Development of a Beverage Model to Test Appetite Control Food Ingredients

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Abstract

The present project is part of the broader 'Foods for Appetite Control' research programme of Plant & Food Research. The programme aims to deliver validated satiety effects (reduce appetite and provide more than four hours of satiety) in foods through phytochemicals and macro-nutrients. As it is necessary to validate the satiety effects through clinical trials, a beverage model was developed. It served as a 'vehicle' for incorporating phytochemicals (*e.g.* fruit extract) and macro-nutrients (*e.g.* viscous fibre – alginate) to deliver their satiety effects, which were validated by a satiety measurement trial.

The development work began with the characterization of viscous fibres. Based on the literature review, pectins and alginates appear to be more satiating than other viscous fibres. It is believed that gastric gelation can induce satiety, through the formation of a gel that has some strength (presumably in the stomach). Based on rheological measurements, Protanal® LF120 alginate and Grindsted® Pectin LA410 were selected for further evaluation in the beverage model. These viscous fibres met the criteria of providing viscosity to the beverage, showing sensitivity to acids and calcium ions resulting in gelation, and contributing to higher gel strength than others that were evaluated.

The beverage model was developed as a partial-meal replacer beverage, which is non-dairy, soy protein-based, fruit-flavoured (blueberry), 250 mL and of neutral pH (~7.2). The development work has established a base formulation and processing method for the beverage model and has successfully incorporated Protanal LF120 (0.25% and 0.5%) and fruit extract (0.2%). Due to its low viscosity and poor stability in UHT-processing even at high levels, Pectin LA410 was excluded from further evaluation. Incorporation of quercetin and isoquercetin into the beverage model was unsuccessful because of their insolubility in water and interactions with soy proteins.

A methodology for satiety measurement was established and a trial was carried out to validate the satiety effects (subjective appetite) of the fruit extract and Protanal LF120 in the beverage model. The trial used a preload (6 test beverages), within-subject (n = 12), repeated measures, completely balanced, crossover and randomized design. The satiety effect of Protanal LF120 was found to be dose-dependent; higher alginate level significantly increased the satiety effect of the beverage. Differences in mean appetite

ratings (P <0.05*)* between low and high alginate levels were 6.9%, 8.3%, 10.6%, 6.3% and 6.7% for hunger, fullness, satiety, desire to eat and prospective food consumption ratings, respectively.

On the other hand, the data did not reveal statistically significant results across all appetite scales (except for hunger, P = 0.015) between beverages with and without fruit extract. In addition, the interaction of alginate*fruit extract was not statistically significant, implying that the higher satiety effect of the high level alginate + fruit extract beverage could be purely due to the alginate. Further testing is warranted: (1) to incorporate higher levels of fruit extract in the beverage model to evaluate any dose-dependency, (2) to determine if an additive or synergetic satiety effect exists with a higher level of fruit extract and high alginate level in the beverage, and (3) to modify the current experimental design to increase power of the study to 80% by increasing the number of subjects.

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