

A COMPARISON OF THE HYDROGENATION OF C18, C20 AND C22 UNSATURATED FATTY ACIDS BY RUMEN MICRO-ORGANISMS

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Rumen micro-organisms effectively hydrogenate di- and tri- C18 unsaturated lipids, which are the principle fatty acid components of dietary feedstuffs. The end-products of lipid bio-hydrogenation are primarily stearic (18:0) and vaccenic (trans Δ 11 18:1) acids (Christie 1981). The aim of this study was to investigate whether these micro-organisms are capable also of hydrogenating eicosapentaenoic (EPA, 20:5) and docosahexaenoic (DHA, 22:6) acids; these are important constituents of fish and marine oils and are investigated because of their ability to inhibit fatty acid and triacylglycerol synthesis in mammals (Harris 1989). Fish oil and sunflower oil substrates were prepared by freeze drying oil/casein emulsions (1:1, w/w). They were incubated anaerobically with strained rumen fluid obtained from sheep fed 800g/d of a pelleted ration of lucerne and oats (3:2 w/w). The degree of hydrogenation and lipolysis was assessed using procedures described by Ashes et al. (1977).

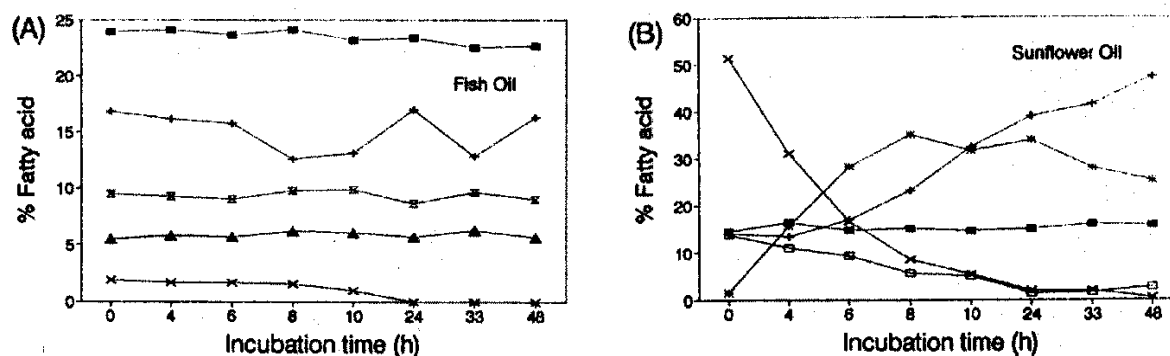


Fig. 1 Ruminal hydrogenation of fish oil and sunflower oil. 16:0 (■), 18:0 (+), 18:1t (*), 18:1c (□), 18:2 (x), 20:5 (X) and 22:6 (▲).

The results (Fig 1) clearly demonstrate negligible hydrogenation of the 20:5 and 22:6 in the fish oil (A) after 48 h, whereas the 18:2 disappears and the levels of 16:0 and 18:0 remain relatively constant. There was however, conversion of 18:1 cis to the trans form (not shown). In sunflower oil (B), the 18:2 cis,cis is extensively hydrogenated after only 10 h and there are corresponding increases in 18:1 trans and 18:0. The failure of the rumen microbes to hydrogenate the 20:5 and 22:6 is not due to inhibition of the rumen lipases by the fish oil, because the extent of lipolysis (as measured by the fatty acid release for the two oil substrates) was similar. In preliminary experiments we were unable to induce an hydrogenating capacity in the micro-organisms by feeding fish oil supplements to sheep (50g/d) for periods up to four weeks.

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