## Original Research Article

# Toxicological and demographic patterns in poisoning fatalities: a retrospective study at AIMS, B. G. Nagara

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### ABSTRACT

**Background:** Poisoning related fatalities represent a major global health concern, contributing to a substantial number deaths each year. Identifying mortality trends from such poisoning is fundamental to designing effective preventive and remedial strategies. The objective of study aims to examine the autopsy profile of poison related fatalities at AIMS, BG Nagara, India.
**Methods:** This study is 4 years retrospective case record analysis of a population comprising suspected poison cases brought for autopsy. The cases with suspected poisoning, confirmed through clinical evaluation or chemical analysis, were included in the study.
**Results:** During the study period, a total of 395 cases were examined, of which 113 (28.6%) were confirmed cases of poisoning. Among these, 90 cases (79.60%) involved males, while 23 cases (20.40%) involved females. The most affected age group was 31-50 years, accounting for 41 cases (36.30%). Regarding the manner of death suicidal poisoning was predominant, with 101 cases (89.40%), whereas accidental poisoning accounted for 12 cases (10.60%). Forensic chemical analysis (FSL) yielded positive identification of poisons in 84 cases (74.30%). Among the identified poisons, organophosphates poisoning was the most prevalent, observed in 57 cases (50.40%). The predominant survival duration prior to death was between one day and one week, observed in 55 cases (48.07%). Seasonal variation analysis showed minimal differences, with peak 29 cases (25.60%) recorded between September and November.
**Conclusions:** Poisoning is a major health issue, especially among middle-aged men, often linked to suicide. Better safety, mental health care and testing can help reduce deaths and improve public health.

**Keywords:** Autopsy, Insecticide, Organophosphates, Poisoning, Suicide

## INTRODUCTION

Poison is any substance that, when introduced into a living organism or comes into contact with any of its part, can cause adverse health effects or lead to death.[1] Poisoning is a serious global public issue, causing thousands of deaths annually, particularly in developing countries.

Investigating poisoning cases is highly challenging and both accidental and intentional poisoning contribute significantly to illness and death worldwide.[2] The world

health organization (WHO) estimates that, in 2016, unintentional poisoning was responsible for 106,683 deaths and a cumulative loss of 6.3 million disability-adjusted life years (DALYs).[3] The morbidity and mortality associated with poisoning cases vary depending on type of toxic agent involved and differ across countries.

In India, fatality resulting from poisoning are classified as unnatural deaths and mandatorily registered as medicolegal cases. In many instances accidental poisoning occurs due to insufficient awareness or lack of information regarding hazardous substances. The rapid advancement

of industrialization and agricultural practices has led to the widespread availability if insecticides, increasing the risk of severe toxic exposure and related health hazards.[4] This study aims to investigate the spectrum of toxic substances involved in poisoning cases within the study area, assess the demographic patterns by identifying the most vulnerable most affected sex and age groups and determine the predominant manner of death in poisoning incidents.

Furthermore, the research seeks to analyze the prevalence of various poisoning cases, surviving rate and seasonal variation encountered in Department of Forensic Medicine and Toxicology.

# METHODS

## Study design

The study follows a retrospective, cross sectional design.

## Study place

The present study was conducted at the Adichunchanagiri Institute of Medical Sciences, B.G. Nagara, a tertiary care teaching hospital situated in Nagamangala Taluk, Mandya District, Karnataka.

## Study duration

This study was conducted from 1st July 2024 to 31st December 2024.

## Inclusion criteria

The study included cases of suspected poisoning confirmed through either clinical diagnosis or positive chemical analysis findings.

## Exclusion criteria

Cases with an unknown history of poisoning, as well as other medicolegal cases, were excluded in the study.

## Data collection

A pre tested proforma was employed for data collection. This cross-sectional study encompassed all poisoning related autopsies conducted between January 2021 and December 2024 at mortuary of Department of Forensic Medicine and Toxicology, Aims, BG Nagara, Mandya, Karnataka.

Important factors such as age and sex distribution, manner of death as per police inquest, forensic science laboratory (FSL) reports on poisoning, types of poisons involved, survival period, seasonal variations were carefully examined. To ensure accurate recording of findings, a detailed proforma was specifically designed.

## Ethical approval

The study obtained formal approval from the institutional ethics committee if AIMS.

## Sample size

The sample size consists of 113 poisoning cases recorded between January 2021 and December 2024.

## Statistical analysis

The collected data was systematically entered into an excel spreadsheet and analyzed using SPSS software (version 22). Descriptive statistical measures, including mean frequency and percentage, were computed. The findings were then presented through relevant tables and figures for comprehensive interpretation.

# RESULTS

During the study period, a total of 395 autopsies were conducted at mortuary of AIMS, B.G. Nagara. Among these, 113 cases (28.6%) were attributed to poisoning (Figure 1). A demographic analysis of poisoning cases revealed a significant gender disparity, with males accounting for 90 cases (79.60%) and females comprising 23 cases (Table 1).

The examination of age distribution indicated that the highest incidence of poisoning related death occurred in 31-50 years age group, with 41 cases (36.30%). This was followed by the 51-70 years age group with 35 cases (31%), the 19-30 years age group with cases (21.20%) and 01-18 years age group with 8 cases (75%).

The lowest incidence was observed among individuals aged above 70 years, accounting for 5 cases (4.40%). These findings highlight a predominance of poisoning fatalities among middle-aged individuals (Figure 2).
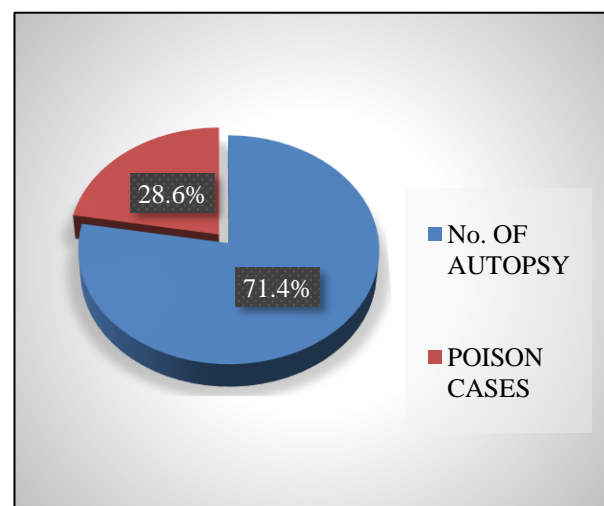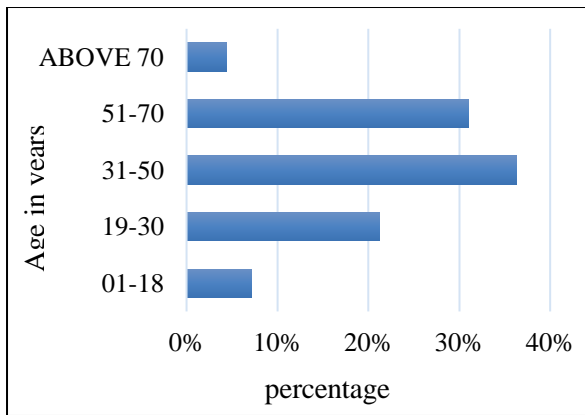


**Figure 1: Distribution of poison cases.**
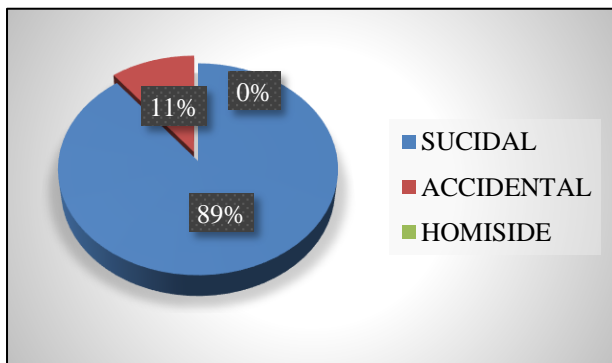
**Figure 2: Age distribution of poison cases.**



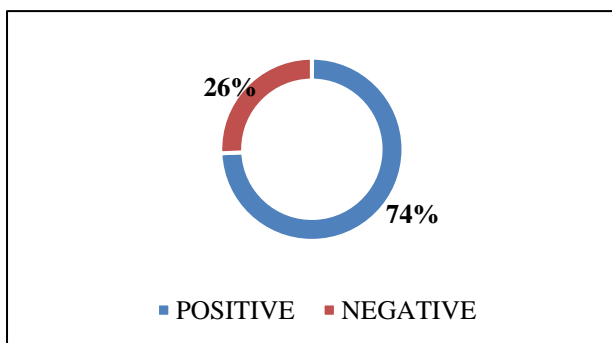**Figure 3: Distribution of Manner of death in poison cases.**
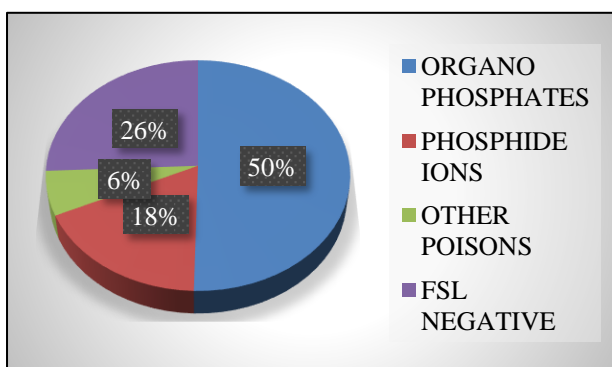


**Figure 4: FSL reports on poison cases.**



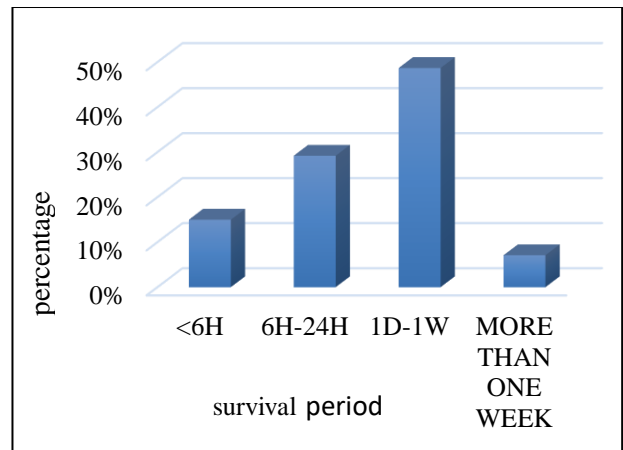**Figure 5: Distribution of classification of poisons.**



**Figure 6: Distribution of survival period.**

This study revealed a significant predominance of suicidal fatalities, accounting for 101 cases (89.40%) of total instances examined. Accidental deaths were comparatively fewer, comprising 12 cases (10.60%). Notably no instance of homicide (Figure 3).

The forensic science laboratory (FSL) chemical analysis reports revealed the presence of toxic substances in a majority of examined cases. Of the total cases analyzed, poisons were positively identified in 84 cases (74.30%) while 29 cases (25.70%) showed no detectable toxic compounds (Figure 4).

Regarding the classification of toxic agents, organophosphate compounds were most frequently encountered, accounting for 57 cases (50.40%). This was followed by phosphide ions, which were identified in 20 cases (17.70%). additionally other toxic substance was detected in 7 cases (6.2%) (Figure 5).

The analysis of survival period showed, the majority of individuals, accounting for 55 cases (48.70%), survived for a period ranging between 1day and 1 week following toxic exposure. This was followed by 33 cases (29.20%), where individuals succumbed within a shorter duration of 6 hours-24 hours. More critical subset of cases, comprising 17 individuals (15%) exhibit survival period less than 6 hours, 8 in total (7.10%) demonstrated survival period extending beyond one week (Figure 6).

The analysis of seasonal variation in case distribution revealed only marginal differences across different time period. The highest recorded incidence observed between September and November, accounting for 29 cases (25.60%).

The remaining three seasonal intervals march-May, June-august and December-February, each exhibit a comparable number of cases, with 28 cases (24.80%) recorded in each period. This near-uniform distribution indicates that the occurrence of poisoning cases may not be strongly influenced by seasonal factors (Table 2).

**Table 1: Gender distribution of poison cases.**

| Gender | Frequency | % |
|--------|-----------|-----|
| Male | 90 | 79.60 |
| Female | 23 | 20.40 |
| Total | 113 | 100 |

**Table 2: Distribution of seasonal variation in poison cases.**

| Seasonal variation | Frequency | % |
|--------------------|-----------|-----|
| March-May | 28 | 24.80 |
| June-August | 28 | 24.80 |
| September-November | 29 | 25.60 |
| December-February | 28 | 24.80 |
| Total | 113 | 100 |

## DISCUSSION

During the study period from January 2021 to December 2024, a total 395 autopsies were conducted in department of forensic medicine and toxicology at AIMS, B G Nagara, Mandya. Among these cases, 113 (28.6%) were determined to be fatalities resulting from poisoning. A notable male predominance was observed, with 90 cases (79.60%) involving male victims, while 23 cases (20.40%) involved female victims.

This gender disparity aligns with findings from similar studies conducted across various regions in India, reinforcing the trend of higher susceptibility to poisoning-related fatalities among males.[2,4-15] The widespread availability of toxic substance, lack of awareness regarding safe handling, inadequate mental health support, substance and alcoholic abuse contribute to this concerning trend.

Our study on age distribution in poisoning- related deaths revealed that highest incidence occurred within the 31-50 years age group. This result is consistent with prior studies conducted by Goswamy et al, Chandran et al, Mahender et al, Kiran et al and Kumar et al, who also observed peak prevalence of poisoning cases in this particular age range.[5,7,10,11,14] However, our findings contrast with those reported by Sharma et al and Kidiyoor et al, who identified age group from 18-30 years are being more significantly affected.[4,15]

Our study on manner of death has revealed that the majority of cases fall under category of suicide. This finding aligns with observation reported in previous studies conducted by Gunjan et al, Sharma et al, Goswamy et al, Ahamed et al, Chandran et al, Shanawaz et al, Barthy et al, Rasheed et al, Kumar et al, Kidiyoor et al, their research also identified suicide as a predominant manner of death, reinforcing the consistency of this trend across different study populations and contexts.[2,4-8,11,12,14,15] The findings from forensic science laboratory's chemical analysis reports indicate a significant presence of toxic substance in majority of examined cases. Out of the total

cases analyzed, 84, were confirmed to contain identifiable toxic compounds, while 29 cases showed no detectable traces of any toxic substance. The results align closely with findings reported in studies conducted by Goswamy et al, an Mahender et al, which similarly observed high prevalence of toxic substance in forensic toxicology cases.[5,10] Detection of poison in forensic tests becomes in cases such where the patient undergone prolonged medical treatment after intake of poison, metabolism and elimination, biotransformation, sample degradation, low initial dose and limiting testing capabilities.

During our research period, organophosphorus compounds emerged as the most frequently encountered toxic agents, accounting for 57 cases, which constitutes 50.50% of total analyzed cases.

This result is consistent with previous studies conducted by Gunjan et al, Sharma et al, Goswamy et al, Ahamed et al, Chandran et al, Shanawaz et al, Yangala et al, Mahender et al, Rasheed et al, Kumar et al, Kidiyoor et al, which also reported a high prevalence of organophosphorus poisoning in forensic toxicology cases. The widespread occurrence of organophosphorus poisoning can be attributed to its extensive use in agriculture as pesticides, easy accessibility and relatively low cost.[2,4-10,12,14,15]

The analysis of survival period revealed that the majority of individuals, comprising 55 cases (48.70%), survived for a duration ranging from one day to one week. This finding contrast with previous studies, such as that Niranjan Kumar Gunjan et al, where the majority of cases had survival period of less than 24 hours.[2] Similarly, Shanawaz et al, reported that most individual survived for a period of 6 to 24 hours, while Kidiyoor et al, survival duration was under 24 hours.[8,15] These discrepancies may be attributed to variations in study populations, the severity of conditions, the availability and quality of medical interventions and differences in healthcare infrastructure across study setting.

Our study on seasonal variation in case distribution revealed only marginal difference across different time periods. The highest recorded incidence was observed between September to November accounting for 29 cases (25.65) the remaining three seasons exhibit a comparable number of cases with 28 cases (24.8%). this is contrast with previous studies where Goswamy et al, reported the highest incidence between June and august, while Kumar et al, observed the peak between march and May.[5,14]

The study did not include psychological evaluation or socioeconomic background of the victims, which could have provided deeper insight into the suicidal intent and preventive strategies. Although spanning four years, the relatively small number of cases per season limits the ability to draw strong conclusions about seasonal variation.

## CONCLUSION

Poisoning remains a significant health concern, with notable impact on middle-aged men and predominant association with suicidal intent. Pesticides are extensively utilized in agricultural practices and their widespread availability has inadvertently facilitated their misuse for suicidal purpose. Prioritizing occupational safety, particularly for individual working in agriculture and industrial sectors helps in preventing accidental toxic exposure. Additionally improving forensic toxicological testing methods can aid in more accurate detection and analysis of toxic substances in medico-legal cases. A combination of regulatory measures, mental health initiatives, medical advancements and public awareness campaigns is essential to mitigate the burden of poisoning-related fatalities and improve overall public health concern.

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