The fibres which prevent type 1 diabetes

Richard Béliveau

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An important preclinical study shows that the fermentation activity of intestinal bacteria produces several fatty acids which block the development of type 1 diabetes.

Type 1 diabetes (T1D) is an autoimmune disorder caused by specific destruction of the cells in the pancreas which are responsible for the production of insulin. There is a strong genetic predisposition for this immune disease, but more and more observations indicate that other factors associated with our daily way of life (diet, excessive hygiene, overuse of antibiotics) can also contribute to the development of this disease. The increased incidence of T1D observed over the past few decades is thus a consequence of particular changes in lifestyle which have surfaced during this period, which suggests that it would be possible to prevent this disease by specific modifications to lifestyle.

CONDUCTOR OF THE IMMUNE ORCHESTRA

It is now well-established that the intestinal microbiome, i.e. the vast bacterial community which lives in the intestine and most particularly within the colon, plays a leading role in the proper functioning of the immune system.

Studies have shown that derangements in the microbiome's composition are associated with immune disorders such as inflammatory bowel diseases, multiple sclerosis, allergies and asthma, which suggests that the microbiome could also play a role in the autoimmunity responsible for type 1 diabetes. It seems that this influence could be due to the ability of these bacteria to metabolize dietary fibre in order to generate short chain fatty acids, such as acetate and butyrate, which are formed in very large quantities within the colon. These fatty acids increase the activity of regulatory T lymphocytes which are essential for maintaining immune tolerance, stabilizing the intestinal barrier in order to limit the infiltration of bacteria into the blood and also possess anti-inflammatory activity.

This suggests that an increase in fermentation activity of the microbiome could stabilize immune function and prevent the development of an auto-immune response leading to the destruction of pancreatic cells involved in the production of insulin.

PROTECTIVE FATTY ACIDS

This hypothesis was reinforced by the results of a study recently appearing in the pages of the prestigious *Nature Immunology*[1]. To examine the effects of an increased level of short chain fatty acids on the risk of diabetes, a team of Australian scientists had the idea to feed animal models with a source of starch that had been modified biochemically with acetate or with butyrate. These starches were resistant to digestion by the stomach but were consequently fermented within the colon by the intestinal bacteria and released large quantities of these fatty acids. This is an interesting model for reproducing the production of acetate and butyrate which occurs by fermentation of alimentary fibre by the intestinal microbiome.

The researchers found that each of these starches (enriched with either acetate or butyrate) provided a marked protection against the development of type 1 diabetes. On the one hand, a diet enriched in acetate caused a strong decrease in white blood cells (T lymphocytes) which possess autoimmune activity, whereas elevated levels of butyrate improved the activity of T lymphocyte regulators. When these two types of starch were administered simultaneously, their combined action led to a complete blockade of the destruction of cells producing insulin and thus stemmed the development of diabetes.

These observations thus suggest that the metabolites generated by the fermentation activity of intestinal bacteria, the short chain fatty acids in particular, exert extremely positive effects on the proper functioning of the immune system. Since alimentary fibre represents the favourite "food" of these bacteria, a diet rich in plants including fruits, vegetables, beans and whole grain cereals represents the best way to optimize the metabolic function of this microbiome and thus to diminish the risk of auto-immune diseases, including type 1 diabetes.

(1) Mariño E et al. Gut microbial metabolites limit the frequency of autoimmune T cells and protect against type 1 diabetes. Nat. Immunol. 2017;18:552-562.

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