P03

Squalene supplementation alters genes associated with liver cholesterol metabolism

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Background – Squalene is a component of shark liver oil and has been speculated to have cholesterol reducing properties. High levels of total and LDL cholesterol have been shown to contribute to the development of chronic heart disease. The liver is central to the regulation of cholesterol metabolism and dietary intervention has long been recognized as a primary means to reduce the risks of chronic heart disease and related ailments.

Objectives – To determine the effect of dietary squalene supplementation on gene transcripts associated with liver cholesterol metabolism. Specifically the effect of squalene supplementation on mRNA levels for proteins that regulate cholesterol biosynthesis (HMDH & ERG1), cholesterol elimination (SRB1), bile synthesis (CP7A1 & CP27A) and cholesterol excretion by the liver into bile (ABCG5 & ABCG8) was investigated.

Design – Rats (n=32) were divided into four groups and supplemented for 12 weeks. Groups one and two were fed a cholesterol rich diet for six weeks followed by six weeks of a cholesterol rich diet plus 1.75mg/day of squalene or 3.5 mg/day. Group three was fed a cholesterol rich diet for 12 weeks and group four was fed standard rat chow for 12 weeks. Blood lipid levels were monitored during the study and liver gene expression was determined at the conclusion of the feeding trial via RT-PCR.

Outcomes – 3.5 mg/day of squalene lowered total and LDL cholesterol in rats consuming a cholesterol rich diet. This dose of squalene also resulted in constant levels of HMDH and ERG1 whereas the cholesterol rich diet halved mRNA levels of these enzymes. Furthermore 3.5 mg/day of squalene caused a greater than 3.0 fold increase in mRNA levels of the proteins SRB1, CP7A1, CP27A and ABCG5.

Conclusion – Dietary squalene supplementation at a dose of 3.5 mg/day lowers total and LDL cholesterol in rats consuming a cholesterol rich diet. These reductions in cholesterol levels may be due to increased cholesterol elimination, bile synthesis and cholesterol excretion by the liver into bile mediated by changes in gene expression of key enzymes involved in these metabolic pathways.

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P04

The effects of four ad libitum diets of varying fibre content on cardiovascular risk factors

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Background – Inverse associations between fibre intake and cardiovascular risk factors are reported in many studies. In a randomised controlled trial we have previously shown that dietary fibre, in the form of a supplement, decreases cardiovascular risk factors in the postprandial period in overweight and obese individuals. The effects of dietary fibre in conjunction with a healthy diet on cardiovascular disease have not been studied in overweight and obese subjects.

Objectives – To evaluate the effects of dietary fibre with or without a healthy eating plan on blood lipids and glucose in overweight and obese individuals.

Design – A 12-week randomized controlled trial, including ad libitum diets and fibre supplements, was undertaken using four groups: (1) control, (2) control plus fiber supplement, (3) healthy diet and (4) healthy diet plus fibre supplement. Participants in groups 2 and 4 were given extra fibre in the form of supplements (36 grams psyllium husk per day). The healthy diet groups (3 and 4) followed a healthy eating plan based on the Australian Dietary Guidelines. Fasting blood triglyceride, total cholesterol, LDL-cholesterol, HDL-cholesterol and glucose were measured at the baseline, six and twelve weeks.

Outcomes – In total, 70 overweight and obese subjects were recruited and 57 (81%) completed the trial. In primary ‘intention to treat analysis’, total cholesterol and LDL-cholesterol were significantly different between all treatment groups and control group (P=0.000 for total cholesterol and LDL-cholesterol). In comparison with control group, total and LDL-cholesterol decreased by 3% and 9% respectively in the control plus fibre group (P=0.03 and P=0.002 for total cholesterol and LDL-cholesterol respectively), by 6% and 8% respectively in healthy diet group (P=0.001 and P=0.013 for total cholesterol and LDL-cholesterol respectively) and by 12% and 13% respectively in healthy diet plus fibre group (P=0.000 for total cholesterol and LDL-cholesterol). There were no differences in triglyceride, HDL-cholesterol and glucose between the groups.

Conclusion – These results suggest that consumption of additional fibre in the form of psyllium husk is as effective as a healthy dietary plan to improve fasting blood cholesterol and LDL-cholesterol in overweight and obese individuals.