

## Plenary 1: Nutrition and Cognition

### Associations between Omega-3 and Omega-6 polyunsaturated fatty acids and cognitive functioning in older adults

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**Background** – The omega-3 (*n*-3) long-chain polyunsaturated fatty acids (PUFA) eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are crucial to brain development and normal brain functioning (1). DHA is particularly important to brain functioning due to its influence on neural cell signalling (2). There is emerging consensus that *n*-3 PUFA may have a significant role in limiting cognitive decline during ageing. DHA concentration in the brain decreases with age in humans (3) and rats (4); and such change is postulated to relate to age-related deterioration in central nervous system functions. Evidence from animal studies supports this; animals fed a low *n*-3 PUFA diet show cognitive deficits (4) that are ameliorated by DHA supplementation (5). DHA also improves memory performance in aged mice (6). Evidence emerging in human studies also suggests a link between *n*-3 PUFA and cognition in ageing. Low total *n*-3 plasma levels have been associated with the presence of dementia (7) in one study. Greater total *n*-3 PUFA and DHA concentrations in erythrocyte membranes (8) and total plasma *n*-3 long-chain PUFA (9) have been inversely correlated with cognitive decline while higher DHA plasma content has been associated with less risk of developing all-cause dementia (10). Total erythrocyte *n*-3 PUFA, DHA, and omega-6 (*n*-6) to *n*-3 PUFA ratio have been associated with better cognitive function in older age (11). However, results from such observational studies are still inconclusive.

**Objective** – The objective is to examine relationships between erythrocyte membrane levels of *n*-3 and *n*-6 PUFAs and cognitive functioning, comprehensively assessed, in a sample of cognitively-healthy (MMSE > 23) older participants.

**Design** – A parallel, randomised, double-blind, placebo-controlled 18-month trial with repeated measures every 6 months, totalling 4 measurement points. Intervention: fish-oil with 1800mg DHA and 540mg EPA or placebo (low-polyphenol olive oil) capsules daily. Participants: 391 (46.3% male) community-dwelling adults, aged 65-90 years ( $M = 73.1$ ,  $SD = 5.5$ ), with a mean of 12.9 years of education ( $SD = 3.8$ ). Main outcome measures: The cognitive domains assessed are working memory, fluid intelligence, short-term memory, long-term memory and retrieval, inhibition, processing speed and perceptual speed. Multiple tasks are used to measure each cognitive domain. Factor scores representing each cognitive domain constitute the dependent variables used in analyses. The factor scores are derived from good fitting confirmatory factor analytic models of the cognitive domains.

**Outcomes** – Multiple regression will be used to examine relationships in the baseline data between erythrocyte membrane levels of *n*-3 and *n*-6 PUFA and the cognitive domains, controlling for possible confounding factors including physical activity, smoking status, age, and years of education.

**Conclusions** – Conclusions will be drawn based on the results.

#### References

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