Effects of Sodium Caseinate on the Oxidative Stability of Omega-3 Rich Oil-in-Water and Water-in-Oil Emulsions

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Polyunsaturated fatty acids (omega-3, omega-6) are susceptible to oxidative deterioration during storage. The aim of this study was to compare the effects of sodium caseinate (NaCN) on lipid oxidation of oil-in-water (O/W) and water-in-oil (W/O) emulsions. 20 wt % camelina/fish oil blend O/W emulsions were produced using a microfluidiser with NaCN (0.25-3.0 wt %) as the emulsifier. W/O emulsions in the range of 30-90 wt % fish oil were produced using a Silverson mixer with NaCN (1.5 wt %) in the aqueous phase and Polyglycerol Polyricinoleate (PGPR) (1.0% wt %) as the emulsifier in the oil phase. Emulsions were analysed for primary oxidation products using the peroxide value (PV) test and for secondary products using the p-anisidine value (p-AV) test, with bulk oil as reference. When a pre-oxidised oil blend was emulsified using NaCN (1.5 wt %) to form a 20% O/W emulsion, PV and p-AV values decreased significantly (P<0.01). After 4 days storage PVs had dropped to 9.65 ± 1.08 6.15 ± 0.31 and 2.67 ± 0.19 μmoles hydroperoxides/g oil during storage at 8°C, 25°C and 60°C, respectively (Day 0 value of 23.94 ± 0.29 μmole hydroperoxides/g oil). Increasing the NaCN concentration from 0.25 wt % to 3.00 wt % decreased the level of oxidation products. When W/O emulsions were analysed, there was little change in PV and p-AV values in contrast to the O/W emulsions. The 50% oil emulsion had a PV value of 6.24 ± 0.28 μmoles hydroperoxides/g (Day 0) and 7.07 ± 0.49 μmoles hydroperoxides/g (Day 3). The p-AV test gave a value of 24.43 ± 0.70 (Day 0) and 24.84 ± 0.06 (Day 3). Lipid oxidation products may separate from the oil phase of the emulsion in the presence of NaCN in O/W emulsions, possibly due to formation of protein hydroperoxides. In contrast, lipid oxidation products were detected continually throughout storage in the W/O emulsions.