

Epidemiology of Malaria in Khorasan Razavi Province North-eastern of Iran within last 7 years (April 2001- March 2008)

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Citation

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Abstract

Malaria is a critical world health problem in recent years. Several factors have led for increasing its incidence such as wide use of insecticide and drug resistance. It still remains as a concern in Iran. It is under control in all parts except in three south-eastern provinces. Aim of the study: Khorasan Razavi is of the Iranian province that has lot immigrants each year. Therefore, epidemiological study of the malaria is necessary in non-endemic provinces. Methods: This research was a descriptive study to evaluate epidemiological status of the malaria within April 2001 till March 2008 using all patients' data from whole of the province. Results: Total recorded cases were 945 within 7 years. The highest incidence was observed in 2001 and the lowest was in 2006. Plasmodium vivax was observed in 911 cases and 30 cases were P. falciparum. Mix species were in 4 cases. Malaria incidence had decreased since 2001. 34.6% of transmitted cases were local, 61% were transmitted from (other provinces) inside and outside the country, relapse cases were 5.4% and transmitted routes of the rest cases were unknown. The highest incidence was observed in 15 years old and higher and in men. Mashhad and Sarakhs cities had the highest rate. Conclusion: Prevented efforts must be continually taken in spite of decreasing rate of the malaria.

INTRODUCTION

Malaria is a preventable and curable and the most important parasitic disease in the world (1- 2). About 40% of world population lives in malarious areas in under developed countries. This disease is one of the important socio-economical factors for developing of each country that a lot of investment needs to be considered for it. Malaria had being widely prevalent for a long time in Iran. The results of anti-malaria campaign and malaria eradication program (MEP) up to 1973 caused almost elimination of malaria in the north parts of Zagross Mountains, which were in the consolidation phase of MEP. In south parts of Zagross Mountains the incidence of malaria cases considerably reduced and the total annual malaria cases in Iran were coming down to 12000 in 1973. However, these temporary relative successful results of MEP in Iran encouraged the health authorities to integrate MEO in Communicable Diseases Control (CDC). (3).

This integration caused reduction of MEP activities and resulted elevation of malaria incidence. The objectives of anti-malaria campaign were decreasing of malaria transmission and infection rates in the residual foci in south

part of Iran and sustaining the north parts free of malaria as far as possible. In 1980 the Ministry of Health according to suggestions of Malaria National Scientific Committee and WHO malaria advisors changed MEP to MCP (malaria control program). (4). Now the most important malaria transmission areas i.e. the problem areas are in southeast part of the country including Sistan-Baluchestan, Hormozghan Provinces, and south part of Kerman Province with a combined population of approximately 3 million and are considered to be "refractory malaria region". Annual Parasite Incidence (API) was reported to be 8.74 per 1,000 populations (5).

The present problems of MEP in the south parts of Iran include: plurality of malaria vectors and their various behaviors, resistance of the main vector *A. stephensi* to some insecticides, long distances between some villages without suitable transportation roads, structure of living houses, socio-economic conditions, immigration from malarious neighbors countries and some other operational problems (6).

Recently, a new threat of imported malaria emerged from the Northwestern part of the country, Parsabad area, which was

affected by a serious epidemic of *P.vivax* (5). Thus it can transfer from the endemic parts to other parts because of the ecological and regional conditions and its reservoirs. According to the Deputy of Health 24241 microscopic slide (out of 1358262) were positive for malaria in 2003 containing 19% *P. falciparum*, 80% *P.vivax* and 1% mix. 90% of the positive cases were reported from south of Zagros and southeastern of Iran (7).

The disease has lost its important situation in other provinces, and has been decreased since 1991. It seems taken decisions are faced with major problems because of immigrants from Pakistan and Afghanistan (5). In this research we are going to design an epidemiological study of the malaria in Khorasan Razavi province that is faced with lots of immigrants each year to have a correct health and treatment efforts.

MATERIALS AND METHODS

Study design: This research was a descriptive case series study based on collecting data from Health center on referred rural and urban population for malaria disease during April 2001 till March 2008. Active case finding were performed by checking suspected people at their house by providing blood smears, and inactive case finding was based on providing smears from those patients referring to health centers having fever and chills in under those population by the health centers.

The blood samples were taken from all feverish immigrants' population from endemic area specially those from Sistan and Baluchestan, Hormozgan and Kerman provinces and those groups from Pakistan and Afghanistan.

Study area: Khorasan Province has recently divided to three provinces "South, North and Razavi provinces". Khorasan Razavi Province vast is 127432 Km² with 20 cities and 3767 villages. It is restricted to country of Turkmenistan in north and north-east, Afghanistan in east, Yazd, Semnan and North Khorasan provinces in west and south Khorasan province in the south. Its vicinity to the Afghanistan and Pakistan has previously caused increasing rate of the disease.

Samples and staining method: Peripheral blood smears were taken from all these persons who have fever. Slides were prepared in both thin film at one end and thick film at the other, fixed only the thin portion, then stained both parts of the film with Giemsa's stain simultaneously (8) and examined under microscope by 100x magnification.

Plasmodium species, epidemiology date of the infection, transmitted route to the patients and relapse cases were determined. Positive results were entered to the study after its confirmation in health center of the province.

Transmitted routes were categorized as local transmission (based on rejection following criteria: having no recent travelling, lack of receiving blood, no history of the previous infection and other form), transmission from outside the country, transmission from those high risk provinces. All data were analyzed by SPSS (version 14) and square test.

RESULTS

126084 data were collected from 20 cities that 945 positive cases were reported for malaria. *P.vivax* was observed in 911 cases and 30 cases were positive for *P.falciparum*. Mix species was observed in 4 cases. API (Annual Parasite Incidence) was decreased from 10 in 2001-2002 to 0.48 in 2007-2008, that the highest positive rate were 494 for 2001-2002 and has reduced to 26 cases in 2007-2008 (Table 1). 665 were male while the pregnant women were 4 cases from the rest 280.

The highest positive rate of malaria was observed in students (26.1%) and then in workers (18.4%) and then in housekeepers and self-employment groups (17.4%). Male patients had at higher risk than female patients nearly three times (70.4%)(Figure No.1). All patients were studied in four age group and those having higher age than 15 had the highest infected rate (72.4%). The youngest patient was 28 days neonatal and the eldest one was a patient with 81 years of old (Table No.2).

The highest positive rate was observed in Mashhad and Sarakhs cities (Table No.3). 315 positive cases (34.6%) were locally transmitted that they were mostly reported in 2001-2002 from Sarakhs city. 576 cases (61%) were transmitted from outside the province including abroad, high risk provinces and other provinces. 418 cases were from abroad that 381 patients (40%) were immigrated people from Afghanistan and Pakistan, 37 of positive cases were those returned people to the country that infected from outside of the country. The rest 158 positive cases were from other provinces including high risk places and other provinces. Relapse cases were 49 cases (5.4%) that mostly were observed in 2002-2003 in Sarakhs City. It was due to improperly treatment of infected cases in 2001 of Sarakhs city. We were not able to determine the transmission route in five cases (Table No.4).

All cases infected with *P.vivax* had suitable respond to Chloroquine. Those cases infected with *P.falciparum* were also treated with Chloroquine and Primaquine. Relapse was observed in 12 of these cases that treated with Fansidar and Quinine. The high incidence rate were observed in summer with 506 cases (53.5%) specially in August in the study period (20.6%)(Table No.5).

DISCUSSION

The most influential parameters on malaria are immunological and genetically characteristics of population at risk of infection, parasitic species, type of mosquito, rate of raining and humidity, distribution of mosquito feed areas, use of anti-malarial drugs and other controlling equipments for reducing the risk of transmission (9-10). The conditions of geographical, climatic, irrigation, environmental, tribal and population movement, structure of living houses, transportation roads, and distance among villages, illiteracy, economic and social problems, etc are favorable for malaria transmission in Iran (5).

Control and prevention of malaria is faced with serious problem because of parasitic resistant to some anti-malarial drugs and mosquito resistant to some insecticides as well as mosquito and parasite species.

Distribution of malaria is depending to socio-economical parameters and availability of primarily welfare such as having house, road, electricity, health service and enough awareness in personal prevention. Therefore these parameters have main role success in controlling of malaria. At the present time control of the malaria is faced with major problem because of political situation of neighbor countries specially Afghanistan that lots of job-seeking persons are immigrating to Iran (7). Iran is among the countries located in the Eastern Mediterranean Region with low malaria endemicity and in its some areas, there is the risk of malaria transmission (11). Malaria is the most important parasitic disease in Iran.

Malaria has been controlled in most parts of the country after ninety decade, but re-appeared again because of drug resistant, immigrant and travelling especially in endemic area. Thus lots of concerns needs to taken (12). One of the main problems in the control of malaria is resistance of *P. falciparum* to Chloroquine and some other antimalarial drugs, which is now more or less common in the malaria endemic areas in the world (9).

Khorasan Razavi has visitors sometime about four times of its population because of religious situation of the province and also a lot of immigrant people seeking for the job. This situation caused malaria cases to be highly reported. Malaria rate was 2.75 per 100,000 of population the 61% of cases were Afghan immigrant and visitors. Local transmission of the disease was about 33%. A lot of observed cases were from infected family member of those afghan immigrant people that they were not properly treated in their own country. Another high risk groups are family member of those called to military services in Sistan and Balouchestan province especially to Chahbahar city that transferred type B of the disease to their family after coming back.

This study showed *P. vivax* had the highest rate that is comparable to other researches in other parts of Iran. *P.vivax* was observed in 97.5% cases in study performed in Baboulsar and 1996 till 1997 (13). In other research performed in Kermanshah 8.5 per 100,000 reported during 1985 till 1996 that has similar rate in male and female with mean age of 20. Ninety eight percent of cases were *P.vivax* at the Kermanshah study (14).

Decreasing and increasing rate of this study was similar to the study performed in Esfahan provinces (15). Reported study from Altamim province of Iraq indicated that the highest cases were infected locally not due to immigration opposite with our results that had direct correlation to economical situation and performing controlling program in region (11).

Decreasing and increasing of malaria rate has been observed in Nicaragua that is one of the most infected countries in the Central America. High prevalence of the malaria in this country was due to the war that distributed to non-war area (16). Analyzed data revealed malaria had increasing and decreasing rate in Khorasan Razavi province. Increasing rate in 2001-2 and 2002-3 was due to local transmission of the disease as well as immigration of Afghan people, but it decreased from 52.3% in 2001-2002 to 2.8% in 2007-2008 of all positive cases at the end of study. It is in agreement of previously reported study. Total reported malaria cases in Iran reduced from 96340 (with 45% *P. falciparum*) in 1991 to 18966 (with 12% *P. falciparum*) in 2005. About 30 to 50% of malaria patients have been among foreign immigrants (4). Besides, local transmission was not observed from 2002 till 2003, because of ecological status of the region and presence of *Anopheles superpictus*. It is underline the preventing efforts are more important to risk of

malaria epidemic.

The most affected group of people was 15 years old and higher group and male patients. Therefore we must concern on young males that are potentially working group. Confirming other studies (26-33) the most prevalent time is observed in warm months because of increasing the mosquitoes.

In last study performed during 1982 till 1991 in east Azarbaijan province 184 out of 444 total malaria, of locally observed cases were from Moghan plateau (17). In the meantime Ataiyan reported just 44 of total 636 malaria cases were Iranians from Zanzan province and the rest infected people had Afghanistan nationality (18). This finding was observed and confirmed in studies performed in Hamadan Provinces (19). The main transmission route in these provinces is local transmitted form. Malaria is critical at Cystan and Balouchestan province because of immigration from Pakistan and Afghanistan. Analyzed data determined 418 out of 945 cases of malaria were from immigration of abroad the country. It is also reported 3532 out of 4991 of observed malaria cases in Khorasan province within 1986 till 1990 were transmitted from abroad (21).

According to the National Strategy Plan for Malaria Control, in respect to malaria status the total country has been classified in four strata (7).

Areas where local transmission of malaria occurs such as areas in Sistan- Baluchestan, Hormozghan and south parts of Kerman provinces and occasionally some areas in Ardebil, Boushehr, Fars and Khorasan Provinces.

ii) Areas where the imported cases are found and the potential risk of malaria transmission exists such as areas in Gilan, Mazandaran, and Golestan Provinces.

iii) Areas where the imported cases are found, but there is no risk of malaria transmission such as Yazd, Kurdistan, and Hamadan Provinces.

iv) Areas where no malaria case was reported during the last three years. It seems there was no such area in Iran.

The main technical elements of the strategy of malaria control which are or should be applied in MCP all over the country, particularly in areas where there are local malaria transmissions or there is potential risk of malaria transmission are usually:

- i) Early case detection and prompt treatment
- ii) Plan and implement suitable preventive measures including vector control
- iii) Improving information and reporting system
- iv) Providence and prevention of local malaria outbreak or epidemy
- v) Carry on training and refreshing courses for senior staff and technical personnel
- vi) Establish continuous quality control system for malaria microscopic diagnosis and cross checking of examined slides
- vii) Monitoring of the response of *P. falciparum* and *P. vivax* to anti-malarial drugs
- viii) Planning and performing basic and applied researches on the local existing malaria problems
- ix) Sustaining supervision and evaluation malaria control activities

All of the above activities need financial and scientific support and supervision of the national health authorities and collaboration of academic and research centers as well as the international organizations such as Roll Back Malaria/ WHO (1, 22)

CONCLUSION

Awareness of the people for transmission route of the malaria, controlling visitors and immigrations of Iranian and non-Iranian nationality and treatment of them, continuously identifying the *Anopheles* mosquitoes and finally exchanging epidemiological data and drug resistance rate of the disease are the most influencing parameters to control the malaria.

Figure 1

Figure No.1: Prevalence rate of malaria in Khorasan Razavi Province based on the patients job

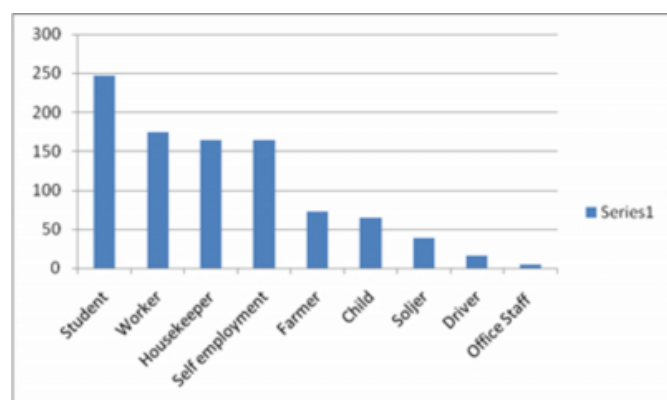


Figure 2

Table No. 1: Distribution Frequency of Parasite and epidemiological criteria in Khorasan Razavi Province (2001-2008)

SPR ¹	API ²	ABER ³	mis	P. falciparum	P. vivax	Positive cases	Prepared slides	Province population	Studied year ⁴
2.56	10.26	0.39	3	8	483	494	19233	4812241	2001-2
1.02	4.31	0.42	0	4	204	208	20388	4818512	2002-3
0.44	1.97	0.44	0	7	93	100	22365	5072541	2003-4
0.31	1.05	0.34	0	2	52	54	17854	5127409	2004-5
0.29	0.88	0.31	1	2	43	46	15666	5197674	2005-6
0.11	0.32	0.28	0	4	13	17	14788	5267939	2006-7
0.16	0.48	0.29	0	3	23	26	15790	5409873	2007-8

¹ ABER: Annual Blood exam Rate, ² API: Annual Parasite Incidence, ³ SPR: Slide Positive Rate

⁴ Data were analyzed based on Iranian year starting April ending March of the next year

Figure 3

Table No. 2: Age Distribution Frequency of malaria in Khorasan Razavi Province (April 2001- March 2008)

Age	P. vivax		P. falciparum		Mix		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
0-4	51	5.6	0	0	0	0	51	5.4
5-9	99	10.9	2	6.7	0	0	101	10.7
10-14	108	11.9	1	3.3	0	0	109	11.5
Over 15	653	71.7	27	90	4	100	684	72.4
Total	931	100	30	100	4	100	945	100

Figure 4

Table No3: Distribution frequency of malaria based on parasite species in Khorasan Razavi Province (2001-2007)

Parasite	P. vivax		P. falciparum		Mix		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
City								
Mashhad	481	52.8	21	70	3	75	505	53.4
Sarakhs	351	5.38	3	10	1	25	355	37.6
Torbat-e-Jam	49	4.5	1	2.3	0	0	50	5.3
Nishabour	10	1.1	1	2.3	0	0	11	1.2
Taybad	8	9.0	1	2.3	0	0	9	1
Ghoochan	5	5.0	1	2.3	0	0	6	0.6
Kashmar	4	4.0	0	0	0	0	4	0.4
Fariman	2	2.0	1	2.3	0	0	3	0.3
Bardskan	0	0	1	2.3	0	0	1	0.1
Khauf	1	1.0	0	0	0	0	1	0.1
Total	910	100	30	100	5	100	945	100

Figure 5

Table No. 4: Distribution frequency of malaria based on living area in Khorasan Razavi Province (2001-2007)

	Living Area		Total
	Rural	Urban	
Local transmission	315	0	315
Transmitted from outside the country(A)	40	378	418
Transmitted from high risk provinces(B)	18	106	124
Transmitted from other provinces(C)	16	18	34
Relapse	45	4	49
Unknown	1	4	5
Total	430	515	945

Figure 6

Table No. 5: Distribution frequency of malaria during the 12 month of year in study period

Studied years	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
2001-2	18	44	63	84	140	107	12	11	7	2	6	0	494
2002-3	10	37	57	35	26	20	4	3	8	0	2	6	208
2003-4	9	11	11	13	8	18	15	4	3	4	2	2	100
2004-5	5	6	12	11	8	5	4	3	0	0	0	0	54
2005-6	2	3	6	8	6	3	8	3	4	1	2	0	46
2006-7	1	0	2	4	2	1	4	0	2	0	1	0	17
2007-8	0	2	0	2	3	2	2	3	2	4	5	1	26
Total	45	103	151	157	193	156	49	27	26	11	18	9	945

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