J. Basic. Appl. Sci. Res., 3(8)410-417, 2013

ISSN 2090-4304
Journal of Basic and Applied Scientific Research
www.textroad.com

Determining Clinical Symptoms of Getting Poisoned by Aluminum Phosphide in Comparison with Getting Poisoned by Zinc Phosphide, in Relation with Patients of Loqman Hospital

Maryam Teimoory[1], Abbas Aghabiglooie[2], Shahin Shadinia[3]

[1,2]Tehran Medical University
[3]Shahid Beheshti Medical University

ABSTRACT

Aluminum phosphide and zinc phosphide poisoning has been increased during the last years in Iran. Aluminum and zinc phosphides are two rodenticides that are used a lot as a result of easy access and low price; however, they have caused poisoning issues and even death. In this research, 50 medical files of acute zinc phosphide poisoning and 50 cases of acute aluminum phosphide poisoning that have been admitted to poisoning wards of Loghman poison center in Tehran from march 2010 to September 2011 would be studied. In fact, this research compares the presentation of toxicity, prognostic factors and outcome between these two groups. Dizziness, shortness of breath, digestive disorders, nervous disorders, cardiovascular problems, pulmonary edema, hypocalcaemia, electrocardiographic disorder, *Thrombocytopenia*, and *methemoglobinemia* are all symptoms of getting poisoned by these two phosphides. Since there is not a specific antidote for them, it is very important to diagnose apparent clinical symptoms related to them. The purpose of present paper is to recognize these symptoms better and to make medical groups familiar with different aspects of toxicology related to aluminum and zinc phosphides poisoning. Although shock and severe hypotension resistant to treatment are the most common causes of morbidity in ALP poisoning, they have been seen with low frequency in ZP poisoning. Moreover, though hemodynamic instability and cardiac dysrrhythmias are common symptoms in ALP poisoning, they are not common symptoms in ZP poisoning. In spite of similar mechanisms for both poisons, acute ZP poisoning shows less mortality in comparison with ALP poisoning.
KEYWORDS: mental phosphide, aluminum phosphide, zinc phosphide, poisoning, toxicology

1. INTRODUCTION

Metal phosphides are widely used as strong pesticides and in particular, as strong rodenticides. Use of aluminum phosphide, zinc phosphide and calcium phosphide is common in a number of countries in the world. For the first time, aluminum phosphide was used in India as a rodenticide. In Iran, especially in northern parts of it, aluminum phosphide is used to protect race and other crops in storage and also to avoid damages resulting from presence of vermin. These factors along with low price, high detoxification and easy access lead to direct or accidental acute poisoning that cause death.

During the last years, zing phosphide poisoning and aluminum phosphide poisoning have increased in some countries especially Iran. [1] based on a study in Loqman hospital located in Iran, the most common cause of death in 2006 after taking drugs was poisoning (aliminium and zink phosphides poisoning), moreover, the most common cause of toxicity in Mazandaran province (located in north of Iran) had been aliminium and zink phosphides poisoning during 1997 to 2000. [2]

Death resulted from metal phosphides poisoning is caused by heart inflammation and death of some of internal elements of body. Metal phosphide dose leading to death is between 0.5 to 0.15 grams; moreover, in north of India, aluminum phosphide poisoning is the most common cause of death in suicide cases. [2]

In previous years, reported cases related to phosphide poisoning was not noticeable, during years 1900 to 1958 only 59 cases were related to metal phosphides poisoning and just 26 deaths were reported in medical records. However, during the last 35 years, many reported cases were associated with poisoning, moreover, high death toll related to zinc phosphide, aluminum phosphide and calcium phosphide have been reported. In India, there is a report related to epidemiology of phosphide poisoning from 1980 to 1990, Khoshla and colleagues have also reported 92 cases of aluminum phosphide poisoning in India during 1989 to 1991. [3]

Furthermore, Singh and colleagues reported that from 1989 to 1994, among 195 cases of acute poisoning of taking aluminum phosphide in India, 115 cases led to death. Also, in Iran Jalali and colleagues reported that from 1997 to 1998 there were 349 death cases resulted from poisoning with chemical medical factors among poisoned people older than 12 hospitalized in Loqman hospital, 9 cases of death resulted from poisoning was related to aluminum phosphide poisoning. Moreover, Abdolahi and Jalali (1997), in a six months lasting research in 1994 revealed that 48 cases were related to zinc or aluminum phosphide poisoning. In terms of

*Corresponding Author: Maryam Teimoory, Tehran Medical University. maryamteimoory19@gmail.com

mortality or acuteness, zinc phosphide is weaker than aluminum phosphide, but in available articles, these two phosphides have never been compared with each other, they are usually studied together as "metal phosphides". The workers of Loqman hospital believe that rate of zinc phosphide poisoning has increased during the last years. Therefore, in the present paper clinical symptoms of zinc phosphide poisoning has been studied in comparison with aluminum phosphide poisoning regarding patients of Loqman hospital.

Main body

Chemical study of aluminum and zinc phosphides poisons

Aluminum phosphide is shown with AIP(molecule formula)and it is dark gray or yellow crystallized. It is a protoplasmic poison that prevents enzymes synthesis and protein syntheses and exerts its poisonous effect on living cells. [4]Aluminum phosphide has commercial names such as Phostoxin, Quickphos, Phosfume, Synfum and Celphos. In Iran, Aluminum phosphide is known as "phostoxin".

On the other hand, zinc phosphide is shown with Zn3P2 molecule formula and molecule weight 258/09 in the form of powder or squared crystals which are dark gray and have weak odor of phosphorus. Toxic feature of aluminum phosphide is because of its phosphine gas that does not allow body to produce vital cells and enzymes, and then it destroys tissues in the body. Reaction of aluminum phosphide with fluid in the body produces phosphine gas. [5]

Clinical symptoms of metal phosphides

Metal phosphides poisoning happens through phosphine gas inhalation or poison ingestion. This phosphine prevents cytochrome c oxidase , brings about disorders related to mitochondrial morphology , decreases oxidative inhalation up to %70 and finally destroys mitochondrial membrane. Acute cardiovascular collapse secondary and adrenal injuries are two main mortal consequences of the phosphine. The interval between phosphide poisoning and emergence of symptoms is short. Zinc phosphide is similar to aluminum phosphide, but it does not produce gas as soon as aluminum phosphide, then it is less dangerous. Oral poisoning via distributing phosphine gas leads to symptoms such as lethargy, increase of breath speed, decrease of appetite, coma, renal failure and even death. In low doses of poison, the poisoned patient would be treated during several weeks. [3]

In metal phosphide poisoning, symptoms appear very quickly and in 10 or 15 minutes. [6] Primary symptoms are lack of appetite and sleepiness, if it is poisoning through ingestion, vomiting or epigastric pain will happen as well. During the first 12 to 24 hours of poisoning, majority of deaths happen as a result of cardiac arrest, deaths happening after 24 hours are resulted from hepatic failure, usually poisoning symptoms are resulted from disorders of cardiovascular system of pulmonary disorders. If there is a food poisoning, digestive system disorders will appear as well.

Clinical symptoms include nausea, vomiting, dizziness, paresthesia, diplopia, coughs, shortness of breath, shock, wetness of skin, weak pulses, disorders of myocardial contraction, fluid loss leading to circulatory failure, acute pulmonary edema, acute renal failure, abdominal pain, hepatic necrosis, enzyme related disorders, and in some cases black vomiting, black feces, sweating and physical weakness. [4]

Since there is not any specific antidote for metal phosphides, most of poisoned people die. People who work in grain stores and are in contact with phosphine gas may show symptoms such as cough, shortness of breath, headache, and numbness, lack of appetite and epigastric pain. [5] Moreover, continuous contact with phosphine gas leads to toothache, lower jaw inflammation, and jaw necrosis which are known as Phossy Jaw. Intense skin contact with phosphine gas leads to increase of skin sensitivity. [6]

Epidemiology

Studies which are related to the mentioned issue and have been studied in Iran would be described briefly in this section. Shadnia and colleagues (2001) reported a poisoning with 12 milligrams of aluminum phosphide in which the poisoned individual went to hospital after 6 hours of consumption, however, he was treated in hospital. Doctor Hasanian and colleagues in 2005 studied the poisoned patients of Loqman hospital- they were all older than 12- and they found that among 28002 poisoned patients, % 43/45 of them were hospitalized, while %1/08 of them finally died. The cause of death, first referred to drug consumption (% 33/ 22), and then it referred to rodenticides- especially aluminum phosphide-(% 12/17). According to another study, Kapoor and colleagues (2006) reported that among 301poisoned patients who went to Swarap rani nahru hospital located in Allah abad, 83 cases were related to aluminum phosphide poisoning among which %45 died.

Moreover, Wilson and colleagues (1980) reported 31 cases of phosphine gas poisoning in a ship transporting crops, 2 children were among them, one of them died. The child who died had symptoms such as headache, nausea, vomiting, shortness of breath, paresthesia , diplopia, intention tremor, ethoxy, necrosis, pulmonary edema and so forth.

Lohan Shyam and colleagues (2002) , studied poisoning cases related to Nepal poisoning center for 5 years and they found that 178 cases were associated with zinc phosphide, however, 79 percent of them showed no symptoms at the time of going to hospital, 18 percent had some weak symptoms, while 2 percent of them had

average symptoms. There was no relation between entrance time and intensity of symptoms, moreover, common symptoms encompassed abdominal pain (62 percent), vomit (23 percent), dizziness (119 percent) and headache (13 percent). [7]

Chugh and colleagues (1998) studied 20 cases of zinc phosphide poisoning in terms of clinical symptoms including nausea, abdominal pain, heartbeat, sweating, dyspenea, tachypnea, acidose metabolica, shock, hypotension and death. A similar study was done (1997) on workers who were in contact with zinc phosphide for about 11 years. They showed nervous- psychological symptoms such as fear, nervousness, early fatigue, castration, hyper flexy, ploy neuropathy, radiculopathy, cervical myelopathy, attention failure, abnormal changes in electrocardiogram and inhalation system disorders. [6]

Another study in this field was done by Louriz and colleagues from 1992 to 2009. They divided 49 patients poisoned by aluminum phosphide into survived group and died group and then they studied 50 parameters such as shock, electrocardiogram, low consciousness level, renal failure, and using vascular obstruent in each of the groups and compared them. They declared that mortality of aluminum phosphide was related with shock and change in consciousness level. [8]

Table 1: Frequency distribution of patient's clinical symptoms based on NV in zinc phosphide poisoning and aluminum phosphide poisoning

Descriptive statistics		Valid percent	Frequency	Variable category
1	Mode	%78	39	+
-	-	%22	11	-
Descriptive statistics		Valid percent	Frequency	Variable category
1	Mode	%58	29	+
-	-	%42	21	-

According to table 1, 78% of patients poisoned by zinc phosphide had NV up to 22 percent, while 22 percent of them did not have NV. Moreover, mode is equal to 1 and this number shows maximum frequency for presence of NV in zinc phosphide poisoning. Also, 58% of patients poisoned by aluminum phosphide had NV up to 58%, while 42 percent of them did not have NV. Moreover, mode is equal to 1 and this number shows maximum frequency for presence of NV in aluminum phosphide poisoning.

Table 2 Frequency distribution of patient's clinical symptoms based on GIB in zinc phosphide poisoning and aluminum phosphide poisoning

Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	0	0	+
-	-	%100	50	-
Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	0	0	+
-	-	%100	50	-

According to table 2, 100% of patients poisoned by zinc phosphide had GIB. Moreover, mode is equal to 2 and this number shows maximum frequency for absence of GIB in zinc phosphide poisoning. 100% of patients poisoned by aluminum phosphide had GIB. Moreover, mode is equal to 2 and this number shows maximum frequency for absence of GIB in aluminum phosphide poisoning.

Table 3 Frequency distribution of patient's clinical symptoms based on Headache in zinc phosphide poisoning and aluminum phosphide poisoning

Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	%48	24	+
-	-	%52	26	-
Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	%38	19	+
-	-	%62	31	-

According to table 3, 48% of patients poisoned by zinc phosphide had a headache, while 52% of them did not have it. Moreover, mode is equal to 2 and this number shows maximum frequency for absence of headache in zinc phosphide poisoning. Also, 38 percent of patients poisoned by aluminum phosphide had a headache, while 62 percent of them did not have it. Moreover, mode is equal to 2 and this number shows maximum frequency for absence of headache in aluminum phosphide poisoning.

Table 4 Frequency distribution of patient's clinical symptoms based on abdominal pain in zinc phosphide poisoning and aluminum phosphide poisoning

Descriptive statistics		Valid percent	Frequency	Variable category
1	Mode	%90	45	+
-	-	%10	5	-
Descriptive statistics		Valid percent	Frequency	Variable category
1	Mode	%56	28	+
-	-	%44	22	-

According to table 4, 90 percent of patients poisoned by zinc phosphide had an abdominal pain, while 10 percent of them did not have it. Moreover, mode is equal to 1 and this number shows maximum frequency for presence of abdominal pain in zinc phosphide poisoning. Also, 56 percent of patients poisoned by aluminum phosphide had an abdominal pain, while 44 percent of them did not have it. Moreover, mode is equal to 1 and this number shows maximum frequency for presence of abdominal pain in aluminum phosphide poisoning.

Table 5 Frequency distribution of patient's clinical symptoms based on epilepsy in zinc phosphide poisoning and aluminum phosphide poisoning

Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	0	0	+
-	-	%100	50	-
Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	%4	2	+
-	-	%96	48	-

According to table 5, 100 percent of patients poisoned by zinc phosphide had epilepsy. Moreover, mode is equal to 2 and this number shows maximum frequency for absence of epilepsy in aluminum phosphide poisoning. Also, 4 percent of patients poisoned by aluminum phosphide had epilepsy, while 96 percent of them did not have it. Moreover, mode is equal to 2 and this number shows maximum frequency for absence of epilepsy in aluminum phosphide poisoning.

Table 6 Frequency distribution of patient's clinical symptoms based on agitation in

Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	%48	24	+
-	-	%52	26	-
Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	%16	8	+
-	-	%84	42	-

According to table 6, 48 percent of patients poisoned by aluminum phosphide had agitation, while 52 percent of them did not have it. Moreover, mode is equal to 2 and this number shows maximum frequency for absence of agitation in aluminum phosphide poisoning. Also, 16 percent of patients poisoned by zinc phosphide had respiratory depression, while 84 percent of them did not have it. Moreover, mode is equal to 2 and this number shows maximum frequency for absence of respiratory depression in zinc phosphide poisoning.

Table 7 Frequency distribution of patient's clinical symptoms based on shock in zinc phosphide poisoning and aluminum phosphide poisoning

Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	%22	11	+
-	-	%78	39	-
Descriptive statistics		Valid percent	Frequency	Variable category
1	Mode	%92	46	+
-	-	%8	4	-

According to table 7, 22 percent of patients poisoned by zinc phosphide had shock, while 78 percent of them did not have it. Moreover, mode is equal to 2 and this number shows maximum frequency for absence of shock in zinc phosphide poisoning. Also, 92 percent of patients poisoned by aluminum phosphide had shock, while 8 percent of them did not have it. Moreover, mode is equal to 1 and this number shows maximum frequency for presence of shock in aluminum phosphide poisoning.

Table 8 Frequency distribution of patient's clinical symptoms based on coldness in zinc phosphide poisoning and aluminum phosphide poisoning

Descriptive statistics		Valid percent	Frequency	Variable category
1	Mode	%64	32	+
-	-	%36	18	-
Descriptive statistics		Valid percent	Frequency	Variable category
1	Mode	%96	48	+
-	-	%4	2	-

According to table 8, 64 percent of patients poisoned by zinc phosphide had coldness, while 36 percent of them did not have it. Moreover, mode is equal to 1 and this number shows maximum frequency for presence of coldness in zinc phosphide poisoning. Also, 96 percent of patients poisoned by aluminum phosphide had coldness, while 4 percent of them did not have it. Moreover, mode is equal to 1 and this number shows maximum frequency for presence of coldness in aluminum phosphide poisoning.

Table 9 Frequency distribution of patient's clinical symptoms based on cyanosis in zinc phosphide poisoning and aluminum phosphide poisoning

Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	%18	9	+
-	-	%82	41	-
Descriptive statistics		Valid percent	Frequency	Variable category
1	Mode	%62	31	+
-	-	%38	19	-

According to table 9, 18 percent of patients poisoned by zinc phosphide had cyanosis, while 82 percent of them did not have it. Moreover, mode is equal to 2 and this number shows maximum frequency for absence of cyanosis in zinc phosphide poisoning. Also, 62 percent of patients poisoned by aluminum phosphide had cyanosis, while 38 percent of them did not have it. Moreover, mode is equal to 1and this number shows maximum frequency for presence of cyanosis in aluminum phosphide poisoning.

Table 10 Frequency distribution of patient's clinical symptoms based on sweating in zinc phosphide poisoning and aluminum phosphide poisoning

Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	%8	4	+
-	-	%92	46	-
Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	0	0	+
-	-	%100	50	-

According to table 10, 8 percent of patients poisoned by zinc phosphide had sweating, while 92 percent of them did not have it. Moreover, mode is equal to 2 and this number shows maximum frequency for absence of sweating in zinc phosphide poisoning. Also, 100 percent of patients poisoned by aluminum phosphide had sweating. Moreover, mode is equal to 2 and this number shows maximum frequency for absence of sweating in aluminum phosphide poisoning.

Table 11 Frequency distribution of patient's clinical symptoms based on xerosis in zinc phosphide poisoning and aluminum phosphide poisoning

Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	%30	15	+
-	-	%70	35	-
Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	%6	3	+
-	-	%94	47	-

According to table 11, 30 percent of patients poisoned by zinc phosphide had xerosis, while 70 percent of them did not have it. Moreover, mode is equal to 2 and this number shows maximum frequency for absence of xerosis in zinc phosphide poisoning. Also, 6 percent of patients poisoned by aluminum phosphide had xerosis, while 94 percent of them did not have it. Moreover, mode is equal to 2 and this number shows maximum frequency for absence of xerosis in aluminum phosphide poisoning.

Table 12 Frequency distribution of patient's clinical symptoms based on flashing in zinc phosphide poisoning and aluminum phosphide poisoning

Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	%16	8	+
-	-	%84	42	-
Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	%0	0	+
-	-	%100	50	-

According to table 12, 16 percent of patients poisoned by zinc phosphide had flashing, while 84 percent of them did not have it. Moreover, mode is equal to 2 and this number shows maximum frequency for absence of flashing in zinc phosphide poisoning. 0 percent of patients poisoned by aluminum phosphide had flashing. Moreover, mode is equal to 2 and this number shows maximum frequency for absence of flashing in aluminum phosphide poisoning.

Table 13 Frequency distribution of patient's clinical symptoms based on dysrhythmia in zinc phosphide poisoning and aluminum phosphide poisoning

Descriptive statistics		Valid percent	Frequency	Variable category
2	Mode	%4	2	Vf
-	-	%96	48	Vt
Descriptive statistics		Valid percent	Frequency	Variable category
1	Mode	%58	29	Vf
-	-	%42	21	Vt

According to table 13, 4 percent of patients poisoned by zinc phosphide had dysrhythmia Vf, while 96 percent of them were Vt. Moreover, mode is equal to 2 and this number shows maximum frequency for Vt in zinc phosphide poisoning. Also, 58 percent of patients poisoned by aluminum phosphide had dysrhythmia Vf, while 42 percent of them were Vt. Moreover, mode is equal to 1and this number shows maximum frequency for Vf in aluminum phosphide poisoning.

METHODOLOGY

The studied population in this paper was poisoned patients of Loqman hospital, they were all suffering from zinc and aluminum phosphides poisoning. In this study, sampling is not done, instead according to size of the poisoned patients of Loqman hospital this research was done referring to medical records and documents archived in hospital. [9] In this research, a collection of symptoms related to zinc and aluminum phosphides poisoning were collected as well. Poisoning symptoms in patients were recorded based on time: 6 hours after poisoning, 7 hours after poisoning, 24 hours after poisoning and more than 24 hours after poisoning. [10]According to error type one (5 percent), power (20percent), aluminum phosphide poisoning leading to death(60 percent) and zinc phosphide poisoning (25 percent), sample size of the group were determined about 50people. [11]

After collecting and coding data, data were entered to SPSS 18 software, and qualitative data were separated to explanatory variables with the help of frequency distribution table. [12]

Variables including Dizziness, shortness of breath, digestive disorders, nervous disorders, cardiovascular problems, pulmonary edema, hypocalcaemia, electrocardiographic disorder, Thrombocytopenia, and methemoglobinemia are defined as following:

- Dizziness is impairment in spatial perception and stability. Because the term dizziness is imprecise, it can refer to vertigo, presyncope, disequilibrium, or a non-specific feeling such as giddiness or foolishness
- Dyspnea, shortness of breath (SOB), or air hunger, is the subjective symptom of breathlessness.
- Digestive disorders are the difficulties in digesting food.
- Cardiovascular disease refers to any disease that affects the cardiovascular system, principally cardiac disease, vascular diseases of the brain and kidney, and peripheral arterial disease.
- A neurological disorder is any disorder of the body's nervous system.
- Pulmonary edema is fluid accumulation in the air spaces and parenchyma of the lungs. It leads to impaired gas exchange and may cause respiratory failure.
- In medicine, hypocalcaemia is the presence of low serum calcium levels in the blood, usually taken as less than 2.1 mmol/L or 9 mg/dl or an ionized calcium level of less than 1.1 mmol/L or 4.5 mg/dL. It is a type of electrolyte disturbance.
- The terms thrombocytopenia and thrombopenia refer to a relative decrease of platelets in blood.

- The Brugada syndrome is a genetic disease that is characterised by abnormal electrocardiogram (ECG) findings and an increased risk of sudden cardiac death.
- Methemoglobinemia (or methaemoglobinaemia) is a disorder characterized by the presence of a higher than normal level of methemoglobin.

DISCUSSION AND RESULTS

Clinical symptoms of zinc phosphide poisoning are different from clinical symptoms of aluminum phosphide poisoning.

H_0: there is no significant difference between clinical symptoms of zinc phosphide poisoning and aluminum phosphide poisoning.[13]

H_1: there is a significant difference between clinical symptoms of zinc phosphide poisoning and aluminum phosphide poisoning.

In order to compare all effects of two poisonings and find the difference between them, t test of independent groups are used first, and then analysis of variance is used to analyze the final model to discover clinical symptoms in both groups. [14]

Table 14 Estimation of t statistic and level of significance of clinical symptoms difference

Sig	Degree of freedom	T statistic value	Variable	Column
./.32	98	-2/173	NV	1
./317	98	-1/005	Headache	2
./000	98	-4/103	Abdominal pain	3
./156	98	1/429	Epilepsy	4
./321	98	-./997	Agitation	5
./000	98	6/135	Respiratory depression	6
./000	98	9/895	Shock	7
./000	98	4/320	Coldness	8
./000	98	4/976	Cyanosis	9
./042	98	-2/064	Sweating	10
./002	98	-3/255	Xerosis	11
./003	98	-3/055	Flashing	12
./000	98	7/118	dysrhythmia	13
./000	86	5/551	SBP6h	14
./000	93	7/597	SBP7-24h	15
./943	42	./072	SBP>24h	16
./525	80	./639	RRzh	17
./020	67	-2/384	RR7-24 h	18
./699	37	./390	RR>24h	19
./400	86	-/864	Tzh	20
./848	93	-./192	T7-24h	21
./993	42	-./008	T>24h	22

In the above table, t statistic value and observed level of error related to studied variable, all of them have 99 percent significant difference with one another. Moreover, variables of NV, sweating and RR7-24h are all in confidence interval 95 percent. Other variables are approximately equal between two poisonings and they do not have a significant difference.

Table 15 Analysis of variance for all components of clinical symptoms

Sig	F statistic	Squares mean	Degree of freedom	Sum of the squares	Model
./000	15/040	44/890	1	44/890	Intragroup
		2/985	98	292/500	intergroup
			99	337/390	Total

According to table 30, Analysis of variance for all components of clinical symptoms is shown among two groups reporting that difference between zinc phosphide poisoning and aluminum phosphide poisoning is significant in confidence interval 99 percent. Therefore, the hypothesis is proven and null hypothesis is rejected. In other words, there is a significant difference between zinc and aluminum phosphide poisoning. Also, other factors as sum of squares, degree of freedom, squares mean, F statistic and sig are shown.

Table 16 Analysis of variance for all components of vital signs

Sig	F statistic	Squares mean	Degree of freedom	Sum of the squares	Model
./000	14/412	461/251	1	461/251	intragroup
		32/006	98	3136/545	intergroup
			99	3597/796	Total

According to table 31, Analysis of variance for all components of vital signs is represented which there is a significant difference between vital signs of zinc and aluminum phosphide poisoning. Also, other factors as sum of squares, degree of freedom, squares mean, F statistic and sig are shown.

REFERENCES

[1]. Shadnia, Sh. , Soltaninejad, K, Ghaemi, M, Abdolahi, M, (2006) ."A review on toxicology of aluminum phosphide", Babol medical sciences college magazine, p: 53-63

[2]. Hoseinian Moqadam, H, Pajoumand, A, (2005) ."One year lasting review on teenagers and adults poisoned and hospitalized in Loqman hospital located in Tehran", Pajouhandeh, p: 169-176.

[3]. Mehrpour, A., Shadnia, S. , Chalky, N., (2009). "Study of electrolytes changes and sugar changes in patients suffering from acute aluminum phosphide poisoning", legal medicine.

[4]. Proudfoot A. (2009). "Aluminium and zinc phosphide poisoning". Informa health care..57(2):89-100.

[5]. Rodenberg HD,Chan CC,Watson WA. (1989). "Zinc phosphide poisoning ingestion:a case report and review". Hum Toxicol..31(16):559-62.

[6]. A Wahab, MS Zaheer, S Wahab, RA Khan. (2008)."Acute aluminium phosphide poisoning: an update"..*Hong Kong Journal of Emergency Medicine*: 152.

[7]. Abdollahi M, Jalali N, Sabzevari O, Hosseini R, Ghanea T. (1997). "A restrospective study of poisoning in Tehran". J Toxicol Clin Toxicol; 35(4):387-93.

[8]. Alter P, Grimm W, Maisch B. (2001). "Lethal heart failure caused by aluminium phosphide poisoning". Intensive care med; 27(1):327.

[9]. Amr MM, Abbas EZ, El-Samra M, El-Batanouni M, Osman AM. (1997). "Neuropsychiatric syndroms and occupational exposure to zinc phosphide in Egypt". Environ res; 73(1-2): 200-6.

[10]. Chan LT, Crowley RJ, Delliou D, Geyer R. (1983). "Phosphine analysis in postmortem specimens following ingestion of aluminium ohosphide". J Anal Toxicol; 7(4): 165-7.

[11]. Chugh, SN. (1991). "Incidence & outcome of aluminium phosphide poisoning in a hospital study". *The Indian journal of medical research* 94: 232–5.

[12]. Cienki JJ. (2001). "Non-anticoagulant rodenticides". Ford MD, Delaney Ka, Ling Lj, Erikson T(eds), Clinical toxicology, 1st ed, Philadelphia, W. B. Saunders Co; pp:858.

[13]. Ellenhorn MJ. Ellenhorn. (1997). "Medical toxicology, diagnosis and treatment of human poisoning", 2nd ed, Baltimore, Williams & Wilkins; pp: 1657-9.

[14]. Goel A.Aggarwal P. (2007). "Pesticide poisoning". Natl Med J India.. 20(4): 182-91.

[15]. Gupta S, Ahlawat SK. (1995). "Aluminium phosphide poisoning: a review". J Toxicol Clin Toxicol; 33(1):19-24.

[16]. Hadad LM, Shannon MW, Winchester JF. (1998). "Clinical management of poisoning and drug overdose". 3rd ed, Philadelphia, W. B. Saunders Co; pp: 872-3.

[17]. Khosla SN, Handa R, Khosla P. (1992) . "Aluminum phosphide poisoning". Trop Doct; 22(4):155-7.

[18]. Mathai, Ashu; Bhanu, Madhuritasingh, (2010). "Acute aluminium phosphide_poisoning: Can we predict mortality?". *Indian Journal of Anaesthesia* 54 (4): 302–7.

[19]. Rodenberg HD, Chang CC, Watson WA. (1989). "Zinc phosphide ingestion: a case report and review". Vet Hum Toxical; 31(6): 559-62.

[20]. Schonwald S. (2001). "Medical toxicology: a synopsis and study guide". Philadelphia, Lippincott, Williams & Wilkins; pp:731-2.

[21]. Sharma A, Gathwala G. (1992). "Oral aluminium phosphide poisoning in Indian children". J Trop Med Hyg 95(3):221-2.

[22]. Sharma A, Gathwala G. (1992). "Oral aluminium phosphide poisoning in india children". J Trop Med Hyg; 95(3): 221-2.

[23]. Singh S, Singh D, Wig N, Jit I, Sharma BK, (1996). "Aluminum phosphide ingestion—a clinico-pathologic study". *J Toxicol Clin Toxicol* 34 (6): 703–6.

[24]. Siwach, SB; Gupta, A, (1995). "The profile of acute poisonings in Harayana-Rohtak Study". *The Journal of the Association of Physicians of India* 43 (11): 756–9.