REVIEW OF MALARIA IN SAUDI ARABIA, CURRENT STATUS AND FUTURE PROSPECTS

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ABSTRACT
Malaria is a timeworn illness as the mankind itself. Malaria is caused by Plasmodium spp, a protozoan parasite which makes it responsible for over one million people death annually. The demonstrations of malaria disease are conducted through the erythrocytes infection by the parasite asexual stages, so it is believed to be a possibility multisystem disease, as every body's organ is reached by blood. The essential mode of malaria transmission is via the female Anopheles mosquito bites, while the other modes of infection include the transplacentally route, infected blood transfusion and rarely by needle-stick injuries. Saudi Arabia is the only country that hosts annually large numbers of pilgrims of different nationalities that may pose a significant burden in tackling the spread of epidemic diseases. In Saudi Arabia, Plasmodium falciparum is the predominant species, as well as the P. vivax is also reported. The malaria incidence performed along the Southern Region of the Red Sea coast, down to the border with Yemen. Saudi Arabia took the decision to remove it especially in the border villages by mapping malaria foci and the investigation of all infected cases using the clinical diagnosis, then by making free laboratory diagnosis and giving the suitable medication.

KEYWORDS: Malaria disease, Saudi Arabia, Plasmodium falciparum, P. vivax, Anopheles mosquito

INTRODUCTION
Malaria is considered the most widespread infectious diseases in the tropical and sub-tropical countries, it is an ancient disease caused by the protozoan parasite, Plasmodium spp. The main mode of malaria infection transmission is by the female Anopheles mosquito bites, however the transplacentally route, the infected blood transfusion and the rarely needle-stick injuries are considered other malaria infection routes (World Health Organization, 2011a). Four species of Plasmodium parasite can infect humans under favorable conditions, these are P. falciparum, P. vivax, P. ovale and P. malariae (Spinello et al., 2012). Recently P. knowlesi is considered the fifth species that can cause human malaria (Daneshvar et al., 2009).
Malaria disease caused death for more than one million every year (World Health Organization, 2011a). It mostly affects children, pregnant women and non-immune persons who often die because of anemia and cerebral complication (Quintero et al., 2011). Infection by *P. vivax* is increasingly reported as a cause of worldwide severe malaria (Lança et al., 2012). Neurological involvement in *P. falciparum* malaria is frequent and almost a quarter of children who survive cerebral malaria, promote neurological sequelae (Idro et al., 2007). Malaria affects approximately the entire blood components and it is an exact hematological transmittable disease (Wickramasinghe and Abdallah, 2000; Rodrigues-Morales et al., 2006; Khan et al., 2014).

All aspects of malaria epidemiology, including its prevalence in community, the infection age, the occurrence of disease syndromes, and the total malaria mortality are almost influenced by malaria transmission intensity (Hay and Snow, 2006; Hay et al., 2008; Gething et al., 2011).

Saudi Arabia extends over 2,150,000 square kilometers, dominating almost 80% of the Arabian Peninsula, existing in the Southwest corner of Asia. The Kingdom is at the intersection of Asia, Africa and Europe, it is enclitic by the Red Sea on the West side, by Yemen and Oman on the South side, by the Arabian Gulf and the United Arab Emirates and Qatar on the East side, and finally by Jordan, Iraq and Kuwait on the North side. Saudi Arabia’s Red Sea shore spreads about 1,760 kilometers while the Arabian Gulf coastline almost 560 kilometers (http://www.mofa.gov.sa). According to the 2010 census, the Saudi Arabia’s population is 27 million, including 8.4 million foreign residents (http://www.saudiembassy.net), Egyptian worker make up the biggest number of expatriates, getting 16% of all the foreign workers, followed by India, Pakistan, Yemen and the Philippines (http://www.mofa.gov.sa).

The Malaria incidence in Saudi Arabia is represented along the South region of the Red Sea coast to the down border of Yemen. The Malaria Saudi type is related to the malaria type of Afro-tropical countries which is *P. falciparum* (World Health Organization, 2011b). Three species of *Anopheles* mosquitoes have been identified in Saudi Arabia which playing an important role in spreading the disease (Warrell, 1993; Malik et al., 1998). The malaria control actions in Saudi Arabia initiated in the Eastern province in 1948 and the national malaria control service was established in 1956 as a result of cooperation for a joint Saudi World Health Organization (WHO) pilot malaria control project, which was launched in 1952. The pre-eradication plan with WHO was signed in 1963, it included the extermination
of infection reservoirs, health education for public people, vector control in wide scale in the hyperendemic sites, using larvicides in regular periods, spraying space in low volume, immediate therapy of malaria cases and training the health workers on how to control the spreading of malaria (Phillips, 2001; Memish et al., 2014). The aim of this review is highlight the status of malaria in Saudi Arabia and the efforts of the Kingdom in order to limit the disease spread and to achieve prosperity for both citizens and residents.

CURRENT STATUS

In Saudi Arabia, malaria is recognized and had been identified in pre-Islamic Arabic writings, the experiences on "oases malaria" had been previously outlined by some researchers (Daggy, 1959), and the four species of malaria have been known in the Kingdom of Saudi Arabia (Sebai, 1988; Annobil et al., 1994). Asir region, the South region of Kingdom consists of the highlands, the extension of the Sarawat Mountains parallel to the Red Sea, and the lowlands which named Tihama. Malaria has been documented to be in endemic pattern in Tihama (Farid, 1956; Haddad, 1990), as well as the disease is known in different regions of Saudi Arabia (El-Refaie et al., 1984; El-Sebai and Makled, 1987; Malik et al., 1998).

The risk of getting infection with malaria in Saudi Arabia was restricted to the Southwestern area with the maximum number of malaria cases was from Asir and Gizan regions (Annobil et al., 1994; Banzal et al., 1999). Since 1978, The Eastern Province of Saudi Arabia was considered free of local transmission of malaria which was due to the malaria control program initiated in 1948 (Sebai, 1988). There were 78.7% of imported malaria cases outside the Saudi Arabia and 21.3% from the kingdom. The most common countries of acquisition malaria were Sudan, Pakistan and India (Figure 1) and the most recurrent species were $P. \text{ vivax}$ (54.4%), $P. \text{ falciparum}$ (43%) and 1.8% was $P. \text{ malariae}$ (Al-Tawfiq, 2006).

![Figure 1: Map of Saudi Arabia used as a guide for the degree of malaria risk with the surrounding countries (www.fitfortravel.nhs.uk)](image-url)
During the period from 1991 to 1995, three hundred and thirty four cases of confirmed malaria documented in Asir Central Hospital, Abha. 84.4% were Saudis and 15.6% were non-citizens from various nationalities in the age range from two months to 80 years. Most of the malaria patients were from the lowlands of Tihama. The Saudi patients suffered from *P. falciparum* (97.2%) while expatriates complained from *vivax* malaria (46.2%) which showed a travel history to the endemic area with resistant malaria countries (Malik et al., 1998). The Kingdom of Saudi Arabia in 1998 was suffered its worst malaria epidemic, that recorded in the Southern Kingdom of Saudi Arabia, a total of 36,139 locally transmitted cases and the incidence reached as high as 44/1000 in the malarious regions (Coleman et al., 2012).

The epidemiological feature of malaria was different from one region in the Kingdom of Saudi Arabia to another and even from one place in the region to another. This variation is related to the environmental conditions variation caused by the spacious area of Saudi Arabia, also the epidemiological aspects differ in the same place, from year to year, and it was influenced by malaria control measures (Health Statistical Yearbook, 2006).

The incidence of notified malaria cases (local and imported cases) in the endemic zones of Saudi Arabia during the period of 2006–2011 is presented in Table (1). The highest occurrence of malaria local cases was mentioned in Jazan region as 57.8% in 2006 and 85.5% in 2011. For the imported cases from inside the Saudi Arabia, the highest disease incidence in 2006 was in the Eastern region (39.8%) and there was no malaria cases reported in any endemic zones during the years from 2009 to 2011. Jazan was recorded from 2006 to 2010 as highest epidemic region by malaria, which distributed in imported cases from outside Saudi Arabia as 54.3%, 69.6%, 40.7%, 58.6% and 28.4% respectively, while the Eastern region recorded the disease incidence in 2011 as 25.9%.

The ecological situations participate in a significant part in the malaria allocation. They affect the species of mosquito, their life cycle and the mosquito in the environment. They also play a role in the parasite, *Plasmodium* spp., and life-span in the mosquito. In 2006, no local case had been documented in Riyadh, Jeddah, Taif, Eastern region, Al-Ahsa, Hafr Al-Baten, Qaseem, Bishah, Tabouk, Hail, Northern border, Najran, Al-Bahah, Al-Jouf and Qurayyat while the South and the Southwestern regions were considered to be highly endemic. 86.9% of total cases (1278 individuals) had been detected in the new comers. 78.9% of all cases had been mentioned among foreigners while 8.05% of cases among those people came from the endemic areas to the save areas (Health Statistical Yearbook, 2006).
Table 1: The high incidence of notified malaria cases in the endemic zones of Saudi Arabia during the period of 2006 – 2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Region Name</th>
<th>Positive Cases/Total Cases</th>
<th>% Infection</th>
<th>Region Name</th>
<th>Positive Cases/Total Cases</th>
<th>% Infection</th>
<th>Region Name</th>
<th>Positive Cases/Total Cases</th>
<th>% Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>Jazan</td>
<td>59/1,166</td>
<td>57.8</td>
<td>Asir</td>
<td>61/1,166</td>
<td>53.7</td>
<td>Makkah</td>
<td>5/166</td>
<td>3</td>
</tr>
<tr>
<td>2007</td>
<td>Asir</td>
<td>129/2,079</td>
<td>6.3</td>
<td>Jazan</td>
<td>89/2,079</td>
<td>43.8</td>
<td>Qassim</td>
<td>32/2,079</td>
<td>12.9</td>
</tr>
<tr>
<td>2008</td>
<td>Jazan</td>
<td>28/537</td>
<td>5.3</td>
<td>Asir</td>
<td>4/282</td>
<td>125</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2009</td>
<td>Jazan</td>
<td>31/308</td>
<td>55.5</td>
<td>Asir</td>
<td>19/308</td>
<td>32.7</td>
<td>Qassim</td>
<td>858</td>
<td>13.3</td>
</tr>
<tr>
<td>2010</td>
<td>Jazan</td>
<td>18/29</td>
<td>17.7</td>
<td>Asir</td>
<td>11/29</td>
<td>37.9</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2011</td>
<td>Jazan</td>
<td>59/69</td>
<td>85.5</td>
<td>Asir</td>
<td>549</td>
<td>13</td>
<td>Qassim</td>
<td>1,469</td>
<td>1.5</td>
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</table>

Imported Cases from Inside KSA

<table>
<thead>
<tr>
<th>Year</th>
<th>Region Name</th>
<th>Positive Cases/Total Cases</th>
<th>% Infection</th>
<th>Region Name</th>
<th>Positive Cases/Total Cases</th>
<th>% Infection</th>
<th>Region Name</th>
<th>Positive Cases/Total Cases</th>
<th>% Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>Eastern</td>
<td>41/1,083</td>
<td>39.8</td>
<td>Asir</td>
<td>30/1,083</td>
<td>28.5</td>
<td>Makkah</td>
<td>10/1,083</td>
<td>0.9</td>
</tr>
<tr>
<td>2007</td>
<td>Makkah</td>
<td>41/1,118</td>
<td>37.5</td>
<td>Asir</td>
<td>30/1,118</td>
<td>28.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2008</td>
<td>Asir</td>
<td>11/29</td>
<td>39.0</td>
<td>Jeddah</td>
<td>3/29</td>
<td>24.1</td>
<td>Riyadh</td>
<td>2/29</td>
<td>17.2</td>
</tr>
<tr>
<td>2009</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Imported Cases from Outside KSA

<table>
<thead>
<tr>
<th>Year</th>
<th>Region Name</th>
<th>Positive Cases/Total Cases</th>
<th>% Infection</th>
<th>Region Name</th>
<th>Positive Cases/Total Cases</th>
<th>% Infection</th>
<th>Region Name</th>
<th>Positive Cases/Total Cases</th>
<th>% Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>Jazan</td>
<td>59/1,008</td>
<td>59.3</td>
<td>Eastern</td>
<td>130/1,008</td>
<td>13.5</td>
<td>Jeddah</td>
<td>65/1,008</td>
<td>6.4</td>
</tr>
<tr>
<td>2008</td>
<td>Jazan</td>
<td>542/1,450</td>
<td>37.5</td>
<td>Riyadh</td>
<td>250/1,450</td>
<td>17.3</td>
<td>Eastern</td>
<td>250/1,450</td>
<td>17.3</td>
</tr>
<tr>
<td>2009</td>
<td>Jazan</td>
<td>1,304/2,275</td>
<td>57.6</td>
<td>Eastern</td>
<td>230/2,275</td>
<td>12.6</td>
<td>Riyadh</td>
<td>227/2,275</td>
<td>10.5</td>
</tr>
<tr>
<td>2010</td>
<td>Jazan</td>
<td>543/1,512</td>
<td>35.7</td>
<td>Eastern</td>
<td>508/1,512</td>
<td>20.6</td>
<td>Riyadh</td>
<td>248/5,512</td>
<td>13.6</td>
</tr>
<tr>
<td>2011</td>
<td>Eastern</td>
<td>794/2,717</td>
<td>29.9</td>
<td>Jazan</td>
<td>696/2,717</td>
<td>25.3</td>
<td>Riyadh</td>
<td>330/2,717</td>
<td>12.0</td>
</tr>
</tbody>
</table>

In 2007, Riyadh, Taif, Eastern region, Al-Ahsa, Hafir AlBaten, Qaseem, Tabouk, Hail, Northern border, Najran, Al-Bahah, and Qurayyat were considered as free areas that no local case had been reported. There was a noticeable raise in the cases number in January, February, March, April and December in all regions, especially in Jazan which was measured as one of the highly endemic area (Health Statistical Yearbook, 2007). Also, in 2008, there was no local cases had been detected in all the epidemic regions of Saudi Arabia except that of Jazan and Asir. A percentage of 73.6 from the local cases were in age of 15 years and above and the rest (26.4%) were less than 15 years, as 5.6% in age of 1-4 years, 10.5 in age of 5-9 years, 9.5% in age of 10-14 years and 0.9 in age of less than one year (Health Statistical Yearbook, 2008).

There were 2333 malaria cases were reported in 2009, 1.7% of them were considered as local cases and the rest were imported cases (Nzila and Al-Zahrani, 2013), while in the Eastern Province, there were 99.1% imported cases and 0.9% were from Saudi people. The local malaria infections with *P. falciparum* were documented in the Southwestern regions of Jazan.
and Asir (Bashawri et al., 2001), while the acquisition malaria mainly from the boundary countries as Yemen and Sudan. In *P. falciparum* infection, splenomegaly was reported from Jazan and Asir patients as 39% and 45% respectively (Malik et al., 1998; Banzal et al., 1999; Khan et al., 2014).

During the years of 2009, 2010 and 2011, all the local areas were documented only in Jazan, Asir and Qunfudah, while all the imported cases had been detected in the foreigners people coming from outside the kingdom of Saudi Arabia (Health Statistical Yearbook, 2009, 2010 & 2011). According to the epidemiological aspects reported in the Health Statistical Yearbook (2012), a total of 3406 malaria cases were recorded, 37.3% were malignant malaria infected by *P. falciparum* and 61.6% were benign malaria infected by *P. vivax*, while the rest were mixed malaria as 0.12% (Figure 2). In the point of seasonal variation of malaria cases, there was a noticeable increase in patient’s number from January to February (Figure 3). The distribution of malaria reported cases by the parasite type between the different regions were mentioned in (Figure 4), while the cases distribution according to different age groups within endemic zones was showed in (Figure 5), that out of all malaria cases, 91.1% were in age of more than 10 years. Malaria is frequently transmitted by the infected female mosquito bite (Figure 6). When a mosquito bites a malaria infected person, the blood is taken and the malaria parasites grow in the mosquito's gut, then travel to salivary glands to mix with saliva and injected again with blood meal into the human blood. The parasites pass through human liver cells for several days, and then go to the red blood corpuscles to grow and multiply. The infected red corpuscles rupture and the free parasites reenter the new red blood corpuscles. When a mosquito bites the malaria infected person, the transmission cycle is complete (http://www.moh.gov.sa). The disease transmission was found to happen during the year, with peaks in the summer and rainy season (Gething et al., 2011).
Figure 3: Notified malarial cases by month in Kingdom of Saudi Arabia (Health statistical year book, 2012)

Figure 4: Reported Malarial cases by region and type of parasite in Kingdom of Saudi Arabia (Health statistical year book, 2012)

Figure 5: Notified malarial cases in endemic zones by age group in Kingdom of Saudi Arabia (Health statistical year book, 2012)
From 1981 to 2005, eleven mosquito surveys were recorded in Saudi Arabia, seven of them were done in the South western region. The full description of mosquito species collected from Saudi Arabia before 1956 was done by Mattingly and Knight (1956). The latest survey of mosquito species was done in AL-Ahsaa district, Eastern region. The survey exposed the presence of five mosquito species, one of them was *Anopheles multicolor Cambouliu*, which more prevalent in the seasons of spring and winter (Ahmed et al., 2011). Transmission intensity maps are essential to recognize the mosquito’s populations at special risk levels and to estimate impartially the disease management options, so such maps should be often updated to continue applicable operationally (Gething et al., 2011).

The medical manifestations of malaria are mainly due to the parasite merozoites releasing from the infected red corpuscles which causing fever and other malaria symptoms (White, 2009), which are similar to the common viral symptoms that lead to an interruption in the disease diagnosis (Murphy and Oldfield, 1996). Most malaria patients indicate chills in 97% of patients, fever in less than 92%, while headache in 70 % and diaphoresis in 64% of individuals (Genton and Acremont, 2001).

Anemia, the deficiency of red blood cells or of hemoglobin in the blood, Splenomegaly, the abnormal enlargement of the spleen, Thrombocytopenia, the deficiency of platelets in the blood, Hepatomegaly, the abnormal enlargement of the liver, and Acute renal failures were the most severe complications related to *P. falciparum* infection. In Saudi Arabia, Thrombocytopenia was revealed in *falciparum* malaria patients and in 65% of *vivax* malaria cases. In Eastern region of Saudi Arabia, anemia was discovered in 60% *P. falciparum* malaria (Bashawri et al., 2001). The splenomegaly was reported in Jazan in 39% of *P.
malaria patients and in Asir region as 45% (Malik et al., 1998; Banzal et al., 1999; Khan et al., 2014).

During the period from 1988 to 1993, a predictable study was conducted to estimate the malaria pattern in the hospital children and to believe the malaria effect on overall childhood death and morbidity in Asir region. The total of 233 malaria cases (2.4%) were diagnosed with fever and hepatosplenomegaly in Asir Central Hospital, Abha among 9259 children, majority of them were below four years age. Fever, vomiting hepatosplenomegaly and anemia were general medical results. During their study, two patients died from cerebral malaria for one patient and severe hemolytic anemia and hemoglobinuria for the other patient (Annobil et al., 1994).

The thrombocytopenia and haemoglobinemia were better known in Jazan, Saudi Arabia patients infected with \textit{P. falciparum} than those with \textit{P. vivax}, though, anemia, jaundice, convulsions and acute renal failure were significantly high in \textit{P. falciparum} cases than those infected with \textit{P. vivax}. The occurrence of splenomegaly and neurological sequelae were lower in \textit{P. vivax} patients than those infected by \textit{P. falciparum}. Both in \textit{P. falciparum} and \textit{P. vivax} patient’s malaria, splenomegaly, jaundice and neurological sequelae were approximately twice in children less than 10 years compared with the older patients (Khan et al., 2014).

\textit{Falciparum} malaria in Saudi Arabia has been extensively measured to be chloroquine-sensitive (Warrell, 1993). Though, there has forever been an anxiety concerning the establishing chloroquine resistance, owing to the great movement of emigrants and pilgrimages between the Kingdom of Saudi Arabia and the endemic countries with resistant malaria (Farid, 1956; Haddad, 1990; World Health Organization, 2010). Malaria cases of chloroquine resistance had been mentioned in expatriates working in Saudi Arabia who had lately came from endemic countries (Ministry of Health, 1984; El-Sibae, 1991).

**FUTURE PROSPECT**

The national malarial control programs have been established in the Kingdom of Saudi Arabia in the past four decades, the programs objective was to reduce malaria incidence and to eradicate the disease (Freeman, 1984). In 2004, the Kingdom of Saudi Arabia decide to eliminate extensively malaria following the strategy depend on improving the surveillance, epidemiological investigation of all malaria cases, mapping the malaria foci and conducting the cross-border initiatives in border villages, which including the surveillance units with
Yemen that offer free diagnosis and medication for the legally or illegally Yemeni people (World Health Organization, 2011b).

In malaria elimination stage in the Kingdom of Saudi Arabia, the report mentioned that malaria cases declined by more than half in period from 2000 to 2010 (Figure 7), and the deficiency in disease cases has been assisted by the high coverage of indoor residual spray, by the use of insecticide-treated bed nets and by the consistent availability of antimalarial drugs. The danger of gaining malaria in Saudi Arabia is restricted to the Southwestern region, with maximum number of malaria cases reported from Asir and Gizan regions. In addition, *falciparum* malaria in Saudi Arabia has been extensively measured to be chloroquine-sensitive (Warrell, 1993). Though, there has always been an anxiety about establishing chloroquine resistance, because of the great movement of expatriates and pilgrimages between the Kingdom of Saudi Arabia and the endemic countries with resistant malaria (Farid, 1956; Freeman, 1984; Haddad, 1990; Malik et al., 1998), as the disease transmission in Al-Baha with Chloroquine-resistant *P. falciparum* was mainly reported (Malik et al., 1990).

The presence of malaria-carrying vectors, especially *Anopheles stephensi* and *A. fluviatilis*, had been eradicated by Saudi Aramco and the government of Saudi Arabia in 1948-1955, thereafter efforts of malaria eradication were held by the Saudi government accompanied with annual surveys of malaria infection by Aramco (Freeman, 1984; Nzila and Al-Zahrani, 2013). Permanent monitoring of malaria cases and efficient management is desirable to avoid the preamble of disease into the non malarious regions of Saudi Arabia. An effective
observation to monitor frequent travelers from high risk areas for malaria is not extensively experienced (Freeman, 1984).

Throughout history, various processes for controlling the mosquito larvae were applied, and they comprised the chemical and biological procedures. The chemicals substances can impact the non target inhabitants and the mosquito can improve impedance against them (Thavaselvam et al., 1993; Kumar and Hwang, 2006). The biological control includes using the biotoxins or the natural enemies for destroying the diseases vector of insects. The biological procedure involves using bacteria, plant, nematodes, invertebrate predators, larvivorous fish and fungal pathogens such as *Bacillus thuringiensis ispaceleensis* (Bti) and *Bacillus sphaericus* (Bs), which consider the most successful procedure for mosquito control that kill their larval stages (Lacey and Lacey, 1990; Das and Amalraj, 1997; Walker, 2002). The chemicals substances or insecticides were heavily utilized after the world war II and produced the enthusiasm against the major human scourges such as malaria and yellow fever. The WHO started the international malaria enucleation programs and achieved in removing malaria from 36 countries, firstly by spraying inside human homeland with the comparatively cheap remaining insecticide named as dichlorodiphenyltrichloroethane (DDT). All governments all over the world reassessed the techniques of insecticides. Also, there was considerable fall in the helpful insect species, flow of secondary domestic animals, pollution of food and environment, as well as the bioaccumulation of the insecticides remaining in the non target creatures, inclusive the human body. Moreover, in some regions, the pathogens in progress build up a resistance to antimalarias drugs (Al-Akel and Suliman, 2011).

Malaria control efforts in the Arabian Peninsula have been supported by the political commitment and the enlarged financial support from the Gulf States governments. Accordingly, the disease trouble is being minimized noticeably and the transmission has been discontinuous in a number of countries all over the region. Nevertheless, malaria stays endemic in restricted sites as Yemen and the Southwest of Saudi Arabia. In addition to the local transmission, the imported malaria endures an additional cause of the disease (Al-Hamidhi et al., 2014).

Malaria is widespread and endemic in Jazan region and Tihama valley as the control measures program was lately used in these Saudi regions. In the past, the control program was neglected in these Saudi areas for the absence of communication methods that no paved roads were existed and for the lack in workers. *P. falciparum* was responsible about 90% of malaria cases and *Anopheles arabensis* was the main vetro for transmission disease. The anti-
malaria control actions depend on controlling the mosquito larvae by spraying the breeding foci, this procedure was spread in everyplace of Saudi Arabia except the free areas from the mosquito vector. Houses in high density areas malaria were sprayed by the insecticides, which have remaining effect. The Saudi areas with high cases of malaria were sprayed by a spray substance of minute particulates that can reach all the deep narrow spaces. Using the Mechanical control method was conducted by spreading the insects nets that impregnated with insecticides. Increase the health education program and activation the cooperation with governmental and private sectors in mosquito control measures. In Saudi Arabia, usually the insect survey is completed all the year and all over the Saudi regions to revise the insect density, lifestyle and activities, and their susceptibility to the special insecticides (Health Statistical Yearbook, 2011; Coleman et al., 2012).

CONCLUSION
Malaria is a dangerous illness, if not suitably and opportune treated, may cause death or other lethal complications. There are many risk factors for malaria such as those people with AIDS, pregnant women, young children or infants, the international travelers between endemic areas, the poor and low health care regions which increase the malaria risk all over the world. Malaria symptoms are comparable to the viral diseases such as influenza, though earlier awareness has to be done if the body temperature is high, particularly in places susceptible to disease spreading. In the beginning of any suspicious symptoms, the person should visit a doctor immediately and tell him about the latest place he visited during the last year especially these places, which has malaria history. In case of need travelling to malarious region, the individual should get appropriate medications on two or three months before travelling, which varies according to different places. The suitable drugs should be taken from 2-3 weeks before travelling and after returning as well as during staying in the malarious area. For *falciparum* malaria, the Chloroquine, Quinine sulfate or Mefloquine are described for treatment. Artemisinin which is derived from the Chinese herb Artemesia, known as Shehan is frequently described for treat malaria in Asia Continent. The overdoses of antimalarial drugs could be lethal, so should strictly comply the medication prescription.

Malaria is still a health problem in some Saudi Arabia regions such as Asir region, also malaria transmission is yet happen in the North, Western and particularly in the Southwestern region of Saudi Arabia, however it has been greatly controlled in the Eastern region, which considered now non endemic region. While the present malaria control management has reduced risk of malaria in Saudi Arabia, the range of *Plasmodium* sp. variety and their
genetic construction was comparable to malaria species identified in Yemen where the transmission of disease is big.

The existing control efforts managed by the Saudi government should believe the strategies to control flow of imported malaria into the region. The procedures locating the \textit{P. falciparum} endemicity levels are extremely complicated, locative varied, and temporally effective. Even as the location variation in hazard authorizes the increasing of strong maps that can act as disease control leader, the effective nature of malaria endemicity implies that such malaria maps should be frequently updated if they are to continue applicable. The continuing scale-up of main malaria management actions appears the major possible disruption to native and regional malaria transmission for several decennium, and raises the necessity for permanent estimation of hazard.

The Ministry of Health in Saudi Arabia encourages other means of prevention including that relates to use an anti-mosquito as cream for applying it on the human skin. Wearing protective clothes such as trousers, full-sleeve shirts at the activity time of mosquito, which usually between sunset and dawn. Putting Premethrin on clothes, hats and shoes before travelling for protecting human face and neck from mosquito bites. Sleeping under a mosquito net sprinkled with Permethrin if there is no air-condition in the living place. Taking the preventive medicine before, during and after travelling to malaria regions. Controlling places of mosquitoes reproduction to mantian the human health and to reduce the risk of getting infection with malaria.

**REFERENCES**


46. Royal Embassy of Saudi Arabia, Washington, DC. http://www.saudiembassy.net/about/country-information/


