

Relationship between Levels of Chlorinated Hydrocarbon Insecticides in Human Milk and Serum

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Since Laug, et al. (1) first showed the presence of p,p'-DDT in human milk in 1950, there has been increasing interest in this result of environmental pollution. Other chlorinated hydrocarbon insecticides are also found in human milk (2). Despite reassurances as to the safety of present residues of chlorinated hydrocarbon insecticides in foodstuffs (3,4), concern about this problem persists. Epidemiologic surveys have been performed analyzing blood samples for insecticide concentrations, and it appears that the presence of p,p'-DDE, a metabolite of DDT, in serum is indicative of chronic DDT exposure, while p,p'-DDT levels are measures of recent exposure (5,6). Similarly, Robinson (7) has shown that there is a relationship between the concentration of dieldrin in blood and average daily dietary intake of this insecticide.

If a relationship exists between p,p'-DDE levels in the blood and in the milk of the same human subject, some valuable epidemiologic information might be gained from studying insecticide residues in breast milk. Curley and Kimbrough recently measured plasma and milk levels of p,p'-DDE in five subjects and found no correlation (2). The purpose of the current investigation was to study the relationship between levels of chlorinated insecticides in human serum and milk in a larger sample taken from populations in different ecological areas.

MATERIAL AND METHODS

Twenty-eight lactating women were the subjects of this study. Twelve (subjects 1-12) were from McAllen, Texas, in an agricultural area near the outlet of the Rio Grande River; nine (subjects 13-21) were from El Paso, Texas, a city with light industry in a semi-arid farming and ranching area about 1,000 miles upstream from McAllen on the Rio Grande River; and seven (subjects 22-28) were from Houston, Texas, a heavily industrialized city about 300 miles from McAllen. Breast milk samples were obtained by manual expression

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TABLE 1

Insecticide Residues in Parts per Billion (ppb). Trace Amounts
Considered to be 0.5 ppb For Statistical Purposes

Subject	p,p'-DDE		p,p'-DDT		Dieldrin		BHC	
	Serum	Milk	Serum	Milk	Serum	Milk	Serum	Milk
1	49.8	30.0	13.3	10.4	1.2	1.2	2.3	3.5
2	32.0	19.0	7.6	6.0	0.5	1.8	2.0	12.3
3	65.0	203.0	5.1	19.3	0.5	2.5	3.0	22.3
4	43.0	52.5	16.0	10.0	2.1	4.5	2.9	8.4
5	114.0	37.5	15.0	6.4	1.4	1.6	10.2	19.5
6	41.2	131.0	9.7	47.7	0.5	1.9	3.3	10.4
7	51.5	236.0	5.4	34.4	0.5	0.0	1.7	18.7
8	10.0	58.5	6.2	32.5	0.5	5.6	0.0	6.6
9	54.5	218.0	8.2	48.6	1.1	5.4	3.5	37.0
10	61.0	20.4	13.8	6.8	0.5	1.1	2.4	6.3
11	65.5	149.0	13.6	42.6	1.5	4.8	2.4	6.3
12	33.2	236.0	8.5	41.7	0.5	4.2	0.0	6.0
13	17.7	72.5	3.7	16.4	0.0	0.5	0.0	0.0
14	23.3	53.9	5.2	11.4	0.0	0.0	0.0	0.0
15	21.0	34.1	4.5	8.4	0.0	0.0	0.0	0.0
16	6.1	13.4	0.5	4.2	0.0	0.0	0.0	0.0
17	12.0	18.0	6.2	12.0	0.0	0.0	0.0	0.0
18	39.7	29.1	8.1	9.0	0.0	0.5	0.0	0.0
19	42.4	60.7	23.9	40.5	0.0	3.0	0.0	0.0
20	23.2	20.6	7.2	6.8	1.4	0.0	0.0	0.0
21	14.7	15.3	3.2	4.0	0.0	1.3	0.0	0.0
22	41.0	65.4	17.6	35.9	2.4	21.0	2.4	6.2
23	43.0	79.7	21.2	47.8	2.8	2.6	2.9	5.4
24	55.5	91.0	9.7	18.0	3.9	2.5	1.8	4.2
25	60.5	131.0	11.5	29.4	6.0	15.6	2.5	9.0
26	13.2	16.7	4.4	8.0	2.0	1.9	0.0	3.6
27	27.8	125.0	7.2	39.5	1.3	4.8	2.1	7.5
28	42.9	138.0	15.9	56.6	1.3	4.2	0.5	7.5
Mean	39.5	84.1	9.7	23.4	1.2	3.3	1.6	7.2
S.D.	22.9	71.1	5.7	17.1	1.2	4.4	1.8	7.4
r	0.33		0.44		0.62		0.62	

directly into a chemically clean glass container. Blood samples were obtained at the same time and the serum separated. Both samples were immediately frozen.

2 ml. samples of blood serum (8) and milk (2) were extracted with hexane. The blood extract was concentrated to the desired volume and injected into the gas-liquid chromatograph (GLC); the milk, however, needed Florisil clean-up prior to concentration and injection into the GLC. Analyses were accomplished with a MicroTek 220 gas chromatograph equipped with a tritium foil detector. Columns used were 1.5% OV-17 and 1.95% QF-1 on Chromosorb W 100/120 mesh H.P., and 4% SE-30 6% QF-1 on Chromosorb W 80/100 mesh H.P. Temperatures for the GLC were as follows: column temp. 200° C; inlet temp. 225° C; detector temp. 205° C. Results were confirmed in conjunction with thin-layer chromatography. The data were submitted to statistical analyses using standard methods (9).

RESULTS AND DISCUSSION

Table 1 gives the results of the assays for the four most frequently occurring chlorinated insecticides - p,p'-DDE, p,p'-DDT, dieldrin, and hexachlorocyclohexane ("beta benzene hexachloride," BHC). All samples of milk and serum in this study contained p,p'-DDE and p,p'-DDT, and most samples contained dieldrin and BHC. In addition, eleven women had traces of o,p'-DDT in either their serum or milk (range 0.5-3.4 ppb), and two women had traces of heptachlor epoxide (range 1.0-1.8 ppb) in both their milk and serum.

A correlation between the milk and serum levels of the four principal chlorinated insecticides could not be established utilizing linear regression analysis, as can be seen by the low values of the Pearson Product Moment of Correlation (r).

Dieldrin and BHC were particularly noticeable by their virtual absence in samples from El Paso (subjects 13-21). The levels of p,p'-DDE, p,p'-DDT, dieldrin, and BHC in all milk samples are comparable to those reported elsewhere (10, 11), and there appears to have been little or no increase in these levels over the past 20 years (11).

The lack of correlation between the milk and serum levels of these insecticides is significant in terms of epidemiologic research. It appears that concentrations of p,p'-DDE in human milk do not have the same significance as those in serum, where chronic exposure can be estimated from the p,p'-DDE levels.

No conjecture can be made at this time as to whether the exposure is recent or chronic on the basis of milk levels.

SUMMARY

Simultaneous chlorinated hydrocarbon insecticide analyses were performed on milk and serum from twenty-eight lactating women living in three widely scattered cities in Texas. No correlation could be established between milk and serum levels of p,p'-DDE, p,p'-DDT, dieldrin, or BHC. It was concluded that breast milk insecticide levels do not have the epidemiologic significance that the serum levels suggest.

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