chain PUFAs for term infants.

### The weaning diet

Weaning foods are generally low in fat content and low in DHA content. There have been few studies designed to assess the effect of solid-food interventions on DHA status, growth and development. Because of the low fat content of most weaning foods and the fact that the volume of food consumed is relatively small, it is difficult to increase DHA intake of the weaning infant without specific enrichment. Omega-3-enriched eggs have been shown to substantially

increase the DHA intake and status of young children without changing their growth rates.<sup>11</sup> Whether there is any influence on developmental outcomes is not known.

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