



Evaluation of rice tablet (Aluminum Phosphide) poisoning in Iranian consumers

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Abstract: The abuse of some pesticides especially to suicide is one of the current problems of pesticides. Aluminum phosphide induced poisoning usually happens to suicide and sometimes it is due to accidental occupational exposure and in a few cases, it has some criminal intentions. This study is conducted to evaluate patients poisoned with aluminum phosphide. In the present study, the medical records of cases of poisoning with rice tablets (aluminum phosphide) hospitalized in Ahvaz Razi hospital is studied. Accordingly, a checklist is prepared that included demographic information of patients (age, gender) and information on patient records (information on poisoning) are completed using the patients' medical records. The analysis of data is done by SPSS V22. 18 patients poisoned with rice tablet (aluminum phosphide) are studied. Results of the study show that 11 patients are male and seven are female. The mean patient age is 27.06 ± 8.04 years that is 28 ± 9 and 25 ± 6.02 in men and women respectively. Statistical tests show no statistically significant difference in mean age in both genders ($P > 0.05$). Among patients, 11 subjects took aluminum phosphide to attempt suicide and 3 cases took it unintentionally and of course the reason is not mentioned in four cases. Among the patients who tried to commit suicide by taking aluminum phosphide, 6 cases are male and 5 cases are female that no statistically significant difference is observed between the genders in this respect ($P > 0.05$). In addition to the study of the complications caused by this poisoning and its mortality, it is recommended to responsible authorities to provide the necessary educations and treatments to prevent this type of poisoning.

Key words: Rice Tablet; Aluminum Phosphide; Poisoning; Suicide

Introduction

The use of pesticides for agricultural purposes increases the quality and quantity of crops through pest eradication and today it plays an important role in providing food for humans. Although the rational and principled use of these factors could play a fundamental role in ensuring human health by increasing the quantity and quality of agricultural products (1), the abuse of some pesticides especially to suicide is one of the current problems of pesticides. Along with other chemical poisonings including poisoning by chemical weapons (2), one of the ways of poisoning with chemical agents is the abuse of pesticides. One of these pesticides is aluminum phosphide pesticide. Aluminum phosphide that is known as "rice tablet" is among the most dangerous pesticides in developing countries often taken deliberately and intentionally (3). Consuming only half a tablet (1.5 g) of a standard tablet can lead to death due to multiple organ failure. Unfortunately, this dangerous substance is publicly available in many regions of Iran abundantly and although in recent years it has been increasingly used in the suicide

attempts, given that in Iran garlic tablet, vegetable rice tablet (Banan) and aluminum phosphide are known as "garlic tablet" in the market, in some cases fatal poisonings due to accidental ingestion of aluminum phosphide are also reported (4). The substance releases colorless phosphine gas (PH₃) in the presence of water, steam, or stomach acid which is a poisoning factor (5). Aluminum phosphide induced poisoning usually happens to suicide and sometimes it is due to accidental occupational exposure and in a few cases, it has some criminal intentions (6). Various social, geographical, psychological factors and unfortunately its availability have added to the extent of poisoning by this lethal substance (7). PH₃ is an effective factor that leads to the inhibition of cytochrome C oxidase and the production of reactive oxygen chains. Oxygen free radicals are responsible for the organ's hypoxia and this hypoxia is a prominent symptom of phosphine poisoning (8). Previous studies have shown that deaths from poisoning with rice tablet has a significant correlation with the length of time

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between exposure and getting to the clinics, number of tablets taken, systolic blood pressure, PH, HCO₃ concentration and oxygen saturation percentage; thus based on the relationship between poisoning and the length of time between exposure and getting to the clinics, number of tablets taken, systolic blood pressure, PH, HCO₃ concentration and oxygen saturation percentage, it is proposed to use these measures to estimate prognosis in this poisoning (9). Severe systemic symptoms appear as hypotension, cardiovascular collapse, and severe heart failure symptoms quickly and in less than one hour of oral administration of aluminum phosphide and eventually in case of severe toxicity stop the cardiovascular functioning and death during the first 24 hours (10-11). Regarding the treatment of these patients it should be noted that the use of vasopressor agents, fresh blood and bronchodilators according to the patient's condition is recommended and also in case of pulmonary edema it is possible to use the diuretics if the patient does not have hypotension (12). Despite the fact that suicide rate in Iran is lower than western countries, the rate of deliberate self-poisoning has had a higher growth than population growth and toxicity of drug abuse has changed sex pattern of the poisoned patients. It seems that national policy for controlling drug abuse and life skills training was inadequate and immediate interventions are required to support patients and high risk groups (13). As discussed before, despite the progress in the management and intensive cares, this poisoning remains a common cause of morbidity and mortality in developing countries including Iran (10). Therefore, knowledge of the variables associated with the disease both on psychological information leading to suicide and physical and poisoning information in patients could help to prevent further poisoning with this substance. Therefore, this study is conducted to evaluate patients poisoned with aluminum phosphide.

Material and Methods

After obtaining permission from the Ethics Committee of the University in the present study the medical records of cases of poisoning with rice tablets (aluminum phosphide) hospitalized in Ahvaz Razi hospital is studied. Accordingly, a checklist is prepared that included demographic information of patients (age, gender) and information on patient records (information on poisoning) are completed using the patients' medical records. In the case of incomplete records the patient will be contacted and if for any reason this is not done or the patients have no information about the case, the file will be excluded from the study. In order to analyze the data using descriptive statistics such as frequency tables, charts and numeral figures the variables of

interest will be discussed. The analysis of data is done by SPSS V22.

Results

In this study, 18 patients poisoned with rice tablet (aluminum phosphide) are studied. Results of the study show that 11 patients are male and seven are female. The mean patient age is 27.06 ± 8.04 years that is 28 ± 9 and 25 ± 6.02 in men and women respectively. Statistical tests show no statistically significant difference in mean age in both genders ($P > 0.05$). Among patients, 11 subjects took aluminum phosphide to attempt suicide and 3 cases took it unintentionally and of course the reason is not mentioned in four cases. Among the patients who tried to commit suicide by taking aluminum phosphide, 6 cases are male and 5 cases are female that no statistically significant difference is observed between the genders in this respect ($P > 0.05$).

Table 1: Age Status

Gender	Mean	N	Std. Deviation	P-Value
Male	28.00	11	9.000	P>0.05
Female	25.00	7	6.028	
Total	27.06	18	8.047	

Table 2: Prevalence of suicide in Patients

Suicide	Gender		P-Value
	Male	Female	
Yes	6	5	P>0.05
No	3	0	
Unknown	2	2	
Total	11	7	

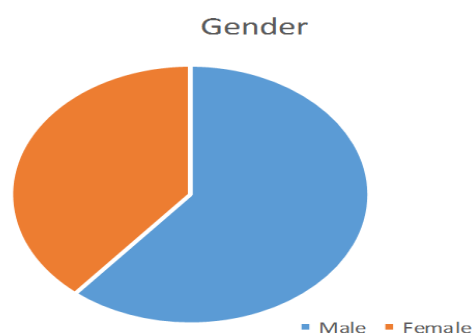


Figure 1: Gender Status

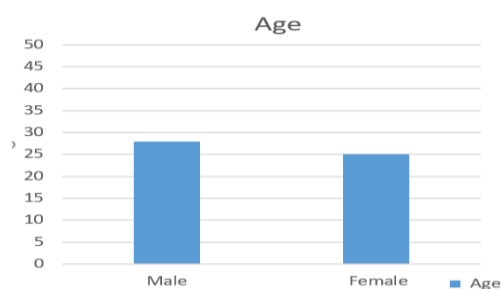


Figure 2: Age Status

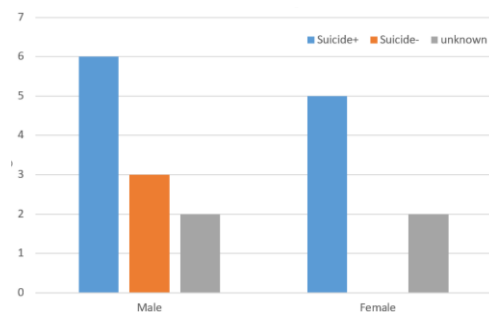


Figure 3: Reason of Use

Discussion and Conclusion

In the past, the number of cases of poisoning with phosphine was relatively low and within the period of 1900-1958 only 59 cases of poisoning with phosphine gas and metal phosphide with 26 deaths have been reported in the medical literature (14). In the last 35 years, many cases of poisoning with high mortality rates due to exposure to aluminum, zinc and calcium phosphide are reported that except for rare cases of them that have been accidental, most of them were associated with suicide (15). In Iran, there are few reports of poisoning by these pesticides most of which have been due to the accidental inhalation of phosphine gas (16-17). Aluminum phosphide is highly toxic and lethal compound that reacts rapidly with water and acid after ingestion and the phosphine gas (PH₃) which is its active ingredient causes poisoning. Studies have shown that the main effect of the poison is the inhibition of cytochrome C enzyme and oxidative phosphorylation in the mitochondria (18-19). The symptoms appear following the tablets' exposure to the stomach acid, the release of phosphine gas and a few minutes after swallowing. Toxicity symptoms include restlessness, tachycardia, tachypnea, acidosis and hypotension. Aluminum phosphide poisoning starts ranges between nausea and vomiting to multi-organ failure and death that happens within 24-48 hours after poisoning (20). As mentioned before, along with other symptoms caused by this substance, in case of food poisoning gastrointestinal irritation symptoms such as nausea, vomiting and epigastric pain are also observed (21). Since few studies have been conducted with the aim of monitoring the patients' symptoms, this study evaluated gastrointestinal side effects in patients poisoned with aluminum phosphide. As shown in the results most of the patients poisoned with aluminum phosphide that had gastrointestinal problems were women and all of them were young. Also, most patients had taken the drug consciously to commit suicide. To learn more about these symptoms there is a need to compare the results with other studies to allow detailed information about the onset of the symptoms based on variables such as gender and age. Thus, the results of the following study will be compared with other studies. In Rahbar Taramsari

et al., (22) in a study titled "Evaluation of patients poisoned with rice tablet" which is conducted in Iran, it is mentioned that all patients have gastrointestinal complications. In their study as well as the present study, the mean age of patients was at a young age. However, unlike the present study, the number of men was more than women in their study. They also reported that 100% of their patient's tool aluminum phosphide to commit suicide while this rate was lower in the present study. It should be noted that their study was conducted in northern Iran while the present study was conducted in South West Iran. Khodabande *et al.*, (23) in a study titled "the prevalence of symptoms leading to death in poisoning with rice tablet" that was performed in Iran reported that most of their patients were male and they were teenagers and young people. Also, the reported gastrointestinal symptoms as vomiting started 10-15 minutes after taking the rice tablets before referring patients to the emergency room in 96.4% of cases but in the present study most subjects were female and all of them had gastrointestinal symptoms. The thing that is important in this study and other similar studies is that the patients poisoned with aluminum phosphide are young people who committed suicide at a young age by taking this tablet and usually have gastrointestinal side effects. The review of these studies indicates the importance of education in society and addressing the psychological and sociological factors is the key point in the prevention of poisoning. So, in addition to the study of the complications caused by this poisoning and its mortality, it is recommended to responsible authorities to provide the necessary educations and treatments to prevent this type of poisoning.

References

1. Cienki JJ. Non-anticoagulant rodenticides. Ford MD, Delaney KA, Ling LJ, Erikson T (eds), Clinical toxicology, 1st ed, Philadelphia, W.B. Saunders Co 2001; pp: 858
2. Rahmani H, Javadi I, Shirali S. Respiratory Complications Due to Sulfur Mustard Exposure. International journal of current research and academic review. 2016 Jun;4(6):143.
3. Mehrpour O, Farzaneh E, Abdollahi M. Successful treatment of aluminum phosphide poisoning with digoxin: A case report and review of literature. Int J pharmacol. 2011;(7):761-4.
4. Taheri S K, Afzali S, Khaled Naghshbandi M, Norouzi F, Mohammadi N. Report of Two Cases of Accidental Poisoning Due to "Rice Tablet" Misuse. IJFM. 2011; 17 (3) :199-203
5. Wahab A, Zaheer MS, Wahab S, Khan RA. Acute aluminium phosphide poisoning: an update. Hong Kong J Emerg Med. 2008 Jul 1;15(3):152-5.

6. Musshoff F, Preuss J, Lignitz E, Madea B. A gas chromatographic analysis of phosphine in biological material in a case of suicide. *Forensic science international*. 2008 May 20;177(2): 35-8.
7. Lessenger JE. Case report: Multiple system illness in a woman exposed to aluminum phosphide. *Journal of Agromedicine*. 1999 Jul 2;6(1):25-31.
8. Sciuto AM, Wong BJ, Martens ME, Hoard-Fruchey H, Perkins MW. Phosphine toxicity: a story of disrupted mitochondrial metabolism. *Annals of the New York Academy of Sciences*. 2016 May 1.
9. Rahbar Taramsary M, Orangpoor R, Zarkami T, Palizkar M, Mousavian S. Survey Patients Poisoned with Aluminum Phosphide (Rice Tablet). 3. 2006; 14 (56) :42-47
10. Marashi S.M, Arefi M, Behnoush B, Nasrabad M.G, Nasri-Nasrabad Z. Could hydroxyethyl starch be a therapeutic option in management of acute aluminum phosphidotoxicity? *Medical hypotheses*. 2011; 76:596–8.
11. Shadnia S, Sasanian G, Allami P, Hosseini A, Ranjbar A, Amini-Shirazi N, et al. A retrospective 7-years study of aluminum phosphide poisoning in Tehran: Opportunities for prevention. *Hum Exp Toxicol*. 2009; 28:209-13.
12. Morgan, DP. Recognition and management of pesticide poisoning, 3rd ed, US environmental protection agency. Washington DC, US government printing office 1982; pp: 68.
13. Hassanian Moghaddam H, Pajoumand A. A One-Year Epidemiological Study of Acute Poisoning among Adults and Adolescents Admitted to Loghman Hospital, Tehran between 2005 and 2006. *Pajoohandeh Journal*. 2007; 12 (3) :169-176
14. Morgan, DP. Recognition and management of pesticide poisoning, 3rd ed, US environmental protection agency. Washington DC, US government printing office 1982; pp: 68.
15. Haddad LM, Shannon MW, Winchester JF. Clinical management of poisoning and drug overdose, 3rd ed, Philadelphia, W.B. Saunders Co 1998; pp: 872-3.
16. Shadnia S, Sasanian G, Allami P, Hosseini A, Ranjbar A, Amini-Shirazi N, et al. A Retrospective 7-years Study of Aluminum Phosphide Poisoning in Tehran: Opportunities for Prevention. *Hum Exp Toxicol*. 2009; 28: 209-13.
17. Moghadamnia A, Abdollahi M. An Epidemiological Study of Poisoning in Northern Islamic Republic of Iran. *East Mediterr Health J*. 2002; 8 (1): 88-94
18. Dua R, Gill KD. Effect of aluminium phosphide exposure on kinetic properties of cytochrome oxidase and mitochondrial energy metabolism in rat brain. *Biochim Biophys Acta* 2004; 1674(1): 4-11.
19. Singh S, Bhalla A, Verma SK, Kaur A, Gill K. Cytochrome-c oxidase inhibition in 26 aluminum phosphide poisoned patients. *Clin Toxicol (Phila)* 2006; 44(2): 155-8.
20. Christophers AJ, Singh S, Goddard DG, Nocera A. Dangerous bodies: a case of fatal aluminium phosphide poisoning. *Medical journal of Australia*. 2002 Apr 15;176(8):403
21. Chan LT, Crowley RJ, Delliou D, Geyer R. Phosphine analysis in postmortem specimens following ingestion of aluminium phosphide. *J Anal Toxicol* 1983; 7(4): 165-7.
22. Rahbar Taramsary M, Orangpoor R, Zarkami T, Palizkar M, Mousavian SA. Survey patients poisoned with aluminum phosphide (Rice Tablet). *Journal of Guilan University of Medical Sciences*. 2006 Jan 15;14(56):42-7.
23. Khodabandeh F, Kahani A, Soleimani G. The Study of Fatal Complications of “Rice Tablet “Poisoning. *IJFM*. 2014; 20 (2) :27-36.

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