A food preservative which promotes the development of diabetes

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A fascinating and disturbing study reports that propionate, a preservative currently added to a host of food products, causes an increase in several hormones involved in the development of obesity and diabetes.

SHELF LIFE

One of the principal characteristics of most industrially processed foods is their long shelf life. While food prepared at home rapidly loses its freshness and should be consumed within a brief period of time, an equivalent food purchased from a store generally has a greatly prolonged shelf life and should remain edible for a number of days (and sometimes even for several months) after it is prepared.

This difference is due to the addition of several preservatives to these industrially prepared products: whether they are nitrates and nitrites, sulfites, sodium benzoate, potassium sorbate, butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT) or propyl gallate (to name but a few), these additives collectively prolong the shelf life of a very large number of food products by preventing the growth of bacteria and mold or by preventing fats from becoming rancid.

These preservatives do not exhibit acute toxicity in the short term, but some of them can have harmful effects over the long term. One needs to only think of nitrites and nitrate which form carcinogenic nitrosamines following their reaction with the proteins in meat, a phenomenon which contributes to the increase in cancers of the digestive tract which has been observed in those who consume large quantities of cured meats. The example of nitrites/nitrates thus suggests that these preservatives (or rather additives in general) may not be as harmless as had been thought and that it is important to study their effects on health in greater detail.

THE CASE OF PROPIONATE

Propionate is a short chain fatty acid largely used as a preservative due to its very strong anti-mold activity (it is found in bread, pizza, pastries, cereals, pasta, flavoured yogurts, sauces and some cheeses, to name a few uses). But beyond preventing the growth of molds, propionate is noted for its stunning ability to increase the production of glucose when it is administered to animals, a property which is specifically exploited to increase the concentration of glucose in the milk of cows.

One should, however, consider the effects of this induction of glucose by propionate in humans; hyperglycemia stimulates the production of insulin and the storage of energy in the form of fat, which suggests that the consumption of processed foods containing propionate could contribute to the significant increase in the incidence of overweight individuals in the population.

AN OBESOGENIC AGENT

The results of a recent study support this possibility and raise an alarm about the large-scale use of propionate as a preservative[1]. In this study, the researchers first observed that addition of propionate to the diet of laboratory animals caused activation of the sympathetic nervous system, leading to a rapid increase of both glucagon and of fatty acid-binding protein 4 (FABP4), two hormones which activate the production of glucose by the liver. This phenomenon is rather surprising since these hormones are normally produced only when the blood levels of glucose are very low (during fasting, for example). It thus seems that propionate can disrupt the mechanism which controls metabolism and force the production of glucose even if the body does not need it, which can lead, after repeated exposure, to a chronic hyperglycemia and a sharp increase in the risks for obesity and diabetes. Along the same lines, the researchers noted that repeated administration of propionate to animals, at doses equivalent to those which are consumed by humans, led to weight gain and to insulin resistance, a key step in the development of type 2 diabetes.

A randomized, double-blind experiment suggested that this metabolic disruption provoked by propionate also occurs in humans. The researchers separated their volunteers into two groups, one in which the participants ate a meal containing 1 g of propionate (a quantity equivalent to that provided by typical consumption of processed foods), and another which ate the same meal but without the preservative. By comparing the composition of blood samples taken at different times following the meal, the researchers observed that individuals who had eaten the propionate-supplemented meal showed significant increases in norepinephrine (a marker for activation of the sympathetic nervous system) as well as of glucagon and FABP4, the two hormones involved in the production of glucose by the liver. In other words, whether in mice or in humans, propionate acts as a metabolic disruptor and can thus potentially increase the risks for obesity and diabetes following repeated exposure. It's another good reason to prepare one's own meals more often in order to better control what one eats.

(1) Tirosh A et al. The short-chain fatty acid propionate increases glucagon and FABP4 production, impairing insulin action in mice and humans. Science Translational Medicine, (2019) volume 11, issue 489.

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