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Preliminary Study of Organochlorine Compounds in Milk Products, Human Milk, and Vegetables

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It is well known that the widespread use of organochlorine compounds has caused serious problems to man due to their bioaccumulation in several organisms. The majority of these compounds are toxic in high levels and a few are carcinogenic in small animal tests. They reach man through the foodchain and accumulate in various organs, but mainly in fatty tissues (Acker et al. 1975).

In the United States, from 1200 analysed samples of milk and milk products 77,6 % contained various organochlorine pesticides (Moll 1980). In W.Germany it was also found that quite high lindane concentrations (up to 1,9 mg/l) exist in cow-milk samples (Koch 1981). It is well established that even human milk contains organochlorine pesticides. In some cases, their concentrations were 10 to 20 times higher than those found in cow-milk (Newton and Greene 1972; Moll 1980, Wickström et all. 1983).

The organochlorine compounds are not only present in milk and milk products but also in fruit and vegetables due to the extensive use of the corresponding pesticides in intensified cultivation (Thier 1982). Thus, in some countries of the EEC it was verified that the concentrations of pesticides in fruit and vegetables in many cases exceed the permissible levels (Moll 1980).

In addition it was interesting to conduct a similar survey on the presence of organochlorine compounds in samples of cow-milk, milk products, human milk, fruit and vegetables from different areas of Northern Greece.

The results will show the extent of their accumulation and the measures which must probably be taken. The use of DDT and other organochlorine compounds in Greece was completely restricted in 1972.

MATERIALS AND METHODS

Thirty samples of human milk and equal number of cow-milk were collected from different areas of Northern Greece, during a period of one year. The samples were treated according to the AOAC method. After this treatment the fat was extracted using a mixture of diethyl ether/light petroleum, 1: 1 (V/V). The extracted fat was dissolved in light petroleum and the organochlorine pesticides were partitioned into acetonitrile. The organic phase was then purified chromatographically on a Florisil column and reduced to a smaller volume (2ml). The identification of organochlorine pesticides was carried out by a combination of GC/MS technique. A Hewlett-packard GC/MS type 5709A system was used for the identification and determination of organic compounds. This unit was equipped with a linear electron capture detector and a data system. A glass column packed with 1% of SE 30 in chromosorb G (AW - PMCS) was used and a mixture of Argon/Methane 90:10 with a flow rate of 40-60 ml/min was served as a carrier gas (Weil and Quentin 1974a; Weil and Quentin 1974b).

For fruit and vegetables the following procedure was used: Samples of 100-300 g were homogenised and treated with methanol. The filtrate was extracted with n-Hexan for 2 hours and then discoloured with a solution of conc. KOH. The organic phase containing the pesticides was directly extracted with a microseparator and reduced to 2 ml by using a rotary evaporator. The determination was carried out by the combination of GC/MS.

RESULTS AND DISCUSSION

Results in mg/kg fat, from 30 analysed human milk samples are given in table 1, and they are compared with those found in other countries. As it is shown in this table, all the human milk samples contained DDT, Lindane, Hexachlorbenzene (HCB) and Heptachlorepoxide (HE). For the case of HCB a significant difference was noticed in concentrations between the min 0,1 and max 1,6 mg/kg. No significant variatons were noticed between the different rural and urban areas, concerning their concentrations in pesticides. These values, compared with those found in W.Germany and Sweden are lower for all the organic compounds, as shown in table 1.

The results from the analysed cow-milk and milk products are given in table 2. The main contamination of the Greek milk is mainly due to the HCH. These values compared with the permissible values recommended by W.Germany and FAO are lower and at the same level as the imported milk from other countries of EEC. The number of organochlorine pesticides of the Greek and imported milk products is limited and their concentrations were found to be in low levels.

Table 1. Organochlorine compounds in human milk (mg/kg fat) (mean values)

Compounds	Greece (1983)	Germany (1975)	Sweden (1976)
β-HCH	-	0,56	0,15
γ-HCH (Lindane)	0,015	0,09	-
HCB (Hexachlor-benzene	0,65	2,6	0,11
DDT	0,035	0,64	0,4
HE (Heptachlor-epoxide)	0,003	0,1	-

Table 2. Organochlorine compounds in milk and milk products (mg/kg fat) (mean values)

Com-pounds	Greek Milk1	Greek Milk2	German Milk	Greek Cheese	Greek Butter	German Cheese	Holand Butter	Milk values W.Germany	Permissible FAO
α-HCH	0,007	0,015	0,0012					0,1	-
β-HCH	0,009	0,003	0,0011		0,010			-	
γ-HCH	0,022	-	-				0,02	0,1	0,01
DDT	0,03	-	-					-	-
DDT+DDE								1,0	1,2
HCB	-	-	-	0,005		0,008		0,5	0,3
Dieldrin	-	-				0,015	0,02	0,15	0,15
PCB	-	-			0,012		0,025		
Endrin	-	-					0,008		
HE	-	-						0,1	0,15

Table 3. Organochlorine compounds in fruit and vegetables (mg/kg) (mean values)

Compounds	cabba-ges	endi-ve	cauli-flower	car-rot	pep-per	cucum-ber	egg-plant	spi-nach	toma-to	pea-ch	gra-pes	apple	pear
DDT	0,7		-			0,04	0,3		4,0	-	0,75	0,17	0,06
HE	0,3												
HCB	-	0,015				0,02							
A-60	1,3	2,3	6,5	4,6	5,8	8,5	5,2	4,5	2,3	0,2	4,3	0,2	0,22
Dichlor-biphenyls	0,3	1,1						0,5	2,0	0,5	0,05	-	-
Trichlor-biphenyls	0,1	0,1	0,5	0,2	0,35	0,04	0,15	5,0	2,5	0,7	0,3	0,5	0,1
Lindane	-	-	0,08	-									

The concetrations of organochlorine compounds which were found in fruit and vegetables are also in low levels and much lower than the highest permissible values as recommended by FAO and WHO. The same samples which were analysed after a usual washing with water, contained significally lower concentrations of organochlorine compounds in almost all cases. The low concentrations of these compounds in fruit and vegetables are propably due to the fact that their use in Greece is not permissible. Actively, all the used pesticides have been substituted with biodegradable ones like the organophosphoric compounds and the carbamates derivatives since 1973.

From the data on human milk, milk products, fruit and vegetables from different areas of N.Greece, the concentrations of organochlorine compounds were lower than values determined by different international organisations and about equal to levels in samples of those products imported from other countries.

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