Oxidative stress induced by omega-3 fatty acids is dependent on background diet fatty acid composition

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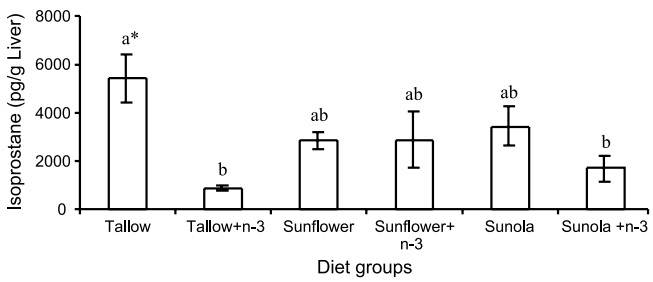
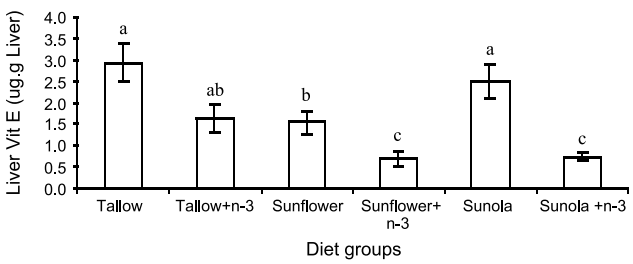
Oxidative stress is indicated in the pathophysiology of human disease, especially chronic 'lifestyle' disease such as cardiovascular disease, arthritis, cancer and cataracts. Our laboratory has recently demonstrated that dietary fat type influences CCl_4-induced oxidative stress (1). It is generally assumed that dietary omega-3 fatty acids are vulnerable to oxidative damage, therefore, may increased oxidative stress. Indeed recent studies have shown that omega-3 fatty acids increase activity of antioxidant enzymes such as glutathione peroxidase and superoxide dismutase and can induce expression of these enzymes (2). This study aimed to test the hypothesis that the addition of omega 3 fatty acids, in the form of Flaxseed oil (50 g/kg diet), in conjunction with saturated (tallow), monounsaturated (Sunold) and polyunsaturated (Sunflower omega-6) fatty acids in the background diet will differentially effect of CCl_4 induced oxidative stress in rat. Rats were randomly divided into six diet groups (n = 9) where three groups were fed the background diets with fat type predominantly saturated, monounsaturated or omega 6 (200 g/kg diet). Three groups were fed the three background diet in conjunction with n-3 fats (50 g/kg diet flaxseed, 150 g/kg diet saturated, monounsaturated or omega-6 polyunsaturated). The rats were fed the diets for four weeks, and then oxidative stress was induced using CCl_4.

The addition of omega-3 fatty acids to the diet reduced the concentration of arachidonic acid measured in the plasma and liver in the saturated fat diet to a greater degree than the monounsaturated diet and this was to a greater degree than the omega-6 polyunsaturated diet. Concomitantly the increase in the concentration of eicosapentanoic acid and docosapentanoic acid following the feeding of omega three fatty acids was in the same order.

In conclusion, there is reduction of the oxidative stress caused by the addition of omega 3 fatty acids to a background saturated fat diet. This reduction of oxidative stress is not evident when the background diet is comprised of either monounsaturated or n-6 polyunsaturated fat. In plasma the addition of the omega three fatty acids did not significantly alter the oxidative stress (as measured by 8-iso-$PGF_{2\alpha}$) regardless of the background dietary fat type. However, in the liver there was a significant decrease in isoprostane concentration in the diet group that had a background diet of saturated fatty acids. Inclusion of omega-3 fatty acids in the diets resulted in a reduction of Vitamin E concentration in plasma and liver but the reduction was only statistically significant in the monounsaturated and polyunsaturated diet groups ($P < 0.05$).





* Values without the same superscript are significantly different ($p<0.05$)

References

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