New evidence for epigenetic effects of diet on healthy aging

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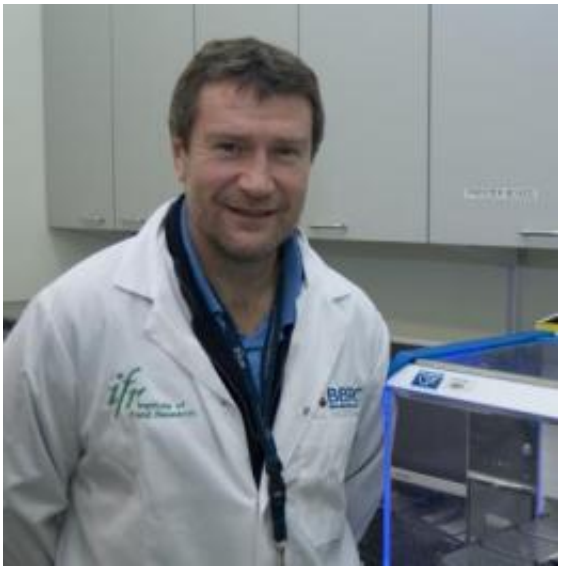

This is Dr. Nigel Belshaw of the Institute of Food Research. Credit: Institute of Food Research

New research in human volunteers has shown that molecular changes to our genes, known as epigenetic marks, are driven mainly by ageing but are also affected by what we eat.

The study showed that whilst age had the biggest effects on these molecular changes, selenium and vitamin D status reduced the accumulation of epigenetic changes, and high blood folate and obesity increased them. These findings support the idea that healthy ageing is

affected by what we eat.

Researchers from the Institute of Food Research led by Dr Nigel Belshaw, working with Prof John Mathers and colleagues from Newcastle University, examined the cells lining the gut wall from volunteers attending colonoscopy clinic. The Institute of Food Research is strategically funded the Biotechnology and Biological Sciences Research Council and this study was also funded by the Food Standards Agency.

The study volunteers were free from cancer or inflammatory bowel disease and consumed their usual diet without any supplements. The researchers looked for specific epigenetic modifications of the volunteers' genes that have been associated with the earliest signs of the onset of bowel cancer – an age-related disease. These epigenetic marks, known as DNA methylation, do not alter the genetic code but affect whether the genes are turned on or off. These methylation marks are transmitted when cells divide, and some have been associated with the development of cancer. The investigators studied the relationship between the occurrence of these epigenetic marks at genes known to be affected in cancer, and factors including the volunteers' age, sex, body size and the levels of some nutrients in the volunteers' blood. The biggest influence on gene methylation was age. This fits with the fact that the biggest risk factor for bowel cancer is age, with risk increasing exponentially over 50 years old.

The findings, published in the journal *Aging Cell*, showed that men tended to have a higher frequency of these epigenetic changes than women, which is consistent with men being at a greater risk of bowel cancer. Volunteers with higher vitamin D status tended to show lower levels of methylation, and a similar effect was observed for selenium status. Again, this is consistent with the known links between higher vitamin D and selenium and reduced bowel cancer risk.

The B vitamin folate is essential for health, but in this study, high folate status was associated with increased levels of epigenetic changes linked with bowel cancer. These findings are consistent with some epidemiological studies suggesting that excessive folate intakes may increase risk in some people. The researchers intend to investigate the mechanism for the observed effect of folate on DNA methylation in a follow-up study.

Obesity is also a risk factor for bowel cancer. This study found relationships between body size (height, weight and waist circumference) and epigenetic changes. How excess body weight induces these epigenetic changes, and the consequences for gut health, are currently being investigated at IFR and in Newcastle University.

In summary, the results of this study support the hypothesis that ageing affects the epigenetic status of some genes and that these effects can be modulated by diet and body fatness.

More information: Nutritional factors and gender influence age-related DNA methylation in the human rectal mucosa, *Aging Cell*, doi: 10.1111/acel.12030

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