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Effect of Ileal Resection on Bile Acid Output in the Bile and Faeces*

Bile acids are synthesized in the liver from cholesterol and, after conjugation with glycine or taurine, are secreted in the bile. Having contributed to fat absorption in the upper small bowel, they then travel along the intestine and are largely reabsorbed by an active transport mechanism in the ileum (3, 7). Only a small percentage (6 %) of the bile acids escape intestinal absorption (5) so that the liver synthesizes only enough of them to replace their fecal loss. Since distal small intestinal resection impairs the entero-hepatic circulation of bile acids, functional adaptations appear to occur in resected animals to compensate fecal bile acid loss (8).

In the present work we have studied the effect of 50 % distal small intestine resection on bile acid output in the bile and faeces. Female Wistar albino rats were randomly assigned to individual cages and to commercial rat chow. Two groups of eight animals each were studied: A: sham operated rats, and B: rats with 50 % distal small intestine resection. The general design of the experimental procedure used in the current study, together with details of the surgery, care and management of the experimental animals, have previously been described (11). All the experimental measurements were done 5 months after surgical operation. To measure bile acid output in the bile and faeces, the rats were anaesthetized with sodium Pentobarbital (4.5 mg/100 g b.w.) after a 24 h fast. Laparotomy was performed and the common bile duct cannulated with PE-10 polyethylene tubing to collect bile for 30 min. Bile was collected between 9:00 a.m. and 11:00 a.m. to avoid variations due to the circadian rhythm. Faeces were collected during 1 day, weighed wet and heated for 24 h at 110°C, and then bile acids were extracted following the DE WAEL method (2). Bile acids in both bile and faeces were determined by an enzymatic method (4). Fecal water was calculated as the difference between wet and dry weights.

As could be expected body weight was impaired by intestinal resection (459 ± ± 18 g in sham animal v.s. 380 ± 26 g in resected rats). The intestinal resection (50 %) increased bile flow and decreased both bile acid concentration and output in the bile (table I). Also, bile acid output in faeces was significantly increased 5 months after distal small bowel resection (table II). Since the resected animals

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Table I. *Effect of intestinal resection on bile acid output in the bile.*
Data are the mean values ± S.E. of eight animals in each group. t-Student test.

Group	Bile acid (mM)	Bile flow (ml/day)	Bile acid output (μmol/day)
A	33.06 ± 2.39	10.56 ± 0,96	324.5 ± 27.84
B	19.86 ± 1.06*	13.44 ± 1.92 (N.S.)	262.1 ± 31.70 (N.S.)

* $p < 0.001$; N.S. non significant, as compared to sham group.

Table II. *Effect of intestinal resection on bile acid loss in faeces.*
Data are the mean values ± S.E. of eight animals in each group.

Group	Faeces output (g/day) Wet weight	Faeces output (g/day) Dry weight	Fecal water (ml/day)	Fecal bile acid output (μmoles/day)
A	2.34 ± 0.24*	1.83 ± 0.17**	0.51 ± 0.05*	108.7 ± 17.60*
B	1.49 ± 0.21	1.23 ± 0.13	0.26 ± 0.02	28.0 ± 3.16

* $p < 0.001$; ** $p < 0.05$, as compared to sham group (t-Student test).

were without ileum, both the observed decrease in bile acid output in the bile and the increase in fecal bile acid output could be explained by a decrease in intestinal bile acid reabsorption. It is of interesting to note that following intestinal resection the enhancement in fecal bile acid loss (4-fold increase) was much greater than the decrease in bile acid output in the bile (1.2-fold decrease). This observation suggests that the bile acid synthesis may be stimulated following distal small bowel resection. Supporting this view is the observation that the activities of hepatic 3-hydroxy-3-methylglutaryl Coenzime A reductase and of cholesterol 7α-hydroxylase, which are rate limiting enzymes for cholesterol and bile acid synthesis, were increased when the entero-hepatic circulation was impaired (1, 10, 12).

Daily fecal mass and fecal water content were significantly increased in resected animals (table II). The increase in fecal water content could be due to increased dyhydroxy bile acid input into the colon (9).

In conclusion, the present study supports previous findings (6, 11) suggesting that the decrease in enterohepatic circulation caused by distal small bowel resection might be physiologically compensated by an increase in hepatic bile acid synthesis.

Key words: Bile, Bile acid, Ileal resection.

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