Epidemiology of malaria in Al-Tameem province, Iraq, 1991–2000

M.A.A. Kadir,¹ A.K.M. Ismail² and S.S. Tahir³

¹College of Medicine, Tikrit, Iraq.
²Public Health Laboratory, Al-Tameem, Iraq.
³Directorate of Health, Al-Tameem, Iraq.

Received: 12/02/2002; accepted: 14/05/2002

ABSTRACT To determine the rates of malarial infection in different areas of Al-Tameem province, we conducted a cross-sectional study from 1991 to 2000. We found an overall infection rate of 0.76% by Plasmodium vivax. Infection rates were highest in Dibis district (1.12%), followed by infections from outside the province (0.93%) and in Hawija district (0.89%) and Kirkuk (0.62%) and Dakok (0.17%). Rates of infection varied by year with the lowest rate in 1991 (0.02%) and the highest rate in 1996 (1.84%). All ages were represented, with the highest rate of infection among 21–30-year-olds. Males had a slightly higher rate of infection (0.78%) than females (0.73%).

Epidémiologie du paludisme dans la province d’Al-Tamim (Iraq), 1991-2000

RESUME Afin de déterminer les taux d’infection paludéenne dans différentes zones de la province d’Al-Tamim, une étude transversale a été réalisée de 1991 à 2000. On a trouvé un taux global d’infection par l’espèce Plasmodium vivax de 0,76 %. Le taux d’infection était le plus élevé dans le district de Dibis (1,12 %) suivi par les infections provenant de l’extérieur de la province (0,93 %) et dans les districts de Hawija (0,89 %), de Kirkouk (0,62 %) et de Dakok (0,17 %). Les taux d’infection variaient selon l’année, avec le taux le plus faible en 1991 (0,02 %) et le taux le plus élevé en 1996 (1,84 %). Tous les âges étaient représentés, le taux d’infection le plus élevé se trouvant dans le groupe d’âge des 21-30 ans. Les hommes avaient un taux d’infection légèrement plus élevé (0,78 %) que les femmes (0,73 %).
Introduction

Malaria is a disease caused by the *Plasmodium* genus of protozoa (mainly *P. falciparum*, *P. vivax*, *P. ovale* and *P. malariae*). The protozoa have a life-cycle divided between a human host and an insect vector, i.e. the *Anopheles* spp. mosquito. Of 380 species of *Anopheles* genus mosquito, the females of 60 species are able to transmit malaria [1]. The mosquito thrives in warm, humid climates where pools of water provide perfect breeding grounds. It proliferates where awareness is low and where health care systems are inadequately developed [2].

The global outlook for malarial infection is worsening. Currently 40% of the world’s population reside in malaria-prone areas, i.e. over 2200 million people. Each year, of an estimated 300–500 million clinical cases, there are in excess of 1 million deaths, the majority of whom are young children [3].

Malaria is endemic in Iraq. From 1929 to 1956 the mortality rate from malaria was 9.7%. The total infection rate during that period was 12.7% [4]. To combat the disease, a universal eradication programme was begun in 1957. By the beginning of the sixth year of eradication (1962), 4.4 million of the 4.5 million Iraqis considered at risk of malaria had entered the consolidation phase with only 0.4 million people in the river tracts and valleys of the mountainous northern part of the country requiring residual insecticidal protection [5]. The total number of positive malaria cases from 1961 to 1967 was 47 834 [5,6]. From 1970 to 1975, there were 47 395 cases, of which 45 928 were due to *P. vivax* and 1467 to *P. falciparum* [7]. Between 1977 and 1982, malaria prevalence varied between 5069 cases and 2422 cases per year with approximately 99% due to *P. vivax* [8,9]. During those years, 3899 cases were imported from abroad; of them, 3668 were *P. vivax*, 200 were *P. falciparum*, 16 were *P. malariae* and 15 were mixed infections [10].

In Al-Tameem province during 1980–1990, the highest rate of malarial infection was in 1988 and the lowest in 1985 (Figure 1). The overall rate of infection was 2.02% (1.29% were males and 0.73% were females) in 19 641 blood smears examined from different locations in the province [11]. All were due to *P. vivax* infection.

The present study examined the distribution of malaria infection in Al-Tameem

![Figure 1: Distribution of malaria in Al-Tameem province, Iraq, 1980–90](image1.png)
province and the sex and age distribution of infected individuals in different locations of the province with the aim of supporting eradication efforts in the area.

**Methods**

This cross-sectional study was conducted in Al-Tameem province, Iraq, during 1991–2000. Al-Tameem is in northern Iraq, bordered by the provinces of Arbil, Sulaimaniya, Nineveh, Salahaddin and Diyala. The study was conducted among populations in the different districts of the province, i.e. Kirkuk, Hawija, Dibis and Dakok, as well as populations from other provinces including Salahaddin, Nineveh, Sulaimaniya, Arbil, Diyala, Najaf and Baghdad.

Samples were collected by the authors by non-randomized technique from cases attending the Central Public Health Laboratory in Kirkuk city and the primary health care centres in nearby districts and during a survey in cooperation with the malaria team of the Directory of Health, Al-Tameem province.

Both thin and thick blood smears were collected from 261,763 individuals (165,721 males and 96,042 females; age range: < 1–60 years). Blood smears were examined after staining with Giemsa stain in the Central Public Health Laboratory, Kirkuk.

**Results**

Of 261,763 blood smears examined, 2003 (0.76%) were positive for *P. vivax* (Table 1). The positive cases were from the Al-Tameem districts of Kirkuk (654), Hawija (537), Dibis (694) and Dakok (46). In addition, 72 positive cases were from individuals attending the Central Public Health Laboratory and primary health centres but originating in the provinces of Salahaddin, Nineveh, Sulaimaniya, Arbil, Diyala, Najaf and Baghdad. The infection rate was lowest in 1991 (0.02%), increased to 0.23% in 1992, peaked in 1996 (1.84%), and then declined from 1997 (0.45%) to 2000 (0.12%) (Figure 2).

Table 2 shows the sex and age distribution of malarial infection. The rate of infection in males (0.78%) was slightly higher than in females (0.73%). The highest rate of infection was among the 21–30-year-old age group, followed by 31–40 years, 11–20 years, ≥ 40 years and ≤ 10 years respectively.

**Discussion**

Our study indicates that *P. vivax* infection is still endemic in Al-Tameem province. The overall rate of infection (0.76%) was lower than reported in 1996 (2.24%) and in 2001 (2.02%) in different areas of Al-Tameem, but higher than reported in 1966 and in 1978 (0.001% and 0.05% respectively) [5,9,11,13,14].

The increase in the rate of infection during 1994–96 may be related to the economic sanctions imposed on Iraq that resulted in a lack of suitable drugs, difficulties of transportation to endemic areas and a lack of effective insecticides.

The decline in the rate of infection from 1997 to 2000 may be attributed to the efforts of the Al-Tameem Health Authority in controlling the rate of infection and the increased availability of drugs and insecticides from the United Nations oil-for-food programme.

The distribution of malaria infection in Al-Tameem is province-wide. This may be due to people from the city centres traveling to rural areas for farm work or by vis-
### Table 1 Distribution of malaria infection by year and sector

<table>
<thead>
<tr>
<th>Year</th>
<th>Kirkuk Examined</th>
<th>+ ve</th>
<th>Hawija Examined</th>
<th>+ ve</th>
<th>Dibis Examined</th>
<th>+ ve</th>
<th>Dakok Examined</th>
<th>+ ve</th>
<th>Other provinces* Examined</th>
<th>+ ve</th>
<th>Total Examined</th>
<th>+ ve</th>
<th>Positive (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>4 011</td>
<td>2</td>
<td>5 116</td>
<td>0</td>
<td>1 071</td>
<td>0</td>
<td>1329</td>
<td>0</td>
<td>25</td>
<td>0</td>
<td>11 552</td>
<td>2</td>
<td>0.02</td>
</tr>
<tr>
<td>1992</td>
<td>18 220</td>
<td>45</td>
<td>15 100</td>
<td>19</td>
<td>4 220</td>
<td>27</td>
<td>3 000</td>
<td>1</td>
<td>2 2001</td>
<td>5</td>
<td>42 541</td>
<td>97</td>
<td>0.23</td>
</tr>
<tr>
<td>1993</td>
<td>21 423</td>
<td>135</td>
<td>12 120</td>
<td>94</td>
<td>10 188</td>
<td>47</td>
<td>11 012</td>
<td>5</td>
<td>31 111</td>
<td>12</td>
<td>57 854</td>
<td>293</td>
<td>0.51</td>
</tr>
<tr>
<td>1994</td>
<td>10 012</td>
<td>139</td>
<td>10 325</td>
<td>281</td>
<td>8 998</td>
<td>114</td>
<td>647</td>
<td>3</td>
<td>164</td>
<td>7</td>
<td>30 146</td>
<td>544</td>
<td>1.80</td>
</tr>
<tr>
<td>1995</td>
<td>9 986</td>
<td>167</td>
<td>7 773</td>
<td>109</td>
<td>11 918</td>
<td>273</td>
<td>14 36</td>
<td>14</td>
<td>114</td>
<td>7</td>
<td>31 227</td>
<td>570</td>
<td>1.82</td>
</tr>
<tr>
<td>1996</td>
<td>8 745</td>
<td>127</td>
<td>2 317</td>
<td>21</td>
<td>4 112</td>
<td>161</td>
<td>3 064</td>
<td>19</td>
<td>9 18</td>
<td>25</td>
<td>19 156</td>
<td>53</td>
<td>1.84</td>
</tr>
<tr>
<td>1997</td>
<td>7 912</td>
<td>18</td>
<td>1 818</td>
<td>8</td>
<td>4 515</td>
<td>28</td>
<td>917</td>
<td>4</td>
<td>9 59</td>
<td>14</td>
<td>16 121</td>
<td>72</td>
<td>0.45</td>
</tr>
<tr>
<td>1998</td>
<td>8 012</td>
<td>12</td>
<td>2 317</td>
<td>2</td>
<td>5 423</td>
<td>12</td>
<td>1 734</td>
<td>0</td>
<td>233</td>
<td>0</td>
<td>17 719</td>
<td>26</td>
<td>0.15</td>
</tr>
<tr>
<td>1999</td>
<td>6 788</td>
<td>7</td>
<td>2 002</td>
<td>2</td>
<td>4 127</td>
<td>10</td>
<td>2 303</td>
<td>0</td>
<td>98</td>
<td>2</td>
<td>15 318</td>
<td>21</td>
<td>0.14</td>
</tr>
<tr>
<td>2000</td>
<td>10 517</td>
<td>2</td>
<td>1 512</td>
<td>1</td>
<td>7 257</td>
<td>22</td>
<td>716</td>
<td>0</td>
<td>127</td>
<td>0</td>
<td>20 129</td>
<td>25</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Total 105 626 654 60 400 537 61 829 694 26 158 46 7750 72 261 763 2003

Positive (%) 0.62 0.89 1.12 0.17 0.93 0.76

+ ve = positive for Plasmodium vivax.

*Other provinces = infections that originated outside of Al-Tameem province.
itors travelling from neighbouring provinces such as Sulaimaniya, Arbil and Mosul where malaria is also endemic [13].

The higher rate of infection among males may due to greater exposure to the vectors of malaria because of the greater number of males than females working in the agriculture sector, especially in the evening when irrigation tasks are performed. Our observed male–female infection trend was similar to a 1996 epidemiological study in Al-Tameem [13]. However, our results differed from a 1983 study that reported a higher rate of infection among females in Al-Najaf province [15].

Malaria infection was distributed across all age groups, with the highest rate among those aged 21–30 years. This might have been because a large number of men in this age group work in the agricultural sector or because young men might have been less

Table 2 Distribution of malaria infection in Al-Tameem province by age group and sex

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Males Examined</th>
<th>+ve</th>
<th>%</th>
<th>Females Examined</th>
<th>+ve</th>
<th>%</th>
<th>Total Examined</th>
<th>+ve</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1–10</td>
<td>6 040</td>
<td>7</td>
<td>0.11</td>
<td>4 600</td>
<td>5</td>
<td>0.11</td>
<td>10 640</td>
<td>12</td>
<td>0.11</td>
</tr>
<tr>
<td>11–20</td>
<td>32 300</td>
<td>242</td>
<td>0.75</td>
<td>10 250</td>
<td>78</td>
<td>0.64</td>
<td>44 550</td>
<td>32</td>
<td>0.72</td>
</tr>
<tr>
<td>21–30</td>
<td>76 381</td>
<td>722</td>
<td>0.94</td>
<td>44 400</td>
<td>405</td>
<td>0.91</td>
<td>120 781</td>
<td>1127</td>
<td>0.93</td>
</tr>
<tr>
<td>31–40</td>
<td>42 100</td>
<td>312</td>
<td>0.74</td>
<td>28 536</td>
<td>203</td>
<td>0.71</td>
<td>70 636</td>
<td>515</td>
<td>0.73</td>
</tr>
<tr>
<td>41+</td>
<td>8 900</td>
<td>18</td>
<td>0.20</td>
<td>6 256</td>
<td>11</td>
<td>0.17</td>
<td>15 156</td>
<td>29</td>
<td>0.19</td>
</tr>
<tr>
<td>Total</td>
<td>165 721</td>
<td>1300</td>
<td>0.78</td>
<td>96 042</td>
<td>703</td>
<td>0.73</td>
<td>261 763</td>
<td>2003</td>
<td>0.76</td>
</tr>
</tbody>
</table>

+ve = positive for Plasmodium vivax.
likely to cover themselves adequately during the most at-risk times of day. This finding was similar to other reports from Al-Tameem province and from Thailand [11,13,16].

References


11. Al-Jebouri SH. Epidemiology of malaria in Al-Tameem province, with a study of some biochemical changes in blood infected with Plasmodium vivax [MSc thesis]. Tikrit, College of Medicine, Tikrit University, 1997.


