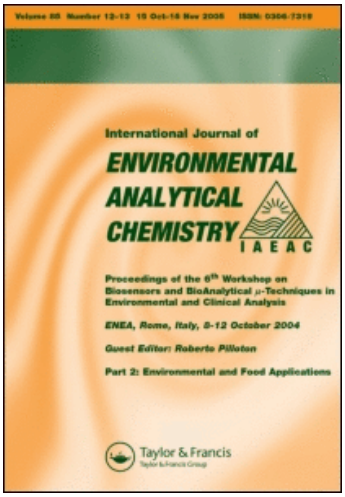

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A Pilot Study on Levels of Organochlorine compounds in Human Milk in Nigeria

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A Pilot Study on Levels of Organochlorine Compounds in Human Milk in Nigeria

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Concentrations of some persistent organochlorine compounds (OCC) in human milk samples from Nigeria are determined. Apart from the commonly detected insecticide residues in Nigerian environment (DDT-complex, HCH-isomers and HCB), polychlorinated biphenyls (PCBs) were also found in four out of the thirty-five samples analysed; the values varied from 0.32–0.62 mg/kg milk fat. In general, concentrations of the insecticides were low. *p,p'*-DDD was not detected in appreciable and quantifiable levels.

KEY WORDS: Organochlorine compounds, human milk, Nigerian general population.

INTRODUCTION

In industrialized countries, extensive studies have been carried out to establish the extent and magnitude of pollution of the environment by contaminants such as those originating from the use of persistent organochlorine compounds (OCCs). Examples of such OCCs are the chlorinated insecticides, DDT and hexachlorocyclohexane (HCH), as well as the industrially used polychlorinated biphenyls (PCBs). The

levels present of these compounds in human milk, are well documented in Western European countries, Japan and the USA: In contrast to this, very little has been reported on the prevalence of the OCCs in developing countries, where the use of pesticides such as DDT and HCH, still continues.

Recently, the United Nations Environment Programme (UNEP) and the World Health Organization (WHO) commissioned a pilot project involving several countries, on assessment of human exposure to pollutants through biological monitoring. There was, for various reasons, no active participation from any country in Africa and South America. The major pollutants recommended for evaluation included DDT-complex, HCH-isomers and PCBs.

Because of the importance attached to human milk and its role as the major vehicle for excretion of these substances in lactating women, breast milk was chosen as the body fluid to be studied for exposure monitoring of the suckling child and the degree of contamination of the general population. Studies on chlorinated pesticides in human milk have shown that there is a correlation between milk fat and body fat concentration of the organochlorine compounds.[1,2]

This study on breast milk is one of the series in a preliminary survey of the prevalence of organochlorine pesticide contamination of the Nigerian general population.

MATERIALS AND METHODS

Thirty-five samples of human milk were obtained from the maternity unit at the University Teaching Hospital in Benin City between 1981 and 1982. The mothers were generally 20–33 years old, residing in various parts of Bendel State of Nigeria. Samples were kept frozen until analysis.

The extraction, clean-up and quantitations of the residues were carried out according to the modified procedures of McLeod and Ritcey,[3] Jensen *et al.*,[4] Janson *et al.*[5] and Jensen[6] as employed by the Swedish National Food Administration in the UNEP/WHO programme.[7] All extractions were carried out with acetone/hexane mixture (1 + 1). The percentage fat in the samples ranged from 0.89–5.1 with a mean value of 3.8.

Analysis of the extracts was done by gas liquid chromatography on a model 3700 Varian Aerograph Gas Chromatograph equipped with a ^{63}Ni electron capture detector. The column used for quantitation was a 25 m × 0.25 mm glass capillary column coated with QF1 and SF 96 (2+1). The operating conditions were: injector temperature 220°C; detector 320°C; column 185° isothermal for 2 minutes then programmed at 4° ml/minute to 230°C; carrier gas flow (nitrogen) 4 ml/minute. Injection mode was splitless. PCBs were determined using individual peak concentrations with Clophen A50 as standard.

RESULTS AND DISCUSSION

The analytical data, as shown in Table I, indicate the mean levels of the organochlorine compounds expressed in mg/kg of the extractable lipid. The major compounds present in all the samples were *p,p'*-DDT and its metabolite *p,p'*-DDE and beta-HCH. HCB, alpha- and gamma-HCH were found in limited number of samples. Traces of *o,p'*-DDT were also indicated in some samples.

TABLE I

Levels of selected organochlorine compounds in human milk samples collected in Benin, Nigeria. The concentrations are expressed in mg/kg milk fat.

Compounds	Range	Mean level
HCB	0.02–0.44	0.10
alpha-HCH	0.01–0.09	0.04
beta-HCH	0.09–0.99	0.47
gamma-HCH	0.01–0.11	0.05
p,p'-DDE	0.28–1.9	1.1
p,p'-DDT	0.12–1.0	0.41
PCBs[a]	0.32–0.62	0.48

[a]Found only in four samples.

While the mean levels reported in UNEP/WHO programme[7] for DDT were 1.8, 1.1 and 0.71 mg/kg for China, India and Mexico respectively, the range for Nigeria in this study was 0.12–1.0 mg/kg with a mean value of 0.41 mg/kg. The corresponding levels found in Federal Republic of Germany, U.S.A., Sweden and Belgium were 0.25, <0.10, 0.09 and 0.13 mg/kg respectively. Table II shows a summary of the levels found by the participating countries in UNEP/WHO programme[7] and the mean values found in this survey. The relatively high levels of the various residues found in China, India and Mexico may certainly be due to the continuing use of these insecticides in agriculture and public health programmes. On the other hand, the relatively low residue levels in Nigeria may be due to low level usage compared to the large scale application in China and India.

In the case of beta-HCH, the high value is certainly due to its high bioaccumulation compared to the pesticidally active gamma-isomer. It is also possible that the technical hexachlorocyclohexane is used in Nigeria as unseparated mixture.

Of particular interest is the presence of PCBs in four of the samples. This is unexpected as Bendel State of Nigeria is really not an industrialized area. Unfortunately it was not possible to trace the background of the sample donor. Nevertheless, the relatively high levels of PCB in these samples is indicative of the extent of pollution of these hitherto "pristine" environments. This goes to confirm the numerous reports that organochlorine compounds have become universal pollutants since they are detected in virtually all animal tissues, even those sampled in remote parts of the world far from areas of large scale application. Concern over the potential adverse effects of these chemicals in man has led to extensive routine environmental monitoring programme in the developed countries. In the light of the residue levels found in this preliminary survey, there is need for proper screening of the tropical environment of the developing countries for these residues if irreparable damage to wild-life, man and his environment is to be avoided in these areas.

TABLE II

Summary of the median levels and range of selected organochlorine compounds in human milk found by the participating countries in UNEP/WHO programme compared to the mean levels and range obtained in this study. (Values in mg/kg milk fat.)

Country	Year	HCB	β-HCH	γ-HCH	p,p'-DDE	p,p'-DDT	PCBs
Belgium	1982	0.3 (0.01–4.0)	0.20 (0.03–0.68)	<0.01 (<0.01–0.10)	0.94 (0.15–5.2)	0.13 (0.04–0.60)	0.81 (0.1–2.3)
China	1982	—	6.6 (0.89–19)	0.03 (0.005–1.4)	4.4 (0.66–26)	1.8 (0.52–9.7)	—
F.R. Germany	1981	1.1 (0.074–2.1)	0.28 (0.02–3.6)	0.062 (0.005–0.41)	1.2 (0.12–5.1)	0.25 (0.02–1.9)	2.1 (0.24–10)
India	1982	—	4.6 (1.4–12)	0.037 (0.007–0.64)	4.8 (0.39–17)	1.1 (0.26–7.6)	—
Israel	1981/82	0.060 (0.02–0.70)	0.29 (0.08–1.4)	<0.02 (<0.02–0.37)	2.2 (0.50–8.1)	0.23 (<0.20–1.8)	0.45 (<0.05–2.1)
Japan	1980/81	0.063 (0.025–0.15)	1.9 (0.49–7.8)	0.011 (0.001–0.039)	1.5 (0.39–5.4)	0.21 (0.07–1.2)	0.35 (0.10–0.98)
Mexico	1981	—	0.40 (0.07–3.6)	—	3.7 (1.2–30)	0.71 (0.29–9.4)	—
Sweden	1981	0.084 (0.044–0.23)	0.085 (0.03–0.20)	0.003 (0.001–0.058)	0.81 (0.36–2.2)	0.09 (0.04–0.33)	0.97 (0.40–1.8)
USA	1979	—	<0.05 (<0.05–0.30)	—	1.6 (0.40–17)	<0.10 (<0.10–3.1)	<1 (<1–3)
Yugoslavia	1981/82	0.21 (0.08–0.49)	0.28 (0.10–1.1)	—	1.9 (0.20–4.8)	0.18 (<0.10–0.43)	0.63 (0.32–1.6)
Nigeria	1981/82	0.10 (0.02–0.44)	0.47 (0.09–0.99)	0.05 (0.01–0.11)	1.1 (0.28–1.9)	0.41 (0.12–1.0)	0.48 (0.32–0.62)

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