

Association between Neu5Gc carbohydrate and serum antibodies against it provides the molecular link to cancer

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Video Abstract

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Abstract

Consuming high amounts of red meat is commonly linked to an increased risk of developing cancer, especially colorectal cancer. At the same time, antibodies against Neu5Gc, a carbohydrate derived from red meat, have been observed to worsen cancer in “human-like” mice. While these antibodies and red meat consumption are each believed to increase cancer risk, it remains unknown how diet affects the antibodies. Now, research suggests that consuming Neu5Gc from red meat and dairy can modulate the amounts and properties of anti-Neu5Gc antibodies in humans, providing clues to how the carbohydrate might be linked to cancer. The team behind the study calculated daily intake of Neu5Gc for more than 19,000 subjects aged 18 years or older. These participants provided regular logs of food consumed over 24-hour periods as part of the NutriNet-Santé study, which was designed to investigate relationships between nutrition and health status. Antibodies against Neu5Gc and their properties were evaluated using precision techniques for 120 representative individuals. Results showed that [a diet high in Neu5Gc], sex, and age affected various aspects of antibodies against Neu5Gc, including the amount of antibodies and the specificity with which those antibodies bind their target. Men consumed more Neu5Gc than women, mostly from red meat, and also showed higher overall levels of anti-Neu5Gc antibodies. A detailed glycan microarray analysis revealed that high Neu5Gc specificity and increased amounts of anti-Neu5Gc antibodies were associated with higher consumption of Neu5Gc from red meat and cow dairy. The study is the first to provide experimental evidence of an association between a dietary carbohydrate and the induction of antibodies against it, other than in allergy. The findings suggest that the positive correlation observed between dietary meat and a higher incidence of colorectal cancer could be mediated by an increase in certain antibodies against Neu5Gc. That enabled researchers to formulate a Gcemic index to measure the amount of Neu5Gc in foods. The index could potentially be adapted to provide dietary recommendations that help reduce cancer risk. More work is needed to explore that relationship and Neu5Gc’s possible role in other diseases.