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Dietary fat control of the exocrine pancreas in normal states and in obesity: The role of ER stress

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Abstract

Digestive enzymes of the exocrine pancreas are the gateway for entrance of nutrients into the human body. We demonstrate how different dietary fatty acids differentially regulate expression of pancreatic lipases throughout life. Moreover, maternal dietary fat acts in nutritional programming of the embryo, determining the newborn's exocrine pancreas function. In adults, high dietary fat consumption is a risk factor in the etiology of pancreatitis and pancreatic cancer. We demonstrate that chronic surplus of dietary fat results in overflow of fat to the exocrine pancreas, culminating in cellular dysfunction: chronic overload of saturated dietary fat induces an exocrine pancreas acinar cells lipotoxic effect, expressed in triglycerides accumulation, enhanced apoptosis and imbalance of anti-apoptotic and pro-apoptotic transcripts. Exocrine pancreas acinar cells have a highly developed endoplasmic reticulum (ER) system, which accommodates their high protein production rate, but is also involved in lipid synthesis and is ultimately prone to stress upon overload insults. We show that in pancreatic acinar cells, acute challenge with different fatty acids (mono and polyunsaturated) significantly increases triglycerides accumulation (dependent on type of fat), and affects the UPR response. Additionally, chronic consumption of fat by C57BL/6J mice results in elevated pancreatic ER stress response. Thus, pancreatic lipases are differentially regulated by different dietary fats; furthermore, in dietary fat overload, different fatty acids affect acinar cell stress to different extents, mediating pathological effects of obesity on the exocrine pancreas. The differential effect of the various fatty acids has potential nutritional and therapeutic implications.

Biography

Ruth Birk completed her B.Sc. in both Clinical Nutrition and Food Biotechnology, followed by M.Sc. and Ph.D. in Biochemistry and Nutrition at the Hebrew University of Jerusalem (Israel), continuing to postdoctoral training in Molecular Nutrition at the University of Maryland (USA) and a second postdoctoral training in Human Genetics at the Weizmann Institute of Science (Israel). She is the head of the nutrigenetics and nutrigenomics research group at the Department of Nutrition at Ariel University, Israel. Her research focuses on nutrigenetics and nutrigenomics studies related to obesity, digestion and physical activity.