

Effects of Dietary Supplementation of Korean Soybean Paste (Doen-jang) on the Lipid Metabolism in Rats Fed a High Fat and/or a High Cholesterol Diet

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OBJECTIVE :

This study was performed to investigate the effects of dietary supplementation of Korean traditional soybean paste (doen-jang) on the changes of serum lipid components and histopathological changes of organs in rats fed a high fat and/or a high cholesterol diet.

DESIGN :

This was an open-group prospective clinical intervention.

METHODS :

A total of one-hundred and twenty eight three-week-old male Sprague-Dawley rats were divided into 16 groups (n=8) by a randomized blocking method. The rats consumed one of the experimental diets: the control diet, a high fat diet (40% of the total calories), a high cholesterol diet (1% of the total weight), or a high fat and high cholesterol diet for 13 consecutive weeks. Each of these diet groups were divided into 4 groups: one with no soybean paste added, one with just 0.5% soybean paste added, one with 1% soybean paste added, and one with 5% soybean paste added. These levels were taken from the data of the National Nutrition Survey of Korea from 1992 to 1998. From this data, we know that Koreans, on an average, eat less than 0.5% soybean paste per person, per day. A Korean traditional soybean paste was used for this study. All of the preparation methods for the soybean paste followed the recommendations of the Korea Food Research Institute. After ripening 6 months, it was incorporated into the diet. Blood specimens were obtained at the baseline and after 13 weeks of dietary intervention. At the end of the study the organs (liver, heart, and kidney) were excised, and pieces of the organs were taken for histopathological examination. Food intake, body weight, food efficiency ratio, relative organ weights, and fecal lipid levels were determined at the end of the experiment.

RESULTS :

The feeding of high fat and/or high cholesterol diets resulted in many deleterious effects including increased food intake, weight gain, and organ weights; increased fecal lipid levels; increased serum triglyceride, total lipid, free cholesterol, ester-cholesterol, total cholesterol, low-density lipoprotein (LDL) cholesterol levels, and atherogenic index; increased lipase, AST, ALT, ChEase, and LDHase activities; decreased high-density lipoprotein (HDL) cholesterol levels; and most significantly severe fatty changes in the livers, compared with the control and soybean paste control groups. The feeding of 0.5% soybean paste reduced the adverse effects of the high fat and/or the high cholesterol diet on the food efficiency ratio, weight gain, relative organ weights, fecal lipid levels, and serum lipid component levels. Significant decreases ($p < 0.05$) in triglyceride, total lipid, total cholesterol, and LDL-cholesterol were seen. A significant increase was found in the level of HDL-cholesterol ($p < 0.05$). A significant decrease was observed in the atherogenic index. Also it recovered the levels of lipase, AST, ALT, ChEase, and LDHase activities. No significant changes in levels of serum free-cholesterol and ester-cholesterol were observed. It was helpful to reduce the severe histopathological lesions of livers. Although changes in these findings were observed in all of the groups with soybean paste, the most profound inhibitory changes were evident at the 5% level of soybean paste in the results of histological study of livers. In each group, adding soybean paste reduced the adverse effects of high fat and/or high cholesterol diets in ratio to the amount of soybean paste added to the diet.

CONCLUSIONS:

Dietary supplementation of 0.5% soybean paste results in reductions in several risk factors for lipid metabolism in rats fed a high fat and/or a high cholesterol diet, especially improved serum lipid component levels and the histopathological lesions of the livers. The feeding of 1% and 5% soybean paste showed even more reduction of risk factors. These results suggest that Korean soybean paste has a protective effect on a high fat and/or high cholesterol diet. Long-term, placebo-controlled clinical trials are needed to evaluate the effect of soybean paste on the lipid metabolism in the human population.