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Aluminium Phosphide related Suicidal events in Northern Region of Bangladesh

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ABSTRACT

Introduction: *The prevalence of suicide by using the chemical compound Aluminium phosphide (ALP) is widespread but, there is a scarcity in the database regarding ALP poisoning in the Northern region of Bangladesh. Therefore, this study finds out the unnatural deaths by ALP poisoning in this region.* ***Methods:*** *The Department of Forensic Medicine and Toxicology, Rajshahi Medical College, Rajshahi, conducted this study reporting 52 ALP poisoning related suicidal cases between January, 2019 to June, 2021. The data were collected from the documents in the Department of Forensic Medicine and Toxicology. This form consisted of information about the sex, age, religion, address and marital status and professions of the deceased individuals. Results: This study reveals that, females were more prone to committing suicide by ALP poisoning than men. Similarly, higher number of married individuals than unmarried ones committed suicide by using ALP. Unfortunately, Natore district had the highest number of death cases due to ALP poisoning than any other district. Conclusion: The ALP commonly used as an insecticide; thereby it is very much available as a suicidal agent. So, by limiting the accessibility of ALP containing products may be an effective approach to reduce the unnatural death.*

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INTRODUCTION

Aluminium phosphide (ALP) is one of the major causes of suicidal poisoning worldwide.[1,2] Toxicity by ALP is caused by the liberation of phosphine gas, which causes hypoxia due to inhibition of oxidative phosphorylation leading to circulatory failure.[2] Phosphine gas is produced from ALP according to the following reactions:

$AlP + 3H_2O = Al(OH)_3 + PH_3$ (in air), and $AlP + 3HCl = AlCl_3 + PH_3$ (in stomach)

Lethal dose of ALP is 1 to 1.5 gm and deaths are reported even with a dose of 150 to 500 mg.[3] After ingestion, toxic features usually develop within a few minutes. The major lethal consequence of ALP ingestion is profound circulatory collapse which is secondary to these toxins that lead to direct effects on cardiomyocytes, fluid loss, and adrenal gland damage.[4] The signs and symptoms are nonspecific, dose dependent those developed

with time passing. The dominant clinical feature is severe hypotension which is noncompliant to dopaminetherapy.[5]Other features may include dizziness, fatigue, tightness in the chest, headache, nausea, vomiting, diarrhoea, ataxia, numbness, paraesthesia, tremor, muscle weakness, diplopia, and jaundice.[6,7,8]If severe inhalation occurs, the patient may develop acute respiratory distress syndrome (ARDS), heart failure, arrhythmias, convulsion, and coma. Late manifestation includes liver and kidney toxicities.[6,7, 8]

The diagnosis of ALP poisoning usually depends on the clinical suspicion or history described in self-report or by attendants. Treatment of ALP toxicity is mainly supportive as there is no specific antidote. Mortality with ALP poisoning is very high, ranging from 37% to 100%. [8, 9]

In Bangladesh, ALP is known as Rice tablet as well as Gas tablet called by general peoples. **T**he lack of report regarding the death due to ALP poisoning in Rajshahi region influenced us to do this study. For this reason, we conducted this study to observe the suicidal cases due to ALP poisoning in the northern region of Bangladesh.

METHODS

This descriptive study was conducted in the Department of Forensic Medicine and Toxicology, Rajshahi Medical College, Rajshahi, Bangladesh from January, 2019 to June, 2021. Total 52 study subjects of suicidal event caused by Aluminium phosphide (ALP) were included in this study. All information presented in this study was collected from the preserved documents of the dead bodies for autopsy in the Department of Forensic Medicine and Toxicology after taking permission from the College authority. In addition, Ethical clearance has been taken from the Ethical Clearance Committee (ECC) of Rajshahi Medical College. The data were consisted of information about the sex, age, religion, address, marital status and profession of the deceased individuals. Statistical analysis (percentage calculation) and graph generation were performed in Microsoft Excel (version 2007).

RESULTS

In terms of the gender of people dying from ALP poisoning (Figure 1), 24 (46%) were males and 28 (54%) females were found in the information collected from 52 deceased individuals.

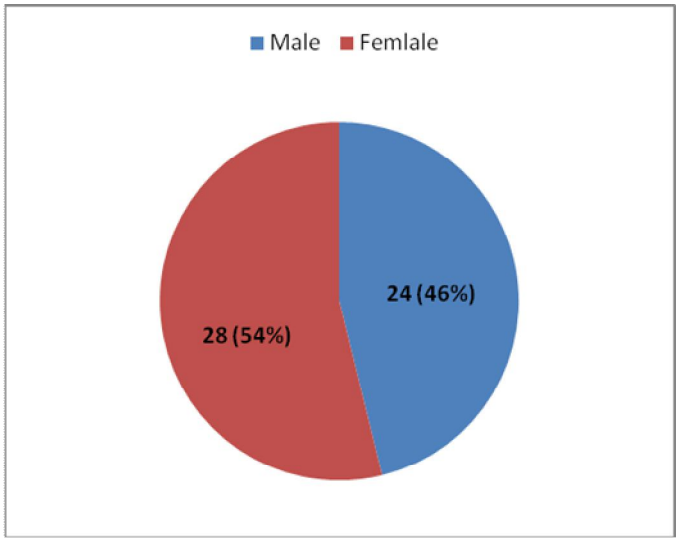

Figure 1: Distribution of the individuals according to the gender

The age of the individuals present in the data set of 52 cases of death by ALP poisoning was divided into 4 distinct classes as shown in Table I. The same percentage (3, 5.77%) of young females (age class 0-15) and older individuals (age class 46-60) were found. Among the older individuals, 2 (66.67%) of them were female and 1 (33.33%) of them was a male. However, a higher number (31, 59.62%) of young adults in the age range of 16-30 were present in this data set. There were 15 (48.39%) men and 16 (51.61%) women in this age group. The number of middle-aged people who died due to the effects of ALP was found to be 15 (28.84%). Out of these 15 people, there were 8 (53.33%) men and 7 (46.67%) women.

As illustrated in Table I, a majority (47, 90%) of the deceased individuals were Muslims while only one-tenth (5, 10%) of them followed the Hindu religion. More specifically, there were 3 (60%) Hindu men and 2 (40%) Hindu women. Whereas, for Islam religion followers, there were 21 (44.68%) males and 26 (55.32%) females.

Table I: Socio-demographic characteristics of study subjects (n-52)

Characteristics	Variables	Male	Female	Total (%)
Age (in years)	0-15	0	3	3 (5.77)
	16-30	15	16	31 (59.62)
	31-45	8	7	15 (28.84)
	46-60	1	2	3 (5.77)
	Total	**24**	**28**	**52 (100)**
Religion	Islam	21	26	47 (90)
	Hindu	3	2	5 (10)
	Total	**24**	**28**	**52 (100)**
Marital Status	Married	15	20	35 (67)
	Unmarried	9	8	17 (33)
	Total	**24**	**28**	**52 (100)**
Residence of Victim	Chapainawabganj	3	1	4 (7.68)
	Kushtia	1	0	1 (1.92)
	Natore	8	10	18 (34.62)
	Naogaon	5	7	12 (23.08)
	Pabna	2	3	5 (9.62)
	Rajshahi	5	7	12 (23.08)
	Total	**24**	**28**	**52 (100)**

Table I illustrates that about one-third (17, 33%) of the individuals who died due to ALP poisoning were unmarried, while two-thirds (35, 67%) of them were married. In terms of married people, there were 15 (42.86%) married males and 20 (57.14%) married females. On the contrary, there were 9 (52.54%) unmarried males and 8 (47.06%) unmarried females.

The address of the deceased was collected and tabulated as shown in Table I. The district where the highest number of ALP poisoning cases was reported was Natore (18, 34.62%). Among the cases, there were 8 males and 10 females. In contrast, there was only 1 male case reported in Kushtia. There were 12 (23.08%) ALP poisoning associated deaths in the both district of Rajshahi and Naogaon. Whereas, there were 5 (441.67%) males and 7 (58.33%) females present in the cases of Naogaon district. To add, there were 4 (7.68%) cases reported in the district of Chapainawabganj, among them 3 males and 1 female. Moreover, 5 (9.62%) cases for the district of Pabna, among them 2 males and 3 females.

In the data set of 52 death cases by ALP poisoning (Figure 2), people of various professions are observed to be affected. The occurrence is relatively higher among housewives (20, 38.46%) and students (11, 21.15%). According to the data collected, 6 (11.54%) farmers, 2 (3.85%) fishermen and 4 (7.69%) drivers were found to have traces of ALP poisoning. Moreover, 6 (11.54%) businessmen also passed away due to the same fatality. Finally, there were 3 (5.77%) people in the job/service sector found in the reported cases.

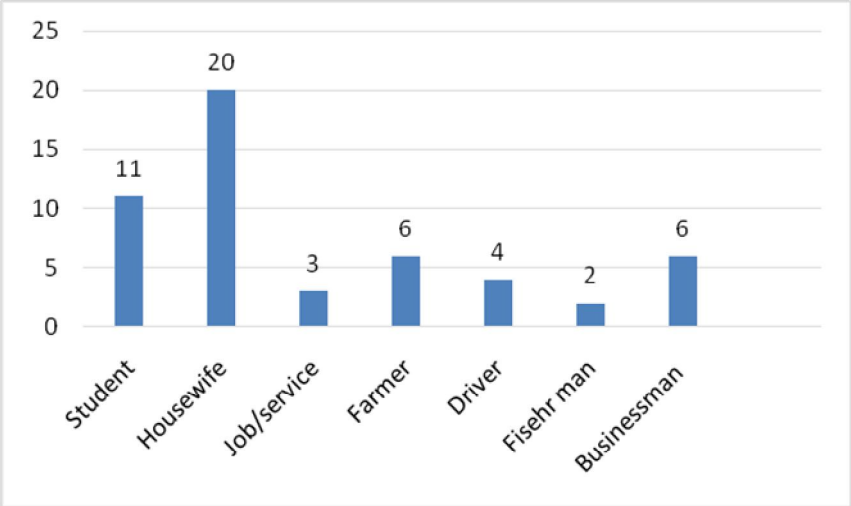

Figure 2: Distribution of the individuals according to the profession.

DISCUSSION

Our data is the first statement regarding the suicidal events due to Aluminium phosphide (ALP*)* poisoning in the northern region of Bangladesh. But similar study was inadequate in other regions of Bangladesh, for that reason, now it is very much difficult to compare the findings of our study with those previous reports.

In this study, we found maximum (28, 54%) ALP poisoning in female among the deceased, which is consistent with the findings of the researchers in Bangladesh,[10,11] those stated in their observations that females were more prone to commit suicide compared to their male counterpart could be the result of familial disharmony.[12] They also evaluated the ALP poisoning emergency cases from Kumilla region and mentioned that the number of female was higher than male. In addition, they studied and found in terms of age class, the highest ALP poisoning cases (31, 59.62%) was observed in between 16-30 years old and categorized 15 men and 16 women.

In this study, total 15 died due to ALP poisoning in between 31-45 years age group of people but Saha et al[12] in their study mentioned that maximum death of patients were in between 15 - 45 years old.

Another reseacher[13] established that suicidal events occur more with the increase of age but the young adults are more prone. In our study, majority (47, 90%) of the deceased individuals were Muslim. This signifies that our country is of Muslim majority.

In developing countries, it had been observed that a case of married female considered as a single risk factor for suicide.[13, 14] In our study, among 28 deceased female, 20 were housewives, 7 were students, and 1 was working woman, which signify the mentioned statement.

ALP is a well-known, highly effective, and frequently used outdoor and indoor insecticide and rodenticide.[15] The easy availability of ALP in Bangladesh may be due to the dependency on agriculture. Interestingly, the economy of Natore district is mostly agriculture dependent.[16] Naogaon is the central part of the Varendra region, and most of the people in this district are farmers.[17] Chapainawabganj district is completely dependent on agriculture.[18] Rajshahi district also

dependent on agriculture but the agricultural products are not accustomed like other districts.[19] The economy of Pabna district is quite different from others, but maximum people (34%) depend on agriculture.[20] Therefore, the agricultural dependency may be the contributing factor of the easy availability of ALP in house or at the surrounding of the deceased person. These explanations ascertain the frequent occurrence of suicidal event by ALP.

CONCLUSION

Aluminium phosphide (ALP) is commonly used as an insecticide which is very much available in the open market. The Department of *Agricultural* Extension (DAE) of Bangladesh can play a key role for controlling easy availability of ALP. This effort may reduce the death due to poisoning by ALP and any other chemicals or pesticides.

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Conflict of interest: Author declares that there is no conflicts of interest.

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