Optimisation of Oxidative Stability of Omega-3 Enriched Milk

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An increasing amount of evidence compiled over the last 30 years, supports the nutritional benefits of dietary long chain omega-3 polyunsaturated fatty acids (PUFA). This has intensified the research regarding incorporation of PUFA-rich oils into real food systems. The major challenge is clearly oxidative protection of the highly unsaturated and thus very oxidatively unstable PUFA, mainly EPA and DHA. This presentation highlights some of our recent findings concerning prevention of lipid oxidation in pasteurized milk enriched with fish oil, which is rich in these omega-3 PUFAs. The overall objective has been to understand which parameters that determine the oxidative stability of this particular emulsion, and also to investigate what is required to obtain an emulsion, stable against oxidative deterioration and with acceptable sensory characteristics.

Overall, our work has shown that high quality fish oil is very important. Especially, it has been shown that the peroxide value (PV) needs to be low. Our results indicate that oil PV should be below 0.5 meq/kg oil, and preferably around 0.1 meq/kg. Secondly, further protection of the milk emulsion against oxidation can be achieved through addition of either rapeseed oil or antioxidants. Different effects of different antioxidants have been shown. Ascorbyl palmitate was the most efficient antioxidant in retarding oxidation during storage, while EDTA was only effective when PV of the starting fish oil was high (1.5 meq/kg). The chain breaking antioxidants α– and γ–tocopherol were prooxidant when added as a mixture, but γ–tocopherol showed antioxidative properties when added alone. However, a mixture of rapeseed oil and fish oil has proven very stable against oxidation, and is therefore a useful alternative to stabilised fish oil for the enrichment. Finally, our experiments have shown that the oxidative stability of the fish oil-in-milk emulsion is improved by homogenising at high temperature and high pressure (72°C, 225 bars), compared to low temperature and pressure (50°C, 50 bars).