

Fascioliasis in Iran

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ABSTRACT

Fascioliasis, a secondary zoonotic disease until mid-1990s is emerging or re-emerging in many countries. Fasciola, a leaf-like worm, is deemed to be one of the most neglected parasites which is responsible for fascioliasis and can lead to livestock and human infection. In the last few decades, its significant outbreak led it to become an important health problem and financial loss all around the world. Fascioliasis has uneven geographic distribution. It has been seen in 61 countries, where it is able to put 180 million individual's lives at stake. According to the WHO, Iran is an endemic region for fascioliasis and it had become included among six countries that have been affected by this helminth. It has been estimated that 6 million Iranian are at risk of this disease. This disease has become a major issue and has been frequently seen in the Northern provinces, suited alongside the shore of the Caspian Sea, particularly in Gilan Province, where the greatest fascioliasis outbreak happened. The important factors such as management and husbandry of flocks and herds, climate conditions, food habits, ecological aspects of transmission of Fasciola, presence of interface host, and free ruminants grazing are the main reasons behind the existence of this zoonotic disease in north of Iran.

Keywords: Fasciola; Fascioliasis; Iran; Zoonotic disease; Epidemiology

INTRODUCTION

Zoonotic diseases have been a global public health problem for a long time. Among helminth diseases of sylvatic ruminants, fascioliasis has become from a secondary zoonotic disease to an important parasitic disease due to its massively destructive effects on animals or humans and its great economic loss [1]. The infection caused by liver fluke species of the genus Fasciola is now considered as an emerging or re-emerging infection as well [2][3]. Two trematodes of the family Fasciolidae, *F. hepatica* and *F. gigantica* are able to infect humans and animals. However, in tropical countries where both species exist at the same time, *F. hepatica* is endemic in highlands and *F. gigantica* is endemic in lower regions [4]. Nowadays, fascioliasis is classified as a tropical disorder [2]. Both species are different from each other regarding their transmission, epidemiologic, and phylogenetic properties [5]. This infection can cause severe damages and even leads to death [2]. It has been proven that definitive hosts of *F. hepatica* are mostly sheep, but other herbivorous and omnivorous animals

such as goats, cattle, horses, camels, vicuna, hogs, rabbits, and deer have been infected with this parasite as well. Fasciola hepatica was the first described trematode and has been always known as infection in domestic animals its definitive hosts. Humans as incidental hosts of this parasite have two distinct clinical phases based on the hepatic migratory phase of the larvae and the presence of the adult worm in the bile duct [6]. These two phases in human fascioliasis are: acute or hepatic phase and chronic or biliary phase. After 1-3 months of infection, the hepatic phase can be characterized by the migration of immature worms through the liver parenchyma [7]. The life cycle of Fasciola spp. depends on the presence of a snail such as *Lymnaea truncatula* for *F. hepatica* and *L. auricularia* and *L. gedrosiana* species for *F. gigantica* as an intermediate host [8]. Infection in Fasciola's hosts (humans and mammals) results in ingesting raw watercress, other fresh aquatic vegetation or water contaminated with the metacercariae of the parasite [6][9]. Fascioliasis can be diagnosed by several techniques, however, serological tests such as ELISA test with 100% sensitivity and

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Received: September 05, 2020; **Accepted:** August 30, 2021; **Published:** September 09, 2021

Citation: Torbehbar EB (2021) Fascioliasis in Iran. Clin Microbiol 10: p218

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97.8% specificity have higher sensitivity and accuracy, which is more reliable to use in the acute phase of the disease [8]. According to the World Health Organization, Triclabendazole is the drug choice to treat patients infected by this helminth globally [10].

The economic effects of the disease are due to increased liver meat's condemnation and decreased animal productivity that leads to weight loss and low-growth in infected animals [2]. It has been estimated that fascioliasis financial effects cost over US \$ 3.2 billion annually [1].

Epidemiological analysis of human and animal fascioliasis has shown that 91 million people are at risk universally, and 2.4 to 17 million individuals have been infected by *Fasciola hepatica* [2]. Several factors like ingesting contaminated aquatic plants, climate conditions and drug resistance increase this infection [11].

This disease has widespread geographical distribution. It has been reported that *F. hepatica* has infected many people in countries with a temperate climate such as in Europe, America, Australia, while *F. gigantica* has been mostly seen in tropical regions like Africa and Asia [4]. Among Asian countries, Iran is one of the main endemic regions and had the highest rate of liver disease caused by fascioliasis [2].

METHODS

The published cases of fascioliasis in Iran were reviewed narratively via a search in PubMed, Scopus, SID, Google Scholar, Iran Medex and Springer. This review article searched the literature articles that evaluated the prevalence of fascioliasis infection in human and animal hosts in different parts of Iran. All local and international English journals up to 2020 have been examined and necessary information about the human and animal fascioliasis and its prevalence in Iran was extracted.

FINDINGS

Epidemiological analysis of human and animal fascioliasis has shown a wide range of infections in different areas of the world [5]. The prevalence of *Fasciola* sp. does particularly exist in areas with rigorous sheep or cattle production [2]. Countries including Bolivia, Peru, Egypt, Iran, Portugal, and France have shown the highest rate of fascioliasis infection so far [6]. Among published cases from Asian countries over the course of 25 years, Iran with approximately 81 million population had the most reported human fascioliasis. In different provinces of Iran such as Kurdistan, Zanjan, Kermanshah, Mazandaran, Tehran, Azerbaijan and Gilan, fascioliasis is present. Even though human fascioliasis has been reported from different parts of Iran more than 30 years ago, cities alongside the Caspian Sea have long been known to have the highest rate of human and animal fascioliasis prevalence [12]. In Iran, the economic loss of fascioliasis due to liver condemnation is US\$ 8.2 million per annum [10]. In the case of host gender, it should be noted that among Asian Countries, in Iran and Egypt, females are infected more often than males [10]. In 1989, the first largest outbreak of human fascioliasis in the world occurred in Gilan Province, Iran that involved more than 10,000 individuals in two districts of

Gilan Province, namely Bandar Anzali and Rasht. During a short period, thousands of patients with common symptoms such as epigastric and right upper quadrant pain, fever, chill, sweating, weight loss, urticarial and chest signs along with high eosinophilia attended medical centers. 10 years later, in 1999, the second large outbreak took place, affecting an estimated 10.000 to 15.000 people. Hundreds of human fascioliasis cases occurred before and after the second outbreak, which established Gilan Province as an exceedingly endemic area for human fascioliasis. As a result, Bandar Anzali seemed to be the most important endemic area of human fascioliasis during the epidemic and inter-epidemic periods. Then, because of unique epidemiological characteristics of fascioliasis in this area, a pattern namely "Caspian Pattern" has been created [10][13]. This term is specifically for the transmission in Caspian Sea areas, which is considered as a hypoendemic area with large-scale epidemics with ability to affect more than 10.000.people [12]. These two outbreaks result in the region's environmental conditions and dietary habits, which dramatically increased the awareness around fascioliasis among Iranian physicians and parasitologists. [7][10]. Two vital sources of infection in northern Iran are green salt and elaborated olive name: "Zeitoon parvardeh", with mixture of ground aquatic plants such as *Mentha pulegium*, *Mentha piperita* and *Eryngium coucasicum* [10].

In 2005, another study in Rasht and Bandar Anzali has been conducted a coproscopic analysis on 156 cattle, 171 calves, 178 sheep, 85 buffaloes, 79 horses, and 10 manure samples taken from 10 different freshly preserved animals to detect any sign of fascioliasis. Of these, 32.1%, 0%, 32%, 17%, 50%, and 100% of samples have shown infection respectively. It should be considered that different factors including uncommon practice of sheep breeding, low population of horses in studied areas, and predomination of cattle and to a lesser extent buffalo affected the result. Mazandaran Province, near to Gilan Province, with similar climate conditions and animal husbandry management, has shown a 7.3% infection in sheep and 25.4% of infection in cattle [1]. According to the data from the Gilan Central Veterinary Office and observations by Ashrafi et al., fascioliasis in cattle was far more prevalent than sheep or goats in endemic areas like Bandar Anzali and Rasht. Based on the morphology analysis of this survey, it has been shown that *F. gigantica* was the main fasciolid with 91.1% than *F. hepatica* with only 8.9% rate of infection [4].

A narrative review article by Ashrafi has been conducted in 2015. This survey has been monitoring human fascioliasis from 1998 to 2014 in different districts of Gilan Province, districts such as Bandar Anzali, Rasht, and Lahijan. Based on this study Gilan Province had the total of 8,689 positive cases, in which Rasht had the highest rate of infection and Lahijan had the lowest rate of fascioliasis in the course of 16 years. Moreover, the collected data about the prevalence of animal fascioliasis from different parts of Iran demonstrated the following result: Tehran Province: 31.2%, 25.2%, 64.3%, Hamadan Province: 4.9%, 9.5%, 4.5%, Lorestan

Province: 2.6%, 2.8%, 2.6%, Fars Province: 1.07%, 0.59%, 0.24%, and Golestan Province: 2.5%, 3.1%, 0%, were the rates

of fascioliasis infection in sheep, cattle, and goat respectively [13]. In Semnan, Zanjan, Qazvin, Kerman, Hormozgan, Bushehr, and Yazd provinces, fascioliasis just was diagnosed in sheep with the maximum rate in Hormozgan Province (2.49%). Buffalo infection has not been reported in any of these provinces [13].

During the course of three years, from 2008 to 2013, another study was performed in Bandar Anzali. Among 1,984 individuals, aged 10 to 80 years participated voluntarily in this survey, 30 individuals (19 females and 11 males) were infected with *Fasciola*. Overall, the prevalence of fascioliasis in this region was 1.36% and 0.45% based on serological and coprological examinations [14].

In 1998, a small outbreak occurred in the Kangavar district in Kermanshah Province. From then onwards, until 2008, 17 new cases have been reported in the capital of Kermanshah as well. However, in this region, the rate of animal fascioliasis is more prevalent than human fascioliasis, except for a small outbreak. It seems that culture plays a significant role in this regard. Another Province of Iran, Kohgiluyeh and Boyer-Ahmad Province which is located in the southwest of Iran has shown a suspicious prevalence rate of human fascioliasis, mainly *F. hepatica*. 1.8% of individuals have been detected by ELISA test that had the history of consuming wild freshwater plants. Also, from 2010 to 2011, in Ardabil Province, in the northwestern of Iran, which is bordering the Republic of Azerbaijan, among 458 individuals, 1.96% of them were reported to be infected with fascioliasis [13].

Nasturtium microphyllum, *Mentha longifolia*, *Eryngium* spp., *Mentha* spp., *Nasturtium* spp. and *Falcaria vulgaris* are the main plants implicated in human fascioliasis transmission [13] [15].

A review survey by Khademvatan et al. has been performed in 2019 to examine the prevalence of fascioliasis in livestock and humans in some parts of Iran. In the case of human fascioliasis, 8,703 human cases that have been examined by the ELISA test, the highest rate belonged to Gilan Province with 50% and the lowest rate belonged to Chaharmahal and Bakhtiari Province with 0.13%. Altogether, in 6,713,135 domestic animals were examined, the rate of infection was 1.8%. The overall prevalence ranges are as follows: 4.2% in sheep,

9% in cattle among, 3.1% in goats among, 5.3% in camels, 14.7% in water buffalos, 5.1% in horses, 6.7% in donkeys, with a total number of 122,720 animals were infected with this helminth. Relevant factors like proper intermediate host, appropriate environment, optimum temperature (10-25°C), and sufficient humidity have been considered as well [9].

From 2012 to 2013, a study in Kashan, the northern part of Isfahan Province, has been conducted during four seasons. The livers of 251,325 slaughtered animals (88,939 sheep, 151,924 goats, and 10,462 cattle) were examined at Kashan abattoir in order to detect *Fasciola* parasite. The total prevalence rate of liver condemnation was around 3%. Meticulously, 3.28% of sheep, 2.76% of goats, and 3.68% of cattle were infected. Based on the studied region estimation, the financial damage of fascioliasis is approximately US\$ 41.784 per annum [2].

A study conducted by Sabbaghian et al. in Khuzestan Province, Southern Iran to identify animal fascioliasis. The infection rate in this region was 57% for buffaloes, 54% for cattle and 35% for sheep [16]. The same study in the same area by Sahba et al. has shown different results. The infection rate was 91.4%, 49.2%, 29% and 11.2% in buffaloes, cattle, sheep and goats respectively.

CONCLUSION

Animal husbandry plays a significant role in socio-economic evolution and food industry. In the past few decades, parasites such as *Fasciola* has been threatening productivity of animals [9]. According to the WHO, Iran is one of the 6 countries where fascioliasis is a major problem [7]. Several factors such as the biology of the vector, biology of the parasite, management and husbandry of flocks and herds, climate conditions, drug resistance, food habits, ecological aspects of transmission of *Fasciola*, presence of interface host, and free ruminants grazing are the main reasons behind the existence of this zoonotic disease in Iran [2]. Both human and animal fascioliasis are prevalent in Iran, but Gilan Province with several favourable conditions such as high rainfall, appropriate temperature and humidity, food habits etc. had had the highest rate and have been an endemic area since 1989. Based on recent studies, livestock fascioliasis is taking place in different areas of the country, while human fascioliasis depends on appropriate conditions to occur and it exists in a few geographical zones. Based on the geographical distribution of *Fasciola* in Iran, the north and the west of Iran had the most prevalence rate, and the central Iran lowest prevalence rate [9].

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