

PERSISTENT ORGANOCHLORINE POLLUTANTS IN HUMAN ADIPOSE TISSUE FROM SAVANNAH, GEORGIA, U.S.A.

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Introduction

Polychlorinated biphenyls and chlorinated hydrocarbon pesticides such as DDT, chlordane, hexachlorobenzene, hexachlorocyclohexane and mirex are identified by the United Nation Environment Programme (UNEP) as the most unwanted organic pollutants and powerful threats to wildlife and human health on a global basis (1). Their exposure to humans and animals is of serious concern owing to chronic toxicity, endocrine disruption, reproductive toxicity, immunotoxicity and carcinogenicity (1-5). The organochlorine compounds possess a lipophilic character, tend to bioaccumulate, and magnify with higher trophic level in animals. As humans occupy the top most position in trophic levels, they obviously receive highest level of these contaminants from aquatic and terrestrial food chain. The pollutants that accumulate in human tissues are known to pass through the placenta to the developing fetus and cause adverse effects (1). Growing concern over the recent decades about possible effects of these chemicals on human health and environment has resulted in restriction on production and use of these chemicals at many levels from local to global (1,2). However, several developing countries still use inexpensive DDT and other organochlorines for agriculture and public health programs and their demand is increasing. Major route of human exposure to these organic pollutants is consumption of contaminated food including, fish, meat, and dairy products (2). Since the United States imports several food stuffs from the countries where these chemical are being produced and/or used, human exposure to these chemicals in the U.S. is continuing (6,7). Number of studies measured the levels and temporal trends of PCBs and pesticides in human tissues (8-12). However, very little information is available on the status of organochlorine contamination in human adipose tissue from people living in the city of Savannah, southeast coast of the United States. In this study we used liposuction fat samples of adult male and females from a plastic surgery center and measured selected PCB congeners and chlorinated pesticides. Personal attributes such as age, marital status, dietary intake (vegetarian, non-vegetarian), lactational history, region of residency were collected from the donors.

Material and Methods

Adipose tissue from 11 adult individual were used for PCB congeners and pesticide analyses. During the liposuction procedure, 10-15g fat tissue was directly transferred into a pre-cleaned I-Chem bottle and stored immediately at -20°C until further analysis. The sample contained a small amount of blood. About 2-3g of sample was homogenized with about 50g of anhydrous sulfate salt and Soxhlet extracted for 16 hrs using 3:1 mixture of methylene chloride and acetone. PCB-103 was spiked as surrogate standard prior to extraction. K-D concentration was done to reduce the volume of the extract. Fat removal was performed using Florisil dry column chromatographic methods [8]. Separation of PCBs and pesticides was done using silica gel column chromatography. After concentration sulfuric acid treatment, the samples were injected into gas chromatograph with ^{63}Ni electron capture detector. Quantitation procedures of PCB congeners and chlorinated pesticides were described elsewhere [13] , Adipose tissue samples and the details of the donors are given in Table 1.

Table 1. Personal attributes of fat sample donors. All donors are married and non-vegetarians.

Serial #	Age	Sex	Residence	Lactation yes/no	Tissue Location
1	44	F	Savannah, GA	yes	abdomen
2	36	F	Soperton, GA	yes	abdomen
3	68	F	Savannah*	no	abdomen
4	46	M	NA	no	NA
5	47	F	Savannah, GA	no	abdomen
6	47	F	NA	no	NA
7	49	F	NA	no	NA
8	49	F	Hiton Head, SC	no	abdomen
9	49	F	Rincon, GA	no	abdomen
10	45	F	NA	no	abdomen
11	62	F	Hiton Head, SC	no	NA

*Originally from Missouri.

Table 2. Total PCBs and chlorinated pesticides concentrations in human adipose tissues from Savannah, GA., USA.

ANALYTE	Concentration Range (ng/g fat wt.)	Mean n=11
PCBs	98.74-879.72	476.70
HCB	1.77-19.34	10.25
Gamma-HCH	0.06-1.01	0.44
Aldrin	0-1.49	0.82
2,4'-DDE	1.35-4.22	2.86
Cis-CHL	0-10.25	3.19
Trans-N	2.42-113.58	51.92
4,4'-DDE	15.23-760.34	279.93
2,4'-DDD	0-1.29	0.45
4,4'-DDD	0	0
2,4'-DDT	0-0.2	0.02
4,4'-DDT	1.81-32.49	10.34

Results and Discussion

Table 2 presents concentrations of total PCBs and chlorinated pesticides. Total PCB concentration range from 98.74 to 879.72 ng/g fat wt. with a mean value of 477 ng/g fat wt. In comparison with earlier time trend data [8,9] the total PCB concentration observed in human fat samples shows a steady state or a tendency for declining trend. Among various pesticides measured 4,4'-DDE a metabolite of 4,4'-DDT was found to have significantly higher concentration (15.23 to 760.34 ng/g fat wt.) than other pesticides. HCB, cis-chlordane and trans-nonachlor were also detected (Table 2). Concentration of 4,4'-DDT ranged from 1.81-32.49 with a mean value of 10.34 ng/g fat wt. Detection of 4,4'-DDT in fat tissues indicate the recent exposure to this pesticide. Laden *et.al.* [11] reported that women living in the western United States had higher levels of DDE, and women in the Northeast and Midwest had higher levels of PCBs as compared to other parts of the country. Present study showed that women in the southeast revealed higher concentrations of PCBs than pesticides. Considering the total DDT concentrations reported during 1950's through 1980's in human fat tissues from the United States [14-17], the levels recorded in the present study show a declining trend of DDT exposure.

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