

ANALYSIS AND BEHAVIOR OF RESIDUAL ORGANOCHLORINE COMPOUNDS IN BREAST ADIPOSE TISSUES AMONG JAPANESE WOMEN

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Abstract

Ten kinds of residual organochlorine compounds (p,p'-DDT, o,p'-DDT, p,p'-DDE, HCB, α -HCH, β -HCH, γ -HCH, δ -HCH, vinclozolin, and methoxychlor) in human adipose tissues were analyzed. The adipose tissues were obtained from 35 Japanese women who underwent surgery for breast cancer. The adipose tissue samples were homogenized and organochlorine compounds were extracted with organic solvents. After treatments using partition, sulfuric acid washing and clean-up procedure, organochlorine compounds were quantified using gas chromatography and mass spectrometry (GC-MS). Detectable levels of organochlorine compounds such as p,p'-DDT, p,p'-DDE, HCB, vinclozolin, and methoxychlor were found from all samples. Among these compounds, p,p'-DDT, p,p'-DDE and HCB were detected at relatively high concentrations. Positive correlations were observed for p,p'-DDE and HCB levels to the volunteers age. However, no significant relationships were observed for their parity history or lactation history to residual organochlorine levels.

Introduction

Organochlorine pesticides had been widely used and contributed to the prevention of epidemic and improvement of farm products because of their excellent insecticidal and herbicidal efficacies¹. Due to their stable chemical properties in the environment, the organochlorine compounds persist in the most environmental compartment, including the atmosphere, soil and water. And also these compounds have been magnified their concentrations along with food chains, and finally accumulated in human blood and adipose tissue². Some of the organochlorine compounds are classified into persistent organic pollutants (POPs). Residual organochlorine compounds might have adverse health effects to human including neurotoxicity and endocrine disruption³.

Since 1973, production and trading of such organochlorine pesticides were banned in Japan. Moreover, a

number of countries have banned or restricted from use since 2001. Despite the control for over thirty years, high concentrations of organochlorine compounds have been detected in adipose tissue and blood samples of human⁴. Organochlorine compounds are also detected placenta and human milk showing birth and nurse are the major transformation route of the compounds from mothers to children⁵. A possible association between high concentration levels of the organochlorine compounds and breast cancer risk has been reported.

In this study, we determined residual levels of organochlorine pesticides and related compounds such as p,p'-DDT, o,p'-DDT, p,p'-DDE, HCB, α -HCH, β -HCH, γ -HCH, δ -HCH, vinclozolin, and methoxychlor in adipose tissues obtained from Japanese women diagnosed as a breast cancer.

Materials and Methods

In 2001, adipose tissue samples were collected from 35 Japanese women who underwent surgery for breast cancer at hospitals in Kagoshima city in Japan and offered via Department of Medicine at Kagoshima University. Participants gave written informed consent and allowed adipose tissue to be used for analyses. Ethics committee of Kagoshima University approved the study protocol. Samples were collected in glass vials, coded, and stored at -80 °C.

One gram of adipose tissue was subjected to the analysis of organochlorine compounds. After adding 1 g of Na₂SO₄, 5 ml of n-hexane:t-butyl methyl ether (1:1) and surrogate solution containing ¹³C₁₄-DDT, the tissue sample was homogenized by sonication. Separated organic layer was removed and treated with 1.0 ml of 6N-HCl and 6 ml of 2-propanol, centrifuged and evaporated to dryness. The extract was dissolved into acetonitrile:hexane and then evaporated off. The extract was cleaned up through sulfuric acid treatment and silica-gel and florisil column, and then eluted with 60 ml of hexane:dichloromethane. The final extract was concentrated to near dryness. One hundred micro-liter of syringe spike solution containing phenanthrene-d₁₀ was added, and then 10 kinds of organochlorine compounds were analyzed by GC-MS under SIM mode.

Student's t-test was used to examine the relationship between OCs levels and lifestyle. Pearson correlation coefficient was calculated to compare OCs levels in the adipose tissue to age and lactation history. Spearman's rank correlation was calculated to investigate the relationship between OCs levels and parity history. A p-value less than 0.05 was considered to indicate statistical significance.

Results and Discussions

Concentrations of organochlorine compounds (OCs) in human adipose tissues of breast cancer in this study are listed in Table 1. From all samples, detectable levels of OCs such as p,p'-DDT, p,p'-DDE, HCB, vinclozolin,

Table 1 Organochlorine compounds levels in adipose tissue

	N	Mean	S.D.	Median	Range
o,p'-DDT	35	5.2	2.9	4.8	0.6-12.8
p,p'-DDT	35	11.2	5.8	10.4	2.9-23.2
p,p'-DDE	35	594.8	389.0	545.6	8.3-1975.3
ΣDDTs		611.1	390.3	567.1	44.3-1988.7
α-HCH	24	3.9	4.8	2.0	N.D.-19.9
β-HCH	9	0.6	1.5	-	N.D.-7.1
γ-HCH	6	0.4	1.0	-	N.D.-3.3
δ-HCH	3	0.1	0.2	-	N.D.-0.1
ΣHCHs		4.9	5.3	2.8	1.0-19.9
HCB	35	70.0	62.6	39.5	5.9-270.3
Vinclozolin	35	3.6	3.7	1.7	0.2-10.6
Methoxychlor	35	21.0	24.7	10.8	0.4-96.9

ng g⁻¹ lipid

and methoxychlor were found, and concentrations of p,p'-DDT, p,p'-DDE and HCB were relatively high, especially p,p'-DDE levels were about 60 times high when compared with other OCs compounds. High levels of p,p'-DDE is due to metabolism of p,p'-DDT. There was no significant differences in the concentrations of OCs with age except for p,p'-DDE and HCB.

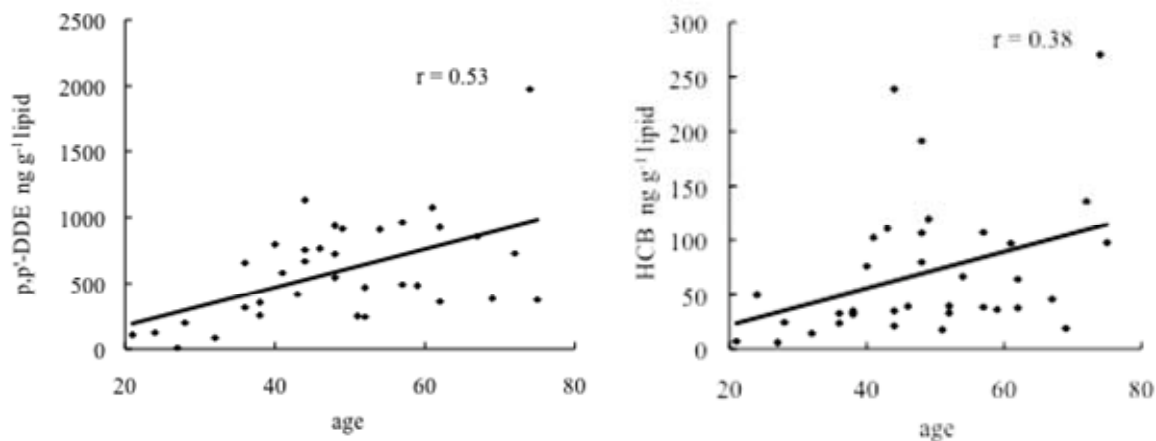


Fig. 1 Relationship of p,p'-DDE and HCB concentrations to age

Concentrations of p,p'-DDE and HCB increased with aging as shown in Fig.1. Not only in human body, but also throughout the food chain, p,p'-DDT is metabolized to p,p'-DDE. Generally, p,p'-DDE has high accumulative property, then the excretion rate from human body is very small. In this study, we obtained the association between the concentrations of p,p'-DDT and of p,p'-DDE (Fig. 2). HCB is not degraded in the environment.

In addition, HCB is not metabolized and eliminated in the human. Significant increasing tendency of p,p-DDE and HCB by age were observed in this study. It has been reported that concentrations of OCs decrease with increasing of the number of previous children nursed^{6,7}. However, this results of our data suggest that there are no significant correlations between the concentrations of OCs of human adipose tissues and parity and lactation period.

In this study, we determined residual levels of organochlorine pesticides and related compounds in adipose tissues obtained from Japanese women diagnosed as a breast cancer. As a result, there are no association ($p > 0.05$) between the concentrations of OCs in human adipose tissues of breast cancer and parameters.

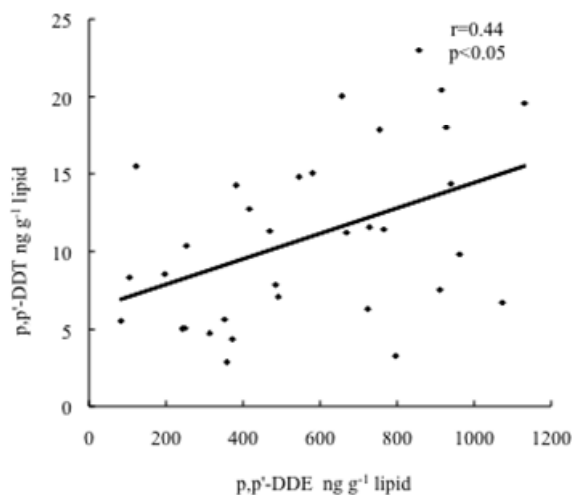


Fig.2 Association between p,p'-DDT and p,p'-DDE

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