

PERSISTENT ORGANIC POLLUTANTS IN HUMAN BREAST MILK FROM TWO METROPOLITAN CITIES IN THE EAST COAST OF INDIA

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Abstract

Many of the Asian developing countries are well known as sources for the POPs chemicals used for agriculture and disease control purposes. Recent studies have shown that some of those countries with high economic growth rates are becoming sources for many industrial and non-intentional toxic chemicals also, thus polluting the environment and biota including human. In this context, our recent studies on the milk samples from the mothers living in and around the open municipal dumping sites of the two metropolitan cities, Chennai and Kolkata had considerably higher levels of different persistent organic pollutants (POPs) than the samples from their respective control sites, situated at places far away from those dumping sites. We have noticed region specific differences and temporal variations in the accumulation patterns of different POPs chemicals. Differences were also observed in the levels of TEQs of dioxins and related chemicals (DRCs) and polychlorinated biphenyls (PCBs) between the milk samples from the two cities. Number of years of stay of mothers near the dumping site was found to have significant effect on the levels of dioxin-like PCBs and total PCBs in their respective milk samples.

Introduction:

India is one of the remaining countries engaged in large scale manufacture, use and export of the toxic chlorinated pesticides and also still using some industrial chemicals which were already banned in developed nations. Our recent investigations on POPs pollution in the Asian developing countries has shown that the environmental samples and animals living near the innumerable municipal dumping sites in those countries are having considerable concentrations of highly toxic, unintentionally produced contaminants such as PCDDs/DFs, PBDEs, and also some organochlorines (OCs) like *co-planar* PCBs, which are probably formed by the spontaneous combustion or intentional incineration of the wastes¹⁻⁴. Especially the finding of such contaminant residues in the human breast milk of India is of particular concern because infants and children may be more seriously susceptible to the toxic implications of any toxicant than the adults. These results highlight the need to determine organochlorine contamination in Indian human milk in the populations living in different cities of India, especially in mother livings in and around the dumping sites and assess their historical trend and effects of the ban imposed in recent years.

Materials and Methods

Human breast milk samples were collected from the mothers living in and around the open dumping sites at the suburbs of the two metropolitan cities Chennai and Kolkata, both situated on the east coast of India (Fig. 1). Eighteen and 20 samples were collected from the mothers living near the open dumping site of municipal wastes in Kolkata and Chennai, respectively. Samples were also collected from far away locations from the dumping sites of Kolkata ($n = 14$), Chennai city proper ($n = 12$), Parangipettai fishing village ($n = 6$) and also from Chidambaram agricultural area ($n = 8$). HCHs, DDTs, PCBs, CHLs and HCB were measured in the samples from Chennai, Perungudi, Parangipettai and Chidambaram. Apart from these five chemicals, concentrations of PCDDs, PCDFs, *non-ortho* PCBs and *mono-ortho* PCBs were also quantified in the mothers milk from Kolkata dumping site and its control site. The Toxic equivalents of the dioxins and related chemicals (TEQs)

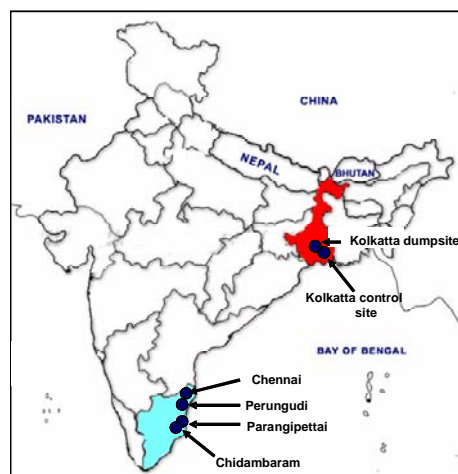


Fig. 1. Sampling sites

were calculated using WHO-TEFs⁵. Statistical analyses were conducted by using Mann-Whitney U test and Spearman's rank correlation coefficient. Our previous data on the dioxin levels in Chennai dumping site milk samples are also used for comparison².

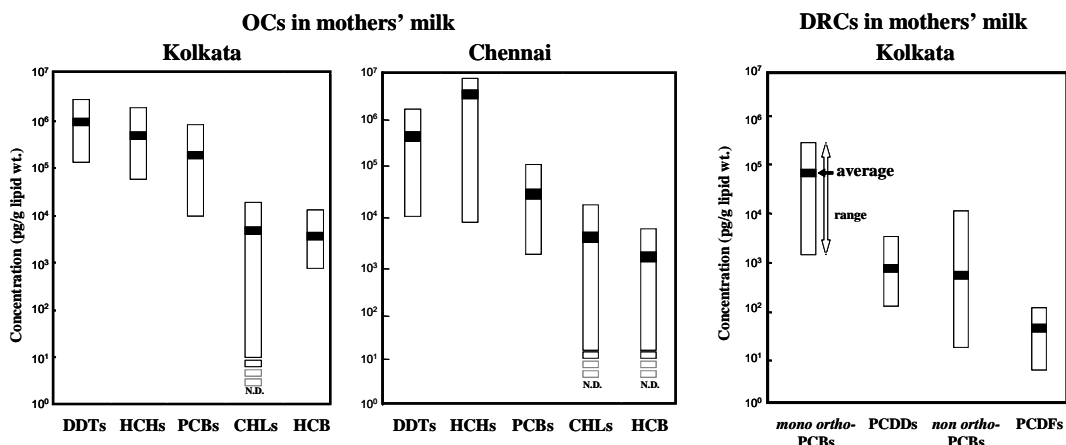


Fig. 2. Concentrations of OCs (ng/g lipid wt.) and DRCs (pg/g lipid wt.) in mothers' milk from India

Results and Discussion

All the samples contained measurable quantities of the POPs measured (Fig. 2). Among PCBs and organochlorine pesticides, DDTs were highest in Kolkata milk followed by HCHs>PCBs>CHLs>HCB. This order was different from the pattern observed in Chennai milk, in which HCHs were dominant, indicating region specific exposure to OCs in India. As far DRCs, *mono-ortho* PCBs were predominant followed by PCDDs>*non-ortho* PCBs>PCDFs and this pattern is similar to that in human milk from Chennai, reported previously¹.

When compared with our previously reported data⁶ a clear temporal increase of HCHs and DDTs were observed in Chennai mothers, but not in other southern sampling locations (Fig. 3), indicating region specific and still continuing usage of OCs in India, in spite of several ban and restrictive measures imposed years earlier. Apart from this, while not much contamination by PCBs were observed in Chennai dumping site (Perungudi), higher concentrations of PCBs were found in Kolkata dumping site than the control site indicating the presence of specific PCB source there. Further, *non-* and *mono-ortho* PCBs in human breast milk were significantly higher than those from control site, whereas no such difference was found for PCDDs and PCDFs. Levels of TEQs and PCBs in dumping site from Kolkata were notably higher than those from Chennai dumping site (Perungudi) indicating that the magnitude of pollution by these contaminants in the Indian environment could be different domestically (Fig. 4). Furthermore, levels of TEQs and PCBs in

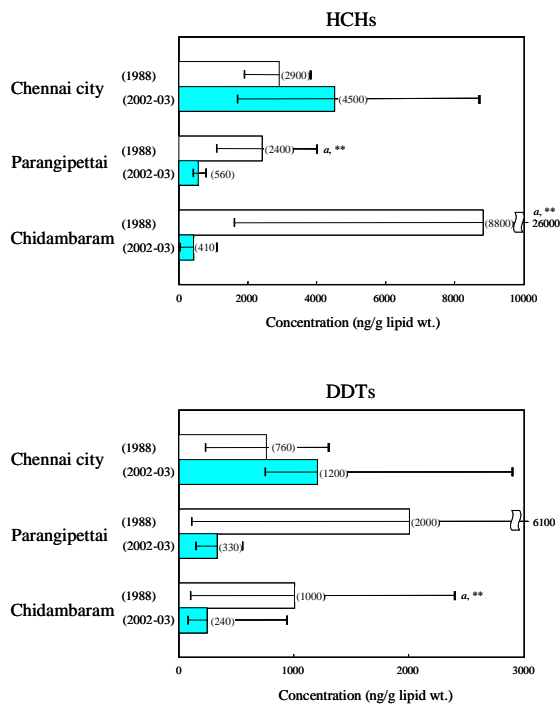


Fig.3. Temporal trends of HCHs and DDTs in mothers' milk from three locations in South

Kolkata milk were higher than in Japanese milk⁷ showing that the mothers near Kolkata dumping site are exposed to levels of these toxic chemicals comparable to general public of developed nations. We also found that the concentrations of total and dioxin-like PCBs in the Kolkata dumping site milk significantly increased with the number of years of stay there (Fig. 5), indicating the area may be a major source for residents around there.

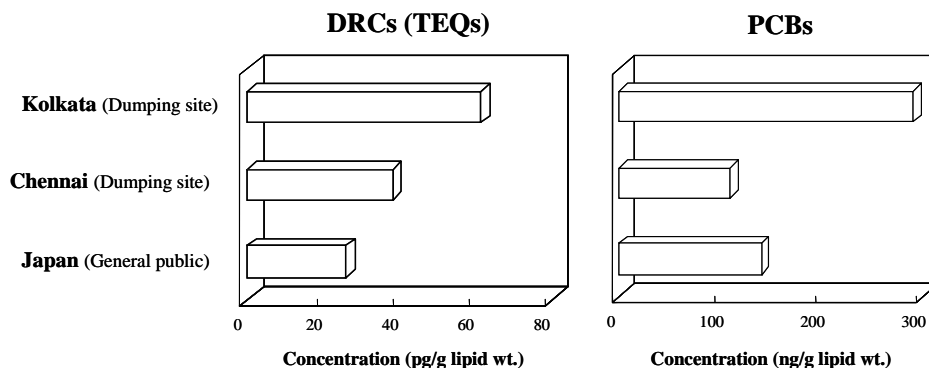


Fig. 4 Comparison of TEQs and PCBs in mothers' milk from two cities in India and Japan

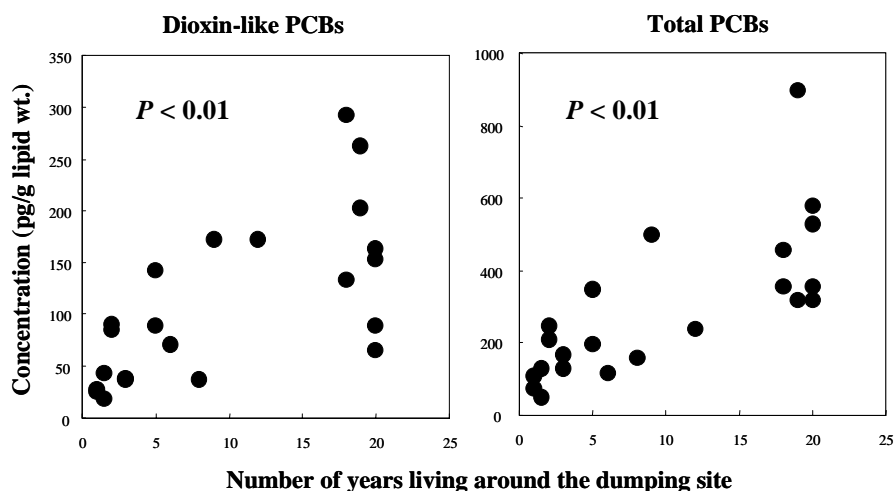


Fig. 5. Relationship between levels of PCBs in human milk from Kolkata dumping sites and number of years of stay around the site

All our findings points out region specific differences of several OC pollutants in India, especially in big cities and also around open dumping sites, which may again increase in the future, because of increasing industrialization, increase in the number of municipal and e-waste dumping sites, uncontrolled use of agricultural chemicals, etc. This shows the necessity of wide scale monitoring in other major cities of India and their suburbs.

Acknowledgements

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