Journal of
Babol University of Medical Sciences
JBUMS
e-ISSN: 2251-7170 p-ISSN: 1561-4107

Clinical and Epidemiological Indicators of Patients Poisoned with Agricultural Pesticides during a Five-Year Period

E. Shakeri (MD)[1], F. Bagherian (MD)[2], H. Gholinia (MSc)[3], Z. Hosseini Marznaki (MSc)[4], A. A. Manouchehri (MD)[*2]

1.Student Research Committee, Babol University of Medical Sciences, Babol, I.R.Iran.

2.Clinical Research Development Unit of Shahid Beheshti Hospital, Babol University of Medical Sciences, Babol, I.R.Iran.

3.Health Research Institute, Babol University of Medical Sciences, Babol, I.R.Iran.

4.Imam Ali Hospital, Mazandaran University of Medical Sciences, Amol, I.R.Iran.

•**Corresponding Author: A. A. Manouchehri (MD)**

Address: Clinical Research Development Unit of Shahid Beheshti Hospital, Babol University of Medical Sciences, Babol, I.R.Iran.

Tel: +98 (11) 32256285. **E-mail:** drmanouchehri@yahoo.com

Article Type

Research Paper

Received:
Apr 3rd 2024
Revised:
May 14th 2024
Accepted:
May 30th 2024

ABSTRACT

Background and Objective: Pesticide poisoning is one of the common causes of hospitalization and death. Since the pattern of poisoning depends on various factors such as access to different poisons, and social, economic, cultural and religious beliefs of the society, this study was conducted with the aim of investigating the clinical and epidemiological indicators of patients poisoned with agricultural pesticides in Babol, northern Iran.

Methods: This cross-sectional study was conducted on 316 patient files at Shahid Beheshti Hospital in Babol by census method from 2016 to 2021. Basic and demographic information, pesticide use and clinical symptoms of patients admitted to hospitals affiliated to Babol University of Medical Sciences with definitive diagnosis of pesticide poisoning were investigated.

Findings: The mean age of the patients was 36.52±16.35 years and 77 people (24.4%) died. Out of 316 examined patients, 206 (65.2%) were younger than 40. 185 people (58.5%) were men and 113 people (35.8%) were city residents. It was taken orally by 284 people (89.9%) and it was inhaled in 32 people (10.1%). The highest consumption time was in summer among 98 people and the lowest consumption time was in winter among 65 people. In 280 people, the cause was deliberate and suicidal use, and it was unintentional in 36 people. 90 people had a history of mental disorders.

Conclusion: The results of the study showed that the most cases of poisoning with pesticides are in young men and consumed orally.

Keywords: *Poisoning, Pesticide, Suicide Attempt, Epidemiology*.

Cite this article: Shakeri E, Bagherian F, Gholinia H, Hosseini Marznaki Z, Manouchehri AA. Clinical and Epidemiological Indicators of Patients Poisoned with Agricultural Pesticides during a Five-Year Period. *Journal of Babol University of Medical Sciences*. 2024; 26: e50.

[DOI: 10.22088/jbums.26.1.50]

Introduction

Pesticide poisoning is one of the most common public health challenges in the world (1). According to studies, the incidence of poisoning in developing countries is 13 times higher than in industrialized countries. Moreover, developing countries consume 85% of the global production of pesticides (2). Therefore, due to the increased consumption and availability of all kinds of pesticides, poisoning with these poisons has a higher incidence rate in developing countries (3). In the last few decades, significant changes have been made in the pattern of acute poisoning due to tremendous advances in the fields of agriculture, pharmacology, and industry technology (4). Agricultural poisoning in developing countries is an important health problem and causes a large number of people to be hospitalized (5). Furthermore, due to the high toxicity of substances and the lack of available medical centers in developing countries, a large number of cases of agricultural poisoning lead to death (6).

Pesticides include all insecticides, herbicides, rodenticides, fungicides, etc. and various compounds such as organophosphates, organochlorines, carbamates and biological substances are used in their production and can cause harm or even death (7). On the other hand, due to the lack of sufficient familiarity of pesticide users with the correct principles of combat, this work is done incompletely or indiscriminately, and therefore, in addition to not achieving the desired result, it causes disruption of the natural balance and accidental or intentional poisoning of consumers in the long term (8). Poisoning can be caused by various ways such as oral, inhalation and injection, and the effects it causes can be local and general (9).

Poisoning with organophosphorus compounds is one of the main clinical problems in the world, especially in developing countries, which is associated with high mortality. Neurobehavioral dysfunction caused by exposure to pesticides includes adverse changes in the central and peripheral nervous system that lead to changes in memory, mood, attention, disorganized thinking as well as difficulty concentrating, dizziness, and continuous and excessive headaches. Fatigue, insomnia and nervous system disorders depend on the dose, frequency of exposure, type of pesticides, toxicity and duration of exposure to pesticides (10). The type of pesticide, the duration and manner of exposure, the individual's health status, including nutritional and skin conditions, determine the possible health consequences. Some adverse health effects associated with pesticides include dermal, gastrointestinal, respiratory, reproductive, endocrine, carcinogenic, and neurological effects (11). Based on the results obtained by Jorsaraei et al., awareness of the potentially harmful effects of pesticides on fertility and finally pregnancy should increase among people who are in contact with these pesticides occupationally (12). The use of pesticides is very common in most parts of Iran, which results in considerable complications and deaths.

As the center for planting rice and all kinds of citrus fruits, Mazandaran province in the north of Iran has a special position and is highly influenced by pesticides and poisoning caused by pesticides. On the other hand, traditional farming methods and the farmers' lack of knowledge about the effects of these pesticides have increased the number of patients affected by pesticides. Therefore, according to the mentioned points, this study was carried out in order to investigate the pattern of poisonings, and clinical and epidemiological indicators of patients affected by agricultural pesticides during the years 2016 to 2021 in Shahid Beheshti Hospital in Babol.

[DOI: 10.22088/jbums.26.1.50]

Methods

After being approved by the Ethics Committee of Babol University of Medical Sciences with the code IR.MUBABOL.REC.1402.099, this cross-sectional study was conducted in the form of a census by examining 316 cases of hospitalized patients during the years 2016 to 2021 with definitive diagnosis of pesticide poisoning in Shahid Beheshti Hospital, Babol. The definitive diagnosis of pesticide poisoning was made through laboratory findings and clinical symptoms in patient records. The type of herbicide was also generally investigated in this study.

Incomplete cases were excluded from the study. Information related to hospitalized patients with definitive diagnosis of pesticide poisoning was collected using a checklist, which included basic information (type of consumption, history of illness, cause and time of consumption), demographic information including age, gender, education, occupation, marital status, family income as "low family income" (10 million Tomans and less) and "adequate family income" (above 10 million Tomans), place of residence, as well as information related to clinical symptoms, including the level of consciousness and performed actions. Then the data were analyzed using SPSS version 16 and T-Test and Chi-Square tests, and $p<0.05$ was considered significant.

Results

In this study, the status of 316 patients affected by pesticide poisoning was investigated. The mean age of the patients was 36.52±16.35 years. 77 people (24.4%) died (Table 1). Out of 316 examined patients, 110 (34.8%) were over 40 years old. 58.5% of them were men and 35.8% were city residents. 43% of patients were employed. Education of 41.5% of patients was lower than high school diploma. The family income of 65.2% of the patients was adequate for their needs. 58.2% of them were married. Out of 88 patients aged 30 to 39 years, 26 of them died. Of the 131 women, 35 died. Among the patients living in the village (139 people), there were 28 deaths. Among the unemployed patients, 34 people died and among the patients with high school diploma, 32 people died. Among 110 patients with low family income, 28 of them died. There were 39 deaths among married people. Based on the results of chi-square test, no statistically significant relationship was observed between demographic characteristics of patients and mortality. Out of 88 patients aged 30 to 39 years, 26 of them died. Out of 284 patients (89.9%) with oral consumption, 77 (27.1%) died.

In 284 people (89.9%), consumption was done orally and 280 people (88.6%) consumed it with the intention of suicide. A statistically significant relationship was observed between patient mortality and level of consciousness at admission and the variables of type, method, time and cause of consumption and emergency measures ($p<0.05$). The deaths of the oral group were higher than those of inhalation. Deaths in winter were more than other seasons. In patients with a level of consciousness less than 9, the rate of death was higher than in other groups. No statistically significant relationship was observed between history of suicide, history of mental illness, history of heart disease, and history of diabetes and patient mortality (Table 2).

The length of stay in the emergency room among deceased patients was shorter than living patients, which was statistically significant ($p<0.05$). The length of stay in the ICU among deceased patients was longer than alive patients ($p<0.05$) (Table 3).

[DOI: 10.22088/jbums.26.1.50]

Table 1. Review of the demographic characteristics of the studied subjects based on mortality

Variable	Total frequency Number(%)	The final outcome		p-value*
		Death 77(24.4) Number(%)	Recovery 239(75.6) Number(%)	
Age (years)				
<20	48(15.2)	7(14.6)	41(85.4)	0.26
20-29	70(22.2)	16(22.9)	54(77.1)	
30-39	88(27.8)	26(29.5)	62(70.5)	
>40	110(34.8)	28(25.5)	82(74.5)	
Gender				
Man	185(58.5)	42(22.7)	143(77.3)	0.413
Woman	131(41.5)	35(26.7)	96(73.3)	
Residence				
City	113(35.8)	33(29.2)	80(70.8)	0.247
Village	139(44)	28(20.1)	111(79.9)	
Outskirts	64(20.3)	16(25)	48(75)	
Job				
Employed	136(43)	33(24.3)	103(75.7)	0.84
Unemployed	133(42.1)	34(25.6)	99(74.4)	
Other	47(14.9)	10(21.3)	37(78.7)	
Education				
Illiterate	58(18.4)	14(24.1)	44(75.9)	0.138
Below high school Diploma	131(41.5)	25(19.1)	106(80.9)	
High school diploma	99(31.3)	32(32.3)	67(67.7)	
Academic	28(8.9)	6(21.4)	22(78.6)	
Family income				
Low	110(34.8)	28(25.5)	82(74.5)	0.74
Adequate	206(65.2)	49(23.8)	157(76.2)	
Marital status				
Single	86(27.2)	26(30.2)	60(69.8)	0.2
Married	184(58.2)	39(21.2)	145(78.8)	
Deceased spouse	23(7.3)	4(17.4)	19(82.6)	
Divorced	23(7.3)	8(34.8)	15(65.2)	

*Chi-square test

[DOI: 10.22088/jbums.26.1.50]

Table 2. The frequency of the type, method, time and cause of consumption and measures taken in the emergency room, level of consciousness upon arrival, history of suicide, history of mental illness, history of heart disease, and history of diabetes in association with the mortality of patients with agricultural pesticide poisoning

Variable	Total frequency Number(%)	The final outcome		p-value*
		Death 77(24.4) Number(%)	Recovery 239(75.6) Number(%)	
Type and method of consumption				
Oral	284(89.9)	77(27.1)	207(72.9)	0.001
Inhalation	32(10.1)	0(0)	32(100)	
Consumption time				
Spring	73(23.1)	12(16.4)	61(83.6)	0.002
Summer	98(31)	18(18.4)	80(81.6)	
Autumn	80(25.3)	20(25)	60(75)	
Winter	65(20.6)	27(41.5)	38(58.5)	
Reason for use				
Intentional, suicidal intent	280(88.6)	75(26.8)	205(73.2)	0.005
Accidental	36(11.4)	2(5.6)	34(94.4)	
Emergency measures				
Stomach pumping	171(54.1)	55(32.2)	116(67.8)	<0.001
Charcoal sorbitol gavage	12(3.8)	0(0)	12(100)	
Antidote prescription	46(14.6)	4(8.7)	42(91.3)	
Other	67(21.2)	6(9)	61(91)	
Dialysis	20(6.3)	12(60)	8(40)	
Consciousness level at admission				
<9	39(12.3)	28(71.8)	11(28.2)	<0.001
9-13	105(33.2)	38(36.2)	67(63.8)	
13-15	172(54.4)	11(6.4)	161(93.6)	
History of suicide				
Yes	60(19)	15(25)	45(75)	0.89
No	256(81)	62(24.2)	194(75.8)	
History of mental illness				
Yes	90(28.5)	27(30)	63(70)	0.141
No	226(71.5)	50(22.1)	176(77.9)	
History of heart disease				
Yes	33(10.4)	7(21.2)	26(78.8)	0.65
No	283(89.6)	70(24.7)	213(75.3)	
History of diabetes				
Yes	20(6.4)	4(20)	16(80)	0.62
No	294(93.6)	73(24.8)	221(75.2)	

*Chi-square test

[DOI: 10.22088/jbums.26.1.50]

Table 3. The relationship between the length of stay in the emergency room and ICU, and the mortality of patients affected by agricultural pesticide poisoning

Variable	Total mean Median (IQR)	The final outcome		p-value
		Death 77(24.4) Median (IQR)	Recovery 239(75.6) Median (IQR)	
Length of stay in the emergency room (hours)	0 (0-5)	0 (0-0)	5 (0-6)	<0.001
Length of stay in ICU (days)	0.5 (0-2)	1 (1-2)	0 (0-2)	<0.001

Discussion

In this study, most cases of pesticide poisoning were in the age group of less than 40 years, which is not consistent with the results of other studies (13-16). In this study, more than half of poisoning cases occurred in men, which is consistent with the results of other studies (17-20). Of course, some studies also showed that the rate of poisoning in women is higher than in men. Several studies have shown that drug poisoning and suicide are more severe in women than in men (16, 21). It can probably be due to the fact that women are more prone to changes in external factors than men and need more psychological support (21, 22).

The results of the present study showed that unlike most studies (23-25), the rate of suicide attempts was higher among men. Due to the higher prevalence of major depression among women, this issue may be due to the fact that in this study, cases of intentional and accidental poisoning were also evaluated, not just suicide cases. The results of the present study have also shown that most of the cases leading to poisoning occurred in the residents of the village and the outskirts of the city, which is similar to the results of other studies in this field (25). The cause of poisoning in Iran differs according to the type of access and climatic conditions, and perhaps it can be said that the ease of access to pesticides in villages compared to urban areas has caused the occurrence of poisoning in the present study. Since the occupation of most people in the villages of Babol is agriculture, poisoning with pesticides is not far from expected.

In this study, most cases of poisoning were oral and gastrointestinal, which is consistent with the results of Zhang et al. (18), Barary et al. (16), Hawton et al. (26), Oraie et al. (27). A study by Kır et al. also showed that most cases of pesticide poisoning occur through the gastrointestinal tract and skin exposure is secondary (28). In fact, poisoning through the digestive system can occur less accidentally and this route can be used for suicide, while pesticide poisoning through the skin and inhalation can occur accidentally or during work.

Most of the poisoned people in the present study were employed and had enough income to meet their needs. However, the results of most studies in Iran and other countries have shown that insufficient income is one of the causes of poisoning. The results of the study by Zhang et al. (25) have also shown that most of the poisoned people were from the poor families and their education was below high school diploma. The results of the study by Eizadi-Mood et al. (20) and Zhang et al. (25) were also in line with the results of the present study. The results of this finding are not far from expected because people with limited literacy have fewer opportunities to get familiar with the principles of exposure to pesticides and take the necessary precautions against it. In this study, most of the poisoning cases were done for intentional reasons and with the intention of suicide, which is consistent with the results of other studies (29). The existence of economic, social, and cultural problems is among the important issues that can provide the basis for intentional poisoning (29).

[DOI: 10.22088/jbums.26.1.50]

Most of the poisoners were married. In the studies of Eizadi-Mood et al. (20) and Torkashvand et al., intentional poisoning was significantly higher in divorced and widowed individuals than in single and married individuals. They found that the increase in mental pressure and problems caused by the breakdown of the family foundation can be among the factors of suicide attempts in these people (30). Also, nearly half of the pesticide poisoning deaths have been referred to these centers in summer and autumn. The results of the studies of Eizadi-Mood et al., Adibelli et al., and Idiz et al. showed that most poisonings occurred in spring and summer (20, 31, 32). This difference can be attributed to the use of pesticides in different seasons of the year and in different geographical areas. However, when the cause of poisoning is evaluated, it is believed that their use for suicide is not affected by the season and this issue may occur at any time of the year. The fact that suicidal poisonings are the most frequent in all studies also supports this view (33). Nearly one third of the dead people were poisoned due to intentional consumption. According to the report of the World Health Organization, most intentional and suicidal poisonings occur in Asian countries and with pesticides (34). In some countries, deaths from pesticide poisoning are declining, which may be attributed to enacting laws banning the use of highly toxic pesticides in agriculture, a measure that has been effective in other countries (35, 36). However, the high rate of suicide by poisoning may be related to various reasons such as increased unemployment, urbanization, breakdown of the family support system, and economic problems (37, 38).

The results of the present study showed that there was no statistically significant relationship between mortality of patients and history of suicide attempts or mental illness. The results of a study by Eizadi-Mood et al. showed a significant relationship between previous history of suicide attempts and self-harm with pesticide poisoning, which is not consistent with the results of the present study (20). The results of a study by Torkashvand et al. (30) and Manouchehri et al. (29) showed that there is a significant relationship between people with a history of previous poisoning, psychiatric disorders and the use of drugs related to current poisoning. In a systematic review, suicide attempt in Iran was associated with psychiatric disorders. 45% of the investigated people had a mental disorder (39). Since previous studies were only conducted on people with suicide attempts, but the current study included all poisoned patients (intentionally and accidentally) and was not specific to patients with suicide attempts, so this variable was not significant. The results of the study by Barary et al. showed that more than half of the patients were women (51.7%) and most cases of poisoning were seen in patients between 15 and 25 years (34.2%). It was also found that suicide constitutes a large part of poisoning cases (65.6%) and women tend to commit suicide more than men (64.3% vs. 35.7%, respectively) (16). In terms of age below 40 years and the number of cases of poisoning with suicidal intent, it is consistent with this study, but in terms of gender, in the study of Barary et al., the number of women was more than men. The reason for the difference could be that in our study, only cases of poisoning with pesticides were examined, but in the study of Barary et al., all cases of poisoning were examined, including pesticides, drugs and anabolic steroids, phosphides, alcohol, corrosive agents, gases, heavy metals, and food.

The results of a study by Mehdizadeh et al. showed that the highest rate of poisoning is in the young age group and due to suicide (40), which is consistent with the results of the present study in terms of age group. The results of this study showed that the frequency of accidental poisoning with pesticides in patients has a considerable rate, which indicates lack of awareness in the field of transportation, proper storage and use of pesticides by users. Therefore, it is suggested to raise awareness about the methods of pesticide contamination in the community, to teach the correct way to transport, store and use these poisons, to encourage people to reduce the use of pesticides and to use alternative pest control methods. In addition, the results of the present study showed that special attention should be paid to intentional

[DOI: 10.22088/jbums.26.1.50]

poisoning by pesticides. Based on the results of this research, with changes in health policies at the city level, it is possible to have public education programs for families with the aim of basic treatment measures at home in possible cases of poisoning to reduce the prevalence and death rates caused by pesticide poisoning.

One of the limitations of the current study is its retrospective nature, which ruled out the possibility of clinical interviews to complete the self-reported data due to the impossibility of the clients being present at the time of completing the questionnaires to answer the possible questions of the researchers. Also, due to the incompleteness of some files, it was not possible to access its information. Statistics based on hospital information in a limited period of time may not reflect the exact situation of poisoning in that area. This research was done only in Babol and by reviewing hospital files and in a limited time, and it is necessary to be careful to generalize the results and if possible, the reasons and factors should be compared by conducting such a research in other places.

Conflict of interest: The authors deny any potential conflict of interest related to the research, writing, and publication of this article.

Acknowledgment

We would like to thank the Vice-Chancellor of Research and Technology and the Student Research Committee of Babol University of Medical Sciences as well as the Research Development Unit of Shahid Beheshti Hospital.

[DOI: 10.22088/jbums.26.1.50]

References

1.Ödek Ç, Akça H, Erol M, Demir R, Tunç M, Aydınalp A, et al. Retrospective Analysis of Demographic, Epidemiologic, and Clinical Characteristics of Poisoning Cases Followed in Pediatric Intensive Care Unit. Cocuk Acil ve Yogun Bakım. 2019;6(2):72-8.

2.Mehrpour O, Akbari A, Jahani F, Amirabadizadeh A, Allahyari E, Mansouri B, et al. Epidemiological and clinical profiles of acute poisoning in patients admitted to the intensive care unit in eastern Iran (2010 to 2017). BMC Emerg Med. 2018;18(1):30.

3.Kassiri H, Feiz-Haddad MH, Ghasemi F, Rezaei M, Ghanavati F. An epidemiologic and demographic survey of poisoning in Southwest of Iran. Middle-East J Sci Res. 2012;12(7):990-6.

4.Sepahi S, Gerayli S, Delirrad M, Taghavizadeh Yazdi ME, Zare-Zardini H, Bushehri B, et al. Biochemical responses as early and reliable biomarkers of organophosphate and carbamate pesticides intoxication: A systematic literature review. J Biochem Mol Toxicol. 2023;37(3):e23285.

5.Nozari M, Esmaili-Sari A, Moradi AM, Bahramifar N, Taghavi L. Contamination, ecological, and health risk assessment of heavy metals and organophosphorus pesticides in single, double, and ratoon cropping of rice: a case study in Mazandaran, North of Iran. Environ Monit Assess. 2023;195(3):376.

6.Rezaei Orimi J, Nasiri E, Talebi P, Mahmodpoor G. Investigating the Unintentional Poisoning Epidemiology in Prehospital Emergency Center in Qaemshahr City, Iran. Health Emerg Disaster Q (HDQ). 2023;8(2):115-24.

7.Hassaan MA, El Nemr A. Pesticides pollution: Classifications, human health impact, extraction and treatment techniques. Egypt J Aquat Res. 2020;46(3):207-20.

8.Eyvazi A, Pournajaf A. Epidemiology of field poisoning with Pesticides in farmers in Elam province. J Ilam Univ Med Sci. 2004;12(3):40-5. [In Persian] Available from: https://www.magiran.com/paper/438428/

9.Doğruyol S, Akbaş İ, Çakır Z. Demographic and clinical characteristics of carbon monoxide poisoning: Data between 2014 and 2018 in Erzurum. Eurasian J Toxicol. 2018;1(1):15-20.

10.Mohammadi N, Rastgoo N, Esmaeil Zadeh S. Epidemiological and Clinical Features of Acute Poisoning in Children in a Referral Teaching Hospital in Iran, 2015-2018. J Compr Ped. 2020;11(4):e97867.

11.Şık G, Demirbuğa A, Annayev A, Deliceo E, Tufan AE, Çıtak A. Retrospective Analysis of Demographic, Epidemiologic, and Clinical Characteristics of Poisoning in Pediatric Intensive Care Unit. Bezmialem Sci. 2020;8(4):357-62.

12.Jorsaraei SGA, Gholamitabar Tabari M. The effect of organophosphate pesticides on fertility. J Babol Univ Med Sci. 2014;16(Suppl 1):7-14. [In Persian]

13.Sontakke T, Kalantri S. Predictors of Mortality in Hospitalized Patients with Pesticide Poisoning. Cureus. 2023;15(7):e41284.

14.Pedersen B, Ssemugabo C, Nabankema V, Jørs E. Characteristics of Pesticide Poisoning in Rural and Urban Settings in Uganda. Environ Health Insights. 2017;11:1178630217713015.

15.SadeghiehAhari S, Farzaneh E, Amani F, Azari Sh. Epidemiology of poisoning due to agricultural pesticides in patients referred to Ardabil city hospitals, 2012. J Health. 2014;5(3):240-7. [In Persian]

16.Barary M, Pirzadeh M, Rezaeian N, Dadashnia M, Mohammadi-Daniali S, Pahlavani F, et al. An epidemiological study of poisoning cases in Babol (northern Iran) from 2015 to 2018. Caspian J Intern Med. 2021;12(1):35-44.

17.Getie A, Belayneh YM. A Retrospective Study of Acute Poisoning Cases and Their Management at Emergency Department of Dessie Referral Hospital, Northeast Ethiopia. Drug Healthc Patient Saf. 2020;12:41-8.

18.Zhang Y, Yu B, Wang N, Li T. Acute poisoning in Shenyang, China: a retrospective and descriptive study from 2012 to 2016. BMJ Open. 2018;8(8):e021881.

[DOI: 10.22088/jbums.26.1.50]

19.Rezaei J, Nasiri E, Moalemi M, Padashi S, Hatami M. Epidemiology of acute poisoning in Mazandaran province, Iran. Int J Med Toxicol Forensic Med. 2020;10(3):27632.
20.Eizadi-Mood N, Mahvari R, Akafzadeh Savari M, Mohammadbeigi E, Feizi A, Mirmoghtadaei P, et al. Acute pesticide poisoning in the central part of Iran: A 4-year cross-sectional study. SAGE Open Med. 2023;11:20503121221147352.
21.Bachmann S. Epidemiology of Suicide and the Psychiatric Perspective. Int J Environ Res Public Health. 2018;15(7):1425.
22.Sourander A, Klomek AB, Niemelä S, Haavisto A, Gyllenberg D, Helenius H, et al. Childhood predictors of completed and severe suicide attempts: findings from the Finnish 1981 Birth Cohort Study. Arch Gen Psychiatry. 2009;66(4):398-406.
23.Schrijvers DL, Bollen J, Sabbe BG. The gender paradox in suicidal behavior and its impact on the suicidal process. J Affect Disord. 2012;138(1-2):19-26.
24.Freeman A, Mergl R, Kohls E, Székely A, Gusmao R, Arensman E, et al. A cross-national study on gender differences in suicide intent. BMC Psychiatry. 2017;17(1):234.
25.Zhang X, Zhao W, Jing R, Wheeler K, Smith GA, Stallones L, et al. Work-related pesticide poisoning among farmers in two villages of Southern China: a cross-sectional survey. BMC Public Health. 2011;11:429.
26.Hawton K, Bergen H, Waters K, Ness J, Cooper J, Steeg S, et al. Epidemiology and nature of self-harm in children and adolescents: findings from the multicentre study of self-harm in England. Eur Child Adolesc Psychiatry. 2012;21(7):369-77.
27.Oraie M, Hosseini MJ, Islambulchilar M, Hosseini SH, Ahadi-Barzoki M, Sadr H, et al. A Study of Acute Poisoning Cases Admitted to the University Hospital Emergency Department in Tabriz, Iran. Drug Res (Stuttg). 2017;67(3):183-8.
28.Kır MZ, Öztürk G, Gürler M, Karaarslan B, Erden G, Karapirli M, et al. Pesticide poisoning cases in Ankara and nearby cities in Turkey: an 11-year retrospective analysis. J Forensic Leg Med. 2013;20(4):274-7.
29.Manouchehri A, Marznaki ZH, Atim LM, Mohammadian Amiri M, Kaggwa MM. The relationship between causes of suicidal attempts in Iran and individual and social variables: a retrospective study. BMC Psychiatry. 2022;22(1):780.
30.Torkashvand F, Sheikh Fathollahi M, Shamsi S, Kamali M, Rezaeian M. Evaluating the Pattern of Acute Poisoning in Cases Referred to the Emergency Department of Ali-ebn Abi Taleb Hospital of Rafsanjan from October 2013 to September 2014. J Rafsanjan Univ Med Sci. 2015;14(4):311-24. [In Persian]
31.Adibelli D, Özkan İ, Özkan HÖ. Retrospective analysis of pesticide poisoning in rural area. East J Med. 2019;24(3):289-98.
32.Idiz N, Karakus A, Dalgıç M. The forensic deaths caused by pesticide poisoning between the years 2006 and 2009 in Izmir, Turkey. J Forensic Sci. 2012;57(4):1014-6.
33.Lee YY, Chisholm D, Eddleston M, Gunnell D, Fleischmann A, Konradsen F, et al. The cost-effectiveness of banning highly hazardous pesticides to prevent suicides due to pesticide self-ingestion across 14 countries: an economic modelling study. Lancet Glob Health. 2021;9(3):e291-e300.
34.Mew EJ, Padmanathan P, Konradsen F, Eddleston M, Chang SS, Phillips MR, et al. The global burden of fatal self-poisoning with pesticides 2006-15: Systematic review. J Affect Disord. 2017;219:93-104.
35.Maksimović ŽM, Jović-Stošić J, Vučinić S, Perković-Vukčević N, Vuković-Ercegović G, Škrbić R, et al. Acute organophosphate and carbamate pesticide poisonings - a five-year survey from the National Poison Control Center of Serbia. Drug Chem Toxicol. 2023;46(1):113-21.

[DOI: 10.22088/jbums.26.1.50]

36.Knipe DW, Gunnell D, Eddleston M. Preventing deaths from pesticide self-poisoning-learning from Sri Lanka's success. Lancet Glob Health. 2017;5(7):e651-2.
37.Islambulchilar M, Islambulchilar Z, Kargar-Maher MH. Acute adult poisoning cases admitted to a university hospital in Tabriz, Iran. Hum Exp Toxicol. 2009;28(4):185-90.
38.Tüfekçi IB, Curgunlu A, Sirin F. Characteristics of acute adult poisoning cases admitted to a university hospital in Istanbul. Hum Exp Toxicol. 2004;23(7):347-51.
39.Ghoreishi SA, Mousavinasab N. Systematic review of researches on suicide and suicide attempt in Iran. Iran J Psychiat Clin Psychol. 2008;14(2):115-21. [In Persian]
40.Mehdizadeh Gh, Manouchehri AA, Zarghami A, Moghadamnia AA. Prevalence and Causes of Poisoning in Patients Admitted to Shahid Beheshti Hospital of Babol in 2011-2012. J Babol Univ Med Sci. 2015;17(7):22-8. [In Persian]

[DOI: 10.22088/jbums.26.1.50]