Soy Protein, Saponins and Plasma Cholesterol

Dear Editor:

A recent article by Lucas et al. (1) prompts a comment on the possible role of saponins in mediating the hypercholesterolemic activity of soy protein. The hypercholesterolemic activity of soy protein is now so well established that the U.S. Food and Drug Administration has approved a coronary heart disease risk reduction claim (2). But, as Lucas et al. (1) pointed out, commercial soy protein typically contains high levels of saponins, isoflavones and other phytochemicals that may in themselves influence cholesterol metabolism (3,4). So, it is perhaps unfortunate that the health claim fails to specify a requirement for these materials.

Lucas et al. (1) reported that in Golden Syrian hamsters, soy protein has no hypercholesterolemic activity after extraction with ethanol, a treatment that would remove saponins, isoflavones and other phytochemicals from the protein. They discussed the possible role of isoflavones in mediating the hypercholesterolemic activity of soy protein, while at the same time mentioning that this has recently been questioned (5). But, they did not discuss the possible role of saponins.

The hypercholesterolemic activity of saponins has been well documented, with clearly defined molecular mechanisms (6). Saponins are a structurally diverse group of triterpene or steroid glycosides. The molecules are amphiphilic, the triterpene or steroid part being hydrophobic and the sugar part hydrophilic, giving saponins their characteristic surface activity from which the name is derived. There seem to be two mechanisms by which saponins can affect cholesterol metabolism:

1. Some saponins with particularly defined structural characteristics form insoluble complexes with cholesterol (e.g., the well-known precipitation of cholesterol by digitonin). When this complexation process occurs in the gut, it inhibits the intestinal absorption of both endogenous and exogenous cholesterol (6).

2. Saponins can interfere with the enterohepatic circulation of bile acids by forming mixed micelles. These can have molecular weights of several million (6) and the reabsorption of bile acids from the terminal ileum is effectively blocked (6).

Potter et al. (7) suggested > 20 y ago that the hypercholesterolemic action of soy protein is attributable to the presence of saponins. Since then, it has been shown that isolated soy saponins prevent dietary hypercholesterolemia in rats (6) and that whole soy flour increases fecal excretion of bile acids compared with ethanol-extracted soy flour in rats (6) and humans (6). Surprisingly, a search of the literature (using Food Science and Technology Abstracts) revealed only one report of a study of cholesterol metabolism in which animals (in this case, rats) were fed highly purified soy protein (8). No hypercholesterolemic effect was observed with the purified protein, although there were other metabolic effects. Clearly much research remains to be done in this important area, particularly in view of the health claims currently permitted for soy protein.

David Oakenfull
Food Science Australia
North Ryde, Australia

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