

## **Organochlorine Pesticide Residues in the Serum of Mothers and Their Newborns from Three Yugoslav Towns**

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The use of pesticides may lead to nondesirable consequences. As food represents the major source of intake of DDT and other chlorinated hydrocarbon pesticide residues for general population (Campbell et al. 1965; Durham et al. 1965; Morgan and Roan 1970) the first step in estimating whether chlorinated hydrocarbon pesticides ingested through food may have adverse effects on man is to estimate the level of pesticide residues in the blood. Insecticide transfer from mother to fetus was observed by Denes (1962), and was subsequently confirmed by a number of authors (Curely et al. 1969; Komarova 1970; O'Leary et al. 1970; Schvartsman et al. 1974; Bažulić et al. 1978).

This paper examines the levels of chlorinated pesticides in the serum of mothers and their newborns living in three towns - Zagreb, Titov Veles and Pula - from three different regions of Yugoslavia. Some differences in the amount and type of agriculture and in nutrition manners are present in these regions (A. Brodarec, personal communication), but the observed mothers were not occupationally exposed to pesticides.

### **MATERIALS AND METHODS**

The serum samples were collected at the Department of Pediatrics, Division of Neonatal Medicine, University of Zagreb, and at the Medical Center Titov Veles and the Medical Center Pula during 1978-1981. The samples (N=190) were obtained by venipuncture one or two days postpartum in Zagreb and Titov Veles, and immediately from umbilical cord in Pula. After centrifugation at 3000 rpm for 20 min the serum was kept frozen in glass-stoppered tubes with n-hexane at -20 °C until extraction which was made by a slightly modified method described by Bloomer et al. (1977). The serum (2 ml) was extracted three times with n-hexane (6 ml) on rotary shakers. The combined hexane extracts were evaporated to a small volume and analysed by gas chromatography. A Hewlett Packard 5730A equipped

with a 1.8 m x 4 mm ID glass column filled with 8% QF-1 and 4% SF-96 on 100/120 mesh Chromosorb W was used for the analyses. Nitrogen was used as a carrier gas at 45 ml/min. Temperature of injector, column, and 63-Ni detector were 250, 170, and 300 °C, respectively.

## RESULTS AND DISCUSSION

In serum samples from mothers and their newborns only the presence of alpha-HCH, lindane, p,p'-DDE, o,p'-DDT, p,p'-DDD and p,p'-DDT could be demonstrated. The average recovery rate for pesticides was 85, 93, 91 and 101 % for lindane, p,p'-DDT, o,p'-DDT, and metabolites of DDT respectively. The results of the analyses are presented in Table 1, 2. and 3. All residue levels are expressed as µg/l and have been corrected for recovery efficiency.

Table 1. Chlorinated hydrocarbon pesticide concentrations in the serum of mothers and their children from Zagreb (N=31)

Pesticide	Mean (n)	
	Mothers	Children
alpha-HCH	2.2 ± 4.4 (16)	3.0 ± 4.4 (21)
lindane	3.7 ± 2.9 (25)	6.9 ± 8.0 (26)
p,p'-DDE	10.7 ± 9.5 (31)	6.4 ± 3.1 (29)
o,p'-DDT	0.3 ± 0.9 (4)	1.0 ± 1.9 (11)
p,p'-DDD	1.2 ± 2.0 (12)	2.4 ± 5.9 (17)
p,p'-DDT	8.1 ± 9.9 (26)	3.2 ± 3.3 (21)
ΣDDT	671.7	432.2

Table 2. Chlorinated hydrocarbon pesticide concentrations in the serum of mothers and their children from Titov Veles (N=31)

Pesticide	Mean (n)	
	Mothers	Children
alpha-HCH	1.9 ± 2.5 (14)	2.7 ± 3.5 (20)
lindane	3.7 ± 4.9 (18)	6.9 ± 9.6 (23)
p,p'-DDE	35.1 ± 35.8 (26)	17.3 ± 36.0 (21)
o,p'-DDT	1.2 ± 6.2 (2)	2.2 ± 12.4 (1)
p,p'-DDD	14.7 ± 68.1 (5)	10.7 ± 44.5 (3)
p,p'-DDT	11.2 ± 54.5 (5)	12.9 ± 38.3 (4)
ΣDDT	2107.7	1438.6

Table 3. Chlorinated hydrocarbon pesticide concentrations in the serum of mothers and their children from Pula (N=33)

Pesticide	Mean (n)	
	Mothers	Children
alpha-HCH	1.4 ± 3.5 (9)	1.9 ± 5.2 (9)
lindane	1.7 ± 3.2 (15)	2.6 ± 4.9 (12)
p,p'-DDE	11.2 ± 8.3 (30)	6.3 ± 11.1 (23)
o,p'-DDT	< 0.1 (0)	0.9 ± 5.0 (1)
p,p'-DDD	0.6 ± 1.8 (5)	2.8 ± 13.3 (5)
p,p'-DDT	3.6 ± 7.8 (17)	34.3 ± 171.5 (14)
ΣDDT	554.3	1491.2

The means are  $\mu\text{g/l} \pm \text{SD}$ , (n) = number of positive samples,  $\Sigma\text{DDT} = \text{p,p'-DDT} + \text{o,p'-DDT} + 1.114 (\text{p,p'-DDE} + \text{p,p'-DDD})$

Since concentrations vary considerably, differences between serum levels of pesticides in samples were determined using t-method at  $P < 0.05$  and  $P < 0.01$ , and regression coefficient at  $P < 0.01$ . Results showed that the concentrations of p,p'-DDE, p,p'-DDT and lindane between cities have been statistically different. Namely, the mothers' serum from Pula contained significantly less lindane than that from Zagreb and Titov Veles ( $P < 0.05$ ). In Pula mothers' serum p,p'-DDT concentrations were significantly lower than in mothers' serum from Zagreb ( $P < 0.05$ ). Mothers' serum from Titov Veles contained significantly more p,p'-DDE than mothers' serum from Zagreb and Pula ( $P < 0.01$ ). In the children's serum only a difference in lindane concentrations was observed. The children's serum from Pula contained less lindane than that from Zagreb and Titov Veles ( $P < 0.01$  and  $P < 0.05$  respectively). For other insecticides the observed differences were not statistically significant, but significant differences in insecticides levels between mothers and their newborns were observed for lindane, p,p'-DDE and p,p'-DDT in Zagreb ( $P < 0.05$ ,  $P < 0.05$  and  $P < 0.01$  respectively) and in Pula and Titov Veles for p,p'-DDE only ( $P < 0.05$ ). Greater amounts of p,p'-DDE and p,p'-DDT, but not of lindane, were found in the mothers' serum from Zagreb and only for p,p'-DDE in Titov Veles and Pula.

For each set of samples a regression was calculated to determine the mother/child dependency. Some of the extreme values were not taken into account (N=87). A significant regressive coefficient was found for p,p'-DDE and lindane only (0.29 and 0.28 respectively,  $P < 0.01$ ). At the practically same mean levels of total DDT in the mothers and their newborns (35.0 and 35.4 respectively)

the ratio DDE/total DDT was 0.54 for the mothers and 0.28 for the newborns. This difference may suggest a less efficient placental interchange for DDE than for DDT. A probability of decreased capability in the embryo and neonate to convert DDT to DDE has not to be discarded.

## REFERENCES

- Bažulić D, Kipčić D, Štampar-Plasaj B, Jerić J, Bujanović V, Juzbašić N (1978) Residues of chlorinated pesticides in mother's and child's serum. *Arh hig rada* 29: 125-128
- Bloomer AW, Nash SI, Price HA (1977) A study of pesticide residues in Michigan's general population 1968-1970. *Pestic Monit J* 11:111-115
- Campbell JE, Richardson LA, Schafer ML (1965) Insecticide residues in the human diet. *Arch Environ Health* 10:831-836
- Curley A, Copeland MF, Kimbrough RD (1969) Chlorinated hydrocarbon insecticides in organs of stillborns and blood of newborn babies. *Arch Environ Health* 19:628-632
- Denes A (1962) Problems of food chemistry concerning residues of chlorinated hydrocarbons. *Nahrung* 6:48-56
- Durham WF, Armstrong JF, Quinby GE (1965) DDT and DDE content of complete prepared meals. *Arch Environ Health* 11:641-647
- Komarova LI (1970) The excretion of DDT in mothers' milk and its effect on the organism of mother and child. *Pediatr Akus Ginek* 1:19-20
- Morgan DP, Roan CC (1970) Chlorinated hydrocarbon pesticide residues in human tissues. *Arch Environ Health* 20:452-457
- O'Leary JA, Davies JE, Edmundson WF, Reich GA (1970) Transplacental passage of pesticides. *Am J Obstet Gynecol* 107:65-68
- O'Leary JA, Davies JE, Feldman M (1970) Spontaneous abortion and human pesticide residues of DDT and DDE. *Am J Obstet Gynecol* 108:1291-1292
- Schvartsman S, Almeida WF, Costa Vaz FA, Corradini HB, Pigati P, Gaeta R, Ungaro MT (1974) Blood levels of DDT in nonoccupationally exposed mothers and newborn infants in a city in Brazil. In: Coulston F, Korte F (eds) *EQS Environmental Quality and Safety*. Academic Press, New York, p 154

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