

PROJECT REPORT

The HEALTHGRAIN project: new insights in cereal grain fibres

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Cereal grain-based products with health benefits represent a growing part of the health-related food market. Market growth in recent years has been supported significantly by the adoption of health claims (USA – 1999, UK – 2002 and Sweden – 2003) linking whole grain-based products with a reduction in risk of coronary heart disease. These products are associated with a range of other health benefits including reduced risk of obesity, diabetes and some types of cancer. With respect to the classical health and well-being benefits of cereal fibre – contributing to intestinal regularity – recent review papers confirm the superior performance of cereal grain fibre compared with fibres from other origins. Whereas the market growth of whole grain products is expected to continue in the coming years, research in Europe is focussing on exploring options for a wider range of healthy cereal grain-based products, based on a deeper understanding of the mechanisms of whole grain health benefits. And the 16M HEALTHGRAIN 6th EU Framework Programme Integrated Project is playing a key role with 43 research partners from universities, institutes and leading cereal industries.

HEALTHGRAIN started in 2005 and will finish in 2010. But, the foundations were laid in 2002 with the EU-funded International Association for Cereal Science and Technology (ICC) Strategic Conference on Future Cereal Research in Europe. HEALTHGRAIN aims to improve consumers' well-being and reduce their risk of metabolic syndrome-related diseases in Europe by increasing intake of protective compounds from whole grains or parts thereof.

HEALTHGRAIN and dietary fibre

The HEALTHGRAIN research programme is contributing significantly to our growing insight into cereal grain fibres, their composition, distribution in the grain kernels and actual as well as potential contribution to health and well-being.

Key findings include:

- The majority of fibres are concentrated in the bran. In wheat, the outer bran layers (the pericarp) contain only insoluble fibre whilst the aleurone layer also contains soluble fibre. The fibre content of white flour, consisting mainly of endosperm, is 5–10 times lower than in bran while soluble fibre can make up 10% to 50% of total fibre. Degree of substitution in arabinoxylan fibres is also subject to change.
- The major HEALTHGRAIN 'diversity screen' exercise was analysis of fibre components and phytochemicals – specifically sterols, tocopherols, alkylresorcinols, folates and phenolic acids – in 150 wheat lines and 50 lines of other cereals including 17 rye lines grown on a single site, and 26 selected wheat and five rye lines grown on several sites. Levels of fibre varied with a factor of almost two, and were for the most part caused by genetic variations. Much wider variations were observed for most phytochemicals. But, it is possible to combine high levels of active components with good yield and processing properties.
- With new approaches for milling, and related dry separation techniques, the amounts of different bran layers can be varied; emphasis is given to flours with high levels of aleurone, the fraction also highest in phytochemicals and soluble fibre. With specific approaches, fractions high in arabinoxylans can be prepared.
- Wet processing techniques can be applied on slurries of wheat starch plants and in this way fractions of soluble arabinoxylans and prebiotic arabinoxylan oligosaccharides can be obtained and added as functional ingredients to bakery and other products.
- Studies *in vivo* in rats and pigs showed colonic production of the beneficial butyrate short chain fatty acids was highest in wheat and rye fractions with the most aleurone, with a good correlation between arabinoxylan and butyrate levels.
- Human studies *in vivo* also showed beneficial effects linked to products high in aleurone.
- HEALTHGRAIN is also exploring slow release of glucose from products with resistant or slowly digestible starch, a

clear benefit of which is the 'second meal effect'; following a meal with resistant or slowly digestible starch, glucose release from a subsequent meal is also retarded. Slow glucose release is beneficial for diabetics and may contribute to the prevention of Type 2 diabetes.

- Using the wealth of data from the diversity screen, HEALTHGRAIN demonstrated the viability of NIR analysis in cereal grains for total arabinoxylan, water extractable (~soluble) arabinoxylan, sterols (cholesterol lowering) and alkylresorcinols (marker of whole grain content). Also, ranking in terms of relative content of β -glucans can be obtained. We are currently exploring commercial implementation of this system.

Follow-up of the HEALTHGRAIN project

The cooperation within the HEALTHGRAIN consortium has generated many benefits including a limited set of well-characterized raw materials and allocation regime, outsourcing work to partners with specific expertise, and enhancing

awareness of current insights and new opportunities in the area of cereal grain-based products with health benefits. HEALTHGRAIN PhD students have been very successful in winning awards for best presentation, posters and cereal research, largely because of the optimal exploitation of expertise by the research organizations involved. It is for these reasons that the HEALTHGRAIN Board is exploring how the network created by the project can be maintained and extended.

At present, a Strategic Research Agenda is being prepared for the next 3–4 years; the aim being to execute this Agenda in a set of coherent public, primarily nationally funded projects with networking activities financed by our industrial partners. In addition to research, we also want to increase our dissemination to industry, consumers, dieticians and nutritionists, health professionals and disease foundations/charities for conditions such as heart health, diabetes and cancer, where consumers and patients will benefit from diets rich in grain fibre and in other bioactive components.