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The effect of β-glucan molecular weight on the quality of extruded breakfast cereals

MA Brennan, CS Brennan

Institute of Food, Nutrition & Human Health, Massey University, Palmerston North, New Zealand

Background – Traditionally the consumption of extruded breakfast cereals results in a high glycaemic response. This is in part due to the extrusion process which disrupts the structure of the food matrix and the integrity of starch granules within he cereal mixture. β-glucans have been shown to have an effect in reducing the amount of starch hydrolysis during digestion and have been linked to a retention of starch structure.

Objective – To quantify effects of differing β-glucan preparations (differing in molecular weight profile) inclusions into an extruded breakfast cereal in relation to starch structure, gelatinisation and hydrolysis.

Design – β-glucan (high molecular weight and low molecular weight) was added to a wheat flour breakfast cereal base at 2.5 and 5% levels (w/w). Extruded breakfast cereals were made from the base preparations. Expansion ratio, cereal pasting properties (using the rapid visco-analyser) and chemical composition were determined. In vitro starch digestibility was measured to determine the effect of dietary fibre and extrusion processing on readily, slowly digestible starch fractions.

Outcomes – The incorporation of high molecular weight β-glucan significantly reduced the expansion ration of the breakfast cereal (compared to the control sample). Low molecular weight β-glucan were similar in physical characteristics to the control sample. The degree of starch gelatinisation (as evidenced by starch pasting properties) and starch hydrolysis were significantly reduced by the incorporation of either high or low molecular weight β-glucan preparations.

Conclusions – This work demonstrates that although differences in cereal structural characteristics are possible with the incorporation of differing molecular weight β-glucans, both high and low molecular weight β-glucans decrease the potential glycaemic response (starch hydrolysis) at similar levels.

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Effect of carbohydrate distribution on postprandial glucose peaks using continuous glucose monitoring in type 2 diabetes

KL Pearce, M Noakes, J Keogh, PM Clifton

CSIRO, Health Sciences and Nutrition, Adelaide, South Australia, Australia 5000[1],
University of Adelaide, Department of Physiology, Adelaide, South Australia, Australia 5000[2]

Background – Large postprandial glucose peaks are associated with increased risk of diabetic complications

Objective – To investigate the effect of carbohydrate distribution on postprandial glucose (PPG) excursions using continuous blood glucose monitoring (CGMS), when consuming a moderate carbohydrate diet in energy balance in subjects with Type 2 diabetes. We hypothesised that an even distribution of carbohydrates attenuate PPG excursions compared to 3 other carbohydrate distribution interventions.

Design – 23 subjects with Type 2 diabetes were randomized to each of 4, 3-day 9MJ interventions in a cross over design with a 4 day wash out period. Identical foods were provided for each treatment with a total carbohydrate: protein: fat ratio of 40%:34%:26%, but differing in carbohydrate content at each meal**:** even distribution (CARB-E ~70g carbohydrate), breakfast(CARB-B), lunch(CARB-L) and dinner(CARB-D) containing ~125g carbohydrate in the loaded meal. Glucose levels were continuously measured using CGMS. Outcomes were assessed by postprandial peak glucose (G_{max}), time spent above 12 mmol/L (T>12) and total area under the glucose curve (AUC_{20}).

Outcomes – Daily G_{max} differed between treatments (p=0.003) with CARB-L(14.2 $\pm$ 1.0mmol/L) = CARB-E (14.5$\pm$0.9mmol/L) = CARB-D(14.6$\pm$0.8mmol/L) < CARB-B(16.5$\pm$ 0.8mmol/L). Meal G_{max} was weakly related to carbohydrate amount and glycemic load (r=0.40-0.44). T>12 differed between treatments (p=0.014) and there was a treatment x fasting blood glucose (FBG) interaction (p=0.003) with CARB-L(184$\pm$74min) <CARB-B(190$\pm$49min) <CARB-D(234$\pm$87min) <CARB-E(262$\pm$91min). Total AUC_{20} was not significantly different between treatments. After adjustment for FBG treatment became significant (P=0.006), AUC_{20} CARB-L(10049$\pm$718) <CARB-E (10493$\pm$706) <CARB-B(10603$\pm$603) < CARB-D(10717$\pm$638) [mmol/Lx20hr].

Conclusion – CARB-E did not optimise blood glucose control as assessed by postprandial peaks whereas CARB-L provided the most favourable postprandial profile.