

# Outcomes of Patients with Acute Chemical Poisoning in Public Referral Hospitals of Bahir Dar City, Ethiopia

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## ABSTRACT:

**Background:** Acute chemical poisoning is a global public health concern. It is influenced by factors such as geographical differences, availability of chemical substances, occupation, and industrialization. Widespread pesticide use in developing countries increased its incident. There is insufficient epidemiological data in the region to manage and intervene the problem. The study aims to assess the outcome of acute chemical poisoning cases in two public specialized hospitals of Bahir Dar city, Ethiopia from May 2022 to November 2023.

**Method:** A retrospective cross-sectional study was conducted at the Emergency departments of the two public hospitals in Bahir Dar City from May 2022 to November 2023 to assess the outcome of acute chemical poisoning cases. A total of 619 registered patients diagnosed with poisoning were included in the study. Socio-demographic data were collected from the medical records of acute poisoning patients using a data collection checklist. Descriptive analysis was performed using statistical tools in Statistical Package for Social Science (SPSS), and the results were presented through tables and graphs. Ethical approval was obtained from the Amhara National Regional State Public Health Institute Research Ethics Review Board (ARRERB), and cooperation letters to the hospitals were requested.

**Results:** There was a higher incidence of chemical poisoning in females than in males. Seventy percent of the cases were between 15-29 years of age. 86.16% of the chemical poisoning cases were attributed to Organophosphates and Metallo Phosphides. The most reported complaints 97.4% cases were vomiting, and abdominal pain. Chemical poisoning cases were primarily intentional accounting for 93.3% of the cases. Twelve percent of acute chemical poisoning cases were died. The study indicates a higher (32.10%) cases in Spring and fewer (18.01%) cases in Autumn.

**Conclusion:** Acute chemical poisoning is more common in females and youths aged 11-30 years, primarily due to organophosphorus chemicals, often resulting from intentional poisoning. Effective strategies are essential for safely storing and distributing highly toxic chemicals, especially to prevent children from accessing them.

**Keywords:** Acute chemical poisoning; Bahir Dar; Ethiopia; hospital; outcome; patients; pattern.

## አገጽጽተ ጥናት

**የጥናት መግቢያ:-** አጣጣሪ የኬሚካል መመረዝ የዓለም የተበረታታ ጤና አሳሳቢ ጉዳይ ነው። እንደ መልካምድራዊ ልዩነቶች፣ የኬሚካል ቁሶች ተደራሽነት (መገኘት መቻሉ)፣ ወረራና የኢንዱስትሪ መስፋፋት የመሳሰሉ ተላውጦቶች በአጣጣሪ የኬሚካል መመረዝ መከሰቶች ላይ ተፅዕኖ ያደርጋሉ። በሚደግ ላይ ባሉ ሀገሮች የፀረ ተባይ ኬሚካሎችን በሰፋ ጥቅም ላይ ማዋል አጣጣሪ የኬሚካል መመረዝ መከሰቶችን ይጨምራል። በክልሉ ችግሩን በአግባቡ ለመያዝና ለችግሩ ምላሽ ለመስጠት በቂ በአጣጣሪ የኬሚካል መመረዝ መከሰቶች ላይ ያተኮረ ሳይንሳዊ የስርጭትና ቁጥጥር ጥናት መረጃ የለም። ይህ ጥናት እ.አ.አ. ከግንቦት 2022 እስከ ኅዳር 2023 በነበረው ጊዜ በባሕር ዳር ከተማ፣ ኢትዮጵያ ውስጥ በሚገኙ ሁለት የመንግሥት ስፔሻላይዥድ ሆስፒታሎች ውስጥ በአጣጣሪ የኬሚካል መመረዝ ታማሚዎች ላይ የተስተዋሉ ፓተርኖችና የተገኙ ውጤቶችን መገምገም ነው።

**የጥናት ዘዴ:-** በአጣጣሪ የኬሚካል መመረዝ ታማሚዎች ላይ የተስተዋሉ ፓተርኖችና የተገኙ ውጤቶችን ለመገምገም፣ እ.አ.አ. ከግንቦት 2022 እስከ ኅዳር 2023 በነበረው ጊዜ በባሕር ዳር ከተማ ውስጥ በሚገኙ ሁለት የመንግሥት ስፔሻላይዥድ ሆስፒታሎች ውስጥ በድንገተኛ ክፍሎች ላይ ዳጎራይ ተሻጋሪ ጥናት ተካሂዷል። በጥናቱ በመመረዝ ምርመራ የተመዘገቡ 619 ታማሚዎች ተካትተዋል። የማኅበረ ሥነ ህዝባዊ ተላውጦቶች መረጃዎች ቴክኒሲቶችን

በመጠቀም ከአጣጣሪ የመመረዝ ታማሚዎች የሕክምና መዝገቦች ተሰብስበዋል። የተሰበሰበው መረጃ የኤስፒኤስኤስ (SPSS) ስታቲስቲካዊ መሳሪያዎችን በመጠቀም በገጣጭ ትንተና ቀርቧል። መረጃው ተተንትኖ የቀረበው ሰንጠረዦችንና ግራፎችን በመጠቀም ነው። የምርመራ ሥነምግባራዊ ማረጋገጫ ከአማራ ክልል የምርመራ ሥነምግባር ግምገማ ቦረድ ተገኝቶ የነበረ ሲሆን ለሆስፒታሎች የትብብር ደብዳቤ ተልኳል።

**የጥናት ውጤት:-** የጥናቱ ውጤት እንደሚያሳየው ከጾታ አንጻር የኬሚካል መመረዝ መከሰት ከወንዶች የበለጠ በሴቶች ላይ ከፍተኛ ነበር። ከእድሜ አኳያ ደግሞ 70 በመቶ የሚሆኑት የኬሚካል መመረዝ ታማሚዎች ከ15-29 ዓመት የእድሜ ክልል ያሉ ወጣቶች ነበሩ። 86.16 በመቶ የሚሆኑት የኬሚካል መመረዞች የተከሰቱት በኦርጋኖፎስፎሬት (Organophosphate)ና በሜታሊክ ፎስፎይድ (Metallo phosphide) አማካኝነት የተከሰቱ ነበሩ። 97.4 በመቶ የሚሆኑት ታማሚዎች ያሳዩዋቸው ምልክቶች ማስመለስና የሆድ ህመም ነበሩ። የኬሚካል መመረዞች የተከሰቱት በቀዳሚነት (93.3 በመቶ) ሆነ ተብለው ነው። 12 በመቶዎቹ የኬሚካል መመረዝ ታማሚዎች ሞተዋል። ጥናቱ ከፍተኛ የኬሚካል መመረዞች (32.1 በመቶ) የተከሰቱት በጸደይ እንደነበርና ዝቅተኛ የኬሚካል መመረዞች (18.1 በመቶ) ደግሞ የተከሰቱት በበልግ እንደነበር አሳይቷል።

**የጥናት ማጠቃለያና ምክረጠብ:-** አጣጣሪ የኬሚካል መመረዝ መከሰት ከ11-30ዓመት የእድሜ ክልል ባሉ ወጣቶች ከፍተኛ ነበር።

ለመመረዘት በጣም የተለመዱት ኬሚካሎች ኦርጋኖፎስፎረት የነበሩ ሲሆን ሆነ ብሎ መመረዝ ደግሞ ዋነኛው አጣዳፊ የኬሚካል መመረዝ መከሰት ምክንያት ነበር። በጣም መርዛማ የሆኑ ኬሚካሎችን አቀማመጥና ሥርዓት በተለይ ልጆች እንዳይደርሱቸው ውጤታማ የመመረዝ መከላከያ ስልቶች ያስፈልጋሉ።

**ቁልፍ ቃላት:-** አጣዳፊ የኬሚካል መመረዝ፣ ባሕር ዳር፣ ኢትዮጵያ፣ ሆስፒታል፣ ውጤት፣ ተማሚዎች፣ ፓተርኖች

### BACKGROUND

A poison is any substance that is harmful when ingested, inhaled, injected, or absorbed in to the body. Poisoning is a qualitative term that refers to a chemical substance’s ability to have a negative or harmful effect on the body <sup>1</sup>. Poison can enter the body through various routes, leading to systemic and local effects. Poisoning can happen intentionally or accidentally, such as through occupational exposure, environmental contact, or everyday activities at home. Accidental or non-intentional poisoning refers to incidents where drugs or chemicals are used inadvertently, without purpose <sup>2</sup>.

Acute chemical poisoning refers to the rapid onset of toxic effects, typically within 24 hours of exposure, regardless of the route of exposure, whether intentional or unintentional <sup>3</sup>. It is a frequent cause of emergency admissions and hospitalizations, often leading to illness and death. Poisoning represents a substantial global public health issue <sup>4,5</sup>. According to World Health Organization (WHO) data from 2012, around 193,460 deaths worldwide were attributed to unintentional poisoning, with 84% of these occurring in low- and middle-income countries <sup>4</sup>. The World Health Organization (WHO) estimates that deliberate ingestion of pesticides causes 370,000 deaths each year, ranking poisoning among the top 50 causes of death worldwide <sup>6</sup>.

The actual number of incidents could be higher since many cases of poisoning go unreported <sup>7</sup>. Patterns and causes of acute poisoning vary across geographical regions, even within the same country or region <sup>7</sup>. Studies indicate that the incidence of poisoning in a particular area is influenced by the accessibility of toxic substances, the prevalent occupations within the community, and religious and societal factors <sup>8</sup>. The number of cases is increasing daily due to changes in lifestyle and social behavior <sup>4</sup>. The rapid expansion of industry and the widespread use of pesticides and drugs have resulted in increased incidents of poisoning and potential harm when used incorrectly <sup>8, 9</sup>. Agricultural pesticides and household cleaning agents are commonly used poisons in developing countries <sup>10</sup>. The increase in poisoning cases in developing nations is attributed to inadequate regulation of drugs and chemicals, weak surveillance systems, insufficient enforcement measures, and easy access to various substances <sup>9</sup>.

Acute pesticide poisoning, especially in developing countries, results in substantial morbidity and mortality due to factors such as lack of standardized case definitions, underreporting, inadequate documentation, and a shortage of tools and expertise <sup>11, 12</sup>.

In a study conducted at two hospitals in Ambo, Ethiopia, the hospital prevalence of acute poisoning was 1.7% <sup>13</sup>. It is notably more prevalent among females and individuals under 30 years of age <sup>10</sup>. According to the Ethiopian Public Health Institute (EPHI), in their epidemiological bulletin for week 23, a total of 387 cases of chemical poisoning and 21 deaths were reported from January 1, 2022, to June 6, 2022. Among these, 216 cases (55.81%) and 11 deaths (52.38%) occurred in the Amhara region <sup>14</sup>.

Although acute chemical poisoning is a prevalent health issue, it is often overlooked due to challenges in diagnosing poisoning cases <sup>15</sup>. Understanding current trends is essential for improving diagnosis, management, intervention, and prevention strategies. Therefore, this research aimed to investigate the patterns and clinical outcomes among acute poisoning cases treated at Felege Hiwot Comprehensive Specialized Hospital (FHCSH) and Tibebe Ghion Specialized Hospital (TGSH) over nineteen-month period from May 2022 to November 2023.

### METHODS

#### Study Area and Period

Bahir Dar, the capital city of the Amhara Region, is located 567 km northwest of Addis Ababa, the capital city of Ethiopia. The city is situated at the geographical coordinates of 11° 35' 34" N and 37° 23' 03" E. The city administration includes three smaller urban areas: Zegie, Tis Abay, and Meshenti. According to the Bahir Dar administration's estimation for 2022, the city's total population was approximately 422,580, with females accounting for 51% (215,516 individuals). Bahir Dar is administratively divided into 20 kebeles, which are the smallest administrative units in the country. The area encompasses a total of 40,893 households, with an average of 4.47 persons per household. The population density is 753 persons per square kilometer. Approximately 81.2% of the population resides in urban areas, while the remainder lives in rural kebeles surrounding Bahir Dar<sup>16</sup>. The city hosts three public hospitals, 10 health centers, 15

health posts, four private general hospitals, and 16 private clinics. The study was conducted at the Emergency Departments (ED) of two selected public hospitals: Felege Hiwot Comprehensive Specialized Hospital (FHSRH) and Tibebe Ghion Specialized Hospitals (TGS) in Bahir Dar city administration, located in the northwest region of Ethiopia, from May 2022 to November 2023.

### Study Design and Study Population

An institutional-based retrospective cross-sectional study was conducted to assess the patterns and clinical outcomes of acute poisoning cases at the Emergency Outpatient Departments (EOPD) of the two selected hospitals.

### Inclusion criteria

Patients of all age groups who presented with acute poisoning to the emergency department were included and listed in the registry of emergency cases during the study period.

### Exclusion Criteria

Patients with recreational drugs of abuse (such as alcohol and cocaine), patients affected by natural poisons like stings and envenomation, and acute poisoning cases with incomplete information on the patient registry form were excluded from the study. Only one case of acute chemical poisoning was excluded due to incomplete data.

### Sampling Technique and Sample Size

The sample size comprised all recorded data of acute chemical poisoning cases at the Emergency Departments (ED) of the two purposely selected high-volume specialized public hospitals in Bahir Dar city: Felege Hiwot Comprehensive Specialized Hospital (FHSRH) and Tibebe Ghion Specialized Hospital (TGS). A total of 619 patients were registered in the Emergency Department of these hospitals with a primary diagnosis of acute chemical poisoning, and their histories were documented in the emergency registry forms. During the study period were included in the study.

**Dependent Variables:** Outcome of Acute chemical poisoning

**Independent Variable:** Age, sex, route of poisoning, type of chemical poisoning, poisoning situation, and season of poisoning.

### Data Collection Tool and Procedure

A data collection checklist containing the variables to be collected from the patient registry was prepared and used for data extraction. The data were collected by two BSc nurses with experience in data collection,

who were trained on the data collection process. Patients with acute poisoning were identified and selected from the patient registration books. Socio-demographic data (age, sex), route of exposure, clinical presentation/presenting complaint, type of poisoning, season of poisoning, and outcome of poisoning were extracted from the patients' medical records.

### Data Quality Assurance, Data Processing, and Analysis

The data collection process was supervised and supported by supervisors. Data recorded in Microsoft Excel was immediately checked for completeness, accuracy, and consistency after collection, and was appropriately organized and stored for compilation and analysis. After reviewing and ensuring completeness, Statistical Package for the Social Sciences (SPSS) version 25 software was used to analyze the data. Descriptive statistical tools, such as percentages and frequencies, were employed to report the data. Results were presented using percentage breakdowns, frequency tables, and figures.

### Operational Definition

- **Acute chemical poisoning:** Acute chemical poisoning occurs when toxic effects manifest immediately, typically within 24 hours of exposure to the chemical.
- **Intentional poisoning:** Poisoning occurs when a person ingests or administers a substance with the intent to cause harm.
- **Unintentional poisoning:** Poisoning can occur when a person ingests or administers a substance unintentionally or without apparent reason, resulting in harm.
- **Outcome is death:** A case of chemical poisoning in the emergency department of a hospital is considered acute when toxic effects manifest rapidly after exposure to the chemical. The clinical outcome is recorded as death if the patient succumbs to the poisoning before being discharged from the hospital.
- **Outcome is alive:** When a chemical poisoning case in the emergency department of the hospital is presented as an acute chemical poisoning and when the clinical outcome during discharge from the hospital is alive.
- **Left against medical advice:** When a case of chemical poisoning is presented in the emergency department of the hospital, and the patient is unable to follow the medical advice or treatment options provided by the healthcare providers.

## RESULTS

### Socio-demographic characteristics

The study revealed that acute chemical poisoning cases were more prevalent among females (66.56%) than males (33.44%). Most cases occurred in the age group 15-39 years, constituting approximately 70% of all acute chemical poisoning cases (22.1% aged 15-19, 29.8% aged 20-24, and 18.1% aged 25-29). The

majority of cases were from Bahir Dar City Administration (358 cases, 57.84%). Awi, Bahir Dar, Central Gondar, East Gojjam, South Gondar, and West Gojjam were the residence zones of the cases among which 358 (57.84%) were from Bahir Dar, 117(18.9%) from West Gojjam, 117(18.9%) from South Gondar, 10(1.62%) from East Gojjam, 10(1.62%) from C. Gondar, 7(1.13%) from Awi zone (Table 1).

Table 1 Socio-demographic characteristics of patients presenting with chemical poisoning cases at Felege Hiwot Comprehensive Specialized Hospital and Tibebe Ghion Specialized Hospitals from May 2022 to November 2023 (n=619)

Variable	Category	Frequency (n)	Percent (%)
Sex	Female	412	66.56
	Male	207	33.44
Age by 5-year Category	0-4	2	.3
	5-9	1	.2
	10-4	10	1.6
	15-19	137	22.1
	20-24	185	29.8
	25-29	112	18.1
	30-34	52	8.4
	35-39	35	5.6
	40-44	30	4.8
	45-49	22	3.55
	50-54	16	2.6
	55-59	8	1.3
Residence of acute chemical poisoning cases	60-64	6	1.0
	>=65	3	.5
	Awi	7	1.13
	Bahir Dar	358	57.84
	Central Gondar	10	1.61
	East Gojjam	10	1.61
	South Gondar	117	18.90
West Gojjam	117	18.90	

### Proportion of acute chemical poisoning cases per age categories

The proportion of chemical poisoning cases among individuals aged 15-19, 20-24, 25-29, and 30-34 was 22.13%, 29.89%, 18.09%, and 8.40% respectively, collectively accounting for 78.5% of all chemical poisoning cases within the 15-34 age group. A similar trend was observed among residents of Bahir Dar, with

percentages of 22.63%, 30.73%, 21.23%, and 8.10% in the respective age groups, totaling 82.69% of all cases among Bahir Dar residents.

Regarding age, acute chemical poisoning cases were similar among Bahir Dar city residents and the overall cases at the two hospitals. Most of these cases occurred in the 15-30 age group (Figure 1).

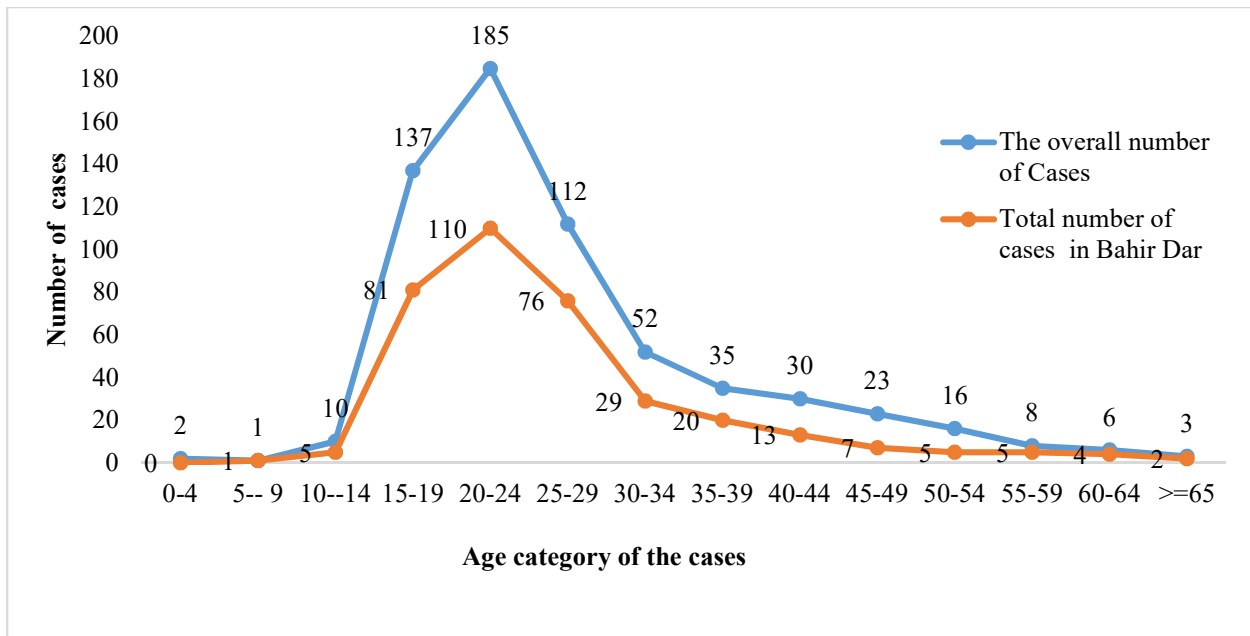


Figure 1 Acute Chemical Poisoning Cases by Age Group at Felege Hiwot Comprehensive Specialized Hospital and Tibebe Ghion Specialized Hospital, Bahir Dar City, Amhara Region, Ethiopia (May 2022 – November 2023)

**Type of chemical poisoning agent and clinical presentations**

The types of complaints commonly associated with chemical poisoning include vomiting, abdominal pain, difficulty breathing, burning sensation, chest pain, fatigue, and loss of consciousness. According to the study, vomiting was the most commonly reported

symptom among poisoning cases, noted in 61.34% of cases, followed by abdominal pain, reported in 36.07% of cases. Furthermore, the study found that 95.4% of chemical poisonings were attributed to five types of chemicals: Organophosphates (57.95%), Metallo Phosphides (28.21%), rat poison (3.76%), drug overdose (2.74%), and bleach (2.74%) (Figure 2).

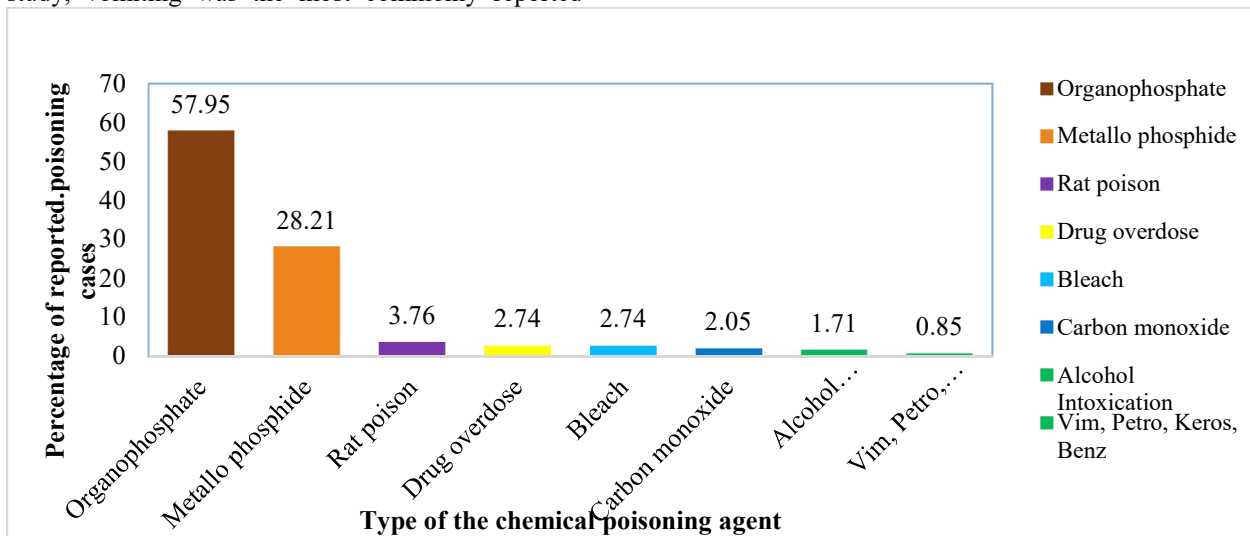


Figure 2 Distribution of chemical poisoning agents among patients presented at Felege Hiwot Comprehensive Specialized Hospital and Tibebe Ghion Specialized Hospitals, Bahir Dar City, from May 2022 to November 2023, Amhara Region, Ethiopia.

**Outcome of acute chemical poisoning**

The acute chemical poisoning cases were reported by two specialized public hospitals in the Amhara region: Felege Hiwot Comprehensive Specialized Hospital,

which accounted for 80.3%, and Tibebe Ghion Specialized Teaching Hospital, which accounted for the remaining 19.7% of cases. Regarding the outcomes of poisoning, the majority (87.6%) of cases showed improvement and survival, while 12.1% of acute

chemical poisoning cases resulted in death, with only 0.3% leaving against medical advice (Figure 3).

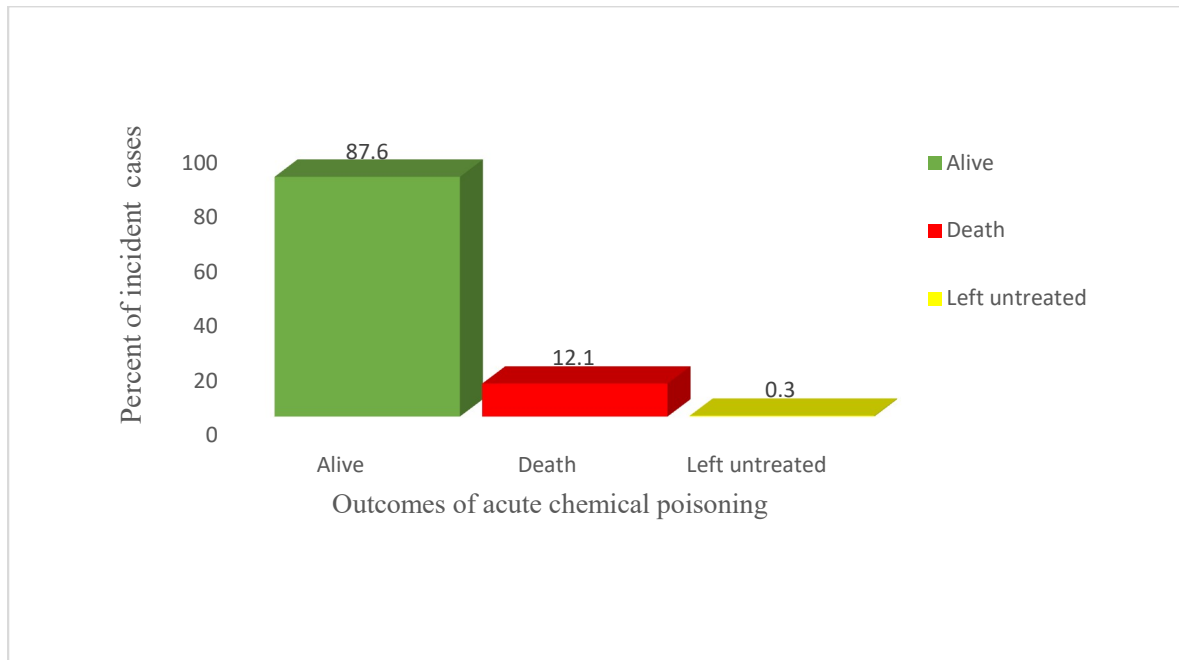


Figure 3 Outcome of chemical poisoning among cases presented at Felege Hiwot Comprehensive Specialized Hospital and Tibebe Ghion Specialized Hospitals, Bahir Dar City, Amhara Region, Ethiopia, from May 2022 to November 2023.

#### Pattern of Acute Chemical poisoning per season

The causes of acute chemical poisoning included both intentional and accidental occurrences. The study revealed that the majority, 97.3% of cases, were intentional, while the remaining 2.7% were accidental. A one-year data to illustrate seasonal variations showed a higher number of cases occurring in Spring, with proportions of 32.10% in Spring, 27.48% in Winter, 22.40% in Summer, and 18.01% in Autumn (Figure 4).

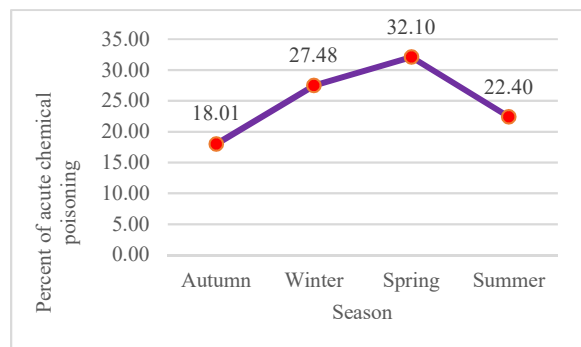


Figure 4 Trends in acute chemical poisoning cases by season among patients presented at Felege Hiwot Comprehensive Specialized Hospital and Tibebe Ghion Specialized Hospitals, Amhara Region, Ethiopia.

#### DISCUSSION

The study found that females accounted for 66.56% of poisoning cases, representing a ratio of 1.99:1 compared to males. This trend mirrors findings from other studies: in Wellega, Ethiopia, 59.2% of poisoning cases were females<sup>9</sup>; a review across Ethiopia indicated rates as high as 78% of chemical poisoning cases in females<sup>10</sup>. Similar proportions were observed in Goztepe Training and Research Hospitals in Turkey (64.7%)<sup>17</sup>, as well as in studies conducted in central and zonal district hospitals and a tertiary care hospital in South India<sup>2, 18</sup>. A possible explanation for these findings is the higher suicide rates among females in Ethiopia, influenced by cultural norms and practices. Young females in Ethiopia often experience close monitoring by their families, leading to behaviors such as concealing intimate relationships to avoid conflict. This can result in familial and personal discord, potentially prompting suicide attempts involving various poisons or drugs<sup>19</sup>.

The average age of acute chemical poisoning cases by the current study was 26.45 years, with a standard deviation of 10.7 years. The finding was consistent with the findings of studies which found that the average age of acute chemical poisoning cases were: 25.5 years at University of Gondar Teaching Hospital<sup>20</sup>, 25.18 years in Adama referral hospital<sup>21</sup>, 24.36 years in teaching hospitals of Northwest

Ethiopia<sup>19</sup>, 23.1 years in hospital of Adama medical college<sup>22</sup>, 25 years in Tikur Anbessa specialized teaching hospital 23, and 27.4 years in Goztepe Training and Research Hospitals in Turkey<sup>17</sup>. It was also found that 77.38.5% of the cases were between 11 to 30 years. This finding was similar to a study conducted at Tikur Anbessa Hospital in Addis Ababa, where 87.9% of poisonings occurred among individuals aged between 13 to 30 years<sup>23</sup>, 66.2% between age 12-29 years in two hospitals of Ambo 13, 70.4% in age between 11-30 years in Debre Markos<sup>24</sup>, 76.7% between age group 11-30 years in Dessie Referral Hospital Ethiopia<sup>25</sup>, 79.6% between age group 13-34 years in Addis Ababa Burn, Emergency, and Trauma Hospital<sup>26</sup>, 88.42% between age group 11-30 years in University of Gondar teaching hospitals northwest Ethiopia<sup>27</sup>; 60.9% between 10-30 years in a tertiary care teaching hospital in Southern India<sup>28</sup>. In this study, the age group most vulnerable to acute chemical poisoning was young adults between 15-30 years of age. This finding aligns with similar studies conducted in Ethiopia<sup>10</sup>, Kenya<sup>29</sup>, India<sup>30</sup>, Iran<sup>31</sup>, and China<sup>32</sup>. The high incidence of acute chemical poisoning among young adults can be partially attributed to their susceptibility to stressful life circumstances and their emotional vulnerability, which may lead to suicidal tendencies. Additionally, this age group often experiences adjustment disorders, further predisposing them to suicidal behaviors<sup>33</sup>. moreover, young adults in this age group frequently encounter challenges such as romantic disappointments, job or academic failures, and the pressure of meeting parental expectations, all of which can contribute to their heightened risk of chemical poisoning and suicidal acts<sup>31-33</sup>.

The study found that Organophosphate and Metallo Phosphide were the most common chemical agents involved in poisoning cases, accounting for 57.95% and 28.21% of cases, respectively. Specifically, the study confirmed the presence of 61.3% Organophosphate and 25.7% Metallo Phosphide at DMCSH<sup>24</sup>. This finding is aligned with studies in selected hospitals in Wollega Ethiopia<sup>9</sup>, Ambo Ethiopia<sup>13</sup>, Dessie Ethiopia<sup>25</sup>, teaching hospitals in Lusaka, Zambia<sup>34</sup>, urban referral hospitals in Lusaka, Zambia<sup>35</sup> which reported organophosphates were the most commonly used chemical poisoning. The prevalence of organophosphate poisoning may be attributed to their widespread use as chemical agents, with agrochemicals being the most commonly used for self-harm in developing countries<sup>36, 37</sup>. A study in Ethiopia (2016) found that pesticides, herbicides, and insecticides are the most common cause of poisoning in less industrialized countries, due to poor safety

culture, illiteracy, ignorance, and lack of protective devices<sup>38</sup>.

This study found that the cause for majority (97.3%) of chemical poisoning cases were intentional poisoning. This finding is similar with the finding of studies: 98.0% in Addis Ababa Ethiopia<sup>26</sup>, Though relatively lower as compared to our finding, higher intentional poisoning cases were also reported 76.9% in Ambo Ethiopia<sup>13</sup>, 77.8% in Nepal<sup>38</sup>, and 96.6% in Tikur Anbesa Hospital Addis Ababa, Ethiopia<sup>23</sup>, which revealed intentional poisoning was the most common cause or manner of poisoning. The current findings indicate a higher incidence rate than those reported in Wollega, Ethiopia (46.45%)<sup>9</sup>, Dessie, Ethiopia (64.2%)<sup>25</sup>, and India (68.40%)<sup>39</sup>. The discrepancies observed may be from socioeconomic disparities, as well as the varying availability and accessibility of poisonous substances. Moreover, the high intentional poisoning rate can be attributed to various factors including familial, social, economic, psychological, personal challenges, and immaturity or inadequacy in coping with immediate situations.

The study indicated an overall mortality rate of 12.1%, which is higher than the rates observed in Dessie, Ethiopia (6.6%)<sup>25</sup>, Southern India (5.32%)<sup>28</sup>, Wollega, Ethiopia (7.10%)<sup>9</sup>, and Jimma, Ethiopia (5.8%)<sup>23</sup>. However, this rate is low compared to studies conducted in Metu, Ethiopia 27.6% (8), in five public hospitals of Amhara Ethiopia 18%<sup>40</sup>. The variations in these rates may be attributable to factors such as the timeliness of diagnosis, the type of poison exposure, the patient's time of arrival at the hospital<sup>13,24</sup>, the initial severity<sup>41</sup>, pre-hospital care and transportation services.

An analysis of the one-year trend in acute chemical poisoning cases revealed seasonal variations. Specifically, the percentages of cases in Spring, Winter, Summer, and Autumn were 32.10%, 27.48%, 22.40%, and 18.01%, respectively.

This study finding aligns with the finding from University of Gondar Ethiopia, which reported that 32.2% of cases were admitted during Ethiopia's spring season<sup>27</sup>. A similar finding was reported by a study in Wollega Ethiopia<sup>9</sup>. However, it was in contrast with the finding of a study in Dessie, Ethiopia, 31.7% of acute chemical poisoning cases were reported in autumn and 15.8% during spring<sup>25</sup>. Studies in Palestine and others also discovered similar seasonal variations in the number of poisoning cases<sup>34</sup>. Based on our observation the higher number of acute chemical poisoning cases in winter could be explained because of the easy availability and storage of agrochemical pesticides and insecticides of grains during the Ethiopian harvesting periods.

### Limitation of the Study:

One of the limitations of this study is that it attempted to determine the pattern of the acute chemical poisoning cases using only the existing variables and it was difficult to get additional variables.

### CONCLUSION

This study revealed that poisoning incidents were more frequent among females than males, with individuals aged 11 to 30 years being particularly vulnerable. Agrochemicals, especially organophosphorus insecticides, were identified as the most commonly used substances in these cases. Furthermore, the study found that nearly all cases of acute chemical poisoning were intentional and frequently associated with self-harm. A notably high mortality rate was also observed in attributed to chemical poisonings.

### Recommendation

It calls for an urgent need to raise public awareness about the severity of this issue. Developing and implementing effective poisoning prevention strategies could significantly mitigate its impact on the health of the general population.

- Policies and regulations should be developed and strictly implemented to limit the access to toxic chemicals, especially among sensitive demographics such as young females.
- It is imperative to set up Poison Information and Control Centers that offer essential public and medical information, establish standard case definitions, provide treatment protocols, and facilitate training for prompt diagnosis and treatment to support informed decision-making.
- Healthcare facilities are encouraged to meticulously record and report instances of acute chemical poisoning, ensuring accurate data collection for evidence-based policy formulation.

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### ABBREVIATIONS

EOPD: Emergency Outpatient Department of two selected public hospitals:

FHCSH = Felege Hiwot Comprehensive Specialized Hospital and

TGSH: Tibebe Ghion Specialized Hospitals Specialized Hospital

SPSS: Statistical Packages for Social Sciences

PIC: Poison Information Center

ACP: Acute Chemical Poisoning

ARRERB: Amhara Regional Research Ethics Review Board

### ETHICS APPROVAL AND CONSENT TO PARTICIPATE

An ethical approval letter was obtained from the Amhara National Regional State Public Health Institute Research Ethics Review Board (ARRERB with a Ref:NoH/R/T/T/D/07/78 on Date: 12/06/2024GC). Letters of cooperation were also sent to the respective hospitals involved in the study. After data collection, all personal identifiers were removed to ensure confidentiality and privacy of the data. Strict measures were taken to maintain the confidentiality of the information throughout the study.

### CONSENT FOR PUBLICATION

Not applicable.

### AVAILABILITY OF DATA

All the datasets analyzed during the current study are available from the corresponding author upon reasonable request.

### COMPETING INTERESTS

The authors declare that they have no competing interests.

### FUNDING

Funding was not received from any organization.

### CONTRIBUTION OF AUTHORS

DS, GD, SL, HA, and AA conceived the study, carried out the overall design, analyzed, and interpreted the data, statistical analysis. All Authors have reviewed the manuscript.

### AUTHOR'S INFORMATION

DS had a Master's degree in Biomedical Science.



## REFERENCE

- <sup>1</sup>Jesslin J AR, Churi S. Assessment of prevalence and mortality incident due to poisoning in a south Indian tertiary care teaching hospital. *Indian J Pharm Sci Medknow Publications*. 2010;72(5):587.
- <sup>2</sup>Pokhrel D, Pant, S., Pradhan, A., & Mansoor S. A comparative retrospective study of poisoning cases in central, zonal and district hospitals Kathmandu University Journal of Science, Engineering and Technology, 2008;4(1):40.
- <sup>3</sup>WHO. Acute & Chronic Poisoning effects, 2016.
- <sup>4</sup>WHO. Poisoning Prevention and Management. 2016;
- <sup>5</sup>Mariam ETG GB. Global epidemiology of acute poisoning with an emphasis to Ethiopia: systematic review. *Int J Pharma Sci Sci Res*. 2016; 2(4):161–71.
- <sup>6</sup>World Health Organization. “Poison Prevention and Management,” International Programme on Chemical Safety, WHO, Geneva, Switzerland, 2018.
- <sup>7</sup>Abd-Elhaleem ZAE MB. Pattern of acute poisoning in Al Majmaah region, Saudi Arabia. *Am J Clin Exp Med Science Publishing Group*. 2014;2 (4):79–85.
- <sup>8</sup>Varsha P, Bharat, P., Swapnil, P., & Raju, G. Profile of organophosphorus poisoning cases in a tertiary care hospital in central India. *Indian Journal of Forensic Medicine & Toxicology*. 2020;14(4): 369–372.
- <sup>9</sup>Woyessa AH, & Palanichamy, T. Patterns, associated factors, and clinical outcomes of poisoning among poisoning cases presented to selected hospitals in Western Ethiopia: Hospital-based study. *Emergency Medicine International*. 2020;1 (9)
- <sup>10</sup>Chelkeba L, Mulatu, A., Feyissa, D., Bekele, F., & Tesfaye, B. T. Patterns and epidemiology of acute poisoning in Ethiopia: Systematic review of observational studies. *Archives of Public Health*. 2018; 76(1):1–10.
- <sup>11</sup>Thundiyil JG SJ, Pronczuk J. Policy, and practice acute pesticide poisoning: a proposed classification tool. *Bull World Health Organ*. 2008;041814
- <sup>12</sup>Marks C vHN, Edwards N, Kanema C, Kapindula D, Menge T, et al. A promising poison information Centre model for Africa. *African J Emerg Med Elsevier*. 2016;6(2):64–9.
- <sup>13</sup>Tefera GM, & Teferi, L. G. Prevalence, predictors, and treatment outcome of acute poisoning in Western Ethiopia. *Open Access Emergency Medicine*. 2020; 12(12): 365–375.
- <sup>14</sup>Institute EPH. Center for Public Health Emergency Management Weekly Epidemiological Bulletin Week 23: June 6 – June 12. 2022.
- <sup>15</sup>Singh NP KG. Poisoning: Basic considerations and epidemiology. In: Munjal YP, Sharma SK, Agarwal AK, Gupta P, Kamath SA, Nadkar MY, et al., editors. *API text book of medicine*. vol vol 2 Association of Physicians of India; 2015.
- <sup>16</sup>Economics BARSFa. Bureau of Finance and Economic Commission Bahir Dar Bahir Dar: BoFEC. 2022.
- <sup>17</sup>Fatma Sari Dogan VO, Behcet Varisli, Onur Incealtin, Zeynep Ozkok, The Analysis of Poisoning Cases Presented to the Emergency Department within a One-Year Period *Turk J Emerg Med*. 2014;14 (4):160-164. doi: 10.5505/1304.7361.2014.87360
- <sup>18</sup>Jasem DZ N, Ramaswamy R, Roy AD, Reddy AM. Incidence and assessment of antidotes in organo phosphate poisoning at a tertiary care hospital, south india. *World J Pharm Res* 2014; 3(10):1652–9.
- <sup>19</sup>Adinew GM AA. Pattern of acute poisoning in teaching hospital, Northwest Ethiopia. *Int J Pharmacol Toxicol*. 2016;4(1)
- <sup>20</sup>Adinew GM AA, Birru EM. Pattern of acute organophosphorus poisoning at University of Gondar Teaching Hospital, Northwest Ethiopia. *BMC Res Notes* 2017;10(1).
- <sup>21</sup>FBD. JW. Outcome among patients presented to Adama referral hospital. *Ethiopia Md Med Data* 2016;8(3):185–9.
- <sup>22</sup>Chala TS GH, Hussen M. Two-year epidemiologic pattern of acute pharmaceutical and chemical poisoning cases admitted to Adama hospital medical college, Adama, Ethiopia. *Asia Pacific J med Toxicol Mashhad University of Medical Sciences* 2015;4(3):106–1.
- <sup>23</sup>Desalew M AA, Amanuel A, Addisu M, Ethiopia T. Pattern of acute adult poisoning at Tikur Anbessa specialized teaching hospital, a retrospective study. *Ethiopia Hum Exp Toxicol England* 2011;30(7):523–7.

- <sup>24</sup>Abraham Teym MM, Enyew Fenta, Temesgen Ayenew, Firehiwot Fentahun, Eniyew Tegegne, and Alehegn Aderaw Alamneh. Patterns, Clinical Outcome, and Factors Associated with Poisoning Outcomes among Poisoned Patients in Northwest Ethiopia, *SAGE Open Nursing* 2024; Volume 10: 1–9, doi:DOI: 10.1177/23779608231226081
- <sup>25</sup>Getie and Belayneh. A Retrospective Study of Acute Poisoning Cases and Their Management at Emergency Department of Dessie Referral Hospital, Northeast Ethiopia, Dove press, Drug, Healthcare and Patient Safety, 2020.
- <sup>26</sup>Biruktawit Zemedie MS, and Ayalew Zewdie acute Poisoning Cases Presented to the Addis Ababa Burn, Emergency, and Trauma Hospital Emergency Department, Addis Ababa, Ethiopia: A Cross-Sectional Study, *Emergency Medicine International*, Volume 2021; Article ID 6028123.
- <sup>27</sup>Adinew, G. M. "Pattern of acute poisoning in teaching hospital, northwest Ethiopia." (2016): 47-52.
- <sup>28</sup>Arulmurugan C. SA, Mohammad Gani. A retrospective study of paradigm and outcome of acute poisoning cases in a tertiary care teaching hospital in Southern India. *International Journal of Research in Medical Sciences Int J Res Med Sci* 2015 3(10):2654-2657 doi.org/10.18203/2320-6012.ijrms20150808.
- <sup>29</sup>Bundotich JK GM. Acute poisoning in the Rift Valley Provincial General Hospital, Nakuru, Kenya: January to June 2012. *S Afr Fam Pract*. 2015; 57(3): 214–218. doi:10.1080/20786190.2014.975448
- <sup>30</sup>Nadeem MN, Maqdoom, M., & Akif, M. E. A prospective observational study on pattern of poisoning cases reported to emergency department of a teaching hospital in South India. *Biomedical and Pharmacology Journal*2020;13(4):1863–1869.
- <sup>31</sup>Islambulchilar M IZ, Kargar-Maher M. Acute adult poisoning cases admitted to a university hospital in Tabriz, Iran. *Hum Exp Toxicol*. 2009 28(4):185–190. doi:10.1177/0960327108099679
- <sup>32</sup>Zhang Y YB, Wang N, Li T. Acute poisoning in Shenyang, China: a retrospective and descriptive study from 2012 to 2016. *BMJ Open*. 2018;8(8) doi:10.1136/bmjopen-2018-021881
- <sup>33</sup>Farzaneh E MO, Alfred S, Moghaddam HH, Behnoush B, Seghatoleslam T. Self-poisoning suicide attempts among students in Tehran, Iran. *Psychiatria Danubina*. 2010;22(1):34–38.
- <sup>34</sup>Hakim A KR, Mufti S, Krishan K, Singh Y. Pattern, profile, and outcome of poisoning cases: a study at a large teaching hospital in India. *JK Pract*. 2014;19(1–2):36–40.
- <sup>35</sup>Z'gambo J SY, Michelo C. Pattern of acute poisoning at two urban referral hospitals in Lusaka, Zambia. *BMC Emerg Med* 2016;16 (1:2) doi:10.1186/s12873-016-0068-3
- <sup>36</sup>Teklemariam E TS, Jemal A. Pattern of acute poisoning in Jimma University Specialized Hospital, South West Ethiopia. *World J Emerg Surg* ;7(4):290 2016. Doi: 10.5847/wjem.j.1920-8642.2016.04.009
- <sup>37</sup>Kaale E MA, Risha P, Hasham S, Mwambete K. A retrospective study of poisoning at Muhimbili National Hospital in Dar-Es Salaam, Tanzania. *J Public Health Front* 2013;2(1):21–26.doi: 10.5963/PHF0201003
- <sup>38</sup>Maheswari E AL, Chacko CS, Saraswathy GR, Ramesh AC. Assessment of pattern, severity, and outcome of poisoning in emergency care unit. *J Appl Pharm Sci*. 2016; 6 (12):178–183. doi:10.7324/JAPS
- <sup>39</sup>V. Ramanathk and D. Naveenkumarh. "Study the assessment of poisoning cases in a rural tertiary care teaching hospital," *Asian Journal of Pharmaceutical and Clinical Research*. 2012; vol. 5 (no. 2) pp. 335–338.
- <sup>40</sup>Gashachew Bayleyegn Reda HKA, Hidja Mustofa, Mekonnen AZGZWB. Outcome of Poisoning and Associated Factors Among Patients Admitted at Referral Hospitals in Northwest Ethiopia, 2022: A Multicenter Retrospective Study, *Open Access Emergency Medicine*. 2023; doi: 415-425, DOI: 10.2147/OAEM.S414743.
- <sup>41</sup>Goldhill D, McNarry A. Physiological abnormalities in early warning scores are related to mortality in adult inpatients. *Br J Anaesth*. 2004;92(6):882–884. doi: 10.1093/bja/ae113