MeSO2-DDE Levels in Human Milk Samples Collected in a Malarious Area of México

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Introduction

In addition to the nutritional and immunological benefits of human milk, pediatricians and scientists have begun to recognize a wide range of chemical contaminants found in human milk and their potential adverse health effects on children. The most widely recognized group of chemical contaminants are the fat-soluble, environmentally persistent organohalogen compounds such as dichlorodiphenyltrichloroethane (DDT), polychlorinated biphenyls (PCBs), and dioxins.

DDT [1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane] a persistent insecticide was used worldwide in agriculture and in malaria control programs. Recently, the Stockholm Convention on Persistent Organic Pollutants which came into force on 17 May, 2004, outlawed the use of 12 industrial chemicals including DDT. However, one exemption clause allows malaria-endemic nations to use DDT strictly for indoor residual wall spraying. The United Nations Environment Programme estimates that about 25 countries will use DDT under exemptions from the DDT pesticide ban. Therefore, many individuals are still highly exposed to DDT and to its metabolites, due to past or to present applications.

In Mexico, DDT was used until the year 2000, and we have shown high blood concentrations of DDT in women living in a malarious area where DDT was heavily sprayed. Taking into account these results, we decided to study the concentrations of DDT and its metabolites in human milk samples. We took advantage of this work, and the levels of DDE methyl sulfone (MeSO2-DDE) were also analyzed, as this toxic metabolite has not been studied in women heavily exposed to DDT.

Materials and Methods

Population . Women aged 16-39 years, were living in South Mexico in the communities of El Ramonal (n=5, high exposed community); La Cigüeña (n=9, median exposed community); Tapachula, (n=11, median exposed community), and Faja de Oro (n= 12, low exposed community), The level of exposure to DDT was determined according to the concentrations found in soil (data not shown). All women had a similar ethnic and socioeconomic background (low income Mexican indigenous), and had lived in their community for at least five years prior to the study. After informed consent was obtained, a questionnaire was applied and milk samples were taken manually. The questionnaire registered sociodemographic characteristics, occupation, reproductive history, alcohol consumption, tobacco exposure, history of DDT spraying at home, and exposure to other pesticides.

Analysis. For the analysis of DDT and its metabolites, 5 g of milk were used per sample. Proteins were denaturalized with isopropanol and formic acid; then, in order to separate the p,p'-MeSO2-DDE from p,p'-DDT, p,p'-DDE and p,p'-DDD compounds, two extractions were performed, the first one used ethyl-hexane (1:1) and the second one used DMSO and hexane. The organic phase of this last extraction containing DDT, DDE and DDD, was treated with H_2SO_4 and hexane, after cleaning it using a SiO_2: H_2SO_4 conc (2:1) column. Elution was performed with hexane:dichloromethane (2:1). The p,p'-MeSO2-DDE which was present in the DMSO phase was extracted with H_2O and hexane, then the extract was cleaned with a SiO_2: H_2SO_4 conc. (2:1) column using dichloromethane for elution. After elution, the sample was evaporated to 0.2 ml by nitrogen current, and it was resuspended in 1.0 ml of hexane. This procedure was repeated five times. Concentration of the sample to 1 ml was done previous to the analysis by GC-EC.

Results and Discussion

In Table 1 are depicted the results obtained in this study. It can be observed that in general the levels of DDT and its metabolites in milk were higher in the exposed areas than in the less-exposed or control areas (Ramonal > Cigüeña = Tapachula > Faja de Oro), and they were higher than the concentrations found in Sweden in 1992.

As expected, the concentrations of MeSO2-DDE in Mexico also reflected the higher exposure in this country. The concentrations of MeSO2-DDE found in milk samples in Mexico were 18 times higher (El Ramonal) than in Sweden in 1992.

Table 1. Blood levels of DDT, DDE and MeSO2-DDE in milk collected from women living in malarious communities of Mexico

Compound	Ramonal (n=5)	Cigüeña (n=9)	Tapachula (n=11)	Faja de Oro (n=12)	Sweden 1992
DDT	1378	233	247	56	22
DDE	6016	1402	1226	468	227
MeSO2-DDE	7	2	5	2	0.4

Mean values in ng/g lipid.

Taking into account the total DDT milk concentration found in El Ramonal and the daily amount of milk that is ingested by an infant, it can be estimated that the exposure to DDT and DDE through milk ingestion in this community is 1.4 to 20.0 times higher than 20 µg/kg/day that is the guideline set by the World Health Organization for total DDT.[1] Thus, there is a need to define pathways of exposure to DDT for women living in these areas, in order to propose a risk reduction program. Furthermore, taking into account the toxicity MeSO2-DDE2,studies are also needed in order to define the risk in those infants exposed to this compound.

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References

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