PCBs, HCB, HCHs and DDE in Human Serum, Follicular Fluid, and Seminal Plasma

Hans-Rudolf Timneberg and Andrea Hagenmaier

Universitäts-Frauenklinik, D-7400 Tübingen

Introduction

Several reports in recent years suggest that the ubiquitous low level contamination with persistent toxic substances plays a role in human infertility. A major obstacle in carrying out an epidemiological study in this area appears to be the difficulty in obtaining samples of follicular fluid and seminal plasma, especially from control groups. The aim of this study was therefore to obtain information on the correlation between serum and follicular fluid levels and seminal plasma levels respectively for some chlorinated compounds, both with respect to fluid volume and fat content.

Materials and Methods

Samples: 30 matched samples of human serum and follicular fluid and 6 matched samples of human serum and seminal plasma were analyzed for polychlorinated biphenyls (PCBs), hexachlorobenzene (HCB) hexachlorcyclohexanes (HCHs) and dichlorodiphenyldichlorethene (DDE). All samples were collected from patients of an in vitro fertilization program. Follicular aspiration was performed via sonographically guided transvaginal puncture, semen was collected by masturbation into a sterile plastic container. Follicular fluid diluted with medium or contaminated with blood was excluded from this investigation.

Analytical procedure: Samples were acified and extracted with hexane. Without further clean-up the extracts were analyzed on two column GC with ECD-detection. Peak identification was carried by retention index calculation. PCB-concentration is given as the sum of the PCB-congeners 28, 52, 101, 138, 153 and 180.

Results

In Fig. 1 and 2 the range of concentrations as well as the mean (indicated by a horizontal line) for b-HCH, g-HCH, HCB, DDE and PCB for serum and follicular fluid (Fig. 1) and serum and seminal plasma (Fig 2) both per fluid volume and on fat basis (cholesterol + triglycerides) are shown.

Serum and follicular fluid concentration on a fluid volume basis (Fig 1 A) show for the 30 samples analysed on the average a tendency to be lower in follicular fluid. This is in contrast to previously reported results (Baukloh et. al. 1984). On the basis of fat content, however, the concentrations are on the average 3 to 4 times higher in follicular fluid (Fig. 1 B)

Between serum and seminal plasma on the average (6 samples) no difference can be detected in the concentration levels both on the basis of fluid volume and fat content.

On a fat basis the average concentrations are similar to those reported for mothers milk (Chemische Landesuntersuchungsanstalten Baden-Württemberg, Annual Reports):

1987 (n=1019) in mg/kg fat: b-HCH 0.08, g-HCH 0.02, HCB 0.29, DDE 0.71, PCBs 1.33;

1988 (n=1400) in mg/kg fat: b-HCH 0.07, g-HCH 0.01, HCB 0.21, DDE 0.59, PCBs 1.16.

In Fig 3 and 4 the results for individual samples are shown for DDE and PCBs. The correlation between serum concentration and follicular fluid concentration and serum concentration and seminal plasma concentration respectively for individual samples is only reasonably good, indpendent of the basis of calculation (fluid volume or fat).

The high DDE levels in follicular fluid of some samples (on fat basis) are correlated with persons who previously were residents of eastern countries (Yugoslavia, Greece, Romania, Turky).

Conclusions

On the basis of concentration per fluid volume no significant difference was detected between the concentrations in serum and follicular fluid and seminal plasma respectivly. There was however a tendency for higher levels in serum compared to follicular fluid levels. The concentrations measured were in the same range as previously reported in the literature.

When the concentration was calculated on fat basis (cholesterol + triglycerides) the concentration for all four compounds was on the average three to four fold higher in the follicular fluid, due to the lower fat content. The concentrations on fat basis were similar to those reported for mothers milk.

On the basis of fat concentration no difference was detected between serum level and seminal plasma level. The PCB concentration in seminal plasma was lower than that previously reported in the literature.

There are dinstinct differences in concentrations of individual samples when the concentrations for b-HCH, g-HCH, HCB, DDE and PCBs are determined on fluid volume basis or fat basis. It is suggested to use for better comparison with other analytical values, e.g. from mothers milk, the fat content as the basis for reporting values in this area.

It might be speculated that the contaminants could be actively transferred into the follicular fluid.

Despite the fact that our results can be regarded only as preliminary we suggest the use of serum values for an epidemiological study of the role of environmental contaminants on human fertility.

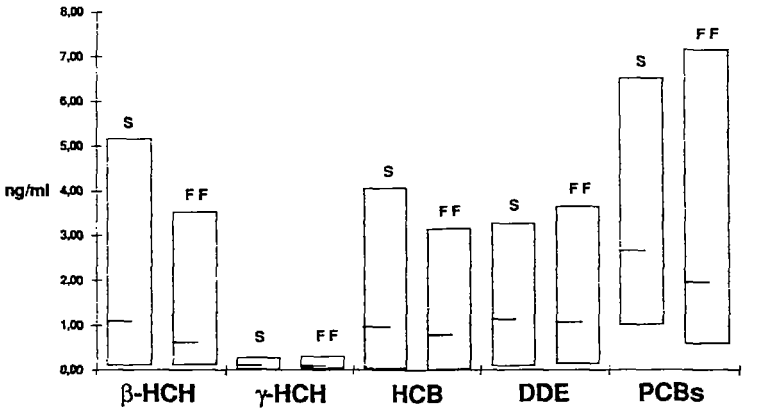
Reference:

Bauldoh V., Bohnet H.G., Trapp M., Heeschen W., Feichtinger W., Kemeter P., New York Academy of Sciences vol. 442, 240-250

Figure 1

Range of concentrations for human serum (S) and follicular fluid (FF)

A) calculated on a fluid volume basis



B) calculated on the basis of fat content

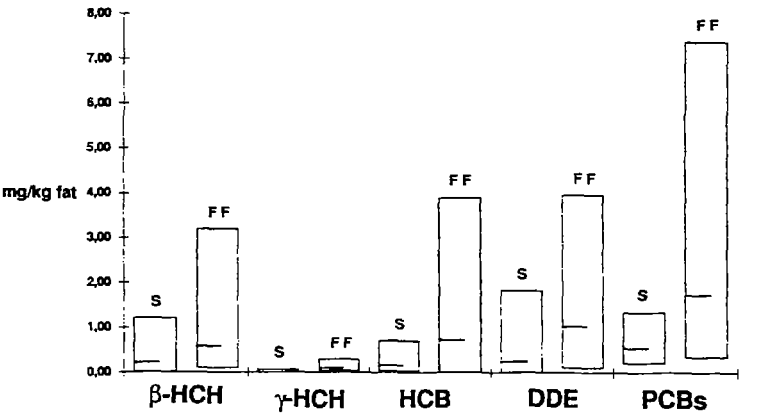
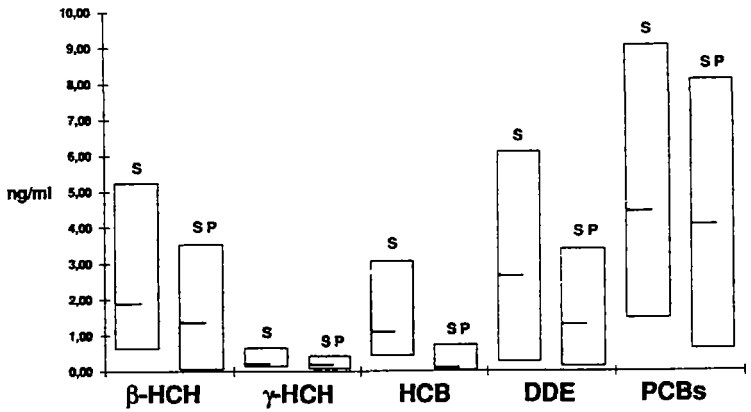


Figure 2

Range of concentrations for human serum (S) and seminal plasma (SP)

A) calculated on a fluid volume basis



B) calculated on the basis of fat content

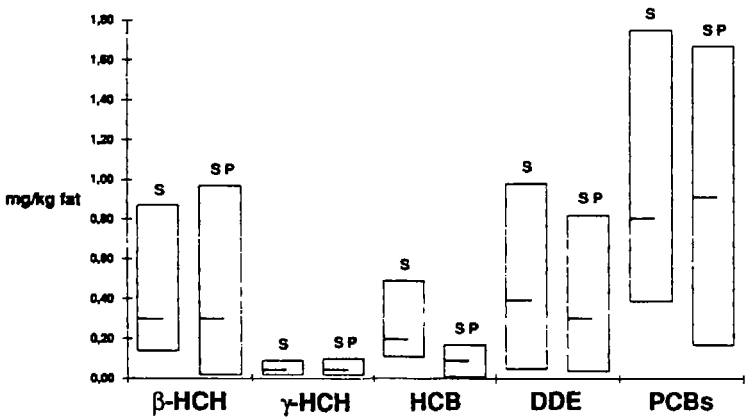


Figure 4

Concentrations of DDE and PCBs in individual samples of human serum and seminal plasma

A) calculated on a fluid volume basis

B) calculated on the basis of fat content

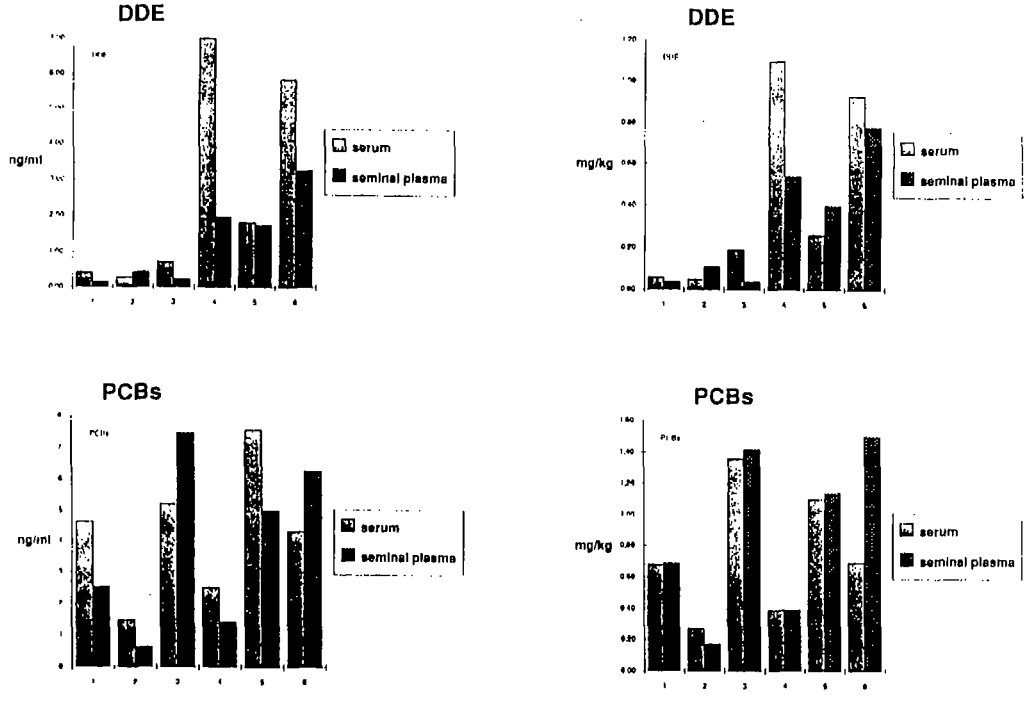


Figure 3

Concentrations of DDE and PCBs in individual samples of human serum and follicular fluid

A) calculated on a fluid volume basis

B) calculated on the basis of fat content