

EFFECT OF ORGANOPHOSPHATE PESTICIDE METASYSTOX ON LIPIDS IN DISCRETE AREAS OF RAT BRAIN

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Metasystox (O-O-dimethyl-S-2-ethylsulphonyl), 3 mg/kg body weight, intra-peritoneally (ip) was injected daily for 10 days. The effects of the pesticide on various lipid fractions in the discrete areas of the brain were studied. The daily ip dose of metasystox depleted the level of total lipids, phospholipids, cholesterol and gangliosides in cerebral hemisphere, cerebellum and brain stem.

INTRODUCTION

Many acute effects of organophosphorus compounds are related to inhibition acetylcholinesterase activity¹. DDVP and Malathion alter the levels of total lipids, phospholipids and cholesterol in different regions of the central nervous system²⁻³. Metasystox results in lowering of amino acid neurotransmitters in different regions of the rat brain⁴. Metasystox also alters the levels of DNA, RNA and protein in different regions of rat brain⁵. The present investigation was carried out to determine the effect of metasystox on the levels of total lipids, phospholipids, cholesterol and gangliosides in the discrete regions of the rat brain.

EXPERIMENTAL

16 male albino rats weighing 150 ± 20 g maintained on pellet diet (Lipton India Ltd.) and water ad libitum. Animals were divided into two groups, viz, experimental and control, 8 animals each. Metasystox (Bayer India Ltd.), 3 mg/kg body weight, was injected daily for 10 days to the rats of the experimental group, while animals of control group received an equal volume of physiological saline. All animals were sacrificed by decapitation on the 11th day. Their brains were removed quickly and kept on an ice-cold petridish. Different parts of the brain were weighed and homogenized in a glass homogenizer with chloroform-methanol (2 : 1)⁶. Further isolation of lipids was carried out as described by Islam *et al*⁷. Total lipids were estimated according to the method given by Woodman and Price⁸. The method of Zak *et al*⁹ was used for the estimation of cholesterol. The colorimetric method was used for estimating gangliosides¹⁰. The method of Marinetti¹¹ was used for phospholipid estimation and data were analysed using Student's *t* test.

RESULTS AND DISCUSSION

The present study was made on the total lipids, phospholipids, cholesterol and gangliosides of different regions of the rat brain following Metasystox intoxication.

From Table 1 it is evident that the administration of Metasystox (3 mg/kg body wt.) to rats causes a significant diminution in the levels of total lipids, phospholipids, cholesterol and gangliosides.

TABLE 1
ALTERATIONS IN THE LEVEL OF TOTAL LIPIDS, PHOSPHOLIPIDS, CHOLESTEROL AND GANGLIOSIDES IN DIFFERENT REGIONS OF RAT BRAIN FOLLOWING THE ADMINISTRATION OF METASYSTOX (3 mg/kg body wt.) DAILY FOR 10 DAYS

	Cerebral hemisphere			Cerebellum			Brain stem		
	Control	Experimental	% Change	Control	Experimental	% Change	Control	Experimental	% Change
Total Lipids	124.4 ± 15.8	94.2‡ ± 6.4	24.27	108.5 ± 14.6	87.8‡ ± 10.0	19.07	142.7 ± 16.2	118.3* ± 18.5	17.09
Phospholipids	46.7 ± 3.9	45.1 ^{NS} ± 3.7	3.42	42.6 ± 5.1	38.9 ^{NS} ± 4.7	8.68	58.7 ± 6.0	51.1* ± 5.2	12.94
Cholesterol	26.8 ± 3.1	19.5‡ ± 2.7	27.23	22.4 ± 3.0	18.1‡ ± 1.9	19.19	30.2 ± 4.1	20.4‡ ± 3.7	32.45
Gangliosides	1.40 ± 0.17	1.13‡ ± 0.14	19.28	1.10 ± 0.14	0.83‡ ± 0.06	24.54	0.90 ± 0.13	0.65‡ ± 0.65	27.77

* $P < 0.05$ † $P < 0.01$ ‡ $P < 0.001$

NS—Not Significant values expressed as mg/g fresh tissue Mean ± S.D.

Brain contains a considerable level of lipids and glycolipids. The total amounts of lipids in both gray and white matter are large, although the lipid content of white matter (approximately 65% by unit dry weight) is larger than that of gray matter (approximately 35–40%)¹². In the present report it was observed that metasystox altered the levels of total lipids, phospholipids, cholesterol and gangliosides in the rat brain. Organophosphate pesticide DDVP has been shown to alter the levels of total lipids, phospholipids and cholesterol in different parts of the brain². Metasystox has been reported to increase lipid peroxidation and lipase activity in rat brain¹³. The increased activity of lipase could be a possible explanation for decreased concentration of lipids¹⁴. Malathion alters the levels of total lipids, phospholipids and cholesterol in different regions of the central nervous system³. Another sulphur containing organophosphate, parathion, has been shown to alter the levels of total lipids, phospholipids and cholesterol in different parts of the rat brain¹⁵. The increment in the brain lipid peroxidation also contributes to the decrement in the level of brain lipids¹⁶. The decrease in phospholipid concentration is supported by the finding of Nelson and Barnum¹⁷ who observed inhibition of phospholipid biosynthesis by organophosphorus.

Gangliosides are present only in the gray matter of the brain¹⁸. Gangliosides are localized primarily in the plasma membrane, but small amounts of gangliosides are also detectable in myelin¹⁹. Gangliosides act as receptor substances for neurotoxins^{20–22}. In the present investigation metasystox depleted the level of gangliosides in different parts of the brain. The mechanism explaining the decrease in ganglioside content after administration of organophosphate is unclear.

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