British Journal of Nutrition (2008), **99**, 691
doi: 10.1017/S000711450782410X

Nutrition Discussion Forum

Concerning the effects of oat and barley β-glucan and molecular weight on blood lipids

The recent paper from Keenan *et al.*[1] clearly demonstrated therapeutically useful blood lipid modifications in subjects consuming isolates of barley β-glucan. The most important aspect of the study was that significant effects were observed at two daily doses (3 and 5 g) and at two different molecular weights of β-glucan. The retention of efficacy at lower molecular weight was sufficient for the journal to include an invited commentary in the same issue[2], since the standard mechanism proposed for the action of soluble fibre is that viscosity in the gut modifies bile acid absorption with beneficial effects on circulating cholesterol. If viscosity is a relevant property, then it is the product of concentration in solution and molecular weight of the polysaccharide that controls the effect[3], although the role of variously hydrated particulates must also be considered[4]. Thus, to evaluate studies which deal with questions of dose and viscosity, it would be appropriate to have descriptions of methodologies used to arrive at values for dose, 'solubility' and, especially in this instance, molecular weight distribution. Presumably, these parameters were measured when designing the test foods. In view of the critically important suggestion in this paper that molecular weight and/or viscosity may have less of an influence on blood lipid response than previously thought, it would have been helpful to readers to see this information, or at least been provided with a reference to consult.

It would seem an essential requirement of testing the physiological activity of a chemical component that the method and analysis be described, but in all the long history of clinical studies of oat and barley β-glucan this has seldom been done (or at least reported in the published paper). Journals should request this information in submitted manuscripts. Since above a critical concentration, the viscosity (at zero shear rate) of random coil polysaccharides increases to the fourth power of concentration this measurement is particularly crucial. More generally than viscosity, the viscoelastic character of the polysaccharides may be important, and the elastic, or gelling, behaviour of the cereal β-glucans is critically controlled by molecular weight and structure[5]. In this respect the different cereals behave quite differently. If comparisons of efficacy between two or more foods are to be made, then additional data on β-glucan solubility and molecular weight (or some measure of viscoelasticity) of extracts of those foods would greatly help advance the literature on the subject.

The suggestion that viscosity might not be important for cholesterol lowering is of considerable value to development of foods containing β-glucan and other soluble fibres, such as guar gum, since viscosity usually leads to lower palatability. The restrictions stipulated for allowed products in the FDA health claim lose rationality if viscosity is irrelevant. Instead, we can only use the less useful statement that 'food form is important', though without physicochemical data it is impossible to determine how food form affects efficacy. The results of Keenan *et al.*[1] also raise the question of what mechanism is actually involved, although it is possible that the isolates as used provided sufficient viscosity to be in a plateau range of effect. Hopefully, further studies will clarify these issues, but this will only be the case if appropriate physicochemical measurements are performed and reported.

Peter J. Wood and Susan M. Tosh
Agriculture and Agri-Food Canada/
Agriculture et Agroalimentaire Canada
Food Research Program
93 Stone Road West
Guelph, Ontario N1G 5C9
Canada
woodp@agr.gc.ca
toshs@agr.gc.ca

References

1. Keenan JM, Goulson M, Shamliyan T, Knutson N, Kolberg L & Curry L (2007) The effects of concentrated barley β-glucan on blood lipids in a population of hypercholesterolaemic men and women. *Br J Nutr* **97**, 1162–1168.
2. Poppitt SD (2007) Soluble fibre oat and barley β-glucan enriched products: can we predict cholesterol-lowering effects? *Br J Nutr* **97**, 1049–1050.
3. Wood PJ, Beer MU & Butler G (2000) Evaluation of role of concentration and molecular weight of oat β-glucan in determining effect of viscosity on plasma glucose and insulin following an oral glucose load. *Br J Nutr* **84**, 19–23.
4. Rayment P, Ross-Murphy SB & Ellis PR (2000) Effect of size and shape of particulate inclusions on the rheology of guar galactomannan solutions. *Carbohydr Polymers* **43**, 1–9.
5. Böhm N & Kulicke WM (1999) Rheological studies of barley (1 → 3),(1 → 4)-β-glucan in concentrated solution: mechanistic and kinetic investigation of the gel formation. *Carbohydr Res* **315**, 302–311.