

## Biochemical Changes Due to Carbofuran, Sevin and Rogor Administration to Albino Rats

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Some biochemical changes brought about by oral administration of the pesticides like sevin, rogor and carbofuran to adult male rats were studied. Increase in blood sugar and serum transaminase activities were observed in the acute experiment with all the pesticides. Brain acetyl cholinesterase was affected to a greater extent in the acute experiment than in subacute experiment. Six days after the administration of carbofuran at 10mg/Kg body weight the activity of brain cholinesterase was still 45 per cent less than the normal activity.

The pesticides are being increasingly used in agriculture and public health. Not only farm labourers and people involved in pesticide industry but also common people who eat plant foods containing pesticide residues are exposed to the harmful effects of pesticides. The different pesticides cause varying effects on different plants and animals depending upon the dose of the pesticide. Some of the biochemical alterations brought about by the pesticide carbofuran, sevin and rogor are compared and discussed here.

### MATERIAL AND METHODS

The albino rats maintained in the Biochemistry Department of the Tamil Nadu Agricultural University, Coimbatore were used throughout the study. The technical grade pesticides dissolved in acetone were administered to the rats through stomach tube. The control rats received only acetone. The animals

were anaesthetized with ether and blood was collected by cardiac puncture within one hour after pesticide administration in acute experiment and after 60 days in subacute experiment. The liver and brain were removed washed in cold saline and stored in ice. The tissues were homogenised in 0.25M sucrose in a tissue homogeniser. The protein was estimated according to Lowry's method (1951) and transaminases and blood sugar was estimated as given by Varley (1976). Acetyl cholinesterase (AChE) was assayed according to Pilz (1974) and each value is an average value from atleast five rats.

### RESULTS AND DISCUSSION

#### Acute Experiment

The blood sugar was increased in the acute experiment with all the three pesticides, the increase being the

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highest due to rogor (Table I). Further study is required to find out whether this increase is due to decreased utilisation of glucose or due to increased gluconeogenesis. There was significant decrease in serum protein due to sevin administration only.

The measurement of transaminase in serum is an indication of the extent of liver damage. The activities of serum transaminases were higher in all the rats, the increase ranging from 23 to 52 per cent. Kashyap *et al* (1976) have reported increased transaminase activity due to BHC ingestion, the increase being directly proportional to the concentration of BHC administered.

Most of the pesticides inhibit the enzyme AchE of the nervous system of higher animals. About 16 per cent of the farm workers of New Jersey (Quinones *et al*, 1977) and 66 per cent of agricultural aviation technicians (Stoyanov and Jonchov, 1977) had low AchE activity. The accumulation of acetyl choline will lead to impaired vigilance, slowing of information processing, memory deficit, anxiety and irritability (Levin and Rodnitzky, 1976). The present results indicated complete inhibition of AchE of rat brain due to carbofuran, 84 per cent inhibition due to rogor and 41 per cent inhibition due to sevin (Table II).

#### Subacute Experiment

In the subacute experiment the blood sugar, serum protein and transa-

minases were not affected appreciably (Table II). AchE inhibition was observed in all the cases though to a smaller extent only. Carbofuran and sevin are carbamate pesticides and rogor is an organophosphorus compound. From LD50 values (Table I) it may be inferred that carbofuran is the most toxic one among the three pesticides. The subacute experimental period of 60 days is roughly equal to 1/15th of the life period of the rat. But human beings are continuously exposed to varying concentrations of pesticides almost throughout the life period. To study the effect of pesticides for such long periods chronic experiments exposing rats to pesticides for several months must be carried out.

In another experiment the biochemical parameters were measured six days after the administration of carbofuran at 10mg/Kg body weight. The blood sugar, serum protein and transaminase activities were near normal levels (Table III) indicating rapid recovery of liver after pesticide poisoning. Kerel and Saxena (1975) observed hyperproteinemia for four weeks in gerbils administered with chlordane. But in agricultural aviation technicians normal levels of AchE was observed only after cessation of work for 60 days. In the present study the animals recovered remarkably within six days. However, the acetyl cholinesterase activity was still lower in sevin and carbofuran administered rats.



## REFERENCES

- KAREL, A. K. and S. L. SAXENA. 1975. Investigation on the serum proteins of *Meriones hurrianae* Jerdon. *Arch. Int. Physiol. Biochem.* 83: 287-92.
- KASHYAP, S. K., S. K. GUPTA, H. V. BHATT and M. P. SHAH. 1976. Acute oral toxicity of BHC in albino rats. *Indian J. Med. Res.* 64: 768-72.
- LEVIN, H. S. and R. L. RODNITZKY. 1976. Behavioural effects of organophosphate. *Clin. Toxicol.* 9: 391-405.
- LOWRY, O. H., N. J. ROSEBROUGH, A. L. FARR and R. J. RANDALL. 1951. Protein measurement with Folin phenol reagent. *J. Biol. Chem.* 193: 265-75.
- PILZ, W. 1974. In 'Methods of enzymatic analysis' Vol. 2. Ed. Bergmeyer, pp. 840-45.
- QUINOMES, M. A., J. D. BOGDEN, D. B. LOURIA A. EL-NAKAH and C. HANSEN. 1977. Depressed cholinesterase activities among farm workers in New Jersey. *Biol. Abs.* 63: 3538.
- STOYANOV, T. and D. JONCHOV. 1977. Dynamics of cholinesterase in flight crow in agricultural aviation. *Biol. Abs.* 63: 3541.
- VARLEY, H. 1976. In 'Practical clinical biochemistry'. pp 8990 and 293-94.

TABLE II: Biochemical changes due to pesticides - Subacute experimental

Unit	Control	Carbaryl	Sevin	Rogor
Pesticide dose (mg/kg body weight) (Daily for 30 days)	—	—	5	5
Food intake (mg/100ml)	18	89	110	102
Serum protein (mg/100ml)	4.9	4.3	5.1	4.8
Brain acetylcholinesterase (IU)	810	610	480*	560
1000	101	88	102	102
1000	11	11	7.4	8.8



TABLE I Biochemical changes due to pesticides - Acute experiment

	Unit	Control	Carbofuran	Sevin	Rogor
Oral LD50 value (For male rats)	mg/Kg body weight	—	11	850	300
Dose administered	mg/Kg body weight	—	10	400	300
Blood sugar	mg/100ml	96	137*	141**	218**
Serum protien	g/100ml	5.0	4.1	3.2*	5.6
Brain acetyl cholinesterase	IU	589	NA	346**	97**
SGOT	IU	10.3	15.4**	12.7*	14.9**
SGPT	IU	7.1	10.6	8.8	10.8

NA : No activity detected.

SGOT : Serum glutamate - oxaloacetic transaminase.

SGPT : Serum glutamate - pyruvate transaminase.

\*, \*\*: Significant at 0.05 and 0.01 probability level respectively.

TABLE II Biochemical changes due to pesticides - Subacute experiment

	Unit	Control	Carbofuran	Sevin	Rogor
Pesticide dose (Daily for 60 days)	mg/Kg body weight	—	1	5	5
Blood sugar	mg/100ml	92	90	110	103
Serum protein	g/100ml	4.9	4.9	5.1	4.9
Brain acetyl cholinesterase	IU	570	513*	495*	566
SGOT	IU	10.2	9.8	10.2	10.2
SGPT	IU	7.2	7.2	7.4	6.8

SGOT : Serum glutamate - oxaloacetic transaminase.

SGPT : Serum glutamate - pyruvate transaminase.

\*: Significant at 0.05 probability level.



TABLE III - Carbofuran induced biochemical changes - Length of period

	Unit	Normal	Carbofuran 1 hr.	144 hr.
Pesticide dose	mg/Kg body weight	—	10	10
Blood sugar	mg/100ml	96	137*	108
Serum protein	g/100ml	5.0	4.1	4.7
Brain acetyl cholinesterase	IU	589	NA	321*
SGOT	IU	10.3	15.4**	10.9
SGPT	IU	7.1	10.6*	7.5

NA : No activity detected.

SGOT : Serum glutamate - oxaloacetic transaminase.

SGPT : Serum glutamate - pyruvate transaminase.

\*, \*\*: Significant at 0.05 and 0.01 probability level respectively.