

## Research project objectives

The aim of the project is to verify the following research hypothesis:

The actual exposure of consumers to perfluorinated compounds in Poland may exceed thresholds set by the EFSA.

## The basic research to be carried out

The proposed research project is focused on the basic study in the fields of food science, food analysis and food safety. The aim of the project is to analyse the occurrence of perfluorinated compounds (PFCs) in food products and consumer exposure estimation to these compounds in the recommended diet option (proper nutrition pyramid) and the actual food consumption based on Central Statistical Office data for 2014.

The literature shows that PFCs prevalence in food can be a new and insufficiently explored field of food safety and human health. The limited available data on the occurrence of PFCs and the preliminary findings of the experts point to the urgent need to determine the scale of food contamination with these compounds, which would allow to estimate their intake by Polish consumers. The analysis of the occurrence of perfluorinated compounds (PFCs) in food will include perfluorinated acids (PFCAs) and sulfonates (PFASs). The following food groups will be addressed: cereals, fruit and vegetables, milk and dairy products, products with a high content of proteins, lipids and water, and additionally spices which are an integral component of recipes. Moreover, a special purpose nutritional products for children will also be subjected to analysis. Daily intake of PFCs will be calculated in two options. The model daily intake (MDI) of PFCs will be calculated on the basis of the proposed model of daily intake of foodstuffs whereas the actual daily intake (ADI) of PFCs will be calculated on the basis of average monthly per capita consumption of selected foodstuffs in Polish households in 2013 (Central Statistical Office data for 2014). Such analysis will be conducted for children aged 1-3 years (risk of malformation) and men aged 26-60 years (risk of infertility).

The research conducted in the framework of the proposed project is of fundamental value, the results of which will contribute to the development of food science dealing with the problems of PFCs contaminated food intake and accumulation of these harmful substances in the human body.

Estimating PFCs prevalence scale in food will contribute to verification of the existing state of knowledge in this field. The project will bring the information necessary for further work of experts in estimation of dietary exposure of people and will contribute to research progress into their effects on human physiological processes, which in the context of public health cannot be overestimated.

## Reason for choosing the research topic

Perfluorinated compounds are a group of organofluorine compounds, aliphatic hydrocarbons, in which all or almost all hydrogen atoms have been replaced with fluorine. They are classified as a persistent and bioaccumulative substances. It is estimated that the world production of these compounds is 5-6.5 thousands of tonnes per year. Perfluorinated compounds are used in heavy industry- including paper and textile treatments, production of fluoropolymers, cosmetics, as well as in insecticide formulations and firefighting foams. They are commonly found in everyday goods. Bioaccumulation in food products is the most significant source of human exposure to PFCs. Preliminary data on the effect of domestic cookware on PFCs levels attributable to the preparation of food indicated no elevated levels, although in only a limited number of experiments. Greaseproof packaging for convenience foods and special packaging may also introduce PFCs into food, via migration. Food packaging products made of paper usually contain coating/additives containing PFCs for oil and water resistance. The presence of strong C-F bonds makes them chemically resistant to hydrolysis, photolysis, microbial degradation or metabolism. They decompose only in very high temperatures in specially prepared furnaces. By now there has been no evidence for degradability of these compounds. A person can be exposed to these compounds through the consumption of food and drinking water, as a result of their migration to food from packaging as well as through the lungs and skin by daily contact with the products that surround us.

The "technological" advantage of PFCs related to their unique ability to modify the surface properties of the materials becomes a drawback when they pass to the environment. Their physicochemical properties are the cause of easy migrating to the environment and food, and consequently, after food consumption, of bioaccumulation in the body. At the cellular level, some PFCs may be responsible for the changes in the lipid transport pathways and metabolism, impairing transport across cell membranes, or disturbances in the lipid collapse. PFCs are well absorbed from the intestine and mostly accumulate in the liver, causing its damage and impair the function of the thyroid hormones. Toxicodynamic animal studies have shown that even very small doses of perfluorinated sulfonates may impair reproductive function (even in next generations) and also adversely affect fetal development reducing the percentage of live births and reduce the survival of newborns. In the context of the current demographic problems in Poland, in part related to problems with having children, becomes an important issue of social dimension.

The few fragmentary studies have shown that the occurrence of PFCs in food is a new and insufficiently explored area of food safety hazards. The only available opinion of the European Food Safety Authority (EFSA) from 2008 concerning human risks is focused on two dominant PFCs i.e. perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). Indicated tolerable daily intake (TDI), NOAEL dose (no-observed-adverse-effect-level) and LOAEL dose (lowest-observed-adverse-effect-level) were preliminarily estimated based on the toxicological studies with animals. The limited available data and EFSA findings indicate the urgent need to identify PFCs in food, which would help to assess their actual content and potential risks. Analysis of the prevalence of perfluorinated compounds in food may open a whole new area of research in the field of food safety and human health. Currently in the EU there are no regulations defining the PFCs permissible content in food, water and solid matter suspended in the air even though their presence has been confirmed in the blood plasma of EU citizens and people at increased risk at work. Currently, based on the opinion of EFSA, Poland and the US are among the countries with the populations with the highest risk of exposure to perfluorinated compounds.

Results from the project will provide new knowledge on the prevalence of perfluorinated compounds in food. The strength of the project is the spectrum of the analyzed foods, including foods of plant and animal origin and water. The results will bring the basis for further work carried out by experts in the field of human exposure risk assessment in relation to significant potential threat to the public health.