



Original Article

Epidemiology of malaria in Ramhormoz county, southwest of Iran, during 2001-2016



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ABSTRACT

Introduction: One of the most important infectious diseases, especially in subtropical and tropical regions in developing countries is Malaria. Due to the importance of the infectious disease in these areas, the aim of current study is to evaluate epidemiology of malaria through microscopic evaluation in Ramhormoz County, southwest of Iran, during 2001-2016.

Methods: In this descriptive cross-sectional study, the blood specimens were collected from all suspicious malaria individuals referred to the Ramhormoz Healthcare Network. For the preparation of peripheral blood smears, one drop of sample was carefully placed on a microscopic slide and the slide was also stained by the Giemsa staining. In order to the detection of the parasite, the peripheral blood smears were evaluated via optical microscope.

Results: In this study, of 2769, 40 (1.44%) individuals were infected to *Plasmodium vivax*. The highest frequent of malaria was observed in 2001, 2002 with 13 (8.49%) and 11 (6.79%) cases, respectively as well as the lowest prevalence was seen in 2007, 2010, 2012, 2014 and 2015 with nil case. From a total of 40 malaria confirmed cases during the years, 34 (85%) and 6 (15%) were male and female, respectively. Also, of 40, 34 (85%) and 6 (15%) cases were lived in the rural and urban areas, respectively.

Conclusion: These findings showed a significant decrease in malaria incidence in Ramhormoz County, southwest of Iran during 2001-2016. Based on the climatic status of the County, the risk of malaria epidemics must be considered constantly and the control programs should be continued until the elimination of disease.

Introduction

In the past decades, health authorities have paid more attention to the control programs for malaria elimination in malaria-endemic countries (1, 2). The disease is one of the most important infectious diseases, particularly in subtropical and tropical regions in developing countries (3, 4). The infectious

disease is often transmitted by the female Anopheles mosquitoes. Malaria is also transmitted by other transmission routes including organ transplantation, blood transfusion and transfer through the placenta (3). Approximately, 106 countries (3.3 billion people) live at the risk of malaria. Annually, 200–300 million persons become infected with the malaria worldwide (3). In spite of great development in

public health in recent years; yet, the disease is usually considered a major public hygiene concern in some regions and countries including Thailand, sub-Saharan Africa and India that are approximately 95% of total malaria cases in the world (5). Iran is considered as a country with intermediate endemicity for this disease (5). Apart from climate, other factors including cultural and economic status of the region, residence, number of entered migrants to the region, personal and social lifestyle, and quality and quantity of the disease control programs in the areas hamper the prevalence of malaria (6). In the current years, the rate of malaria incidence has a declining trend throughout Iran. According to World Health Organization (WHO) in the 2009, Iran is in a phase of pre-elimination for malaria. In addition, *Plasmodium vivax* (*P. vivax*) has been detected as the major species and *Plasmodium falciparum* (*P. falciparum*) is more limited to the southeast and east of Iran (4, 7, 8). The southeast and south of Iran (the provinces of Sistan-Baluchestan, Hormozgan, and Kerman) are usually considered as the infectious disease endemic zones constituting about 95% of total cases (with Annual Parasite Incidence between one and eight per thousand population) (9). Due to the importance of the infectious disease in developing countries such as Iran and particularly in subtropical and tropical regions such as Ramhormoz County; therefore, the aim of the current study is to evaluate epidemiology of malaria through a microscopic evaluation in Ramhormoz County, southwest of Iran, during 2001-2016.

Methods

Study area

Ramhormoz is a county in Khuzestan Province in southwest of Iran. The capital of the county is Ramhormoz. At the 2006 census, the county's population was 97,561, in 20,648 families.

Ethics Statement

Informed consent was obtained from individuals involved in this study.

Sample collection

In the descriptive cross-sectional study, a few drops of blood samples were collected using a sterile lancet from all suspicious malaria individuals referred to the Ramhormoz Healthcare Network, Khuzestan province, Southwest of Iran during 2001- 2016. The nature as well as purpose of the research was

conveyed to the referred people and after taking informed consent initially and the samples were obtained among them. Using a questionnaire, some demographic details such as gender, nationality (Iranian or non- Iranian), age, residence, and other details (informed consent) was completed from subjects (4).

Sample preparation

For the preparation of peripheral blood smears, one drop of sample was carefully placed on a microscopic slide. Afterwards, the slides were stained by the Giemsa staining. the peripheral blood smears were evaluated via optical microscope In order to the detection of the parasite (4).

Results

2769 people were all suspicious of being malaria patients referred to Ramhormoz Healthcare Network, Khuzestan province, Southwest of Iran during 2001-2016 that 1030 (37.19%) and 1739 (62.8%) individuals were females and males, respectively. Table 1 shows the epidemiology of malaria in Ramhormoz County, southwest of Iran, during 2001-2016. Based on this table, 40 (1.44%) individuals are observed to be in a positive state for malaria during the years that they were infected with *P. vivax*. The age mean in infected individuals was 25.23. The highest frequent of malaria was observed in 2001, 2002 with 13 (8.49%) and 11 (6.79%) cases, respectively as well as the lowest prevalence was seen in 2007, 2010, 2012, 2014 and 2015 with nil case. From a total of 40 malaria confirmed cases during the years, 34 (85%) and 6 (15%) were males and females, respectively. Also, 40, 34 (85%) and 6 (15%) cases lived in the rural and urban areas, respectively.

Discussion

To quantify and monitor malaria, the epidemiology of the disease in endemic countries is a key component. In many regions, with malaria control interventions, the transmission risk of the disease is being reduced (2). To evaluate and monitor the malaria transmission, the metrics varies among regions and countries. The microscopic examination of blood smears is an indicator and it is often used for monitoring and surveillance including the outbreak of blood stage infection (10). Due to the importance of the infectious disease in developing countries and particularly in subtropical and tropical regions; the aim of the current study is to evaluate epidemiology

of malaria through microscopic examination in Ramhormoz County, southwest of Iran, during 2001-2016. Our findings

indicated that in Rafsanjan county (14), Qom province (15), Isfahan province (12) and Yazd province (16), Khuzestan province (4), more than 50% malaria cases were related to the refugees.

Table1. Epidemiology of malaria in Ramhormoz County, southwest of Iran, during 2001-2016

Year	Subjects (n)	Referred females n (%)	Referred males n (%)	Positive cases n (%)	Female n (%)	Male n (%)
2001	153	51 (33.3)	102 (66.6)	13 (8.49)	3 (23.0)	10 (76.9)
2002	162	63 (38.8)	99 (61.1)	11 (6.79)	2 (18.1)	9 (81.8)
2003	155	57 (36.7)	98 (63.2)	5 (3.22)	0 (0)	5 (100)
2004	183	73 (39.8)	110 (60.1)	3 (1.63)	1 (33.3)	2 (66.6)
2005	169	68 (40.2)	101 (59.7)	1 (0.59)	0 (0)	1 (100)
2006	180	68 (37.7)	112 (62.2)	2 (1.11)	0 (0)	2 (100)
2007	176	78 (44.3)	98 (55.6)	0 (0)	0 (0)	0 (0)
2008	191	71 (37.1)	120 (62.8)	1 (0.52)	0 (0)	1 (100)
2009	187	70 (37.4)	117 (62.5)	1 (0.53)	0 (0)	1 (100)
2010	193	72 (37.3)	121 (62.6)	0 (0)	0 (0)	0 (0)
2011	156	55 (35.2)	101 (64.7)	1 (0.64)	0 (0)	1 (100)
2012	179	67 (37.4)	112 (62.5)	0 (0)	0 (0)	0 (0)
2013	151	56 (37)	95 (62.9)	1 (0.66)	0 (0)	1 (100)
2014	192	72 (37.5)	120 (62.5)	0 (0)	0 (0)	0 (0)
2015	162	50 (30.8)	112 (69.1)	0 (0)	0 (0)	0 (0)
2016	180	59 (32.7)	121 (67.2)	1 (0.55)	0 (0)	1 (100)
Total	2769	1030 (37.19)	1739 (62.8)	40 (1.44)	6 (15)	34 (85)

indicated that 40 (1.44%) individuals were observed positive for malaria that these individuals were infected with *P. vivax*. According to previous studies, *P. vivax* has reported that it is a dominant parasite in Iran (4, 11, 12). The highest frequent of malaria was observed in 2001, 2002 with 13 (8.49%) and 11 (6.79%) cases, respectively as well as the lowest prevalence was seen in 2007, 2010, 2012, 2014 and 2015 with nil case. In accordance with these results, Mesdaghinia *et al.* (13) in Iran, in 2013 indicated that in 1995, 66075 malaria cases were observed while in 2012, only 3200 malaria positive cases were reported. Also, Salmanzadeh *et al.* in Khuzestan province indicated that of 541 malaria positive cases, 161 (29.75%) cases was seen as the highest number in 2001 (4). Accordingly, the annual incidence rate of the disease declined significantly during the years. Migration from malaria endemic zones to Iran can lead to increasing the risk of malaria. For example, more than 2 million Afghan refugees have migrated to Iran in the recent years. These migrations have caused several serious problems in the disease control program (7). In this regard, it has been

Also, another result of the study showed that from a total of 40 malaria confirmed cases during 2001-2016, 34 (85%) and 6 (15%) were males and females, respectively. Based on the results, this prevalence was higher in males than females. In accordance with these results, in the conducted study by Soleimanifard *et al.* (12) in Isfahan province, in 2011 was shown that 93.5% of malaria positive cases were males. In addition, Sarafraz *et al.* (11) in East Azerbaijan province, in 2014 indicated a 86.46% of total cases were males. Also, in another study in Khuzestan province, indicated that 541 malaria were positive cases, 498 (92.05%) and 43 (7.95%) were males and females, respectively (4). Contrary to these studies, gender is not involved in resistance and sensitivity to the disease directly but it is related to cultural habits, social activities, job, and type of coating. Accordingly, it is established that there are no significant differences between males and females (17). Also, another finding of the study was that of 40 malaria positive cases, 34 (85%) and 6 (15%) cases were lived in the rural and urban areas, respectively. It is established that apart from climate, other factors

including cultural and economic status of the region, residence, number of entered migrants to the region, personal and social lifestyle, and quality and quantity of the disease control programs in the areas hamper the prevalence of malaria (6). The inconsistency in the results of research and other studies can be explained by occupations, number of persons referring to Healthcare Network, and cultural habit of the region, sanitary status, type of sampling, geographical location, methodology, and many other factors.

Conclusions

These findings showed significantly a decrease in malaria incidence in Ramhormoz County, southwest of Iran during 2001-2016. Based on the climatic status of the County, the risk of malaria epidemics must constantly be considered and until the elimination of the disease, the control programs should be continued.

Ethical disclosure

Informed consent was obtained from individuals involved in this study.

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Authors' Contributions

All authors contributed equally in planning and carrying out this project.

Conflict of interest

The authors declare no conflict of interests.

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None declared.

References

1. Stevenson JC, Stresman GH, Baidjoe A, Okoth A, Oriango R, Owaga C, et al. Use of different transmission metrics to describe malaria epidemiology in the highlands of western Kenya. *Malaria J*. 2015; 14(1):418. doi: [10.1186/s12936-015-0944-4](https://doi.org/10.1186/s12936-015-0944-4)
2. Cotter C, Sturrock HJ, Hsiang MS, Liu J, Phillips AA, Hwang J, et al. The changing epidemiology of malaria elimination: new strategies for new challenges. *The Lancet*. 2013; 382(9895):900-11. doi: [10.1016/S0140-6736\(13\)60310-4](https://doi.org/10.1016/S0140-6736(13)60310-4)
3. Del Prado GR, García CH, Cea LM, Espinilla VF, Moreno MF, Marquez AD, et al. Malaria in developing countries. *J Infect Dis*. 2014; 8(1): 1-4. doi: [10.3855/jidc.4610](https://doi.org/10.3855/jidc.4610)
4. Salmanzadeh S, Foroutan-Rad M, Khademvatan S, Moogahi S, Bigdeli S. Significant decline of malaria incidence in southwest of Iran (2001–2014). *J Trop Med*. 2015; 2015.
5. Bhatia R, Rastogi RM, Ortega L. Malaria successes and challenges in Asia. *J Vector Borne Dis*. 2013; 50(4):239-47.
6. Halimi M, Delavari M, Takhtardeshir A. Survey of climatic condition of Malaria disease outbreak in Iran using GIS. *J School Public Health Institute of Public Health Res*. 2013;10(3):41-52.
7. Hemami MR, Sari AA, Raeisi A, Vatandoost H, Majdzadeh R. Malaria elimination in Iran, importance and challenges. *Int J Prev Med*. 2013; 4(1):88. PMID: [23413116](https://pubmed.ncbi.nlm.nih.gov/23413116/)
8. Haghdoost AA, Alexander N, Cox J. Modelling of malaria temporal variations in Iran. *Trop Med & Int Health*. 2008; 13(12):1501-8. doi: [10.1111/j.1365-3156.2008.02166.x](https://doi.org/10.1111/j.1365-3156.2008.02166.x)
9. Raeisi A, Gouya MM, Nadim A, Ranjbar M, Hasanzehi A, Fallahnezhad M, et al. Determination of malaria epidemiological status in Iran's malarious areas as baseline information for implementation of malaria elimination program in Iran. *Iran J Public Health*. 2013; 42(3):326. PMID: [23641411](https://pubmed.ncbi.nlm.nih.gov/23641411/)
10. Moss WJ, Dorsey G, Mueller I, Laufer MK, Krogstad DJ, Vinetz JM, et al. Malaria epidemiology and control within the international centers of excellence for malaria research. *Am J trop Med Hygiene*. 2015; 93(3_Suppl):5-15. doi: [10.4269/ajtmh.15-0006](https://doi.org/10.4269/ajtmh.15-0006)
11. Sarafraz S, Mehrabani NG, Mirzaei Y, Jafari R, Mehrabani RG, Hayati VR, et al. Epidemiology of malaria in East Azerbaijan province, Iran, from 2001 to 2013. *J Parasitic Dis*. 2016; 40(3):813-7.
12. Soleimanifard S, Akbari M, Sabetghadam M, Saberi S. Malaria Situation in Isfahan in the Last Five Years. *J Isfahan Med School*. 2011; 29(132).
13. Mesdaghinia AR, Vatandoost H, Hanafi-Bojd AA, Majdzadeh R, Raeisi A. Conducting international diploma course on malaria program planning and management (1996–2012). *J Arthropod Borne Dis*. 2013; 7(2): 100-12. PMID: [24409435](https://pubmed.ncbi.nlm.nih.gov/24409435/)
14. Zia Sheikholeslami N, Rezaeian M. The retrospective epidemiological study of malaria in Rafsanjan, Kerman province, from 1999 to 2005. *J Healt*. 2010; 1(1):24-30.
15. Saghafipour A, Noroozi M, Karami-Jooshin M, Abbas P. Epidemiological Features of Malaria in Qom province from 2001 to 2011. *Zahedan J Res in Med Sci*. 2012; 14(8):70-3.
16. Khalili MB, Anvari-Tafti M, Sadeh M. Epidemiological pattern of malarial disease in the province of Yazd, Iran (Since 1986-2006). *World J Med Sci*. 2009;4(1):41-5.
17. Alemu A, Muluye D, Mihret M, Adugna M, Gebeyaw M. Ten year trend analysis of malaria prevalence in Kola Diba, North Gondar, Northwest Ethiopia. *Parasites & Vectors*. 2012; 5(1):173. doi: [10.1186/1756-3305-5-173](https://doi.org/10.1186/1756-3305-5-173)