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Burden of *Plasmodium vivax* and *Plasmodium falciparum* in Afghan Refugee Camps located at Ghamkol Road Peshawar bypass District Kohat

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Abstract
Malaria is the infection which predominantly affects developing countries and is the cause of elevated level of mortalities and health issues. Afghan Refugee camp no. 1, 2 and 3 (which are situated at Peshawar bypass of district Kohat) were selected as target area. Blood sample was collected from susceptible Afghan refugees who showed symptoms of Malaria infection. Blood sample was tested through Microscopy, RDT and Haemoglobin analysis. A total of 220 blood samples [Male = 156 (70.90%) and Female = 64 (29.09%)] were randomly collected from susceptible peoples residing in Afghan refugee Ghamkol camp district Kohat in the months of May 2011 to June 2012 Male population was found more infected as compare to female. Teen-agers were more prone to malaria infection. *P. vivax* was more prevalent as compare to *P. falciparum.* No male was found positive with the infection of *P. falciparum*. About 8/220 (3.63%) cases were misdiagnosed by microscopy, while about 2/220 (0.90%) cases were misdiagnosed by RDT. A high prevalence of both *P. vivax* and *P. falciparum* was observed in the months of August – October. A comparatively low Hb level was observed in Malaria positive cases i.e. an average 7.4gm/dL in *P. falciparum* positive cases while 9.98 gm/d Lin *P. vivax* positive cases. Due to lack of expertise malaria cases can be misdiagnosed which may lead to improper treatment of the patient. Malaria if diagnosed properly, it is very difficult task to identify a morphological form of the parasite and to identify it. Afghan refugee's teen-agers are more susceptible for getting Malaria infection as they wander over streets and collect garbage and trash; they spend their most of the time in unhygienic condition they are also spotted taking bath in ponds and stagnant water which are specifically mosquito breeding site. A comparatively high percentage of malaria infection was found in the months of August – October i.e. 39/56 (69.64%) as they are considered to be humid months in Pakistan, this season is very favourable for mosquito breeding.

Keywords: Afghan Refugees Kohat, *Plasmodium vivax, Plasmodium falciparum*

Introduction
Malaria is a primitive blood infection that is caused by a many species of a parasite i.e. plasmodium. This disease is mainly transmitted by a female mosquito of genus Anopheles [1] it is one out of five most harmful blood infections which infect local population easily (Jamal *et al*., 2005). Malaria is the infection which predominantly affects developing countries and is the cause of elevated level of mortalities and health issues [2]. About 300 to 500 million population are affected by this infection while it causes about 1.5 to 2.7 million mortalities every year throughout the world [3]. It is the major cause of death among blood infections [4]. Malaria is mainly caused by plasmodium species, many species of plasmodium cause this infection to primates and other animals, but some of them are responsible to infect human, which includes *Plasmodium falciparum, Plasmodium vivax*, *Plasmodium ovale* and *Plasmodium malariae* [3]. *Plasmodium vivax* is the common cause of malaria infection but the most severe type of malaria infection is caused by *Plasmodium falciparum* that results in declined blood sugar, kidney failure, black water disease and also non-cardiopulmonary edema. The most dangerous attack of malaria infection is caused when parasites migrate to the brain through blood stream called cerebral malaria. [4-5]. In Pakistan Malaria infection is predominant. [6]. It is estimated that about 500,000 malaria positive cases are reported throughout the country every year [7]. Afghanistan which is saturated at the boundary of Pakistan has an elevated level of malaria statistics.

It is estimated that about 3 million cases of malaria infection are reported every year from Afghanistan, most of them are of *P. falciparum* and *P. vivax* [8]. According to so many reports it is confirmed that only 2 species of Plasmodium i.e. *P. vivax* and *P. falciparum* are responsible for malaria infection in Pakistan (Khan *et al.*, 2004). Study reveals that Afghan refugees residing in Pakistan are more prone to get malaria infection. It is also suggested that infection of Afghan Refugees is brought from Afghanistan with the population flow from there [9].

Materials and Methods

Study Area

District Kohat is situated in Khyber Pakhtunkhwa province of Pakistan. Afghan Refugee camp is situated at Peshawar bypass of district Kohat, near Hangu road. It is partitioned in to 3 sub-camps i.e. Camp no. 1, 2 and 3.

Patient selection and Sampling

Afghan refugees residing camps in Kohat were the target population in this study. About 4 ml blood samples were collected non- randomly from susceptible respondents displaying malaria symptoms. Data of each subject was recorded on questionnaire.

Sample Preparation for diagnostic tests.

For diagnosis of different tests Blood Sampleswere transported to the Molecular Parasitology Laboratory, Department of Zoology Kohat University of Science and Technology Kohat. Following techniques were applied to get accurate results.

1. Hemoglobin Analysis

Hemoglobin level was analyzed by manual Hellige Hemometer kit (USA) as per manufacturer protocol.

2. Microscopy

For the finding of malarial parasites thin and thick smears of microscopic slides were prepared and air dried. Thin smears were then fixed by methanol and both the smears were then stained by Giemsa which was diluted 1:6 in distilled water [15].Then the slides were dried for few minutes, then washed gently with tap water and analyzed under 100x binocular microscope (Olympus Japan) with the help of immersion oil for clear visibility. A key for the detection of different stages of *Plasmodium vivax* and *Plasmodium falciparum* was used as a standard. Each slide was examined for 10-20 minutes under microscope.

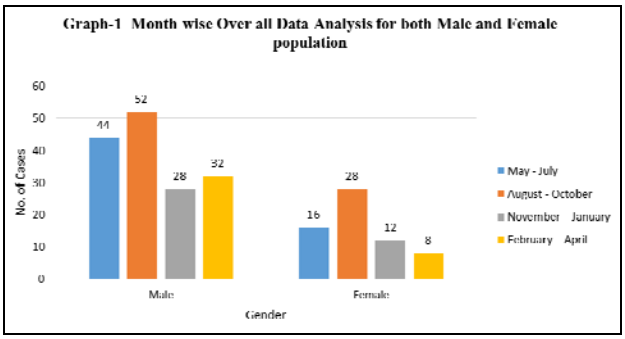
3. Rapid Diagnostic Test (RDT)

For comparative result analysis Rapid Diagnostic Test technique was performed in field by Bioline RDT (Germany) strip. About 1 ml blood was dropped on the RDT strip and then buffer was added to flush the blood on the strip. Specific bands for the *P. vivax* and *P. falciparum* were detected on the strip.

Results

Month wise Over all Data Analysis for both Male and Female population.

A total of 220 blood samples [Male = 156 (70.90%) and Female = 64 (29.09%)] were randomly collected from susceptible peoples residing in Afghan refugee Ghamkol camp district Kohat in the months of May 2011 to June 2012.In the months of May, June and July overall 60 samples were collected which consist of 44 males and 16 females. In August, September and October about 80 samples were collected out of which 52 were from male while 28 were from female. In November, December and January about 40 samples were collected from susceptible afghan refugees, in whom 28 were male and 12 were female. In the months of February, March and April a total of 40 blood samples were collected in which 32 were from male while 8 were from female population



Gender wise comparative analysis of *P. falciparum* by microscopic examination

In this study both *Plasmodium vivax* and *Plasmodium falciparum* infection was diagnosed by two basic techniques i.e. Microscopy and Rapid Diagnostic Test. Overall 6/220 (2.72%) patients were confirmed positive for *Plasmodium falciparum* infection by microscopic examination of blood smear. Among 64 female patients 6(9.37%) were confirmed positive while no male was reported positive for *P. falciparum* infection (Table-1)

Table I

Diagnostic Test	*P. falciparum* +ve (n)	Male n (%)		Female n (%)	
		+ve	*-ve*	*+ve*	*-ve*
Microscopy	6	0(0.00)	156(100.0)	6(9.37)	58(90.62)

Gender wise comparative analysis of *P. vivax* by microscopic examination

About 103/220 (46.81%) cases were confirmed positive my microscopic examination of blood smears for the infection of *Plasmodium vivax*. About 74/156(47.43%) males were confirmed positive and 82(52.56%) were found negative, while patients 26/64(40.62%) females were confirmed positive and 38(59.73%) were found negative for *P.vivax* infection (Table-II).

Table II

Diagnostic Test	*P. vivax* +ve (n)	Male n (%)		Female n (%)	
		+ve	*-ve*	*+ve*	*-ve*
Microscopy	103	74(47.43)	82(52.56)	26(40.62)	38(59.73)

Gender wise comparative analysis of *P. falciparum* by RDT

Results of RDT for the infection of *Plasmodium falciparum* were comparatively same to the microscopy, where 6/64(9.37%) female patients were confirmed positive while no male was reported positive for *P. falciparum* infection (Table-III).

Table III

Diagnostic Test	*P. falciparum* +ve (n)	Male n (%)		Female n (%)	
		+ve	*-ve*	*+ve*	*-ve*
RDT	6	0(0.00)	156(100.0)	6(9.37)	58(90.62)

Gender wise comparative analysis of *P. vivax* by RDT

RDT test revealed that overall 109/220 (49.54%) cases were confirmed positive for *Plasmodium vivax* infection. These figures were recorded high as compare to microscopy. About 78(50.00%) male patients while 28/64(43.75%) female patients were infected with *P. vivax* infection (Table-IV).

Table IV

Diagnostic Test	*P. vivax* +ve (n)	Male n (%)		Female n (%)	
		+ve	*-ve*	*+ve*	*-ve*
RDT	109	78(50.00)	78(50.00)	28(43.75)	36(56.25)

Detection of *P. vivax* and *P. falciparum* infection via microscopy and their prevalence in different age groups.

Patients were divided into 7 different age groups as shown in table-v, microscopic examination was carried out for the detection of *P.v* and *P.f* species. A total of 103/220(46.81%) samples were confirmed positive for *P.v* infection while 6/220 (2.72%) were found positive for the infection of *P.f,* in age group <1 year a total of 4(1.81%) samples were collected, no patient was confirmed positive for the infections of *P.v* and *P.f.* in age group 1-10 years a total of 46/220 (20.90%) blood samples were collected, in this age group 17/46 (36.95%) patients were confirmed positive for *P.v* Infection while 2/46 (4.34%) patients were confirmed positive for *P.f* infection. In age group 11-20 years a total of 70/220 (31.81%) respondents were included in the study among which 38/70 (54.28%) patients were confirmed positive for the infection of *P.v* while 4/70 (5.71%) were reported positive for the infection of *P.f.* In age group 21-30 about 56/220 (25.45%) respondents were included in the study. Among those 28/56 (50.00%) were positive for the infection of *P.v* while no one was confirmed positive for the infection of *P.f.* In age group 31-40 years a total of 34/220 (15.45) blood samples were collected where 16/34 (47.05) were confirmed positive for the infection of *P.v* while no one was confirmed positive for the infection of *P.f* in this group. About 4/220 (1.81) respondents of age group 41-50 were included in the study where only 2(50.00) were *P.v* positive while no case of *P.f* was observed. Similarly, out of 6/220 (2.72) samples collected from age group 50< years only 2/6 (33.33) samples were confirmed positive for *P.v* infection while no *P.f* infection was reported in this age group. A high prevalence of *P. vivax* infection 38/70 (54.28) as well as of *P. falciparum* 4/70 (5.71)was observed in age group 11-20 years (Table-V).

Table V

Age Groups (in years)	Microscopy n (%)				Total Cases
	P.v		*P.f*		
	+ve	-ve	+ve	-ve	
<1	0(0.00)	4(100.00)	0(0.00)	4(100.00)	4(1.81)
1-10	17(36.95)	29(63.04)	2(4.34)	44(95.65)	46(20.90)
11-20	38(54.28)	32(45.71)	4(5.71)	66(94.28)	70(31.81)
21-30	28(50.00)	28(50.00)	0(0.00)	56(100.00)	56(25.45)
31-40	16(47.05)	18(52.94)	0(0.00)	34(100.00)	34(15.45)
41-50	2(50.00)	2(50.00)	0(0.00)	4(100.00)	4(1.81)
51<	2(33.33)	4(66.66)	0(0.00)	6(100.00)	6(2.72)
Total	103(46.81)	117(53.18)	6(2.72)	214(97.27)	220

Detection of *P. vivax* and *P. falciparum* infection via RDT and their prevalence in different age groups.

Results of RDT were found comparatively same to the Microscopic examination of blood smears with few differences. In microscopic examination about 17/46 (36.95) patients were found positive for *P.v* infection while RDT revealed about 21/46 (45.65) patients positive for *P.v* infection. A total of 4/46 (8.69) patients were misdiagnosed by microscopy. Similarly, in age group 21-30 about 28/56 (50.00) patients were confirmed positive by microscopy while RDT confirmed 32/56 (57.14) *P.v* positive cases. 4/56 (7.14) cases were misdiagnosed by microscopy. Microscopy reported 16/34 (47.05) *P.v* positive samples in age group 31-40, while RDT revealed that only 14/34 (41.17) patients were positive for *P.v* Infection. 2/34 (5.88) samples were reported as false positive by RDT (Table-VI).

Table VI

Age Groups (in years)	RDT n (%)				Total Cases
	P.v		*P.f*		
	+ve	-ve	+ve	-ve	
<1	0(0.00)	4(100.00)	0(0.00)	4(100.00)	4(1.81)
1-10	21(45.65)	25(54.34)	2(4.34)	44(95.65)	46(20.90)
10-20	38(54.28)	32(45.71)	4(5.71)	66(94.28)	70(31.81)
21-30	32(57.14)	24(42.85)	0(0.00)	56(100.00)	56(25.45)
31-40	14(41.17)	20(58.82)	0(0.00)	34(100.00)	34(15.45)
41-50	2(50.00)	2(50.00)	0(0.00)	4(100.00)	4(1.81)
51>	2(33.33)	4(66.66)	0(0.00)	6(100.00)	6(2.72)
Total	109(49.54)	111(50.45)	6(2.72)	214(97.27)	220

Comparison of Microscopy and RDT in different age groups of Male Population for *P. vivax* infection

In gender based comparative analysis of Afghan male population, RDT confirmed 10/30 (33.33%) male positive for *P.v* infection in age group 11-20 years, while microscopy confirmed 8/30 (26.66%) males positive for it. About 3/30 (6.66%) males were misdiagnosed by microscopy. Similarly, in age group 21-30 RDT diagnosed 24/30 (63.15%) males with *P.v* infection while microscopy detected only 20(52.63%). 4/38 (10.52%) males were misdiagnosed by microscopy (Table-VII).

Table VII

Age Groups	*Microscopy n (%)*		*RDT n (%)*		Total
	P.v +ve	*P.v* -ve	*P.v* +ve	*P.v* -ve	
<1	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
1-10	8(26.66)	22(73.33)	10(33.33)	20(66.66)	30(19.23)
11-20	30(55.55)	24(44.44)	30(55.55)	24(44.44)	54(34.61)
21-30	20(52.63)	18(47.36)	24(63.15)	14(36.84)	38(24.35)
31-40	12(50.00)	12(50.00)	10(41.66)	14(58.33)	24(15.38)
41-50	2(50.00)	2(50.00)	2(50.00)	2(50.00)	4(2.56)
51>	2(33.33)	4(66.66)	2(33.33)	4(66.66)	6(3.84)
Total	74(47.43)	82(52.56)	78(50.00)	78(50.00)	156

Comparison of Microscopy and RDT in different age groups of Male Population for *P. falciparum* infection

No case of *P.f* was misdiagnosed by either of the test; results of microscopy and RDT were same as no male was positive with *P.f* infection in any age group (Table-VIII).

Table VIII

Age Groups	Microscopy n (%)		RDT n (%)		Total
	P.f +ve	*P.f*-ve	*P.f*+ve	*P.f*-ve	
<1	0(0.00)	0(100.0)	0(0.00)	0(0.00)	0(0.00)
1-10	0(0.00)	30(100.0)	0(0.00)	30(100.0)	30(19.23)
11-20	0(0.00)	54(100.0)	0(0.00)	54(100.0)	54(34.61)
21-30	0(0.00)	38(100.0)	0(0.00)	38(100.0)	38(24.35)
31-40	0(0.00)	24(100.0)	0(0.00)	24(100.0)	24(15.38)
41-50	0(0.00)	4(100.0)	0(0.00)	4(100.0)	4(2.56)
51>	0(0.00)	6(100.0)	0(0.00)	6(100.0)	6(3.84)
Total	0(0.00)	156(100.0)	0(0.00)	156(100.0)	156

Comparison of Microscopy and RDT in different age groups of Female Population for *P. falciparum* infection

Only 2/16 (12.5%) cases of *P.v* were misdiagnosed by microscopy in age group 1-10 years of female population as RDT confirmed 11/16(68.75) cases positive for *P.v* infection while microscopy diagnosed 9/16 (56.25) for the infection of *P.v* (Table-IX).

Table IX

Age Groups	Microscopy n (%)		RDT n (%)		Total
	P.v +ve	*P.v* -ve	*P.v* +ve	*P.v* -ve	
<1	0(0.00)	4(100)	0(0.00)	4(100)	4(6.25)
1-10	9(56.25)	7(43.75)	11(68.75)	5(31.25)	16(25.00)
11-20	8(50.00)	8(50.00)	8(50.00)	8(50.00)	16(25.00)
21-30	8(44.44)	10(55.55)	8(44.44)	10(55.55)	18(28.12)
31-40	4(40.00)	6(60.00)	4(40.00)	6(60.00)	10(15.62)
41-50	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
51>	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Total	29(45.31)	35(54.68)	31(48.43)	33(51.56)	64

Comparison of Microscopy and RDT in different age groups of Female Population for *P. falciparum* infection

Results of microscopy and RDT were same as No case of *P.f* was misdiagnosed by either of the test (Table-X).

Table X

Age Groups	Microscopy n (%)		RDT n (%)		Total
	***P.f* +ve**	***P.f* -ve**	***P.f* +ve**	***P.f* -ve**	
<1	0(0.00)	4(100.0)	0(0.00)	4(100.0)	4(6.25)
1-10	2(12.5)	14(87.50)	2(12.5)	14(87.50)	16(25.00)
11-20	4(25.00)	12(75.00)	4(25.00)	12(75.00)	16(25.00)
21-30	0(0.00)	18(100.0)	0(0.00)	18(100.0)	18(28.12)
31-40	0(0.00)	10(100.0)	0(0.00)	10(100.0)	10(15.62)
41-50	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
51>	0(0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Total	6(9.37)	58(90.62)	6(9.37)	58(90.62)	64

Month wise Comparative Data analysis in Male and Female for Microscopy

A total of 106 samples were confirmed positive by microscopy, out of them 71(66.98%) were male while 35(33.01%) were female. In the months of May - July a total of 36 (33.96%) samples were collected, out of them 26 (72.22%) males and 10 (27.77%) females were positive for the infection of *P. vivax.* In the months of August - October, a total of 56(52.83%) samples were collected, 39(69.64%) males and 11(19.64%) females were positive for the infection of *P. vivax,* while 6(10.71%) females were positive for the infection of *P. falciparum.* In the months of November - January, a total of 8(7.54%) samples were collected, out of them 2(25.00%) males and 6(75.00%) females were positive for the infection of *P. vivax.* In the months of February - April, a total of 6(5.66%) samples were collected, out of them 4(66.66%) males and 2(33.33%) females were positive for the infection of *P. vivax.* A comparatively high percentage of malaria infection was found in the months of August - October (Table-XI).

Table XI

Months	Total (n)	Male		Female	
		P.v	***P.f***	***P.v***	***P.f***
		+ve	**+ve**	**+ve**	**+ve**
May - July	36 (33.96)	26(72.22)	0(0.00)	10(27.77)	0(0.00)
August - October	56(52.83)	39(69.64)	0(0.00)	11(19.64)	6(10.71)
November - January	8(7.54)	2(25.00)	0(0.00)	6(75.00)	0(0.00)
February - April	6(5.66)	4(66.66)	0(0.00)	2(33.33)	0(0.00)
Grand Total	106	71(66.98)	0(0.00)	29(27.35)	6(5.66)

Month wise Comparative Data analysis in Male and Female for RDT

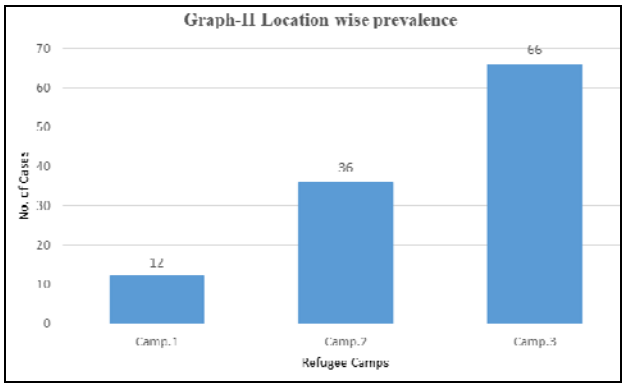
A total of 112 samples were confirmed positive by RDT out of them 75(66.96%) were male while 37/112 (33.03%) were female. In the months of May - July a total of 36(32.14%) samples was collected, out of them 28(77.77%) males and 8(22.22%) females were positive for the infection of *P. vivax.* In the months of August 2011 - October 2011, a total of 58(51.78%) samples were collected, 41(70.68%) males and 11(18.96%) females were positive for the infection of *P. vivax,* while 6(10.34%) females were positive for the infection of *P. falciparum.* In the months of November - January, a total of 8(7.14%) samples were collected, out of them 2(25.00%) males and 6(75.00%) females were positive for the infection of *P. vivax.* In the months of February - April, a total of 10(8.92%) samples were collected, out of them 4(40.00%) males and 6(60.00%) females were positive for the infection of *P. vivax* (Table-XII).

Table XII

Months	Total (n)	Male		Female	
		P.v	***P.f***	***P.v***	***P.f***
		+ve	**+ve**	**+ve**	**+ve**
May - July	36(32.14)	28(77.77)	0(0.00)	8(22.22)	0(0.00)
August - October	58(51.78)	41(70.68)	0(0.00)	11(18.96)	6(10.34)
November - January	8(7.14)	2(25.00)	0(0.00	6(75.00)	0(0.00)
February - April	10(8.92)	4(40.00)	0(0.00)	6(60.00)	0(0.00)
Grand Total	112	75(66.96)	0(0.00)	31(27.67)	6(5.35)

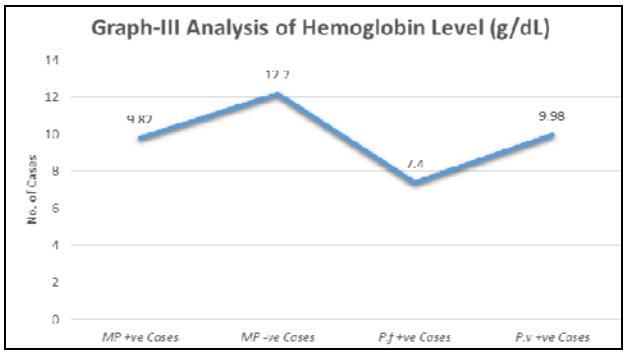
Location wise prevalence

Afghan refugee Ghamkol camp is divided in to three parts i.e. Sub-campno.1, 2 and 3. 54/220 (24.54%) Samples were collected from Sub-camp. 1, out of which 12/54 (22.22%) were positive and 42/54 (77.77%) were negative. 100/220(45.45%) samples were collected from Sub-camp no.2 out of which 36/100 (36.00%) were positive and 64/100 (64.00%) were negative. While out of 64/220 (30.00%) samples collected in Sub-camp no.3, 62/64(96.87%) were positive and only 2 were negative. A large number of population 62/64 (96.87%) was observed positive in Sub-camp no.3 (Graph-II).



Comparative Analysis of Hemoglobin level in both infected in non-infected population

An average low Hb level i.e. 9.82gm/dL was observed in overall malaria positive cases as compare to negative ones which was 12.2gm/dL. An average Hemoglobin level in *P. vivax* positive population was about 9.98 gm/dL while in *P. falciparum* positive cases it was 7.4gm/dL. Low Hb level was observed in the infection of *P. falciparum* (Graph-III)**.**



Discussions

Malaria is one of the major health complications throughout the world. Malaria is caused by many species of plasmodium parasite, its proper identification during diagnosis is very important for its treatment as there are so many morphological forms of this parasite [10]. As malaria is also a health issue in Afghanistan so there was a threat to Pakistan as well because of a large amount of population flow from Afghanistan [11]. The current study revealed that Afghan refugees are at higher risk of malaria Infection as Refugee camps are not in condition as they should be. This study is quite parallel to a study conducted by Suleman, 1988 [9]. There are a large number of mosquito breeding sites due to ponds and water logging conditions. Refugees are always dependents and are in poor socioeconomic conditions, they cannot afford their basic facilities that are why they are unable to protect themselves from such infections and diseases. In current study it was revealed that the basic reason for getting malaria infection is poor hygienic conditions and mosquito breeding sites in refugee camps. This study shows same results with the statistics of W.H.O, 1990 and Zulueta, 1989 [12, 13]. Current study revealed 109/220 (49.54%) *P.v* positive cases while 6/220 (2.72%) *P.f* cases in all age groups, these findings are somewhat matching with the study of Idrees *et al*., 2007 [14] In this study it was reported that Malaria infection was more prevalent in the month of August, September and October i.e. *P.v* was 41/58 (70.68%) while *P.f* was about 11/58 (18.96). These months are humid and temperature is suitable for mosquito breeding so there is a large amount of mosquitos near breeding sits that is why in these months the infection of Malaria is at its elevated level.

Conclusions

About 4/156 (2.56%) samples from male patients while 2/64 (3.12%) samples from female patients were reported negative by microscopy while they were confirmed positive by RDT. This may be due to lack of expertise required to the identify *Plasmodium* species. As RDT is a field diagnosis technique and based on ELISE so there are minimal chances of error in the diagnosis of *P.v* and *P.f* species. Afghan teen-agers are more susceptible for getting Malaria infection. There is logic behind this high prevalence, Majority of Afghan refugees are totally dependents on aids provided by govt. of Pakistan as well as by Non-government organizations, they are jobless, to meet their basic requirement they choose child labour as well. Afghani refugee Children of age group 10-20 (in Pakistan) wander over streets and collect garbage and trash, they spend their most of the time in unhygienic condition. Most of them are spotted taking bath in ponds and stagnant water which are specifically mosquito breeding site, which is why this age group is more prone to get Malaria infection. RDT is a reliable field diagnostic technique but often it gives false positive results in low parasitemia. In this study male were found more infected with the infection of *P. vivax* i.e. 78/156 (50.00%), no male was found positive for the infection of *P. falciparum.* About 6/64(9.37%) female we confirmed positive for *P. falciparum* infection. A comparatively high percentage of malaria infection was found in the months of August – October i.e. 39/56 (69.64%) as they are considered to be humid months in Pakistan, this season is very favorable for mosquito breeding. In this study it is revealed that Afghan Refugee sub-camp no. 3 is more prone to malaria infection as this area consist of a poor sanitary system and a large no. of mosquito breeding sites in the form of stagnant water and ponds. It is concluded from this study that malaria infection has a drastic affect in decreasing level of Haemoglobin. The Level of Haemoglobin was observed more decreasing in the infection of *P. falciparum* as compare to the *P. vivax* infection.

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