Chapter 29
Taurine Feeding Inhibits Bile Acid Absorption from the Ileum in Rats Fed a High Cholesterol and High Fat Diet

Naomichi Nishimura, Tatsuro Yamamoto, and Toru Ota

Abstract We have previously reported that taurine-mediated reductions in plasma cholesterol in cholesterol-fed rats were caused by increased excretion of bile acids into feces. In the present study, we examined the effect of taurine on bile acid secretion into bile and the absorption of bile acids from the ileum. Male Wistar rats were divided into 2 groups, one group that was fed a diet containing 1% cholesterol (HC diet) and the other group fed a HC diet supplemented with 1% taurine for 2 weeks. Bile acid concentrations in the mesenteric blood, the distal ileum and the colorectal digesta were determined. Mesenteric bile acid concentration in the distal ileum was significantly lower in rats fed the taurine containing diet than in those fed only the HC diet. Colorectal, but not distal ileal, bile acid concentration was significantly higher in rats fed the taurine diet than in those fed the HC diet. However, the secretion of bile acids into the bile was similar in the two groups. These results suggest that the absorption of bile acids from the distal ileum to the rectum is inhibited by taurine.

Abbreviations HC, the diet containing 1% cholesterol

29.1 Introduction

Taurine has a plasma cholesterol-lowering effect in rats fed a high cholesterol diet (Yokogoshi et al. 1999; Yamanaka et al. 1985; Murakami et al. 1999). Taurine feeding induces increased fecal bile acid excretion (Yamanaka et al. 1985; Nishimura et al. 2003). Since bile acid excretion constitutes a major route of elimination of cholesterol from the body (Turley and Dietschy 1988), we believe that the taurine-mediated increase in fecal bile acid excretion may be the primary factor underlying the plasma cholesterol-lowering effect of taurine.

Bile acid excretion is thought to depend on cholesterol catabolism, bile acid secretion into bile and the absorption of bile acids from the distal ileum.
Therefore taurine seems to act on one or more of these processes. We and Yokogoshi et al. (1999) showed in a previous study that taurine induced hepatic gene expression of cholesterol 7α-hydroxylase, which is a rate-limiting enzyme of cholesterol catabolism (Yokogoshi et al. 1999; Nishimura et al. 2003). These data suggest that taurine enhances cholesterol catabolism, thereby increasing bile acid excretion. We recently demonstrated that plasma VLDL+LDL-cholesterol concentration negatively correlated with fecal bile acid excretion (unpublished data). But fecal bile acid excretion didn’t correlate with CYP7A1 activity (unpublished data). These results suggest that the increase in bile acid excretion by the taurine fed rat may involve factors in addition to enhanced cholesterol catabolism. Therefore, we examined whether taurine affects bile acid secretion into bile and the absorption of bile acids from the distal ileum. Few studies have examined the effect of taurine on the secretion and absorption of bile acids.

29.2 Methods

29.2.1 Animals and Diets

The study was approved by the Nayoro City University Animal Use Committee. The animals were maintained in accordance with the guidelines for the care and use of laboratory animals, Nayoro City University.

Male Wistar rats weighing 100 g were obtained from Japan SLC (Hamamatsu, Japan). They were housed in individual cages containing stainless steel screen bottoms in a room maintained at 23 ± 1°C with lighting from 0700 to 1900. Rats were acclimated by feeding a 20% casein diet containing 10 g/kg for 14 d before feeding test diets in order to raise the serum cholesterol concentration, the composition of which was, in g/kg, as follows: casein, 200; α-cornstarch, 362; sucrose, 181; corn oil, 50; lard, 100; AIN-93G mineral mix (Reeves et al. 1993), 35; AIN-93 vitamin mix (Reeves et al. 1993), 10; choline chloride, 2.0; cholesterol, 10; and cellulose, 50.

After the induction period, the rats were divided into 2 groups of six each based on body weight and serum cholesterol concentration. The rats received HC diets with or without 10 g/kg taurine supplementation for 14 days. Taurine was supplied by Taisho Pharmaceutical Co., Ltd. (Tokyo, Japan).

29.2.2 Sampling Procedures

We collected blood samples from the tail veins on days −14, −7, 0 (start of taurine administration), 3, 7, 10 and 14 in experiment 1, and on days 0 and 14 in experiment 2 for determination of the total plasma cholesterol concentration. Feces were collected to determine bile acid concentration. They were lyophilized, weighed and stored at −40°C until analysis of bile acids.