



**World Health
Organization**



International Food Safety Authorities Network (INFOSAN)

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INFOSAN Information Note No. 02/2007 - Biomonitoring of POPs

Biomonitoring of Persistent Organic Pollutants (POPs)

SUMMARY NOTES

- Persistent organic pollutants (POPs) are a group of organochlorine and related chemicals which concentrate in the food-chain and in the human body.
- These chemicals have a number of toxic properties and some are of special concern because they can mimic the action of hormones at extremely low levels.
- The World Health Organization (WHO) through its GEMS/Food Programme has long encouraged countries to undertake exposure studies of these contaminants in food and in the diet.
- WHO has also supported the biomonitoring of human milk for PCDDs, PCDFs and dioxin-like PCBs as one of the most cost-effective approach for protecting public health from the risks posed by these chemicals.
- In 2004, the Stockholm Convention on Persistent Organic Pollutants was ratified by governments with the goal of reducing the amount of these substances released into the environment.
- WHO has now revised its protocol guidelines for the biomonitoring of human milk to assess the effectiveness of the Convention in reducing POPs emissions.
- Countries are encouraged to participate in the Fourth WHO-Coordinated Survey of Human Milk for POPs, which is intended to protect both public health and the environment from these chemicals.

Introduction

Persistent organic pollutants (POPs) are a group of organochlorine and related chemicals, which tend to resist degradation and bioaccumulate in the food-chain. As a result, traces of these chemicals can be found in the human body, usually arising from the consumption of such foods as fish, meat, eggs and dairy products. Environmental studies have shown that certain wild animal species have been adversely affected by POPs in their food sources, including such effects as cancer, skeletal disorders and reproductive failure. Some of these chemicals are of special concern because they can mimic the action of hormones and cause health effects at extremely low levels.

Most concerns are with twelve POPs, the so-called "dirty dozen". Nine of these are older pesticides, including aldrin, DDT, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex and toxaphene, whose production and use have been banned or strictly regulated by most countries for some time. In addition, three other POPs of concern are industrial chemicals, including the widely used polychlorinated biphenyls (PCBs) as well as two groups of industrial by-products, polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). While production of PCBs has been largely banned for many years, electrical transformers and other equipment containing these chemicals are still in use and present serious disposal problems. In regard to PCDDs and PCDFs, better manufacturing controls and reduction of emissions from combustion processes, e.g. power generation and waste incineration plants, have made a measurable impact on decreasing levels of these chemicals in human milk, particularly in Europe.

In spite of the transient risk posed by POPs in human milk, scientific evidence for the health and other benefits of breastfeeding has continued to increase. WHO can now say with full confidence that breastfeeding reduces child mortality and has health advantages that extend into adulthood. On a population basis, exclusive breastfeeding for six months is the recommended feeding mode for the vast

majority of infants, followed by continued breastfeeding with appropriate complementary foods for up to two years or beyond.

The Stockholm Convention

In 2004, the Stockholm Convention on Persistent Organic Pollutants was ratified by governments with the goal of reducing the amount of these substances in the environment and in people. The Conference of Parties to the Convention convened by the United Nations Environment Programme (UNEP) has identified human milk as one of the core matrices for monitoring the effectiveness of the Convention in achieving its goal, which is required under Article 16 of the Convention. Among other things, the Convention:

- Bans outright the production and use of 8 pesticides - aldrin, endrin, dieldrin, chlordane, heptachlor, hexachlorobenzene, mirex, and toxaphene.
- Establishes a long-term goal of eliminating DDT use but permits public health exceptions for its use in mosquito control to fight malaria.
- Immediately prohibits PCB production and requires a phase-out of ongoing uses over time to be completed by 2025.
- Promotes concerted action to minimize the release of industrial by-product POPs like PCDDs and PCDFs.
- Emphasizes preventive measures to address POPs at their source.
- Establishes the means and mechanisms to assist developing countries in eliminating POPs.
- Takes a precautionary approach for identifying and acting against chemicals with POPs characteristics by the establishment of a scientific "POPs Review Committee" to evaluate additional chemicals for incorporation into the treaty.

POPs in food

The World Health Organization (WHO) through its GEMS/Food Programme* has long encouraged countries to undertake exposure studies of contaminants in food. This has been central to efforts by WHO to promote food safety and consumer health. Since 1976, WHO GEMS/Food has collected information on levels and trends of many POPs in food and animal feed. The extensive GEMS/Food database on pesticide POPs in food is accessible through the WHO portal Summary of Information on Global Health Trends (see <http://SIGHT.who.int/newsearch.asp?cid=131&user=GEMSuser&pass=GEMSu>). The more analytically complex POPs, such as PCDDs, PCDFs and dioxin-like PCBs, require expensive and technically demanding methods of analysis. Therefore, reliable and comparable data on these chemicals in food is still rather limited. In 2002, the Joint FAO/WHO Expert Committee on Food Additives estimated that a considerable proportion of the population is exposed to these chemicals at levels above the Provisional Tolerable Monthly Intake established for this group of POPs. Almost all of this exposure is through food, particularly food of animal origin.

PCDDs, PCDFs and dioxin-like PCBs in human milk

WHO has long supported the biomonitoring of human milk for PCDDs and PCDFs as well as dioxin-like PCBs as a cost-effective approach for protecting public health from the risks posed by these chemicals. Over the period 1987-2003, WHO has coordinated three international studies of human milk on the levels and trends of PCDDs, PCDFs and dioxin-like PCBs. Results have indicated a continuing trend towards lower levels of these POPs in human milk as countries took action to reduce emissions.

Analysis of human milk, maternal blood and adipose tissue are all relevant matrices for assessing body burdens of these chemicals. On a fat basis, analysis of these tissues give comparable results. However, WHO and most countries have recognized human milk as the preferred matrix for biomonitoring of these POPs as it has several important advantages, including:

- Non-invasive sampling;
- High fat content;
- Ease to collect large volumes, e.g. 50 ml;
- Little risk from infectious agents;
- Individual samples can be pooled, thus saving analytical cost; and,

* GEMS/Food = Global Environment Monitoring System / Food Contamination Monitoring and Assessment Programme

- Shipping through normal channels.

In addition to maternal exposure, human milk data can provide information on the exposure of infants to these chemicals. Because human exposure to POPs is mainly through food, human milk data can also provide guidance on reducing exposure of the population through food control measures. As mentioned above, parties to the Stockholm Convention have recognized human milk as one of the core matrices that should be monitored to assess the effectiveness of measures taken to reduce emissions of POPs at their source.

Revision of the WHO Protocol Guidelines

To meet the requirements of Article 16 of the Convention, the ad hoc WHO Human Milk Survey Advisory Group was convened to review of the existing protocol guidelines. A number of recommendations were made to reduce variability in the results in order to more accurately assess changes in levels of POPs over time. Significant changes include the recruitment of 50 individual donors instead of 10. In addition, the guidelines recommend that individual samples be analysed for the nine pesticide POPs and marker PCBs in order to provide information on the distribution of levels to enable the statistical assessment of time trends. Pooled samples will now be analysed for all twelve Stockholm POPs. Ethical issues, like informed consent and confidentiality, have also been strengthened. Given that breastfeeding reduces child mortality and has health benefits that extend into adulthood, great effort has been made in the revised guidelines to further protect, promote and support breastfeeding in the context of these human milk studies. National protocols should closely follow the key elements of the guidelines, but sufficient flexibility is allowed to accommodate country-specific needs. The latest version of the protocol guidelines can be accessed through the WHO Food Safety Website at: <http://www.who.int/foodsafety/chem/pops/en>

Fourth WHO-Coordinated Survey of Human Milk for POPs

Using the revised guidelines, WHO launched its fourth coordinated survey of human milk in September 2005. To promote the quality of data at the national level, the fourth round includes proficiency tests for determination of pesticide POPs and marker PCBs by national participating laboratories. This exercise is being organized by the WHO Reference Laboratory at the State Laboratory for Chemical and Veterinary Analysis (CVUA) in Freiburg, Germany, which also provides the analysis of pooled samples for the study. Preliminary results of these tests suggest that many laboratories have difficulty in reliable detection and determination of many POPs of interest. This signals the need for more stringent quality assurance measures and, in some cases, capacity building before acceptable results can be achieved. These findings have major implications for the on-going fourth round and for the availability of reliable monitoring data for evaluation of the Stockholm Convention.

Presently a total of 11 countries have submitted pooled samples under the 4th WHO-Coordinated Study and another 17 countries have indicated an interest to do so. WHO continues to seek the support of governments and donors to fund the participation of developing countries in this round. However, it is important that countries initiate this work as soon as possible so that monitoring information can be available to the Conference of Parties to the Convention when it meets in May 2009.

Contact Information

The fourth round remains open and countries wishing to participate or to have more information should contact the WHO Secretariat for the study by e-mail at popsmilk@who.int or by facsimile at +41 22 791 4807.

INFOSAN serves as a vehicle for food safety authorities and other relevant agencies to exchange food safety information and to improve collaboration among food safety authorities at both the national and international level.

INFOSAN Emergency, embedded in INFOSAN, links official national contact points to address outbreaks and emergencies of international importance and allows for the rapid exchange of information. INFOSAN Emergency is intended to complement and support the existing WHO Global Outbreak Alert and Response Network (GOARN).

INFOSAN is operated/managed by WHO, Geneva. It currently includes 154 Member States.

More information is available at: www.who.int/foodsafety