Concurrent Session 10: Omega 3s

Technologies for bioprotection of marine omega-3 fatty acids

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Background - The life-prolonging benefits of regular consumption of long chain essential PUFAs, particularly marine omega-3 are now well recognized. Literature evidence exists for health benefits including; prevention of cardiovascular diseases (thrombosis, cardiac arrhythmias, sudden cardiac death, hypertension), inflammatory diseases (rheumatoid arthritis, ulcerative colitis, lupus, psoriasis), dyslexia and conditions of hyperactivity and depression.

Objective - Omega-3 oils are costly ingredients and it is critical, if omega-3 functional foods are to be produced at realistic prices, to maximise absorption (bioavailability) in the gastro-intestinal tract and thus minimise the required levels of the oils in food. Microencapsulation is a technology of entrapping some active materials or ingredients into a sealed matrix which can release their contents at controlled rates under specific conditions.

Method - The problems of eliminating undesirable fishy odour and taste have largely been overcome using microencapsulation technology with our research group making important contributions to solving these problems. Novel technology for making nano-emulsions containing high levels of omega-3 has been developed in our laboratory, and recently patented. Concurrently, these oils have been encapsulated in food-grade biopolymer matrices in the form of nanoparticles or microparticles with a view to developing systems for targeted delivery to the lower gastrointestinal tract. Interfacial engineering techniques have been used to deposit these materials onto the surface of small emulsion droplets, containing high concentrations of omega-3 fatty acids.

Results - The results showed that the designed multilayered emulsions and microparticles were resistance to harsh conditions of gastric environment without release of oil droplets while they disintegrate or collapse slowly to provide sustained release of oil in the lower intestine. All the polymeric particles loaded with omega-3 emulsions were found to be stable in simulated gastric fluid (SGF), even in presence of pepsin enzyme. The release of intact emulsions was observed in the simulated intestinal fluid (SIF). These polymeric microparticles also showed protection of omega-3 fish oil from oxidation.

Conclusions - The absorption of these oil droplets in the small intestine is expected to enhance the bioavailability of omega-3 fatty acids. The local absorption of omega-3 fatty acids in the colon will be beneficial for preventing the inflammatory bowel disease and colon cancer.

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Nutrition, learning and behaviour: omega-3 fatty acids and micronutrients for childhood developmental difficulties

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The brain requires a range of synergistically acting nutrients to function optimally. Accordingly, there is evidence that nutrition is important not only for children’s health but also for their learning and behaviour. Particular attention has been given in recent decades to the role of omega-3 polyunsaturated fatty acids (PUFA) in the brain and mental health. Over half of the dry weight of the brain is composed of lipids, of which about 35% are phospholipids containing omega-6 PUFA arachidonic acid (AA) and omega-3 PUFA docosahexaenoic acid (DHA). DHA is highly concentrated in neural phospholipids, with important roles associated with membrane fluidity and neural transmission. Its precursor eicosapentaenoic acid (EPA) is required for synthesis of eicosanoids with a range of biological functions including anti-inflammatory, anti-thrombotic and vasodilatory effects. Consumption of omega-3 PUFA has declined in Western societies and low omega-3 levels have been associated with a range of psychiatric conditions including developmental disorders in childhood. It is of concern to note that 14% of Australian children suffer from a mental health problem, with the most commonly occurring symptoms being those associated with attention deficit hyperactivity disorder (ADHD). A recent study conducted in South Australia found improvements in these symptoms, notably hyperactivity, impulsivity and inattention, following omega-3 supplementation, supporting results of a similarly large study in the UK. More work needs to be done in this area to identify children most likely to benefit from supplementation, underlying biological mechanisms, the nature of the PUFA supplement that assists with symptoms, and objective cognitive and academic outcomes. Furthermore, a number of nutrients are involved in PUFA metabolism and functions, and children with ADHD have also been identified as having deficiencies in nutrients such as zinc and magnesium. Therefore future studies could also explore combined nutritional influences on learning and behaviour in children.