Classification of Poisonings and Natural Toxins in Iranian Medicine and its Comparison with Modern Classification

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ABSTRACT

Poisoning is an essential public health issue that causes deaths worldwide yearly. This study aims to determine the Classification of poisonings and natural toxins in the Eighth to twelfth centuries AD in Iranian medicine primary sources and compare it with modern medicine. This research is a review study based on the library method. In this study, the terms in Persian and Arabic languages were extracted from the Al-Sumum section of Iranian medicine's primary sources. Current medical literature (using PubMed, Scopus, Google Scholar, Web of Science, Magiran and SID databases) was also searched with equivalent terms. Then, the obtained results were expressed separately. The results showed that poisoning in Iranian medicine, in terms of entry; includes two categories of gastrointestinal and injectable, based on the type of toxic substance; it consists of three categories; plants, animals, and minerals, based on their habitat: They are divided into two categories; marine and terrestrial, and based on their temperament, they are divided into two categories: hot-tempered and cold-tempered. Poisonous animals such as snakes are divided into three classes: poisonous, semi-venomous and harmless. In modern medicine, the types of poisoning include two kinds of poisoning with medicinal and non-medicinal substances. These recommendations, which result from hundreds of years of experience of Iranian physicians, could be helpful; however, future experimental investigations are needed to approve their safety and efficacy along with the possible mechanisms of action.

KEYWORDS: Poisons, Poisoning, Classification, History of Medicine, Medicine, International Classification of Diseases

INTRODUCTION

Poisoning is an essential public health issue that affects a large proportion of emergency room referrals and causes many deaths each year worldwide[1-7]. The true extent of the problem of poisoning in medicine is almost unknown due to the extent and variety of chemicals and methods of poisoning, and the daily entry of new toxins into the market has made toxicology and treatment of poisoned patients more dynamic and diverse[9].

Significant changes in the pattern of poisoning have happened in recent decades due to wonderful advances in agriculture, pharmacology, and industrial technology. In developed countries, household chemicals and prescription drugs are the most common poisoning causes. In contrast, in developing countries, agricultural chemicals, including pesticides, play a more significant role in causing poisoning[10,11].

With the advent of Islam, many physicians began to

write books containing their critiques and adaptations of translated texts. This movement was the beginning of a significant change and a new period in the history of Iranian medicine in which Muslim physicians wrote medical books and innovated medicine. In the early centuries of Islamic civilization, on the one hand, great physicians, with their writings, caused richness. On the other hand, establishing many hospitals in different cities led to significant growth in the health and treatment of Islamic communities[12].

On this basis, the texts of Iranian medicine from the Eighth to twelfth AD and with emphasis on the three books of Ferdows al-Hikma fi al-Tib (Paradise of Wisdom) by Ali ibn Sahl Rabban al-Tabari (838-870), al-Qanun fi al-Tib (Canon of Medicine) by Avicenna (980-1037) and Zakhira-e Khwarazm-shahi is a Persian medical encyclopedia written by the Persian, Ismail Gorjani (1042–1137) have mentioned valuable discussions about poisonings[12,13].

Iranian physicians, in separate and dedicated sections of their works, regularly classify the types of poisoning and natural toxins, how to diagnose, symptoms, signs

and side effects of poisoning, and finally, the treatment methods of poisoning (medicinal and non-medicinal) and They have stated the medicinal contents used[13].

There are limited papers on the Classification of poisonings and natural toxins in Iranian medicine. "Al-Hamoud", in a study entitled "The course of toxicology in Islamic medical texts", has studied the works of Islamic scientists on poisoning but had limited reference to the Classification of poisonings and natural toxins. In another study entitled "Medicinal aspects of opium as described in Avicenna's Canon of Medicine", Opium poisoning and toxicity of opioids used in therapy were examined, and the effects of opium on sensation and pain in the works of Avicenna. Another study has been conducted by "Rezaei Orimi and Nasiri" on evaluating, diagnosing and treating oral poisoning in Iranian medicine and Diagnosis and Management of Bites in the Canon of Medicine of Avicenna. However, despite examining the treatment of poisoning in Iranian medicine, the mentioned studies could not specifically evaluate the Classification of poisonings and natural toxins[13].

Due to the change in lifestyles over time, there is a possibility of changes in the factors that cause poisoning in humans. Therefore, considering the sources of Iranian medicine that are full of valuable medical information, identifying the Classification of poisoning may help find the root of poisoning and reduce the causes of poisoning.

The importance of this research is that due to the tendency of physicians and people to use plants and natural substances for medicinal and medical applications in recent years, the prevalence of plant poisoning is increasing, and This is primarily due to their unconscious and arbitrary use of plants and toxic natural substances that they believe have therapeutic value. Instead, self-medication with plants and natural substances and their use is considered as causes of poisoning in adults. According to the mentioned cases, knowledge of the Classification of poisonings and natural toxins is necessary for medical staff.

In this study, the question will be answered how the sources of Iranian medicine have classified poisonings and natural toxins. This study aims to determine the Classification of poisonings and natural toxins in the Eighth to twelfth centuries AD in Iranian medicine primary sources and compare it with modern medicine.

METHODOLOGY

This research is a review study based on the library method. In this study, the terms in Persian languages, such as "poison, poisoning, poisonous plants, sting", and words in Arabic, such as "Al-Sumum, Al-Sam, Al-Sumum Al-Mashroubah, Al-Sumum Al-Nabatiah, Al-Sumum Al-Haiwaniah" "Al-Sumum Al-Jamadiah" were extracted from the Al-Sumum section of Iranian medicine primary sources. Current medical literature (using PubMed, Scopus, Google Scholar, Web of Science, Magiran and SID databases) was also searched with equivalent terms. Then, the obtained results were expressed separately. In this study, we discuss the Classification of poisonings and natural toxins according to PM and modern medicine.

Findings

The results showed that poisoning in Iranian medicine is based on the type of toxic substance; it consists of three categories; plants, animals, and minerals. Thus, the plant class includes 79 poisonous plants, the animal class includes 101 poisonous animals, and the mineral class contains 17 toxic minerals, for which a total of 197 toxins have been reported.

Poisoning, in terms of entry into the body, includes two categories: gastrointestinal (plant, animal and mineral) and injectable (Bites and stings). And based on their habitat: They are divided into two categories; marine and terrestrial, and based on their temperament, they are divided into two categories: hot-tempered and cold-tempered.

Poisonous animals such as snakes are divided into three classes: poisonous, semi-venomous and harmless, and scorpions are divided into nine species in colour, including white, yellow, red, grey, earthy black, green, gold, wine, and smoky. Bees are divided into large and small groups in size and normal and honey bees in terms of type. (**Table I**)

Classification of types of poisonings and natural toxins in Ferdows al-Hikma fi al-Teb

Ali ibn Rabban Tabari has dedicated a short part of the book Ferdows al-Hikma fi al-Tib to the subject of natural poisons[14]. He has divided the discussion of toxins into two main parts; The first part is about poisons, the second part is about the signs and symptoms of exposure to poisons and also antidotes.

In a general classification, Tabari divides all toxins in nature into nine broad categories in terms of their origin, including plant poisons (such as Cashew nut), poisonous gums (such as opium), poisonous seeds (such as Hemp), and toxic roots (such as Aconite), venoms in the saliva of the mouth (such as snake and rabid dog venom), venom in the animal's tail (such as scorpion), venom in the animal's nose (such as bee), venom in animal breath (such as tannin or dragon) and The winds come from poisonous places.

Tabari divided toxins in terms of temperament into two categories: hot-tempered and cold-tempered. Hot-tempered toxins include snake venom and poisonous plant toxins such as Aconite and Cashew nut, and cold-tempered toxins include plant toxins such as

opium and Hemp and mineral toxins such as Mordarsang (Lithargyoum).

In a general categorization, Tabari divides all toxins into three categories: poisonous plants, poisonous animals, and toxic minerals, so their consumption causes poisoning in humans.

Toxic plants such as soranjan (Colchicum), (Oleander) and Afion (opium), poisonous animals such as Alakolang (cantharides), mice and spiders, and poisonous minerals such as zibagh (Hydrargyrum vivum) and Mordarsang (Lithargyoum)[14].

Classification of types of and natural toxins in the book Al-Qanun fi Al-Tib

Avicenna has divided the chapter on poisoning into five discourses and 22 chapters. According to Avicenna, all animals are toxic in two ways. The first type is that the animal has a poisonous gem, such as the sea rabbit and chameleon (warrior), and the second type is that the animal is not poisonous in the gem but is transformed and turned into poison, like the meat of a frozen fish and milk that coagulates in the stomach. Therefore, the venom of living things is divided into four types: one is that the animal's meat is spontaneously poisonous, and the second is that all the animal's organs are poisonous. The third is that one of the organs of the living thing is poisonous, and the fourth is that some moisture in the living thing is poisonous[16].

Digestive toxins include three types: plant, animal, and mineral. Based on this, poisonous plants such as cannabis, mushrooms, Hemlock, tatura (Datura), oleander and Hellebor Black, poisonous animals such as Alakolang (cantharides), sea rabbit, salamander (It is a kind of lizard), frog and fish and poisonous minerals (15 minerals) such as Gypsum inustum, Mordarsang (Lithargyoum), Hydrargyrum vivum, Calx Quick and Zarnikh (Orpiment Yellow Sulphioe of Arsenic) cause gastrointestinal poisoning[16].

Poisonous plants are divided into two categories: hot-tempered and cold-tempered. Avicenna divides poisonous plants into two categories: hot-tempered (49 Materia Medica) and cold-tempered (11 Materia Medica). Poisonous plants such as Aconite, Qorun -e -sonbol, Euphorbia, white hellebore and black hellebore are among the poisonous plants of warm temperament and poisonous plants such as opium, Jozmasel (Datura), yabruh (Mandragora), Zeytonieh (Dorycnium spp), Hemlock and mushrooms A group of poisonous plants are cold-tempered[16].

The present study showed that Avicenna regularly classifies various poisonous animals and insects. He named about 79 poisonous animals (22 species of vermin, 30 species of snakes, 18 species of tarantulas and nine species of scorpions), described their physical, behavioural and physiological characteristics, and then explained the signs and symptoms of poisoning. Avicenna paid particular attention to snakes, so he referred to 30 types of snakes and classified them into three general categories in terms of toxicity (poisonous and lethal, average dangerous and harmless). It has been described in twenty-one separate chapters. The first group, like the queen snakes (shahbanoo), are very venomous and dangerous snakes, and the person bitten by the snake dies within three hours. Second-class snakes, such as Vipera (Afei), are called medium-sized snakes in danger. They are poisonous and deadly and kill the patient for three to seven days. The third category is infrequent for a person bitten by a snake to die[16].

Classification of types of poisonings and natural toxins in Zakhira-e-khawarizam-Shahi book

Seyyed Ismail Gorjani discussed the poisonings in his book Khwarezm-shahi[18]; he divided the toxins into plant, animal and mineral. Poisoning is also caused by gastrointestinal and injectable routes (bites and stings). Poisonous plants include two categories warm-tempered (32 Materia Medica) and cold-tempered (10 Materia Medica).

Seyyed Ismail Gorjani, in his book Khwarezm-shahi Reserve, considers all poisons to include two types: The first type is that it is detrimental to its quality, which provides for four corrosive and rotting species such as sea rabbit, hot and burning such as euphorbia, cold and decomposing such as Afion (Opium) and the kind that takes the way of inhaling, which is in the whole body, and throws sedation because it is Mordarsang (Lithargyoum). The second type is that his essence is against the essence of the people, such as Aconite and Qorun -e -sonbol. "

According to Gorjani, there are four types of animal poisons. "Some say that their meat is harmful, such as Frog, Alakolang (cantharides) and Sea rabbit; Some say that one of his limbs is harmful; Some of it is that moisture comes out of his body, it is toxic, and some of it is that there is no harm in him, but it is harmful due to a side effect, to rot in the stomach[17].

Gorjani divides snakes into three categories. The first categories are: "Asam snake, Sphellus (queen), Jermana, Khataf (swallow snake), dry snake, saliva (spitting snake), Egyptian, Mogharne (horned snake) and Adrius." The venom of the second-class snakes is more curable and less likely to kill, which are: "Viper snake, blood-sucking snake, mutasha (thirsty snake), jumper (jumping snakes), oak snake, al-Jawarthiyah and Al-Hiyyah al-Raqsa (spotted snake)". The third class is intermediate and includes tannin or sea dragon and samurai[17].

Classification of types of poisonings and natural toxins in modern medicine

In modern medicine, poisonings are divided into different types. According to the International Classification of Diseases (ICD-10), the types of poisoning are classified into two parts: drug and medical poisoning and biology and non-drug and non-medical poisoning, which are described in **Table I**[19].

Poisonings are also divided into different types based on their effect on the body's vital organs. This Classification includes reproductive toxicity and teratology, respiratory toxicity, cardiovascular toxicology, neurological toxicology, liver toxicology and renal toxicology[10].

According to the new Classification, poisonous plants are divided into seven categories, including toxalbuminins (castor and licorice), anticholinergic alkaloids (tatura and cannabis seeds), cardiac glycosides (oleander, fescue, black currant and lily of the valley), and amygdala. Cyanogenic glycosides (apple, apricot, pear and peach), solanine (black currant, potato, eggplant and tomato), soluble and insoluble oxalates (rhubarb and diphenbakhia), plants were affecting microtubules (sunflower), and plantain (Toxic shockers) are[20]. Venomous and venomous marine animals are classified into seven classes: senidaria, echinoderms, scorpions, morsels, sponges, conifers, and sea snakes[21].

In another classification, poisonings are divided into four parts: digestive, inhalation, adsorption, and injection, based on their exposure to toxic substances. Eating is the most common way poisonous substances enter the body. Common ingested toxins include "household products, petroleum products, detergents (alkalis and soaps), cosmetics, medicines, foods and plants." The most common inhalants are: "toxic gases, carbon monoxide, ammonia, chlorine, fortone, fumes, fumes and toxic aerosols, carbon tetrachloride, methyl chloride, tear gas, mustard gas and nitrous oxide." The most common poisonings caused by adsorption are caused by contact with poisonous plants such as poison ivy, poison sumac

TABLE I: CLASSIFICATION OF THREE CHARACTERISTICS OF POISONING BY INTERNATIONAL DISEASES (ICD-10)

Poisoning by drugs, medicaments and biological substances(T36-T50)	ICD-10*	Toxic effects of substances chiefly nonmedicinal as to source (T51-T65)	ICD-10**
Poisoning by systemic antibiotics	T36	Toxic effect of alcohol	T51
Poisoning by other systemic anti-infectives and antiparasitics	T37	Toxic effect of organic solvents	T52
Poisoning by hormones and their synthetic substitutes and antagonists, not elsewhere classified	T38	Toxic effect of halogen derivatives of aliphatic and aromatic hydrocarbons	T53
Poisoning by nonopioid analgesics, antipyretics and antirheumatics	T39	Toxic effect of corrosive substances	T54
Poisoning by narcotics and psychodysleptics [hallucinogens]	T40	Toxic effect of soaps and detergents	T55
Poisoning by anaesthetics and therapeutic gases	T41	Effect of metals	T56
Poisoning by antiepileptic, sedative-hypnotic and antiparkinsonism drugs	T42	Toxic effect of other inorganic substances	T57
Poisoning by psychotropic drugs, not elsewhere classified	T43	Toxic effect of carbon monoxide	T58
Poisoning by drugs primarily affecting the autonomic nervous system	T44	Toxic effect of other gases, fumes and vapours	T59
Poisoning by primarily systemic and haematological agents, not elsewhere classified	T45	Toxic effect of pesticides	T60
Poisoning by agents primarily affecting the cardiovascular system	T46	Toxic effect of noxious substances eaten as seafood	T61
Poisoning by agents primarily affecting the gastrointestinal system	T47	Toxic effect of other noxious substances eaten as food	T62
Poisoning by agents primarily acting on smooth and skeletal muscles and the respiratory system	T48	Toxic effect of contact with venomous animals	T63
Poisoning by topical agents primarily affecting skin and mucous membrane and by ophthalmological, otorhinolaryngological and dental drugs	T49	Toxic effect of aflatoxin and other mycotoxin food contaminants	T64
Poisoning by diuretics and other and unspecified drugs, medicaments and biological substances	T50	Toxic effect of other and unspecified substances	T65

*Source: ICD-10 online. URL: https://icd.who.int/browse10/2019/en#/T36-T50
**Source: ICD-10 online.   URL:https://icd.who.int/browse10/2019/en#/T51-T65

and poison oak. Most injectable poisonings are caused by the bites and stings of animals and insects, fire ants and bees, mites, spiders, scorpions, snakes and aquatic animals[22].

In the studied Classification of poisonings in Iran, nine categories include "drug poisoning, insecticide and organophosphorus poisoning, drug poisoning, carbon monoxide poisoning, alcohol poisoning, food poisoning, bites and food poisoning," Herbal and chemical poisoning has been identified[23]. In another general classification, poisonings are divided into eight categories, which include: "Medicinal compounds, medicinal plants, poisonings with illegal drugs (drugs, methadone, tramadol, "Alcohol, stimulants (methamphetamine products, cannabis and pesticides), organophosphate compounds (metal phosphides), bites and stings, natural elements (fungi, fluoride, lead, datura, stramonium) and carbon monoxide".[24]

DISCUSSION

According to the findings of this study in two sections of the study of Iranian medicine texts and sources of modern medicine, it has been determined that in Iranian medicine, the types of poisoning based on the type of toxic substance; They consist of three categories: "plant, animal and mineral". Thus, the plant class includes 79 poisonous plants, the animal class includes 101 poisonous animals, and the mineral class contains 17 toxic minerals, for which a total of 197 toxins have been reported[26]. However, according to modern medicine, types of poisoning are divided into two types based on the International Classification of Diseases (ICD-11): intoxication with drugs and medical substances and poisoning with non-pharmaceutical and non-medical substances[19].

It seems that this difference in Classification is due to the growth and development of today's societies and the existence of many chemical and industrial materials and drugs that have entered the community in various fields decades ago and have overshadowed human life so that the tendency to classify toxins from natural materials to unnatural, chemical and industrial materials. Of course, another type of toxin classification in the Khwarezmshahi Reserve Book is similar to the International Classification of Diseases (ICD-10). In this way, it has divided toxins into medicinal and non-medicinal. It is a type of drug with a toxic property. Its essence is non-toxic, including infectious drugs (such as Sea rabbit meat), inflammatory and warming drugs, antipyretic drugs (such as opium) and respiratory drugs. They are bodies (like Lithargyoum), and the non-medicinal type is that its essence is poisonous, like an Aconite toxic plant.

This study's preliminary results are based on the texts of Iranian medicine in the third to seventh centuries AH (Ferdows al-Hikma fi al-Tib, al-Qanun fi al-Tib, and Khwarazmshahi reserve), classify poisonings in terms of the entry of toxins into the human body. Injectable splits. Gastrointestinal toxins include "poisonous plants, poisonous animals, and toxic minerals." Injectable toxins cause poisoning in two ways. One occurred through the bite of snakes, scorpions, tarantulas, and other biting insects, and the other through bites involving the bites of domestic and wild animals such as dogs, wolves, lions, leopards, and humans bites.

But in modern medicine, poisonings are divided into four categories based on how toxins enter: gastrointestinal, injectable, inhaled and dermal[8,9,27-29]. The results of epidemiological studies show that the most common exposure to toxins is gastrointestinal or oral[5,24-26,30,31]. In general, gastrointestinal poisoning is widespread in Iranian medicine and modern times, which can be due to its ease of access and use. Bites have also been prevalent in the past, while today, they are less common due to lifestyle changes, urban sprawl, and deforestation.

According to our study in Iranian medicine, poisonous plants were divided into two groups based on their temperament: warm-tempered (such as oleander, Euphorbia and Qorun -e -sonbol) and cold-tempered (such as opium, cannabis and Hemlock), but in modern medicine, their poisonous plants are divided according to effective substances. These include toxalbuminins, anticholinergic alkaloids, cardiac glycosides, amygdalin and cyanogenic glycosides, solanine, soluble and insoluble oxalates, plants affecting microtubules, and plants with neurotoxicity[20]. Toxic plants are also divided into different categories in terms of their effects on the human body, such as poisonous plants affecting the nervous system, gastrointestinal tract, urinary tract, skin and eyes, embryonic plants, deadly human plants and toxic plants that cause bleeding[9].

The reason for such a division is the difference between Iranian and modern medicine's basics. Iranian medicine is based on natural affairs, and they are matters that maintain the balance of the body in every way and include seven components: Elements, compositions, mixtures, organs, spirits, powers and actions, respectively. By definition, temperament is a quality that results from the action and reaction between the opposing qualities of the elements of the elements[12,31].

Due to the high prevalence of gastrointestinal poisoning in the past (according to the sources of Iranian medicine), which is often due to the consumption of various types of medicinal products

(plant, animal and mineral) and instead due to the high prevalence of drug poisoning in the present era which often occurs in the gastrointestinal tract. It can be concluded that the most common case in the Classification of gastrointestinal poisonings in the past and present eras have been medicine, i.e. in the past, medicinal components (plant, animal and mineral). In the current era, chemical and synthetic drugs cause most gastrointestinal poisonings. In this study, more attention has been paid to animal poisoning. Two ways to cause animal poisoning; one through bites of stinging animals and the other through the use of poisonous animals (such as cantharides, sea rabbits and frogs). Bites of stinging animals include snakebites, scorpion bites, Tarantula bites, bee bites, bites of wild and domestic animals (dogs, wolves, leopards and monkeys), poisonous marine animals' bites and bites of various types of insects.

Toxic animals are divided into two types in terms of toxicity: animals with toxic gems and metamorphosed species due to age and rot, such as old meat. Examining the works of Iranian scientists, we find that they have been able to emphasize the poisoning caused by toxic creatures, categorize them and provide the necessary treatments. These include the Classification of tarantulas (12 Tarantulas), the identification of pests (25 species), the types of snakes (29 species), the types of poisonous marine And terrestrial animals, the types of predators and wild animals, the types of domestic animals and the types of reptiles and bites. However, most of these issues, as in the past, exist in modern medicine and medical resources of the present age and have been mentioned. According to our study, snake venom is diverse and numerous, and many venomous and non-venomous snakes have been identified. All snakes were divided into three categories: venomous, semi-venomous and harmless, while in modern medicine, snakes are classified into three categories: venomous, semi-venomous and non-venomous.

CONCLUSION

Iranian medical texts are a precious source for classifying the types of poisoning, which have regularly categorized the types of gastrointestinal poisoning and bites. Along with what has been said in the study of Iranian medical texts, the most common Classification of poisonings has been related to gastrointestinal poisoning (plants, animals and toxic minerals) and bites. Iranian medicine physicians have tried to increase the speed and ease of diagnosis and treatment of bites by placing poisonous plants, animals and insects in separate categories. Thus, many of these classifications can be contained within the national and global disease classification system and can be introduced as an essential source for future research to solve the poisoning problem.

AUTHOR CONTRIBUTION

Razaei Orimi J: Author of the thesis, drafting, and writing Persian thesis.
Nasiri E: Advisor of the thesis, title selection consultation, drafting & writing the Persian article.
Siamian H: English translation, title selection, Consultation in ICD and Classification of poisoning and natural toxins in Iranian medicine and its comparison with modern classification drafting, endnote and Latin paper, finalization of the article.
Moallemi M: Title selection consultation, article writing.
Balaghafari A: Consultation in ICD and Classification of poisoning and natural toxins in Iranian medicine and its comparison with modern Classification.
Padashi S: Consultation in title and methods of the thesis

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