

### **Functional retinal changes induced in guinea pigs in 16 weeks on diets low in n-3 polyunsaturated fatty acids**

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We have previously shown that guinea pigs raised through two generations on diets containing safflower oil as the only source of fat (less than 0.7% n-3 polyunsaturated fatty acids, PUFA) showed depletion of docosahexaenoic acid (DHA) in the retinal lipids compared with a group fed canola oil (1). Fatty acid analyses of the retinal phospholipids revealed that the group fed canola oil had 21% DHA compared with 2% for the group fed safflower oil. The electroretinogram (ERG) readings were obtained using intraocular electrodes at 6 light levels spanning the rod-cone domains. The ERG waveforms showed significant reductions in the a- and b-wave amplitudes for the safflower oil group compared with the canola oil-fed animals.

The aim of the present study was to examine (i) whether dietary manipulation of n-3 PUFA levels could alter the retinal PUFA profile and ERG function in albino and coloured guinea pigs fed from weaning to 24 weeks, and (ii) whether dietary source of n-3 PUFA (canola oil) would allow guinea pigs reared on safflower oil diets to recover tissue DHA levels and retinal function (the ERG waveforms were examined using corneal electrodes). Weanling guinea pigs of albino and pigmented strains were fed diets containing either safflower oil or canola oil from 3 weeks of age until 24 weeks on the diet. The retinal phospholipid fatty acids were examined at 0, 4, 6, 12 and 24 weeks on the diet.

The results showed that the DHA level in the retinal phospholipids increased from 14% at weaning to 19% by 24 weeks in the two strains fed canola oil. In contrast, both strains of guinea pigs fed safflower oil showed a steady depletion of retinal DHA with time on diet. The retinal DHA level was 8% at 6 weeks on diet, 5.5% at 12 weeks on the diet and 4.5% at 24 weeks. There was no evidence of an effect of the strain of guinea pigs on the retinal PUFA profile.

A second experiment showed that refeeding safflower oil-fed guinea pigs at 6 and 11 weeks for a further 5 weeks with canola oil (to 11 and 16 weeks, respectively) did not lead to retinal DHA levels equal to that of guinea pigs reared continuously on canola oil. In this experiment, the ERG studies conducted at 11 weeks on the diet did not reveal differences between the diet groups (retinal DHA values were 15% in the safflower group compared with 22% in the canola group,  $p < 0.0001$ ), however at 16 weeks the ERG a-b wave amplitude in the guinea pigs fed safflower oil was significantly lower ( $p = 0.014$ ) than those fed canola oil (10% retinal DHA versus 22% in the control guinea pigs). The ERG a-b wave amplitudes in the canola guinea pigs were not significantly different to those of the safflower oil- canola oil refed group. The corneal electrodes produced signals of comparable magnitude to the previous studies using intravitreal electrodes.

This data reveals that a significantly reduced retinal ERG response can be obtained in weanling albino guinea pigs fed safflower oil for 16 weeks.

1. Weisinger HS, Vingrys AJ, Sinclair AJ. The effect of DHA on the electroretinogram in the guinea pig. *Lipids* 1996;31:65-70.