

The biological activity of soybean saponins and its implications in colon carcinogenesis

Mi-Kyung Sung* and A. Venketeshwer Rao. Department of Food and Nutrition, Sookmyung Women's University, Seoul, Korea*, and Department of Nutritional Sciences, University of Toronto, Toronto, Canada

Epidemiological studies have observed a negative association between increased plant food consumption and colon cancer incidence. This observation led to the postulation that several biologically active compounds including saponins in plant foods may exert anticarcinogenic properties. Saponins possess membranolytic activity through interaction with membrane components. However, the extent of membranolysis depends on their chemical structure. Saponins are categorized as neutral or acidic depending on the presence of acidic residue(s) in their aglycone moiety. Acidic saponins include non-edible plant saponins such as gypsophilla and quillaja saponin. Neutral saponins include soybean saponins, the major source of dietary saponins. However, based on the ability to hemolyze erythrocytes, neutral saponins have been considered biologically inactive. Therefore, overall objective of this research was to investigate the biological activity of soybean saponins on cell membrane, and to determine the physiological importance of this interaction in human colon carcinoma cells using *in vitro* and *in vivo* models. The result of this research indicated that soybean saponins possess membranolytic activity. However, they were much less disruptive to cell membrane compared to acidic saponins. Also, their membranolytic activity was shown to be dependent on the polarity. Among different membrane lipid components, sphingomyelin showed significant affinity towards soybean saponins, whereas gypsophilla and quillaja saponin possessed higher affinity for cholesterol. Results from animal feeding studies indicated that saponins increase cell proliferation of colon epithelium suggesting there is an interaction between epithelial cell membrane and ingested saponins. The growth and viability of human colon carcinoma cells were significantly reduced by soybean and gypsophilla saponin in a dose-dependent manner. However, membrane permeability was not increased in a dose-dependent fashion in cells treated with soybean saponins. Morphological observations indicated that soybean saponins form vesicles in cytoplasm of the cell, whereas gypsophilla saponin primarily induced membrane surface changes. In this study, plant saponins including soybean saponins are suggested as anticarcinogens. Acidic saponins are more active on cell membrane, however, they possess higher toxicity. Neutral saponins, on the other hand, have low toxicity, which is preferred as chemopreventive agents.