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Research Article

IMPACT OF ORGANO PHOSPOROUS PESTICIDES ON SPRAYING WORKERS

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ABSTRACT

India being an agricultural country, the pesticide usage causes a serious environmental and public health problem. Due to large demand of food many farmers are resorting to extensive and rather over use of organophosphate pesticides to increase their agricultural yields. The sprayers who are involved in the spraying activity of pesticides in fields get the direct exposure of pesticides due to unsafe and non-preventive work practices. They do not use the safety masks, gloves and other protective gears during the spraying of pesticides which results into the access of pesticides in the blood stream through inhalation and dermal exposure which can adversely affect their eyes, skin and the respiratory system. In the present study changes in the neurotransmitter enzymes such as acetyl and butryl cholinesterase's are studied in agricultural workers exposed to organophosphorous pesticides during agriculture practices of spraying in the areas of Nambur, Guntur district, A.P, INDIA. These changes are significant as it was found to be more than 45% in Acetyl cholinesterase (AChE). First absorption, by people resulting toxicity as chronic by the production of oxygen free radicals, being heterotrophic metabolically, results in the alteration of homeostasis leading to oxidative stress that culminates the non maintenance of the antioxidants continuously due to imbalance.

INTRODUCTION

Pesticide is the name used to describe a range of substances or mixtures used to kill, reduce or repel many types of pests. There are many types of pesticides according to their use and chemical composition such as Organochlorines, organophosphates and synthetic pyrethroids etc. Pesticides are extensively used worldwide in agricultural practices to control pests and increase crop yield. In recent years, their use has increased considerably. As an agricultural developing nation India too relies predominantly on chemical pesticides to sustain a large population. Pesticides have potential to kill a wide variety of insect pests and in doing so they harm the ecosystem in general and human health in particular. Being agriculture oriented nation the primary occupation of rural population depends on spraying indiscriminately a diverse group of agro-chemicals to save the crops [(6)].

The pattern of pesticide usage in India is different from that for the world in general. in India 76% of the pesticide used is insecticide, as against 44% globally[(10)]. The use of herbicides and fungicides is correspondingly less heavy[(7)]. The main use of pesticides in India is for cotton crops (45%), followed by paddy and wheat [(18)].

Guntur district in Andhra Pradesh, India is predominantly an agricultural district located on the western bank of the lower reaches of river Krishna (Lat 150 181 - 160 501 , North Long.700 101 - 800 551 East) traditionally, tobacco, cotton, chillies, black gram and green gram are cultivated in wetland regions. The dry land commercial crops entail heavy investments and yield good profits. Also, it is well known that all these are heavily sprayed crops. Andhra Pradesh uses about 22.5% of the total amount of pesticides produced and marketed in India. Guntur District top the state in this, spending Rs. 450 crore and 500 crore during 2001-02 and 2002-03, respectively. Of this, major consumption was recorded for two major commercial crops, i.e., cotton and chilies[(3)].

Most organophosphorous pesticides exert their toxicity on the target or non target organs through inhibition of acetylcholine esterase in the nerve and muscle tissues[(11)]. The agri sprayers which include farmers and labor as sprayers, an attempt is made to know how ignorance illiteracy and illusion could give a sociological problem regarding the proper care to be taken while spraying, of course this study is an attempt at local area because monitoring plays a major role in abatement.

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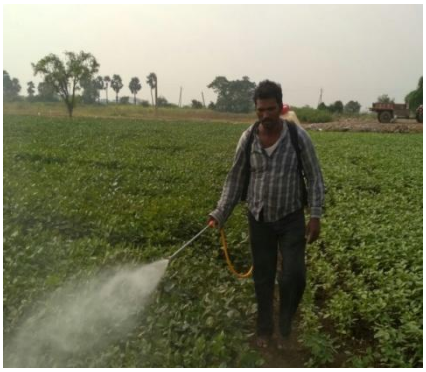
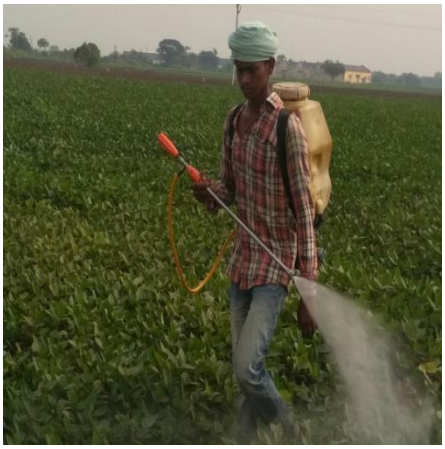
Exposure to organophosphorus pesticides through direct contact, ingestion or inhalation can have a deleterious effect on human health; additional residue in food also contributes to the health risk.[18] OPs act by inhibiting acetylcholinesterase (ACHE), an enzyme that is essential for the proper functioning of the nervous system[13] as it hydrolyzes the neurotransmitter acetylcholine in the nerve synapse[14].

Phosphorous compounds have been used for agricultural pests and vector borne diseases control for many decades. Human poisioning due to these insecticides may occur by exposing to insecticides, during chemical tools and dish washing. They can cause human poisoning and lead to an acute or a chronic disease such as mild or severe disorders in the cholinesterase enzyme function and consequence blocking the neurons activities by disrupting of cholinesterase enzyme function, which ending to death finally[2].

MATERIAL AND METHODS





All the individuals were provided a questionnaire seeking information on the types of pesticides they mostly used protective equipment or cloths during preparation and application of pesticides, concentrations recommended for pesticides use. In addition, the questionnaire elicited information about the re-entry period (the minimum amount of time that must pass between the times of application of pesticide and the time the farmers could go into the field without wearing personal protective equipment). The individuals selected included those who worked in both field crops and vegetables on the same ground but in different seasons.

Study areas and population

This study was carried out on the agricultural workers from small villages located within large intensive agriculture area in Guntur (district), A.P. All persons were initially contacted by phone, areas were selected according to the repeated sprays of pesticides. This study group included 50 persons who were occupational pesticide sprayers and field helpers, whose age ranges from 20 to 45 years. 50 normal healthy individuals taken as control, who were of similar age groups from the same area. They neither performed any spraying activities nor have any kind of pesticide exposure.

The farmers were divided into two categories

Group - I Male pesticide sprayers.

Group - II Male pesticide mixers

Group – III Female helpers.

The study group subjects were routinely engaged in spraying pesticides continuously for four to five hours daily spreading from the month of June to October. The blood was collected at the end of this period as exposure to pesticides is maximal during this time of year.

Exposure assessment

Atmospheric temperature:

During the period of survey, the atmospheric temperature was 25-33^{0}C;74% of the spray men had sweating on the forehead or all over, and 68% of them wiped of their sweat with hands or

sleeves, which were usually, therefore, contaminated with pesticides and lead to secondary dermal exposure.

Collection of blood samples

Blood samples were collected in heparin containing tubes by puncturing the anticubital vein.

SERUM: serum is a clear, yellowish coloured fluid which is part of the blood. It does not contain white or red blood cells or a clotting factor. It is the blood plasma without the fibrinogens.

Collection of serum: Lavender-Top Tube (EDTA)

This tube contains EDTA as an anticoagulant -- used for most haematological procedures. After the tube has been filled with blood, immediately invert the tube several times to prevent coagulation and preserve the sample at 4^0C.

Ache activity

Blood Acetyl cholinesterase (AChE) and Buytyrl cholinesterase (BChE) activity was determined by the method of Ellman[(5)]. Venous blood is collected into heparinized tubes and subjected to centrifugation for plasma without removing any erythrocytes. Then the erythrocytes are suspended into water to makeup to the same volume of the whole blood and to this 0.1M phosphate buffer is added and then frozen in order to haemolyse the erythrocytes. After thawing, the suspension is further diluted with buffer and thiol reagent DTNB added. Ten minutes after DTNB, acetyl thiocholine (ATCh) is added. The absorbance is read at 412 nm against a blank containing hemolysed erythrocytes suspended in buffer.The BChE activity in plasma is also with 1.0Mm ATCh using the same buffer and DTNB reagent. The enzyme activities are measured at 25or 37^0C. The concentration of haemglobin in the erythrocytesuspension is determined spectrophotometrically at 546 nm at room temperature. The activities of AChE and BChE were expressed as micromoles of hydrolysed ATCh per minute and per milliliter of whole blood and plasma [(16)].

RESULTS AND DISCUSSION

Table no-1 Assay of Activity of ACHE

	Result	Control	Reference Range
Group – 1	1024 µmoles/min/ml ± 0.04	3509 µmoles/min/ml ± 0.03	3000 – 6500 µmoles/min/ml
Group– 2	2114 µmoles/min/ml ± 0.02	4112 µmoles/min/ml ± 0.01	3000 – 6500 µmoles/min/ml
Group– 3	2716 µmoles/min/ml ± 0.01	5015 µmoles/min/ml ± 0.03	3000 – 6500 µmoles/min/ml

Values are the means of five observations: (±) indicates the standard deviation values are significant at P > 0.05

Table 2 Assay of activity BCHE

	Result	Control	Reference Range
Group– 1	1195 µmoles/min/ml ± 0.02	3509 µmoles/min/ml ± 0.03	3000 – 6500 µmoles/min/ml
Group– 2	2035 µmoles/min/ml ± 0.01	4112 µmoles/min/ml ± 0.02	3000 – 6500 µmoles/min/ml
Group – 3	2257 µmoles/min/ml ± 0.03	5015 µmoles/min/ml ± 0.04	3000 – 6500 µmoles/min/ml

Values are the means of five observations: (±) indicates the standard deviation values are significant at P > 0.05

DISCUSSION

Results of cholinesterase enzyme activity test on Agricultural workers at small Villages located in Guntur district showed decrease in activities than normal persons. Similar findings were observed by various researchers (3,7,10). Organophosphate inactivation of cholinesterase enzyme. Such matter caused acetylcholine piled on nerve and occurrence of overstimulus on receptor nerve[(17)]. Experimental studies have also shown that subacute exposure to OP pesticides caused an 85% inhibition of BChE [(15)].

CONCLUSION

The present study revealed that the activity of Acetyl choline esterase and Butyryl choline esterase was decreased in agricultural workers who exposed to organophosphorous pesticides. Most farmers in our study were not aware of the health hazards caused by the inappropriate handling of pesticides. Awareness needs to be created on use of personal protective measures among farmers, while handling pesticides. Farmers needs to be encouraged to reduce, if not eliminate the use of pesticides, with the introduction of incentives to the farmers to help them shift from synthetic pesticides to bio-pesticides and organic farming.

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