

Dietary oat β -glucan affects kinetics of glucose absorption and insulin secretion in grower pigs

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The role of dietary β -glucan in glucose absorption and insulin secretion is not known. Kinetics of absorption may impact the metabolic status following a meal. Effects of dietary β -glucan on glucose absorption and insulin secretion were studied in three 35-kg pigs, surgically modified with catheters in the portal vein and carotid artery and an ultrasonic flow probe around the portal vein. Pigs were fed 3 wheat and soybean-based diets containing 0, 3, and 6% concentrated oat β -glucan twice daily for 6 consecutive 7-d periods in a double 3 x 3 Latin square. On d 7 of each period, serial blood samples were taken for 12 h postprandially: every 15 min from -15 to 60 min, then 30 min to 240 min, 60 min to 480 min, and at 600 and 720 min; blood flow was measured simultaneously. Plasma was analyzed for glucose, insulin, and C-peptide. Glucose absorption and insulin and C-peptide production rate were calculated from blood portal-arterial differences x blood flow.

Preprandial portal glucose was 5.5 mmol/L and increased postprandially to 10.5 mmol/L, with the highest peak for 0% β -glucans. Blood flow and carotid glucose increased after feeding and were not affected by diet. Dietary β -glucan decreased glucose absorption rate at 45 min and thereby reduced net glucose absorption during the first h after feeding. Dietary β -glucan reduced carotid insulin at 30 min postprandial. Dietary β -glucan decreased portal but not carotid C-peptide. Dietary β -glucan decreased net release of C-peptide in the portal vein at 30 min postprandial, but did not affect corresponding insulin values, indicating that β -glucan affected insulin secretion and prehepatic insulin homeostasis.

Implications: Oat β -glucan as a soluble, viscous fiber decreases the speed of glucose absorption and reduces peak insulin secretion; thus, dietary β -glucan in the long term improves carbohydrate metabolism. Specific fiber sources thus not only serve as a nutrient, but may also affect absorption of other dietary nutrients by the pig.