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INFLUENCE OF DIETARY CHOLESTEROL ON THE LIVER LIPID METABOLISM AND PLASMA CHOLESTEROL IN SHEEP

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Natural diets of ruminants as compared to the diets of some monogastric animals, contain low levels of fat and very little cholesterol (Palmquist, 1976). Extraneous cholesterol incorporated into the diets of ruminants is extensively hydrogenated in the rumen and rendered unavailable for absorption. Cholesterol can be protected against ruminal hydrogenation by encapsulating it in a formaldehyde treated casein matrix (Ashes et al. 1978) and when fed in this form to lactating ruminants was found to markedly suppress the secretion of long chain fatty acids in milk fat (Gulati et al. 1978).

Two experiments were conducted in which protected cholesterol was added to a basal diet or a basal diet containing a protected lipid supplement. Two control sheep were fed 800 g/day of a diet containing 60% lucerne chaff and 40% crushed oats. Two other groups of 3 sheep were fed the basal diet at the same level plus 1-2 g/day cholesterol in either the protected or unprotected form. Mean plasma cholesterol in all sheep at the start of the experiment was 63 mg % rising to 94 and 135 mg % over the 14 week experimental period for sheep receiving unprotected and protected cholesterol, respectively. The control sheep showed no change. The livers of sheep consuming unprotected or protected cholesterol weighed 599 g and 732 g, respectively, and contained 1.37 and 2.84% cholesterol compared with the control values of 530 g and 0.13 %. On the protected cholesterol diets the livers were pale-white, very friable, and cirrhotic in appearance indicating gross impairment of liver function.

In the second experimental diet containing protected lipid supplement was fed to two groups of sheep with and without protected cholesterol. In both groups plasma cholesterol rose from 78 mg % to 137 mg % over a four month experimental period. However, the rise was more rapid in the animals fed cholesterol. The livers of sheep fed protected cholesterol showed fatty infiltration and cirrhosis.

These results indicate that dietary cholesterol protected against ruminal hydrogenation may have far reaching metabolic implications for ruminants as compared to the effects produced by similar levels of dietary cholesterol in monogastric animals.

ASHES, J.R., GULATI, S.K., COOK, L.J., MILLS, C.S. and SCOTT, T.W. (1978) J. Lipid Res. 19: 244.

GULATI, S.K., COOK, L.J., ASHES, J.R. and SCOTT, T.W. (1978). Lipids. Submitted for publication.

PALMQUIST, D.L. (1976). J. Dairy Sci. 59: 355.

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