

## ORIGINAL ARTICLE



### The Effect of Water on the Prevalence of Communicable Diseases in Shiraz

#### Abstract

For a long time, in different periods, Shiraz water was supplied from wells, aqueducts (qanat) and springs, which were generally open and hence got polluted in different ways on its way to the residential area. The consumption of these polluted waters resulted in the outbreak of infectious and contagious diseases, at times, killing a lot of people. Mohammad Namazi, having faced with the issue of unhealthy drinking water and consulted various specialists, found that the unsanitary drinking water was responsible for most gastrointestinal diseases as well as contagious diseases. In addition to constructing educational and health facilities, Namazi decided to develop a proper piping system for drinking water. At that time, even in the capital of Iran, there was not such a system. The present descriptive study, together with the library research method by scrutinizing local papers and newspapers, aims to first address the effect of the contaminated waters on the spread of contagious diseases and then the role of water piping system in reducing diseases in Shiraz. Research findings show that water supply and sanitation are important in reducing diseases such as typhoid, typhus, cholera and many waterborne diseases.

**Key words:** Water piping system, Disease Outbreaks, Shiraz, Typhoid Fever, Typhus, Cholera

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## Introduction

Water is one of the most important and vital sources to human life, whose availability is determinant in the creation and prosperity of human societies and civilizations. Water plays an important role in the fertility of the earth, and wherever water is found, there will be traces of life. Generally speaking, the development and progress of human societies are closely contingent upon the presence of water. That is to say, life and existence of all living beings (human beings, animals and plants) and the formation of communities largely depend upon the availability of water. However, despite the importance and necessity of water in human life, water can be the source of various diseases and if contaminated, it acts as a source of infection.

The present study seeks to explain waterborne diseases and discuss how water piping has been effective in reducing diseases. To this end, three points are taken into account: 1- Water supply channels 2- Waterborne diseases 3- Water piping.

For a long time, springs, aqueducts (qanat) and wells were main sources of drinking water in Shiraz. However, owing to the high mineral content of the water derived from wells, it was not usually safe for drinking. Water of aqueducts and springs flowed into the city of Shiraz was stored in water reservoirs, and the water-carriers (saqqas) used to collect water from the reservoir and by using large containers, carry water to people's homes. Prior to water supply systems in Shiraz, most people consumed their water from shallow wells.

In Al Buyeh period, aqueduct water was used for drinking in Shiraz. The aqueduct was built by Rokn Abad in 338 AH. The source of this water was on the slopes of Bamu Mountain about 2.5 hectares north of Shiraz, beginning at Akbarabad strait. Although it did not have much water, it was famous for irrigating the gardens and landscapes around.<sup>1</sup>

Concerning the consuming waters of Shiraz, Maqdisi reported that the water in the wells of Shiraz was heavy and the lightest water was the aqueduct that flew from Gooyom, the city lying to the west of Shiraz.<sup>2</sup>

During the Atabakan period, there were reservoirs and aqueducts in the upper part of Shiraz. Shiraz water supply during this period was supplied by Raknabad, Zangi and Saadi aqueducts.

Zangi aqueduct, located in the southern slope of the Bamu Mountain, was another source of Shiraz's drinking water that was built by Atabak Mozafar al-Din Zangi bin Moodoud (557-577 AH). This water was extremely good for drinking.<sup>3</sup> Despite its good quality for drinking purposes, quantitatively speaking, there was little water and at times, the aqueduct ran dry for some years, but by inhabitants' continual dredging,

1- Ibn Battuta, 1958: 194.

2- Maqdisi, 1982 :641

3- Forsat Shirazi, 1998: 706.



the water could be used again for drinking.

The Saadi aqueduct originated from the Saadi strait between the Saadi Mountains and the Chehel Magham Mountains on the east side of the city. The aqueduct, after crossing bandar aqueduct (or Caat-e Saadi), and irrigating the gardens and surrounding plains, entered the city.<sup>4</sup>

In the Safavid period, aqueducts were the most important source of water supply of the city. However, residents complained of water shortages. Figueroa, the Spanish ambassador to the Iranian court, explained that despite the fact that Shiraz was located in the mountainous region and the region suffered lack of rainfall, there were many aqueducts to supply water<sup>5</sup>.

Regarding water supply, Zandiyeh period resembled Safavid period. One of Karim Khan's important tasks during his rule was to construct water channel for transferring water from Rahn Abad river to Shiraz. He had also four large water reservoirs built to hold the water supplied by the aqueducts.<sup>6</sup>

In the Qajar period also the aqueduct was the most important source of drinking water and the city's water was highly polluted. During this period, Hussein Khan with the authority of Mohammad Shah, transferred the water of Shish Pir River to Shiraz. It took them three years to accomplish this (1264-1261 AH). In 1294 AH, Prince Haji Farhad Mirza Motameduldouleh, the governor of Fars province had Karimkhan's aqueducts repaired and dredged. He also ordered the construction of a new aqueduct in the land near the Azam Creek, northwest of Shiraz. In 1296 AH, Mirza Ali Mohammad Khan had the aqueduct of Limak repaired and dredged and dedicated the drinking water to the people of Bala Mahale, lying to the south of Shiraz.<sup>7</sup>

Tang-e Qarapiri (strait) or Bibiche Kushk (summerhouse) were large aqueducts around Shiraz. The aqueducts named Tangheqirapiri, Kushak Bibicha in Moeinabad, Kheirat, Khebre, Jalali, Haji Shams, Mansour Abad and Sheikh Mohammadi originated from large aqueducts. The aqueduct of Khairat, founded in 1058 AH by the minister, Mirza Mu'in al-Dawlah Mohammad Shirazi, contained the most water and supplied water to the Moshir neighborhood.

One of the largest aqueducts in Shiraz was Rezaabad aqueduct, or Qavami, which was built by Mirza Ali Mohammad Khan Qavam al-Molk and named after his son, Mohammad Reza Khan Qavam al-Molk Reza. These aqueducts supplied the consuming water of neighborhood of Lab-e-Ab, Bala Qaft, Qavam neighborhood, and part of the eastern and southeastern houses of the old city of Shiraz<sup>8</sup>.

The water of Azam Creek was also one of the drinking water sources of Shiraz. The water flowed through the dry river

4- Hosseini Fasaai, 1988: 905.

5- Figueroa, 1984: 144-142.

6- Mousavi Nami Isfahani, 1938: 159-160.

7- Hosseini Fasaai, 1988: 903-904.

8- Forsat Shirazi, 1998: 866.



to a place called Maghsam Aala, and from there it flowed into streams. One of these streams flowed beneath the dry rivers and was divided into two branches by Shirazians, referred to as Aabbandi and Nahri streams. The former did not reach Shiraz but only irrigated agricultural lands. After passing through the gardens and some mills, the river water reached a neighborhood, called Shahzade and Darvaz-e Isfahan<sup>9</sup>.

Until 1331 solar year, supplying Shiraz's drinking water was performed in this way. That is to say, the aqueducts and springs provided the drinking water stored inside the reservoirs. Some areas also obtained drinking water directly from the streams. Many houses used surface wells for acquiring drinking water.

### **Shiraz Water Pollution and Waterborne Diseases**

Shiraz drinking water was supplied from surface sources. As the water flowed in the open air channels inside the city, it was contaminated on its way to the residential area, especially in the southern part of the city. The streets were muddy and were washed away during the rainfalls and hence the mud could enter the streams of water. There was no car in the city, and horse-drawn carriages were used as the means of transportation. The carriage stations were usually in the corner of the streets, near the water channels. Horses' feces and urine entered the streets by raining water and polluting it, turning the water color black. In some places the surface of the water, like the peacock feather, was colorful. Bridges had been struck on the bogs below which the dogs lived and when water flowed in the channels (once every 2-3 days), it would contaminate with dog feces.<sup>10</sup> For this reason many well-off individuals had wells of about 30 meters deep in their homes and used these wells for drinking. However, most of these wells were contaminated with sewage because of its proximity to the sewage and wastewater. Some houses had Haws (a small pool) that were filled with rainwater once every four days. Due to the muddy climates, these Hawses were constantly in need of dredging. Complete dredging was not possible and this would lead to increased contamination of drinking water in homes. Hand-pump-like devices were used for harvesting a small amount of pond sludge. Many insects were found in the water of these ponds, resembling *Descurainia sophia*, while, in fact, they were often larvae and insects. The local people would clear the water from these insects by means of very fine fabric, collecting so many insects that could effectively feed the poultries and roosters. Moreover, there were a lot of mosses and sludge in the water and the water inside the ditches was in poor condition. There were abundant leeches in the water, as well. In summer, thugs

9- Hosseini Fassaei, 1988: 1594.

10- Anonymous, 1943, No. 79: 3.



and bullies of the area used this water for swimming. In the atmosphere, leeches were abundantly found.<sup>11</sup>

Another source of contaminants was water drawn from the dead-body bathing houses (Ghasalkhane). Ghasalkhanes were generally next to the creeks and were built a few meters under the ground and could be reached through a few steps or a corridor. Sometimes they use the watercourse assigned for the public to wash the corpse<sup>12</sup>.

In general, people were careless about drinking contaminated water, mainly because of their misunderstanding of one of the Islamic commands that water, soil and sun and fire are among natural cleansers. Especially running water removes contaminants. So people used the running water for drinking, regardless of the contamination.

Surveys conducted on virus cognition of streams, spring-houses, and ablution rooms, mortuaries, sanctuaries, cisterns and reservoirs and hot water reservoir in traditional baths have gradually been identified with transmitting more than 100 different types of diseases. These diseases originated either directly from using contaminated water (drinking) or indirectly (washing, bathing, fruits and vegetables, etc.). The spread of various diseases necessitated the provision of safe and sanitary water in the city of Shiraz. One of the most important diseases caused by contaminated water was typhoid fever. Different types of fever are diagnosed, one, in Greek, known as Sonaches.<sup>13-15</sup> The disease is an infectious disease caused by *Salmonella typhi*. The bacteria, through the mouth and digestive tract, spread to other parts of the body, including the bile. After a while, symptoms of the disease would appear in the affected person. One of the major health problems of Iran in the Pahlavi era was poor and unsafe drinking water, exposing people to various diseases. At that time, most cities in Iran lacked safe drinking water and were supplied through aqueducts and streams, as well as that sold by the water-carriers (saqqas). The water in the sanctuaries was not always safe and potable, contributing to outbreaks of typhoid and diarrhea.<sup>16</sup> Furthermore, the some consumed the water collected from the rivers, springs and wells. These sources of water were not always sanitary because in some areas the water level was very high, near the surface of the ground and hence could be easily contaminated by sewage.

In addition to potable water, bathhouse reservoirs could also contribute to transmitting typhoid. Because most of these reservoirs were not drained for a long time (sometimes more than a month), and in case a person with infectious diseases, such as typhoid, entered the bathhouse reservoirs which were used in common by others, the disease would spread. The water of reservoirs was drained about three times

11- Kanafchian, 2014: 43-44.

12- Rice, 2004: 192.

13- Typhoid

14- Ibid.

15- Ibid.

16- Anonymous, 1943, No. 78: 3.



a year, greatly contributing to the spread of diseases. Physicians also usually prescribed enema with bath water, which would add to the problem. For a long time, public baths were reluctant to use showers.<sup>17</sup>

In 1322 AH, following the World War I and civil conflicts, and as a result, a decline in public health surveillance, contagious diseases, the most troublesome of which was typhoid, spread in Shiraz. Nair Shirazi wrote that the disease killed numerous people, mainly due to the consumption of contaminated fruits and vegetables and the lack of personal hygiene and contaminated baths.<sup>18, 19</sup> To combat this disease, physicians suggested the followings: isolating the sick from the healthy, burning patients' clothes, providing some lime for use in polluted areas, banning importing lettuce to the City, frequently draining aqueducts, refraining from eating raw vegetables and drinking stagnant polluted water.<sup>20</sup>

In this city, the disease threatened people's life for years. Water was the main source of contamination, and contaminated the whole neighborhood, aqueducts and a large numbers of people. Aside from that, water would contaminate milk and vegetables. Formerly, unhealthy ice was also a main factor in the transmission of disease. Water and contaminated hands were also responsible for the contamination of milk or dairy products and ice cream. That's why the municipality prohibited consuming milk and ice cream at the time of disease outbreak.<sup>21</sup> In 1314, 56 people (2352-350 / 154) and in 1322, 2667 people were infected with typhoid, 490 of whom died in Shiraz. Hence, the Ministry of Health formally stated that polluted drinking water was the underlying cause of this calamity because the water source was open and exposed to any pollutants (Figure 1). The letter asked the municipal staff to take full care of the city's waters and prevent laundry and garbage disposal, in Ghasr-e-dasht and Abiverdi neighborhoods, which were the center of the outbreak<sup>22-26</sup>. In 1323, the total number of typhoid fatalities in three months of August, September and October were 75 people in Shiraz. In 1330, in the same three months, 5 and in 1331 only 2 persons died<sup>27</sup>.

Another waterborne illness is cholera. Cholera is an acute intestinal infection caused by a microbe called *Vibrio cholerae*. After one drinks the contaminated water, this germ having passed through the gastric passage multiplies in the intestine, like diarrhea symptom, leading to toxin secretion and increasing excretion of water and other minerals from the intestinal wall associated with diarrhea<sup>28</sup>. In the past, cholera was an endemic disease in Iran that adversely affected people in various cities over the years, killing large number of them in a short period of time. As a result of the unsanitary condition of water distribution, illnesses often quickly spread

- 17- Flor, 2007: 83.
- 18- Nayyer Shirazi, 2008: 447.
- 19- Anonymous, 1943, No. 127: 1-3.
- 20- Anonymous, 1943, No. 125: 3.
- 21- Anonymous, n.d., No. 293-12398: 17.
- 22- Ibid.
- 23- Anonymous, n.d., No. 350-2352: 154.
- 24- Anonymous, n.d., No. 293-12006535: 0002.
- 25- Nadim, 2016: 109-116.
- 26- See also the article review of the typhoid event of 1322.
- 27- Anonymous, n.d., No. 293-033520: 115-117.
- 28- Heidari, 2017: 208.



throughout the city. Cholera contamination was also mostly caused by aqueduct condition with open lids every two to three meters. This method of distributing water was responsible for transmitting the disease from one neighborhood to the other. At the time of the outbreak, in order to control the disease, health tips such as drinking boiled water and eating cooked vegetation, burning the clothes of the deceased, pouring lime into the wells and not eating contaminated vegetation were frequently given to People, but they did not pay attention to these instructions. This, in turn, would accelerate the outbreak.

29- Weishard, 1989: 104.

صورت آمیز سیر در شهر شیراز در سال ۱۳۱۴

نوع بیمار	تعداد مبتلایان	تعداد درگذشتگان	ملاحظات
۱- دانه‌ریزی	۹۴ نفر	۵ نفر	
۲- برص	۴۸۹	۲۲	
۳- کولرا	۲۹	—	
۴- شنگه	۲۷۶	۱۱	
۵- تب	۵۶	۱	
۶- تب تیفوئید	۳	۲	
۷- امهال	۵۷	—	
۸- همه‌گیر	۲	—	

Figure 1. Statistics of patients and deaths due to Communicable diseases in 1935.

In different historical periods, due to the lack of supervision over the sources of water supply and its distribution, people in Shiraz had no way other than drinking contaminated water from open rivers, aqueducts, etc. in which plant residues or human and animal waste were usually found. Drinking this untreated water would cause bloody diarrhea or dysentery. This was exacerbated in the summer because of drinking more water and a kind of syrup usually made from sweetened ice which was also contaminated<sup>29</sup>. When people afflicted with these diseases, it was necessary to drink plenty of fluids to make up for lost body water and this would make the problem worse. And the more the contaminated water was drunk, the less effective would be the treatment. There were many problems in preparing ice for different types of drinks in Shiraz before water pipes were constructed for public use. Since a large percentage of the city's ice sheets were consumed from natural glaciers around the city, which was



far away from the city, hence, the ice would be in contact with a variety of pollutants along the route. Then, the consumers were exposed to all kinds of infections and germs. On the other hand, the existing ice plants in the city also used well water to supply their required water and as mentioned above the well water was also contaminated by various factors. Then, it was decided to provide people living in the city with safe water through water pipes and attempted to install public taps in various parts of the city. The ice plants also were forced to use sanitary water for making ice<sup>30</sup>.

In 1322, following the outbreak of disease, the municipality issued some health instructions to those involved in selling juice and lemon juice in Shiraz, commanding that they should wash the related utensils with boiling water and cover them with fine fabrics; In addition, they should have proper practice of personal hygiene<sup>31</sup>. The death toll in 1313 were 33 cases, and 57 cases in 1314<sup>32</sup>. In 1323, there were 426 deaths reported. During the three months of August, September and September 1330, 21 people died of bloody stool diarrhea and during the same period in 1331, 16 people died<sup>33</sup>. (Figure 2)

- 30- Anonymus, 1952, No. 1496: 2.
- 31- Anonymus, n.d., No. 98-293-686: 3.
- 32- Anonymus, n.d., No. 350-2352: 154, 299.
- 33- Anonymus, n.d., No. 0117-033520: 293.

مقایسه آمار تنفیحات با بیماری های مهال و غیر مهال در ماه مرداد ۱۳۳۰ و ماه مشابه آن (مهر مرداد جاری)

شماره ثبت	نام ماه	مهال		غیر مهال		مجموعه		مجموعه	مجموعه	مجموعه	مجموعه	مجموعه
		دکتر	بابت	دکتر	بابت	دکتر	بابت					
۱	مرداد ۱۳۳۰	۱۰	۱۳	۵	۷	۱۵	۶	۲۰	۲۰	۲۰	۲۰	۲۰
۲	مرداد ۱۳۳۱	۸	۱۰	۲	۴	۵	۶	۱۰	۱۰	۱۰	۱۰	۱۰

مقایسه آمار تنفیحات با بیماری های مهال و غیر مهال در ماه شهریور ۱۳۳۰ و ماه مشابه آن (مهر مرداد جاری)

شماره ثبت	نام ماه	مهال		غیر مهال		مجموعه		مجموعه	مجموعه	مجموعه	مجموعه	مجموعه
		دکتر	بابت	دکتر	بابت	دکتر	بابت					
۱	شهریور ۱۳۳۰	۶	۷	۲	۴	۸	۶	۱۴	۱۹	۱۹	۱۹	۱۹
۲	شهریور ۱۳۳۱	۳	۳	۱	۴	۴	۴	۸	۷	۷	۷	۷

Figure 2. Statistics on deaths from communicable diseases in 1951(August and September)

Some diseases occur because of lack of access to water. In this case, the water quantity played a greater role than water quality. Trachoma and typhus were good examples. In-



ing the amount of water and improving the accessibility and sanitation of the waters were effective ways to prevent these diseases.

### **Typhus**

Typhus, known as typhus fever, is an infectious disease that is indirectly caused by lack of access to safe and hygienic water, and can be transmitted from the bites of lice<sup>34</sup>. The lice contributed to the transmission of the disease in different ways, namely public places, such as schools, cafes, movie theatres, buses and carts. Moreover, those in charge of public baths did not observe the sanitary principles and by letting even ill people enter the bathhouse reservoirs would help the spread of the disease.<sup>35</sup>

Shiraz baths, except for some baths in which hygienic principles were attended to and did not have a bathhouse reservoirs (khezina), others by neglecting hygienic principles helped accelerating the spread of various diseases. The water of these baths was often dirty and in most of them, the reservoir was left open and its water was not drained and cleansed for months. The municipal health authorities also paid no attention to this issue and the owners of the baths accepted all people, healthy or ill, to earn more money, contributing to the increase of death toll. On the other hand, the high cost of coal and its shortage caused postponing the drainage of the reservoir water to later time.<sup>36</sup>

Attempts, included giving Health tips, such as using showers, blocking existing bathhouse reservoirs, changing bathwater monthly, preventing ill-people from coming to the public bath, were made to combat common diseases<sup>37</sup>. In 1322, the number of patients afflicted with typhus was 459 but in 1323, it fell to 135.<sup>38</sup>

In addition to typhus, another water-washed disease is trachoma, a chronic eye infection and one of the most common causes of blindness. The disease is caused by contaminated water, lack of personal hygiene, improper disposal of garbage and waste, close contact with animals and animal waste, use of unsanitary public baths with pollutants and germs. Prior to installing sanitary water supply system in Shiraz, this disease put many people and doctors in trouble. In 1313, 15 people, in 1314, 622 and in 1318, 23 persons lost their lives<sup>39-41</sup>. In 1331, there were 135 people who were diagnosed afflicted with trachoma.<sup>42</sup>

Another common disease of the day was Dracunculiasis, afflicting the residents of Shiraz, mainly due to lack of access to clean and sanitary waters. In terms of clean drinking water, people were in dire straits, as there was rain once a year in Shiraz and rainwater was stored in underground water reservoirs

- 34- Athari, 1996: 294.
- 35- Dehghannezhad, 2010:56.
- 36- Anonymous, 1951: 4.
- 37- Anonymous, n.d., No. 243-47304: 34.
- 38- Anonymous, 1945: 2.
- 39- Anonymous, n.d., No. 350-2352: 299.
- 40- Anonymous, n.d., No. 350-2352: 70.
- 41- Anonymous, n.d., No. 293-38366: 3.
- 42- Anonymous, 1952, No. 1312: 2.



to be used all year round. In these stagnant waters, which remained in the reservoirs for more than a year, all kinds of parasites and worms were reared, and the inhabitants drinking this water often adversely affected with Dracunculiasis, or Guinea- worm Worms, causing very thin worms entering the skin and producing severe pain. Removing the worms was very difficult and painful. The only way to counter and prevent this disease could be maintained through consuming clean and boiling water.<sup>43</sup>

### **Malaria**

Malaria is an infectious disease transmitted to humans through the malaria parasite existing in the body of the Anopheles mosquito. This mosquito is commonly found in pits and lagoons that were contaminated and stagnant<sup>44</sup>. Shiraz suffered from this disease for many years, mainly because of the unsanitary disposal of sewage and polluted water of the reservoirs, as reported in 1313<sup>45</sup>. In 1322, the number of malaria cases was 62 and the number of deaths in the three months of August, September, but September in 1330 in Shiraz was 1 and no fatality was reported in the same months of the year 1331<sup>46</sup>.

The prevalence of infectious diseases and the high mortality in different periods of time prompted doctors to declare that contaminated water was responsible for these diseases, encouraging people to use boiling water and refrain from drinking contaminated water. They got infected. Therefore, access to safe and hygienic water was one of the most important needs of Shiraz. At different times, different authorities, including Karim Khan Zand who attempted to transfer water from Rokny river and Hossein Khan attempting to transfer water from Shish-pir river was far from success. As the minerals found in Shiraz' drinking water made water hard, in 1316, the British Consul General in Shiraz tested different waters of Shiraz and declared that Raknabad water flowing from the North and Tang Allah Akbar was the best potable water. Therefore, all governmental departments and affluent people began using the water of this spring. This led to a big crowd of people going there and standing for long hours in queue. Hence, Azam al-Zawraa ordered digging a deep well in front of the headquarters. After Shabdiz, the mayor, was summoned to Tehran, Sepehr, the subsequent mayor, continued the project and finally, the pipeline, dedicated to the city by Iranian and British oil company Shiraz Branch, was installed and led water from the well to the intersection of Lotfali Khan Zand in 1317. At the intersection, a water storage source surrounded by multiple taps for public use was constructed. Having tested the water, British Consul General

43- Anonymous, n.d., No. 350-891: 8.

44- Alijani, 2014: 60.

45- Anonymous, n.d., No. 98-293-1770: 14.

46- Anonymous, n.d., No: 293-033520: 115-117.



said that this water is even safer and healthier than Raknabad water. This encouraged people to use this water because it was both healthier and closer to their homes<sup>47</sup>. Later on, the only practical measure to provide safe drinking water the attempt made by Mohammad Namazi to supply the city with water pipes.

47- Azam Qodsi, 1963: 199.

### **Water Piping System**

In 1323, Mohammad Namazi returned to Shiraz and decided to spend part of his fortune on establishing a medical center. After studying and consulting with experts, he found that the root causes of many diseases in Shiraz were directly and indirectly related to water. Since the city lacks sanitary water, he decided to have a water piping system be designed and constructed to supply the households with sanitary water.

In order to equip Shiraz with water piping system, Mohammad Namazi signed a contract with Shiraz Mayor, to design and construct such a system. In this contract, it was assigned that according to Shiraz Municipality council's stipulation found in the income statement, the municipality would depreciate certain percent for the water revenue and the company's personnel and expenses. In addition, the municipality of Shiraz agreed to construct a company called "Joint-stock water company" and accordingly would depreciate twelve percent of the interest of the water company yearly. Namazi was initially intended to transfer the water of Shish pir to Shiraz, but Mohammad Bagher Khalili disagreed with this project and he decided to supply urban water by digging deep wells. After a while, Namazi bought all the stock of the company and began digging wells and constructing water reservoirs as well as launching water piping system. Then, his cousin, Mahdi Namazi was assigned to be in charge of the Water Company, and Abulqasim Houshmand, who was one of the well-known judges, and the general director of the Fars Registrar for some time, agreed to perform the executive affairs of the company. Two US companies, Alexander Gabe and Flash Company, undertook to design and execute the water well drilling and city piping system. The complete plumbing plan for the city was prepared by Charles Kidder-sley and Monsieur Olivier, was appointed as the technical advisor of the Alexander Gippe and Partners Company. By digging ten wells at a depth of 85 meters below the surface, the water of eight of wells were stored in two storage tanks, one near the Quran gate and the other at the foot of the Three Mill mountain, at the heights of the city. The two tanks stored 5800,000 liters and 30,000,000 liters, respectively, with a total of 88,000,000 liters of water. The water from these tanks was directed, through the 12-inch-diameter steel pipes, to



the city's main streets and then connected to the by-lanes by smaller cast-iron pipes, with a total pipeline of more than 115 kilometers.

The plumbing of the city was to be completed by the end of 1929 and by April 1330 the water would flow into the pipes. However, the project, practically, was completed in 1331 on the evening of Friday 12 May 1331, on the Shah's 13-day trip to Shiraz. Before its official opening, only the affluent people could have access to the piped water.

According to the report of the mayor of Shiraz, Mohammad Qoli Qavami, by September 7, 1331, 25 public valves had been installed for public use, and the neighborhoods in the south of the city still lacked piped water. Schools also lacked piped water, so the education and culture head of the Shiraz contracted with the Saqqas (water carrier) to supply the purified water to the schools<sup>48</sup>. As the alleys in older neighborhood of Shiraz were very long and narrow, it was very expensive and time consuming to have household tap connection. On the other hand, the inhabitants of this part of the city were too poor to apply for that. So the engineers in their detailed design had decided to satisfy the needs of the inhabitation of those areas by installing public valves. But when the project started, the inhabitants complained and expressed their strong desire to supply them with household tap connection. This would help them get rid of consuming contaminated stagnant water. Hence, the founder of the project respected the need of the residents and decided to connect the whole city to the water piping system.

A look at the statistics of contagious diseases in the years before and after Shiraz was equipped with drinking water pipelines reveals a sharp decline of the water-borne diseases, as reported by newspapers and found in documents related to Shiraz health centers and municipalities. In 1324 solar year, the statistics of contagious diseases in Shiraz were as follows: Typhus 18.3%; Typhoid 8.2%, Diphtheria 6.2%, Smallpox 2.5%, measles 3.9%.<sup>49</sup>

After the city was equipped with the plumbing system in 1331, the inhabitation had access to hygienic and safe water, and the number of fatal diseases, such as intestinal arthritis, diarrhea, typhoid and parathyroid was significantly reduced<sup>50</sup>. Mohammad Namazi also wrote in a letter to Estakhr newspaper: "I received and happily read the good news related to the fall of death tolls because of diarrhea and typhoid within a ten-month period in 1330 solar year prior to connecting the houses to the pipe network and comparing it with that after the household tap connection within the same time period in 1331 solar year (according to the attachment of your letter No. 808 dated Ordibehesht, 8. Although only one-third of

48- Modares Sadeghi, 1952: 50.

49- Anonymous, 1945: 2.

50- Anonymous, n.d., No. 293-33520: 109-111.



Shiraz's houses have been connected to the water piping system so far, a reduction of forty-one percent death tolls from diseases during this period is very satisfactory. I hope, after all the 7000 houses have been connected to the piping system, the death tolls from water-related illnesses will reduce more significantly.

It was very satisfactory that, as reported by physicians, there was a noticeable decline in the number of gastrointestinal diseases from the time when people used safe water. In addition, most of those suffering from indigestion no longer complained about it. In order to reduce the risk of further water-borne illnesses, the inhabitants were advised not to use of Haws water (a small pool) for hand washing and dishwashing, even if the haws was filled with water from the pipe. So the health administration and physicians, in general, should make people understand that Haws water is not healthy and is bad for them, leading to gastrointestinal and contagious diseases.<sup>51</sup>

### Conclusion

Water is vital for human life, but despite its significant role in human life if it is polluted, it can turn into the most dangerous threats to human life. The city of Shiraz did not enjoy safe drinking water until 1331. Prior to this date, Shiraz's water, including drinking water was supplied by springs, wells, and aqueducts. These water sources themselves could have been a source of contamination and infection, as these springs and aqueducts were flowing openly into the city, being exposed directly or indirectly to different contaminants (on washing clothes, waste disposal, etc.). Contaminated water was consumed for drinking, washing vegetables, fruits, bathing, etc. This would adversely affect people's health and the inhabitants would be afflicted with diseases such as typhus, typhoid, Cholera, etc. Having faced these serious health problems, Mohammad Namazi determined to construct water piping system in Shiraz, and equip people with piped water supply. Such safe water substituted unsanitary water of wells, water reservoirs, tanks, barrels, jars, buckets, etc. And public baths were gradually abandoned and private baths at home took their place, reducing and ultimately eradicating a number of infectious diseases.

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51- Anonymous, 1953, No. 1548: 1, 2.



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