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This study aimed to determine the effects of prenatal DDT exposure on the development of cognitive abilities in children. It specifically aimed to use this information as a factor to consider in the determination of the risks of DDT use as a measure against malaria

The subjects were selected based on year and location of birth, specifically 1997-1999 and Ribera d'Ebre and Menorca, Spain. Ribera d'Ebre is in the vicinity of a factory that used to produce DDT, and Menorca displayed high levels of DDE, a breakdown product of DDT, in newborns. The subjects were selected as infants, and DDT exposure testing as well as demographic interviews were conducted during this time. Later, when the subjects were approximately 4 years old, neuropsychological testing was conducted. There were 475 children included in the study, with 70 coming from the Ribera d'Ebre area, and 405 coming from Menorca. Gender and socio-economic class were fairly evenly distributed in both groups. These subjects do represent a sensitive group, as they are very young and live in areas with known factory pollution, resulting in the potential for prenatal exposure to DDT.

DDT exposure was measured at the time of delivery, through testing of umbilical cord serum in the subjects. Subjects were hence exposed primarily in utero, and during breastfeeding. Approximately 80% of the total subjects had quantifiable (>0.01 ng/ml) concentrations of DDT, while 100% had quantifiable concentrations of DDE. The data is provided in medians, percentiles, and maximums, with the Ribera d'Ebre group having a 0.05 ng/ml median and a 1.87 maximum for DDT exposure, and the Menorca group having a 0.08 median and a 2.28 maximum.

The study showed a significant association between an increase in DDT concentration and a decrease in scores on cognitive ability, verbal skills, and memory. The most relevant table was Table 5, which was adjusted for confounding factors, DDE exposure, and the differences between the Ribera d'Ebre and Menorca groups. It shows the associations between ranges of DDT concentration and deviation of neurodevelopment scores from the reference scores of subjects with the lowest DDT exposure. In addition to overall associations, it also separated the scores by gender. This table was the most important because of its removal of factors other than

DDT exposure, which was the focus of the study, and showed the associations most clearly and accurately. It was also the table most mentioned in the paper's discussion, indicating that the researchers found it to be the most relevant as well. At exposures above 0.20 ng/ml, all subjects showed an average decrease of 5.87 points in general cognitive ability, 7.86 points in verbal skills, and 10.86 points in memory, all of which are at least 3 points higher than the standard error values and therefore statistically significant. The associations were even stronger in girls, with a decrease ranging from roughly 3-7 more points of decrease than the overall scores.

In the discussion, the authors cite multiple other studies in which similar results were observed, specifically concerning DDT's effect on mental capabilities and neurobehavioral dysfunction. It brings up other studies in which the effects of DDE on such traits were *not* observed, but it mentions that these studies had smaller sample sizes and lower overall levels of DDE exposure. This was important because while this study was specifically looking at the effects of DDT, it also found a significant link between neurodevelopment and DDE exposure, so it adjusted the data based on that finding to get a more accurate read on the effects of DDT. The researchers concluded that prenatal exposure to DDT, even at low doses, is associated with a detriment effect on the cognitive function of preschoolers.

I personally concluded that this study showed a significant and important effect of prenatal DDT exposure that should be considered in the application of DDT in malaria prevention. The results were based upon low concentrations resulting from DDT presence in the environment, and still showed significant detrimental effects. This does concern me, particularly because the proposed use of DDT is indoors and concentrated, and would therefore have potentially more extreme effects on the cognitive abilities of children living in the homes in which DDT is used.

From this reading, I support the emphasis on alternatives to DDT for malaria management and the eventual phase out of DDT use overall. This study indicated significant effects of DDT exposure that cannot be overlooked, even for the benefits of its use to prevent malaria.

TABLE 5. Adjusted associations (β (standard error)) between DDT† concentration (ng/ml) and the general cognitive, verbal, and memory McCarthy areas‡ according to gender for the two cohorts recruited in Spain in 1997–1999§

	No.	General cognitive	Verbal	Memory
All infants				
Reference¶	203	104.03	98.38	88.93
0.051–0.10	86	1.45 (2.72)	1.80 (3.36)	1.64 (4.53)
0.101–0.20	74	−2.01 (2.95)	−4.02 (3.65)	−4.46 (4.92)
>0.20	112	−5.87 (2.60)*	−7.86 (3.21)*	−10.86 (4.33)*
Girls				
Reference¶	101	104.67	97.22	88.22
0.051–0.10	48	−1.37 (3.95)	−2.26 (4.86)	−2.46 (6.61)
0.101–0.20	33	−0.44 (4.47)	−2.58 (5.51)	−4.76 (7.47)
>0.20	55	−8.89 (3.89)*	−12.79 (4.80)**	−17.19 (6.51)**
Boys				
Reference¶	102	102.64	101.99	96.54
0.051–0.10	38	3.39 (4.09)	5.66 (5.05)	2.47 (6.82)
0.101–0.20	41	−5.15 (4.06)	−6.65 (5.01)	−6.30 (6.77)
>0.20	57	−3.74 (3.63)	−3.41 (4.47)	−5.63 (6.04)

* $p < 0.05$; ** $p < 0.01$.

† DDT, *p,p′*-DDT (bis[*p*-chlorophenyl]-1,1,1-trichloroethane; MCSA, McCarthy Scales of Children's Abilities.

‡ The mean score for the general cognitive scale is 100, with a standard deviation of 15.

§ Each column is a different multivariate model. Adjusted for gender, school trimester at examination, psychologist, breastfeeding, maternal social class, and maternal consumption of alcohol and use of tobacco during pregnancy.

¶ Infants in the lowest quartile of DDT exposure (≤0.05 ng/ml). Neurodevelopment scores are centered to the mean.