# RELATIONSHIP BETWEEN IN-VITRO VISCOSITY OF DIFFERENT FIBRES AND THEIR IN-VIVO GLYCEMIC IMPACT IN RATS

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The addition of viscous fibre such as guar gum to carbohydrate meals has previously been shown to reduce postprandial hyperglycemia (Jenkins et al. 1979). These polysaccharides absorb water and the resultant increased viscosity is thought to delay glucose absorption in the intestine. A correlation between viscosity determined in vitro prior to ingestion and the reduction in postprandial hyperglycemia has been demonstrated (O'Connor et al. 1981). However upon dilution with acidifying and neutralising secretions in the gut the viscosity of several fibre types are significantly reduced (Edwards et al. 1987). In this study we examined the correlation between the viscosity of several fibre types before and after acidification and reneutralisation and their subsequent effect on postprandial glucose response.

Four fibre types were studied, guar gum, methylcellulose, xanthan gum, and bran which served as a non-viscous control. The fibres (7% w/w) were added to a high carbohydrate, low fat diet (70% energy as CHO, 10% as fat). The viscosities were determined in vitro after 1:6 dilution with tap water and a 1 hour incubation at 37°C. Additionally viscosities were measured after further dilution with acidifying (0.1 mmol/l HCl, 54 mmol/l NaCl) and reneutralising (120mmol/l NaHCO3, 5 mmol/l KCl and 30 mmol/l NaCl) solutions to mimic the conditions of the stomach and small intestine. Viscosities were measured on a Brookfield viscometer (shear rate of 0.005 revs/sec) at 37°C. The Bran diet had no measurable viscosity. Results are shown in the table below.

| | One hour incubation | Acidification/ reneutralisation | % of initial viscosity |
|---|---|---|---|
| Xanthan gum | $114x10^3$ ($7.2x10^3$) | $122x10^3$ ($2x10^3$) | 107 |
| Methylcellulose | 541 (20) | 288 (27) | 53.2 |
| Guar gum | $64.7x10^3$ ($5.2x10^3$) | $23.4x10^3$ ($1.8x10^3$) | 36.2 |

TABLE : Viscosities in Centpoise (cP). Results average of 3 measurements (SE)

The in-vivo postprandial glucose response to the four diets was determined in 16 male Sprague-Dawley rats. After an overnight fast the rats were fed by gastric intubation 0.2 g carbohydrate of each of the four diets. Tail vein blood samples were collected over 2 hours for glucose determination. The glucose results were expressed as incremental areas under the blood glucose curve and showed that the bran control diet gave the largest postprandial glucose response of 89.4±24.6 mmol/l /min (mean± SE). The blood glucose responses for the viscous fibres related to the acidified/reneutralised diluted vicosity. The glucose responses were 53.8±0.6, 75.6±14.2 and 82.3±17.1 mmol/l /min for xanthan gum, guar gum and methylcellulose respectively.

The results indicate that despite large reductions in the viscosity of guar gum following acidfication and reneutralisation the acute postprandial blood glucose response could be predicted from initial viscosity measurements of the food samples.

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