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Acute effects of apple and blackcurrant polyphenol-rich extracts on postprandial glycaemia and vascular function in healthy men and women

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Elevated postprandial glucose concentrations lead to endothelial dysfunction. Certain fruit polyphenols (e.g. phloridzin, anthocyanins) inhibit intestinal glucose transport[1]. Others (e.g. anthocyanins, proanthocyanidins, ellagitannins) reduce starch- and sucrose-digesting enzyme activity[2]. The effects of consumption of apple polyphenols on postprandial glucose concentrations following starch/sucrose-containing meals have not been fully characterised. The aim of this study was to determine whether postprandial glycaemia and vascular function following high-carbohydrate meals were influenced by a polyphenol-rich apple extract, with and without an anthocyanin-rich blackcurrant extract.

Twenty-five healthy subjects (20 M, 5 postmenopausal W, mean age 32 y, SD 14) completed a randomised, double-blind, crossover study. Three matched fruit cordial drinks contained either 1) 1·2 g apple polyphenols (A); 2) 0·6 g apple polyphenols + 0·6 g blackcurrant anthocyanins (1·4 g blackcurrant polyphenols) (AB); or, 3) no added polyphenols (CON; control). The drink (12·2 g carbohydrate, 195 kJ) was administered immediately before a high-carbohydrate meal (41 g starch, 22 g sucrose, 1·3 MJ). Venous plasma glucose was measured at baseline and frequent time-points up to 2 h, and digital volume pulse stiffness index (DVP-SI) and reflection index (DVP-RI) were assessed at baseline and 1, 1½ and 2 h.

Plasma glucose total iAUC 0–120 min ($P < 0{\cdot}05$) and early iAUC 0–30 min, Cmax and Tmax were reduced by treatments A and AB compared with CON (all $P < 0{\cdot}0001$). Mean differences in iAUC 0–30 min were: A - CON, −25·3 mmol/L·min (95 % CI −33·6, −16·9); AB - CON, −33·1 mmol/L·min (95 % CI −42·4, −23·8); AB - A, −7·8 mmol/L·min (95 % CI −12·5, −3·2). The overall treatment effect was significant for changes in DVP-RI ($P = 0{\cdot}015$), a parameter of vascular function which is indicative of small- to medium-sized arterial stiffness and influenced by peripheral arterial vasodilation. DVP-RI significantly decreased following A compared to CON but the decrease following AB was not statistically significantly different from CON (mean differences in ΔDVP-RI (% units)): A-CON, −6 % (95 % CI −11, −2); AB-CON, −3 % (95 % CI −8, 1); AB-A, 3 % (95 % CI −4, 10). There were no significant effects of treatment on DVP-SI, an indicator of stiffness of large elastic arteries.

In conclusion, consumption of 1·2 g apple polyphenols reduced plasma glucose concentrations following a starch and sucrose-containing meal and prevented the postprandial increase in pulse wave reflection associated with postprandial glycaemia. Although the lower dose of apple polyphenols (plus blackcurrant polyphenols) had a slightly larger inhibitory effect on glycaemic response, there was no significant amelioration of postprandial vascular dysfunction. These findings suggest that apple polyphenol metabolites absorbed within 2 h of ingestion may have been primarily responsible for the observed improvements in postprandial vascular function within this timeframe.

1. Schulze C, Bangert A, Kottra G, *et al.* (2014) *Mol Nutr Food Res* **58**, 1795–808.
2. Williamson G. (2012) *Mol Nutr Food Res.* **57**, 48–57.