

Original Article**Malaria Situation in an Endemic Area, Southeastern Iran**

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Abstract

Background: Malaria is an endemic infectious disease in southeastern parts of Iran. Despite years of efforts and intervention programs against malaria, transmission still occurs in Jask County.

Methods: The epidemiological perspective of malaria in Jask County was conducted by gathering data from Jask County health center, during 2006-2010. A knowledge, attitude and practice study was also carried out. Data analysis was conducted using SPSS ver. 11.5.

Results: A total of 2875 malaria cases were recorded, with highest and lowest numbers in 2007 and 2010, respectively. The number of cases had a decreasing trend from 1022 cases in 2006 to 114 cases in 2010. The main causative parasitic agent was *Plasmodium vivax*. Blood examination rate and slide positive rate were also decreased from 39.5% and 4.3% in 2006 to 15.6% and 1.4% in 2010, respectively. Most of people interviewed in the KAP study had a good knowledge about malaria transmission and symptoms but their use of the bed net for prevention was low (35%).

Conclusion: Malaria incidence had significant reduction during the study years. The main reason for this may be due to changing environmental condition for Anopheline breeding and survival because of drought. Another reason may be integration of vector management by using long lasting insecticide treated bed nets, active case detection and treatment by implementation of mobile teams and increasing in financial sources of malaria control program. Knowledge, attitude and practice of people were good in malaria control and prevention, but needs to do more activities for health education and awareness.

Keywords: Malaria situation, Jask County, Iran

Introduction

More than half of the world's population in approximately 100 countries is exposed to malaria. According to figures provided by the World Health Organization (WHO 2011a), 36%

of the global population live in areas where there is risk of malaria transmission, 7% reside in areas where malaria has never been under meaningful control, and 29% live in areas

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where malaria was once transmitted at low levels or not at all, but where significant transmission has been re-established.

In Iran, the total population at risk of malaria is 2,714,648 (4% of the total population) mainly living in southeastern provinces, namely Sistan and Baluchistan, Kerman and Hormozgan (WHO 2011a). There are some studies in last decade focused on malaria situation analysis (Hanafi-Bojd et al. 2010, Vatandoost et al. 2010, 2011), as well as epidemiological features and community based studies in malarious areas of southern parts of Iran (Rakhshani et al. 2003, Salehi et al. 2010, Hanafi-Bojd et al. 2011a, Youssefi and Rahimi 2011, McKelvie et al. 2012, Zoghi et al. 2012).

According to the national strategy plan for malaria control, in respect to malaria status the total country has been classified in four strata:

1. Areas where local transmission of malaria occurs such as areas in Sistan and Baluchistan, Hormozgan and south parts of Kerman, and occasionally some-areas in Ardebil, Bushehr, Fars and Khorassan-e-Razavi Provinces.
2. Areas where the imported cases are found and the potential risk of malaria transmission exists such as areas in Guilan, Mazandaran, and Golestan Provinces.
3. Areas where the imported cases are found, but there is no risk of malaria transmission such as Yazd, Kurdistan, and Hamedan Provinces.
4. Areas where no malaria case was reported during the last three years. It seems there was no such area in Iran.

Malaria remains an important public health concern in Jask County, where transmission occurs regularly, and infected immigrants can play an important role as mobile reservoirs (Personal communication with health center authorities). Therefore it is important to do a situation analysis of the disease for planning the control activities in future. The aim of conducting a situational analysis is to systematically understand the malaria epidemi-

ology of an area in a very short space of time and the health status, system and resource available for controlling the disease (WHO 2011b). A successful planning for the County, needs to use of the information that is already available and analyzing in such a way as to understand the problems. On the other hand, the main point of the beginning of the situational analysis is to collect the data from respective references such as, health network office, hospital, health centers, communities, meteorology department and others. These items are covered by international diploma courses on malaria planning and management, as a joint training course by WHO and Tehran University of Medical Sciences (Mesdaghinia et al. 2013).

The general objective of this study was to facilitate the development of friendly-user implementation plan for Jask County to identify malaria-relevant gaps with its possible solutions.

Materials and Methods

Study area

Jask County (25° 64' N, 57° 77' E) is a sea port located in South-Eastern corner of Iran adjacent to the Oman Sea, with a surface area of 16063 km² (Fig. 1). Total population of the County is 50070 (74% are living in rural areas). There are scattered inhabitants and their occupation is mainly fishing and trade.

Data collection

In this retrospective study, the needed data for 2006-2010 were obtained from health center of Jask, published papers and reports, weather forecasting organization of the city and annual reports of Hormozgan official authorities. An excel databank was created and analysis was conducted using this software. A knowledge, attitude and practice (KAP) study was conducted to evaluate the knowledge, attitude and practice of people who referred to

the urban health center of Touhid, about malaria using structured questionnaire and interviewing.

Data analysis

For this purpose SPSS ver. 11.5 was used and graphs were prepared by excel 2007.

Results

A total of 2875 malaria cases were recorded and treated during the study period (Fig. 2). *Plasmodium vivax* is the main malaria parasite (94.92%) in the County followed by *P. falciparum* (5.08%). Average of malaria morbidity in months of the years during the study period showed two peaks in May and November, respectively. The maximum and minimum of Annual Parasitic Index (API) were observed in 2006 (22.1) and 2010 (2.1), respectively (Table 1). Most of cases were reported to be autochthonous during 2006-2009, while in 2010 the imported cases were higher. Blood Examination Rate (BER) has increased to 2007 and then collapsed, but Slide Positive Rate has a decreasing trend during the study period, although it shows a peak in 2008 (Table 1). Autochthonous cases of malaria have decreased during the study period, while the imported cases had an increasing trend (Table 1). Figure 2 shows the distribution of malaria cases based on rural districts of the Jask County during the study period.

During April-May and October-November the temperature is between 25-30 °C with a relative humidity of more than 60% (Fig. 3), the suitable climatic factors for mosquito breeding and increasing longevity. Based on the unpublished reports of Jask health center, *Anopheles stephensi* and *An. culicifacies* seems to be the main vectors in the area. These species are active during the year due to favorite climatic conditions. There was no published entomological investigation in the Jask area for fauna, density, insecticide sus-

ceptibility and parasitic infection of Anopheline mosquitoes.

The health facilities and personnel of the County were included: one urban health center, 6 rural health centers, one sub health center, 27 health houses, one hospital, 11 physicians, 6 public health officers and 49 health care workers (Behvarz). Furthermore, malaria control program has had a total of 25 mobile teams.

Based on the national protocol, malaria control interventions in the area are including case detection and treatment, indoor residual spraying by Deltamethrin WP 10% in rural area with 90% coverage, distributing Long Lasting Insecticide impregnated Nets (LLINs) in rural areas with 80% coverage, as well as larviciding. Data obtained from the Jask County health center shows high IRS coverage during the study period and distribution of LLINs during 2009 and 2010. These vector control activities along with other measures such as good active case detection (Table 2) and increasing the financial resources of malaria control program for the study area are the main reasons for the decline of the disease.

A total of 41 people (64.3% males, 35.7% females) participated in the KAP study, 96.4% under 45 years old. The education level was categorized in four levels: illiterate (10.7%), primary school (32.1%), high school (25%), and university degree (32.1%). Among the respondents just 17.9% had a history of malaria infection. Most of the study population (82.1%) believed that mosquito bite is the transmission route of malaria and fever is the main symptom. When they asked about the role of insecticide treated bed net (ITNs) for prevention malaria, 67.9% answered yes, meanwhile 60.7% was agree that water storage utensils can increase the risk of malaria transmission. The attitude of respondent showed 28.6% and 39.3% were respectively agree and strongly agree with this fact that ITNs can prevent malaria transmission. These

rates about using insecticide were 50% and 17.9%, respectively. In practice, 78.6% stated that they allow the spray men to spray their house, 96.4% will refer to the nearest

health center as soon as their child feels feverish, but just 35.7% used ITNs during last year (Table 3).



Fig. 1. Location of Jask County in Iran

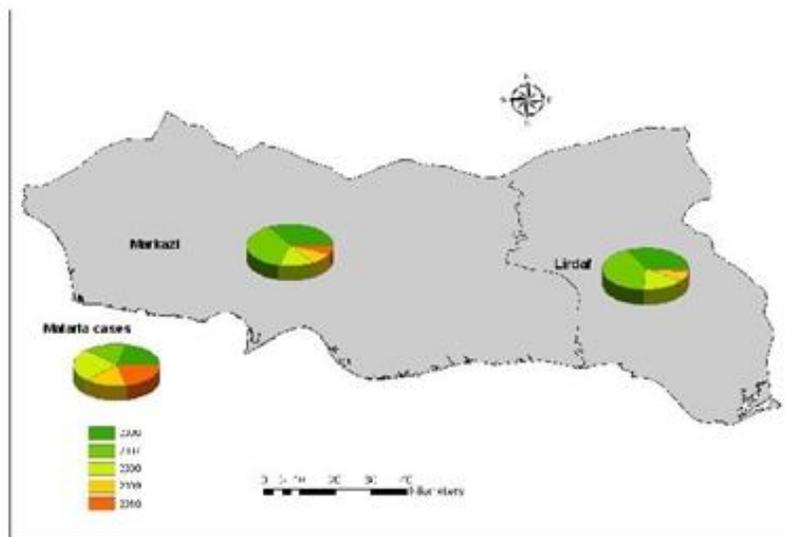


Fig. 2. Malaria distribution map, Jask County, 2006-2010

Table 1. Malaria indices in Jask County, Southeastern Iran, 2006-2010

Year	Malaria indices			No. Cases				
	SPR	API	BER	Autochthonous	Imported	<i>P. vivax</i>	<i>P. falciparum</i>	Total
2006	4.3	22.1	39.5	1000	22	1000	22	1022
2007	2.5	21.6	50.6	1013	12	954	70	1024
2008	3.5	10.6	28.1	485	27	495	11	506
2009	2	4.2	20.6	162	47	183	26	209
2010	1.4	2.2	15.6	34	80	97	17	114

SPR: Slide positive rate, API: Annual parasitic index, BER: Blood examination rate

Table 2. Activities of malaria control program in Jask County, Southeastern Iran, 2006-2010

Index	Year				
	2006	2007	2008	2009	2010
Total No. of distributed LLINs	0	0	0	3560	2660
IRS coverage	No data	95%	93.2%	93.8%	95%
Active case detection	687	879	335	118	87
Mobil teams	25	25	25	25	25

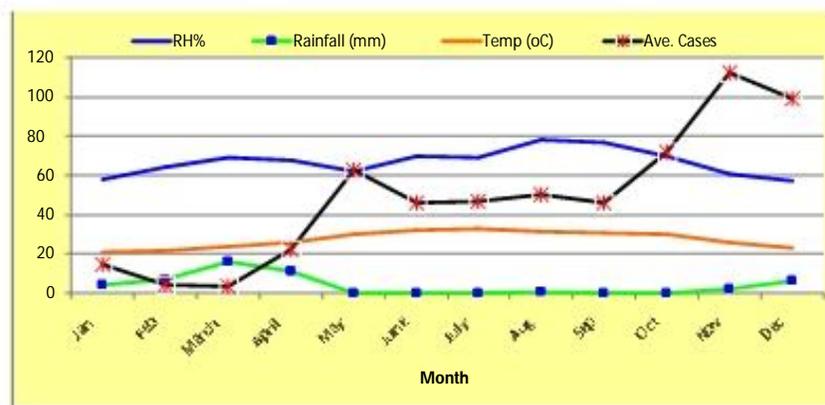


Fig. 3. Average of malaria cases in relation to climatology parameters in Jask County, southeastern Iran, 2006-2010

Table 3. KAP study on malaria, Jask Country, 2011

Question	Answer	Frequency	Percent
Gender	Female	10	35.7
	Male	18	64.3
Age	15-30	17	60.7
	30-45	10	35.7
	45<	1	3.6
Martial status	Single	9	32.1
	Married	18	64.3
	Widow	1	3.6
Education level	Illiterate	3	10.7
	Primary/secondary	9	32.1
	High school	7	25
	University	9	32.1
Job	Employed	12	42.9
	Unemployed	15	53.6
	Retired	1	3.6
History of malaria infection	Yes	5	17.9
	No	23	82.1
Transmission route	Air	1	3.6
	Mosquito bite	23	82.1
	Food	2	7.1
	I don't know	2	7.1
Malaria symptoms	Fever	23	82.1
	Cough	4	14.3
	Other	1	3.6
Using insecticide treated bed nets can prevent us from getting Malaria	True	19	67.9
	False	6	21.4
	I don't know	3	10.7

Table 3. Continued...

Storing water in utensils can increase the risk of malaria transmission	True	17	60.7
	False	6	21.4
	I don't know	5	17.9
Using insecticide treated nets can prevent malaria transmission	Strongly disagree	3	10.7
	Disagree	2	7.1
	Uncertain	4	14.3
	Agree	8	28.6
	Strongly agree	11	39.3
Applying Insecticide Residual Spray can prevent malaria transmission	Disagree	4	14.3
	Uncertain	5	17.9
	Agree	14	50
	Strongly agree	5	17.9
The price of insecticide treated nets is low	Strongly disagree	1	3.6
	Disagree	3	10.7
	Uncertain	12	42.9
	Agree	11	39.3
	Strongly agree	1	3.6
Applying Insecticide Residual Spraying control malaria transmission, cannot contaminate our house	Strongly disagree	2	7.1
	Disagree	1	3.6
	Uncertain	7	25
	Agree	16	57.1
	Strongly agree	2	7.1
I allow the spray man to spray my home to prevent malaria transmission	Yes	22	78.6
	No	3	10.7
	Don't answer	3	10.7
If my child feels feverish, I bring him/her to the nearest health center	Yes	27	96.4
	No	1	3.6
If I see a place with stagnant water around my house, I will prefer to	Add oil	5	17.9
	Land filling or drainage	19	67.9
	leaving	4	14.3
I used ITN for prevention of malaria in the last 1year	Yes	10	35.7
	No	18	64.3

Discussion

Both *P. vivax* and *P. falciparum* are reported from the Jask County, although *vivax* malaria is dominant species. There is also report of malaria due to imported species *P. malariae* in Bandar Abbas, west of the study area, but this species is not common in Iran (Nateghpour et al. 2010b). Since drug resistance is reported from malaria parasites in Iran (Raeisi et al. 2006, Nateghpour et al. 2010a), it is suggested to do such a survey in Jask County for better understanding the situation of malaria and planning control programs in the area.

Although there is no published report on Anopheline mosquitoes of the study area, five malaria vectors including *An. stephensi*, *An. culicifacies*, *An. dthali*, *An. superpictus* and *An. fluviatilis* are reported to be active in Bashagard, adjacent to the north of Jask County (Hanafi-Bojd et al. 2012a,b). Among these species, *An. stephensi* and *An. culicifacies* were

collected during the entomological activities of Jask health center. These two species are reported as main malaria vectors of south and southeastern parts of Iran (Vatandoost et al. 2006, Hanafi-Bojd et al. 2011a,b).

As it can be understood from the climatology chart (Fig. 3), the mosquito breeding can be done around the year, because of favorable condition. Therefore, a comprehensive entomological study on the fauna of Anopheline and their density during the year, their parasitic infection and susceptibility status to WHO recommended insecticides/ larvicides is suggested and should be included in malaria vector control activities in the area.

Regarding to our results, the knowledge, attitude and practice of the respondents was relatively good in malaria control and prevention, but needs to do more health education to improve their awareness. The relative good

level of knowledge may be due to living people in an endemic area for malaria. The same results were obtained by Hanafi-Bojd et al. (2011a) in Bashagard County, north of the study area. Some other studies reported an increasing trend in literacy can be a protective factor for malaria morbidity (Koram 1989, Masoumi et al. 2003). One-third of the respondents in a KAP study in Baluchistan area, east of the Jask County, considered malaria as an important disease in the area, and more than 58% of them considered mosquitoes to be the cause of the malaria disease. So it can be concluded more contact with malaria rural areas resulted to more knowledge about the disease (Rakhshani et al. 2001).

Constraints and challenges seems to be: massive population movement between Iran, Pakistan and Afghanistan, vector control challenges at the County, inadequate skilled medical staff in malaria case management, weak inter-sectoral coordination for malaria control especially in urban areas, low socio-economical status of those who live in the area.

The most important immigrants in south-eastern part of the country are illegal and so they pass the unofficial borders, their exact number and infection to infectious diseases including malaria is unknown. But it is necessary to plan for detection of asymptomatic cases that may act as the reservoir of the disease (Nateghpour et al. 2011, Turki et al. 2012).

Priority areas for malaria control in the study area are: strengthening malaria surveillance system in the County, developing integrated vector management strategy, strengthening vector control activities by larviciding at the County level, capacity buildings on prompt case detection and treatment in the immigrant population, supporting cross border coordination with Afghanistan and Pakistan, strengthening malaria early warning and early detection system and developing malaria epidemics preparedness plan based on a powerful database that should be established for the area. Therefore it is recommended to

reinforce human capacity on malaria control activities at different levels of health personnel, strengthen the existing vector management program at the County level, establishing a spatial malaria database for the County and training ArcGIS to the malaria experts of the County to handle the database, developing and implementation a plan for malaria epidemics preparedness and response, build up malaria surveillance system with appropriate epidemic thresholds in epidemic-prone settings, support operational research in the field of malaria entomology and parasitology as well as insecticide resistance.

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