FREQUENCY OF VARIOUS HUMAN MALARIA INFECTIONS IN HOTTEST AREAS OF CENTRAL BALOCHISTAN, PAKISTAN: DUKI, HARNAI, AND SIBI

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ABSTRACT

Objective: This study was designed to assess the frequency of malaria infection in human population Duki, Harnai and Sibi the hottest areas of centre Balochistan, Pakistan.

Study Design: A descriptive study.

Place and duration of study: The study was conducted in Balochistan from July 2004 to June 2006.

Patients and Methods: This study was conducted in Duki (8 localities), Harnai (7 localities) and Sibi (10 localities) and malarial parasites were identified in the blood slides of suspected patients from July, 2004 to June, 2006 and encompassed 6730 subjects.

Results: Out of 6730 suspected cases of malaria, 2304 (34.2%) were found to be positive for malarial parasite in blood smear slides. Out of positive cases, 1316 (57.1%) were identified as Plasmodium falciparum infection, 988 (42.8%) cases with P. vivax. Seasonal variation was also noted in Duki area with highest (81.8%:36/44) infection of P. falciparum. in April and lowest (72.2%:26/36) infection in December. In Harnai area highest (84.2%:32/38) infection of P. falciparum in December and lowest (61.1%:11/18) infection in January. Similarly, in Sibi area highest (81.5%:31/38) infection of P. vivax in August and lowest (58.8%:30/51) infection in May. Infection with P. falciparum in male in Duki area was 62.5 % (10/16), 68.9% (60/87) in Harnai, 63.1% (24/38), infection with P. vivax in Sibi area, while in females 27.2% (6/22), 31.7% (13/41) and 21.4 % (36/168) respectively. There was no case of P. malaria and P. ovale infection observed in the present study.

Conclusion: Human Malaria is quite frequent in the Duki, Harnai and Sibi, which were the hottest areas of Balochistan in Pakistan. In clinically suspected cases of malaria, there are very high slide positivity rate. Plasmodium falciparum is slightly more frequent. In Duki and Harnai, plasmodium falciparum is more frequent while in Sibi Plasmodium vivax was most frequent. This high frequency of Human malaria infection should be of great concern for authorities at malaria control programme in Pakistan.

Keywords: Human malarial infection, P. falciparum, P. vivax

INTRODUCTION

Malaria is one of the most devastating diseases in the World. Over 3 billion people live under the threat of malaria in 24 endemic countries [1] and it kills over a million each year- mostly children [2].

Falciparum and vivax malaria are major health problems in Pakistan. In the last decade there has been a six fold increase in falciparum malaria, which now comprises 42% of all malaria cases recorded by National Malaria Control Program (MCP) [3]. Factors

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associated with the upsurge include of chloroquine resistance across the country [3], warmer autumns favoring prolonged transmission [4], and a chronic decline in vector control activities. Anopheles culicifacies, the purported primary vector in the Punjab province [5] was found more or less disappeared by September whereas A. stephensi was found more abundant and more common in North-West Frontier Province than A. culicifacies. In Pakistan and in Duki, Harnai and Sibi also the primary vector species are A. culicifacies and A. stephensi [6-10].

In Pakistan Hozhabri et al. [11] studied prevalence of plasmodium slide positivity among the children treated for malaria at Rural Health Center (RHC) Jhangara, Sindh and observed slide positivity rate 5.9 % (26/438). Bhalli and Samiullah [12] investigated a reviewed 120 cases of falciparum malaria at CMH, Multan to evaluate seasonal variation and modes of presentation. They observed high incidence of falciparum malaria among troops in the moths of August to November. Akbar [13] reported malaria at a children hospital Baqai Medical University and observed high incidence of falciparum as compared to vivax (65% vs 35%). Mohammad and Hussain [14] studied prevalence of malaria in general population of district Buner and highest rate of infection (11.6%) was recorded in August while the lowest rate of infection (3.9%) was noted in March. Malaria in pediatric age group of 200 cases was investigated by Jamal et al. [15] and found high rate of P. vivax (62.5%) than P. falciparum. (36%). Malaria in Karachi and other areas in Sindh was studied by Mahmood [16] and observed P. vivax to be two times higher than P. faciparum. Nizamani et al. [17] found that P. falciparum ratio was noted to be increasing in many districts of Sindh. Malaria in North West Frontier Province (NWFP) was studied by Saleem et al [18] and observed cerebral malaria more common in males and most vulnerable group was pregnant ladies. Akbar et al [19] investigated malaria in children in Mansehra and observed 142 cases suffering from vivax and 12 from falciparum out of 160 cases. Idris et al [20] while studying pattern of malarial infection at Ayub Teaching Hospital Abbottabad found that out of 1994 patients screened, 145 (7.2%) were found infected. P. vivax was seen in the majority (72.4%) than P. falciparum (24.1%).

In Balochistan too, cerebral malaria is a major community problem. Nawaz and Yasmin (21) studied the prevalence of malaria in Afghan refugees settled in urban areas of district Quetta. Durrani et al. [22] studied epidemiology of cerebral malaria and its mortality in patients of Quetta city. Malaria at Zhob Garrison was studied by Khadim [23] during the years 2000 and 2001 and found 665 patients positive for malaria out of 5650 cases. Yasinzai and Kakarsulemankhel [24, 25] investigated the incidence of malaria infection in urban and rural areas of Quetta district. Malaria Control Program (MCP) Balochistan in its yearly reports showed positivity rate 10.1%, P. vivax 6.6%, P. falci[parum 3.5%, 11.2%, 6.6%,4.6% and 12.7%, 8.2%, 4.4% in 2004, 2005, and 2006 respectively [8-10]. Sheikh et al. [26] observed slide positivity 34.8% (91679/2, 63, 018) in Quetta during 1994-1998. While studying malaria in central areas of Balochistan (Mastung, Khuzdar districts), Yasinzai and Kakarsulemankhel [27] observed 2092 (26.6%) confirmed cases of malaria out of 7852 in the year 2004-2006. However, the present study was carried out to determine frequency of malarial parasites in human populations residing in the district of Duki, Harnai and Sibi area.

PATIENTS AND METHODS

A survey was conducted during July, 2004 to June, 2006 in [8,7 & 10] localities of Duki, Harnai and Sibi areas respectively to record and screen species of malarial parasites present in the blood of human patients suffering from malaria.

Location:

Duki (Lat 300,680 Long, Height 1090 M), Harnai (L300, 670L, H 910 M) and Sibi (L290, 670L, H130 M) districts are situated at the

north-eastern side of Balochistan province adjoining in the east with Kohlu district and in the west with Sanjavi and Ziarat area of the province where cases of human malaria are very frequent.

Malaria cases were detected by adapting two ways [28]. Passive case detection (PCD) technique (where blood films were taken from the patients presenting themselves to a health station with symptoms of shivering and fever or a history suggestive to malaria) and is active case detection (ACD) (in which home visits were made to the persons with sign or symptoms of malaria and blood films of both thin and thick were prepared). Blood slides were taken back to the laboratory where they were stained in Giemsa's stain (28). Identification of species of malarial parasites was made from the keys furnished by Sood [29].

STATISTICAL ANALYSIS

Data was analyzed using SPSS version 11.0. Frequency alongwith percentages were used to describe the data. Chi-square test was applied to check the association between age and types of infection. P-value <0.05 was considered significant.

RESULTS

A total of 6730 blood smears were prepared from the various age groups of more than 1 year of age, residing in eight, seven and ten different localities of Duki (table 1-4), Harnai (table 5-8) and Sibi (table 9-12) respectively. However, variations were observed among different localities having different hygienic conditions.

In Duki area (table 1-4), the over all percentage of Plasmodium slide positivity was 33.4 % (710/2125), wherein P. falciparum positivity was observed to be highest (78.5 %: 558/710) as compared with that of P. vivax (21.4 %:152/710). Among Plasmodium slide positivity, children (1-10 years), 83.8 % (99/118) were positive for P. falciparum and 16.1 % (19/118) for P. vivax. The commonest species of malarial parasites observed was P. falciparum (fig. 1) with a highest percentage of 83.9% (99/118) in age group of (1-10) years followed by 78.9 % (217/275) in the age group of 21 years and above, 76.3% (242/317) in the age group of 11- 20 years and above. P. vivax (fig. 2) was also observed to be present in our study but comparatively with a less ratio Association between age and types of infection was found to be statistically insignificant in Duki area (P>0.05)

However, seasonal variation was also noted in Duki area with highest (81.8%:36/44) infection of P. falciparum. in April and lowest (72.2%:26/36) infection in December. Infection with P. falciparum in male in Duki area was 62.5 % (10/16) while in female 27.2% (6/22).

In Harnai area (table 5-8), the over all percentage of Plasmodium slide positivity was 36.9% (640/1734) wherein P. falciparum infection was found to be highest (77.2%:494/640) as compared with the P. vivax (22.8%:146/640). The commonest species of malarial parasites observed was P. falciparum with a highest percentage of 82.9% (102/123) in age group 1-10 years followed by 78.6 % (221/281) in the age group of 11-20 years and 72.4 % (171/236) in the age group of 21 years and above. There was statistically insignificant association between age and types of infection (P>0.05). In Harnai area highest (84.2%:32/38) infection of P. falciparum was observed in December and lowest (61.1%; 11/18) infection in January. Infection percentage of P. falciparum in male was 68.9% (60/87) and in female 31.7% (13/41).

In Sibi area (table 9-12), the over all percentage of Plasmodium slide positivity was 33.2 % (954/ 2871) wherein P. vivax infection was found to be highest (72.3 %: 690/954) as compared with the P. falciparum (27.7%: 264/954). Seasonal variation was also noted in Sibi area with the highest (81.5%: 31/38) infection of P. vivax in August and lowest (58.8%: 30/51) in May. Whereas percentage of infection of P. vivax in male was 63.1% (24/38) and female was 21.4% (36/168). Among Plasmodium slide positivity, children (1-10 years), 70.3 %

(244/347) were found to be positive for P. vivax and 29.6 % (103/347) for P. falciparum. The commonest species of malarial parasites observed was P. vivax with a highest 77.7 % (189/243) in the age group of 11- 20 years and 70.6 % (257/364) in the age group of 21 years and above. However, P. falciparum was also found to be present with a low ratio viz., 29.3 % (107/364), 22.2% (54/243) in the age groups of 21 years and above and 11-20 years respectively. Statistically insignificant association was observed between age and types of infection (P>0.05)

DISCUSSION

Malaria affects an estimated 300 million people and causes more than a million deaths per year worldwide. Falciparum malaria has high mortality as it causes complications like cerebral malaria, renal failure and algid malaria (12).

In Duki and Harnai area the percentage of P. falciparum was observed to be higher 78.5 and 77.1 % respectively as higher rate of P. falciparum was also noted by Akbar (65%) (13) in Children Hospital, Baqai Medical

Table-1: Area and age wise percentage of malaria infection in Duki.

Area	Age (Years)	No of slides examined	Table No of +ve	No of +ve p. vivax (%)	Species wise p. falciparum (%)
Duki	1-10	111	26	4(15.3)	22(84.6)
	11-20	160	56	15(26.7)	41(73.2)
	21-above	152	52	13(25)	39(75)
Baghao	1-10	59	10	2(20)	8(80)
	11-20	74	30	7(23.3)	23(76.6)
	21-above	68	22	5(22.7)	17(77.2)
Panni Kot	1-10	28	8	2(25)	6(75)
	11-20	82	32	7(21.8)	25(78.1)
	21-above	74	28	5(17.8)	23(82.1)
Nanasaheb Ziarat	1-10	79	23	3(13)	20(86.9)
	11-20	132	46	11(23.9)	35(76)
	21-above	142	42	8(19)	34(80.9)
Ismail Shaher	1-10	39	10	2(20)	8(80)
	11-20	88	34	8(23.5)	26(76.4)
	21-above	76	32	6(18.7)	26(81.2)
Ustarana	1-10	43	13	2(15.3)	11(84.6)
	11-20	72	29	6(20.6)	23(79.3)
	21-above	64	26	5(19.2)	21(80.7)
Hoshrhi Shaher	1-10	83	18	3(16.6)	15(83.3)
	11-20	136	48	12(25)	36(75)
	21-above	128	41	8(19.5)	33(80.4)
Tikka	1-10	37	10	1(10)	9(90)
	11-20	94	42	9(21.4)	33(78.5)
	21-above	104	32	8(25)	24(75)

Table-2: Month wise percentage of malaria infection in Duki area

Month	No of slides examined	Total No of +ve	p. vivax (%)	p. falciparum (%)
July 2004	230	72	14(19.4)	58(80.5)
August	336	108	23(21.2)	85(78.7)
September	384	134	29(21.6)	105(78.3)
October	172	54	12(22.2)	42(77.7)
November	136	42	8(19)	34(80.9)
December	114	36	10(27.7)	26(72.2)
January	76	16	4(25)	12(75)
February	68	22	5(22.7)	17(77.2)
March	104	26	6(23)	20(76.9)
April	124	44	8(18.1)	36(81.8)
May	178	70	14(20)	56(80)
June 2006	203	86	19(22)	67(77.9)
Total	**2125**	**710**	**152(21.4)**	**558(78.5)**

Table-3: Age wise over all percentage of malaria infection in Duki.

Age (Years)	No of slides examined	Total no of +ve	Over all % infection	Infection by p. vivax (%)	Infection by p. falciparum
1-10	465	118	25.3	19(16.1)	99(83.8)
11-20	846	317	37.4	75(23.6)	242(76.3)
21-above	814	275	33.7	58(21)	217(78.9)
Total	**2125**	**710**	**33.4**	**152(21.4)**	**558(78.5)**

Table-4: Month and Sex wise percentage of malaria infection in Duki.

Month	No of slides examined	Total No of +ve	Male		Female	
			p. v	p.f	p.v	p.f
July 2004	230	72	11	43	4	14
August	336	108	16	64	6	22
September	384	134	17	81	7	29
October	172	54	9	31	4	10
November	136	42	6	26	2	8
December	114	36	6	18	4	8
January	76	16	4	10	0	2
February	68	22	4	12	0	6
March	104	26	4	14	2	6
April	124	44	8	24	3	9
May	178	70	10	40	5	15
June 2006	203	86	13	49	7	17

Table-5: Area and Age wise percentage of malaria infection in Harnai.

Area	Age (Years)	No of slides examined	Table No of +ve	No of +ve p. vivax (%)	Species wise p. falciparum (%)
Harnai City	1-10	93	30	6(20)	24(80)
	11-20	165	67	13(19.4)	54(80.5)
	21-above	127	56	16(28.5)	40(71.4)
Nakus	1-10	41	13	3(23)	10(76.9)
	11-20	82	34	8(23.5)	26(76.4)
	21-above	83	26	7(26.9)	19(73)
Shahrag	1-10	80	22	4(18.1)	18(81.8)
	11-20	134	58	11(18.9)	47(81)
	21-above	114	39	11(28.2)	28(71.7)
Zinda Pir	1-10	38	13	2(15.3)	11(84.6)
	11-20	67	21	4(19)	17(80.9)
	21-above	76	25	8(32)	17(68)
Sunari	1-10	23	12	1(8.3)	11(91.6)
	11-20	60	30	7(23.3)	23(76.6)
	21-above	68	24	6(25)	18(75)
Babiyaan	1-10	72	19	3(15.7)	16(84.2)
	11-20	125	49	11(22.4)	38(77.5)
	21-above	99	38	10(26.3)	28(73.6)
Tukka	1-10	43	14	2(14.2)	12(85.7)
	11-20	69	22	6(27.2)	16(72.7)
	21-above	75	28	7(25)	21(75)

University, Karachi, Hozhabri et al. (11) (65%) in Jhangara, Sindh and Yasinzai and Kakarsulemankhel (24,25) (65.8%) in Quetta rural and 55.5% in urban area respectively. Slide positivity rate was 16.2% in Quetta rural and 15.4% in Quetta urban as compared to 33.4% in Duki and 36.9% in Harnai district.

During present study in Sibi district high rate of slide positivity (33.2%) and high rate of P. vivax (72.3%) was observed than to the lower rate of slide positivity in Sibi 7.3%,7.5%,6.8% and P. vivax 82.3%, 64.9%, 59% and P. falciparum 17.6%, 35.%, 40.9% reported by MCP [8-10] respectively.

Table-6: Month wise percentage of malaria infection in Harnai area

Month	No of slides examined	Total No of +ve	p. vivax (%)	p. falciparum (%)
July 2004	190	57	11(19.2)	46(80.7)
August	210	62	13(20.9)	49(79)
September	231	68	16(23.2)	52(76.4)
October	253	91	20(21.9)	71(78)
November	131	41	8(19.5)	33(80.4)
December	71	38	6(15.7)	32(84.2)
January	37	18	7(38.8)	11(61.1)
February	41	21	8(38)	13(61.9)
March	79	36	9(25)	27(75)
April	134	48	12(25)	36(75)
May	169	73	17(23.2)	56(76.7)
June 2006	188	87	19(21.8)	68(78.1)
Total	**1734**	**640**	**146(22.8)**	**494(77.1)**

Table-7: Age wise over all percentage of malaria infection in Hanrnai

Age (Years)	No of slides examined	Total no of +ve	Over all % infection	Infection by p. vivax (%)	Infection by p. falciparum
1-10	390	123	31.5	21(17)	102(82.9)
11-20	702	281	40	60(21.3)	221(78.6)
21-above	642	236	36.7	65(27.5)	171(72.4)
Total	**1734**	**640**	**36.9**	**46(22.8)**	**494(77.1)**

Table-8: Month and Sex wise percentage of malaria infection in Harnai

Month	No of slides examined	Total No of +ve	Male		Female	
			p. v	p.f	p.v	p.f
July 2004	190	57	4	37	2	14
August	210	62	6	41	3	12
September	231	68	7	36	4	21
October	253	91	11	51	5	24
November	131	41	3	24	1	13
December	71	38	4	21	2	11
January	37	18	5	8	2	3
February	41	21	7	8	1	5
March	79	36	6	17	3	10
April	134	48	5	28	2	13
May	169	73	4	47	2	20
June 2006	188	87	3	60	1	23

Similarly, low slide positivity rate (2.3%) was observed by Jan and Kiani [30] in Kashmiri refugees settled in Muzaffarabad, Azad Kashmir and with a high prevalence of P. vivax (6.3%) than of P. falciparum (0.6%). Akbar et al. (19) found in children of Mansehra high rate of slide positivity (96.2%) and high rate of prevalence of P. vivx (92.2%) than of P. falciparum (7.7%). Nizamani et al. [17] observed in Sindh 24.1% slide positivity rate and found slowly increasing rate of P. falciparum 33 and 37.2% in the years 2004 and 2005. Idris et al. [20] noted a low slide positivity rate 7.2% at Ayub Teaching Hospital Abbottabad and high rate of P. vivax (72.4%) as compared to P. falciparum (24.1%). Yasinzai and Kakarsulemankhel [27] while studying prevalence of malaria in Mastung and Khuzdar districts found high rate of slide positivity (26.6%) and high prevalence rate of P. vivax (62.5%). In desert area of district Kharan slide positivity rate was observed 43.4% and high prevalence rate of P. vivax (88.6) than of P. falciparum (11.3%) by Yasinzai and Kakarsulemankhel [27]. Low rate 9.6% of slide positivity and high rate of P. vivax 61% was observed in Iranian parts of south-east of Caspian Sea [28].

Table-9: Area and age wise percentage of malaria infection in Sibi.

Area	Age (Years)	No of slides examined	Table No of +ve	No of +ve p. vivax (%)	Species wise p. falciparum (%)
Sibi City	1-10	174	54	40(74)	14(25.9)
	11-20	117	47	35(74.4)	12(25.5)
	21-above	176	61	42(68.8)	19(31.1)
Talli	1-10	108	38	26(68.4)	12(31.5)
	11-20	103	40	31(77.5)	9(22.5)
	21-above	136	47	35(74.4)	12(25.5)
Khajak	1-10	123	42	29(69)	13(30.9)
	11-20	109	35	27(77.1)	8(22.8)
	21-above	144	50	37(74)	13(26)
Loni	1-10	121	39	27(69.2)	12(30.7)
	11-20	92	30	24(80)	6(20)
	21-above	112	41	30(73.1)	11(26.8)
Dehpal Killa	1-10	92	30	20(66.6)	10(33.3)
	11-20	69	16	13(81.2)	3(18.7)
	21-above	81	33	25(75.7)	8(24.2)
Bakhara G. Bulak	1-10	84	33	21(63.6)	12(36.3)
	11-20	57	15	11(73.3)	4(26.6)
	21-above	79	29	17(58.6)	12(41.3)
Gullu Shaher	1-10	111	44	28(63.6)	16(36.3)
	11-20	74	23	17(73.9)	6(26)
	21-above	113	39	26(66.6)	13(33.3)
Murghazani	1-10	76	26	18(69.2)	8(30.7)
	11-20	50	12	10(83.3)	2(16.6)
	21-above	77	25	17(68)	8(32)
Allahabad	1-10	68	18	16(88.8)	2(11.1)
	11-20	48	14	12(85.7)	2(14.2)
	21-above	64	21	15(71.4)	6(28.5)
Gharib Abad	1-10	80	23	19(82.6)	4(17.3)
	11-20	66	11	9(81.8)	2(18.8)
	21-above	67	18	13(72.2)	5(27.7)

Table-10: Month wise percentage of malaria infection in Sibi

Month	No of slides examined	Total No of +ve	p. vivax (%)	p. falciparum (%)
July 2004	199	41	29(70.7)	12(29.2)
August	183	38	31(81.5)	7(18.4)
September	243	78	47(60.2)	31(39.7)
October	271	91	61(67)	30(32.2)
November	301	107	83(77.5)	24(22.4)
December	231	72	51(70.8)	21(29.1)
January	193	57	43(57.4)	14(24.5)
February	211	74	52(70.2)	22(29.7)
March	344	168	128(76.1)	40(23.8)
April	332	145	112(77.2)	33(22.7)
May	202	51	30(58.8)	21(41.1)
June 2006	161	32	23(71.8)	9(28.1)
Total	**2871**	**954**	**690(72.3)**	**264(27.6)**

During present study no mixed infection was observed as the same was also not observed by Yasinzai and Kakarsulemankhel [24, 25 & 27] in rural and urban areas of Quetta district, in Mastung and Khuzdar districts [8-10] respectively. in Sibi district, however, the same was seen 2.3% in Quetta district [26] and Multan district [29], 3.44% at Ayub Teaching Hospital Abbottabad [20], 18.3% in Iranian part of south-east of Caspian Sea (28). P. malaria and P. vivax were not seen in the present study, nor seen by Yar et al [29] and Idris et al [20].

Table-11: Age wise over all percentage of malaria infection in Sibi

Age (Years)	No of slides examined	Total no of +ve	Over all % infection	Infection by p. vivax (%)	Infection by p. falciparum
1-10	1037	347	33.46	244(70.3)	103(29.6)
11-20	785	243	30.95	189(77.7)	54(22.2)
21-above	1049	364	34.69	257(70.6)	107(29.3)
Total	**2871**	**954**	**33.22**	**690(72.3)**	**64(27.6)**

Table-12: Month and Sex wise percentage of malaria infection in Harnai

Month	No of slides examined	Total No of +ve	Male		Female	
			p. v	p.f	p.v	p.f
July 2004	199	41	23	9	6	3
August	183	38	24	3	7	4
September	243	78	37	20	10	11
October	271	91	50	16	11	14
November	301	107	64	10	19	14
December	231	72	39	11	12	10
January	193	57	34	9	9	5
February	211	74	38	11	14	11
March	344	168	92	31	36	9
April	332	145	81	9	31	24
May	202	51	21	13	9	8
June 2006	161	32	19	6	4	3

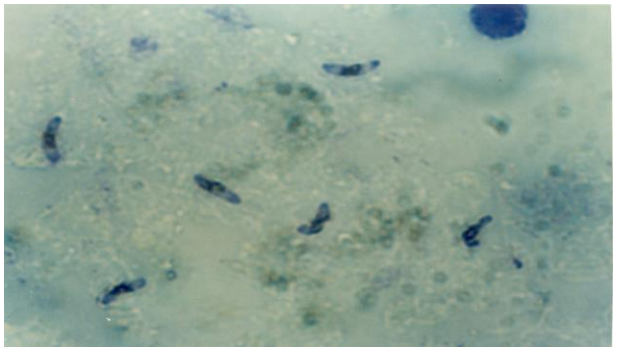

Fig-1: Gametocyte and Ring stage of P. falciparum in blood smear (x100) of malaria patient.

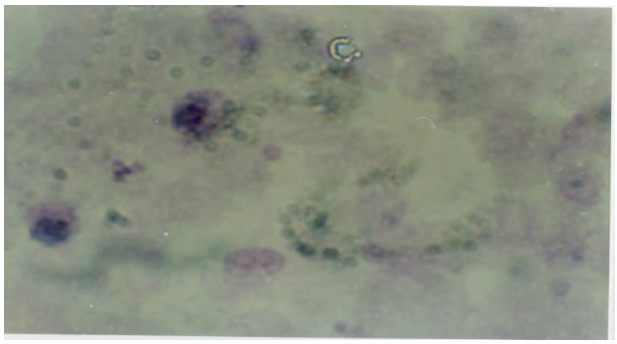

Fig-2: Gametocyte and ring stage of P. vivax in blood smear (x100) of malaria patient.

CONCLUSION

Human Malaria is quite frequent in the Duki, Harnai and Sibi, which were the hottest areas of Balochistan in Pakistan. In clinically suspected cases of malaria, there are very high slide positivity rate. Plasmodium falciparum is slightly more frequent. In Duki and Harnai, plasmodium falciparum is more frequent while in Sibi Plasmodium vivax was most frequent. This high frequency of Human malaria infection should be of great concern for authorities at malaria control programme in Pakistan.

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