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# An Assessment of the Reproductive Toxic Potential of Aroclor 1254 in Female Sprague-Dawley Rats

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Polychlorinated biphenyls (PCBs) and their derivatives are regarded as major global pollutants (RISEBROUGH et al. 1968). In the United States, KUNTZ & STRASSMAN (1976) have found that residual amounts of PCBs accumulate in the tissues of many human subjects. From a toxicological viewpoint, PCB compounds have caused atrophy in reproductive organs, such as the uterus of rabbits, following oral administration of 300 mg of Aroclor 1254 (KOLLER & ZINKL 1973). However, this PCB compound did not produce any trophic response in the uterus of the weanling rats at doses up to 1000 µg/kg, nor did the PCB induce persistant vaginal estrus syndrome when given to these neonates (GELLERT 1978). Furthermore, VILLENEUVE et al. (1971) found no effects on the number of litters, litter size and litter weights of fetuses from rats fed dosages of 100 mg/kg/day Aroclor 1254. Oral administration of 12.5-50.0 mg/kg/day of Aroclor 1254 to rabbits for 28 days of gestation was embryotoxic (VILLENEUVE et al. 1971).

## MATERIALS AND METHODS

Female albino rats (Holtzman strain) ranging from 200-300 g were maintained under standard conditions and subjected to decidualized pseudopregnancy and pregnancy inductions in accordance with previously described procedures (TAT SING & SPENCER 1981). Biochemical and physiological assays and pesticide feeding schedules were conducted in conformity with those in the fore-cited study. Similar statistical measures were employed.

## RESULTS

Uterine protein (Fig. 1), uterine glycogen (Fig. 2), and ovarian protein (Fig. 3) of PCB-treated decidualized pseudopregnant rats were reduced. Placental protein (Fig. 4) and placental glycogen (Fig. 5) concentrations were decreased in pregnant rats after 10 days of PCB treatments. No embryonic resorption was observed in Day 12 dams fed PCB up to 900 ppm (Table 1A). Fetotoxicity of the PCB was demonstrated by a decrease in fetal survival rate per litter, and also by a loss in fetal weight

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loss recorded at birth (Table 1A). Reductions in chow consumption were observed at 300, 600, and 900 ppm test groups (Table 1A). Maternal toxicity as manifested by the loss in body weight appeared in test groups of 600 and 900 ppm (Table 1B).

## DISCUSSION

The data described here demonstrate that dietary administration of the PCB compound (Aroclor 1254) during decidualized pseudogestation produced acute alterations in uterine and ovarian biochemistry. Uterine reductions in protein and glycogen and decreases in ovarian protein occurred in dose-related manners. Moreover, uterine weights were significantly lowered at 750 ppm and above. Hence, there exists a definite and robust uterotoxic influence for Aroclor 1254 in decidualized pseudopregnant rats. Taken altogether, this induced incompetence in uterine biochemistry (endocrine target organ) is paralleled by a significant decrease in a prominent parameter in the biochemistry of the ovary (the juxtaposed endocrine support organ). These results suggest that the lytic action of Aroclor 1254 on the uterus, especially with regards to glycogen, involves a loss of anabolic stimulation from the ovary. Since uterine glycogen is an extremely sensitive criterion for estrogen action (BITMAN et al. 1965), this response here indicates an anti-steroidal role for Aroclor 1254. In harmony with this mechanism, are studies citing the occurrence of metabolic changes in sex steroids in normal cyclic rats following PCB treatment (OBERG & INGVAST 1977; DERR 1978).

In pregnant rats, Aroclor 1254 also affected placental glycogen. Albeit, protein concentrations declined steadily in groups fed low levels of Aroclor 1254, and became progressively reduced with increasing dosages.

VILLENEUVE et al. (1971) reported that no fetal resorption was produced in pregnant rats given daily doses of Aroclor 1254 by oral gavage. In our study, wherein the toxicant was administered via the diet, the fetal survival potential was drastically affected at 300 ppm and greater (Table 1A). Moreover, at dietary exposures of 300, 600 and 900 ppm, the food intakes were diminished. By corroboration, it has been documented that pregnant rats are more susceptible to the toxicological effects of Aroclor 1254 during dietary deprivation (BYRE 1974). Therefore, reductions in the fetal survival rates and neonatal weights may be manifested through a joint function on the part of Aroclor 1254 toxicity and by means of a decrease in nutritional intake by maternal rats (Table 1A).

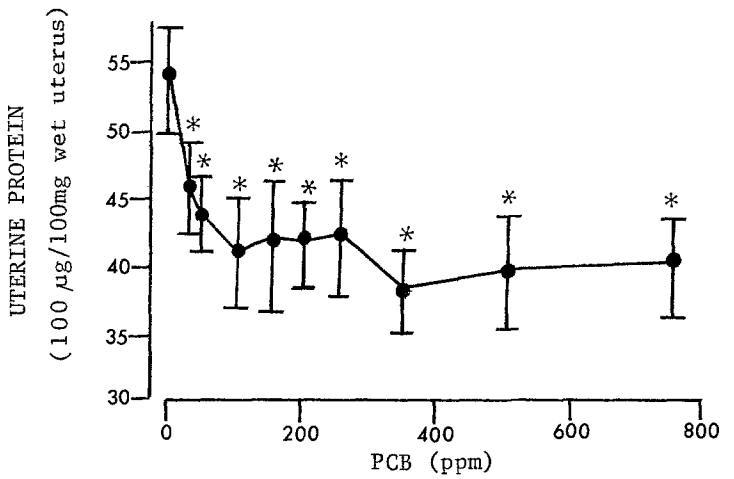


Fig. 1. Uterine protein content of Day 10 decidualized pseudopregnant rats fed different concentrations (ppm) of Aroclor-1254 containing diet. Each point represents the mean of 10 rats and the bar indicates the SE. An asterisk shows values that are significantly different from the control, using Student's t-test ($p < 0.05$).

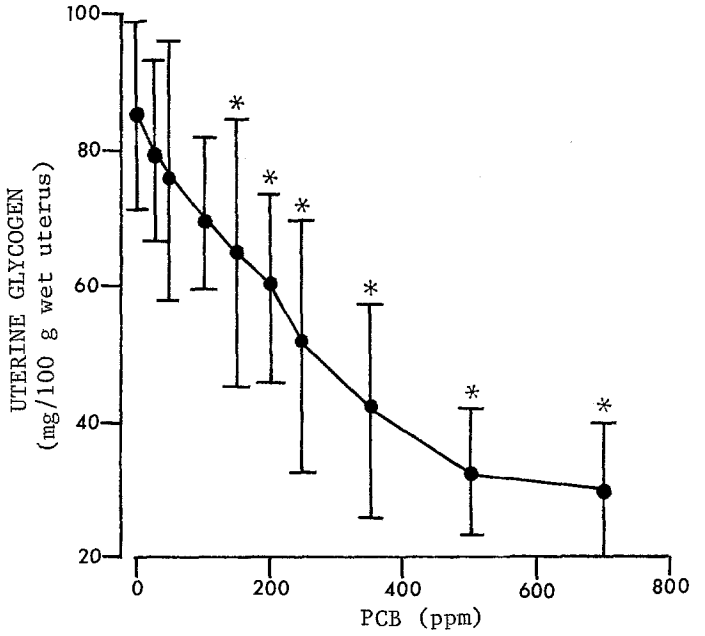


Fig. 2. Uterine glycogen content of Day 10 decidualized pseudopregnant rats fed different concentrations (ppm) of Aroclor-1254 containing diet. Each point represents the mean of 10 rats and the bar indicates the SE. An asterisk shows values that are significantly different from the control, using Student's t-test ($p < 0.05$).

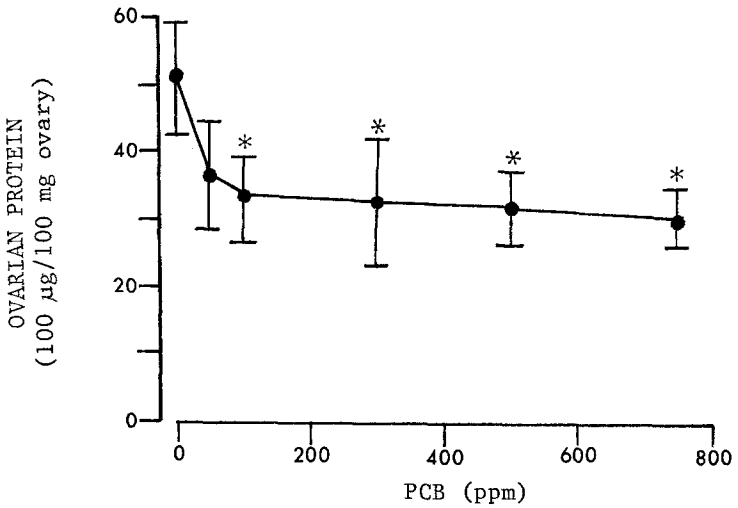


Fig. 3. Ovarian protein content of Day 10 decidualized pseudopregnant rats fed different concentrations (ppm) of Aroclor-1254 containing diet. Each point represents the mean of 5 rats and the bar indicates the SE. An asterisk shows values that are significantly different from the control, using Student's t-test ($p < 0.05$).

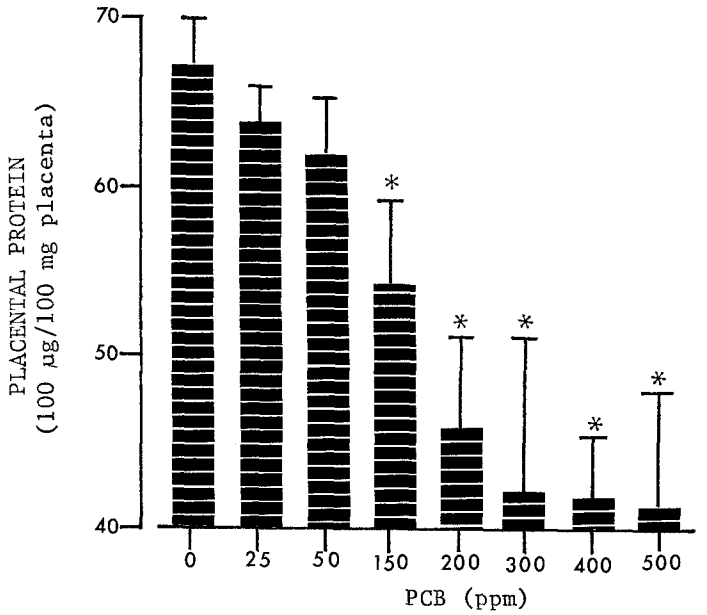


Fig. 4. Placental protein content of Day 16 pregnant rats fed different concentrations (ppm) of Aroclor-1254 containing diet. Each bar represents the mean of 7 rats. The standard errors of the means are plotted above the bars. An asterisk shows values that are significantly different from the control, using Student's t-test ($p < 0.05$).

TABLE 1A
EFFECT OF PCB (AROCLOR 1254) ON PREGNANCY

| Dietary[a] treatment with PCB (ppm) | Daily intake of PCB+chow (g/day/rat) $\bar{X}\pm SE$ | Number of litter | Implantations at Day 6 per dam $\bar{X}\pm SE$ | Number of conceptuses at Day 12 $\bar{X}\pm SE$ | Percentage of fetal survival rate per litter at birth $\bar{X}\pm SE$ | Average fetal weight per litter at birth (g) $\bar{X}\pm SE$ |
|---|---|---|---|---|---|---|
| 0 | 20.8±0.6 | 7 | 12.29±1.17 | 12.29±1.17 | 79.54± 3.84 | 7.02±0.12 |
| 25 | 18.6±0.4 | 7 | 12.40±0.55 | 12.40±0.55 | 66.21± 9.42 | 6.84±0.08 |
| 50 | 18.0±0.6 | 7 | 12.60±0.68 | 12.60±0.68 | 65.87±10.33 | 6.67±0.06 |
| 100 | 19.3±0.1 | 7 | 12.80±0.37 | 12.80±0.37 | 65.38±12.20 | 6.19±0.15[b] |
| 200 | 17.7±0.9 | 7 | 10.60±0.51 | 10.60±0.51 | 63.05± 8.44 | 5.61±0.10[b] |
| 300 | 15.8±0.6[b] | 7 | 12.40±0.40 | 12.40±0.40 | 28.03±12.29[b] | 5.58±0.19[b] |
| 600 | 9.6±0.7[b] | 7 | 12.43±1.37 | 12.43±1.37 | 17.14±11.28[b] | --- |
| 900 | 7.0±0.6[b] | 7 | 12.14±0.75 | 12.14±0.75 | 00.00± 0.00 | --- |
| ANOVA | $< 0.05$ | | | | $< 0.05$ | $< 0.05$ |

[a]Rats were given Aroclor 1254 at respective concentrations in a diet from Days 6 through 15 of pregnancy.

[b]Significantly different from the control, using Student's t-test ($p < 0.05$).

TABLE 1B

BODY WEIGHT OF PREGNANT RATS GIVEN PCB (AROCLOR 1254)

| Dietary[a] treatment with PCB (ppm) | Maternal body weight (g) $\bar{X} \pm SE$ | | Δ Body weight (g) |
|---|---|---|---|
| | Day 6 of gestation | Day 16 of gestation | Day 16- Day 6 |
| 0 | 273± 8 | 302± 4 | + 29 |
| 25 | 232± 8 | 265±12 | + 33 |
| 50 | 226±10 | 255± 8 | + 29 |
| 100 | 243± 7 | 274±10 | + 31 |
| 200 | 220± 6 | 245± 7 | + 25 |
| 300 | 268±12 | 288±10 | + 20 |
| 600 | 233±10 | 215± 5 | - 18 |
| 900 | 223± 6 | 174± 5 | - 49 |
| ANOVA | | $< 0.05$ | |

[a]Rats were given Aroclor 1254 at respective concentrations in a diet from Days 6-15 of pregnancy.

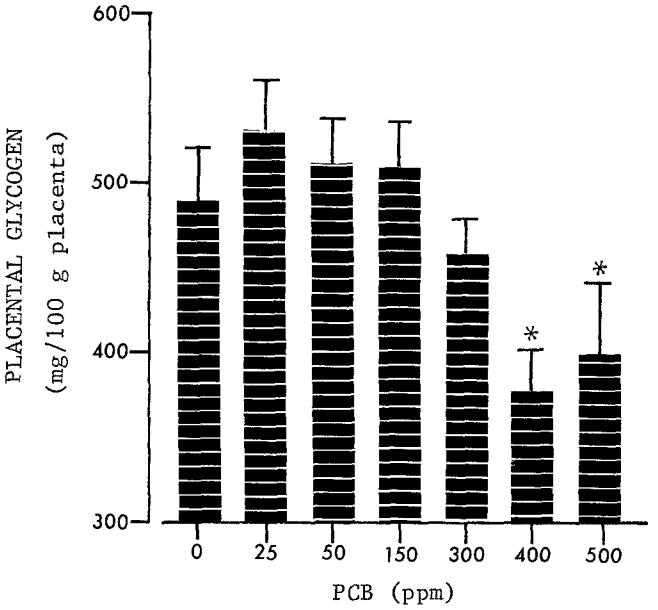


Fig. 5. Placental glycogen of Day 16 pregnant rats fed different concentrations (ppm) of Aroclor-1254 containing diet. Each bar represents the mean of 7 rats. The standard errors of the means are plotted above the bars. The asterisk shows values that are significantly different from the control, using Student's t-test ($p < 0.05$).

The study indicates that Aroclor 1254 caused imbalances in hormonally-mediated biochemical effects in pseudopregnant and pregnant rats. Furthermore, the compound has both indirect or systemic and direct action (reduced fetal survival rates and neonatal weights) on fetal growth and development.

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