

## Cancer, genes and Broccoli - study of genetic differences in cancer protection

As previously announced (PBL News Nos 2 and 4), PBL has licensed to the world's largest fruit and vegetable seed company, Seminis Inc, new varieties of broccoli with increased levels of cancer protective compounds developed by Professor Richard Mithen at the Institute of Food Research in Norwich.



*'super' broccoli developed by traditional plant breeding methods*

A new piece of research from Professor Mithen's group has recently been published in The American Journal of Clinical Nutrition. This reports on dietary studies carried out to understand the benefits of eating broccoli, in particular the new varieties of "superbroccoli", which are the subject of PBL's licence to Seminis.

Professor Mithen said: "Eating a few portions of broccoli each week may help to reduce the risk of cancer. Some individuals, who lack a gene called GSTM1, appear to get less cancer protection from broccoli than those who have the gene.

People who gain less protection from cancer by eating regular broccoli may be able to compensate for the difference in their genetic make-up by eating the new type of broccoli with higher levels of the active plant chemical sulforaphane.

"Our studies suggest that this may be because if you lack the gene you cannot retain any sulforaphane inside your body, it is all excreted within a few hours. However, if you consume larger portions of broccoli, or broccoli with higher levels of sulforaphane, such as the 'super broccoli', you may be able to retain as much sulforaphane in your body as those who have the gene. Eating larger portions may have additional benefits since broccoli is also a rich source of other vitamins and minerals".

Broccoli is the main source of natural compound sulforaphane. It belongs to the crucifer family of plants which includes the brassica vegetables cabbage, cauliflower and Brussels sprouts, and the closely related Chinese cabbage and turnips. Other crucifers include watercress and salad rocket. The most distinctive characteristic of crucifers is that their tissues contain high levels of glucosinolates. When they are eaten, glucosinolates are broken down to release isothiocyanates. There is a well established body of evidence to show that isothiocyanates are among the most potent dietary anticarcinogens known.



*two varieties of broccoli shows standard broccoli on the left ('Iron'), and 'super broccoli' on the right*

Sulforaphane is the main isothiocyanate derived from broccoli. 'Super broccoli' contains 3-4 times more sulforaphane than standard varieties. It has been developed by traditional plant breeding methods.

Fifty per cent of the population lack the GSTM1 gene. While these people may gain less cancer protection from consuming broccoli, it is likely that they gain more cancer protection from eating other types of crucifers, such as cabbages and Chinese cabbage. So the best advice is to eat a mixture of crucifers.

This research was funded by IFR's Core Strategic Grant from the Biotechnology and Biological Sciences Research Council and by the University of Nottingham and Seminis Inc. It is part of ongoing research at IFR to identify the optimal levels of a range of food compounds for human health.

Full reference for the paper:

Glutathione S-transferase M1 polymorphism and metabolism of sulforaphane from standard and high-glucosinolate broccoli. *Am J Clin Nutr*; 82: 1283: 2005

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