Effects of substituting carbohydrates and fat for whey-protein or adding them to whey protein on energy intake and underlying gastrointestinal-mechanisms in healthy older men

C. Giezenaar, T. Hausken, K.L. Jones, M. Horowitz, I. Chapman and S. Soenen, Discipline of Medicine, and NHMRC Centre of Research Excellence in Translating Nutritional Science to Good Health, The University of Adelaide, Royal Adelaide Hospital, SA 5000, Australia.

Background: Protein-rich supplements are used widely for the management of malnutrition in the elderly. Information about the effects of these supplements on energy intake and related gastrointestinal mechanisms is limited.

Objective: The aim was to determine the effect of supplementing carbohydrate and fat for whey-protein, or adding them to whey protein, on energy intake, gastric emptying, gut hormones and appetite in healthy older men.

Design: In randomized, double-blind order, 13 healthy older men (74±6yrs, 82±3kg, body mass index 26±2kg/m^2) ingested drinks (~450 mL) containing either: (i) 70g whey protein (280 kcal; 'protein$_{280kcal}$'), (ii) 14g protein, 28g carbohydrate, 14g fat (280 kcal; 'mixed$_{280kcal}$'), (iii) 70g protein, 28g carbohydrate, 14g fat (504 kcal; 'mixed$_{504kcal}$'), or (iv) an iso-palatable control drink (~2 kcal; 'control'). *Ad libitum* energy intake was quantified from a buffet meal (consumed 180-210min after drink ingestion). Perceptions of appetite and gastrointestinal symptoms (visual analog scales), gastric emptying (3D-ultrasonography), blood glucose and plasma insulin, ghrelin, cholecystokinin (CCK) and glucagon-like peptide 1 (GLP-1) concentrations were measured at regular intervals (0-180min). Differences between study conditions for energy intake, gastric emptying, perceptions of appetite and gastrointestinal symptoms (visual analog scores) and glucose and hormone concentrations were determined using repeated-measures ANOVA, with the treatment as the within-subject factor. Post hoc comparisons were adjusted with the Bonferroni method.

Results: The caloric drinks did not suppress subsequent *ad libitum* energy intake at a buffet meal compared to a non-caloric control (P>0.05). Consequently, there was an increase in total energy intakes (drink plus buffet meal: P<0.05), which was increased most by the mixed$_{504kcal}$ drink, which had the highest energy content. Perceptions of hunger, desire to eat, prospective food consumption, fullness, nausea, and bloating were not different between study days (P>0.05). Protein$_{280kcal}$ drink ingestion was followed by slower gastric emptying, lower ghrelin, and higher CCK and GLP-1 concentrations than mixed$_{280kcal}$ (P<0.05), but comparable gastric emptying and gut hormone responses compared to mixed$_{504kcal}$ (P>0.05).

Conclusions: These findings are likely to have implications to the composition of protein rich supplements for older people as well as for targeting gastric emptying and gut hormone responses by preload intakes.

The study was funded by a Royal Adelaide Hospital Clinical Project Grant and S Soenen was supported by a Royal Adelaide Hospital Florey Fellowship.