Milk Proteins Produce Differential Effects on Energy Balance, Glucose Metabolism and Taste Preference in Diet-Induced Obese Rats

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Milk proteins decrease food intake, body weight, and improve glycemic control in humans and rodents; however, little is known about the underlying mechanisms of improvements in energy balance and glucose metabolism.

We determined the effects of dietary whey, casein, and a combination of the two, on food intake, energy expenditure, body composition, glucose tolerance, metabolic hormones and markers, and taste preference in diet-induced obese rats.

In experiment-1, obese rats were randomized to isocaloric high-fat diets (n=12/group; 33% calories from fat) containing egg white (control; 14% protein calories), whey (WH; 40% protein calories), casein (CA; 40% protein calories) or whey+casein (WHCA; 40% protein calories) with measurements of various behavioral and metabolic parameters. In experiment-2, dietary preference for WH, CA, WHCA, or control diets was assessed.

WH, CA and WHCA decreased food intake, body weight and fat content with WH and CA producing pronounced effects. WH and CA improved glucose tolerance, with WH being more effective. The hypophagic effects of WH and CA were likely due to reduced dietary preference. WH reduced energy expenditure at early stages, whereas CA and WHCA increased energy expenditure at later stages of study. WH, CA and WHCA decreased plasma leptin, glucose-dependent insulinotropic polypeptide and interleukin-6, whereas WH increased glucagon-like peptide-1 concentrations. The CA and WHCA diets increased plasma membrane glucose transporter-4 (GLUT4) to total GLUT4 ratio in skeletal muscle; other markers of glucose and energy metabolism in the adipose and cardiac tissues did not differ.

Together, these data demonstrate that dietary whey, casein, and their combination, improve energy balance through divergent effects on food intake, energy expenditure, glucose tolerance and gut hormone secretion, with whey being more efficacious. These findings have potential significance for developing whey-based functional foods and nutraceuticals for weight and diabetic control.