

**ANTIOXIDANTS LEVELS IN FARMERS OCCUPATIONALLY EXPOSED TO PESTICIDES: A
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ABSTRACT: Occupationally exposed monocrotophos pesticide sprayers revealed various health complications like hyper tension, chronic bronchitis, cardiovascular problems, headache, eye irritation, cold, sinus problems, asthma, backache, fatigue, skin allergy, joint pains and acidity. There was a significant decrease in antioxidant enzyme activity in exposed group when compared to control group. Significant increase was seen in the activity of Glutathione-S-transferase in long term exposure to monocrotophos pesticide sprayers. Present study is an attempt to explore the status of usage of monocrotophos in Ramayanpet Village of Medak district in Andhra Pradesh State of India.

Key words: Monocrotophos, Anti oxidant levels, agriculture

INTRODUCTION

Exposure to low-level of pesticides is known to produce a variety of biochemical changes which may cause adverse biological effects reported in human and experimental studies (Banerjee *et al.*, 1999). Some of the biochemical alterations may not lead to clinically recognizable symptoms. The biochemical changes induced after exposure to pesticides or their active metabolites include target cell/receptor binding, protein and DNA adduct formation, and induction or inhibition of enzymes (Heinzow and McLean, 1994). Oxidative stress can also be induced by pesticides by free radicals formation or by altering antioxidant defence mechanisms and scavenging enzymes (Abdollahi *et al.*, 2004). Oxidative stress has been reported to play an important role in the toxicity of various pesticides, including organochlorines, organophosphates (OPs) (Ranjbar *et al.*, 2002), carbamates and pyrethroids (Kale *et al.*, 1999). The higher oxidative stress in pesticide sprayers was reported by Prakasam *et al.* (2001). The increased formation of reactive oxygen and nitrogen species result in an increase in lipid peroxidation in several tissues mainly the brain, skeletal muscle and red blood cells (RBC) and depleted antioxidant status were reported in several studies of various pesticide exposed populations (Dave 1998, WHO/UNEP 1990). This study is planned to see the oxidative stress and antioxidant status of occupational sprayers of monocrotophos. To achieve our aim, we have measured serum lipid peroxide, erythrocytes superoxide dismutase, serum glutathione S-transferase and Glutathione peroxidase.

MATERIAL AND METHODS

In this study 600 risk prone Male subjects were randomly selected from Medak district of Andhra Pradesh. During 2007-09 and 2009-10 respectively. All the selected subjects were given an informed written consent by informing the objectives of the study. The subjects selected for this study falls in the age group of 20-50 years and belong to the same socio economic status. 110 Agricultural workers were recruited from 600 risk prone subjects for the study. 120 Similarly age sex matched Male subjects who did not have any pesticidal exposure were also selected as controls for comparison. The entire experimental was approved by the institutional ethical committee and utmost care was taken during the experimental procedure. Blood samples were collected by puncturing the anticubital vein into evacuated tubes combining heparin solution as anticoagulant. Lipid peroxidation is assessed by spectrophotometrically (Templar *et al.*, 1999 and Bhuyan *et al.*, 1986). SOD (Super oxide Dismutase) activity in the blood was determined by indirect method based on the ability of the enzyme to inhibit O₂⁻ dependent auto oxidation of pyrogallol (Marklund & Marklund, 1974). Glutathione peroxidase activity in the blood was measured by the method of Martinez, *et al.* (Martinez, *et al.*, 1979). The method followed by Habig *et al.*, (1974) was used for the measurement of Glutathione-S-Transferase.

RESULTS AND DISCUSSION

Pesticides are up taken through the skin, by inhalation and ingestion. The fat-soluble pesticides, and to a smaller extent water-soluble pesticides are absorbed through skin. The vapours of pesticides or droplets which are smaller than 4µm in diameters are absorbed through the lungs. Ingestion of the pesticides can also occur from consumption of contaminated food or by using contaminated utensils. Hands contaminated by pan chewing can also lead to intake of pesticides or while spraying, mixing, or handling the pesticides (WHO / UNEP (1990). The dermal exposure is the most important route of uptake of pesticides for exposed workers. There is a balance between oxidants (reactive oxygen species -ROS, metals) and antioxidants (superoxide dismutase -SOD, vitamins A, E, C, Reduced glutathione -GSH, etc.) in healthy individuals. Any misbalance and destroyed natural antioxidative protection of the cells increase the risk of pathological processes. Pesticides have been shown to initiate peroxidation of lipids in biological membranes (John *et al.*, 2001: Koryagin *et al.*, 2002). Organophosphate causes morphological changes in erythrocytes, that are associated with increased lipid peroxidation (John *et al.*,2001; Thapar *et al.*, 2002). Serum glutathione-S-transferase activity was significantly increased in sprayers of occupationally exposed to monocrotophos as compared to the control group.

Table : 1 - Pesticides Commonly Used by the Farmers

WHO Classification	Chemical Name	No of Farmers	% N=427
I[a]Extremely hazardous - Phorate	Organophosphate	33	7.7
[b]Highly hardous Monocrotophos	O.P	235	55.0
Profenofos	Combination	63	14.8
Carbofuran	Carbamate	11	2.6
II Moderately hazardous,Dimethoate	Organophosphate	196	45.9
Quinalphos	O.P	186	43.5
Endosulphan	O.L	176	41.2
Chloropyrifos	O.P	77	18.0
Fenthion	O.P	21	18.0
DDT	Organochlorine	03	0.7
III Slightly hazardous Malathion	O.P	06	1.4

Table : 2 - Signs and Symptoms of Illness Among Study Population

S.No	Sign and Symptoms	Sprayers N=433	No sprayers N=198	Overall N=631
1	Excessive sweating	38.6	31.8	36.5
2	Burning/itching	37.6	31.3	35.7
3	Dry/sore throat	27.3	21.7	25.5
4	Fatigue	26.3	39.4	30.4
5	Dizziness	25.6	34.3	28.4
6	Skin redness/whitepatches	21.9	17.7	20.6
7	Numbness/muscle weakness	21.7	28.8	23.9
8	Blurred vision	16.2	29.3	20.3
9	Chest pain/burnning feeling	15.7	28.8	19.8
10	Shortness of breath	15	23.2	17.6
11	Excessive salivation	14.8	12.6	14.1
12	Nausea /vomiting	7.4	11.6	8.7
13	Stomach pain	06	16.7	9.4
14	Burning nose	18	13.1	16.5

Increased GST in this study indicates that the monocrotophos and other organophosphate pesticides are mainly metabolised in the liver and excreted as a conjugate of GSH by the reaction catalysed by GST. Increases in the activity of GST was reported in animals chronically exposed to carbofuran (Kaur *et al.*, 2006). Glutathione (GSH) is an endogenous thiol antioxidant that has a multifaceted role in xenobiotic metabolism and is a first line of defence against oxidant-mediated cell injury (Sies, 1999). Studies in animal models suggest that many synthetic organophosphates and organochlorines such as endosulfan and chloryriphos modify the concentrations of GSH (Bebe *et al.*, 2003).

Table-3: Antioxidants Levels in Occupationally Exposed to Pesticides in Study Population

	Years of exposure [5-15]	Mean	F-value	p- value
SOD	Control [120]	1263.2±7.22	45.24	0.001
	Exposed [110]	868.8 ± 17.03		
GPX	Control [120]	20.62±4.13	8.88	0.002
	Exposed [110]	10.7±2.87		
LPO	Control [120]	1.14±0.5	0.36	0.6
	Exposed [110]	2.96±.49		
GST	Control [120]	1.12±0.34	61.2	0.001
	Exposed [110]	2.83±0.94		

Pesticides residues analysis

Farmers had Monocrotophos pesticides residues above the acceptable daily intake in their blood. Peaks reflecting the Monocrotophos residues in the plasma of Ramayampet Agricultural workers.is shown in the fig 1.

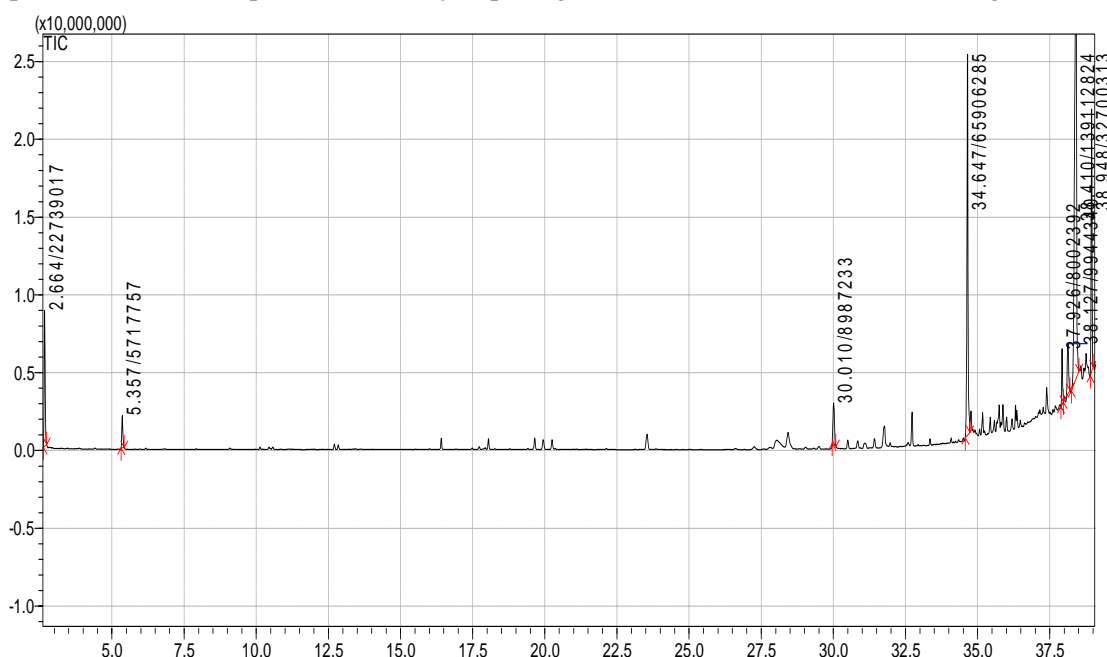


Fig 1: Monocrotophos detected in Agricultural workers

CONCLUSIONS

The overall results in the present study have indicated that Occupationally exposed monocrotophos pesticide sprayers revealed various health complications like hyper tension, chronic bronchitis ,cardiovascular problems ,headache ,eye irritation,cold, sinus problems ,asthma ,backache ,fatigue ,skin allergy ,joint pains and acidity. There was significant decrease in antioxidant enzyme activity in exposed group confirm induction of impairment of antioxidant defence in occupationally exposed to monocrotophos pesticide .Significant increase in Glutathione s transferase in long term exposure to monocrotophos pesticide sprayers. Monocrotophos residues have been detected in occupationally long term exposure pesticide sprayers through GC-MS.

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