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Prevalence of pediatric malaria in Quetta (City) Balochistan, Pakistan

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Abstract

Malaria is a world-wide public health issue caused by protozoan parasite plasmodium, which is comparatively endemic in Pakistan. From 1 August 2017 to 31 July 2018, the specific research was conducted to evaluate the prevalence of Plasmodium infection in Quetta (town). 33 Quetta schools were visited twice a month and 2213 blood slides were taken, 433/2213 of which were positive. However, the most common species recorded was *P. vivax* with the considerably high incidence levels (84.52%) relative to *P. falciparum* (6.01%) and mixed infection (12.29%). In month of august, frequency rate of malarial infection was highest (91.6%) and lowest in March (57.1%). The data was analyzed statistically to check any sort of correlation between gender and types of malaria infection and also difference between types of malaria infection as well as the months of the year. The prevalence of malaria infection was substantially high in males (76.44 %) compared to females (23.55 %). Such a high occurrence of vector borne disease malaria, in children of Quetta exhibit that malaria poses a significant health problem in that particular area, thereby Government and Health Consultants should pay attention for preventing and controlling the infection in children of Quetta city.

Keywords: frequency, *Plasmodium vivax, Plasmodium falciparum,* disease, infection

Introduction

Malaria is a global public health problem caused by protozoan, plasmodium parasite which is highly prevalent in Pakistan. Mainly four types of Plasmodium species are responsible for human protozoal infection *P. vivax, P. malariae, P. falciparum & P. ovale* (Levinsion *et al*., 2008) [1]. The malarial parasites infect the RBCs of blood and cause anemia, nausea and fever (Hulden *et al.,* 2013) [2]. The epidemiologist of protozoa infection focuses on the physiology of the vector, human host and the social and economic situations of the countries. (Rodulfo *et al.,* 2007) [3].

Nowadays, protozoal infection is known as humid infection (Levinsion *et al*., 2008) [1]. In Pakistan, two most important protozoal infection species are *Plasmodium falciparum and Plasmodium vivax*. *P. falciparum* is more complex than other types of malarial infection causing species as *P. falciparum* is responsible for severe anemia, metabolic process distress syndrome, hypo glyseamia, pathology, renal disorder, cerebral protozoal infection, convulsions and shock (White *et al.,* 2014: Dondrop *et al.,* 2004) [5].

Pakistan is facing a major health issue of malaria due to extensive agricultural implementation, broad irrigation network and also monsoon rains, which accord to elevate malarial infection (Tasawer *et al.,* 2003) [6]. In 2004, low malarial incidence was recorded in Azad Kashmir (AJK) and Punjab, moderate incidence rate in Sindh and Khyber Pakhtun khwa, while FATA and Balochistan were having high prevalence of malarial infection (Kondrachine *et al.,* 2008) [7]. Pakistan is an agricultural land with 65% of its populations in rural areas, where stagnant water and limited health facilities contributes to malaria, especially children are affected due to their careless life style. In Pakistan, overall, 9% global cases of *P. vivax* were recorded in 2015, and *P. vivax* cause 10% of universal deaths (Khan *et al.,* 2004) [8]. Nearly 212 million medical cases every year and calculable 430,000 deaths were reported universally because of the protozoal infection.

Approximately, about 3.2 billion people are still in danger of protozoal infection. In 2015, 202, 013 number of protozoal infection cases were reported in West Pakistan (WHO 2016). In past few years, the frequency rate of *P. falciparum* has raised in Pakistan (Zubairi *et al.,* 2013) [10], as drug resistance is the major issue in the treatment of protozoal-infection, together with protozoal infection in children. Autumn is the favorable environmental condition for the growth of mosquitoes (Nizamani *et al*., 2006; Macdonald, 1957) [11, 12], as sporogonic development stops during low temperature in winter season (Trape *et al.,* 1992)[13]. The frequency rate of malarial infection is different during different seasons of the year (Afrane *et al.,* 2004) [14]. The basic objective of this research work was to determine the occurrence of malaria infection in children of Quetta (city) Balochistan

Methods and Materials

The present work on protozoal infection in school children was carried out in various schools and age groups starting from 3 to 5 years, 6 to 10 years, and 11 to 16 years from August 2017 to July 2018. In this study all children included were having fever, chills and vomiting while children excluded from this study, were not having general

symptoms of protozoal infection. During this work, the methodology recommended by the WHO was used and ACD (Active case detection) has detected cases of malaria, which was successfully achieved by monitoring schools and testing patients with symptoms or a history of malaria in their blood.

Blood smears Collection

A total number of 2213 of blood slides were collected twice in a month from 33 distinct Quetta (city) schools.

Preparation of slides from blood smears

Both blood smears (thick and thin) were prepared. After applying spirit on finger-tip and drying it, the fingertip was then pricked and squeezed to get a drop of blood. Clean slide was utilized to transfer blood on it.

a. Preparation of thin blood film slides

With the sting of spreader slide, blood was dispersed equally across a clean and grease free slide for forming a thin film.

b. Preparation of thick RBCs film slides

At the middle of a glass slide a single drop of blood was collected and expanded to create a circular area of reasonable thickness with the aid of another slide (Paniker, 2002) [17]. At the middle of a glass slide a single drop of blood was collected and spread with the help of another. The two slides thin and thick, were fixed 2-5 minutes in methanol and allowed to dry for 15 minutes. Diluted Giemsa stains was used for both films and left for 10-15 minutes to dry and followed by further washing and drying.

Identification of malaria parasites

Under the oil immersion magnifier, the particular blood slides were analyzed. The blood film showed the existence of malaria parasites (thick, thin films) in the 1st and 2nd field. In infection with *P. vivax* and *P. falciparum*, presence of cell crescents creates identification of species according to (Paniker, 2002) [17]. Numerous studies have been developed; however, none of them have been able to alternate the thick and thin blood mark slides that may expose morphology of parasites. This method is considered as the 'gold standard' in identification of malarial parasite (Zaman and beg 2004) [18]. Identification keys of Plasmodium species was prepared by (Paniker, 2002; Cheng, 1986; Sood, 1989; Chiodini, 2001; Sumbal *et al.,* 2018a and b) [17, 19, 20, 21, 15]. Through Trophozoites and gametocytes structures, *Plasmodium vivax* & *Plasmodium falciparum* were identified. Images were enamored by the assistance of light microscope fitted with camera (CH3 Olympus, japan) (figure 1).

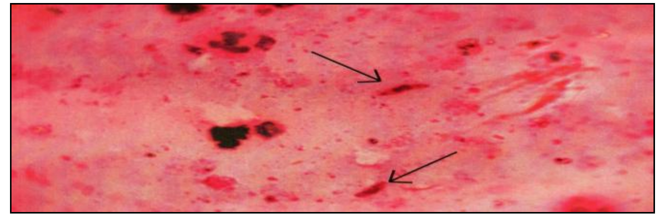


Fig 1: *P. falciparum* gametocytes in thick blood smear

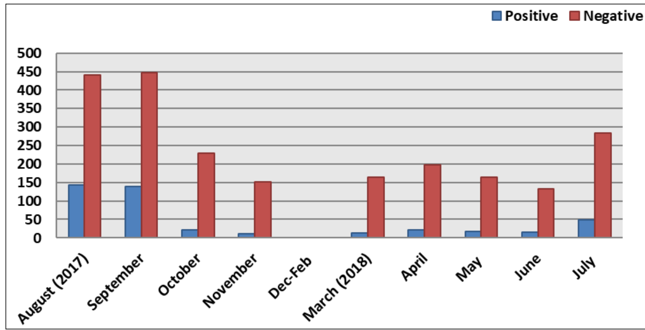
Results and Discussion

From 33 different schools, a total of 2213 blood slides were collected, an overall result (19.5 %), while *P. vivax* was higher (84.5 %) than *P. falciparum* (6.01 % and both types of infection (12.2 %) (Table I). Overall positivity rate of 19.5 % is high as compared to the previous study (6.72 %) regarding children of Quetta (Muhammad and Hussain, 2003) [24]. A study conducted in Panjgur district of Balochistan, (Yasinzai & Kakarsulemankhel, 2013) [23] reported (38.3%) positive cases of malaria.

Another study conducted in Killa Saifullah district of Balochistan (Umer and Yasinzai, 2017) [25], studied the positivity rate of malarial infection as (19.5 %), and *P. vivax* was observed greater (65%) as compared to *P. falciparum* (35%), and both type of malarial infection (1%). The most likely reason behind the high prevalence of disease in school children of Quetta (city), is low economic level of the peoples, especially Govt school children live in congested areas, where chances of infection is comparatively high. Moreover, there is lack of guidance regarding the beneficial role of insecticide spray in the residential areas. In month of August, the frequency rate of protozoal infection was highest (91.6%), and lowest in March (57.1%) (table I), (Graph 1.1). The reasons of high malarial cases in this months and seasons is possibly due to existence of stagnant water, which provide a favorable environmental condition for breading mosquitoes, that can transmit the Plasmodium parasite from infected persons to healthy people and thus the incidence of infection is increased.

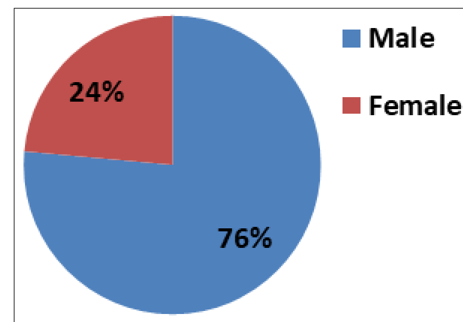
Table 1: Monthly prevalence of malaria disease among children of Quetta (city)

S. No.	Months	Total No. of examined slides	Positive (+ve) slides	*P. vivax*	*P. falciparum*	Mixed Infection
1	August (2017)	441	143	131 (91.6%)	4	8
2	September	447	140	125 (89.2%)	5	10
3	October	230	22	14 (63.6%)	4	4
4	November	151	12	09 (75%)	-	3
5	Dec-Feb	Winter vacations				
6	March (2018)	167	14	08 (57.1%)	2	4
7	April	198	21	14 (66.6%)	3	4
8	May	164	17	14 (82.3%)	-	3
9	June	132	16	10 (62.5%)	2	4
10	July	283	48	41 (85.4%)	2	5
	Total	2213	433(19.5%)	366(84.52%)	22(6.01%)	45(12.29%)



Graph 1: Monthly-wise rate of malaria disease in children

The statistically analyzed data was used to see if there was any association among male/female & type of protozoal infection and association between completely different malarial types and also Months of the year. In (Graph 1.2), Gender-wise occurrence was shown greater (76.44%) in male as compared to female (23.55%), which is relevant to the previously reported rate in male (65.21 %) and female (34.78 %) children of Quetta (K. Hussain *et al.,* 2013) [24], and also with another study (Muhammad and Hussain, 2003; Reza and Taghi, 2011) [24]. The reason behind high incidence rate in male may be due to the reason that male mostly sleeps in open places and having more outdoor activities compared to females, whom are mostly restricted to their homes, so this results in high prevalence rate of malarial infection in male as compared to female.



Graph 2: Malarial disease frequency in male and female children

The data were statistically analyzed through the chi-square test to show that there is particular link among different malarial infection types and age groups.
To determine interrelationship between months and varied types of malarial infection, Chi-Square test was applied. The 42.55 value (p-value < 0.001) was shown highly significant, about 5% level of significance was reported.

Statistical analysis

Table 2

	S. No	Month	A *(fo) (fe)*	B *(fo) (fe)*	C *(fo) (fe)*	Total
Month	1	August (2017)	131 120.8	4 7.26	8 14.8	143
	2	September	125 118.3	5 7.11	10 14.5	140
	3	October	14 18.5	4 1.11	4 2.28	22
	4	November	09 10.1	-	3 1.24	12
	5	Dec- Feb	Winter vacation			
	6	March (2018)	08 11.8	2 0.71	4 1.45	14
	7	April	14 17.7	3 1.06	4 2.18	21
	8	May	14 14.3	-	3 1.76	17
	9	June	10 13.5	2 0.81	4 1.97	16
	10	July	41 40.5	2 2.43	5 4.98	48
	Total		366	22	45	433

The *P. vivax* was comparatively more prevalent than other types of malarial infection. Apart from varied types of infection, occurrence of infection generally was elevated during July-September. Due to the reason of having poor and un-hygienic environments, Pakistan is facing a problem of nearly 2 million cases annually (Yasinzai and Kakar, 2009) [23]. In Pakistan, *Plasmodium vivax* turned out to be a leading species (Zakeri *et al.,* 2010) [28]. Recent research work from Karachi and Sindh on malaria also highlighted the plasmodium infection of *P. vivax* higher than *P. falciparum*. In male the ratio of *P. vivax* was high (63%) than in female (36%). The highest number of cases reported in September (19.03 %), while the lowest number of cases registered in March (3.12 %) (Khattak *et al.*, 2013) [29].

Conclusion

It is believed that malaria in Quetta is a major public health problem, especially in children between ages of 6 to 10. In the month of august, high frequency rate is observed due to suitable environmental condition for the growth of malarial parasite. In both males & females, *P. vivax* frequency rate was greater in contrast to *P. falciparum.* The technique of microscopy has proven very useful in detecting *P. vivax*, *P. falciparum* and mixed infection in school-going children. It is strongly suggested that children with malarial manifestations should be screened for any risk of malarial parasitic infection.

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