

## Evaluation of Fatal Self-Poisoning from Insecticides: An Institutional Based Study

Dr. Netramoni Kakati

Assistant Professor, Department of Forensic Medicine, Silchar Medical College, Silchar, Assam, India.

### ABSTRACT

**Background:** A key element of suicide prevention initiatives involves limiting access to lethal means, as impulsive self-harming behaviors in individuals with minimal intent to die can still result in fatal outcomes if high-lethality methods are readily available. Hence; the present study was conducted to evaluate fatal self-poisoning from insecticides.

**Materials & Methods:** A cohort of 50 patients with a documented history of self-poisoning due to insecticides was recruited for the study. Individuals who had ingested multiple insecticides or other toxic substances were excluded from participation. The patients continued to receive care from the hospital's consulting physicians, who held primary responsibility for their treatment. Management protocols were collaboratively established between the medical and study teams. The medical team independently made decisions regarding intubation and the transfer of patients to the intensive care unit. Atropine was administered following a standardized protocol. Patients deemed seriously ill by the ward's medical staff were transferred to the intensive care unit as beds became available. The activity of butyrylcholinesterase was evaluated, and the concentrations of organophosphorus insecticides in plasma were measured using reversed phase high-performance liquid chromatography.

**Results:** A total of 50 patients were evaluated. The mean age of the patients was 48.9 years. 90 percent of the patients were in rural residence. Chlorpyrifos, Dimethoate and Fenthion insecticide poisoning was seen in 46 percent, 34 percent and 20 percent of the patients respectively. Butyrylcholinesterase

activity among patients with Chlorpyrifos, Dimethoate and Fenthion insecticide poisoning was found to be 6.9 mU/mL, 625.7 mU/mL and 1.9 mU/mL respectively. Organophosphorus insecticide plasma concentration ( $\mu\text{U/mL}$ ) among patients with Chlorpyrifos, Dimethoate and Fenthion insecticide poisoning was found to be 5.9  $\mu\text{U/mL}$ , 713.8  $\mu\text{U/mL}$  and 21.9  $\mu\text{U/mL}$  respectively.

**Conclusion:** Suicide exerts a profound and lasting effect on the family, friends, and colleagues of the individual who have died. There is an urgent need for further research to establish a robust evidence base that can inform public health initiatives aimed at preventing suicides related to pesticide use in these areas.


**Key words:** Self-poisoning, Insecticides.

### \*Correspondence to:

Dr. Netramoni Kakati,  
Assistant Professor,  
Department of Forensic Medicine,  
Silchar Medical College, Silchar, Assam, India.

### Article History:

Received: 02-04-2017, Revised: 25-04-2017, Accepted: 20-05-2017

Access this article online	
Website: <a href="http://www.ijmrp.com">www.ijmrp.com</a>	Quick Response code 
DOI: 10.21276/ijmrp.2017.3.3.107	

### INTRODUCTION

The World Health Organization (WHO) reported an estimated 873,000 suicides globally in 2002, highlighting suicide as a significant contributor to premature mortality worldwide. A key element of suicide prevention initiatives involves limiting access to lethal means, as impulsive self-harming behaviors in individuals with minimal intent to die can still result in fatal outcomes if high-lethality methods are readily available.<sup>1,2</sup>

Consequently, it is crucial to identify the most prevalent suicide methods globally to develop effective strategies for restricting access to these highly lethal means and to enhance healthcare systems' capacity to treat individuals who resort to such methods. The elevated incidence of pesticide-related suicides in developing

nations can largely be attributed to the high fatality rates associated with pesticide ingestion, which starkly contrasts with the lower fatality rates of many substances commonly used in self-poisoning incidents in Western countries. Specifically, self-poisoning with certain widely used pesticides is particularly deadly, with case fatality rates exceeding 70% for substances such as paraquat and aluminium phosphide.<sup>3,4</sup>

Self-poisoning frequently takes place in the aftermath of an acute relational crisis rather than following prolonged periods of premeditation. In a previous study conducted involving 326 individuals who engaged in serious but non-fatal self-harm behaviors, it was found that 83% had consumed pesticides.

Notably, only 40% of these individuals had a diagnosable mental illness, and 35% indicated that they had contemplated self-harm for 10 minutes or less prior to their attempt.<sup>5-7</sup>

Hence; the present study was conducted to evaluate fatal self-poisoning from insecticides.

**MATERIALS & METHODS**

The present study was conducted in the Department of Forensic Medicine, Silchar Medical College, Silchar, Assam (India) to evaluate fatal self-poisoning from insecticides.

A cohort of 50 patients with a documented history of self-poisoning due to insecticides was recruited for the study. Individuals who had ingested multiple insecticides or other toxic substances were excluded from participation.

The patients continued to receive care from the hospital's consulting physicians, who held primary responsibility for their treatment. Management protocols were collaboratively established between the medical and study teams. The medical team independently made decisions regarding intubation and the transfer of patients to the intensive care unit. Atropine was administered following a standardized protocol.

Patients deemed seriously ill by the ward's medical staff were transferred to the intensive care unit as beds became available. The activity of butyrylcholinesterase was evaluated, and the concentrations of organophosphorus insecticides in plasma were measured using reversed phase high-performance liquid chromatography. All data were documented in a Microsoft Excel spreadsheet and subsequently analyzed statistically using SPSS software.

**RESULTS**

A total of 50 patients were evaluated. The mean age of the patients was 48.9 years. 90 percent of the patients were of rural residence. Chlorpyrifos, Dimethoate and Fenthion insecticide poisoning was seen in 46 percent, 34 percent and 20 percent of the patients respectively. Butyrylcholinesterase activity among patients with Chlorpyrifos, Dimethoate and Fenthion insecticide poisoning was found to be 6.9 mU/mL, 625.7 mU/mL and 1.9 mU/mL respectively. Organophosphorus insecticide plasma concentration (µU/mL) among patients with Chlorpyrifos, Dimethoate and Fenthion insecticide poisoning was found to be 5.9 µU/mL, 713.8 µU/mL and 21.9 µU/mL respectively.

**Table 1: Types of insecticides**

Type of insecticides	Number	Percentage
Chlorpyrifos	23	46
Dimethoate	17	34
Fenthion	10	20
Total	50	100

**Table 2: Butyrylcholinesterase activity (mU/mL)**

Type of insecticide	Butyrylcholinesterase activity (mU/mL)
Chlorpyrifos	6.9
Dimethoate	625.7
Fenthion	1.9

**Table 3: Organophosphorus insecticide plasma concentration (µU/mL)**

Type of insecticide	Organophosphorus insecticide plasma concentration (µU/mL)
Chlorpyrifos	5.9
Dimethoate	713.8
Fenthion	21.9

**DISCUSSION**

The report from the World Health Organization presents various recommendations aimed at decreasing the prevalence of suicide. These include enhancing the identification and treatment of mental health disorders, as well as bolstering community-based support systems. While these strategies are crucial for mitigating fatal self-harm on a global scale, their effectiveness in lowering suicide rates in rural Asia remains uncertain.<sup>8-11</sup> Effective primary and secondary prevention strategies tailored to the rural developing world are indeed feasible. Nonetheless, it is imperative that insecticide regulations are implemented on a national scale, ensuring uniform application across all sectors, especially among farming households. This could involve the deregistration of highly hazardous insecticide or permitting the use of safer alternatives only when two insecticides serve the same purpose. Additionally, alternative approaches may include granting insecticide application authority to a limited number of individuals within each community, thereby reducing household access to these chemicals, or establishing secure storage facilities for insecticide,

ensuring they are kept away from residences to minimize risk during periods of heightened stress.<sup>7-9</sup> Hence; the present study was conducted to evaluate fatal self-poisoning from insecticides. A total of 50 patients were evaluated. The mean age of the patients was 48.9 years. 90 percent of the patients were in rural residence. Chlorpyrifos, Dimethoate and Fenthion insecticide poisoning was seen in 46 percent, 34 percent and 20 percent of the patients respectively. Butyrylcholinesterase activity among patients with Chlorpyrifos, Dimethoate and Fenthion insecticide poisoning was found to be 6.9 mU/mL, 625.7 mU/mL and 1.9 mU/mL respectively. Organophosphorus insecticide plasma concentration (µU/mL) among patients with Chlorpyrifos, Dimethoate and Fenthion insecticide poisoning was found to be 5.9 µU/mL, 713.8 µU/mL and 21.9 µU/mL respectively. Gunnell D et al conducted a comprehensive review of global literature to assess the incidence of pesticide-related suicides across the six regions defined by the World Health Organization, as well as to evaluate the global impact of fatal self-poisoning due to pesticides. The researchers utilized a variety of data sources, including

Medline, EMBASE, psycINFO, references from relevant publications, internet searches via Google, and their own curated collections of academic papers and books. Their conservative estimate indicates that approximately 258,234 deaths occur annually from pesticide self-poisoning worldwide, representing 30% of global suicide cases. It is suggested that official statistics from India likely underreport the true incidence of suicides; when applying evidence-based adjustments to these figures, the estimated number of global suicides involving pesticides rises to 371,594. The proportion of suicides attributed to pesticide use ranges from 4% in the European Region to over 50% in the Western Pacific Region. Notably, this variation does not correlate with the amounts of pesticides sold in each area; rather, it is the patterns of pesticide application and the inherent toxicity of the substances that significantly affect the likelihood of their use in fatal self-harm incidents. Pesticide self-poisoning is responsible for approximately one-third of all suicides worldwide.<sup>11</sup> van Spijker et al. examined the conditions and traits associated with suicides. An exploratory psychological autopsy study was carried out involving 19 individuals who survived 13 suicide incidents. The findings indicated that impulsivity significantly contributes to self-poisoning cases, alongside factors such as aggression and the ready availability of pesticides. Cultural influences, upbringing, communication styles, and genetic predispositions might provide insights into the prevalence of self-poisoning as a suicide method among South Asians.<sup>12</sup>

Eddleston M et al conducted a study to evaluate the predictive value of admission plasma butyrylcholinesterase (BuChE) activity and organophosphate (OP) concentration in relation to mortality associated with two specific organophosphorus insecticides. The research involved a prospective analysis of 91 and 208 patients who had been diagnosed with self-poisoning from dimethoate or chlorpyrifos, respectively, and who were treated according to a standardized protocol. Measurements of plasma BuChE activity and OP concentration were taken upon admission, and subsequent clinical outcomes were documented. The findings indicated that a plasma BuChE activity level of less than 600 mU/ml at admission exhibited significant variability in its predictive capabilities; it demonstrated high sensitivity in cases of chlorpyrifos poisoning, yet its specificity was limited to 17.7%. Conversely, while the sensitivity for predicting mortality in dimethoate poisoning was low, the specificity was relatively adequate. Additionally, elevated OP concentrations at admission correlated with poorer clinical outcomes, although a definitive threshold concentration was only identified for dimethoate poisoning. Thus, while admission plasma BuChE activity can yield valuable insights, it necessitates careful interpretation.<sup>13</sup>

## CONCLUSION

Suicide exerts a profound and lasting effect on the family, friends, and colleagues of the individual who have died. Pesticide poisoning is primarily observed in rural regions, and the extensive medical attention necessary for treating patients affected by pesticide toxicity can significantly strain already limited healthcare resources. There is an urgent need for further research to establish a robust evidence base that can inform public health initiatives aimed at preventing suicides related to pesticide use in these areas.

## REFERENCES

1. World Health Report 2004. 2004, WHO, Geneva
2. Chugh SN, Dushyant, Ram S, Arora B, Malhotra KC: Incidence & outcome of aluminium phosphide poisoning in a hospital study. *Indian J Med Res.* 1991, 94: 232-235.
3. Kinyanda E, Hjelmeland H, Musisi S: Deliberate self-harm as seen in Kampala, Uganda – a case-control study. *Soc Psychiatry Psychiatr Epidemiol.* 2004, 39: 318-325.
4. Eferakeya AE: Drugs and suicide attempts in Benin City, Nigeria. *Br J Psychiatry.* 1984, 145: 70-73.
5. Gunnell D, Eddleston M: Suicide by intentional ingestion of pesticides: a continuing tragedy in developing countries. *Int J Epidemiol.* 2003, 32: 902-909.
6. Buckley NA, Karalliedde L, Dawson A, Senanayake N, Eddleston M: Where is the evidence for treatments used in pesticide poisoning? Is clinical toxicology fiddling while the developing world burns?. *J Toxicol Clin Toxicol.* 2004, 42: 113-116.
7. Li XY, Xu YC, Wang YP, Yang RS, Zhang C, Ji HY, et al. Characteristics of serious suicide attempts treated in general hospitals. *Chin J Ment Health* 2002;16: 681-4.
8. Obembe A, Ilechukwu STC, Tunwashe OL, Odukoya O: Self poisoning as seen in Lagos University Teaching Hospital: A Four Year Review. *The Nigerian Medical Practitioner.* 1986, 11: 49-53.
9. Hawton K: Restriction of access to methods of suicide as a means of suicide prevention. *Prevention and treatment of suicidal behaviour from Science to practice.* Edited by: Hawton K. 2005, Oxford: Oxford University Press, 279-291.
10. Jeyaratnam J: Health problems of pesticide usage in the Third World. *Br J Ind Med.* 1985, 42: 505-506.
11. Gunnell D, Eddleston M, Phillips MR, Konradsen F. The global distribution of fatal pesticide self-poisoning: Systematic review. *BMC Public Health* 2007, 7:357
12. van Spijker, B. A. J., Graafsma, T., Dullaart, H. I. A., & Kerkhof, A. J. F. M. Impulsive but fatal self-poisoning with pesticides among South Asians in Nickerie, Suriname: An exploratory autopsy study. *Crisis: The Journal of Crisis Intervention and Suicide Prevention* 2009; 30(2): 102–105. <https://doi.org/10.1027/0227-5910.30.2.102>
13. Eddleston M, Eyer P, Worek F, Rezvi Sheriff MH, Buckley NA. Predicting outcome using butyrylcholinesterase activity in organophosphorus pesticide self-poisoning. *Get access Arrow. QJM: An International Journal of Medicine.* 2008; 101(6): 467–474.

**Source of Support:** Nil. **Conflict of Interest:** None Declared.

**Copyright:** © the author(s) and publisher. IJMRP is an official publication of Ibn Sina Academy of Medieval Medicine & Sciences, registered in 2001 under Indian Trusts Act, 1882. This is an open access article distributed under the terms of the Creative Commons Attribution Non-commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

**Cite this article as:** Netramoni Kakati. Evaluation of Fatal Self-Poisoning from Insecticides: An Institutional Based Study. *Int J Med Res Prof.* 2017; 3(3): 489-91. DOI: 10.21276/ijmrp.2017.3.3.107