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Malaria Among the Students of Religious Schools of Bannu District, Khyber Pakhtunkhwa, Pakistan

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Abstract.- A parasitological survey was conducted from March to May 2002 to assess the prevalence of malaria, among the students of religious schools (Islamic Madaris) of Bannu District. A total of 581 male students of different age groups were examined. The prevalence of malaria was also examined in relation to urban and rural localities, nature of surrounding areas and presence of wire screen in windows of sleeping quarters. Of these 581 individuals, 3.61% were found positive only for *Plasmodium vivax*. No other species of *Plasmodium* was detected. The prevalence of malaria was highest (5.52%) in age group of 5-9 years, intermediate (3.37%) in age group of 10-14 years and lower (2.2%) in age group of 15-19 years, though the differences were not significant. The prevalence of malaria was significantly higher in Madaris located in marshy areas (6.94%) than in those having dry surroundings (2.51%). Similarly, prevalence of malaria was higher in rural settings (4.56%) than in urban settings (2.38%). Also prevalence rate of malaria was lower (1.80%) in Madaris where windows of sleeping quarters were screened than in those where windows were without screens (4.72%).

Key words: Islamic madaris, *Plasmodium vivax*, Rural settings, Taliban.

INTRODUCTION

Malaria is the second most frequently reported disease in under-developed countries of the world which imposes a great burden on health. Globally it is one of the major health problems (WHO, 2008). Around 250 million of malaria cases and one million deaths caused by malaria are reported around the world and in most South East Asia countries, malaria remains a serious threat to public health (Neoh *et al.*, 2011). Four species of *Plasmodium* are involved in the spread of malaria *i.e., P. falciparum, P. vivax, P. ovale* and *P. malariae*. The most dangerous and common species is *P. falciparum* (Awan and Jan, 2008), which is responsible for about 80% of all malaria cases. It is also responsible for about 90% mortality due to malaria (Mendis *et al.*, 2001). *Plasmodium* is protected from attack by body's immune system (Ajab *et al.*, 2010). There are a number of key parasitic products that drive the innate immune response in the malaria-infected human host, including malarial pigment (hemozoin, Hz), glycosylphosphatidylinositols (GPIs), and parasitic antigens. While it is clear that GPIs, which form the connection between the parasite's cellular membrane and external antigens, as well as an array of parasitic antigens play an important role in activating the immune response (Perkins *et al.*, 2011).

The malarial parasites *P. vivax* and *P.m falciparum* have wide distribution. The primary vector species are *Anopheles culicifacies* and *A. stephensi* (Murtaza *et al.*, 2009). Pakistan is listed among moderately endemic countries for malaria. Malaria also considerably affects the health of children (Bryce *et al.*, 2005), especially malnourished, leaving sequelae increasing susceptibility to other infections and impedes their development (Murtaza *et al.*, 2009). Migration of refugees can cause the distribution of malaria in various ways (Rowlanda *et al.*, 2002).

In Pakistan *P. falciparum* is an important public health problem, which annually causing at least ½ million cases of malaria (Ghanchi *et al.*, 2010). In Pakistan Afghan refugees, being more susceptible, are at high risk of malaria infection rather than that they brought a high infection load

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with them from Afghanistan. Therefore, malaria should be controlled on preventive base in Afghan refugees' camps in Pakistan (Suleman, 1988). *P. falciparum and P. vivax* are the major health problems in Pakistan causing malarial infection. At least 39 districts of the two southern provinces of Balochistan and Sindh have been classified as high risk area. In different areas of Pakistan studies have been conducted on prevalence and characterization of *Plasmodium* but host reaction to parasites studies are very meager (Khatoon *et al.*, 2009; Yasinzai and Kakarsulemankhel, 2004; Niazmani *et al.*, 1995). The present study was designed with the main aim of investigating the prevalence of malaria infection among the students of Islamic madaris of Bannu district, Khyber Pakhtunkhwa, Pakistan and creating awareness of malaria disease in them.

MATERIALS AND METHODS

This study was conducted among the male students in selected religious schools (Islamic Madaris) in Bannu District from March to May 2002 (towards the end of foreign forces attack on Afghanistan).

There were three categories of students in Madaris *viz.*, Hafiz-ul-Quran students (age 5-19 years), Qirat and Tajweed students (age 13-22 years), and Dars-e-Nizami students, (age 16-30 years).

Students of only Hafiz-ul-Quran category were screened for malaria. There were 16 schools of Hafiz-ul-Quran students and the number of students were 581 (Table I). All of them were male of age group 5-19 years and were examined for malaria.

A proforma especially designed for this study was used for recording particulars of each student such as name, age, locality of Madrassa, position of hostel, etc., at the time of survey. Both thick and thin smears were prepared for each person using a drop of blood taken by pricking fingertips following the method described by Chawatt (1980). Smear was dried and thin smears were fixed in methanol for 2-3 minutes. These fixed slides were then brought to the laboratory and stained with Giemsa's stain. For Giemsa's staining the fixed slides were placed for 30 minutes in 20 times diluted working solution at room temperature. Properly stained slides showed light pink to straw color erythrocytes and nuclei of white blood cells deep purple. For specific identification of malaria parasite these smears were examined under 100X oil immersion objectives, using 10X eyepiece (Pop, 1959).

Table I.- Names of madaris, number of students in each madrassa and locality of each madrassa.

S #	Name of Madrassa	Locality	No. of students
1	Markaz-ul-Islamic	Ghoriwala	36
2	Markaz-ul-Usman	Ghoriwala	33
3	Kashif-ul-Ulum	Hamidi Road	39
4	Hafiz-ul-Qran	Tarkhewala	38
5	Markaz Abu Hurira	Nurar	39
6	Tahfeez-ul-Qran	Surani	36
7	Dar-ul-Huda	Hamidi Road	36
8	Zia-ul-Qran	Sukari	37
9	Dar-ul-Huda	Jaman Road	32
10	Miraj-ul-Ulum	Bannu City	39
11	Ulum-e-Sharia	Milad Park Bannu City	37
12	Masjid Zanana Hospital	Bannu City	37
13	Tarteel-ul-Quran	Chai Bazar Bannu City	36
14	Tajweed-ul-Quran	Chai Bazar Bannu City	30
15	Jazebia	Tanchi Bazar Bannu City	38
16	Miraj-ul-Quran	Masjid Hafiz Jee Bannu City	35
Total No. of Students			**581**

RESULTS

Out of 581 blood films, 21 slides were found positive for *P. vivax*. indicating 3.61% prevalence. None of the slides contained *P. falciparum* and no mixed infection of both species was found.

Age wise prevalence of malaria

The highest age specific prevalence of malaria (5.52%) was found in 5-9 years age group and the lowest prevalence (2.2%) was found in 15-19 years age group (Table II). A comparison by chi-square (χ^2) test indicated the difference to be non significant ($\chi^2 = 3.10$; df = 2; $P < 0.05$).

Prevalence of malaria according to the environment

The prevalence of malaria was highest (6.94%) in madarais located in marshy areas compared to 2.51% in dry surroundings (Table III).

However, a comparison by chi-square test (χ^2) indicated the difference to be significant ($\chi^2 = 5.55$; df = 1; $P < 0.05$).

Table II.- Age-specific prevalence of malaria.

S.#	Age group (Years)	No. of slides		Prevalence of malaria (%)
		Examined	Positive	
1	5-9	163	9	5.52
2	10-14	237	8	3.37
3	15-19	181	4	2.2
Total	5-19	581	21	3.61

Table III.- Prevalence of malaria according to the nature of surrounding environment of madaris.

Surrounding environment	No. of madaris	No. of students examined	Found positive	Prevalence of malaria (%)
Dry	12	437	11	2.51
Marshy	4	144	10	6.94
Total	16	581	21	3.61

Prevalence of malaria in urban and rural madaris

The infection of malaria parasite was higher (4.56%) in rural madaris than in urban madaris (2.38%) (Table IV). A comparison by chi-square (χ^2) test indicated the difference to be non significant ($\chi^2 = 1.81$; df = 1; $P < 0.05$).

Table IV.- Prevalence of malaria in urban and rural madaris.

Location of madaris	No. of madaris	No. of students examined	Found positive	Prevalence (%)
Rural	9	329	15	4.56
Urban	7	252	6	2.38
Total	16	581	21	3.61

Prevalence of malaria in the presence of protective measures

The rate of infection was higher (4.72%) in madaris which were without wire screen in windows and doors of sleeping quarters than those having it (1.80%) (Table V). However, a comparison by chi-square (χ^2) test indicated the difference to be non significant ($\chi^2 = 3.11$; df = 1; $P < 0.05$).

Table V.- Prevalence of malaria with respect to presence or absence of wire-screen in windows.

Madaris	No. of madaris	No. of students examined	Found positive	Prevalence of malaria (%)
Without wire-screen on windows	10	360	17	4.72
With wire-screen on windows	6	221	4	1.80
Total	16	581	21	3.61

DISCUSSION

This research was carried out during the months of March to May 2002 in religious school students (Madaris) of Bannu District. Only Hifz-ul-Quran students were selected for the detection of malaria parasite. The prevalence of malaria in this survey was found 3.61% which is lower than the prevalence rate (7%) of the survey conducted by Awan and Jan (2008), The reason for low overall prevalence rate in the present study might be because the survey was carried out during dry weather conditions (drought) with low mosquito population as compared to the higher prevalence rate observed previously by Awan and Jan (2008).

As it is a common observation, that in Pakistan *P. vivax* is more common than *P. falciparum*. The incidence rate of *P. vivax* poses a significant health hazard because not only *P. vivax* infection but infection with *P. falciparum* also may lead to serious complications like cerebral malaria (Yasinzai and Kakarsulemankhel, 2008). Similarly, Awan and Jan (2008) while studying the relationship of malaria with rice fields in the different sectors of Bannu district, reported high incidence (6.25%) of *P. vivax* than of *P. falciparum* (0.75%).

In this survey *P. falciparum* was not found, the reason could be because (1) the gametocytes in *P. vivax* appear in the peripheral blood almost at the same time as the trophozoites, whereas in *P. falciparum* the sexual stages require nearly 10 days to develop, and then they appear in large numbers. (2) *P. falciparum* is a tropical species, which does not extend much into temperate region, whereas *Plasmodium vivax* is more adapted to subtropical

and temperate regions (Wilcock and Manson Bahr, 1972). (3) The longevity of *P. falciparum* in man seldom exceeds one year and *P. vivax* usually die-out within three years (Bruce-Chawtt, 1980).

Like previous studies it was also noted that there were some factors which influence the prevalence rate of malaria such as age, surrounding environment, the presence of wire screen in sleeping quarters, rural environment etc. In younger children the prevalence rate of malaria was found higher than the elders, because their immune system was not well developed. A comparison of age-specific parasite rates of malaria in Afghan refugees and a nearby local population at Karachi shows that Afghan refugees are susceptible to malaria even in later age-groups, while infections in the local population were limited to younger age-groups. Similarly, the rate of increase in the prevalence of malaria over the years is much higher in Afghan refugees than in the local population, which is due to the low herd immunity in Afghan refugees (Suleman, 1988). Mixed infection of *P. vivax* and *P. falciparum* was not observed in the current study, but mixed infection of 2.3% was observed in Multan district by Yar *et al*. (1998). Similarly, in those Madaris where surrounding environment was marshy, the prevalence rate was noted higher than those of dry surrounding, because the marshy places are breeding sites of mosquitoes.

It can be concluded that children below ten years of age are most commonly infected which is because of poorly developed immune system and poor hygienic conditions.

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