DDT Association with Glucose-6-phosphate Dehydrogenase

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Sera DDT was found to be associated with red cell glucose-6-phosphate dehydrogenase in 16 black children of Charleston, South Carolina. This is the first association of DDT with a genetic marker although previous studies have consistently shown a two to three fold elevation of DDT among Blacks.

Racial differences in sera DDT levels have been apparent for a number of years (FINKLEA, et al, 1969; DAVIES, et al, 1969; KEIL, et al, 1973). There is disagreement whether these differences are genetically or environmentally mediated. Davies has considered racial differences to be primarily socio-economic while Keil (1973) has introduced data to suggest a genetic reason. More recently Davies (1973) has shown differences within social class which intensify the quandry.

A pilot study was conducted to examine the association between sera DDT levels and an easily measured genetic marker, Glucose-6-phosphate dehydrogenase (G6PD). G6PD, a red cell enzyme which assists in maintaining cell wall integrity, is sex linked and race associated. Deficiency of this enzyme manifests itself by intermittent anemia.

The study population consisted of 16 Black pre-adolescents presenting at a dental clinic. Blood for DDT assay was collected in acid washed nalgene tubes and that for G6PD in glass tubes with EDTA added. Plasma was analyzed for DDT by gas chromatography using the constant extraction modification of the Dale-Cueto method (DALE, et al, 1967). The Gadsden and Cannon (GADSDEN, CANNON, 1964) procedure was used for quantitating G6PD.

DDT levels of this small group had a wide range (9-158 ppb) as did the G6PD (10-111 units). Coincident with the literature (BUETHER, 1967), most of the low G6PD values were among the males. A listing of mean, range, and standard deviations for these parameters is given in Table 1.

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TABLE 1

Mean, Range, and Standard Deviation of Red Cell G6PD and Sera DDT Levels Among 16 Black Adolescents, Charleston, S.C. 1972

	Units	Mean	Range	Standard Deviation
pp'DDT	ppb	21.1	3.7 - 59.5	16.7
op'DDT	ppb	0	0 - .1	0
pp'DDE	ppb	53.4	1.8 - 93.3	28.4
Total DDT[1]	ppb	80.6	9.3 - 158.1	40.3
G6PD	units	55.0	10.6 - 111.4	39.9

[1]DDT + 1.114 (DDE)

TABLE 2

Correlation Matrix of Age, Red Cell G6PD, and Plasma DDT Isomers and Metabolites of 16 Pre-Adolescent Negroes, Charleston, S.C. 1972

	Age	G6PD	pp'DDT	op'DDT	pp'DDE	Total[1] DDT
Age	1.000	-.007	-.359	.057	.026	-.128
G6PD		1.000	-.624**	-.489	-.482	-.615**
pp'DDT			1.000	.379	.326	.671**
op'DDT				1.000	.289	.396
pp'DDE					1.000	.919**
Total DDT						1.000

[1]Total DDT = pp'DDT + op'DDT = 1.114 (pp'DDE)

**Significant at .01 level

A striking correlation (R = -.615) was found between total DDT and G6PD. A slightly stronger association (R = -.624) was shown for the pp' isomer of DDT. The correlation coefficient was high but not statically significant for the op' isomer and the DDE metabolite. A matrix presenting these data is given in Table 2.

To our knowledge, this is the first evidence linking DDT burdens with genetic makeup. Davies, et al (DAVIES, 1970) had sought a correlation of G6PD and DDT several years ago but found no association probably because their method for the enzyme assay could only distinguish between the presence and the deficiency of G6PD.

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