ADDITIONAL FACTORS ASSOCIATED WITH THE EPISODE OF YELLOW FEVER IN VALE JEQUITINHONHA REGION.

ABSTRACT

Several areas of the Vale Jequitinhonha are frequent foci for dengue virus and other flaviviruses. Recently 16 individuals from Serro died of yellow fever, a disease caused by an arbovirus transmitted by the bite of invertebrate vectors. In the sylvatic form of the disease, mosquitoes of the genera Haemagogus and Sabethes have great importance in epidemic areas. In other side, the urban form of yellow fever is transmitted by Aedes aegypti, the same invertebrate vector of the dengue virus. In views of the endemic areas for dengue and the continuous presence of the mosquitoes in the Vale Jequitinhonha region, we performed an epidemiological analysis to verify what probable factors could be related to the yellow fever deaths observed in the Serro district. Data were obtained from a Government data-base, from January 2002 to June 2003. Furthermore, regional maps from the State Forest Institute-MG were used to perform a geographic analysis of dengue and yellow fever focus. All 1514 confirmed cases of dengue were observed in the central area of the Vale Jequitinhonha. The highest number of dengue cases (above 100 cases) was observed in Araçuaí, Berilo, Itinga, Coronel Murta and Francisco Badaró cities. Yellow fever occurrence analysis revealed that 60.7% of the confirmed cases were observed in Serro, a city located in the south of the Vale Jequitinhonha region. The yellow fever cases observed in this city did not present any epidemiological or geographical relation with the dengue cases. Interestingly, all the yellow fever deaths were notified in recently deforested areas of the city. This data represents a regional study and could be relevant in future epidemiologic investigations for prevention purposes.

Key words:

yellow fever, dengue, Vale Jequitinhonha.
INTRODUCTION

Dengue and urban yellow fever can be transmitted by the same species of *Aedes* mosquitoes, an invertebrate vector present exclusively in urban areas (Vasconcelos et al. 2003). *Aedes aegypti* is primarily a daytime feeder and mainly bites in the morning or late in the afternoon in covered areas. Moreover, the *Aedes aegypti* female prefers to lay its eggs in artificial, rather than natural containers that have fairly clean water and are located around human habitation. “Fairly clean” means, for example, that rainwater and plant debris have accumulated, or that people are storing water in uncovered containers. *Aedes aegypti* was eradicated from most of Central and South America after extensive programs developed in the 1950’s, 1960’s and 1970’s. The eradication program was discontinued in the early 1970’s, and this species then began to invade the countries from which it had been eradicated (Gubler 2004, Monath 2001). By the 1990’s, *Aedes aegypti* had nearly regained the geographic distribution it held before eradication was initiated (Figure 1).

![Figure 1: *Aedes aegypti* distribution in the Americas during the 1930s, in 1970 and 1998 (Gubler 2004).](image)

According to recent data, the wide country distribution of *Aedes aegypti* and the deforestation are important factors to increase the number of dengue and yellow fever cases in Brazil (Robertson et al. 1996, Dégallier et al. 1992, Nobre et al. 1994, Nogueira et al. 2001, Massad et al. 2003) (Figure 2). Although there are strong campaigns to avoid the spread of the virus and consequently the diseases, dengue and yellow fever remain a great problem in the most of the Brazil-

ian areas (Brassolatti et al. 2002). The risk of re-urbanization of yellow fever in Brazil has increased in recent years. This situation constitutes a serious public health problem and strong programs for vector control are more frequently undertaken (PAHO 2002). It is important to know that in Africa, the yellow fever virus can be transmitted by *Aedes aegypti* in both urban and near by countryside zones (Bannett et al. 1997). Therefore, the possibility of environmental alterations in the districts, together with the increase in the factors associated with the spreading of the *Aedes* mosquitoes, such as accumulation of water containers, could be additional factors for the re-introduction of the urban yellow fever.

In the Vale Jequitinhonha, an endemic region for several tropical diseases including leishmaniasis, leprosy, schistosomiasis, tuberculosis, chagas disease and dengue, notified in 2002, 16 deaths were caused by yellow fever. Because of the possibility of re-urbanization of yellow fever, due to the re-introduction of *Aedes aegypti* in Brazilian cities, as well as the environmental changes in the semi-rural zones, we aimed to verify what probable factors could be associated with the deaths from yellow fever observed in our region.

![Figure 2: Localization of *Aedes aegypti* and endemic areas for dengue and yellow fever in Brazil. (A) *Aedes aegypti* distribution. (B) Endemic areas with dengue and (C) endemic and transition (darker) areas with yellow fever (MS/FNS 1999, Araújo et al. 1999).](image)

**MATERIAL AND METHODS**

Data were collected from the Government Data Base called Sistema Nacional de Agravos e Notificação (SINAN) from January 2002 to June 2003. We used regional maps and documents provided by the Healthy Action Directory from Diamantina, MG (DADS) and by the State Forest Institute (IEF) located in the Vale Jequitinhonha, MG.
These maps provided data to perform a qualitative analysis and a geographic localization of the dengue and yellow fever focus, as well as to establish a degree of association among the yellow fever confirmed cases and the deforested areas.

RESULTS

1. Dengue and yellow fever confirmed cases.

According to SINAN, 1514 cases of dengue and 155 cases of yellow fever were notified in the Vale Jequitinhonha between January 2002 and June 2003 (Table 1). We performed an evaluation of the number of cases by sex for both diseases, since in the Vale Jequitinhonha Region the movement of men to the countryside in order to work in agriculture, precious stone mining or other subsistence jobs is very common. We did not observe statistically significant differences in the numbers of men and women with confirmed cases of dengue. Dengue virus infected individuals ranged from 11 to 30 years old, representing 41.8% of the total number of cases. On the other hand, 74.8% of the yellow fever cases were observed in men and the age of the infected individuals ranged from 30 to 60 years, representing 48.4% of the observed cases.

Table 1: Cases of dengue and yellow fever notified in Vale Jequitinhonha region between January 2002 - June 2003.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Male (%)</th>
<th>Female (%)</th>
<th>Cases by age (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Number of cases)</td>
<td>0 - 10 years</td>
<td>11-30 years</td>
</tr>
<tr>
<td>Dengue (1514)</td>
<td>43.3</td>
<td>57.7</td>
<td>11.0</td>
</tr>
<tr>
<td>Yellow fever (155)</td>
<td>78.4</td>
<td>21.6</td>
<td>9.0</td>
</tr>
</tbody>
</table>

2. Monthly distribution of dengue and yellow fever confirmed cases.

Our results confirm the increase of dengue and yellow fever cases in the rainy and hot periods of the years (Figure 3). The highest incidence of dengue was registered in February 2003 (36.6% of all cases) while for yellow fever 87.7% of the cases were registered in January 2003. Although these results could be interpreted as unoriginal data, they presented important information for the conduct of public health practices in the Vale Jequitinhonha region, since they indicated an increased number of dengue and yellow fever cases in 2003 as compared to 2002.

3. Geographic analysis of dengue and yellow fever confirmed cases.

Besides the fact that cases of dengue and yellow fever have been notified in the same period in 2003, we decided to verify if there was some geographic association between these diseases. We thought of the possibility that the invertebrate vector, present in the several Vale Jequitinhonha microregions as the transmitter of dengue, could also be associated with the 16 yellow fever deaths observed in January 2003. Figure 4 shows the cities for which more than 100 cases of dengue were notified (Other cities were omitted to facilitate the comprehension of the figure.). As shown in the figure, while the notified cases of dengue were observed in the north of the Vale Jequitinhonha, a region characterized by hot weather temperatures, low rain fall levels and low latitude as compared to the south of the Vale Jequitinhonha, all the registered yellow fever cases were observed in the south (Serrô=60.7%, Sabinoépolis=12.9%, Alvorada de Minas=12.3% and Serra Azul de Minas=10.3% of the cases observed). The south of the Vale Jequitinhonha region presents elevated latitude and predominant by low temperatures. All the 16 deaths were observed in a place called Lucas, a Serro district located in a region called “Zona da Mata” because of the native forest. This native forest is
present close to the Lucas' river that crosses several other cities. Local residents reported that wild primates and mosquitoes are present in areas near the river. These data increase the probability that the deaths observed in Serro has been attributed to sylvatic yellow fever and not urban yellow fever. Entomologic analysis of the area was done by the Zoonoses Center, however the results were not revealed. Moreover, it is important to consider that was not any personal migration to the locality where the infected individuals died of yellow fever.

Figure 4: Geographic analysis of confirmed dengue and yellow fever cases in the Vale Jequitinhonha region.

4. Association between areas and deaths from yellow fever.

Because of the absence of any relation between the yellow fever episode and the current endemic situation of dengue concerning geographic and migratory aspects, we performed an additional analysis to verify other probable factors associated with the deaths by yellow fever. Curiously, the highest incidence and lethality of yellow fever (16 deaths) were verified in the place where the first case was observed. The area is located in the semi-rural zone of the Serro municipality (Ribeirão do Lucas village) and it is characterized by recent deforestation according to the Government Forest Institute (IEF) of Minas Gerais (Figure 5). This region is used by the residents/workers for the practice of fishing and hunting. It is important to note that rural workers from these countryside areas reported the recent occurrence of monkey deaths near the area where all the deaths occurred.

Figure 5: Map of the Serro municipality presenting the deforesed areas and the region where the 16 deaths from yellow fever were observed. The figure was provided by the Government Forest Institute (IEF) and adapted for the epidemiological analysis.

DISCUSSION

Although dengue and Urban yellow fever are transmitted by the same invertebrate vector, the yellow fever episode observed in the south of the Vale Jequitinhonha region did not present any direct relation to the dengue cases. The cities with high prevalence of dengue are geographically separated from the areas where yellow fever cases were notified. However, the results suggest that preventive campaigns cannot be restricted to combating the transmitting vector. The establishment of endemic diseases is based in a multifactorial process in which human actions are very much involved. In this context, the present study revealed that environment preservation could represent an additional factor in arbovirus control, since it limits the diffuse agents of these diseases in their natural habitat. The changes in the environment close to the urban areas can induce comportamental alterations in both humans and vectors that could approximate the necessary conditions for disease establishment. However although the deforestation can represent an addi-
tional factor to the comportamental changes that could interfere in the spreading of the yellow fever, it is still very important to utilize the mechanisms of disease prevention such as the vaccination of the population that lives in endemic areas and people that travel to regions of risk. After this epidemiological occurrence the Vale Jequitinhonha and Zona da Mata were classified as transition areas for yellow fever. So, preventive vaccination is very important in people living and traveling there. Although forest conservation could prevent additional cases, immunization is the unique intervention able to avoid the disease.

REFERENCES


