

New study shows: One-year-old children demonstrate lower concentration of vaccine antibodies with high PFOA concentration in the blood

Communication No 016/2020 from the BfR of 30 March 2020

Perfluorinated and polyfluoroalkyl substances (PFAS), which include perfluorooctanoic acid, are a complex group of synthetic chemicals with high stability and mobility. They have been used for decades in several industrial processes and consumer products as industrial chemicals, due to their special technical properties. They are not easily degradable, and accumulate in the environment, in the food chain and in humans.

Human exposure to PFAS can be established by determining their concentration in the blood. Perfluorooctanoic acid (PFOA) and perfluorooctanoic sulphonic acid (PFOS) are the main compounds in this group. They are known to have negative effects on the immune system in laboratory animals, amongst other effects. Negative associations between PFOA/PFOS concentrations in the blood and concentrations of vaccine antibodies were also observed in children in epidemiological studies. Children with high PFOA concentrations in their blood demonstrated lower concentrations of vaccine antibodies. However, there has still been a lack of scientific data for children at the end of their first year, who by comparison are greatly exposed to these substances while being breastfed over a long period of time. They may possibly be particularly sensitive to effects on the immune system, due to their young age.

A joint investigation by the BfR and Charité has now closed this gap for one-year-old children. Various parameters were determined for the immune system and the concentration of PFAS in blood in a study of 101 children aged one year old. This study also demonstrated a negative association between PFOA concentrations in blood plasma and concentrations of certain vaccine antibodies: Children with high PFOA concentrations in their blood demonstrated lower concentrations of vaccine antibodies. The results were published in the specialist journal *Archives of Toxicology* under the heading 'Internal exposure to perfluoroalkyl substances (PFASs) and biological markers in 101 healthy 1-year-old children: associations between levels of perfluorooctanoic acid (PFOA) and vaccine response'.

<https://link.springer.com/content/pdf/10.1007/s00204-020-02715-4.pdf>

This study has been included as a key study in the new evaluation of health risks for consumers from the intake of PFAS via foods by the European Food Safety Authority (EFSA). Public comments are allowed on the draft of this EFSA opinion until 20 April 2020.

<https://www.bfr.bund.de/cm/349/perfluoroalkyl-and-polyfluoroalkyl-substances-pfas-european-food-safety-authority-draft-opinion-opens-for-public-consultation.pdf>

The study of 101 healthy one-year-old children (21 not breastfed, 80 breastfed long-term) had been carried out over 20 years ago by Charité. At the time, both the load of persistent organic pollutants (e.g. dioxins) and a multitude of biological parameters were investigated in children's blood. The aim of this study was to answer the question of whether an effect on certain bodily functions can result from persistent compounds which accumulate within the child's body during the breastfeeding period. PFAS also belong to this group of substances, and an analysis thereof was carried out on reserved blood samples in 2019. In the targeted

evaluation, scientists determined significant negative associations between PFOA concentrations and concentrations of vaccine antibodies against *Haemophilus influenza*, tetanus and diphtheria. No such associations were demonstrated for PFOS.

Both these results and the results of other studies contributed to the growing evidence that perfluorinated compounds may have a negative influence on the immune system in the event of high exposure. A reduced production of vaccine antibodies should essentially be viewed as undesirable, even when reduced immunisation does not result due to existing safety margins for vaccinations while observing vaccination recommendations. It is currently unclear whether infections may occur more frequently as a result of the influence of PFAS on the immune system. No higher rates of infections were demonstrated by children with high exposure in the study by the BfR and Charité. More knowledge about modes of action, dose-effect relationships and clinical relevance will be required for the ultimate interpretation of data on the effects of PFAS.

In a current draft opinion on health risks associated with the occurrence of PFAS in foods, EFSA has derived a tolerable weekly intake (TWI) for the sum of four PFAS, namely perfluorooctanoic acid (PFOA), perfluorooctane sulphonate (PFOS), perfluorohexane sulphonic acid (PFHxS) and perfluorononanoic acid (PFNA), of 8 nanograms (ng) per kilogram (kg) of body weight per week. This value indicates the weekly amount per kilogram of body weight that is not expected to cause any impairment to human health from lifelong intake. The current derivation is based on observations of negative associations between PFAS blood concentrations and concentrations of vaccine antibodies. With the data from the study by Charité and the BfR, EFSA was able to consider the highest exposed group of children who had been breastfed over a long period in the risk assessment.

The BfR will comment on the EFSA draft opinion. As early as December 2018, EFSA published a re-evaluation of health risks posed by certain perfluorinated compounds in food and derived significantly lower TWI values for two compounds (PFOS and PFOA) than those stated in a previous opinion. EFSA and the BfR see scientific uncertainties and a demand for more research.

More information on the BfR website on perfluorinated and polyfluorinated compounds:

http://www.bfr.bund.de/de/materialien_und_links_zu_perfluorierten_verbindungen-70307.html (in German)

<https://www.bfr.bund.de/cm/349/perfluoroalkyl-and-polyfluoroalkyl-substances-pfas-european-food-safety-authority-draft-opinion-opens-for-public-consultation.pdf>

More information on the topic in German:

https://www.umweltbundesamt.de/sites/default/files/medien/360/publikationen/pfas_lebensmittelkette.pdf

<https://www.springermedizin.de/persistente-organische-kontaminanten-in-lebensmitteln/12332162?fulltextView=true>

<https://link.springer.com/article/10.1007/s00103-017-2583-0>



BfR "Opinions app"

About the BfR

The German Federal Institute for Risk Assessment (BfR) is a scientifically independent institution within the portfolio of the Federal Ministry of Food and Agriculture (BMEL) in Germany. It advises the German federal government and German federal states ("Laender") on questions of food, chemical and product safety. The BfR conducts its own research on topics that are closely linked to its assessment tasks.

This text version is a translation of the original German text which is the only legally binding version.