Commercial soybean starch blocker consumption: impact on weight gain and on copper, lead and zinc status of rats

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Received 15 November, 1990; accepted in revised form 4 May, 1991

Key words: Copper, lead, zinc, starch blockers, α-amylase inhibitors

Abstract. A commercial 'starch blocker' was used to study the digestin of starch (potato) in mature female rats for four weeks. Two levels of 'starch blocker' were used. The first level was calculated to inhibit starch digestion at 50%, the second was calculated to inhibit starch digestion at 100%. No significant effects on the body weights (271.10 ± 29, 277.7 ± 43, 259.1 ± 25 g) were found among the groups of rats at 0%, 50% and 100% inhibition levels, respectively. Feed intakes were not affected. However, fecal copper and zinc excretions increased significantly (p < 0.05) due to the inhibitors. Fecal copper excretions were 0.468 ± 0.14, 0.578 ± 0.09, 0.617 ± 0.07 mg/rat/week, while fecal zinc values were 0.625 ± 0.14, 0.859 ± 0.32 and 0.778 ± 0.26 mg/rat/week when no inhibitor was fed, at 50% inhibition and at 100% inhibition respectively. Thus, while use of 'starch blockers' did not promote weight loss in the mature female rats, utilization of copper and zinc were negatively affected.

Introduction

Among the many products that have been marketed for the intended control of obesity, probably none has had more popular appeal than 'starch blockers'. Rosenbery in 1982 [1] reported a U.S. consumption rate of one million tablets per day as a weight reducing aid for over-weight Americans. These tablets were reputed to contain salivary and pancreatic α-amylase inhibitors from legumes which could prevent the digestion of starch and, by so doing, promote weight loss without any restriction in dietary starch [2–4].

Wheat, rye and kidney beans are known to contain amylase inhibitors [5–8]. The α-amylase inhibitor found in kidney beans is specific for animal α-amylase with an optimal inhibitory activity at pH 5 and at 37 degrees C.
However, human salivary and pancreatic amylases and hog pancreatic amylases have been identified as the only enzymes to be inhibited to a significant degree by Phaseolanin [7]. It has been postulated that oral ingestion of these amylases either in food or as purified substances in tablet form should block the digestion of dietary origin starch [7].

Results of in vitro studies have demonstrated the inhibition of starch hydrolysis by a-amylase inhibitors from several products including wheat and kidney beans [7, 9–11]. However, the effectiveness of these compounds from many other legumes has not been well defined. Earlier studies by Garrow et al. [12] reported both increased fecal caloric excretion and reduction in weight gain in rats when fed an a-amylase inhibitor. Puls and Keup [13] demonstrated a reduction in postprandial glucose and insulin response in humans, rats and dogs when an a-amylase inhibitor from wheat was fed. The inhibitor was more effective when starch was administered to the dogs and rats in the raw than the cooked form. Other investigators found no effect on postprandial hyperglycemia or on increased fecal caloric excretion [9–11].

Most varieties of beans are known to contain, in addition to a-amylase inhibitors, other antinutritional factors [14–16]. Yen et al. [17] demonstrated reduced growth accompanied by enlarged pancreases in animals fed raw soybean meal. In humans acute gastroenteritis due to the ingestion of raw red kidney beans has been reported which was attributed to the lectin content of the beans [18]. Highly variable levels of amylase, amylase inhibitor, trypsin and lectin activities have been reported in several brands of ‘starch blockers’. After having been marketed for several years commercially, the U.S. Food and Drug Commission issued orders requiring the cessation of marketing ‘starch blockers’ for human use.

The present study was designed to evaluate the effectiveness of a soybean derived, commercial ‘starch blocker’ for inducing weight loss using retired breeder female rats and to ascertain concurrent effects on the copper, zinc and lead nutritional status of these rats.

**Materials and methods**

Thirty, retired-breeder, female rats of the Sprague-Dawley strain (from SASCO, Inc., Omaha, NE) were maintained in individual, stainless steel cages in a temperature-controlled (60 °F) room with 12-hour periods of light and dark. Care was taken to avoid contamination of the environment with zinc and lead. All stainless steel feed cups, plastic drinking bottles with stainless steel spouts, were sterilized and rinsed in deionized distilled water.