Fiber and Diabetes

Diabete Metab 1979 Dec;5(4):279-85

[Late hypoglycaemia in chemical diabetes. Abnormalities of pancreatic glucagon secretion and effect of pectine (author's transl)].

[Article in French]

Mirouze J, Orsetti A, Monnier L, Bringer J, Pham TC.

Nineteen patients suffering from chemical diabetes either with (group A, ten cases) or without (group B, nine cases) reactive hypoglycaemia were included in the study and compared with seven control (group C). The following variables were measured over a 5 hour period during a standard oral glucose tolerance test (OGTT): (i) blood glucose by continuous monitoring; (ii) plasma insulin and glucagon levels by radioimmunoassay. Furthermore, in five diabetics of group A, the data from the standard OGTT were compared with those from a pectin-supplemented OGTT (9 g per square meter of body surface). Although the insulin response was similar glucagon levels were significantly higher (45.1 +/- 11.8 pmol/l) (p less than 0.01) in group B than in group A (9.6 +/- 1.3) and C (8.1 +/- 1.4 at 30 minutes). The high glucagon levels noted in group B may explain the absence of reactive hypoglycaemia. <u>The pectin supplementation improved the OGTT pattern by blunting the blood glucose peak (p less than 0.05), and avoiding the reactive hypoglycaemia (p less than 0.01).</u> The addition of pectin did not produce any significant effect on the insulin response while a significant increase in glucagon concentrations (p less than 0.05) was observed beyond the 150th minute. Therefore, the data suggest that pectin may improve the OGTT pattern by increasing the glucagon response in the late period of the test. The development of postprandial reactive hypoglycaemia seldom coincides with a plasma glucagon peak, while the absence of reactive hypoglycaemia tends to be associated with high levels of glucagon, as is the case in overt diabetes mellitus.

Dietary fibres, fibre analogues, and glucose tolerance: importance of viscosity.

Jenkins DJ, Wolever TM, Leeds AR, Gassull MA, Haisman P, Dilawari J, Goff DV, Metz GL, Alberti KG.

To define the type of dietary fibre of fibre analogue with the greatest potential use in diabetic treatment, groups of four to six volunteers underwent 50-g glucose tolerance tests (GTT) with and without the addition of either guar, pectin, gum tragacanth, methylcellulose, wheat bran, or cholestyramine equivalent to 12 g fibre. The addition of each substance significantly reduced blood glucose concentration at one or more points during the GTT and generally reduced serum insulin concentrations. The greatest flattening of the glucose response was seen with guar, but this effect was abolished when hydrolysed non-viscous guar was used. The reduction in the mean peak rise in blood glucose concentration for each substance correlated positively with its viscosity ($r = 0.926$; P less than 0.01), as did delay in mouth-to-caecum transit time ($r = 0.885$; P less than 0.02). Viscous types of dietary fibre are therefore most likely to be therapeutically useful in modifying postprandial hyperglycaemia.

Effect of soluble fibers on plasma lipids, glucose tolerance and mineral balance.

Behall KM.

Beltsville Human Nutrition Research Center, U.S. Department of Agriculture, Maryland 20705.

Fibers are broadly classified as soluble and insoluble based on their physical or analytical properties. Two human studies have been carried out in this laboratory utilizing soluble gums. The first compared a low fiber diet to the diet with an average of 19.5 g of added fiber per day from cellulose, an insoluble fiber, or carboxymethylcellulose gum, karaya gum or locust bean gum, all soluble fibers. Plasma cholesterol levels but not triglycerides were significantly lower when the soluble gums were consumed for 4 weeks each. Glucose and insulin response curves after a standard glucose tolerance test were not significantly different between the 5 diets. Adding refined fibers to the basal diet did not significantly affect apparent mineral balance of calcium, magnesium, manganese, iron, copper or zinc, with the exception of a negative manganese balance after carboxymethylcellulose. The second study added an average of 31.7 g of guar gum per day to the diets of non-insulin dependent diabetic individuals for 6 months. Lipid levels observed at the beginning of the study were not reduced in either group, placebo or guar gum supplemented. Consumption of guar gum significantly reduced the C-peptide but not the glucose response curve. The number of insulin receptors increased while affinity remained the same. Apparent mineral balance was not affected by the consumption of guar gum for 6 months. The combined results of these studies indicates that soluble refined gums may have therapeutic value in reducing cholesterol and improving glucose metabolism without adversely affecting most mineral balances.

J Lipid Res 1995 Nov;36(11):2394-404

Distinct mechanisms of plasma LDL lowering by dietary fiber in the guinea pig: specific effects of pectin, guar gum, and psyllium.

Fernandez ML.

Department of Nutritional Science, University of Arizona, Tucson 85721.

Pectin (PE), guar gum (GG), and psyllium (PSY) lower plasma low density lipoprotein (LDL) cholesterol concentrations in guinea pigs with different orders of magnitude by inducing defined alterations in hepatic cholesterol homeostasis (Fernandez et al. 1994. Am. J. Clin. Nutr. 59: 869-879; 61: 127-134 and 1995. J. Lipid Res. 36: 1128-1138). To further explore specific mechanisms responsible for the differences in plasma and hepatic cholesterol lowering, the effects of these fibers were evaluated on cholesterol absorption, hepatic cholesterol 7 alpha-hydroxylase activity, the rate-limiting enzyme of bile acid synthesis, and in vivo LDL transport to target specific primary and secondary mechanisms accounting for the observed responses. Fibers were fed with physiological (0.04%), low cholesterol (LC), or pharmacological high cholesterol (HC) (0.25%) levels to assess whether cholesterol intake influences plasma LDL lowering mechanisms. Intake of PE, GG, or PSY with LC or HC diets lowered plasma and hepatic cholesterol concentrations ($P < 0.001$). PE and PSY up-regulated 7 alpha-hydroxylase activity 3-fold with LC and PE by 5-fold with HC diets. In contrast, GG intake had no effect on 7 alpha-hydroxylase activity. Cholesterol absorption was reduced 30% by PE intake while no differences were found between control and PSY groups. GG reduced cholesterol absorption only with HC diets. Intake of PE, GG, or PSY with HC diets resulted in faster plasma LDL fractional catabolic rates (FCR) ($P < 0.01$) with no effect on LDL apoB flux rates (FR) or pool size, suggesting that fiber reduced LDL cholesterol concentration without decreasing the number of LDL particles. In addition to reducing LDL apoB FR, PE and PSY increased LDL FCR with HC diets while GG effects were limited to lowering LDL apoB FR. These results indicate that the distinctive reductions in hepatic cholesterol induced by PE, GG, and PSY associated with plasma cholesterol lowering result from different mechanisms specific to each fiber and that the levels of dietary cholesterol contribute to the different metabolic responses.