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The effect of probiotic, prebiotic and polyphenol interventions on gut hormones and markers of glycaemic control: findings from the CABALA study

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Dietary supplementation with pre/probiotics and polyphenol-rich foods lead to altered composition of gut microbiota and may impact on markers of cardiometabolic health via effects on bile acid metabolism(1). Bile acids are implicated in glucose and metabolic regulation, in part due to stimulation of gut hormone secretion via activation of nuclear receptors, specifically, Takeda G-protein receptor 5(2). Further studies are required to elucidate mechanisms underlying the effects of pre/probiotics and polyphenol-rich foods on gut hormones and glycaemic control.

The CirculAting Bile Acids as Biomarkers of Metabolic Health - Linking microbiotA, Diet and Health (CABALA) study investigated how chronic consumption of probiotics (lactobacillus reuteri), prebiotics (oats) and apples (rich in polyphenols/fibre) impact on secretion of gut hormones (glucagon-like peptide-1 (GLP-1), peptide YY (PYY), active ghrelin, pancreatic polypeptide (PP), C-Peptide and gastric inhibitory polypeptide (GIP)), glucose and insulin compared with a control intervention. A single-blind, chronic parallel trial was conducted in 61 volunteers (mean ± SD, age 25 ± 12 y and BMI 24.8 ± 3.3 kg/m2) randomised by age, sex, BMI and total cholesterol to one of four groups: i) 40 g/day of cornflakes with two probiotic capsules or ii) 40 g/day porridge oats or iii) two Renetta Canada apples/day or iv) 40 g/day of cornflakes (control), each with two placebo capsules, for 8 weeks. At week 0 and 8 a blood sample was taken and gut hormones were analysed in the collected plasma using Luminex, serum glucose using a clinical chemical analyser and serum insulin by ELISA. Change in the fasting outcome measures were analysed using a one way ANOVA (week 8 minus week 0).

There were no significant differences in the fasting concentrations of the gut hormones, insulin or glucose between intervention groups at baseline (week 0). Change in fasting GIP was significantly higher following the apples (10.2 ± 2.8 pg/ml) compared with control (1.2 ± 3.5 pg/ml) over the 8-week intervention period ($P = 0.041$). Changes in other gut hormones, insulin and glucose from week 0 to 8 were similar following the interventions.

Although our study has revealed a significant impact of chronic apple consumption (polyphenol rich/prebiotic) on fasting GIP, circulating insulin concentrations were not found to be different between interventions. Further analysis of samples from this study will determine whether the interventions were related to changes in post-prandial glycaemic control and if these changes are mechanistically linked to the gut microbiota composition and circulating bile acids.

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