

Original Research Article

Sero-Prevalence of Malaria among Children's Visit to a Teaching Hospital

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Abstract

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Malaria is known to everyone as a serious and major health issue that is transmitted through mosquitoes. Both urban and rural areas are affected by this health problem. The present study was therefore conducted to determine the sero-prevalence of malaria in children visiting Mardan medical complex Mardan, Pakistan. This study was carried out from January 2018 to December 2018 in Mardan medical complex Mardan, Pakistan. Children having age ranging from two months to 15 years were included in the study. All the included children in our study were with signs and symptoms of malaria. 300 samples were collected totally from children of different ages. Thick and thin smears were prepared from the blood of suspected malaria patients. Out of 300 samples, 90 samples (30%) were found to be malaria positive. The species of plasmodium found in our study were *P.vivax* 54(60%) and *P.falciparum* 36(40%). While there was no case of mixed infections in our study. Prevalence of malaria among positive cases was higher in male 50 (55.55%) in comparison to female 40(44.44%). In the age group ≥ 5 year's higher rate of infections was found while the lowest rate of infection was found in the age group 11-15 years. In August, the highest rate (20%) of infections was found while the lowest rate of infection (3.33%) was observed in March. Our study concluded that in district Bannu malaria is the most common public health issue. Both species of plasmodium, *P.vivax* and *P.falciparum* were found to have existed in district Bannu. In our study it was concluded that *P.vivax* is highly prevalent in comparison to *P.falciparum*. Elimination of poverty, to aware the people about malaria, economic development and to facilitate health adequately are the main factors in district bannu and southern region of Khyber Pakhtunkhwa to eliminate malaria.

Keywords: Malaria; Plasmodium Falciparum, Plasmodium vivax; Sero-prevalence

INTRODUCTION

Malaria is leading the globe in causing high morbidity and mortality rate in children (Zaki and Shanbag, 2011). Usually for malaria there are four species of plasmodium that includes, plasmodium falciparum, plasmodium vivax,

and plasmodium ovale and plasmodium malariae. Plasmodium knowlesi has been found to be the 5th causative agent of malaria in the islands of Borneo and peninsular Malaysia however plasmodium falciparum and

plasmodium vivax are the dangerous species to cause malaria (Elsheikha and Sheashaa, 2007; Cox-Singh et al., 2008).

In under-developed countries the second most commonly observed disease is malaria (Hussain et al., 2013). In more than hundred countries malaria is endemic. It is mainly dominated in Asia, Africa, South America and Central America. Due to malaria 40% of the world is at risk (Portugal et al., 2014; Jamal et al., 2005; Worku and Haileamlak, 2009; Asma et al., 2014). In Pakistan *P. falciparum* and *P. vivax* are normally found (Shaikh et al., 2012). The major factors that increase the potency of malaria are the practices of agriculture, network of irrigation and monsoon rains (Hussain et al., 2013). The World Health Organization world widely estimated a total of 429,000 deaths in 2015 caused by malaria. *P. falciparum* alone was the major (99%) cause of death. In this world wide estimate by WHO, Seventy percent (nearly 303,000) were under the age of five years children (Fact sheet: World Malaria Repor, 2016). In children malaria can copy many diseases and there are no proper clinical observations (Shah et al., 2009). The main clinical features of malaria include high fever, chills, pain in head, sweating, myalgia, pain in abdominal, vomiting, diarrhea, anemia, enlargement of liver, and enlargement of spleen and jaundice (Krause et al., 2007). Atypical presentation of malaria is found in regions where malaria is endemic. This is mainly due to immunity development antimalarial drug resistance and judicious use of antimalarial drugs (Zaki and Shanbag, 2011). Disseminated intravascular coagulation, acute kidney injury, cerebral malaria, hypoglycemia hepatopathy, and severe anemia are the most common complications caused by malaria (Ahmed et al., 2011; Cook and Zumla, 2009). Alone *P. falciparum* or together with *P. vivax* commonly cause hepatic dysfunction (Fazil et al., 2013). Hemolysis of parasitized erythrocytes, hepatic dysfunction and DIC are responsible for causing jaundice in malaria patients (Singh et al., 2010). Many South-east Asian countries have reported severe jaundice caused by malaria but world health organization stated that there was no sign of hepatic dysfunction in these patients (Shah et al., 2009). > 3 mg/dl hyperbilirubinemia, high level of transaminase and clinical or serological absence of hepatitis caused by virus describe malarial hepatitis (Saya et al., 2012).

In the developing world malaria is leading the globe in causing high morbidity and mortality, particularly in Sub Saharan Africa. Here in Sub Saharan Africa malaria transmission is high and in the development of the economy it is considered as a main obstacle (Sachs and AdnMalanet, 2002). Malaria is most commonly observed in Pakistan. Epidemiological data about malaria from different regions of Pakistan is not sufficient to determine the prevalence accurately (Khan et al., 2006). The key public health issue is malaria due to *Plasmodium falciparum* and about 0.5 million cases of malaria is

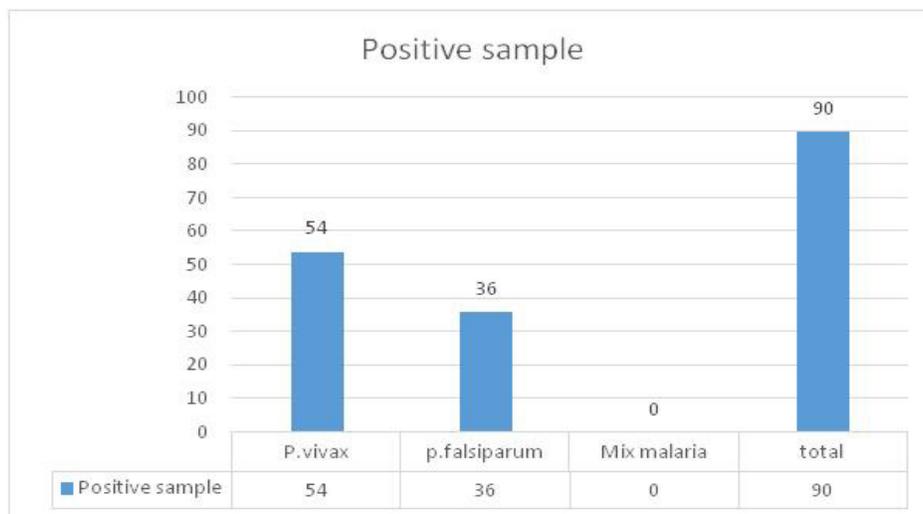
caused by this annually (Ghanchi et al., 2011). It is estimated that 0.25 million cases of malaria occur annually In Pakistan (Yasinzai and Kakarsulemankhel, 2009). In the last 10 years the incidence of malaria increased highly. Among malaria infections the recurrence rate of *P. falciparum* increases from 45% in 1995 to 68% in 2006 (Ghanchi et al., 2011). Most susceptible and high risk people in Pakistan are Afghan refugees, in spite of the fact that from Afghanistan they bring a high load of infection (Suleman, 1988). Malaria is easily curable and can be stopped easily. In the whole world malaria is transmitted by mosquitoes specifically *Anopheles* mosquitoes. It has been observed that temperature has influence on the specific habitats with surface water for reproduction, moisture for survival of adult mosquitos and the rate of development of both vector and population of parasites hence malaria is considered as environmental disease (Ceccato et al., 2005). Numerous factors are responsible for the continuous increase and re-emergence of malaria. These various factors include economic crises, lake or decrease of malaria control program, adaptation of mosquitoes to pesticides, development of antimalarial drug resistance and challenge of the environment. These all play a main role in the increase of the malaria disease. In some states, particularly in Africa, political movements of the population or economic crises are other factors to spread malaria. Correspondingly, new parasites might be brought by migrants and many refugees which might increase malaria transmission in an already settled population. In contrast, migrants from no or low transmission areas are at high risk when they migrate to areas where malaria is endemic (Giada et al., 2003). The present study was therefore conducted to determine the sero-prevalence of malaria in children that are visiting Mardan medical complex Mardan, Pakistan.

MATERIAL AND METHODS

This study was carried out from January 2018 to December 2018 in Mardan medical complex Mardan, Pakistan. Children having age ranging from two months to 15 years were included in the study. All the included children in our study were with signs and symptoms of malaria. 300 samples were collected totally from children of different ages. Thick and thin smears were prepared from the blood of suspected malaria patient. The children were divided into three groups according to age. Group first includes children having age ≥ 5 , group second includes children having age between 6-10 while group three having children age 11-15. Our study inclusion Criteria was patients from many departments of Mardan medical complex Mardan, having signs and symptoms of malaria. Diagnosis based on clinical sign and symptoms such as fever, pain in head, pain in joint, general weakness of body, cough, diarrhea, loss of appetite or

Table 1. Over all prevalence of malaria in children visiting a teaching hospital

Total sample	Malaria positive n (%)	Malaria negative n (%)
300	90 (30)	210 (70)

**Figure 1.** Comparative prevalence of plasmodium spp in children visiting a teaching hospital

feed refusal and pain in abdomen was checked by physicians at various departments of the hospital while the exclusion criteria for our study includes patients already on antimalarial treatment, patients having immunological issues and febrile patients.

This study was approved by the research and ethical committee of the hospital. After getting approval complete record about patient's name, age, sex, details of history and clinical examination was noted. Consent form was obtained from the parents of the children included in our study. Tubing tourniquet was used during collection of venous blood samples. It was tied to the upper arm of all the children with high care. Sufficient safety precautions were taken to certify reliable test results. All the blood samples were processed in aseptic condition to prevent contamination and extra care was taken to avoid the blood borne pathogens. During collection and handling of blood samples protective gloves were used. The blood samples were collected into EDTA bottles and were used for the collection of all blood samples and all the bottles were labelled with the information of patients like name, gender and age. Gentle mixing was done for all the samples. All the samples were processed in the diagnostic laboratory of Mardan medical complex, Mardan. Staining and malaria parasites identification of all the blood samples was done as defined by (Cheesbrough, 2000). Thick and thin smears were prepared from the blood of suspected malaria patients.

On a clean microscopic slide a small drop of blood was positioned close to the end of a slide. For steady smear of a blood a spreader was used diagonally of the

slide and steady movement was given at an angle of 45°. The slides were labelled properly and were allowed for proper drying. For few minutes on slide one volume of Giemsa stain was swamped. Then for about 10 minutes two volumes of buffered distilled water having Ph of 6.8 was added. Thoroughly washing of the slide under tap water was done. The slide was then allowed for dryness. The back of the slide was cleaned with cotton. On stained slides an oil immersion drop was placed for covering a 10mm diameter film area. The slides were then observed for plasmodium parasite identification under X100 objective lens of compound microscope (Cheesbrough, 2000). Positive or negative results were recorded accordingly. Statistically all the results were analyzed.

RESULTS

Malaria is known to everyone as a serious and major health issue that is transmitted through mosquitoes. Both urban and rural areas are affected by this health problem. The present study was therefore conducted to determine the sero-prevalence of malaria in children visiting Mardan medical complex Mardan, Pakistan. Out of 300 samples 90 samples (30%) were found positive for malaria while 210 samples (70%) were negative for malaria (Table 1). The species of plasmodium found in our study were *P. vivax* 54 (60%) and *P. falciparum* 36 (40%). While there was no case of mixed infections in our study (Figure 1). Prevalence of malaria among positive cases was higher

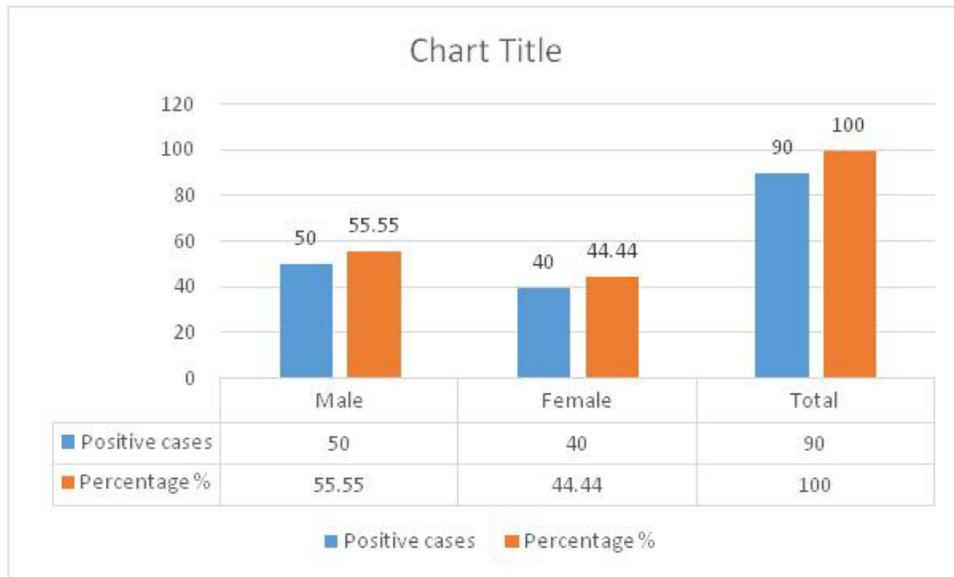


Figure 2. Gender wise prevalence of malaria in children visiting a teaching hospital

Table 2. Sero-prevalence of malaria in different age group of children visiting a teaching hospital

Age group	Positive cases	Percentage
≥5	42	46.66%
6-10	25	27.77%
11-15	23	25.55%



Figure 3. Gametocyte and ring stages of *P. vivax* in blood smear (1000x) of a malaria patient.

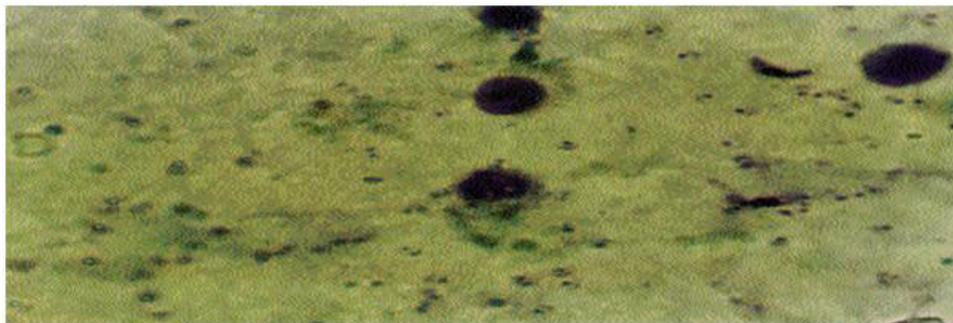


Figure 4. Gametocyte and ring stages of *P. falciparum* in blood smear (1000x) of a malaria patient

Table 3. Month wise sero-prevalence of malaria in children visiting a teaching hospital

Month	<i>Pl. Vivax</i>	<i>Pl. Falciparum</i>	Mixed infection	Total
January	3	1	00	4(4.44%)
February	3	2	00	5(5.55)
March	2	1	00	3 (3.33)
April	4	2	00	6(6.66)
May	4	2	00	6(6.66)
June	4	1	00	5(5.55)
July	3	2	00	5(5.55)
August	10	8	00	18(20%)
September	5	5	00	10(11.11)
October	6	4	00	10(11.11)
November	5	5	00	10(11.11)
December	5	3	00	8(8.88%)
Total	54(60%)	36(40%)	00	90 (30%)

in male 50 (55.55%) in comparison to female 40(44.44%) (Figure 2). In the age group ≥ 5 year's higher rate of infections was found while lowest rate of infection was found in the age group 11-15 years (Table 2). In August, the highest rate (20%) of infections was found while the lowest rate of infection (3.33%) was observed in March (Table 3).

DISCUSSION

Malaria is leading the globe in causing high morbidity and mortality rate in children (Zaki and Shanbag, 2011). Usually for malaria there are four species of plasmodium that includes, *P.falciparum*, *P.vivax*, and plasmodium ovale and plasmodium malariae. Plasmodium knowlesi has been found to be the 5th causative agent of malaria in the islands of Borneo and peninsular Malaysia however plasmodium falciparum and plasmodium vivax are the dangerous species to cause malaria (Elsheikha and Sheashaa, 2007; Cox-Singh et al., 2008). The World Health Organization widely estimates a total of 429,000 deaths in 2015 caused by malaria. Plasmodium falciparum alone was the major (99%) cause of death. In this world wide estimate by WHO, Seventy percent (nearly 303,000) were under the age of five years children (Fact sheet: World Malaria Report, 2016). Malaria is most commonly observed in Pakistan. Epidemiological data about malaria from different regions of Pakistan is not sufficient to determine the prevalence accurately (Khan et al., 2006).The present study was therefore conducted to determine the sero-prevalence of malaria in children visiting Mardan medical complex Mardan, Pakistan. Out of 300 samples 90 samples (30%) were found positive for malaria while 210 samples (70%) were negative for malaria. The species of plasmodium found in our study were *P.vivax* 54 (60%) and *P.falciparum* 36(40%). While there was no case of mixed infections in our study. Prevalence of malaria among

positive cases was higher in male 50 (55.55%) in comparison to female 40(44.44%). In the age group ≥ 5 year's higher rate of infections was found while the lowest rate of infection was found in the age group 11-15 years. In August the highest rate (20%) of infections was found while the lowest rate of infection (3.33%) was observed in March. In the study, the higher rate of infection of *P. vivax* was observed than *P. falciparum*. This might be due to no exothermic cycle and no true relapse occurring in *P. Falciparum* while relapse occurs in *P. Vivax* (Bruce-Chwatt, 1980). Second reason for more prevalence is that in man *P. falciparum* rarely surpasses one year while *P. vivax* ordinarily loses within three years (Robert et al., 1996). The third intention is more virulence of *P. falciparum* as compared to *P. vivax*. In children approximately 50% of the mortality is observed due to *P. falciparum*. But in tropical Africa, this report might have valid consideration but this statement has no meaning for higher prevalence in countries like Pakistan. In earlier research studies high rate of *P. vivax* (60.5%) has been reported (Awan and Jan, 2008) and in another study the high prevalence rate of *P. vivax* (90.4%) was reported in refugees of Kashmir established in Muzaffarabad (Yar et al., 1998). Malaria control program of Baluchistan observed high sero-prevalence (88.5%) of *P. vivax* in Ziarat. *P. vivax* high sero-prevalence was also reported in other parts of Baluchistan (Jan and Kiani, 2001). Previous study reported a high prevalence of *P. vivax* (39.0%) in comparison to *P. falciparum* (36.6%) in the southern region of Punjab (Malaria Control Program Balochistan, 2004). Contrary to our study, previous study in Karachi reported a higher prevalence of *P. falciparum* (90.99%) than *P. vivax* (9.0%). A study done by Awan and Jan (2008) reported a high infection rate in male (7.18%) as compared to females (6.66%) (Awan and Jan, 2008). This high prevalence in male might be due to more deeds outside than females or this may be due to more collection of blood samples from male as compared to females. In numerous infections seasonal variability

has been reported specially in bacterial and malarial infections (Yasinzai and Kakarsulemankhel, 2009; Shehzadi et al., 2011). In numerous studies, for seasonal variability of malaria the focused factors are dry and rainy seasons (Faiz et al., 2011). Many causes have been reported to determine why some *plasmodium spp* or transmission of disease favor precise periods. Rainfall is the key factor that gives breeding ground to the mosquitoes that cause the increase in cases of malaria in the rainy season (Madhavan et al., 2001). In some part of the world the seasonal variability of malaria is under consideration according to Schmalhausen's law. The various that are under consideration includes change in climatic condition and plasmodium parasite and vector behavior (Chaves and Koenraadt, 2010). Occurrence of malaria, meteorological and hydrographical factors have been reported to be associated with *Plasmodium vivax* (Basurko et al., 2011).

CONCLUSION

Our study concluded that in district Bannu malaria is the most common public health issue. Both species of plasmodium, *P.vivax* and *P.falciparum* were found to have existed in district Bannu. In our study it was concluded that *P.vivax* is highly prevalent in comparison to *P.falciparum*. Elimination of poverty, to aware the people about malaria, economic development and to facilitate health adequately are the main factors in district Bannu and southern region of Khyber Pakhtunkhwa to eliminate malaria. In our area seasonal variation of malaria was found. Many environmental factors have influence on the seasonal variation of malaria. We suggest well designed and large study in order to explore the seasonal variation of malaria and its key factors that drive it.

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