

Preliminary Study of Organochlorine Insecticide Residues in Human Adipose Tissue and Blood

Macklad, M.P* and E.E. Enan**.

* Stay El-Barod Research Station, Agric. Research Center

** High Institute of Public Health, University of Alexandria.

Abstract

The present study attempts to establish 1987 baseline level of organochlorine insecticides (OCI) in adipose tissue and blood samples in rural population from Behera governorate, Egypt. Data indicate that the major detected OCI in adipose tissue were DDT, γ -HCH and δ -HCH. DDE and DDT- γ -HCH level exceeds the level of γ -HCH and δ -HCH indicating fresh exposure to γ -HCH. The mean value of DDE was 4.1 ppm exceeds the levels reported for the west European countries. Males exhibited higher OCI levels than females. δ -HCH and DDE were the only detected OCI in blood serum at levels far less than in adipose tissue. Males exhibited also higher levels than females in blood serum indicating that males are more exposed to OCI than females.

Introduction

There is a growing international concern about the potential hazards to human and animal health caused by toxic residue from pesticides. Organochlorine insecticides (OCI) are widely distributed in the biosphere. They tend to be concentrated in fat and great accumulation in animal tissue and even predominantly in adipose tissues. Organochlorine insecticides are reported to be carcinogenic⁽¹⁾, mutagenic⁽²⁾ and cause reproductive⁽³⁾ problems. Man can be exposed to OCI through various routes as ingestion, respiration and absorption through skin or mucous membrane. Their disposition depends upon the pharmacodynamics of the pesticides⁽⁴⁾. The level of OCI in human adipose tissue and blood reflect the historical exposure to insecticides meanwhile, blood appeared to be a good tissue for measuring the recent exposure.

It is essential from a pollution point of view to determine the national mean concentration of OCI to give an index of the average overall degree of exposure of the population to such compounds. The present study attempts to establish a 1987 base line level of OCI in a rural population from Behera governorate, Egypt.

Material and Methods

A total of thirty samples of adipose tissue and blood were collected from rural population (above 25 years old) from Behera governorate, during surgery in Alexandria University Hospital during 1987.

Determination of organochlorine insecticides in adipose tissue (8).

Chemicals : All chemicals are analytical grade, solvents were twice distilled in all glass apparatus.

Equipment : GC Tracor 222 equipped with electron capture detector and 2m glass column packed with 1.95% Sp 2401 and 1.5% Sp 2250 on 100-120 mesh Supelcoport.

Chromatographic conditions : Column temp. 180°C, injection block temp. 220°C and ECD temp. 300°C.

Extraction

0.5 g adipose tissue was macerated in a mortar tissue grinder with 10 ml and 10 ml acetonitrile (10 ml methanol and 10 ml chloroform) for 10 min. Repeat extraction three more times. 10 ml of 2% aqueous sodium sulfate were added to the mixture and shaken well. The aqueous acetonitrile mixture was extracted with 5 ml and 5 ml of hexane, then concentrate was added to 0.5 ml and clean up on florisil column.

Clean up

10 ml of a silica gel column (Kanto No 351/10) and 1.5g of florisil preheated at 60°C for three hours and deactivated with 1% water then wash it with 50 ml distilled hexane followed by 10 ml distilled acetone. Dry and store the column in an oven at 120°C overnight before use.

Procedure

Prevent the column with 10 ml hexane and discard the eluate. To the top of the column the concentrate was added, and eluted with 12 ml hexane followed by 12 ml 1% methanol in hexane, this fraction contain heptachlor, aldrin, p,p DDE, o,p DDT and p,p DDT. The second fraction was collected by eluting the column with a second 12 ml portion 1% methanol in hexane, this fraction contain, dieldrin, heptachlor-epoxide, endrin, B-HCH, Y HCH and p,p DDD. The final volumes were adjusted to 0.5 and 0.3 ml for fraction (1) and (2), respectively. 5 ul from fraction (1) and (2) were injected in GC under the previous mentioned conditions.

Determination of organochlorine insecticides in blood samples⁽⁸⁾

After drawing blood from the donor in the presence of anticoagulant agent, blood was placed in the refrigerator for about 30 min and centrifuged for 10 min. at 2500 rpm to separate clear blood serum. To 2 ml blood serum 6 ml hexane were added and extracted for about 2 hours using shaking rotator at 50 rpm. Five millilitres from the hexane extract were transferred, concentrated to about 0.5 ml and 5 μ l from the concentrate were injected in GC under previous mentioned conditions.

Results and Discussion

Data shown in Table (1) indicate that the major detected organochlorine insecticides (OCI) were α -HCH, β -HCH, γ -HCH, DDE and DDT. The level of β -HCH exceeds the level of α -HCH and γ -HCH, indicating the fresh exposure to lindane⁽⁴⁾. The level of β -HCH ranged between 0.39 and 2.6 with a mean value of 1.25 ppm and between 0.064 and 2.44 with mean value of 0.81 ppm for male and female specimens, respectively. DDE was the major detected OCI in adipose tissue, where it was detected in 100% of the analyzed specimens. meantime DDT was detected less frequently, where it was assessed only in 66% and 50% of the analyzed male and female subjects, respectively.

The level of DDE in adipose tissue ranged between 0.93 and 10.2 with a mean value of 3.7 and between 0.77 and 8.1 with a mean value of 2.74 ppm for male and female specimens, respectively (Table 1).

DDE could be considered as an indicator of the level of OCI in a population and thus could be monitored and compared between different populations and nations⁽⁹⁾. Table 1 indicates that the level of DDE in the rural population from Benera governorate exceeds the levels of the most European countries except Poland and Yugoslavia⁽¹¹⁾, in contrast the mean value of DDT (0.6 ppm) in rural population from Benera was less than many European countries, indicating the rapid transformation of DDT to DDE under the Egyptian conditions (biotic and abiotic factors).

In general, the mean values of OCI in males exceed that in females, where the level of Σ HCH and Σ DDT in adipose tissue in male exceeds that in female by 1.4 and 1.7 fold respectively.

Concerning the level of OCI in blood serum data shown in Table (3) indicate that β -HCH and DDE were the only detected compounds. The level of β -HCH ranged between 1.0 and 9.3 with a mean value of 4.51 ppb and between n.d. and 4.0 with a mean value of 1.4 ppb for male and female subjects, respectively. DDE level in blood serum ranged between 1.32 and 46.38 with a

mean value of 17.04 and between 1.38 and 6.7 with a mean value of 3.8 ppb for male and female specimens, respectively. The mean value of OCI in blood serum in males exceed the level in females, where the level in males compared with females were 3 and 12.2 times for HCH and DDE, respectively, indicating that males were highly exposed to OCI. Blood reflects the recent exposure to OCI, while adipose tissue represent the historic exposure.

Table (1) : Chlorinated insecticides residue in adipose tissue (ppm) in rural population from Behera-governorate, Egypt.

Compound	Male			Female		
	Range	Mean	St.dev	Range	Mean	St.dev
α HCH	n.d.-0.72	0.21	± 0.51	0.02-0.190	0.92	± 0.07
δ HCH	n.d.-2.3	0.99	± 0.68	n.d. -2.3	0.51	± 0.86
β HCH	n.d.-0.32	0.058	± 0.101	n.d. -0.98	0.182	± 0.28
Σ HCH	0.39-2.64	1.25	± 0.75	0.063-2.44	0.816	± 1.21
DDE	0.93-10.2	4.7	± 1.7	0.77 -8.9	2.74	± 3.6
DDT	n.d.-2.3	0.767	± 0.82	n.d.-1.32	0.44	± 0.48
Σ DDT	1.85-17.5	4.46	± 2.52	0.77-10.2	3.19	± 4.08

n.d not detected

no. of samples 30

St.dev : Standard deviation.

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Table (2) : Residue of organochlorine insecticides in adipose tissue in various countries⁽¹⁾

Country	Period	Mean residues (mg/kg)		
		p.p DDE	p.p DDT	HCB
Belgium	1977	3.8	1.09	0.97
Canada	1976	1.72	0.31	0.095
Denmark	1974	1.7	0.3	3.5
Greenland	1974	2.2	0.8	4.3
France	-	1.6	0.65	-
India	-	4.28	2.1	-
Italy	1977	4.13	1.08	-
Japan	1981	3.8	-	0.07
Poland	1979	15.31	1.9	-
Yugoslavia	1976	6.02	0.02	0.43
Zaire	-	3.5	0.93	-
U.K.	1983	1.3	0.11	0.9
Egypt (Behara (governorate))	1987	4.70	0.60	-

Table (3) : Chlorinated insecticide residues in blood serum of rural population from Behera governorate (ppb)

Compound	Range	Male		Female		
		Mean	St.dev	Range	Mean	St.dev
B-HCH	1.0 - 9.3	4.51	± 2.7	n.d-4.0	1.48	± 2.2
DDE	1.32-46.38	17.04	± 16.81	1.38-6.7	3.8	± 1.7

No of samples 30

n.d. : not detected

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دراسة مبدئية عن مستوى التلوث بمتبقيات المبيدات الكلورينية
في عينات من الانسجة الدهنية والدم

د. محمد متحي مقلد - محطة البحوث الزراعية - ايتاي البارود

د. حمام الحفاوي عثان - المعهد العالي للصحة العامة - جامعة الاسكندرية

تم رصد مستوى التلوث بمتبقيات المبيدات الكلورينية في عينات من الانسجة الدهنية والدم
لمجموعة من سكان محافظة البحيرة . وقد دلت النتائج ان اكثر المركبات تواجدت هي
وكنلك مشابهاة المختلفة : α , γ and β وكذلك ددا ، ددت

وعموما الانسجة الدهنية تحتوي على نسب اكر من متبقيات المبيدات الكلورينية عن عينات الدم
وبالنسبة لتاثير الجنس على نسبة التلوث - دلت الدراسة ان نسبة المبيدات الكلورينية في عينات
الرجال تفوق النسبة في عينات النساء مما يدل على ان الرجال اكثر تعرضا للتلوث من النساء
وبمقارنة النتائج المتحصل عليها بشيئاتها في البلدان المختلفة اشنت الدراسة ان مستوى متبقيات
(ددا) المبيدات في الانسجة الدهنية في عينات محافظة البحيرة تفوق معظم البلدان الاوربية
فيما عدا يوجوسلافيا وبولندا .