Partitioning of ß-HCH between blood and adipose tissue in former chemical workers

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1 Introduction

The ß-isomer of hexachlorocyclohexane (HCH) is a lipophilic substance. It accumulates in humans with a half life of about 7 years[1)].

For n=8 former chemical workers having been exposed to HCH corresponding adipose tissue and whole blood determinations of ß-HCH were available. On the relation of determinations of PCDD/Fs in both matrices we reported earlier[2)].

2 Materials and methods

2.1 Study group

The persons belong to a cohort of workers from a plant producing herbicides until 1984[3)]. During a health investigation program by the Institute of Occupational and Social Medicine (University of Mainz) in 1985/86 blood samples were withdrawn from 188 participants and kept frozen at -20°C. For 45 volunteers adipose tissue samples were collected in 1986/87 and the PCDD/F- and ß-HCH concentration were determined by Beck et al.[4)]. A subgroup (n=13) also was part of a half life analysis' study group. In the course of this study[5)] blood samples from 1985/86 had been analyzed in 1994 for 2,3,7,8-substituted dioxins and furans and ß-HCH. Thus determinations in adipose tissue and whole blood on a lipid basis were available for 13 persons. As for 5 persons the time between sampling of blood and adipose tissue exceeded 6 months, they were excluded from statistical analysis.

The eight persons included were men in the age of 37 to 57 (mean 47). Mean time between end of occupational exposure to HCH and sampling was 2.3 years.

2.2 Analytical methods

1 g of whole blood was transferred into a 10 mlg ampoule and mixed with 1.0 ml ethanol and the internal standard ^{13}C-UL-ß-hexachlorocyclohexane. The sample/ethanol mixture was liquid/liquid extracted 4 times with a mixture of hexane/diethylether (10:1,v/v). The combined organic layers were filtered through sodium sulfate and volume reduced under vacuum

control to 1ml. After transferring the sample onto silica column the analyte was eluted with a mixture of hexane/toluene (7:3, v/v). Volume reduction under vacuum control followed by a gentle stream of nitrogene lead to a final volume of 200 µl.

The samples have been injected on a HRGC/HRMS instrument. The ß-HCH was quantified by isotype dilution method using ^{13}C-UL y-HCH as injection standard. The values for ß-HCH are reported on wet weight basis[6].

Fat extraction of adipose tissue was carried out by grinding the material with sodium sulfate and sea sand followed by column extraction with hexane-acetone (2/1[7]). Aliquots of the extracts were used for gravimetric fat determinations[7]. The clean up was performed following the procedure of SPECHT et al.[8] with gel permeation chromatographie (GPC) and Bio-Beads S-X3 and a silica filled column. After evaporation the extract was diluted in toluene and analyzed by HRGC-ECD on DB-5 Band DB-1 column.

2.3 Statistical analysis

A regression model

$$\text{ADIPOSE TISSUE} = a + b * \text{BLOOD}$$

was fitted with constant *a* and slope *b* after a check of the assumption of the blood levels following a normal distribution. The model fit was also examined for potential outliers by a scatter plot.

3 Results

Table 1 shows the parameters of the empirical distribution of levels in blood and adipose tissue. The mean level in blood was 180.1 µg/l while that in adipose tissue was 29.0 mg/kg. Mean time distance was 0.31 yrs. Measurements in blood and fat were highly correlated. The correlation coefficient was 0.93 ($p<0.001$).

Table 1: Concentration of ß-HCH in whole blood (µg/l) and adipose tissue (mg/kg)

	Mean	Median	StDev	Min	Max
Adipose Tissue	29.0	24.8	23.0	0.5	65.1
Whole Blood	180.1	185.5	122.4	3.8	341.0
Time between Samples (yr)	0.31	0.29	0.09	0.24	0.5

In the regression model (Fig. 1) the estimate for the constant *a* did not differ significantly from zero, so a model was fitted without constant *a* and the estimate for *b* could be interpreted as relation of measurements of adipose tissue to blood .

The estimate for b was 0.165 (95%CI 0.131,0.20). Taking into account the different scale of measurement for fat and whole blood this figure can be interpreted that on the average the adipose tissue concentration of ß-HCH (in mg/kg) is 165 times the concentration in whole blood (in µg/l).

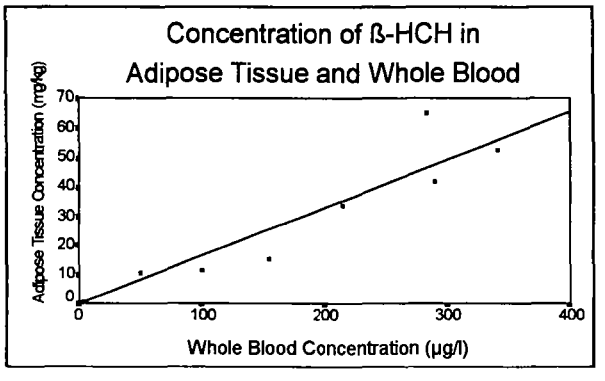
4 Discussion

The partitioning of ß-HCH between blood and adipose tissue was analyzed on the basis of 8 men's determinations in whole blood and adipose tissue.

In spite of the fact that the blood samples had been analysed about 7 years later by a different laboratory, there was an excellent agreement between both results.

The result confirms the finding of BAUMANN et al. (1980)[7], who detected a regression coefficient of b = 0.195 in a similar study.

Fig. 1



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