

## FOOD AND CHEMICAL TOXICOLOGY KNOWLEDGE OF THE PERSIAN ERA: AN OVERVIEW BASED ON EVIDENCE AND FACTS

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### ABSTRACT

The current study is associated with industrial chemical compounds, the manner in which their toxicity is measured and evaluated and the utilization of such assessments in supervisory decision-making. The work begins with standard points pertaining to toxicological information and statistics, accessibility and danger recognition, then proceeds to risk analysis and occupational publicity restricts, and ultimately observes fleetingly three particular toxicological concerns namely asthma, persistent toxic encephalopathy, and minimal toxicity dust impact on the lung, where in actuality the science and technology were not even close to resolve them dating back to Ancient Persia. The general intent behind the study is to raise, or maybe to perform as an indication of numerous issues of specific relevance to industrial and chemicals compounds and the occupational setting pertaining to a specific era of ancient Persia, and preferably to stimulate further consideration and possibly some new initiatives inclined to the areas where it seemed an insurmountable issue for Persian community how to deal with food and chemical toxicology issues. To encapsulate, the statistics and assessment figures revealed in some historical sources with medical and chemical background namely Avicenna's *Canon Of Medicine* or his other famous works including *The Book of Healing* a philosophical, medical and scientific encyclopedia which became a standard medical text at many medieval universities and remained in use as late as 1650.

**Keywords:** *Toxicology Knowledge, Chemical, Food, Persian Era*

### INTRODUCTION

#### *Toxicology and its Background*

Toxicology, the science of poison, is defined as the scientific study of adverse effects of chemical occurred in living organisms. "It involves observing and reporting symptoms, mechanisms, detection and treatments of toxic substances, in particular relation to the poisoning of humans (Smith, 2015)." Usually adverse effects depend on two major factors: 1) routes of exposure (oral, inhalation, or dermal) and 2) dose (duration and concentration of exposure). To explore dose, substances are tested in both acute and chronic models." ([www.2.epa.gov](http://www.2.epa.gov))

Toxicology contains environmental factors and chemical compositions that are available in nature and pharmaceutical compositions which are combined by humans for medical usage. These substances may have toxic result in living organisms such as disorder in growth patterns, aches and pains, disease and death. The dose of the substance is a significant element in toxicology as there is an important relationship between Dose and its effects on the organism. Ottoboni believes that the factors that affect chemical toxicity include "dosage, route of exposure, species, age, sex, health, environment and individual character (Ottoboni, 1991).

The first toxicology data is related to early human that employed poisonous animals and plants in order to hunt, murder and terror. Ebers Papyrus (about 1550 BC) had collected information about the poison of some known toxins including hemlock (deadly Greek poison), root of Aconitum (use for poisoning dart in China), opium that had been used as poison and antidote and some metals such as lead, copper and antimony.

For the first time, a Greek physician Dioscorides strived to categorize plants according to their toxic as well as therapeutic effect. However, French toxicologist and chemist Mathieu Orfila who is credited as the modern father of toxicology created new techniques and explained them in his masterpiece *Traité des*

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*poisons* published in 1814–1815 in two volumes. Paracelsus a renaissance physician, botanist, and alchemist who is known as the father of toxicology demonstrated "everything is poison; there is poison in everything (Holloway, 2014)."

Generally the employment of chemical toxicology in the medical field is pertaining to the treatment of toxin exposure and the expansion of new medications and therapies. Most medications which were used in traditional medicine require the usage of multiple chemical compounds. In the most cases, these chemicals directly affect on body and bring about some positive results such as regression in either illness or symptoms. Chemical toxicology widely includes chemicals used in different kind of fields such as medical, agriculture and even wildlife. One of the main purposes of chemical toxicology research is related to diagnosing the side effects of specific chemicals or toxins when ingested in one's body and the way of recognition as well as treatment when poisoning happens.

The U.S. Society of Toxicology defines toxicology as "the study of the adverse physicochemical effects of chemical, physical or biological agents on living organisms and the ecosystem, including the prevention and amelioration of such adverse effects (Finkel, 2015). However, the word of "poison" brings venomous snakes, poisonous mushrooms and even death to people's mind. But "poison" in flora and fauna is not always malicious and in many cases it can be very effective and helpful. In this article we are going to introduce some herbs particularly hemlock as either "useful poison" or "dangerous poison" in a specific course of Persian era.

*The Canon of Medicine* which is compiled by Persian philosopher Avicenna (Ibn Sina) introduces a clear and well ordered summary regarding to all the medical knowledge of his time. It is considered as "magisterial exposition of Galenic medicine" and it is known as one of the most famous and major books in the history of medicine. In an Islamic era of Iran civilization, *The Canon of Medicine* was one of the three fundamental publications of physicians' medical books. *al-Hawi* by Muhammad ibn Zakariya al-Razi and *Kitab al-Maliki* or *Complete Book of the Medical Art* by Ali ibn al-'Abbas al-Majusi (Latinized as Haly Abbas) are two important books on traditional medicine. In spite of the negative effects of poison that were so obvious, these people strived to find cures through them. For instance, Rhazes was the first man who declared that mercury can be used as a laxative.

McGinnis (2010) believes that Avicenna's *The Canon of Medicine* "served as a more concise reference in contrast to Galen's twenty volumes of medical corpus". Since the dominate language of that time was Arabic, the book originally was written in the Arabic language and it was later translated into Persian, Hebrew, French, Chinese, German, Latin and English. In this book Ibn Sina has described the general principles of medicine based on ideas of Galen and his botanical medicine based on Dioscorides (famous Greek physician, pharmacologist and botanist) writing.

### ***A Glance at the Feature of Hemlock as a Toxic Plant in Persian Era***

*Conium Maculatum* or hemlock (poison hemlock) is one of the toxic plants from the carrot family (Apiaceae). This plant is extremely "poisonous perennial herbaceous flowering plant" and "native to Europe and North Africa."([luirig.altervista.org](http://luirig.altervista.org)) All parts of this plant are poisonous. The younger *Conium* is more toxic than older one. In other words, as the plant start drying, the amount of its poison considerably decreases, but it doesn't disappear totally. Hemlock plant grows in damp areas in soils that contain a lot of nitrogen. Following paragraphs present the toxicological, chemical and botanical aspects of hemlock.

This poisonous plant has a worldwide fame. Poison-hemlock is extremely toxic to both people and animals. In past, especially in ancient Greece, hemlock was used for execution. In order to having the lowest level of pain in the shortest time, giving hemlock to those who possessed civil and social rights was a normal issue. Therefore, when a person condemned to death, drank hemlock, his body gradually became numb and this numbness initiated from his foot and as soon as it reached to heart, it contributed to death. Trial of Socrates, the famous Greek philosopher, who died by drinking a hemlock-based liquid, is the oldest recorded in this case. Plato depicted Socrates' death as follow:

The man...laid his hands on him and after a while examined his feet and legs, then pinched his foot hard and asked if he felt it. He said "No"; then after that, his thighs; and passing upwards in this way he

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showed us that he was growing cold and rigid. And then again he touched him and said that when it reached his heart, he would be gone. The chill had now reached the region about the groin, and uncovering his face, which had been covered, he said – and these were his last words – "Crito, we owe a cock to Asclepius. Pay it and do not neglect it." "That," said Crito, "shall be done; but see if you have anything else to say." To this question he made no reply, but after a little while he moved; the attendant uncovered him; his eyes were fixed. And Crito when he saw it closed his mouth and eyes (Plato, 1990).

"Coniine" is the name of Hemlock's poison, which causes death. The toxin attacks the human central nervous system and leads to disability of vital organs. If a patient inhales toxins, and is quickly transferred to a medical centre, he/she can be saved via artificial respiration; however, ingesting of this kind of poison leads to rapid death of person. The ingestion of more than 0.1 gram of its toxin can be fatal to an adult. The impact of the poison is directly on the central nervous system and after the emergence of symptoms such as nausea and stuttering through the failure on respiratory system, it ends up to death.

On the other hand, despite its deadly feature, this poison is useful and practicable. For many years, Iranian and ancient Greek physicians used this plant as sedative for arthritis therapy. It essentially was used as a pain killer especially in the area of the trigeminal nerve and sciatica pain. Conium Maculatum or hemlock was considered as an antispasmodic, analgesic, debilitating sexual power and anticancer. Hemlock clots bleeding and its juice eliminate ear moisture. Rubbing hemlock on hot gout is very useful. Accordingly, the medicinal consumption of hemlock is divided into two parts: internal and external use.

Persian philosopher Avicenna believed that hemlock is cold and dry in nature and mostly in terms of pharmacological has external usage. However, it can be prescribed with cautious and merely in small amount for internal use. Due to its poisonous feature, the internal consumption of hemlock should be under the supervision of a physician. Excess consumption of prescribed hemlock results in nausea, headache and dizziness. It paralyzes diaphragm muscles and respiratory muscles and finally because of lack of oxygen to the heart as well as brain it contributes to death. Nevertheless, the slight dose of hemlock is extremely effective in pain relief. Persian traditional medicine, usually prescribed hemlock for different kinds of cancer and fortunately in various types of scrofulous tumours, it turned out effective results. In addition, it was helpful to controlling asthma, pertussis, severe cough as well as most of the neurological disorders. Besides, it was recommended in pulmonary tuberculosis elimination.

#### **Internal Use and its Way of Consumption**

The internal use of hemlock is pertaining to muscle stiffness due to Parkinson, spasms of pylorus, lung, colon, uterus, spasmodic cough, shortness of breath caused by emphysema, painful erection, and dysuria.

Extracts: 0.1 to 0.03 g once a day, the maximum daily intake of 0.1 g

Dried fruits: 0.1 to 0.5 g once a day, taken as a 0.1 pill

Tincture of leaves or fruit: 10 to 60 drops taken per day

#### **External Use and its Way of Consumption**

Hemlock plant is a sedative poultice, pain killer and antispasmodic. Poultice of crushed fresh leaves or hemlock volatile oil or Codex ointment or salve 25% was used for the treatment of sciatica. The mixture of 10g hemlock leaves powder with 250 to 300 grams of fresh raw carrots and laying them on the sterile pad and applying it on the breast in order to reduce the pain of breast cancer before surgery is a miraculous remedy. Besides, measuring dose, depending on situation can be either cumbersome or straight process. Since in laboratory the condition can be controlled, therefore, it is considered as the best setting for accurate measurement of dose. "At the other extreme, measuring the doses to which individual humans are exposed in their everyday environment is much more difficult. The amount of a particular agent ingested is likely to vary from day to day and measures of the concentration of the agent in the media of interest (e.g., air or water), are unlikely to be available on a daily basis." (<http://toxlearn.nlm.nih.gov>).

### **CONCLUSION**

Toxicology has a significant place in environmental as well as medical issues, not only in the modern society, but also in traditional community. It "draws upon most of the basic biological sciences, medical

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disciplines, epidemiology and some areas of chemistry and physics for information, research designs and methods (Silbergeld, 2014)". It provides very important information for either epidemiology or medicine in realizing aetiology and illustration of this point that even the poison and fatal substances can be used in human serving. In particular, some poisonous plants such as hemlock used to have a medical usage in ancient Persia.

Although hemlock is quite poisonous and the alkaloids in hemlock causes the blockage of the nerve muscle and respiratory paralysis, this plant was used in the treatment of asthma, whooping cough, tetanus, epilepsy and neurological pains (however, it must be taken under medical supervision). Moreover, the ointments and suppositories of this plant were used for anesthetic and external applications. It should be noticed that the overuse of hemlock causes headaches, toxication and it finally leads to death. The primary symptoms of poisoning are blurred vision, dizziness and headache and eventually the victim will dead between 3 to 6 hours.

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