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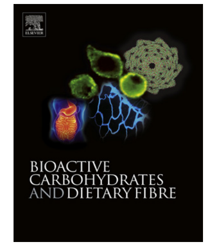

Effects of apple juice-based beverages enriched with dietary fibres and xanthan gum on the glycemic response and appetite sensations in healthy men ☆

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ABSTRACT

In order to verify whether other fibre characteristics, beyond viscosity can have an impact on glycaemia and appetite sensations, the aim of this study was to compare the effects of two palatable juices owning a similar viscosity value but enriched with guar gum/xanthan gum or konjac-mannan/xanthan gum mixture to a control non-enriched juice on the variation of glucose, insulin, C-peptide and appetite sensations in 20 healthy men. In a randomized crossover design, each volunteer consumed two beverages enriched with fibres (guar gum/xanthan gum and konjac-mannan/xanthan gum mixtures) as well as a control beverage without fibre. One week wash-out separated the testing of each beverage. Blood samples were collected to measure glucose, insulin and C-peptide before and after the consumption of each beverage. Appetite sensations were assessed using visual analogue scales. Glucose, insulin and C-peptide concentrations were similar before the consumption of the three juices ($p>0.05$). Juices enriched with fibres failed to significantly reduce postprandial glucose, insulin and C-peptide responses compared to the control beverage. However, consumption of the beverage enriched with konjac-mannan/xanthan gum mixture decreased significantly the appetite score, compared to the two other beverages and increased fullness sensation compared to the guar gum/xanthan gum enriched beverage ($p<0.05$). These results suggest that viscosity of fibre-enriched juices cannot be the unique factor influencing appetite responses. Further studies will be required to determine polysaccharide viscosity and concentration needed to obtain significant effects on glycemic and insulinemic responses for beverages enriched with guar gum/xanthan gum and konjac-mannan/xanthan gum mixtures.

☆The study was approved by the Research Ethics Committee on human experimentation of Laval University; 2007 – 180 A3 R-2/08–09-2009.

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1. Introduction

Increasing dietary fibre intakes is now recognized as an efficient strategy to reduce postprandial glycaemia and insulinaemia and enhance insulin sensitivity (Anderson et al., 2009; Nazare et al., 2009; Weickert & Pfeiffer, 2008). Several studies have claimed that the effect of dietary fibres, especially soluble fibres, on glycemic response depends on their capacity to develop viscosity (Dikeman & Fahey, 2006; Juvonen et al., 2009; Vuksan, Rogovik, Jovanovski, & Jenkins, 2009b). In fact, fibre viscosity would mainly act on two levels: slowing the rate of gastric emptying and decreasing the absorption of glucose in the lumen of small intestine (Wursch & PiSunyer, 1997; Weickert & Pfeiffer, 2008). It has also been suggested that the viscosity of dietary fibres may promote satiety and, consequently, facilitate body weight control (Anderson et al., 2009; Howarth, Saltzman, & Roberts, 2001; Vuksan et al., 2009a). In fact, the increase of chyme viscosity in the gut by soluble dietary fibres may promote gastric distension, slow down the gastric emptying time and prolong the small intestine transit time, which may increase satiety and satiation after meals by mediating signals to the central nervous system (Lyly et al., 2009). Fibre-enriched beverages represent a good vector for fibre intake since viscous dietary fibres are already hydrated before ingestion in beverages as compared with solid meals, leading to a higher viscosity development in the gastrointestinal tract (Dikeman & Fahey, 2006).

Some studies have suggested that viscosity is not the sole factor involved in the regulation of glycaemia and appetite sensations by dietary fibres and have put in perspective the importance of the nature of fibres in the mechanism of action rather than only the viscosity per se (Guerin et al., 2001; Ou, Kwok, Li, & Fu, 2001). However, little is known about the impact of other fibre characteristics beyond viscosity on glycaemia and appetite sensations. In light of previous works, guar gum and konjac-mannan are dietary fibres known to attenuate both blood glucose and insulin responses (Blackburn et al., 1984; Chearskul et al., 2007; González Canga et al., 2004; Jenkins et al., 1978) and promote satiety (González Canga et al., 2004; Lavin & Read, 1995; Sood, Baker, & Coleman, 2008). Moreover, xanthan gum is widely recognized for its high stability in the presence of salt and over a broad range of pH values (Katzbauer, 1998), which may help to preserve and stabilize viscosity induced in fibre-enriched beverages. Considering these previously reported effects of these dietary fibres on glycaemia and appetite sensation responses and in order to verify the impact of the nature of fibres on these variables, the aim of the present study was therefore to compare the effects of two palatable juices owning a similar viscosity value but enriched with guar gum/xanthan gum or konjac-mannan/xanthan gum mixture to a control non-enriched juice on the variation of glucose, insulin, C-peptide and appetite sensations in 20 healthy men. In this study, it is important to highlight that a major methodological issue was to develop fibre-enriched beverages with an acceptable palatability. Since the addition of high doses of fibres into juices may lead to a decrease in the acceptability of these products, beverages were therefore enriched with an amount of dietary fibres which has been previously shown to preserve an acceptable palatability (Paquin, Bédard, Lemieux, Tajchakavit, & Turgeon, 2012).

2. Methods

2.1. Subjects

Twenty healthy non-smoker men aged from 20 to 55 years old were recruited. Baseline characteristics of subjects are shown in Table 1. HDL-cholesterol, LDL-cholesterol, total cholesterol to HDL-cholesterol ratio, triglycerides and glucose concentrations were measured after a 12-h overnight fast. The study was approved by the Research Ethics Committee on human experimentation of Laval University. Informed written consent was obtained from all participants. Subjects received a financial compensation if they completed the study.

2.2. Study design

The study followed a randomized crossover design. Volunteers came three times to the clinical investigation unit of the Institute of Nutrition and Functional Foods (INAF) to drink 300 mL of one of the three different beverages. Subjects were fasted, avoided alcohol intake and strenuous physical training for 48 h before testing. One-week wash-out separated the testing of each beverage. The sequence of beverage intake was randomized for each subject. Before each test, body

Table 1 – Subject's characteristics.

Characteristics	Values[a]
Age (years)	28±7
Height (cm)	177.1±7.8
Weight (kg)	76.7±14.0
BMI (kg/m^2)	24.4±4.0
LDL-cholesterol (mmol/L)	2.62±0.78
HDL-cholesterol (mmol/L)	1.31±0.25
Total cholesterol/HDL-cholesterol (mmol/L)	3.44±0.94
Triglycerides (mmol/L)	0.98±0.46
Fasting glycaemia (mmol/L)	5.14±0.36

[a] Values are means±S.D.; $n=20$.