Short Communication

Distribution and Seasonal Variation of Human Malaria Infection in District Sanghar, Sindh, Pakistan

Seema Perveen Memon*, **Nasreen Memon, Mansoor Ali Shah, Reshma Sahito and Aiman Amur**

Department of Zoology, University of Sindh Jamshoro, Sindh, Pakistan.

Abstract | The study was conducted to examine the prevalence of malaria disease in the district Sanghar of Sindh province, Pakistan. The data were collected from January-December 2018. Gender and age wise distribution of malaria were observed during the study period. Monthly data of malarial patients were collected from Anti-malaria control program (AMCP) of different localities of district Sanghar. Total 26161 suspected cases of malaria were examined, 490 patients were found malaria positive. Among these positive cases, 477 patients were found *Plasmodium vivax* and 13 cases with *Plasmodium falciparum*. Gender wise and age wise malaria were examined, maximum cases were observed in male (283 patients) as compared to female, while in age wise distribution adult (73% patients) have a high percentage of malaria. *Plasmodium vivax 90% infected and remain* the dominant species in District Sanghar, Sindh, Pakistan as compared to *Plasmodium falciparum*. This study is very helpful for the awareness about malaria and its control.

Introduction

Malaria is one of the most serious and widespread tropical disease worldwide very high morbidity and mortality. Approximately 228 million malaria cases were reported and responsible for 4, 00,000 deaths globally in 2019 (WHO, 2019). Malaria was stated as the 5th leading cause of death worldwide. According to WHO, 40% of the population of the world is at risk of emerging malaria (Qureshi *et al.*, 2019). People Socioeconomic conditions and environmental factors are responsible for the prevalence of malaria (Qureshi *et al.*, 2019). In the Pakistan malaria is prevalent and each year approximately 4 million confirmed malaria cases are reported (Khan *et al.*, 2019). Malaria is seasonal disease and transmitted after monsoon. The malarial parasite affected by changes in temperature above 40°C and below 18°C normally cannot develop (Paalmans *et al.*, 2010). Because of high temperature, humidity, large irrigation, agricultural lands and also monsoon season provides suitable breeding environment for mosquitoes, which transfer malaria in this country (Ullah *et al.*, 2018). According to WHO (2018) Pakistan is one of sixth eastern countries with high spread of malaria and nearly 100% of the population is at threat. Malaria prevalence varies in

all provinces and even in different cities with variable environments. The female anopheles mosquitoes are responsible for transfer of protozoan parasites of the genus *Plasmodium*. Five species of genus *Plasmodium* (1) *P. knowlesi*, (2) *P. malariae*, (3) *P. ovale*, (4) *P. falciparum and* (5) *P. vivax* are responsible for transmission of malaria infection in human (Talapko *et al.*, 2019). *Anopheles culicifacies* and *Anopheles stephensi* are the primary vectors of malaria disease in Pakistan (Yasinzai and Kakarsulemankhel, 2009). A lot of research work has been done on malaria disease and its parasite in other areas of Sindh except mentioned localities, so the present research work planned and evaluated for the spread of malaria on the basis of seasonal variation of malarial parasites in rural and urban areas from specific areas of Sindh, Pakistan for the awareness of this fatal disease.

Materials and Methods

The district Sanghar was highly prevalent area of malaria disease, due to this purpose the present research work was designed during 1st January-31st December 2018. The data of malaria patients were collected from Anti malaria control program (AMCP) of different localities of district Sanghar. Malaria disease was observed whole the year in people of district Sanghar, that's why monthly data were collected and examined. Blood slides of suspected cases of malaria were prepared in the laboratory for detection of malaria parasite with coordination of the malaria department of Talukas Hospitals, in which thick and thin films were prepared. After that Giemsa stain were used for staining method and immersion oil for examination under microscope (Grassi, 1900; Bruce-Chwatt, 1988). Total 26161 suspected patient of malaria were observed. Out of which 490 cases were examined with malaria positive infection. Among positive patients, 283 were observed as male patients while 207 were female.

Age-wise distribution were categorized in four groups (1) infant (2) 2-5 year's kids (3) 6–14 years youngsters and (4) Adults. For the findings of seasonal variation, most cases were identified during the September, after the monsoon season. The meteorological data were collected monthly during 2018 from www.time.com of district Sanghar, Sindh, Pakistan (202), the correlation study between Ecological parameters and malarial parasite by SPSS (Software package 21.0).

Results and Discussion

The data were collected during January-December 2018; from highly prevalent localities of district Sanghar, Sindh, Pakistan. The objectives of this research paper are the seasonal changes of malaria, gender-wise and age-wise distribution of malaria disease.

Month wise and seasonal variation of malaria infection
Total 26161 suspected patient of malaria were recorded, out of which 490 cases were found malaria positive infection. The suspected cases were evaluated on the basis of species level, such as 477 patients were found malaria positive with *Plasmodium vivax* and 13 cases were detected *Plasmodium falciparum* (Table 1). The two species of *Plasmodium parasite* were recorded among patients; the highest population of *P. vivax* was recorded as compared to *P. falciparum* in the study areas.

Table 1: *Monthly distribution of malaria cases.*

Month	Avg. Temp. °C	Suspect of malaria	♂	♀	P.v	P.f	Total infected cases of malaria
January	17	2717	21	15	36	00	36
February	21	2377	19	12	31	00	31
March	28	2131	13	07	20	00	20
April	33	2048	18	13	31	00	31
May	36	2192	25	17	39	03	42
June	36	1793	22	18	38	02	40
July	34	1970	24	19	43	00	43
August	33	2150	27	19	44	02	46
September	32	2444	39	28	67	00	67
October	29	2479	31	24	54	01	55
November	23	2084	25	18	41	02	43
December	17	1776	19	17	33	03	36
Total		26161	283	207	477	13	490

The maximum numbers of positive cases were observed during September. In September 2444 suspected cases of malaria were examined. Among these cases, 67 cases were found malaria positive with *Plasmodium vivax*, while no any case of *Plasmodium falciparum* were observed.

In the study area, the maximum ratio was found in *Plasmodium vivax* as compared to *Plasmodium falciparum* (Figure 1). In district Sanghar rainfall starts from July and it was observed that the prevalence of

vector mosquitoes increases after rainfall, because of stagnant water on roads and in streets. As compared to urban areas, rural have not proper sanitation, which is the suitable environment for the breeding of vector mosquitoes. When mosquito population increases, malaria infection also increases in those areas.
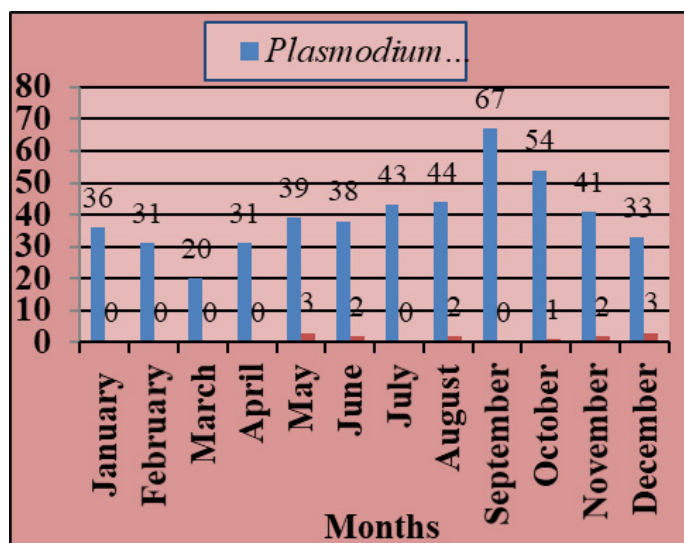

Figure 1: *Month wise and seasonal variation of malaria infection.*

Gender-wise prevalence of malaria
According to gender-wise distribution of malaria high ratio was noted in male as compared to female (Table 1). After testing 490 malaria positive infections, 283 cases were observed as male while 207 cases were female. Same results were observed in district Rahim yar Khan in Pakistan, as in Rahim yar Khan males were highly infected in number (about 70%), while females were in less number such as in (30%) (Majeed *et al.*, 2016). The reason behind that was most male works do outdoor jobs and they have more risk of exposure. Although the district Rahim Yar Khan, Punjab and district Sanghar, Sindh has almost same weather, which gives us the positive clue about seasonal variation according to co-relation between weather parameters and parasite population. The abundance of malaria vector was recorded seasonally.

Age-wise distribution of malaria
Age-wise distribution was classified in four groups (1) infant, (2) 2-5 year's kids, (3) 6-14 years youngsters and (4) Adults. In the comparison of age-wise distribution, maximum number (73%) of malaria cases were found in adult from above mentioned study localities while the minimum number (1%) of cases was recorded in infant (Figure 2).

We have observed that rainfall and temperature

is interconnected with the population of vector mosquitoes and parasite. In Figure 3A-B described (Pearson's correlation coefficient) with the inhabitants of Plasmodium species and weather parameters in Sanghar district during 2018.
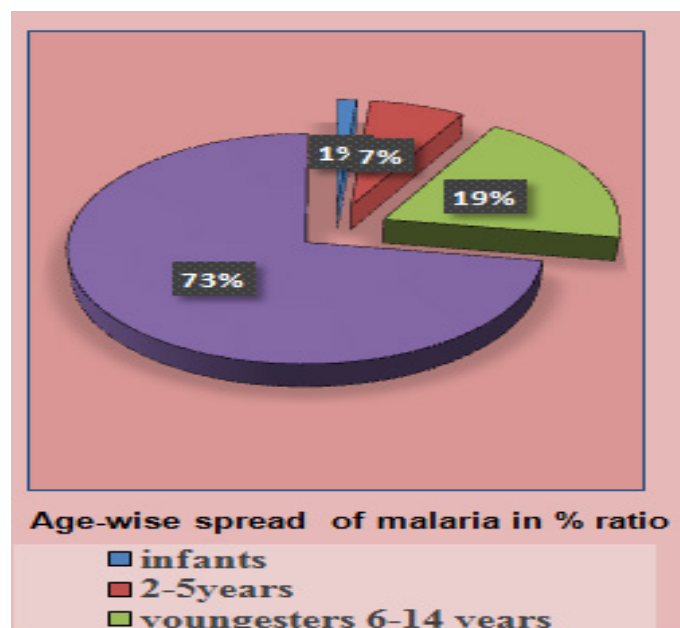

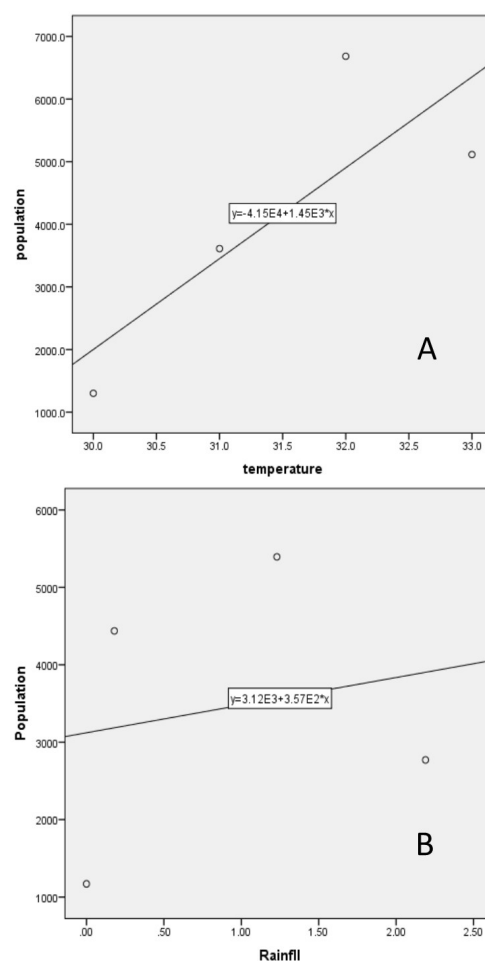**Figure 2:** *Age-wise distribution of malaria.*

Figure 3: *Shows the positive correlation with temperature, rainfall and malaria vector (Parasite plasmodium) during 2018.*

The abundance of malarial vector was observed after rainfall and because of suitable environment of vector mosquitoes, it was observed that the development of vector mosquito's increases and malaria ratio also increases; at this stage this research clearly shows the population of vector and parasite strongly +ve correlated with temperature r=0.81 (Figure 3A-B) and rainfall r=0.43 (Figure 3A-B).

Conclusions and Recommendations

Malaria is extremely fatal disease in this district Sanghar, Sindh, Pakistan. The *Plasmodium vivax* was dominant in study areas (90%) in District Sanghar, Sindh, Pakistan as compared to *Plasmodium falciparum*. Among gender-wise prevalence of malaria maximum ratio was observed in male, while in age-wise malaria occurrence high ratio of malaria were found in adult out of four age groups (infant, 2-5 age group, 6-14 years and adult). It is necessary to apply the precautions against mosquitoes, such as during the summer season or rainfall seasons use the nets and mosquitoes replants, cover all the water reservoirs, spray breeding sites of vector by controlling the populations of mosquitoes we will be safe from this deadly disease.

Acknowledgements

Novelty Statement

The study aimed to investigate the prevalence of malaria disease in the Sanghar district of Sindh, Pakistan. A great deal of research has been done on malaria disease and its parasite in other parts of Sindh, but not in these areas. Plasmodium vivax is dominant over Plasmodium falciparum. In terms of gender, the highest ratio was found in males as compared to females, whereas in comparison with age, maximum cases of malaria have been found in adults.

Author's Contribution

Seema Perveen Memon: Wrote the research article and performed experiments.
Nasreen Memon: Conceived and designed the experiments.
Mansoor Ali Shah: Analyzed the data.
Reshma Sahito: Contributed reagents, materials, analysis tools.
Aiman Amur: Contributed to manuscript revision.

Conflict of interest
The authors have declared no conflict of interest.

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