

'Eternal' chemicals raise liver cancer risk

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Per- and polyfluoroalkyl substances are very stable molecules that are frequently used in the manufacture of industrial and everyday consumer products. In addition to being endocrine disruptors in humans, a recent study suggests that exposure to these chemicals is associated with an increased risk of liver cancer.

Per- and polyfluoroalkyl substances (PFAS) contain extremely stable chemical bonds between fluorine and carbon (F-C) atoms, earning them the derisive nickname "forever chemicals".

These "eternal chemicals" are added to a very large number of products to make them resistant to heat, water, oil and corrosion and are therefore now made ubiquitous in our environment.

The list of products containing PFAS is long, but it is their presence in cosmetics, food packaging, non-adhesive cookware and floor coverings that represent the main sources of human exposure. Moreover, this exposure is much greater than one might suspect: analyzes have indeed shown that these chemicals are present at detectable levels in 98% of the Western population.

FOOD CONTAMINATION

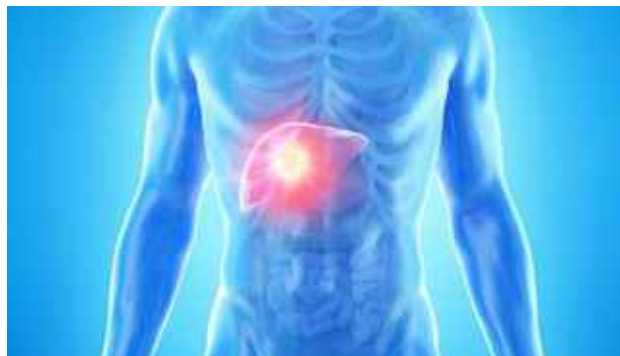
An important vector responsible for the absorption of these chemicals would be the packaging used to wrap several take-out foods. PFAS are added to these products to prevent oil (or salad dressing) leakage and are therefore present in the majority of fast food containers: for example, an analysis by Consumer Reports magazine of more than 100 products from American restaurant chains and supermarkets made it possible to detect PFAS in the wrapping paper used for fries, hamburgers and pizzas, in single-use plates and even molded fiber salad bowls.

Studies indicate that these molecules can migrate into food, particularly when the latter contains a lot of fat and salt, which would explain why PFAS concentrations are higher in the blood of people who eat out most often from the house (1).

Since the half-life of these PFAS is very long (3-7 years in humans), repeated exposure to food products containing these molecules can therefore lead to their accumulation in different organs over time. Not to mention that the packaging containing PFAS is ultimately buried in landfills, where there is a possibility of contaminating the soil and the water table, and therefore of being absorbed indirectly, simply by drinking water (the analysis of Consumer Reports has detected PFAS in almost 100% of tap water across the country and in most brands of bottled water).

HEPATIC IMPACT

PFAS preferentially accumulate in the liver and several preclinical studies have shown hepatotoxicity (release of liver enzymes into the circulation, among others) even at very low doses.



A recent study suggests that a similar phenomenon could affect humans: by comparing the amount of PFAS present in the blood of 50 people with hepatocellular carcinoma (liver cancer) with 50 control individuals of the same age, sex and ethnicity, researchers observed that the presence of higher amounts of PFAS was associated with an increased risk of cancer (2).

This link is particularly pronounced for perfluorooctane sulfate (PFOS), with a 4.5-fold increase in cancer risk in people with the highest blood levels of this molecule.

Further analysis (metabolomics) revealed that PFOS disrupts liver metabolism to cause fatty accumulation in this organ. This hepatic steatosis (fatty liver) is an important risk factor for liver cancer and could therefore play a central role in the cancerous effect of this PFAS.

REDUCE EXPOSURE TO PFAS

PFAS have many important applications and it seems unlikely that they can be phased out completely, at least in the short term. A recent study has shown that the use of two very simple and inexpensive substances (sodium hydroxide and the apolar solvent DMSO) could make it possible to completely decompose these molecules and thus drastically reduce their contamination of the environment (3).

In the meantime, the simplest way to reduce exposure to these substances is obviously to reduce the consumption of fast-food type foods wrapped in packaging or in impermeable containers, as well as cosmetic products that contain PFAS, particularly "water-resistant" or "wear-resistant" cosmetic products.

- (1) Susmann HP et al. Dietary habits related to food packaging and population exposure to PFASs. *Environ. Health Perspect.* 2019; 127: 107003.
- (2) Goodrich JA et al. Exposure to perfluoroalkyl substances and risk of hepatocellular carcinoma in a multiethnic cohort. *JHEP Reports.* 2022; 4(10): 10550.
- (3) Trang B et al. Low-temperature mineralization of perfluorocarboxylic acids. *Science* 2022; 377: 839-845.