

EPIDEMIOLOGICAL STUDY OF ACUTE POISONINGS CAUSED BY CONSUMING VARIOUS CONTAMINATED FOOD, CHEMICAL AND PHARMACEUTICAL SUBSTANCES RECORDED BY IMAM KHOMEINI HOSPITAL OF KERMANSHAH DURING 4 YEARS (2009-2012)

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ABSTRACT

Acute poisoning caused by consuming food, chemicals and pharmaceuticals is one of the main problems of public health, particularly in low and middle-income countries. Epidemiological studies related to various diseases have a key role in diagnosing the sources of contamination, transmission routes, prevalence and spread of various diseases (e.g. varied poisonings) and prevention and control approaches. This study aimed to investigate the epidemiology of acute poisonings caused by consuming food, chemical and pharmaceutical compounds at Imam Khomeini Hospital of Kermanshah during 4 years (2009-2012). We extracted the research data on food, chemical and pharmaceutical poisonings from Imam Khomeini Hospital of Kermanshah during this period of time using 165, 2610 and 3073 records of hospitalized patients in the hospital, respectively. After classifying the data regarding the objectives of the study, they were analyzed by using Excel and SPSS software. We used chi-square test to determine the association between the different variables and poisoning incidence. The results showed that most food, chemical and pharmaceutical poisonings had accrued in spring and summer. They recorded an increase in food poisoning incidence and a decrease in chemical and pharmaceutical poisonings from 2009 to 2012. The incidence of food and chemical poisonings was reported higher in men than in women, while gender differences in the incidence of drug poisoning were quite opposite. Among age groups, the highest incidence for each poisoning occurred in the age group of 30-15 years. Besides, the association between incidence of food, chemical and pharmaceutical poisonings and year, season, month, gender and age groups was significant (P value<0.001). Therefore, responsible organizations need to take steps to train the public and broaden its knowledge of food hygiene and proper usage of chemicals and pharmaceuticals by employing different means (radio, television, newspapers, etc.), considering the significance of this association.

Key words: Food poisoning, Chemical and Pharmaceutical, Imam Khomeini Hospital, Kermanshah, Epidemiological Study.

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Introduction

Acute poisoning as one of the main public health problems carries more weight in low and middle-income countries. Researches, conducted by international organizations have listed it as a crucial troublesome problem in human societies, which especially in developing countries minimizes human development and productivity^(1,2). For example, acute poisoning in Bangladesh kills 2,000 people per year⁽³⁾. In most cases, poisonings cause acute

and immediate risks. If appropriate measures were not taken, they would spread immediately and result in an epidemic in a large group of people on a region. Such poisonings are caused by consuming an external substance considered harmful for human health. Occasionally, it costs a lot to treat them, so that many families might not afford it. Poisonings caused by consuming food substances are one the most important types of poisoning. This kind of poisoning occurs through consumption of the contaminated food or beverage and exposure to

bacterial, fungal, chemical or artificial toxins⁽⁴⁾. Bacteria are the key factors contributing to food poisonings and infections, but only some specific types of them play part in more than 70% of these foodborne illnesses. Food poisoning bacteria are classified into two groups: gram-positive and gram-negative.

The first group (gram-positive) includes staphylococci, streptococci, clostridium, serous bacillus and the second group (gram-negative) consists of salmonella, E. coli, Vibrio parahaemolyticus. Moreover, significant quantities of natural toxic substances exist in plants and animal food products which are of immense importance. Natural toxic substances might be found in animal food products such as shellfish feeding on toxic brown and red algae during a certain season⁽⁵⁾. Millions of people around the world suffer from food poisonings caused by dairy, meat and poultry products annually that in some cases may result in chronic health effects such as joints disease, immune system disorder or renal failure⁽⁶⁾. Food poisoning may occur as a result of consuming food of any type (e.g. homemade, processed or fast food). The best way to prevent food poisoning is proper food preparation, storage, protection and hygiene compliance⁽⁷⁾.

Chemical and pharmaceutical substances may induce poisoning through oral intake, inhalation, injection and skin⁽⁸⁾. Agricultural chemical residues on different parts of plants, fruits and fodder used to feed livestock may also contaminate their milk and meat and cause poisoning in consumers⁽⁹⁾. It is estimated that each year about half of a million people in the world die as a result of chemical poisonings caused by exposure to insecticides⁽¹⁰⁾. Improper use of chemical substances may result in poisoning. For instance, since drugs lose their therapeutic effect in case of overuse, they may produce toxic effects⁽⁸⁾.

Pharmaceutical poisoning is one of the most serious life-threatening poisonings with the highest rate of hospitalization and the most EMS visits. Nearly 15% of the ICU patients are referred to it because of pharmaceutical poisoning^(11, 12). The exact magnitude of this kind of poisoning is still unknown due to the lack of sufficient epidemiological data, but the study of the medical records and the health services reports represent a growing trend of it^(13, 14).

Considering the significance of epidemiological researches on different diseases to diagnose contamination sources, transmission and spread

ways and the incidence rate, as well as on different poisoning prevention and controlling, this study aims to epidemiologically evaluate acute poisonings caused by various contaminated food, chemical and pharmaceutical substances recorded by Kermanshah's Imam Khomeini hospital during 4 years (2009-2012) and access the required data to present proper approaches for preventing or reducing the rate of poisoning incidence.

Material and methods

For this study, we collected the data on food, chemical and pharmaceutical poisonings from medical records of patients hospitalized at Imam Khomeini hospital in Kermanshah during 4 years (2009-2012). The number of food, chemical and pharmaceutical poisoning cases was 165, 2610 and 3070, respectively. It should be noted that there didn't exist a particular base for selecting the cases, thus we examined all medical records archived during this period. We selected Imam Khomeini hospital as the center of our study because most patients of food, chemical and pharmaceutical poisonings are referred to this hospital. After classifying the data according to the aim of the study, we transferred them to excel and SPSS software to be analyzed. To determine the relationship between the rate of poisoning incidence and different variables (season, age, gender) we employed chi-square test at a significant level ($\alpha = 0.05$) and descriptive statistics by cross-table, frequency and descriptive guidelines.

Results

Tables 1-5 represent the frequency distribution of food, chemical and pharmaceutical poisoning incidence at Kermanshah's Imam Khomeini hospital according to year, season, month, gender and age groups from 2008 to 2011. Tables 6-8 show the frequency distribution of food, chemical and pharmaceutical poisoning factors recorded at Kermanshah's Imam Khomeini hospital during the above-mentioned time and table 9 represents the values of Pearson correlation coefficient for the incidence rate of chemical and pharmaceutical poisonings and different variables. The results revealed that food and pharmaceutical poisoning incidence culminated in spring while chemical poisoning incidence in summer.

Type of the poisoning		Season				
		Spring	Summer	Autumn	Winter	Total
Food poisoning	number	111	11	23	20	165
	percentage	67.3	6.7	13.9	12.1	100
Chemical poisoning	number	636	822	598	554	2610
	percentage	24.4	31.5	22.9	21.2	100
Pharmaceutical poisoning	number	1026	956	648	443	3073
	percentage	33.4	31.1	21.1	14.4	100

Table 1: The Frequency's distribution of food, chemical, Pharmaceutical poisoning incidence, which were recorded in Kermanshah's Imam Khomeini hospital based on the seasons during 2009-2012.

Months	Food Poisoning		Chemical Poisoning		Pharmaceutical Poisoning	
	Number	Percentage	Number	Percentage	Number	Percentage
April	9	5.5	223	8.5	319	10.4
May	83	50.3	195	7.5	353	11.5
June	19	11.5	218	8.4	354	11.5
July	4	2.4	259	9.9	321	10.4
August	3	1.8	298	11.4	346	11.3
September	4	2.4	265	10.2	289	9.4
October	9	5.5	218	8.4	257	8.4
November	7	4.2	216	8.3	235	7.6
December	7	4.2	164	6.3	156	5.1
January	5	3	17	6.8	14	4.6
February	7	4.2	188	7.2	165	5.4
March	8	4.8	189	7.2	136	4.4
total	165	100	2610	100	3073	100

Table 2: The Frequency's distribution of food, chemical, Pharmaceutical poisoning incidence, which were recorded in Kermanshah's Imam Khomeini hospital based on the months during 2009-2012.

Type Of Poisoning		Year				
		2009	2010	2011	2012	Total
Food poisoning	Number	28	22	58	57	165
	Percentage	17	13.3	35.2	34.5	100
Chemical poisoning	Number	830	652	637	491	2610
	Percentage	31.8	25	24.4	18.8	100
Pharmaceutical poisoning	Number	1644	465	482	482	3073
	percentage	53.5	15.1	15.7	15.7	100

Table 3: The Frequency's distribution of food, chemical, Pharmaceutical poisoning incidence, which were recorded in Kermanshah's Imam Khomeini hospital during 2009-2012.

Type of the poisoning		Gender		
		Male	Female	Total
Food Poisoning	Number	104	61	165
	Percentage	63	37	100
Chemical Poisoning	Number	1563	1047	2610
	Percentage	59.9	40.1	100
Pharmaceutical Poisoning	Number	1444	1629	3073
	Percentage	47	53	100

Table 4: The Frequency's distribution of food, chemical, Pharmaceutical poisoning incidence, which were recorded in Kermanshah's Imam Khomeini hospital based on the gender during 2009-2012.

Type of the Poisoning		Age Group (Year)					
		0-15	15-30	30-50	50-70	>70	Total
Food poisoning	Number	0	59	57	38	11	165
	Percentage	0	35.8	34.5	23	6.7	100
Chemical poisoning	Number	14	1665	652	208	71	2610
	Percentage	0.5	63.8	25	8	2.7	100
Pharmaceutical poisoning	Number	17	2283	633	114	26	3073
	percentage	0.6	74.3	20.6	3.7	0.8	100

Table 5: The Frequency's distribution of food, chemical, Pharmaceutical poisoning incidence, which were recorded in Kermanshah's Imam Khomeini hospital based on the age group during 2009-2012.

Main reason	Food-Mushrooms	Fruit Juice	Cookies	Dough	Total
Number	157	3	4	1	165
percentage	95.2	1.8	2.4	0.6	100

Table 6: The Frequency's distribution of food poisoning factors which were recorded in Kermanshah's Imam Khomeini hospital during 2009-2012.

During these four years, the incidence rate for food poisonings increased, while for chemical and pharmaceutical poisonings declined. Men were more likely to be affected by food and chemical poisonings than women while this relation reversed for pharmaceutical poisonings. The 15-30 age group had the highest incidence rate. There existed a significant relationship (P value<0.001) between the incidence rate of food, chemical and Pharmaceutical poisonings and season, month, gender and age groups.

Discussion

The results showed that the relationship between the incidence of food, chemical and

Pharmaceutical poisonings and season was significant ($P = 0.001 >$). More than half of the food poisonings occurred in spring (67.3%) and most pharmaceutical and chemical poisonings in spring and summer (33.4% in spring and 31% in summer).

Main Reason	Number	Percentage
Toxin	1510	57.6
Arsenic	256	9.8
Alcohols (methanol, ethanol...)	542	20.8
Detergents	127	4.9
Acid, Alkali	11	0.4
Acidic water/acidic battery	6	0.2
Thinner	4	0.2
Food contaminated with Lizard	4	0.2
Mercury	2	0.1
Sleep aid	3	0.1
Anesthetic substances	2	0.1
Potassium silver	1	0.05
Engine oil	2	0.1
Fertilizer	1	0.05
Gasoline	1	0.05
Mustard	1	0.05
Lime	1	0.05
Soda	1	0.05
Savlon	1	0.05
Anti-freeze	1	0.05
Unknown substances	6	0.2
CO,CO 2 gases	73	2.8
Cl	5	0.2
Oil	49	1.9
total	2610	100

Table 7: The Frequency’s distribution of chemical poisoning factors which were recorded in Kermanshah’s Imam Khomeini hospital during 2009-2012.

This might be due to the increase of journeys in spring. In short distance journeys, it’s recommended to precook food at home and reheat it at the final destination, but it should be reminded that consuming partially reheated food may cause poisoning⁽¹⁶⁾. Rooney RM et al (2004) in their study showed that E coli, shigella, nora viruses, vibrio, staphylococci ureus, clostridium perfringes and cyclospora caused food poisoning among ship’s passengers due to improper heating control, indirect

cross-contamination by the staff, improper reheating and land excursion⁽¹⁷⁾. On long-distance spring journeys, food consumption on the way may be another possible reason of the high incidence rate for poisoning in this season⁽¹⁸⁾. The findings of medical records investigating revealed that the majority of food poisonings were resulted from consuming mushrooms. Edible mushrooms emerge in spring in large quantities from the ground and residents and travelers to these regions tend to pick up and consume them⁽¹⁹⁾.

Main Reason	Pill	Narcotic	Pill And Narcotic	Taking The Wrong Medicine	Total
Number	3068	1	2	2	3073
Percentage	99.8	0.05	0.075	0.075	100

Table 8: The Frequency’s distribution of Pharmaceutical poisoning Factors which were recorded in Kermanshah’s Imam Khomeini hospital during 2009-2012.

Variables		Type of the Poisoning		
		Food	Chemical	Pharmaceutical
Season	P _{value}	< 0.001	< 0.001	< 0.001
	Pearson correlation coefficient	0.139	0.096	0.129
Month	P _{value}	< 0.001	< 0.001	< 0.001
	Pearson correlation coefficient	0.217	0.102	0.139
Year	P _{value}	< 0.001	< 0.001	< 0.001
	Pearson correlation coefficient	0.114	0.226	0.204
Gender	P _{value}	0.01	< 0.001	< 0.001
	Pearson correlation coefficient	0.034	0.13	0.204
Age Group	P _{value}	< 0.001	< 0.001	< 0.001
	Pearson correlation coefficient	0.151	0.156	0.108

Table 9: The pearson correlation coefficient between the level of food poisoning and different variables.

But one of the dangers of collecting mushrooms in the wild is that of toxic look-alikes - poisonous mushrooms that resemble edible ones. This makes it difficult even for professional mycologists to distinguish between them and may be the critical cause of increased rate of poisonings recorded in spring. Food poisonings resulted from consuming toxic mushrooms didn’t depend on food consumption customs, since cooking a poisonous mushroom would not neutralize the toxins⁽²⁰⁾. However, customs of food consumption may affect food poisoning. Although mushroom consumption was the main cause of food poisonings in this study, several other studies have investigated different food poi-

soning causes. For example the study of Tornes et al (2008) on the relationship between epidemiology and risk factor of botulism in children showed that the main food poisoning cause of this type of botulism in the country was consuming home canned food⁽²¹⁾.

An increase in consuming insecticides, frequency of insect and snake bites and pesticide levels used in agriculture may justify the high number of chemical and pharmaceutical poisonings in spring and summer⁽²²⁾. It might be resulted from favorable agricultural soil and increased pesticide use (e.g. organophosphate) in spring⁽²³⁾. This has been confirmed in several scientific researches. In a study conducted by Mohammad Aria et al in Shiraz, for instance, the highest prevalence rate of poisoning was reported in spring with the frequency of 33.08%⁽²²⁾.

In Ali Akbar Moghadamnia's study a similar rate in Mazandaran was recorded in spring with the frequency of 32.2%⁽²⁴⁾. This rate in Attaran and Shariat's research was reported in spring with the frequency of 31.3%⁽²³⁾. Sobhan AR et al (2005) reported that the level of pharmaceutical and chemical poisoning among children culminated in spring and among adults in summer⁽²⁵⁾. The results of their study showed that a significant relationship between food, pharmaceutical and chemical poisonings and month and age ($P=0.001>$).

According to the results food poisoning incidence culminated in May, because the number of recreation travels and mushroom consumption increases in this month⁽²⁰⁾. It has been confirmed in other studied. For example, Mohammad Ariae et al and Ali Akbar Moghadamnia in their studies in Shiraz and Mazandaran reported the highest prevalence rate of poisonings in spring with the frequencies of 33.08%⁽²²⁾ and 32.2%⁽²⁴⁾, respectively. The highest rates of food poisoning incidence in 2009-2012 were 35.2% and 34.5% including food poisonings. It shows that the poisoning incidence rate in the last 2 years of the study in comparison with 2009 and 2010 was higher, which might be the cause of the health ministry more accuracy and attention to recording the poisoning incidence rates in recent years. Besides, more than half of the evaluated pharmaceutical poisonings in this study occurred in 2009, but their incidence rate dropped from then on possibly due to the growth of public knowledge in recent years⁽²⁶⁾. The relationship between food, chemical and pharmaceutical poisonings and gender was significant ($P=0.010$).

Men were more likely to be affected by food poisoning than women (63%) possibly because of their working condition, activities out of the house and exposure to food poisoning factors and consuming more foods prepared away from home⁽²⁷⁾. This situation prevailed among drivers who consume larger amount of fast foods and those who used vegetarian dishes contaminated by toxic mushrooms in their recreation travels⁽²⁸⁾. Thirty three percent of women and forty seven percent of men suffered from chemical and pharmaceutical poisonings resulted from suicide attempts which might be due to the psychological, social and industrial pressure or greater emotional sensitivity of women⁽²⁹⁾. These issues were reported in several studies. Karami et al in their study reported poisoning incidence in 58% of women and 42% of men while the rate of suicide attempt among them was 67.4% and 32.6%, respectively⁽²⁹⁾. This rate was 68% for women and 32% for men in the study of Aiaei et al⁽²²⁾. Afzali and Rashidi in their research recorded the largest number of accidental poisonings among men and the highest rate of suicide attempts among women⁽³⁰⁾.

However, the poisoning incidence rate in the study conducted by Sarkar D et al (2013) in Bangladesh was 51.6% for men and 48.4% for women⁽³⁾. It might be rooted in cultural, social, economic and educational differences⁽²⁵⁾. Food poisoning incidence rate correlated with age groups at a significant level ($P=0.0001>$). Its value for the 15-30 and 30-50 age groups was reported 35.8% and 34.5% possibly due to their prolonged exposure to food poisoning factors (e.g. excessive consumption of fast food in the 15-30 age group). Working condition, different recreation trends and excessive consumption of fast foods and etc may affect food poisoning incidence in this age group⁽³¹⁾.

Lima GC et al (2013) reported the highest rate of food poisonings caused by staphylococci in the 20-40 age group⁽³²⁾, the highest rate of pharmaceutical poisonings in the 15-30 age group (comprising of 74.3% of the cases) and the lowest rate of pharmaceutical poisonings in the 0-15 and above 70 age groups (0.6% and 0.8%). Suicide was the critical cause of most pharmaceutical and chemical poisonings. Southeast Asia had the highest rates of pharmaceutical and chemical poisonings as a result of suicide attempts according to the study of Gunnell D (2003)⁽¹¹⁾. The high prevalence of poisonings in the region might be resulted from less attention to solve the youth-related issues in the family and

society, vulnerability to various challenges of life and inability to solve problems. Low level of education, unemployment or low income rooted in socio-economic issues might cause psychological and mental problems and increase suicide motivation⁽³⁰⁾. Based on these results, relative growth of population in Kermanshah, social and economic changes and lack of skills to solve the youth-related problems may exert significant influence on this issue⁽²⁷⁾. The results of our study are consistent with other studies. Das RK (2007) and Dash SK (2005) studies in India have shown that most poisoned patients were less than 40 years old^(33, 34). Afzali et al reported the highest poisoning prevalence in the 20-30 age groups⁽³⁰⁾. Toxins were regarded as the most critical causes of chemical poisoning possibly due to easy accesses to and limitless trade of them. The cases of poisoning caused by agricultural pesticides were less due to the restriction of these substances^(36, 35).

Consuming household chemicals such as acids, insecticides, rodenticides and etc may be considered another factor of poisonings^(37, 38). Toxins (pesticides in particular) were reported as major causes of poisonings in the study of Prajapati T (2013)⁽¹⁰⁾. Tablets were the common forms of drugs causing poisonings due to the widespread usage of them (e.g. painkillers and sedatives in the form of tablets). Most reported suicides resulted from drug consumption. Usage of painkillers, antidepressants, psychiatric and allergy medications had the highest level among patients according to the study of Sarkar (2013) in Bangladesh⁽⁹⁾. Based on the results, Pearson correlation coefficients were influenced by months, seasons, age groups and consuming of particular food substances. Poisoning potential in particular month and seasons (May and spring) was greater due to the diversity of food preparation, processing, storage and preserving. In relation to gender, Pearson correlation coefficient was very low, because both men and women benefited from an equal diversity in food substances⁽³⁹⁾.

Pearson correlation coefficient in chemical and pharmaceutical poisonings differed from highest to lowest for year, season, month, age group and gender. This fact showed that the rate of both poisonings during the years of the study have decreased significantly by growing people's knowledge and attitudes. Pearson correlation coefficient in chemical poisonings was higher for the 15-30 age group, comprised of individuals with agricultural jobs and more exposed to chemical sub-

stances. In pharmaceutical poisonings due to the increased usage of drugs among the age groups comprised of individuals suffering from an illness, Pearson correlation coefficient was lower. In pharmaceutical poisoning compared to chemical poisoning Pearson correlation coefficient was higher for gender, month and season possibly because of consuming drugs by both men and women. However, in chemical poisonings men consumed more chemical substances, which may explain the higher Pearson correlation coefficient for gender in pharmaceutical poisonings compared to chemical poisonings. Besides, drugs were used during all months and seasons of the year while chemical substances were consumed only in particular months and seasons and in larger quantities.

Conclusion

The results showed that most food poisonings occurred in spring and summer. The number of chemical and Pharmaceutical poisoning culminated in these seasons. For each three types of the poisoning, the age group of 15-30 had the highest level of incidence. Therefore, responsible organization need to take steps to train the public and broaden its knowledge by using different means (radio, TV, newspaper....) to improve food (especially mushrooms) hygiene and food, chemical and pharmaceutical consumption. Minimizing the growing trend of poisoning may be realized by teaching food hygiene especially at outdoor and temporary events (through media, health centers...) along with close monitoring on health centers in terms of food supply and distribution. The teaching programs must be developed considering the gender differences in poisonings such as the high level of chemical poisonings in men and the high level of pharmaceutical poisonings in women. Promotion and provision of medicines prescribed by doctors and pharmacists broaden the individuals' (particularly the youth's) knowledge on side effects of drugs and narcotics. Moreover, the individuals who attempted to commit suicide have to be provided with counseling and psychotherapy. Access restriction on chemicals and drugs and prevention of their overuse may boast significant reduction in poisonings.

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