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**Dietary fibres and their properties:- the possibility of fibre lowering the
glycaemic index of foods post extrusion.**

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Abstract

A series of experiments were devised in order to establish the relationship between fibre addition to an extruded breakfast cereal base recipe and the physical, chemical and nutritional qualities of the breakfast cereals. A twin screw extruder was used for all experiments. Preliminary investigations using, guar gum and inulin additions, illustrated that screw configuration was important in determining the physical properties (degree of expansion, firmness and crunchiness) of the extruded products. Thus a screw configuration featuring a reverse screw and mixing zone within the barrel was selected for the larger research study.

In the extended experimental design guar gum, inulin, wheat bran, swede fibre, and hi-maize were added to a base recipe at; 5, 10 and 15 % of total dry ingredient content. A further experiment was completed to investigate the synergistic effects of adding differing fibres in combination.

Results illustrated that soluble dietary fibres (for instance guar and inulin) created a porous, less firm, but crispier breakfast cereals than the insoluble fibres, which generally produced denser, harder products. The inclusion of fibre into the extruded breakfast cereals did not affect the chemical composition of the breakfast cereal significantly ($P \leq 0.05$) when taking into account the diluting factor of adding the fibre into the base recipe. However moisture loss / retention on extrusion varied significantly ($P \leq 0.05$) between fibre combinations. Thus the moisture loss of samples containing guar or inulin were greater than those samples containing wheat bran and swede fibre. The process of extrusion did not significantly effect the amount of protein, starch or fibre in the samples when the extruded samples were compared to the control samples. Pasting properties of samples were evaluated using the Rapid Visco Analyser. This was conducted to try to determine associations between starch pasting properties (gelatinisation events) of the raw and extruded samples and the physical or nutritional quality of the products. However, the results did not show clear associations.

An *in vitro* analysis was conducted to determine the effect of fibre addition on starch breakdown and subsequent release of reducing sugars. Breakfast cereals which included wheat bran, guar and swede fibre all showed a reduced rate of starch degradation compared to the control ($P \leq 0.05$). These fibres appeared to inhibit the rate of enzyme degradation of starch, in effect increasing the amount of slowly digestible starch in the breakfast cereals. Cereal samples containing inulin did not show this pattern. Generally the rate of inhibition was related to the amount of fibre added to the base recipe. When used in combinations, samples containing inulin and hi-maize were not significantly different to the control in terms of reducing sugar release, whereas inclusion of guar gum significantly reduced this release.

In conclusion, the addition of selected fibres can be used effectively as a method of manipulating the starch degradation rates of extruded breakfast cereals. This has nutritional implications in terms of glycaemic index and loading of breakfast cereals. Further work is required to develop clearer associations between the events of starch gelatinisation during extrusion and the potential glycaemic response.

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List of publications arising from this research project

1. Brennan, M.A., Monro, J.A., & Brennan, C.S. (2008) Effect of inclusion of soluble and insoluble fibres into extruded breakfast cereal products made with reverse screw configuration. *International Journal of Food Science and Technology*. **42: (IN PRESS)**.
2. Brennan M.A., Merts, I., Monro, J., Woolnough, J. & Brennan, C.S. (2008) Impact of guar and wheat bran on the physical, and nutritional, quality of extruded breakfast cereals. *Starch* **60**: 248-256.
3. Brennan, M.A., Woolnough, J.W., Monro, J.A., Merts, I. & Brennan, C.S. (2008) Guar and bran fibre reduces the potential glycaemic impact of extruded breakfast cereals. IN Proceedings of Nutritional Society of New Zealand Volume 32 (Eds C.S. Brennan) Massey University Press, ISSN 0110-4187. pp.
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