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Systematic review to evaluate the oxidative stability of omega-3 nanoemulsion systems suitable for functional food enrichment

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There is increasing evidence in studies conducted over recent decades that numerous health benefits are associated with the consumption of long chain omega-3 (ω−3) polyunsaturated fatty acids (LCω3PUFA) throughout the human lifecycle[1]. This has created a demand for functional food products enriched with LCω3PUFA. Nanoemulsions, systems with extremely small droplet sizes have been shown to increase LCω3PUFA bioavailability[2]. However, nanoemulsion creation and processing methods may impact on the oxidative stability of these systems due to small lipid droplet sizes and large droplet surface areas[3]. This study aimed to systematically review published literature that focused on the oxidative stability of LCω3PUFA nanoemulsions suitable for integration into food vehicles.

The review followed the PRISMA checklist for systematic reviews. Searches were conducted and titles and abstracts screened for relevance by two independent review authors (KEL, LB or LS). Studies were included in the review if they evaluated the oxidative stability of LCω3PUFA nanoemulsions suitable for food enrichment and were published from January 2007 to July 2017.

The search criteria identified 1880 articles, which were reduced to 1403 upon abstract and title screening. Further application of inclusion/exclusion criteria led to the identification of 17 key studies. Researchers used a range surfactants and antioxidants to create systems which, were evaluated during 7 to 100 days of storage. Nanoemulsions were created using high and low power methods with synthetic and natural emulsifiers. Natural emulsifiers offered equivalent or increased oxidative stability compared to synthetic sources, which is useful as consumers are demanding natural, cleaner label food products[4]. LCω3PUFA source oils evaluated included fish (n = 9), flaxseed (n = 2), algae (n = 3), krill (n = 2), walnut (n = 1). Equivalent vegetarian sources of LCω3PUFA to those found in fish oils such as algal oils show potential as they provide direct sources without the need for conversion in the human metabolic pathway. Quillaja saponin is a promising natural emulsifier that can produce nanoemulsion systems with equivalent/increased oxidative stability in comparison to other emulsifiers particularly when additional antioxidants are used. Further studies to evaluate the oxidative stability of quillaja saponin nanoemulsions combined with algal sources of LCω3PUFA are warranted to enable the development of safe, clean label functional food products.

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