

The Epidemiological Status of Malaria During 2006 to 2018 in Larestan City, Southern Iran: A Cross-Sectional Study

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Abstract

Background: Malaria has been considered by health systems as one of the most dangerous human infectious diseases. In Iran, the disease has caused great economic and social damage to the country. The present study was designed to identify the epidemiological situation of malaria during 2006 to 2018 in the southern region of Fars province, southern Iran.

Methods: This is a cross-sectional study. The study population consisted of all people with malaria whose information was recorded at the Larestan Infectious Diseases Center from 2006 to 2018. To extract the data, a checklist was used that included information such as the total number of smears performed each year, the number of positive smears, age of the individual, sex, type of malaria species, and the month of the disease.

Results: Out of a total of 85,201 smear tests performed to identify malaria in the region, 190 had positive smear tests. The majority of the positive cases were Afghan nationalities. Most cases of the disease were seen in 2017, 2008 and 2016, respectively. In all years, men were more likely than women to have malaria, and the highest prevalence was in the age group of 21-30 and 11-20 years, respectively.

Conclusion: Despite the relative decrease in malaria cases in recent decades in Larestan city, in recent years, especially from 2014 to 2018, the increasing trend of the disease has been relatively shown again, so making active diagnosis, equipping health systems and doing more blood smears tests are necessary to reduce the prevalence of malaria in this region.

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Introduction

Malaria has long been considered one of the most dangerous human infectious diseases in health care systems, caused mainly by four types of plasmodium protozoa.¹ In normal conditions, malaria is transmitted to humans through the bite of 70 species of female Anopheles mosquitoes. Disease-producing plasmodium can damage many members of the reticuloendothelial system, such as the spleen, liver, lymph nodes, and bone marrow, by

invading red blood cells and destroying them, causing symptoms such as fever and chills, spleen and liver enlargement, renal disorders, and sometimes coma and death.² Although statistics in Iran show that the number of malaria cases has been declining since 1991, due to such factors as unfavorable environmental conditions, the presence of more than 7 species of Anopheles mosquitoes in the country, population displacement, especially in the eastern borders of the country and the entry of foreign nationalities through these borders, disease control

has been faced with many challenges.³ Today, despite extensive research on malaria eradication, the disease is still a health problem in more than 90 countries with a population of 2.4 billion.¹ According to 2008 reports, about 243 million cases of malaria have been reported, of which about 863,000 have died;⁴ according to a 2012 World Health Organization report, the number of malaria cases is estimated at 219 million and the number of deaths is estimated at 660,000 worldwide.⁵

The Eastern Mediterranean region, which includes 22 countries in West Asia, North and Northeast Africa, is one of the most common regions for malaria with about 7.5 million malaria cases in 2009 and more than 307 million at risk of developing malaria.⁶

Iran has been encountered with a major health problem due to the relatively favorable climatic and geographical conditions in the southern and southeastern regions, as well as its proximity to Pakistan, Afghanistan and Iraq, followed by uncontrolled migration from these countries into Iran.⁷ Prior to the Malaria Control Program in Iran, 4 to 5 million people in Iran were infected with the disease each year, with about 30 to 40 percent dying from the disease.^{8,9}

Malaria is the most important parasitic disease in the world.¹⁰ In Iran, too, the disease has caused great economic and social damage to the country. Sistan and Baluchestan province, due to its long border with Pakistan, has the most positive cases of malaria in the country.¹¹

Due to the endemic nature of malaria in most southern and southeastern regions of Iran, especially in the southern regions of Fars province, as well as the lack of new studies and research in the field of epidemiology of malaria disease in these areas, conducting such a study is necessary for understanding the factors affecting the occurrence of malaria disease; it provides ways of prevention and control. Since fewer studies have been conducted to identify the factors associated with malaria in Larestan region, the present study aimed to examine the epidemiological situation

of this disease during 13 years (from 2006 to 2018) and show a clear picture of the epidemiology of this disease in Larestan region for providing prevention and control programs with higher effectiveness.

Methods

The present study was a cross-sectional study. The study population consisted of all people with malaria who referred to the Center of Infectious Diseases in four cities of Larestan, Gerash, Evaz and Khonj in the south of Fars province in the period 2006 to 2018. The present study was the result of a research project No. 1398-006 and the code of ethics of IR.LARUMS.REC.1398.014 approved by Larestan University of Medical Sciences. Researchers at the Centers for Disease Control have collected medical records of patients with malaria between 2006 and 2018 and included them in a prepared checklist. Information such as the total number of smears performed each year, number of positive smears, age of the individual, sex, type of malaria species and month of the disease were listed in the checklist. Because the medical information related to all patients entered the study during the years 2006 to 2018, the sampling method was based on the entry of all cases of patients with the study (census). Files whose information were incomplete or missing were excluded from the study. During all stages of completing the checklist and entering data into the software, the patients' information was kept confidential. The data were entered into SPSS software version 25. Frequency (percent) was used to measure qualitative variables. Linear, circular, bar charts and table were used to report descriptive statistics.

Results

From 2006 to 2018, a total of 85,201 smear tests were performed to detect malaria in the region, of which 190 had positive smear tests. The majority of the positive cases were Afghan nationalities. In 2011, two smear tests were performed on Pakistanis, both of which were positive (Table 1). The highest number of patients with 29,

Table 1: The number of total smear and positive smears by nationality

Year	Total smear			Positive smear		
	Iranian	Afghan	Pakistani	Iranian	Afghan	Pakistani
2006	4349	3359	0	1	16	0
2007	7651	2063	0	1	22	0
2008	4576	3742	0	1	25	0
2009	4084	5643	0	1	11	0
2010	2399	2722	0	0	3	0
2011	2381	3450	2	0	9	2
2012	1935	4332	0	0	5	0
2013	1298	2156	0	0	1	0
2014	2416	3468	0	0	4	0
2015	1520	3991	0	2	18	0
2016	1762	4037	0	0	25	0
2017	1505	4284	0	0	29	0
2018	1859	4217	0	0	14	0

26 and 25 cases was in 2017, 2008 and 2016, respectively, and the lowest number (1 case) was observed in 2013. The trend has been declining since 2013 and has been on the rise again since 2014. In all years, men were more likely than women to be infected with malaria (Figure 1). The results of the number of cases of the disease by age groups showed that the highest frequency of cases was related to the age group of 21-30 years and 11-20 years, respectively. Children under the age of 10 accounted for 21% of all cases (Figure 2). The highest frequency of Vivax was between July and September, with a peak in August. While the falciparum species is mostly observed in the month of September. Also, the mix mode (Vivax-Falciparum) has been observed more frequently in September (Figure 3).

Discussion

The results of the present study showed that during the years 2006 to 2018, a total of 190 positive smears from malaria were observed in Larestan region in southern Iran. The disease has been declining from 2006 to 2013, but has been on the rise since 2014. In general, the course of the disease decreased from 2006 to 2018, but the difference was not statistically significant. The highest number of cases was in 2017, 2008 and 2016, respectively, and the lowest number in 2013 with 1 positive case. A study by Sarafraz et al. in northwestern Iran found that in 13 years, 133 cases of malaria were reported to be lower than the present study.¹² Another study in Sistan and Baluchestan province in southeastern Iran showed that between 2004 and 2010, 12,233 cases of malaria were detected in the region, far more than the number of cases in the present study.¹³ The results of a study in Iran showed that the incidence of malaria decreased from 1941 to 2006; despite fluctuations during different years and in 2006, the incidence of the disease reached 0.22 per thousand people.¹⁴

In the present study, it was found that the majority of malaria cases (more than 90%) were related to Afghans, which was in accordance with the study of

Ghaffari et al.¹⁵ and in contrast to the study of Alipour in southeastern Iran. It has been shown that most cases of the disease are observed among Iranians.¹³ Another study in Qom province in central Iran showed that the majority of malaria cases were non-Iranian.⁶

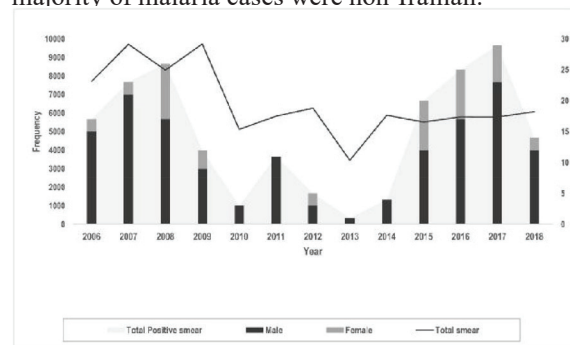


Figure 1: Frequency of positive smear cases by gender and year of occurrence of the disease (2006 to 2018)

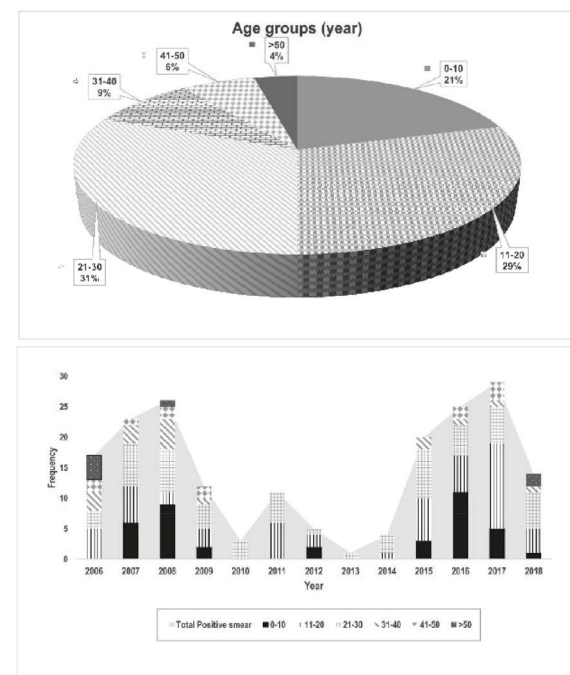


Figure 2: The number of positive smear cases by age groups (above) and the year of occurrence of the disease, (2006 to 2018) (below)

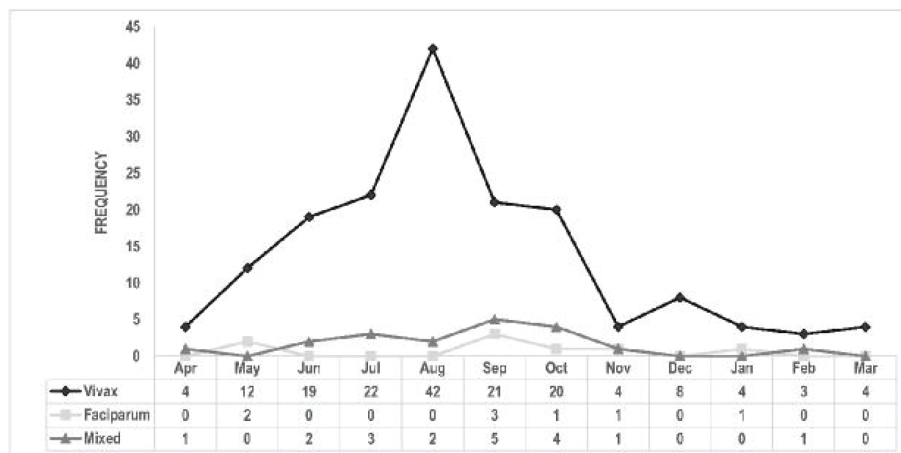


Figure 3: The frequency of positive smear cases by plasmodium species and the month of occurrence of the disease

In the present study, it was found that the predominant species of malaria is *Vivax*, which was similar to the studies conducted in Iran^{12, 16, 17} and in contrast to the study of Maude and colleagues in Cambodia who reported the predominant species of malaria as *Plasmodium falciparum*.¹⁸

The present study found that men were more likely than women to have malaria, which was consistent with the study of Zayeri et al.¹⁹ It seems that men are more at risk of infection with *Anopheles* mosquitoes than women because they wear fewer clothes, work outside, and are non-compliant with certain health tips, so men are more likely to transmit the disease than women.

The results of the present study showed that the age groups of 30-21 years and 11-20 years had the highest statistics of malaria cases, respectively. A study conducted in Iran between 2011 and 2014 found that the highest number of malaria cases was in the 16-25 age group.²⁰ Another study in Iran showed that the mean age of the people with malaria was 31.57 years and the age group of 30-40 years had the highest number.¹²

In the present study, it was found that most species of *Plasmodium vivax* were found between August and September and their peak was seen in August, and the most cases of *Plasmodium vivax* and *Mix* were observed at September. A study in southeastern Iran showed that the highest number of cases was seen in October.¹³ Another study showed that the peak of the disease was in the rainy seasons.¹⁸ A study in China found that high temperature was associated with an increase in the number of new cases of malaria.²¹ Another study reported that for a one percent increase in relative humidity, about 3.99 percent of malaria cases were added monthly.²²

One of the major limitations of this study was the unavailability of important information such as where people lived, their travel history to endemic areas, epidemiological classification of the disease, and other demographic characteristics of the patients.

Conclusion

Malaria is still known as an endemic disease in the southern region of Fars province in southern Iran. Despite the relative decline in malaria cases in recent decades in the region, in recent years, especially from 2014 to 2018, there has been a relative increase in the incidence of the disease, which requires making active diagnosis, equipping the health systems and performing more blood smear tests. The majority of cases were caused by non-Iranians who immigrated to the region from endemic and hyper-endemic areas such as Afghanistan; therefore, it is necessary to constantly check these people for malaria, and educate people in the area about environmental health and personal hygiene.

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Conflict of Interest: None declared.

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