

Concurrent Session 11: Fish and Omega-3 Fatty Acids

Development of land plants containing long-chain omega-3 oils

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Background – Long-chain ($\geq C_{20}$) omega-3 oils [e.g. EPA, 20:5(n-3) and DHA, 22:6(n-3)] have health benefits against coronary heart disease, rheumatoid arthritis and other disorders, and are essential for infant development. Fish oils are the main source of LC omega-3 oils, however, global fish harvests may be unsustainable, indicating a need for new sources of these unique oils. Microalgae are the primary sources of LC omega-3 oils which are transferred up the marine food chain, and ultimately into humans through consumption of seafood.

Objective – Transfer LC-polyunsaturated fatty acid (LC-PUFA) genes from Australian microalgae to land plants.

Design – The research allows the possibility of achieving sustainable production of land plant sources of LC omega-3 oils. Other research focusses on incorporation of these beneficial oils into farmed fish, animals and food products.

Outcomes – A suite of desaturase and elongase genes have been isolated from microalgae, characterized and transferred to *Arabidopsis*, with EPA and DHA produced in oil seeds. SDA and GLA containing cottonseed oil have been achieved, with other oilseed plants containing LC omega-3 oils under development. SDA containing *Echium* oil has been used to enrich farmed Atlantic salmon and other livestock (e.g. chickens) with SDA, and via subsequent conversions, EPA and DPA. LC omega-3 oil is more resistant to rancidity when DHA is located at the TAG sn-2 position compared to sn-1(3).

Conclusions – LC omega-3 oils from higher plants offer alternative sources for use in human nutrition, biomedical applications and aquaculture and other feeds.

Higher dietary docosahexaenoic acid in the neonatal period improves visual acuity of preterm infants: the results of a randomised controlled trial

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Background – The n-3 long-chain polyunsaturated fatty acid, docosahexaenoic acid (DHA), accumulates in retinal photoreceptors during fetal development. Infants born preterm are denied the usual intrauterine supply of DHA. Preterm infants fed formulas enriched with 0.2-0.4% (of total fat) as docosahexaenoic acid (DHA) have improved visual outcomes compared with infants fed no DHA, but the optimal dose of DHA is unknown.

Objective – To assess visual responses of preterm infants fed human milk (HM) and formula with a DHA concentration estimated to match the intrauterine accretion rate (high-DHA group) compared with infants fed HM or formula with DHA concentration according to current clinical practices (control group).

Design – Double-blind randomised controlled trial in preterm infants born <33 weeks gestation. Mothers providing breast milk consumed 3 g of oil in capsules containing either soy oil (no DHA) or tuna oil (900mg DHA) that resulted in human milk with either a standard (0.2%) or high dose (1.0%) of DHA. Infants requiring supplemental milk were fed a preterm formula with a matching DHA composition. Infants were fed the test diets from enrolment (within 5 days of commencing enteral feeds) until reaching their due date. Sweep visual evoked potential (VEP) acuity and latency were assessed at 2 and 4 months corrected age (moCA). Weight, length and head circumference was assessed at the end of the intervention, 2 and 4 moCA.

Outcomes – At 2moCA, acuity of the high-DHA group did not differ from control. By 4 moCA infants in the high-DHA group achieved significantly higher visual acuity (by 1.4 cpd) than the control group ($p < 0.05$). VEP latencies and anthropometric assessments did not differ between the high-DHA and control groups.

Conclusion – By improving visual acuity of preterm infants through DHA supplementation, this trial suggests that the DHA requirement of preterm infants may be higher than currently supplied by preterm formula or in human milk of Australian women.