Biomonitoring of Human Milk

Human milk is the natural and superior food for infants containing the optimal composition to meet their nutritional needs in early life and providing associated immunological, psychological and economic advantages. Evidence for the health advantages of breastfeeding and scientific evidence to support this practice has continued to increase. WHO can now say with full confidence that breastfeeding reduces child mortality and has health benefits 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 (1).

Yet human milk - though still the best food for infants - has been unintentionally compromised by unwelcome chemicals from our environment, as a result of eating, drinking, and living in a technologically advanced world. However, the mere presence of an environmental chemical in human milk does not necessarily indicate that a serious health risk exists for breast-fed infants. Few, if any, adverse effects have been documented as being associated solely with consumption of human milk containing background levels of environmental chemicals, and none have been clinically or epidemiologically demonstrated. Only in very rare situations involving high levels of contamination have effects on infants occurred through human milk consumption. In contrast, epidemiological studies have demonstrated that human milk and the practice of breast-feeding confer significant, measurable health benefits to infants and to nursing mothers. Therefore, it should be understood at the outset that the accumulated data overwhelmingly support the positive health value of breast-feeding infants.

On the other hand, human milk is also a unique biological matrix for monitoring certain environmental contaminants because it can provide exposure information about both the mother and the breastfed infant through a non-invasive method of collection. Human milk is considered to be one of the most important biota to be monitored for the presence of Persistent Organic Pollutants (POPs), which are known to accumulate in the food chain. Consequently, human milk monitoring can yield information about the kinds and quantities of POPs in the environment as well as in our bodies. Better understanding of our exposure to harmful environmental chemicals will the help us better manage such chemicals by eliminating or reducing emissions of such POPs or by limiting their presence in the food supply
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WHO Activities on Biomonitoring of Human Milk

WHO, often in cooperation with FAO, has reviewed the toxicological hazards posed by POPs on many occasions. Beginning in 1963, the Joint FAO/WHO Meetings on Pesticide Residues (JMPR) has evaluated the safety of POPs pesticides and establish acceptable daily intakes (ADIs) for many of them. Later when agricultural uses were withdrawn, JMPR re-evaluated these pesticides and converted the ADIs to tolerable daily intakes (TDIs). Other POPs have been evaluated by the Joint FAO/WHO Expert Committee on Food Additives (JECFA) which has established tolerable intakes for dioxins, dibenzofurans and dioxin-like PCBs. In its most recent evaluation in 2001, JECFA established a tolerable monthly intake for dioxins, dibenzofurans and coplanar PCBs of 70 pg/kg body weight per month, which is one of the lowest tolerable intakes ever set (2). In doing so, it noted that mean exposure of many populations approached or exceed this value. WHO has used human milk for monitoring of human body burdens of chemical contaminants for several decades as it represents an integrated assessment of exposure, e.g. level, frequency and duration. Over the past several decades, GEMS/Food, whose interest is in international exposure studies on contaminants in food, has collected information on the levels and time-trends of many POPs in food, including human milk. WHO has sponsored three special surveys of dioxins, dibenzofurans and dioxin-like PCBs in human milk. The first two took place in 1987-1988(3) and 1992 -1993 (4) and mainly consisted of samples from European countries. In 2000, the WHO European Centre for Environment and Health in Bilthoven in cooperation with GEMS/Food conducted a third survey of human milk for dioxins, dibenzofurans and PCBs, which included a number of countries outside Europe (5). Results showed the variation of contamination profiles indicating different sources of exposure. In addition, a number of countries showed elevated levels of contamination compared to overall median values. In Europe the general downward trend in the levels of dioxins and dibenzofurans indicates a continuing decline in exposure as measures to reduce emissions have been implemented (see Figure 1). Consistent with dietary exposure assessments submitted to GEMS/Food prior to 1992 and risk assessments of certain organochlorine compound in human milk performed in 1998(6), basic monitoring and assessment programmes in all countries for organochlorine compounds in food and human tissues are essential in order to appropriately protect public health from these risks. However, WHO continues to strongly recommend that breastfeeding be encouraged and promoted

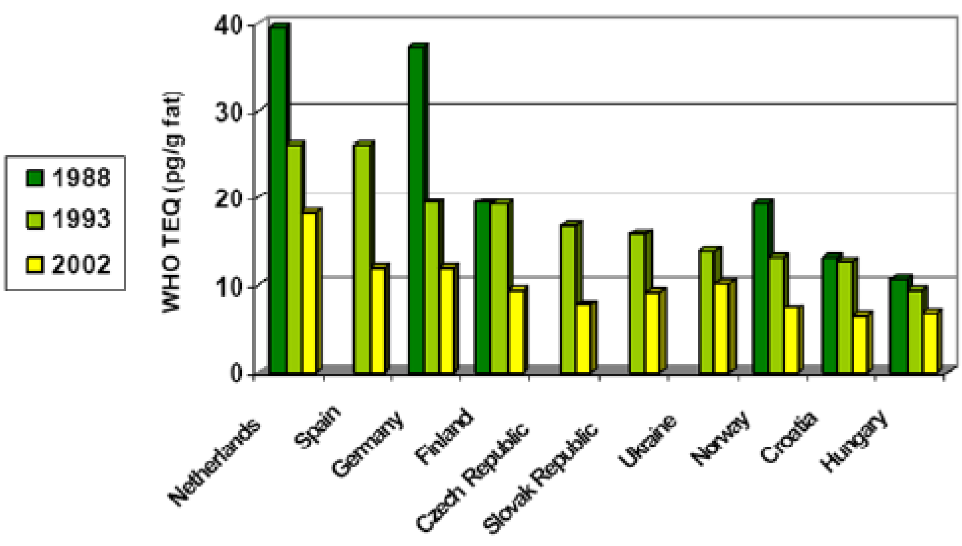

Figure 1 Dioxin levels expressed in WHO TEQs in human milk (5)

In responding to the needs of the Stockholm Convention on POPs, GEMS/Food has developed a new protocol for a Global Survey of Human Milk for POPs in order to meet the health, food safety and environmental objectives of WHO, UNEP and their member counties (7). This survey is being led by the health sector as it involves human subjects, but collaboration with the environmental and other sectors is strongly encouraged. In the area of capacity building of national POPs analytical capabilities, analytical proficiency testing will be used as a tool for assisting laboratories in developing countries to participate in the survey.

The Way Forward

Because of health, food safety and environment concerns raised by the presence of POPs in human milk, the following considerations are stressed:

Primary preventive measures to eliminate and reduce the introduction of POPs in the environment are the most effective long-term way to control exposure to these chemicals. When possible, the use and emission of POPs should be further reduced.

Responsible authorities should examine their food monitoring and control programmes to assess whether greater attention should be paid to foodstuffs potentially high in POPs. It is also important that national governments identify geographical areas with potential for increased infant exposure levels resulting from large scale intoxications, either through occupational exposure or highly contaminated foodstuffs. It is vital that the intake of such fat-soluble, bioaccumulative, toxic compounds be restricted before a woman becomes pregnant, otherwise the infant exposure both *in utero* and through breast milk will be unavoidable.

Tolerable residue levels in foods high in POPs might be considered or dietary advice for girls and women of child-bearing age might be promoted to reduce their consumption of such foods.

Epidemiological studies linked to monitoring of food and human milk are urgently needed to assess the possible long-term health hazard to the newborn and growing infant from the intake of POPs contaminated breast milk. This will enable adequate advice to be formulated on the best breastfeeding practice for mothers at risk.

Responsible authorities should consider incorporating mechanisms to assess potential health risks posed by contaminants in human milk into their national risk assessment procedures.

Decision-making for any contemplated intervention should include a quantitative estimate of risk-based reference intakes for human milk contamination and take into account the well-established benefits of breast feeding as well as socioeconomic factors. Except in the most extreme cases, mothers can and should be reassured that breast milk is by far the best food to give their babies.

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