

EFFECTS OF PRE AND POST EXPOSURE PREVENTIVE MEASURES ON SERUM CHOLINESTRASE LEVEL IN ORGANOPHOSPHORUS COMPOUNDS SPRAY WORKERS

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ABSTRACT

In Pakistan organophosphorus compounds are basic necessity in current farming system. In addition to their benefits in yielding good crops, it causes health hazards to its users; particularly spray workers. Excessive use, inappropriate handling and unsatisfactory personal protective measures while spraying OPs put sprayers at increased risk for acute as well as chronic health hazards. This aspect of occupational exposure is less explored area in Pakistan. Almost all OPs share a general mechanism of action, by phosphorylation of cholinesterase enzyme and buildup acetylcholine neurotransmitter level at nerve terminals.

Objective: The objective of present study was to measure levels of plasma cholinesterase in pesticide spray workers who take and who do not take pre and post exposure preventive measures.

Material and Methods: Serum cholinesterase levels were measured in 123 rural male spray workers selected through purposive sampling method from Lahore district of Punjab. This was done using spectrophotometric analysis. Serum cholinesterase level was measured by means of kits. A planned questionnaire was arranged to get demographic and data about use of pre and post exposure preventive measures.

Results: All spray workers were males with a mean age of 34±9 years, with a mean duration of work experience 10±7 years. The usage of pre and post spraying protective measures in sprayers was significantly correlated with somewhat high mean values of serum cholinesterase activity (6055 u/l) and with a minor risk of OPs related illness, as compared to those sprayers who did not use these devices (4217 u/l).

Conclusion: The above mentioned results propose that sprayers in regular contact with OPs must be screened by clinical symptoms along with serum cholinesterase enzyme levels. It can identify those spray workers who are at threat to develop chronic toxicity. Health education must be given about adopting pre and post exposure preventive measures.

Key words: Organophosphorus compounds (OPs). Serum cholinesterase. Pre and post exposure preventive measures.

INTRODUCTION

Agricultural morbidity and mortality rate has been constantly high around the world for last many years in comparison to other high risk professions.¹ use of organophosphorus pesticides in farms causes more ill effects upon health of spray workers than farmers. Although pesticides cause increased production of crops by saving them from devastating effects of pests yet they yield serious health hazards to spray workers as well as environment.² While spraying agricultural compounds, either at the ground level or from the air, requires to be planned appropriately to reduce the off target toxicity.³ Old studies have revealed that acute toxicity by organophosphate pesticides in farm workers produces ill health effects, but long lasting effects due

to persistent occupational exposure to these chemicals in exposed workers is uncertain yet.⁴ Both urban and rural work involves practice of large number of machines and chemicals, having potential for causing injury to the body of worker. Similarly, toxic material may spill over into the environment affecting adversely the health of worker. Recognition of cause-effect relationship helps devise preventive measure for adoption in future and its medical certification serves the cause of justice to permit proportionate compensation to the worker.⁵ the job of forensic toxicology is to build cause and effect relationship between exposure to a drug or chemical and the toxic or lethal effects that result from this exposure. The occupational surroundings have contributed a

considerable part in the development of unwanted health impacts on human body because of elemental and organic risks for hundreds of years. ⁶ The regular use of older highly toxic OPCs has caused incidental acute or occupational chronic toxicity with high mortality rate specifically in developing countries like India, Pakistan and Bangladesh and it is an ongoing problem still. ⁷ Regulatory toxicology deals with the formation of laws and regulations, to minimize the consequences of these toxic chemicals over humans and the surroundings. ⁸

OBJECTIVE

The objective of present study was to measure levels of plasma cholinesterase in pesticide spray workers who take and who do not take pre and post exposure preventive measures.

MATERIAL & METHODS

Study Design: cross sectional study.

Study Setting: Central lab (Postgraduate Medical Institute/Lahore General Hospital) Lahore.

SAMPLE SELECTION

Inclusion criteria: Spray workers of male gender with exposure of 6 months to one year recently were selected. **Exclusion criteria:** Spray workers suffering from any physical disability, chronic diseases like hypertension, diabetes mellitus were not selected. Spray workers using medicines affecting neuromuscular junction like physostigmine were excluded.

Sample Collection: Samples were taken from Kahana, Mustafa-bad and jhalke sector of district Lahore in Punjab. **Sample Size:** 123 samples were got from spray workers.

Table 1: Age of study population

		N	Mean	Std. Deviation	Std. Error Mean	
Age	Workers	123	34.7805	9.51318	.85777	0.502

WORK EXPERIENCE:

Table 2: work experience of exposed group

		N	Mean	Std. Deviation	Std. Error Mean
Work experience	Workers	123	10.7683	7.37777	.66523

SERUM CHOLINESTERASE LEVELS:

To assess the impacts of organophosphate pesticides the mean values of serum cholinesterase level in OP exposed sprayers.

Table 3: Serum Cholinesterase levels in workers.

S.Cholinesterase	Mean \pm SD	Median (Q ₁ – Q ₃)	p-value*
Workers	4845.3 \pm 1367.9	5023.0 (3948.0 – 5934.0)	< 0.001

Sampling Technique: Non-probability purposive sampling.

Methodology: All participants were given brief details about our objective and answered the questions relating to procedure. Written and informed consent of the subjects was obtained. History was taken and general physical examination conducted, complaints and findings of subjects were recorded on history record proforma.

Sample Collection and Processing: Every worker who agreed to take part in this study filled a questionnaire. Under all aseptic measures; three ml of venous blood was drawn from antecubital vein, for plasma Cholinesterase estimation. Blood transferred into EDTA vial and put in ice box, shifted to central lab of LGH. Plasma separated immediately by centrifuging the sample at 2500 rpm for 10 minutes. Plasma was put into small cups and stored at -20 °C till further analysis. Pseudo cholinesterase is stable in the serum for 1 week at 2 - 8°C and for at least 3 months at - 20°. Plasma Cholinesterase was estimated by spectrophotometer.

RESULTS AND STATISTICAL ANALYSIS

Data Analysis: The data was arranged and interpreted by using SPSS 21 (Statistical Package for Social Sciences). Basic statistical techniques were used. Mean was calculated for serum cholinesterase levels. The data was presented in the form of tables and graphs. A non parametric test, *Mann-Whitney U test was applied. It does not require the assumption of normal distribution and as efficient as t test.

Table 4: Serum cholinesterase in sprayers using pre-spraying measures

A group with gloves,goggles,facemask	N	Mean	Std. Deviation	Std. Error Mean	
No	81	4217.8272	1223.96707	135.99634	<0.001
Yes	42	6055.3095	605.52124	93.43396	

Significant difference in serum cholinesterase level between both groups (with and without using gloves)

Table 5: Serum cholinesterase in sprayers using post-spraying measures

A group taking bath and changes clothes	N	Mean	Std. Deviation	Std. Error Mean	
No	9	3115.3333	973.59193	324.53064	< 0.001
Yes	114	4981.8333	1302.21718	121.96381	

Significant difference in serum cholinesterase level between both groups (with and without taking bath)

DISCUSSION

The Organophosphorus pesticides exposure is very common in agricultural countries. There are several conditions, where community can get expose to organophosphorus compounds, but the workers through occupational exposure are at greater risk than general public due to environmental exposure. Specifically the employees who dredge these pesticide chemicals on crops, farm animals or somewhere else known as pesticide applicators or sprayers, are in more alarming situation because they are in contact with these chemicals directly by spraying them.⁹ Organophosphate compounds are cholinesterase enzyme inhibitors and can cause neurotoxicity symptoms so serum cholinesterase enzyme is a biomarker utilized to observe organophosphates toxicity in workers exposed to them.¹⁰ The current study was conducted to estimate the biochemical parameter (serum cholinesterase) in spray workers exposed to pesticides who were selected from rural agricultural area of district Lahore . Most of the spray workers do not use any face mask, goggles, gloves, chemical resistant long shoes and any protective shield over clothes properly, and even if someone use any protective device, it seems to be inappropriate. Some workers just cover their faces with simple cloth piece only. Even some workers don't alter their clothes afterwards, and if some workers change, then do after one to two hours of spraying. They used to mix chemicals with uncovered hands. They used to eat after washing hands with plain water only, no usage of proper soap even. Very less of the sprayers used to read instructions booklet of pesticides handling before working.

In present study, a questionnaire was given to workers group, regarding personal protective equipment usage and data was analyzed as shown in table no 4 and 5.

As shown in table 4, total 123 workers were included, out of which 81 workers didn't use basic preventive measures before and during spray, while 42 workers used it. So considerably decreased levels of

serum cholinesterase observed in group, not using preventive measures. Significant difference in serum cholinesterase level between both groups with and without using gloves 6055u/ l and 4217u/ l was noted respectively, with a p value less than 0.001. The spray workers told that hot weather was the main trouble faced during spraying and due to humidity they were reluctant in using preventive measures.

CONCLUSION

The above mentioned results propose that sprayers in regular contact with OPs must be screened by clinical symptoms along with serum cholinesterase enzyme levels. It can identify those spray workers who are at threat to develop chronic toxicity symptoms and they must be replaced from their working place until their enzyme levels return within normal range to avoid OPs related morbidity. Health education must be given about adopting pre and post exposure preventive measures.

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