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Persistent Organic Pollutants in Swedish first-time mothers and effects on infant health

AKADEMISK AVHANDLING

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ABSTRACT

Humans are exposed to a variety of persistent organic pollutants (POPs) that have been spread to the environment because of various human activities. Food is the main source of exposure to most POPs. Many POPs are lipid-soluble, accumulate in the human body and are easily transferred to the fetus and to breastfed infants through breast milk. POPs have been shown to cause a number of adverse effects in animals, including effects on reproduction, development and on endocrine, nervous and immune systems.

The overall aims of this thesis were to quantify body burdens of POPs in pregnant and nursing women in Sweden and to study whether current maternal, fetal or infant exposure to POPs is associated with birth weight or markers of thyroid function.

First-time mothers were recruited in Uppsala, Sweden between 1996 and 2010 (POPUP cohort). Samples (breast milk or blood) from the participating women were analysed for polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxin and dibenzofurans (PCDD/Fs) and polybrominated diphenyl ethers (PBDEs). Thyroid hormones were analysed in maternal and infant blood. Data on lifestyle factors and diet were collected by interviews and questionnaires.

The results showed that levels of PCBs and PCDD/Fs in breast milk decreased with 4-8% per year during the study period. Temporal trends for PBDEs varied depending on congener studied, with decreasing levels of BDE-47, -99 and -100 (5-10% per year) and slightly increasing levels of BDE-153 (1% per year). High maternal age and fast weight loss after delivery predicted higher levels of PCBs and PCDD/Fs in breast milk, whereas a high pre-pregnancy body mass index and large weight gain during pregnancy predicted lower levels. Women who were breastfed during infancy, grew up on the east coast of Sweden and had a high consumption of contaminated fatty Baltic fish during the year before pregnancy had higher levels of some POPs in breast milk.

Prenatal exposure to di-*ortho* PCBs (estimated by breast milk levels) was significantly associated with higher birth weight, whereas breast milk levels of PBDEs were associated with lower birth weight. The mean difference in birth weight between the 25th and 75th percentiles of exposure was approximately 100 g for di-*ortho* PCBs and -80 g for PBDEs.

Associations between exposure to PCBs, PCDD/Fs and PBDE and thyroid hormone levels in mothers during pregnancy and in infants after delivery were weak and non-significant in most cases. However, a higher maternal body burden of PCDD/Fs was associated with lower maternal levels of triiodothyronine (T3). This association was similar in early and late pregnancy, which strengthens its reliability.

Altogether, this thesis provides knowledge about exposure to POPs in Swedish first-time mothers that is useful in risk assessments of POPs in food. The margins between current body burdens of POPs and the levels tolerable from a health perspective are in some cases small or non-existent. In addition, the observed associations between POP exposure and birth weight and thyroid hormone status may be of importance for public health. Hence, it is desirable that body burdens of PCBs, PCDD/Fs and PBDEs in Swedish women continue to decrease. Efforts to reduce contamination of the environment and of the food chain should therefore be continued. Monitoring of POP levels in breast milk is an important tool to follow-up human POP exposure.