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A retrospective study on imported malaria in Jordan. 2. Malaria among non-military Jordanians

Etude rétrospective du paludisme d'importation en Jordanie. 2. Le paludisme chez les civils jordaniens

K. A. Kanani · Z. S Amr · R. Alkhatib · B. Shadfan · M. Al-Rashadan · R. B. Hani

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Abstract Cases of imported malaria among civilian Jordanians returning from Asian and African countries from 1991-2011 are documented. A total of 511 cases of imported malaria were diagnosed among civilian Jordanians travelling abroad. Majority of cases were reported among adults over 21 year old accounting for or 87,67% of the total number of cases. Eighteen different categories of occupation were identified, where as students studying abroad showed the highest infection rate (33.2%), especially those returning from India (n=70). Infection among males was as high as 91.78%, compared to 8.22% in females. Females were mostly housewives accompanying their spouses. Cases were reported from 34 Asian and African countries. Most cases were reported among Jordanians returning from Pakistan (23.68%), Yemen (18.6%), India (18.4%) and Sudan (5.1%). The majority of infections were due to *Plasmodium vivax* (n=370, 72.4%), followed by *Plasmodium falciparum* (n=138, 27%). Only one case of *Plasmodium malariae* was observed. Few cases (n=3, 0.65%) of mixed infection with *P. vivax* and *P. falciparum* were reported. Sudan was the main source of *P. falciparum* (25.4%) followed by Yemen (20.3%), while Pakistan was the main source of *P. vivax* (28.9%) followed by India (22.7%). Most mixed infection cases were acquired in Sudan (66.7%).

Keywords Imported malaria · Epidemiology · Non-military · Jordan · Western Asia

K. A. Kanani · B. Shadfan
Parasitic and Zoonotic Diseases Division, Ministry of Health, Amman, Jordan

Z. S Amr (✉) · R. Alkhatib · R. B. Hani
Department of Biology,
Jordan University of Science and Technology, Irbid, Jordan
e-mail : amrz@just.edu.jo

M. Al-Rashadan
Assistant Director, Directorate of Infectious Diseases,
Ministry of Health, Amman, Jordan

Résumé Ce travail recense les cas de paludisme d'importation chez les civils jordaniens revenant de pays africains ou asiatiques entre 1991 et 2011. Au total, 511 cas de paludisme d'importation ont été diagnostiqués chez les civils jordaniens voyageant à l'étranger. La majorité des cas a été rapportée chez les adultes de plus de 21 ans. Dix-huit professions différentes ont été recensées, parmi lesquelles les étudiants poursuivant leurs études à l'étranger ont présenté les taux d'infection les plus élevés (33,2 %), en particulier les étudiants revenant d'Inde (n=70). Les taux d'infection chez les hommes étaient plus élevés (91,78 %) que chez les femmes (8,22%), qui étaient la plupart du temps des femmes au foyer accompagnant leur mari. Des cas ont été rapportés de retour de 34 pays africains ou asiatiques. La plupart des cas ont été rapportés chez les Jordaniens revenant du Pakistan (23,68 %), du Yémen (18,6 %), d'Inde (18,4%) et du Soudan (5,1 %). La majorité des infections étaient dues à *Plasmodium vivax* (n=370, 72,4 %), suivi par *Plasmodium falciparum* (n=138, 27 %). Un seul cas dû à *Plasmodium malariae* a été observé. Quelques cas (n=3, 0,65 %) étaient dus à une infection mixte par *P. vivax* et *P. falciparum*. Le Soudan était la source principale de *P. falciparum* (25,4 %), suivi par le Yémen (20,3 %), alors que le Pakistan était la source principale de *P. vivax* (28,9 %) suivi par l'Inde (22,7 %). La plupart des infections mixtes avaient pour origine le Soudan (66,7 %).

Mots clés Paludisme d'importation · Épidémiologie · Civils · Jordanie · Asie occidentale

Introduction

The epidemiology of malaria among travelers to malaria endemic areas was reported from many parts of the world [11]. It is estimated that about 25-30 million travelers from non-tropical countries travel to malaria endemic countries

[12]. In the United States, about 14000 cases of imported malaria were recorded from 1991-2001 [2]. In Europe, 1659 cases of *P. falciparum* infection were reported among European travelers whom visited malaria endemic countries during 1999-2000 [6]. Romi et al [15] reported 5898 microscopically confirmed cases of imported malaria from 1989-1997, among travelers returning from Africa, Asia and Central-South America to Italy.

In the Middle East, previous studies reported on imported malaria among peacekeeping troops served in malaria endemic areas in Africa and Asia [7]. Jordan has a population of about 7 millions, with many students studying abroad, teachers and technical working force employed in neighboring countries of known malaria endemicity.

In this account, we document imported malaria cases among civilian Jordanians returning from Asian and African countries from 1991-2011, with remarks on high risk groups, country sources of infection and other epidemiological parameters.

Material and methods

The information investigated in the present study was assimilated from records at the Parasitic and Zoonotic Diseases Division at the Ministry of Health since 1991-2011. This division conducts the malaria control programme in the country and is also responsible for detecting and laboratory diagnosis of malaria cases among travelers coming from abroad by collecting blood smears at the time of arrival to the ports of entry and after arrival. Thin and thick blood smears were collected from non-military personnel returning to Jordan, and relevant data including occupation, age, sex, residence address and the country they served in were recorded. Blood smears were stained by Giemsa stain, and examined under the microscope at 600X to 1000X magnification. The malaria parasites species were identified microscopically by the detection of parasites stages in the blood film, by their physical features and by the changes in the shape, size, color and characteristic stipling of infected red blood cells at the Parasitic and Zoonotic Diseases Division.

Results

Over the past 21 years, a total of 511 cases of imported malaria were diagnosed among civilian Jordanians travelling abroad. Maximum number of cases (93) was reported in 1992, then declined reaching as low as 3 in 2005 (Fig. 1).

By age, majority of cases were reported among adults over 21 year old accounting for 87.67% of the total number of cases (Fig. 2). Eighteen different categories of occupation were identified (Table 1). Students studying abroad showed

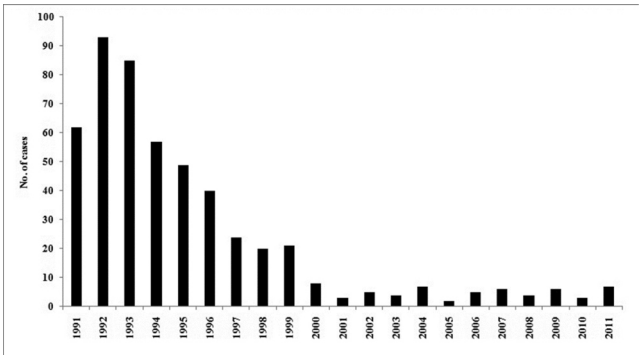

Fig. 1 Number of malaria cases diagnosed during 1991-2011 among non-military Jordanians returning to Jordan / *Nombre de cas de paludisme diagnostiqués de 1991 à 2011 chez les civils jordaniens revenant en Jordanie*

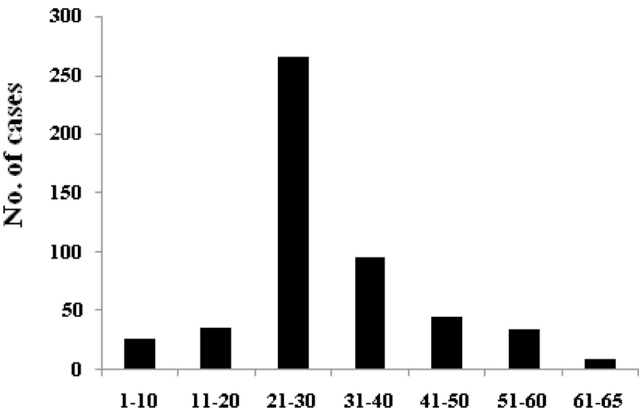

Fig. 2 Age distribution of malaria cases among non-military Jordanians returning to Jordan / *Répartition des cas de paludisme par âge chez les civils jordaniens revenant en Jordanie*

the highest infection rate (33.2%), especially those returning from India (n=70), Pakistan (n=40), Sudan (n=24), Oman (n=10) and Yemen (n=9), followed by teachers (14.5%) serving in Yemen (n=42) Oman (n=14), Sudan (n=4) and Saudi Arabia (n=4). Infection among males was as high as 91.78%, compared to 8.22% in females. Females were mostly housewives accompanying their spouses.

Figure 3 shows the number of reported cases according to the country from which patients returned from. Cases were reported from 34 Asian and African countries. Most cases were reported among Jordanian returning from Pakistan (23.68%), Yemen (18. 6%), India (18.4%) and Sudan (5.1%).

The majority of infections were due to *Plasmodium vivax* (n=370, 72.4%) (Table 2), followed by *Plasmodium falciparum* (n=138, 27%). Only one case of *Plasmodium malariae* was observed. Few cases (n=3, 0.65%) of mixed infection with *P. vivax* and *P. falciparum* were reported.

Table 1 Number of malaria cases according to occupation among non-military Jordanians / *Nombre de cas de paludisme chez les civils jordaniens, selon la profession*.

Occupation	No. of cases	%
Student	169	33.1
Teacher	74	14.5
Merchant	43	8.4
House wife	42	8.2
Religious clerk	33	6.5
Technician	24	4.7
Laborer	21	4.1
Engineer	20	3.9
Private sector employee	19	3.7
unidentified	16	3.1
Child	15	2.9
Driver	9	1.8
Farmer	9	1.8
Retired	8	1.5
Medical doctor and nurses	4	0.8
Accountant	2	0.4
Pilot	2	0.4
Journalist	1	0.2
Total	**511**	**100**

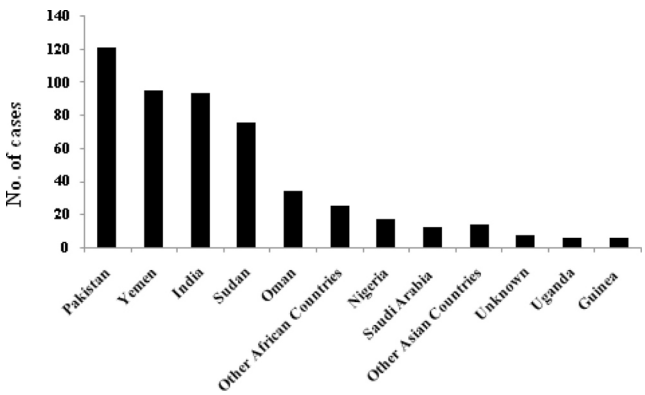

Fig. 3 Number of malaria cases diagnosed during 1991-2011 among non-military Jordanians returning to Jordan according to the country source of infection / *Répartition des cas de paludisme diagnostiqués de 1991 à 2011 chez les civils jordaniens revenant en Jordanie, selon le pays source de l'infection*

Table 2 summarizes malaria species by source country. Sudan was the main source of *P. falciparum* (25.4%) followed by Yemen (20.3%), while Pakistan was the main source of *P. vivax* (28.9%) followed by India (22.7%). Most mixed infection cases were acquired in Sudan (66.7%).

Discussion

Malaria among travelers is considered a serious problem for health care providers in malaria-free countries. Several studies addressed this problem among American and European travelers to countries that are considered of high endemicty for malaria [2,4,11,14,15].

Previous reports pointed out the magnitude of imported malaria among Jordanian peacekeeping troops in Sierra Leone [1,8,9]. Meneizel et al [13] conducted a survey from 2000-2005 among arrivals from various countries to Jordan. They identified 808 positive cases of malaria, 75% were infected with *P. vivax*, 24.9% with *P. falciparum*, and one (0.1%) subject had mixed infection. A total of 811 malaria cases were reported during 1992-2011 among Jordanian military personnel whom served in over 20 countries [7].

All cases returning from *P. vivax* endemic areas are in agreement with the present world map for this parasite, including Pakistan, Yemen, Sudan and India [5]. Funk-Baumann [3] summarized all hot spots for *P. falciparum* world-wide and other human malaria species. Pakistan is plagued with both *P. falciparum* and *P. vivax* [10], while the highest incidence of malaria in the east Mediterranean region with high proportion of *P. falciparum* was reported from Yemen [16].

In the present study, the majority of infections were due to *P. vivax* followed by *P. falciparum*. Prevalences among Jordanian Peacekeeping forces were 83.5% for *P. vivax*, and 13.6% for *P. falciparum* [7]. In Barcelona *P. falciparum* was most frequently detected among African immigrants traveling to Africa for visiting friends or relatives [4].

According to the latest World Health Organization (WHO) estimates of global malaria burden between 2000 and 2012 [16], malaria mortality was reduced by 42% globally and by 49% in African region. The malaria incidence rate was also declined by 25% around the world and by 31% in African region. These substantial reductions occurred as result of a major scale up of vector control interventions including the distribution and use of long lasting insecticides treated nets (LLINs) and indoor residual spraying (IRS), diagnostic testing and treatment of malaria cases with Artemisinin-based combination therapies [17].

Decline in the number of imported malaria cases in Jordan can be also attributed to the awareness among travelers to use prophylactic treatment before leaving Jordan and due to the application of the personal protection measures against mosquito bites during the period of staying in endemic areas. Efforts of the Jordanian Ministry of Health are hereby acknowledged, where advertisement on prevention and prophylaxis against malaria in the local media is continues. Blood sample from travelers returning from malaria endemic countries for active and passive malaria case detection and

Table 2 Number of malaria cases diagnosed during 1991-2011 according to species and country of origin / *Nombre de cas de paludisme diagnostiqués de 1991 à 2011 selon l'espèce et le pays d'origine*.

	P. falciparum		***P. vivax***		***P. malariae***		***P. vivax+P. falciparum***	
	No.	%	No.	%	No.	%	No.	%
Pakistan	14	10.1%	107	28.9%	0		0	0%
Yemen	28	20.3%	67	18.1%	0		0	0%
India	10	7.2%	84	22.7%	0		0	0%
Sudan	35	25.4%	39	10.54%	0		2	66.7%
Oman	8	5.8%	26	7.03%	0		0	0%
Nigeria	12	8.7%	5	1.4%	0		0	0%
Saudi Arabia	3	2.2%	9	2.43%	0		0	0%
Others	28	20.3	33	8.9%	1	100%	1	33.3%
Total	138	100	370	100	1	100	3	100

follow up of cases should be continued. In addition, vector surveillance and integrated vector control interventions should be continued in all receptive areas known as breeding sites for malaria vectors.

Conflict of interest The authors do not have any conflict of interest to declare

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