Persistent organochlorine residues in human breast milk from Hanoi and Hochiminh city, Vietnam: Contamination, accumulation kinetics and risk assessment for infants

Minh N.H., Someya M., Minh T.B., Kunisue T., Iwata H., Watanabe M., Tanabe S., Viet P.H., Tuyen B.C.

Ctr. for Mar. Environmental Studies, Ehime University, Bunkyo-cho 2-5, Matsuyama 790-8577, Japan; Ctr. Environ. Technol. S., Hanoi National University, 334 Nguyen Trai Street, Hanoi, Viet Nam; Univ. of Agriculture and Forestry, Hochiminh City, Viet Nam

Abstract: Despite the ban on persistent organochlorines (OCs) in most of the developed nations, their usage continued until recently in many Asian developing countries including Vietnam, for agricultural purposes and vector-borne disease eradication programs. In this study, we collected human breast milk samples from the two big cities in Vietnam: Hanoi (n=42) and Hochiminh (n=44) and determined the concentrations of persistent OCs such as PCBs, DDT and its metabolites (DDTs), hexachlorocyclohexanes (HCHs), hexachlorobenzene (HCB), chlordane compounds (CHLs) and tris-4-chlorophenyl- methane (TCPMe). The contamination pattern of OCs was in the order of DDTs > PCBs > HCHs > CHLs??HCB??TCPMe. Compilation of available data indicated that DDT residue levels in human breast milk from Vietnam were among the highest values reported for Asian developing countries as well as developed nations. This result suggests recent usage of DDTs in both north and south Vietnam. Interestingly, in both cities, the p,p'-DDT portion was higher in multiparas than those in primiparas. Considering the fact that the interval between the first and the second child of a mother in Vietnam is usually short, this result probably indicates continuous intake of DDTs in the population. Analysis of infant exposure to DDTs via breast milk suggested that the daily intake rates for number of individuals are close to or above the threshold for adverse effects which may raise concern on children health.

Author Keywords: DDTs; Human breast milk; Infant health; PCBs; TCPMe; Vietnam

Index Keywords: Agriculture; Disease control; Metabolites; Risk assessment; Disease eradication; Organochlorides; Chlorine containing polymers; chlordane; chlorphenotane; hexachlorobenzene; hexachlorocyclohexane; methane; organochlorine derivative; polychlorinated biphenyl; DDT; health risk; milk; organochlorine; agriculture; article; Asia; bioaccumulation; breast milk; concentration (parameters); contamination; daily life activity; data analysis; eradication therapy; exposure; health; human; information processing; kinetics; maximum allowable concentration; metabolite; multipara; population research; risk assessment; Viet Nam; Age Factors; Chlordan; DDT; Developing Countries; Developmental Disabilities; Environmental Exposure; Female; Humans; Infant; Insecticides; Lindane; Milk, Human; Parity; Pesticide Residues; Polychlorinated Biphenyls; Risk Assessment; Vietnam; Asia; Eurasia; Southeast Asia; Viet Nam

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Correspondence Address: Tanabe, S.; Ctr. for Mar. Environmental Studies, Ehime University, Bunkyo-cho 2-5, Matsuyama 790-8577, Japan; email: shinsuke@agr.ehime-u.ac.jp
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1. Minh, N.H., Ctr. for Mar. Environmental Studies, Ehime University, Bunkyo-cho 2-5, Matsuyama 790-8577, Japan
2. Someya, M., Ctr. for Mar. Environmental Studies, Ehime University, Bunkyo-cho 2-5, Matsuyama 790-8577, Japan
3. Minh, T.B., Ctr. for Mar. Environmental Studies, Ehime University, Bunkyo-cho 2-5, Matsuyama 790-8577, Japan
4. Kunisue, T., Ctr. for Mar. Environmental Studies, Ehime University, Bunkyo-cho 2-5, Matsuyama 790-8577, Japan
5. Iwata, H., Ctr. for Mar. Environmental Studies, Ehime University, Bunkyo-cho 2-5, Matsuyama 790-8577, Japan
6. Watanabe, M., Ctr. for Mar. Environmental Studies, Ehime University, Bunkyo-cho 2-5, Matsuyama 790-8577, Japan
7. Tanabe, S., Ctr. for Mar. Environmental Studies, Ehime University, Bunkyo-cho 2-5, Matsuyama 790-8577, Japan
8. Viet, P.H., Ctr. Environ. Technol. S., Hanoi National University, 334 Nguyen Trai Street, Hanoi, Viet Nam
9. Tuyen, B.C., Univ. of Agriculture and Forestry, Hochiminh City, Viet Nam

References:

1. Albers, J.M.C., Kreis, I.A., Liem, A.K.D., Van Zoonen, P., Factors that influence levels of contamination of human milk with poly-chlorinated organic compounds (1996) Arch. Environ. Contam. Toxicol., 30, pp. 285-291
2. Breivik, K., Sweetman, A., Pacyna, J.M., Jones, K.C., Towards a global historical emission inventory for selected PCB congeners - A mass balance approach, Global production and consumption (2002) Sci. Total. Environ., 290, pp. 181-198
3. Buser, H.R., DDT, a potential source of environmental Tris(4-chlorophenyl)methane and Tris(4-chlorophenyl)methanol (1995) Environ. Sci. Technol., 29, pp. 2133-2139
4. Cheek, A.O., Kow, K., Chen, J., McLachlan, J.A., Potential mechanisms of thyroid disruption in humans - Interaction of organochlorine compounds with thyroid receptor, transthyretin, and thyroid-binding globulin (1999) Environ. Health Perspect., 107, pp. 273-278
5. Cok, I., Bilgili, A., Ozdemir, M., Ozbek, H., Bilgili, N., Burgaz, S., Organochlorine pesticide residues in human breast milk from agricultural regions of Turkey, 1995-1996 (1997) Bull. Environ. Contam. Toxicol., 59, pp. 577-582
6. Colborn, T., Vom Saal, F.S., Soto, A.M., Developmental effects of endocrine-disrupting chemicals in wildlife and humans (1993) Environ. Health Perspect., 101, pp. 378-384

7. Gammon, M.D., Wolff, M.S., Neugut, A.I., Eng, S.M., Teitelbaum, S.L., Britton, J.A., Environmental toxins and breast cancer on Long Island (II) Organochlorine compound levels in blood (2002) Cancer Epidemio. Biomark. Prevent., 11, pp. 686-697
8. Gladen, B.C., Monaghan, S.C., Lukyanova, E.M., Hulchiy, O.P., Shkyryak-Nuzhnyk, Z.A., Sericano, J.L., Little, R.E., Organochlorines in breast milk from two cities in Ukraine (1999) Environ. Health Perspect., 107, pp. 459-462
9. Harris, C.A., O'Hagan, S., Merson, G.H.J., Organochlorine pesticide residues in human milk in the United Kingdom (1999) Human and Experim. Toxicol., 18, pp. 602-606
10. Heuyer, A.P., Jeurgensen, T., Brock, J.W., Grandjean, P., Organochlorine exposure and breast cancer survival (2000) J. Clinic. Epide., 53, pp. 323-330
11. Hung, D.Q., Thiemann, W., Contamination by selected chlorinated pesticides in surface waters in Hanoi, Vietnam (2002) Chemosphere, 47, pp. 357-367
12. Iwata, H., Tanabe, S., Sakai, N., Nishimura, A., Tatsukawa, R., Geographical distribution of persistent organochlorines in air, water and sediments from Asia and oceania, and their implication for global distribution from lower latitudes (1994) Environ. Pollut., 85, pp. 15-33
13. Kannan, K., Tanabe, S., Quynh, H.T., Hue, N.D., Tatsukawa, R., Residue pattern and dietary intake of persistent organochlorine compounds in foodstuff from Vietnam (1992) Arch. Environ. Contam. Toxicol., 22, pp. 367-374
14. Kannan, K., Tanabe, S., Tatsukawa, R., Geographical distribution and accumulation features of organochlorines residues in fishes from tropical Asia and Oceania (1995) Environ. Sci. Technol., 29, pp. 2673-2683
15. Kelce, W.R., Persistent DDT metabolite p,p'-DDE is a potent androgen receptor antagonist (1995) Nature, 375 (6532), pp. 581-585
16. Konishi, Y., Kuwabara, K., Hori, S., Continuous surveillance of organichlorine compounds in human breast milk from 1972 to 1998 in Osaka, Japan (2001) Arch. Environ. Contam. Toxicol., 40, pp. 571-578
17. Korrick, S.A., Altshul, L., High breast milk levels of polychlorinated biphenyls (PCBs) among four women living adjacent to a PCB-contaminated waste site (1998) Environ. Health Perspect., 106, pp. 513-518
18. Kunisue, T., Minh, T.B., Fukuda, K., Wantanabe, M., Tanabe, S., Titenko, A., Seasonal variation of persistent organochlorines accumulation in birds from lake Baikal, Russia and the role of the South Asian Region as a source of pollution for wintering migrants (2002) Environ. Sci. Technol., 36, pp. 1396-1404
19. Kunisue, T., Watanabe, M., Someya, M., Monirith, I., Minh, T.B., Subramanian, A., Tana, T.S., Tanabe, S., PCDDs, PCDFs, PCBs and organochlorine insecticides in human breast milk collected from Asian developing countries: Risk assessment for infants (2002) Organohalogen Compound, 58, pp. 285-287
20. Li, Y.F., Cai, D.J., Singh, A., Technical hexachlorocyclohexane use trends in China and their impact on the environment (1998) Arch. Environ. Contam. Toxicol., 35, pp. 688-697
21. Longnecker, M.P., Klebanoff, M.A., Zhou, H., Brock, J.W., Association between maternal serum concentration of the DDT metabolite DDE and preterm and small-for-gestational-age babies at birth (2001) Lancet, 358 (9276), pp. 110-114
22. Minh, T.B., Watanabe, M., Tanabe, S., Yamada, T., Hata, J., Watanabe, S., Occurrence of Tris(4-chlorophenyl)methane, Tris(4-chlorophenyl)methanol and some other persistent organochlorines in Japanese human adipose tissue (2000) Environ. Health Perspect., 108, pp. 599-603
23. Minh, T.B., Kunisue, T., Yen, N.T.H., Watanabe, M., Tanabe, S., Hue, N.D., Qui, V., Persistent organochlorine residues and their bioaccumulation profiles in resident and migratory birds from North Vietnam (2002) Environ. Toxicol. Chem., 21, pp. 2108-2118
24. Monirith, I., Nakata, H., Watanabe, S., Takahashi, S., Tanabe, S., Tana, T.S., Organochlorines contamination in fishes and

mussels from Cambodia and other Asian countries (2000) Water Sci. Technol., 42 (78), pp. 241-252

25. Nhan, D.D., Am, N.M., Hoi, Ch., Dieu, L.V., Carvalho, F.P., Villeneuve, J.P., Cattini, C., Organochlorine pesticides and PCBs in the Red river delta, north Vietnam (1998) Mar. Pollut. Bull., 36, pp. 742-749
26. Nhan, D.D., Carvalho, F.P., Am, N.M., Tuan, N.Q., Yen, N.T.H., Villeneuve, J.P., Cattini, C., Chlorinated pesticides and PCBs in sediments and molluscs from freshwater canals in Hanoi, Vietnam (2001) Environ. Pollut., 112, pp. 311-320
27. Noren, K., Meironyte, D., Certain organochlorine and organobromine contaminants in Swedish human milk in perspective of 20-30 years (2000) Chemosphere, 40, pp. 1111-1123
28. Oostdam, J.V., Gilman, A., Dewailly, E., Usher, P., Wheatley, B., Kuhnlein, H., Human health implications of environmental contaminants in Arctic Canada: A review (1999) Sci. Total Environ., 230, pp. 1-82
29. Pandit, G.G., Sahu, S.K., Sadasivan, S., Distribution of HCH and DDT in the coastal marine environment of Mumbai (2002) India. J. Environ. Monit., 4, pp. 431-434
30. Phuong, P.K., Son, C.P., Sauvain, J.J., Tarradellas, J., Contamination by PCBs, DDTs, and heavy metals in sediments of Ho Chi Minh city's canals, Viet Nam (1998) Bull. Environ. Contam. Toxicol., 60, pp. 347-354
31. Polder, A., Odland, J.O., Tkachev, A., Foreid, S., Savinova, T.N., Skaare, J.U., Geographic variation of chlorinated pesticides, toxaphenes and PCBs in human milk from sub-arctic locations in Russia (2003) Sci. Total Environ., 306, pp. 179-195
32. Quinsey, P.M., Donohue, D.C., Ahokas, J.T., Persistence of organochlorines in breast milk of women in Victoria - Australia (1995) Food Chem. Toxicol., 33, pp. 49-56
33. Rahman, M.S., Montanarella, L., Johansson, B., Larsen, B.R., Trace levels of Tris(4-chlorophenyl)methanol and methane in human milk (1993) Chemosphere, 27, pp. 1487-1497
34. Schade, G., Heinzow, B., Organochlorine pesticides and polychlorinated biphenyls in human milk of mothers living in northern Germany: Current extent of contamination, time trend from 1986 to 1997 and factors that influence the levels of contamination (1998) Sci. Total Environ., 215, pp. 31-39
35. Schecter, A., Ryan, J.J., P??pke, O., Decrease in levels and body burden of dioxins, dibenzofurans, PCBs, DDE and HCB in blood and milk in a mother nursing twins over a thirty-eight month period (1998) Chemosphere, 37, pp. 1807-1816
36. Schecter, A., Fuerst, P., Fuerst, C., Meemken, H.A., Groebel, W., Constable, J.D., Levels of polychlorinated dibenzofurans, dibenzodioxins, PCBs, DDT, DDE, hexachlorbenzene, dieldrin, hexachlorocyclohexanes, and oxychlordane in human breast milk from the United States, Thailand, Vietnam and Germany (1989) Chemosphere, 18, pp. 445-454
37. Schoula, R., Hajslov?, J., Bencko, V., Poustka, J., Holadov?, K., Vizek, V., Occurrence of persistent organochlorine contaminants in human milk collected in several regions of Czech Republic (1996) Chemosphere, 33, pp. 1485-1494
38. Smith, D., Worldwide trends in DDT levels in human breast milk (1999) International Journal of Epidemiology, 28, pp. 179-188
39. Stuetz, W., Prapamontol, T., Erhardt, J.G., Classen, H.G., Organochlorine pesticide residues in human milk of a Hmong hill tribe living in Northern Thailand (2001) Sci. Total Environ., 273, pp. 53-60
40. Thao, V.D., Kawano, M., Tatsukawa, R., Persistent organochlorines residues in soils from tropical and sub-tropical Asian countries (1993) Environ. Pollut., 81, pp. 61-71
41. Vos, J.G., Dybing, E., Greim, H.A., Ladefoged, A., Lambr??, C., Tarazona, J.V., Brandt, I., Vethaak, A.D., Health effects of endocrine-disrupting chemicals on wildlife, with special reference to the European situation (2000) Critical Rev. in Toxicol., 30, pp. 71-133
42. Vreugdenhil, H.J.I., Slijper, F.M.E., Mulder, P.G.H., Weisglas-Kuperus, N., Effects of perinatal exposure to PCBs and dioxins on play behavior in Dutch children at school age (2002) Environ. Health Perspect., 110, pp. 593-A598

43. Waliszewski, S.M., Aguirre, A.A., Infanzon, R.M., Silva, C.S., Siliceo, J., Organochlorine pesticide levels in maternal adipose tissue, maternal blood serum, umbilical blood serum, and milk from inhabitants of Veracruz, Mexico (2001) Arch. Environ. Contam. Toxicol., 40, pp. 432-438
44. Walkowiak, J., Wiener, J., Fastabend, A., Heinzow, B., Kr??mer, U., Schmidt, E., Steingr?ber, H., Winneke, G., Environmental exposure to polychlorinated biphenyls and quality of the home environment: Effects on psychodevelopment in early chilhood (2001) Lancet, 358 (9293), pp. 1602-1607
45. Wong, C.K.C., Leung, K.M., Poon, B.H.T., Lan, C.Y., Wong, M.H., Organochlorine hydrocarbons in human breast milk collected in Hong Kong and Guangzhou (2002) Arch. Environ. Contam. Toxicol., 43, pp. 364-372