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DDT (2,2,Bis(p-Chlorophenyl) 1,1,1-Trichloroethane) Induced Structural Changes in Adrenal Glands of Rats

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Oldest chlorinated hydrocarbon insecticide, DDT was used widely to control pest and vector borne diseases in developing countries. Malaria and vector borne diseases can be econometrically controlled by DDT (WHO Environmental Health Criteria 1979). Chronic and acute exposures to DDT result in systemic disorders in human (Boyd & Decastro 1968), as well as this was confirmed in animals (Chadwick et al. 1975). Experimental study revealed that DDT caused the structural and functional changes in thyroid and reproductive system (Rybakova 1968). The effects of DDT on adrenal glands are not well documented. Therefore this experimental investigation was undertaken to evaluate the histomorphological changes of adrenal gland after the treatment with DDT in rats.

MATERIALS AND METHODS

Twenty male albino rats, weighing 150±5g were divided into two groups containing ten each in control Group (A) and experimental Group (B). The latter group was fed DDT (Technical grade; HIL, India) as glycerine suspension at a dose of 20µg/100g/day by intubation for 120 days. Control rats received vehicle (glycerine 0.1ml). The experimental dose of DDT is 0.17% of LD_{50}, (LD_{50}, 113mg/kg Oral in rat; Hayes 1975). The body weight was recorded twice in a week. The animals were killed by decapitation at the end of test period. Adrenals were extricated, weighed and fixed in Bouin's fluid; 5um thick paraffin sections were cut and stained with hematoxylin and eosin. The histological and histometrical observations were carried out at 640 fold magnification.

RESULTS AND DISCUSSION

Significant decrease in body weight of rats after DDT treatment indicated marked retardation of growth. Similarly, significant decrease in adrenal weight revealed the atrophy of the gland (Table 1). Microscopical observation of adrenal gland in control group exhibited normal histological appearance of cortico-medullary cells (Fig.1). In treated group, histology of adrenal gland was altered in comparison to control group. After 120 days, exposure of rats to DDT resulted in hyaline

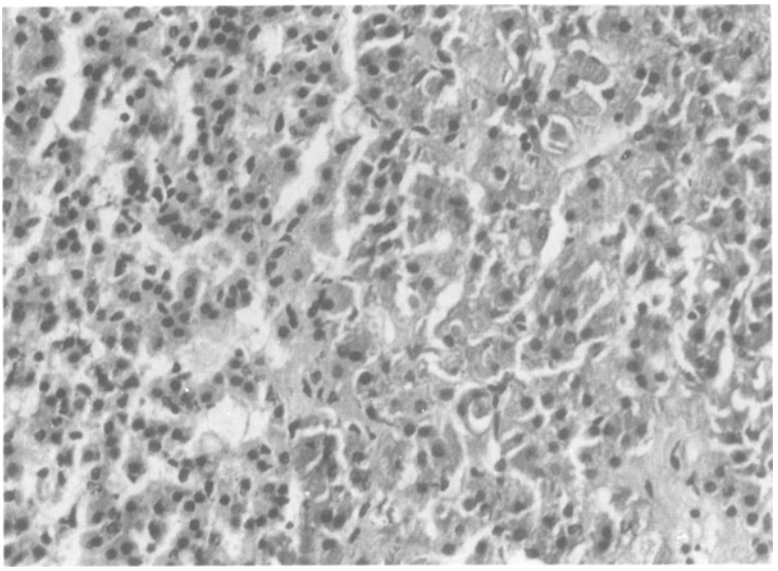

Fig.1 Cross section of control adrenals of rats with clear cortical and medullary zones x 640. C, Cortex M, Medulla

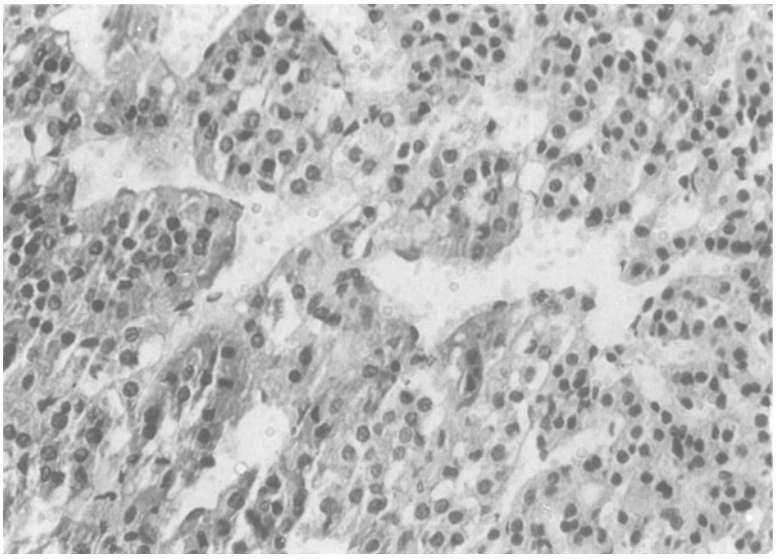

Fig.2 Degeneration in both cortical and medullary regions of adrenals after oral treatment with DDT at a dosage of 20µg/100gm B.W. for 120 days x 640

Table 1. Effect of DDT on body weight, adrenal weight and zonal width of different zones of adrenal gland

	Body weight (g) (n=10)			Adrenal weight (mg) (n = 20)	Zonal width (mu)[e]			
	Initial	Final	% Gain		ZG	ZF	ZR	M
Group A (Control)	151.30 ± 2.88	404.70 ± 4.33	167.5	21.99 ± 1.59	67.55 ± 1.96	407.98 ± 3.06	79.90 ± 1.63	284.33 ± 3.81
Group B (20µg/100g)	149.85 ± 2.21	324.30 ± 3.61**	116.4**	16.70 ± 1.16**	68.54NS ± 1.84	342.40** ± 2.75	73.82** ± 1.39	190.70** ± 2.73

[e]Mean of 20 observations at 640 x magnification, micrometer constant of 1 division = 2.5mu

ZG = Zona glomerulosa, ZF = Zona Fasciculata, ZR = Zona Reticularis, M = Medulla

NS = Not Significant, *$p < 0.05$, **$p < 0.001$

degeneration in medulla than cortex (Fig.2). Chemical stimulus at low dose for short duration caused hypertrophy of the adrenal gland (Roy Chowdhury et al. 1986); while higher dose for longer duration caused the atrophy of the gland (Hart et al. 1973). In the present study, the histometrical observations revealed significant atrophy of all zones of adrenal gland, except zona glomerulosa in group B. The alterations in different zones may be a result of repeated chemical stimulation for longer duration causing hyperactivation of cells and leading to cellular exhaustion. In corroboration with our earlier study on chemical induced stress (Roy Chowdhury et al. 1984), this data indicates the definite impairment of adrenal gland by DDT treatment. It is reported that isomer of TDE inhibited ACTH induced steroid production in the dog at a dosage of 4mg/kg for 30 days (Nichols et al. 1961). The degeneration both in cortex and medulla may be a result of successive stimulation and inhibition of ACTH which was equivocal with TDE action on adrenals. Therefore, this primary investigation reported the histo-architectural impairment after exposure to DDT over a period of 120 days.

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