

Industrial food dyes that inflame the intestines

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A study shows that two food dyes widely used by the food industry are metabolized by gut bacteria into compounds that can cause inflammation of the gut.

The massive arrival on the market of ultra-processed industrial foods has profoundly changed the eating habits of the population. This is certainly not for the best.

On the one hand, these products are usually overloaded with sugar, fat and salt and promote the development of overweight and obesity and therefore diseases inevitably associated with overweight (diabetes, cardiovascular disease, cancer). On the other hand, these processed foods contain many additives (emulsifiers, thickeners, colorings) whose effects on long-term health are little known.

Food colors are certainly one of the most common classes of additives, while paradoxically being the most unnecessary. These molecules do not have any nutritional value or property to improve the texture or the preservation of food and provide absolutely nothing in terms of health benefits.

Their only use is to make processed products more attractive to consumers, for example by mimicking the color of certain fruits known to have positive health effects. In several cases, dyes are therefore used in practice to mask the nutritional poverty of industrial foods.

PRO-INFLAMMATORY DYES

It has been suspected for several years that the increased consumption of processed foods and food additives could play an important role in the phenomenal increase in the incidence of inflammatory and autoimmune diseases observed over the past 50 years.

This is particularly the case with inflammatory bowel diseases, such as Crohn's disease and ulcerative colitis, the incidence of which has increased with the adoption of the modern diet rich in ultra-processed foods (1).

To examine a potential link between the consumption of food dyes and the development of colitis, researchers administered two widely used food dyes, Allura Red AC (Red 40) and Sunshine Yellow (Yellow 6) to genetically predisposed animals to develop this inflammatory disease.

These two substances are azo-type dyes, i.e. made up of two aromatic structures linked together by an N = N nitrogen bond. Red 40 and Yellow 6 alone account for two-thirds of all food colors used by the industry (2) and are therefore an excellent choice for determining whether these substances have the potential to influence the development of colitis.

It seems that this is indeed the case as the addition of one or the other of the two dyes to the animal feed has been shown to be sufficient to cause the overactivation of the immune system responsible for the intestinal inflammation characteristic of colitis (3).



Further analysis revealed that this effect is indirect and requires the transformation of the dyes by certain bacteria present in the intestine, in particular *E. faecalis* and *B. ovatus*.

These bacterial strains contain enzymes capable of reducing the azo group of the two dyes, which generates a metabolite (sodium 1- amino -2- naphthol -6-sulfonate) which has the ability to overactivate inflammation.

GENETIC PREDISPOSITION

It should be noted that the induction of ulcerative colitis by the two dyes requires a genetic predisposition to the disease, in agreement with several observations showing that it is the combination of genes and environmental factors that is responsible for the disease.

As a result, those with an innate predisposition to inflammatory bowel disease could develop the disease when exposed to processed foods containing these dyes.

A similar situation has been observed for Attention Deficit Hyperactivity Disorder (ADHD) in children. Although overall, the consumption of dyes does not appear to have major impacts on the development of this neurological disorder, there is a subpopulation of children who appear particularly sensitive to dyes and develop hyperactivity as a result of their consumption (4).

Since we generally do not know our genetic predisposition to develop a disease, it makes sense that the easiest way to guard against these harmful effects of dyes is to simply limit the consumption of ultra-processed foods to a minimum.

- (1) Ng SC et al. Worldwide incidence and prevalence of inflammatory bowel disease in the 21st century: a systematic review of population-based studies. *Lancet* 2017 ; 390 : 2769-2778.
- (2) Sharma V et al. A global perspective on the history, use, and identification of synthetic food dyes. *J. Chem. Educ.* 2011 ; 88 : 24-28.
- (3) He Z et al. Food colorants metabolized by commensal bacteria promote colitis in mice with dysregulated expression of interleukin-23. *Cell Metab.* 2021 ; 33 : 1358-1371.e5.
- (4) Nigg JT et al. Meta-analysis of attention-deficit/hyperactivity disorder or attention-deficit/hyperactivity disorder symptoms, restriction diet, and synthetic food color additives. *J. Am. Acad. Child Adolesc. Psychiatry* 2012 ; 51 : 86-97.e8.