I

INTRODUCTION

Malaria is an ancient disease and the name malaria was derived from the Italian word mala (bad) and aria (air). It was believed that malaria was caused by bad air. Malaria meaning bad air was so named because of the association of the diseases with the odorous air of swamp, particularly at night (Chandler & Clark, 1961).

Malaria is one of the wide spread and most devastating protozoal disease. It is serious cause of morbidity and mortality for people living in endemic area.

The symptoms of malaria were described in ancient Chinese medical writings. In 2700 BC, several characteristic symptoms of malaria were described in Neiching. Malaria became widely recognized in Greece by the 4^{th} century in the Susruta, a Sannskirt medical treatise, the symptoms of malaria fever were described and attributed to the bites of certain insects. The malarial parasite was first described by Charles Louis Alphonse Laveran, a French army surgeon stationed in Constantine, Algeria in 1880 from the blood of a patient suffering from malaria.

Four pathogenic species of *Plasmodium* parasitic to man are *P. vivax, P. falciparum, P. ovale* and *P. malariae* which results in 4 kinds of malaria fever.

- *P. vivax* (Grassi & Feletti, 1890): Benign simple or tertian malaria.
- *P. falciparum* (Welch, 1897): Malignant tertian, sub-tertian. Astivo autumnal malaria.
- *P. malariae* (Stephens, 1881): Quartan malaria.
- *P. ovale* (Stephens, 1992): Ovale tertian malaria.

It is a disease resulting from infection by minute protozoan parasite of the genus *Plasmodium*. There are nearly 120 species of *Plasmodium* not only infecting man but also apes, monkeys, birds, and other vertebrate host (Bruce- Chwatt, 1993).

The recognition that profound differences exist between the various species has led to the further sub division into various sub-genera (Smyth,1996). Some estimates

indicate *P. vivax* may account for 80% of the infection and is widely distributed in tropics, subtropics and temperate zones (Ichhupaujani & Bhatia, 1998).

About 60 known species of *Plasmodium* cause malaria in man and other animals. These species are commonly referred as malarial parasites. *Plasmodium* is transmitted from infected to healthy person by the bite of infected *Anopheline* mosquitoe and affects mainly the RBC and reticulo-endothelial (RE) systems (Kotpal, 2005).

The four species of *Plasmodium* known to infect man do not produce disease in lower animals (Craig & Faust 1970).Among the 4 species of the parasite only *P. vivax* and *P. falciparum* are reported infecting the people of Nepal (WHO, 1963).

Malaria is seen in all countries extending from 40^0S to 60^0N of the equator covering a large protion of the tropical and subtropical regions. Highly endemic areas are often seen in tropical region when humidity and temperature are favorable for the breeding of *Anopheles* mosquitoes and growth of the parasites in the insect vector.

The life cycle of *Plasmodium* in human is complicated. Malaria parasites show alteration of generation with alteration of hosts. Man is the intermediate host and mosquitoes are the definitive hosts of the parasite.

In context of Nepal only 4 species of *Anopheles* mosquitoes are responsible for the transmitting human malarial parasites which are *A. minimus, A. flaviatilis, A annularis* and *A. maculatus* (VBDRTC, 1999).

The incubation period varies according to the species of *Plasmodium*
Plasmodium vivax-8-31 days
P. falciparum-7-27 days
Plasmodium malariae -8-37 days
Plasmodium ovale-8-31 days

The diagnosis of malarial parasites can be confirmed through the preparation of thick and thin blood films from peripheral blood (Park and Park, 2000).

It is accepted that for the control of malaria either distribution of effective drugs like Choloquine, Quinine, Sulphadoxine and Pyrimethyamine (combinely) or control of vector and vector breeding sites are faithful.

Epidemiology

The situation of malaria in context of the world is not so satisfactory. Malaria is endemic in 107 countries and territories where 40% of the worlds population lives. (http://ww.unicef.org/infobycountry/zambia-2008)

Approximately 300 million (world wide) people are affected by malaria. Previously extremely wide spread malaria was mainly confined to Africa, Asia and Latin America. The problems of controlling malaria in these countries were aggravated by inadequate health structure and poor socio economic conditions. (http://www.wpro.who.int.2007)

Plasmodium vivax causes the most geographically wide spread human malaria accounting annually for 70-80 million clinical cases throughout the tropical and subtropical regions of the worlds (Seung , 2005).

Sistan and Balnchestan Province South East of Iran has been reported as an endemic area of malaria. There, the blood specimens were collected from 140 suspected cases. The result showed that 118 cases (83.3%) were positive for malaria parasites in 60.7% *P.vivax*, 20.7% *P.falciparum* and 2.9% mixed infection (Ebrahim, 2007).

Out of 19.3 million population of Srilanka, 9.3 million resides in malarious areas. During the year 2001, there has been a very significant reduction in the number of malaria patients recorded as compared to the previous years. 50.11% confirmed malaria patient were detected from the total number 925,893 blood smears examined (*P.vivax* 81.3% and *P.falciparum* – 18.7%). During the previous year approximately 200,0000 confirmed cases were recorded (WHO, SEARO, 2002).

It was estimated that approximately two million people of Nepal are at risk distributed at 64 district in 5 developmental region and 10-15% people occurred in deaths annually (EDCD, 2001).

A total 137,444 slides were examined and 5,293 were detected as malaria positive cases in 2063/064. This data was decreased in comparison to the previous year

among them 1297 *Plasmodium falciparum* and 1307 cases were imported (Annual report, EDCD, 2006/07).

The malaria control programme in Nepal was initiated in 1954 through the insect borne disease control programme supported by USAID. In 1958, the malaria eradication programme in the country was launched with the objective of eradicating malaria from the country within a limited time period. Due to various reasons the above objectives could not be achieved and consequently the eradication concept reverted to control program in 1978. Roll Back Malaria (RBM) initiative was lunched to address the perennial problem of malaria in hard core forested, foot hills, inner Terai and hill valley. The strategic plan of RBM was operationalised in 12 districts and currently malaria control activities are carried out in 65 districts at risk of malaria. The global fund has supported malaria control programme in high endemic 13 districts since 2004. Selective and sustainable control measures of malaria control, two rounds of selective indoor residual sparaying in malarious areas was carried out based on criteria set for IRS which launched outbreak areas. In addition to IRS, activities to promote use and acceptance of long lasting insecticide treated bed nets were also carried out under RBM and Global fund programme (EDCD, 2006/2007).

Significance of the study

Malaria is a major health problem, especially for Terai region and is also one of the major health problems in Nawalparasi district. Malaria is an endemic in Nawalparasi district (HMG/MOH, 2005). The present study will assist to explore the malaria treatment strategy, where do the people go for treatment, either Government District Hospital or Private Clinics? Which method they use to diagnose the malaria? It will also state about the current service situation of clinics situated at head quarter (Parasi) of Nawalparasi. It will be helpful for the control of malaria not only in Nawalparasi but also in Nepal.

II

OBJECTIVES

General Objective

The general objective of the study is to determine the prevalence of malaria from suspected cases visiting Government District Hospital and Private Clinics in headquarter (Parasi) of Nawal Parasi District.

Specific Objectives

- To determine the prevalence of malaria cases.
- To compare the malaria positive cases between the Government District Hospital and Private Clinics.
- To explore *P. vivax* and *P. falciparum* cases.
- To assess where do people like to go for treatment (Govt. District Hospital or Private Clinics) and why?
- To find out the diagnostic tools used for malaria at Government and Private levels.
- To determine the way of treatment of Government District Hospital and Private Clinics.
- To find out the Knowledge, Attitude and Practice (KAP) of respondents.

III

MATERIALS AND METHODS

Materials:

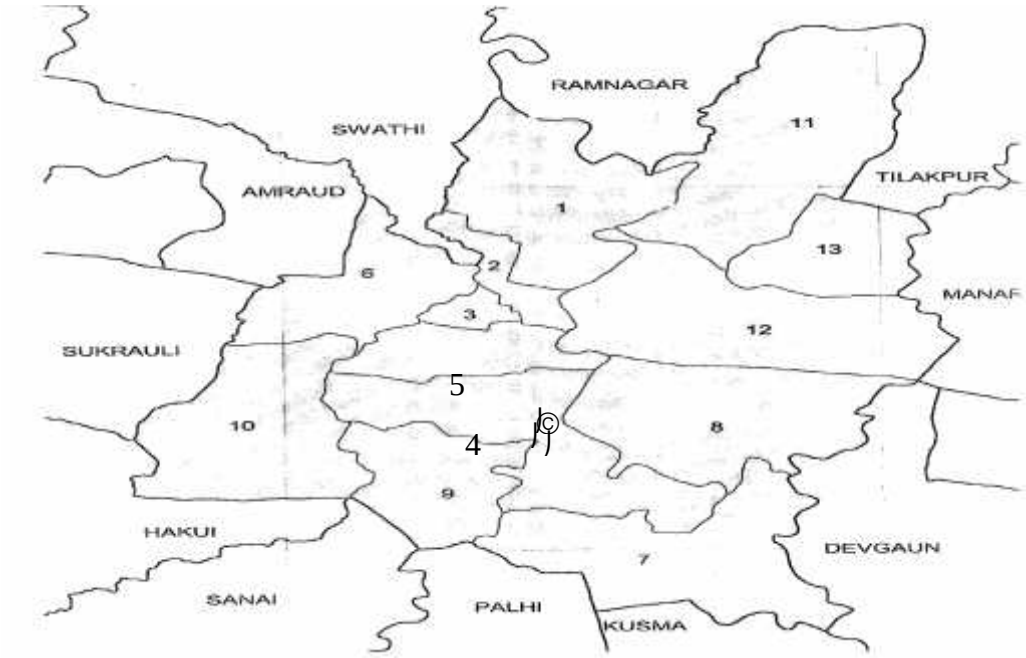
Microscope, cotton wool, beaker, sterile lacents, slide and slide box, staining troughs, timing clock, cover slips, measuring cylinders, slide drying rack and record farm or register.

Chemicals:

Giemsa's stain, distilled water, methylated spirit, water and methanol

Study area:

The study was carried out in Prithivi Chandra District Hospital and Private Clinics (Janta Pthology, Buddha Pathology and Parasi Pathology) located at headquarter of Nawalparasi district bordered with Indian states (Utterpradesh and Bihar) in the South, Palpa and Tanahun in North, Chitwan in East, and Rupandehi in West. The total population of the district is 5,62,870 out of which 2,84,613 are female and 27,82,657 male, 94.70% Hindu, 3.35% Muslim, 1.60% Buddhist and 0.256% Christian.



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⌋ Private Clinics

Nawalparasi is characterized by different ethnic groups like Brahmin, Chhetri, Tharu, Yadav, Gupta, Harijan and Mushar, etc. Seventy three VDCs are in Nawalparasi with 601.75 squire km. agricultural land and agriculture as the main source of economy. The houses are often with adjacent cattle shed and made of bamboo with thatched roof. The geographical distribution of the district is $27^0 12^0$ to $27^0 47^0$ north axis and $80^0 60^0$ to $84^0 35^0$ it is situated from 91m to 1936 m in height. The annual rain fall is 2145 mm. The temperature ranges from 20.5 to 36^0c.

Study period:

The total study period was of 12 months from 10 Aug. 2007 to 9 Aug. 2008.

Study population:

A total of 236 symptomatic patients having fever for 2-3 days, anaemia, headache, vomiting, spelenomegaly, hepatomegaly were included for the study.

Sample collection:

The patients visiting Prithiiv Chandar District Hospital and Private Clinics of head quarter of Nawalparasi were selected for the study. The basic information and other knowledge were recorded from suspected patients through questionnaire survey. The blood was withdrawn from the symptomatic patients by piercing the third finger of the patient's left hand after cleaning with an alcohol swab. The blood was dropped on the slide to prepare the thin and thick smears.

Sample Processing:

The thick and thin blood smears were prepared on the same slide taking three drops of blood and spreading in an area of 10 mm. Thick smears were prepared 10 mm away from the edge of the slide. A single drop was taken for thin smear. It was uniformally spread bringing the spreader (at an angle of $30^0 – 45^0$ from the horizontal and pushing the spreader) steadily down the surface of the slide drawing the blood behind till the smear was formed. After drying, thin smear was fixed in methanol.

The slides were placed in staining rack ensuring that thick films were placed along the end of rack. This film was stained with 3% Giemsa's solution for 30-45 minutes. The stain was washed under tap water.

Distribution of Malaria in Nawalparasi district

Distribution of Malaria in Nepal

Microscopic examination:

The blood film was examined microscopically under 40x and 100x. The thin film consists of a single layer of blood cells. It is used to assist the identification of the malaria species or other morphological character of the parasite. The malarial parasites can be recognized by observing the shape and colors of stain of chromatin and cytoplasm of the parasite. The chromatin is usually round in shape and stains deep red. Cytoplasm varies in shape from ring shape to a totally irregular shape where as in the thick smears the presence of parasites are quickly seen under microscope because they are concentrated in smaller area than in thin films.

Staining of the slides, preliminary examination and final examination of slide were done in Prithivi Chandra District Hospital, Parasi.

Questionnaire Survey:

After completion of the microscopic examination, other findings were recorded in the pre-planned printed questionnaire. The questions were asked face to face, during questionnaire survey to each patient which had symptomatic character of malaria. Generally, name, age, address, sex, occupation, education, knowledge, attitude and practices of malaria were asked to patients.

Data Collection and Analysis:

The primary data was collected from questionnaire survey and microscopical findings. Secondary data was taken from the published and unpublished sources which were based on the primary as well as secondary data. The collected data were presented and analyzed.

IV

LITERATURE REVIEW

Malaria is a globally distributed devastating disease and it causes high morbidity and mortality rate. It is existing for more than a century after its first identification and elucidation. So many researches have been done by many scientists towards diagnosis, immunology, vaccines, molecular biology, chemotherapy of malaria etc. in the past and in recent years. Some research findings have been discussed briefly in this section.

In the last 25 years or so a number of significant advances have been achieved to make a major contribution to the control of this disease.

Some recent findings on Malaria in Global Context

Bangali (2000) mentioned that approximately 88% of the 128 million people in Bangladesh are at risk of malaria. *P. falciparum* is the most predominant species and the current situation of the country shows *P. falciparum* to be declining every year.

Zalis (2000) explored malaria drug resistance. Drug resistance is still a very important obstacle to control malaria in the world. Although many scientific groups are endevaouring to understand the mechanisms of drug resistance, this problem is increasing more rapidly than the implementation of safe and low cost line therapies as Chloroquine was until the mid 1960s.

Roharimalala *et al.*, (2000) found the chemo susceptibility of *P. falciparum* to Chloroquine in Saintemarie in land of Madagasakar.

Zangpo *et al.*, (2000) reported that about more than half the century the population of Bhutan is at risk of malaria. The malaria situation started to worsen from 1990 onwards with a peak in 1994. The percentage of *P. falciparum* ranged for 31.5% - 51%.

Tarimo *et al.*, (2001) suggested malaria diagnosis and treatment under the strategy of the integrated management of childhood illness (IMCL) with a laboratory support from the rapid immuno-chromatographic tests or ICT.

Cravo *et al.*, (2001) found that the genetics of drug resistance using rodent malaria model drug resistance is the most significant obstacles to gaining effective malaria control despite the enormous advances in the knowledge of biochemistry and molecular biology of malaria parasites. Only a few genes determining resistance to the commonly used drugs have been identified.

Yadav *et al.* (2001) reported the baseline malaria incidence ranged from 215-328 cases / 1,000 population/year in different groups of malaria endemic villages of in Orissa state of Eastern India. In November 1990, nylon bed nets treated with Deltamethrin at 25mg/m^2 were given out in two villages (pop. 1,062) and in one village 786 nets were not given.

P. vivax is the predominant parasite and *A. culicifaces* the most important vector. Chloroquine resistance in *P. falciparum* is increasing. There has been an increase of vector populations in areas where water development projects have been implemented with a subsequent increase in malaria transmission. Indoor residual spraying (IRS) has been the main vector control measure used in the country. In view of the resistance to DDT and Malathion, the rotational use of Fenitrothion and a Pyrethroids is now being practiced with the aim of reducing the load of transmission of malaria. (http://www.searo who.int, 2003).

Prazy (2002) studied malaria as a major public health matter in the world is the unique parasitic diseases having the ability for breaking up a military operation for armies in malarious area. Protective measures depend on vectorial prevention and chemoprophylaxis. The *P. falciparum* resistance to different drugs involve difficult to design prophylaxis. French Army health service created a Parasitologic research unit in the tropical institute of army health service. So military European structure in parasitological subject essential assignments are the *P. falciparum*.

Harano *et al.*, (2002) examined the existence of malaria parasite carriers (186) in Myanmar transfusion dependent anemic patients with thalassemia mutations. Two malaria parasites *P. falciparum* & *P. vivax* were detected by the PCR method using a multiplex primer set; Six with *P. falciparum* and 7 with *P. vivax*.

Yadav *et al.* (2002) estimated that in India 723 case of *P. vivax* infection treated with chloroquine alone and followed up weekly for 1 year. The prevalence recurrence of

infection was 8.6% Among, another 759 *P.vivax* cases treated with Chloroquine and a 5 day regimen of Primaquine at 15 mg/day (adult dose). The recurrence of infection was 6.5%.The difference in recurrence was not significant (0.53). It is noted that infection did not recure even without treatment with Primaquine.

Carter *et al.*, (2003) recruited that 25 children who had previously been admitted to hospital with severe. *P. falciparum* malaria and 27 unexposed to the disease, each child at 8-9 year age. At least 2 years after admission to hospital in children exposed to serve malaria.

Cortes *et al.*, (2003) surveyed on malaria in Manitania. It was found that malaria infection rate was 18.5% (77 of 446). *P. falciparum* caused 61.85% of these. *P viax* 35.5% (28 of 77) in Nouakchott. In Kaedi 106 of 416 cases were recorded with *P. falciparum* as the sole pathogenic species.

Malaria transmission occur of South American in 9 countries. It is reported that positivity are decreasing, recently in Mexico and other countries of central America where as increasing in Nicaragua and was stable of fluctuating in other counties. Among the positive cases 25% of *P. falciparum* and 75% of *P. vivax* are reported in south America. In Columbia and Guatemale. 64% and 53% of recorded cases respectively were male. (http://www.rbm.who.int,2003).

Singh *et al.*, (2004) described the malaria was undertaken after reports of high fever and death in Jabalpur. Madhyapradesh (MP) during the dry hot weather. Inquiries revealed that 39 people from 14 family went for collection of Mahua among which two (2) had died. Examination of 37 migrants revealed 84% *Plasmodium falciparum* infection and the death of one migrants investigation on the site of occupational activities of these migrants in Panna revealed 77% *P. falciparum* in rapid fever surveys.

Tongren *et al.*, (2004) have shown that the roll back malaria campaign viewed to halve the global burden of malaria in 10 years but mid way into that campaign. A few new malaria control tools have been introduced and many established method appear to be failing with effective chemotherapy being perhaps the most problematic. Many malaria control experts believe that sustainable reductions in malaria control will be high on impossible in the absence of such a vaccines in Australia.

Pettinelili *et al.*, (2004) reported that drug resistance survey of France was done on endemic Italian Ocean and shown that high prevalence of resistant *P. falciparum* parasites was observed not only to Chloroquine (88%) and Pyrimethamine (99%) but more surprisingly to Quinine (17%), Mefloquine (9%) and Amodiaquine (24%). The resistant properties of *P. falciparum*, people still die of malaria infection this remote territory of France.

Yasinzai *et al.*, (2004) reported that the prevalence of malarial parasite in human population of urban area of Quetta district of Pakistan *P. falcipamm* was observed to be with a higher incidence (16.3%) in the age group of 21 years and above. The genus *Culex* (96%) was more prevalent.

Zhau *et al.*, (2005) analyzed the malaria incidence data of the district level from 1977 to 2002 and total malaria cases data from 1965-2002 in Thailand were analyzed to determine the spatial and temporal dynamics of *P falciparum* and *P. vivax* malaria incidence. Over the 37 year period there was a 35 fold reduction in the incidence rate of *P. falciparum* malaria (11.86%) in 1965 versus 0.34 in 2002 and 97 fold reduction in *P. vivax* malaria (2.89%) in 1965 versus 0.40% in 2002. The incidence ratio of *P. falciparum* to *P. vivax* malaria was reduced from 4.1 to 0.8 during this period.

Vicas *et al.*, (2005) reported that more than 1000 cases of malaria are reported each year among travelers in Georgia, between Oct. 1988 and sep. 2000. One hundred twenty six cases of malaria were diagnosed during study period among them *P. falciparum* (57.4%) and *P. vivax* (23.9%) 72 patients (57.1%) required hospitalized.

Baruah *et al.*, (2005) evaluated drug sensitivities of *P. falciparum* in 4 endemic villages of the Sonitpur district of Assam, involving 218 cases who were tested in vivo over 35 days. Chloroquine resistance was detected at the R1 Level in 29 cases (13%) and RII level in 8 cases (4%). NO RIII Chloroquine resistant cases were detected in the study. RI resistance was observed in the age groups 6-10 years, 11-14 years, and 15 years and above in 16%, 17% and 13% respectively. RII level resistance was observed in 4% of all those groups combined. All the RI and RII resistant cases responded well to a single dosage of Metakelfin (sulfamethoxypyrazine I.P. 1,500 mg and Pyrimethamine I.P. 75 mg).

Blossom *et al.*, (2005) surveyed on a healthy traveler presented with a prolonged illness characterized by low grade of fever and fatigue. Although malaria smears for *P. falciparum* was negative. Malaria diagnosis was ultimately determined by polymerase chain reaction (PCR). The patient was successfully treated and cured. Clinical use of PCR technology may facilitate the identification of cases of smear negative malaria which upto the present time have been difficult to diagnose.

Samudio *et al.*, (2005) observed a high prevalence of mutations associated with Chloroquine, Pyrimethamine and Sulphadixoine. Gamotype analysis of MSP^2 revealed a low genetic diversity of *P. falciparum* parasites circulating in the studied area. The public health implications of these findings for the central America (Kuna Amerindians in Panama) region are discussed.

Cho-min *et al.*, (2005) investigated the costs cured by patients diagnosed with uncomplicated malaria at a formal rural health facility in Myanmar. A cross sectional survey of 410 patients indicated that the majority of patients were male (89.3%) married (84.6%) and the head of their family (80.2%). Diagnosis in rural settings to minimize the financial burden of malaria to the patient and family.

Yakoob *et al.*, (2005) reported the effect of malarial infection during pregnancy on the new born. The Aga Khan University Hospital (AKUH) Karachi reported the comparison of 29 pregnant women with (461) malaria having low birth weight was compared with that in 66 selected pregnant women without malaria.

Yeom *et al.*, (2005) mentioned that *vivax* malaria was endemic on the Korean Peninsula for many centuries until the late 1970. The Republic of Korea (ROK) was declared "Malaria free" since it emergence is 1993. The number of malaria cases in the military increased exponentially through 2000 near the demilitarized zone. Chloroquine and Primaquine have been used in the ROK army since 1997. In an attempt to reduce the number of the malaria cases through out the ROK. Data show that chemoprophylaxis contributed in part.

Malaria is possibly the most infectious disease of humans infecting 5-10% of the world population with 300-600 million clinical cases and more than 2 million deaths annually (Schofield and Grau, 2005).

Gardiner *et al.,* (2005) reported that malaria remains the third leading cause of death attributable an infectious disease world wide.

Situation of malaria in some SEARO countries in 2005. ((http://www.searo.who.int).

Bhutan:

Population at risk	5,25,000
Malaria cases	1,825
Deaths	5
P. falciparum	52.8%
P. vivax	47.2%

Indonesia

Population at risk	94.27 million
Malaria cases	4,33,326
Deaths	97 (incomplete information)
P. falciparum	29.7%
P. vivax	70.3%

India

Population at risk	1044.7 million
Malaria cases	18,17,093
Deaths	963
P. falciparum	44.3%
P. vivax	55.7%

South Korea

Population at risk	11.9 million
Malaria cases	6,728
Deaths	0 (Only *P. vivax*)
P. falciparum	0 %
P. vivax	100 %

Srilanka

Population at risk	7.58 million
Malaria cases	1,640

Deaths	0
P. falciparum	14.1 %
P. vivax	85.9 %

Nepal

Population at risk	28 million
Malaria cases	4,962
Deaths	10
P. falciparum	17.7 %
P. vivax	82.3 %

Manmar

Population at risk	39.0 million
Malaria cases	1,51,508
Deaths	1,707
P. falciparum	73.5 %
P. vivax	26.5 %

Maldives

Malaria is not a public health problem in Maldives. There is no indigenous transmission since 1984 and country is maintaining its malaria free status in the entire SEA Region. Only few imported cases (from 10-39) are reported every year.

Bangladesh

In 2004, there were 1,55,825 probable malaria cases, 59,853 laboratory confirmed cases, and 505 deaths were reported where as in 2005, the malaria situation improved the probable cases and malaria deaths were declined to 1,42,628 (8.5%), 48,121 (19.8%) and 481 (4.8%) respectively. *P. falciparum* increased by 1% only (http://www.searo.who.int).

Despite sophisticated intensive medicine, between one and three malaria associated deaths occur annually in Switzerland. In this respective study 33 deaths (25 men and 8 women) caused by *P. falciparum* malaria reported in Switzerland from 1988- 2002 were analyzed. (Chtriten 2006).

Huang *et al.*, (2006) cerebral malaria has still been a sort of disease with high death rate. The complexity of clinical symptoms of the cerebral malaria frequently results in the delay of diagnosis, by adjusting the Ph of the buffer of regular wrights dyeing. Combining with the decrease of the BPC of peripheral blood. The accurate rate of detection of *P. falciparum* was improved obviously.

Bhatia *et al.*, (2006) studied on genetic polymorphism in T-helper cell epitomic regions of circumsporozoits protein of 148 *P. falciparum* isolate's from different epidemic and endemic regions of India has been analyzed by polymerage chain reaction and sequencing. The variation have been found to been in different regions of India. The variation has also been found to be restricted and could be categorized into 4 groups. Since the variation is restricted prototype variants could be included in a sub unit polyvalent vaccine against sporozoites.

Minizi *et al.*, (2006) found that twelve healthy volunteers in Tanzania were randomized to received a single oral dose of 3 SP tablets each containing 500 mg Sulfadoxine (SDX) and 25 mg Pyrimethamine (PYR) in a form of either A (local pharmaceuticals in Tranzania) or B (fansidar Holf mann la. Roche Basel Switzerland). The relative bio availability (A versus B) were significantly lower than those of formulation of 'B'. These observed differences indicate between the two products.

Kenzie *et al.*, (2006) surveyed on clinical symptoms of mixed species malaria inflections have been variously reported as both less severe and more sever than those of single species infections. Oral temperatures were taken and blood slides were prepared for 2,308 adults in Thailand. According to research microscopists in each year temperatures of patients with mixed *P. vivax* and *P. falciparum* infections were higher than temperatures of patients with *P. vivax* and *P. falciparum* infections.

Usenbayev *et al.*, (2006) analyzed that malaria was not notified in the republic in 1960-1982, with exception of 1963 where one case of imported malaria was identified, 24 cases of locally transmitted malaria were detected 11 of them registered in the Batken district. Osh Region with Tadjikistan and Uzebekistan in 1981 to 2000 a total to 101 cases of malaria were notified in 2001 there was an increase in cases of malaria to 136 cases of malaria were notified. In 2002 a total of 2,744 cases of malaria

were rgistered mainly in the fergana valley. Malaria was imported from Tadjikistan Azerbaijan, Uzebekistan and Afghanistan.

Esam *et al.*, (2006) found that malaria transmission occurs in Saudi Arabia and mainly endemic in the lowlands of Asia region. Malaria parasite diagnosed either traditional diagnosis by thick and thin blood smears or standard method of diagnosis by PCR through the detection of nucleic acids. In this study a total of 44 samples checked by both techniques showed a higher sensitivity than the microscopy parasites were detected in PCR 29 out of 40 and 26 in microscope and of 39 were positive.

Etienne *et al.*, (2006) surveyed the maps of *P. falciparum* malaria transmission in west and central Africa using the mapping malaria risk in African database comprising all malaria prevalence surveys in these regions that could be geolocated the 1846 malaria surveys analyzed were carried out during different season and were reported using different age groupings of the human populations.

Kulkarni *et al.,* (2007) found the objective to measures Pyrethoroid susceptibility in populations of malaria vector and nuisance betting mosquito in Tanzania and to test the biological efficacy of current insecticide formulations used for net treatment methods *Anopheles gambiae*. Giles S.L. *Anopheles funestuss* Giles S.L. and *Culex quinquifasciatus* were collected during there national surveys and two insecticide treated net (ITN) studies in Tanzania. The studies were get positive result for the malarial vectors.

Ahmad *et al.*, (2007) estimated that the malaria is the leading causes of illness and death among children less than 5 years of age. There is limited information on mothers response and experience about diagnosis and treatment of the disease malaria. The study was conducted that between October and November 2003 in Adami Tulu district South central Ethiopia. The children less than 5 years of age were suspected to be malaria 3872 children identified in 2372 house holds 817 (21.1%) had febrile illness reported to be malaria according to the mothers/ care takers. The main symptoms included fever (99%) sleeplessness/restlessness (12.9%) and refusal to be (21.3%) among them 27.3% first case from public clinics. 6.4% received home treatment and 13.3 did not get any care., Strengthening peripheral health services and

community based interventions using CHWS of village levels would improve the early diagnosis and treatment of malaria among children.

Mambo *et al.*, (2007) described about the plasma samples from patients undergoing treatment in malaria endemic countries often contain anti-malarial drugs that may over state effects of specific antibodies in growth inhibition assays (GIA). They describe a modified assay that uses drug resistant *P. falciparum* parasites that circumvents the requirement for dialyzing samples that may likely contain drugs such as Chloroquine and Sulfadoxine/Pyrimethamine (SP).

Malaria is still endemic in 10 counties of the western pacific regions. National Health authorities in several of these endemic countries have made considerable progress in reducing malaria morbidity and mortality. Resistance to Chloroquine and other commonly available antimalarial drugs is a major issue in malaria control in the region as it is worldwide. (http://www.wpro.who.int,2007).

The world Health Organization (WHO) and their partners Roll Back Malaria (RBM) reports that malaria is still the single largest child killer in Africa. The disease takes the lives of some 3,000 children per day. Both partners lunched both treatment and preventive measures including improved water sanitation facilities, increased insecticides spraying and the mass distribution of insecticide treated bet nets (INTs). Eighteen million in Ethiopia and 10 million in Kenya in 2005 (INTs) insecticide treated nets are distributed. (http://www.unicef.org/infocountryzambia2008)

Some Recent Findings on Malaria in Nepalese Context

Hodgson, (1857) mentioned that malaria was highly prevalent in old days of Nepal and the epidemics of the plains hardly ever reached. The Himalayas and Tarai region of Nepal was notorius as a malarious region. Oldfield (1880) has noted about the immunity of the local tribes of Nuwakot, such as Dami, Kumhal, Manjhi, Bramin and Danwar.

There is no documented record about the prevalence of malaria in Nepal during nineteenth century except few historical descriptions. The first documented epidemiological survey dates back to 1925 by major Phipillips of Indian military service in Makawanpur and Chitwan valley, out of 889 children examined, 712 (80%)

had enlarged spleen. The average enlargement of spleen ranged from 65% to 100%. The mortality rate in children was estimated at about 43% among pahadis (hill people) and 17% among tharu people. Upto that period it was further estimated that approximately two million cases of malaria (40% of the total population) occurred annually and 10-15% among those resulted in death (Bista *et al.*, 2002).

From the data available since 1963 the malaria in Nepal reveals periodic upward lifts followed by sharp falls in next two years and then the period of stagnation with slite fluctuation between 25,000 to 40,000 cases lasting for 5-6 years (1963-1971). These cases started rising from 1972 and in 1974 the number of cases reached to 14,000 due to the epidemic in the west regions. The year 1977 could contain malaria in between 10,000 and 13,000 cases annually.

From 1978 the real deterioration of the situation started when the cases reached to 14,212 in 1978 from 11,615 in 1977, with steady increase every year. The number of cases reached to 16,719 in 1983. There was sharp rise to 29,388 cases in 1984 which again escalated to 42,321 in 1985. After 1985, the cases in the country started decreasing. By 1989 the cases again increased to 22,366 which reached to 22,856 in 1990. After 1991 the number of cases gradually decreased and reached to 8,489 in 1998 (HMG, MoH, VDBRTC, 1999).

During the 1999 to 2001, although increase of population, the no. of malaria cases decreased from 8,208 in 1999 to 7976 in 2000 and to 6,555 in 2001. The proportion of *P. vivax* to *P. falciparum* was 5.60% to 0.43% in 1999, 4.56% to 0.53% in 2000 and 4.8% to 0.33% in 2001. (DoHS, Annual Report, 2057/058).

The EDCD reported that 4557 cases of malaria were detected in 2005 slightly decreased from last fiscal year (6,365 in 2004). In 2006 increased by 5,691 and again reduced by 5,293 in 2007. The prevalence of *P. falciparum* are increasing form 11.75% in 2004. 10.75% in 2005. 24.19% in 2006 and 24.5 % in 2007. (DoHS, Annual Reports, 2063/2004).

The country reported 42,321 and 22,333 malaria cases in 1985 and 1989 respectively. *P. falciparum* cases reduced at the same rate as the total malaria cases, but after 1998 the reduction of the former especially indigenous *P. falciparum* cases was slightly accelerated (Bista *et al.*, 2000).

During 1994 to 1995, 5,467 and 5,477 prevalence rate of malaria cases detected, out of them 7,202 and 6,313 incidence rates were imported form India. Among 26 bordering districts of Nepal Kanchanpur and Kailali of the far western, Bardia of Midwestern, Nawalparasi of Western, Dhaunsa and Mahottarai of central, Morang and Jhapa of the eastern regions are the main contributors of malaria cases. The total malaria cases of 26 bordering districts constituted 64.44% of the total malaria cases in 1997 (Bista *et al.*, 2000).

In hospital based study by Sherchand *et al.*, (1998) suggested that the patients with CNS manifestations i.e. encephalitis and meningitis must be diagnosed with high index of suspicion for malaria. Medical officers are trained to recognize as clinical malaria by symptoms which is characteristics 'Vivax paroxysm" there is a need to retain medical officers so, as to detect as well as to treat sever form of malaria mostly occurring with *P. falciparum* malaria.

Bista and Banerjee (2000) presented some data of *P. falciparum* resistant to Chloroquine. During 1979 and 1990, a total of 178 and 84 *P. falciparum* cases showed a resistance of 38% at S/RJI level. No resistance was found to Methoqine and Sulfadoxinme/Pyrimethamine. Therpeutic efficicacy monitoring has revealed rate treatment failures among recipients of S/P treatment.

Chowdhary (2002) found a new rapid method of staining blood cells and malaria parasites with R.C. stain. The traditional methods for staining blood films with leishman's/wright-Giemsa's stain for identification of blood cells and blood parasites are good but they are time consuming, cumbersome and require costly reagents. Morevoer, the beginners viz., medical students make error like under standing, over staining or precipitation of stain leading to difficulty in identification of cells. To alleviate these problems and to help the workers of the malaria eradicating programmes. This rapid and simple method has been devised to stain blood cells and malaria parasite within 50 second.

Among the 1,200 samples of blood donors from Kathmandu, Nepalgunj and Biratnagar were collected and analyzed. In this study 4 (0.33%) were found to be positive for the malarial parasite, 3 (0.25%) from Biratnagar and no any cases were found from Kathmandu and 1% cases were found to be positive from Nepalgunj. All

the malarial infections were due to *Plasmodium vivax* (Source- Scientific World, 2007).

Kavre is one of Nepal's most affected districts and transmission is particularly high between July and September. Worst at risk are 13 districts, including Kavre, where temperature of 20-30^{0}c and an altitude below 2,000 make them ideal mosquito breeding grounds. Other districts including Sindhuli, Ilam, Jhapa, Morang, Mahottary and Dhanusha in the Eastern region, Banke and Bardiya in the Mid-west, and Kanchanpur, Kailali and Dadeldhura in Far west, as well as Nawalparasi in Central region (Http:/www.irinnews.org/report.aspx?).

Malaria Situation in Nawalparasi District from 2004-2007

During the last 4 years (2004-2007) the population of Nawalparasi District has increased from 6,17,176 to 5,55,258. In spite of growth of population, the no. of malaria cases decreased but fluctuate in 2006, from 91 in 2004 to 88 in 2005. Increased by 130 in 2006 and again decreased by 74 in 2007. In other words, the prevalence percent of malaria in 2004 was 3.74%, 3.13% in 2005, 7.44% in 2006 and 4.22% in 2007. The proportion of *P. vivax* to *P. falciparum* was 74.72% to 23.07% in 2004, 84.09% to 14.77% in 2005. 76.15% to 23.08% in 2006 and 78.38% to 21.62 % in 2007. Only one case was found having both (*P. vivax* and *P. falciparum*) characters in 2004-2006 and none in 2007.

Year	No. of malaria Cases	Percentage of Malarial Cases
2004	91	3.74
2005	88	3.13
2006	130	7.44
2007	74	4.22

(source- DoHS of Nawalparasi, 2007).

V

RESULTS

A total of 236 blood samples were collected from clinically suspected cases, with some symptoms of malaria (mostly having fever), visiting Prithbi-Chandra District Hospital and 3 Private Clinics (Janta Pathology, Buddha Pathology and Parasi Pathology) at headquarter (Parasi) of Nawalparasi District. The result has been categorised as :

A. Prevalence,
B. Diagnosis and Teatment Procedure
C. Knowledge, Attitude and Practice (KAP)

A. Prevalence

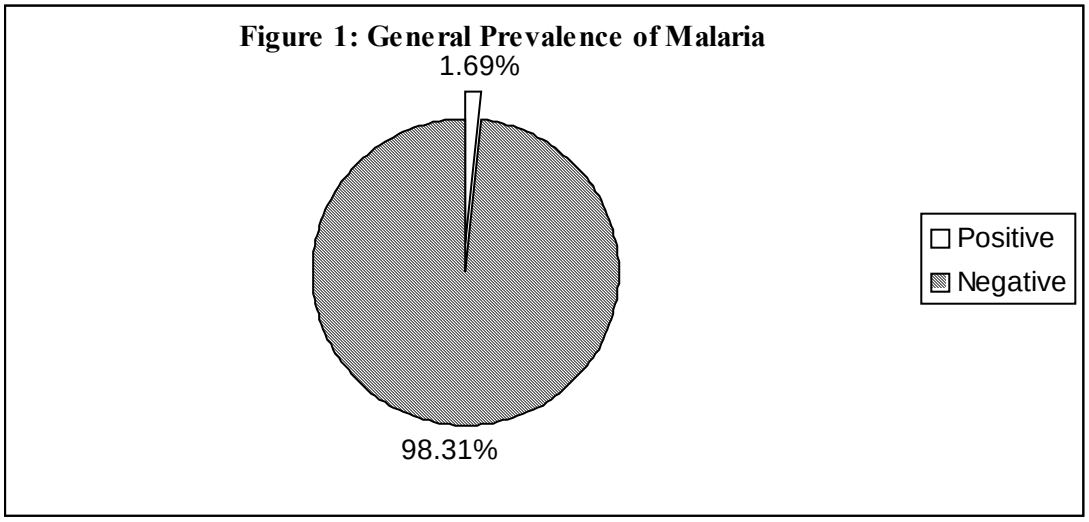
1. General Prevalence of Malaria

Among 236 blood samples, only 4 were found to be infected with malaria i.e. the slide positivity rate was found to be 1.69%.

Table No. 1: General Prevalence of Malaria

Total samples examined	Positive samples	
	No.	Percent
236	4	1.69%

Figure 1: General Prevalence of Malaria



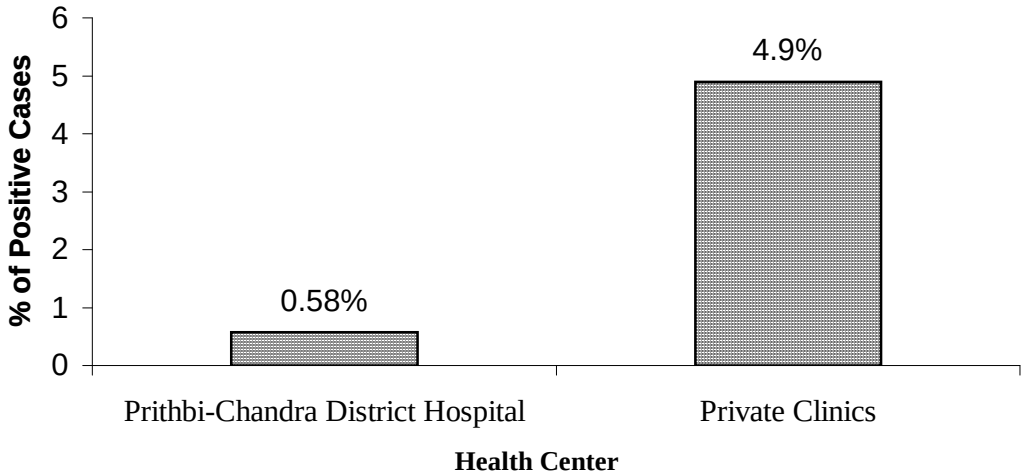
2. Clinic-wise Prevalence of Malaria

Out of 172 blood samples collected from Prithibi- Chandra District Hospital, 1 (0.58%) sample was recorded as positive for malaria. Likewise, out of 64 blood samples collected from Private Clinics, 3 (4.69%) were positive for malaria. According to the data, more positivity was recorded in Private Clinics.

Table No. 2: Clinic-wise Prevalence of Malaria

S.N.	Clinics	Total samples examined	Positive samples	
			No.	Percent
1	Prithbi-Chandra District Hospital	172	1	0.58
2	Private Clinics	64	3	4.9

Figure 2: Clinic-wise Prevalence of Malaria



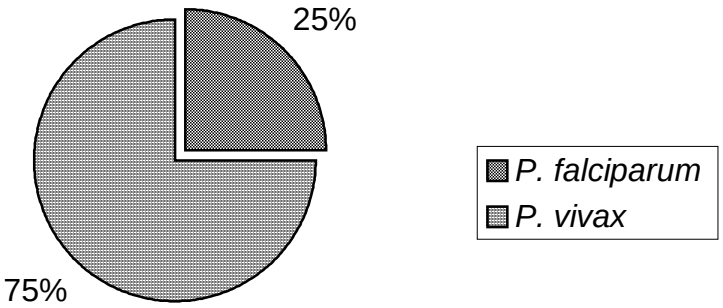
3. Species-wise Prevalence of Malaria

Species-wise identification showed that among 4 positive slides only one (25%) was of *Plasmodium falciparum* and 3 (75%) were of *Plasmodium vivax.*

Table No. 3: Species-wise Prevalence of Malaria

Total suspected cases	Total positive cases	Positive samples			
		P. vivax	%	*P. falciparum*	%
236	4	3	75	1	25

Figure No. 3: Species-wise Prevalence of Malaria



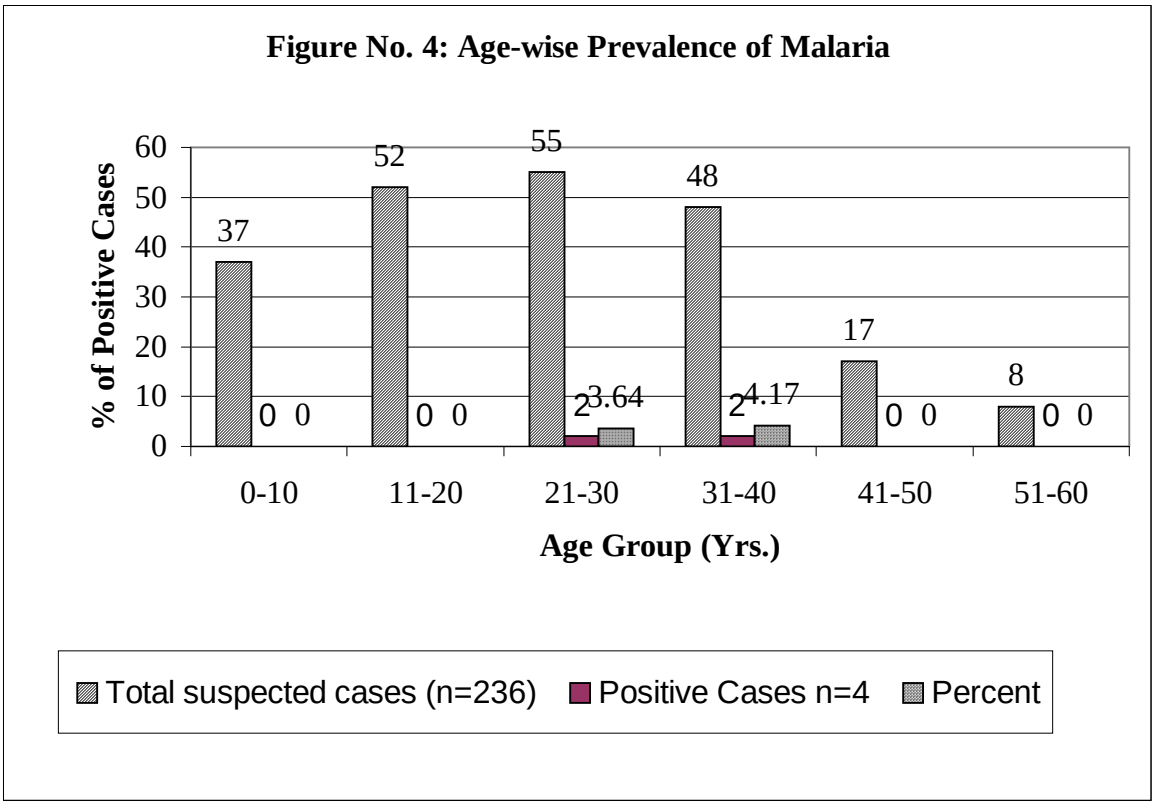
4. Age-wise Prevalence of Malaria

The result of the study indicates that out of the total suspected population 2 (4.17%) positive cases were found from age group 31-40 years and 2 (3.64%) from age group 21-30 years.

Table No. 4: Age-wise Prevalence of Malaria

Age group (yrs.)	Total		
	Total suspected cases (n=236)	Positive Cases (n=4)	Percent
0-10	37	0	0.0
11-20	52	0	0.0
21-30	55	2	3.64
31-40	48	2	4.17
41-50	17	0	0.0
51-60	8	0	0.0
Above 60	19	0	0.0

Figure No. 4: Age-wise Prevalence of Malaria



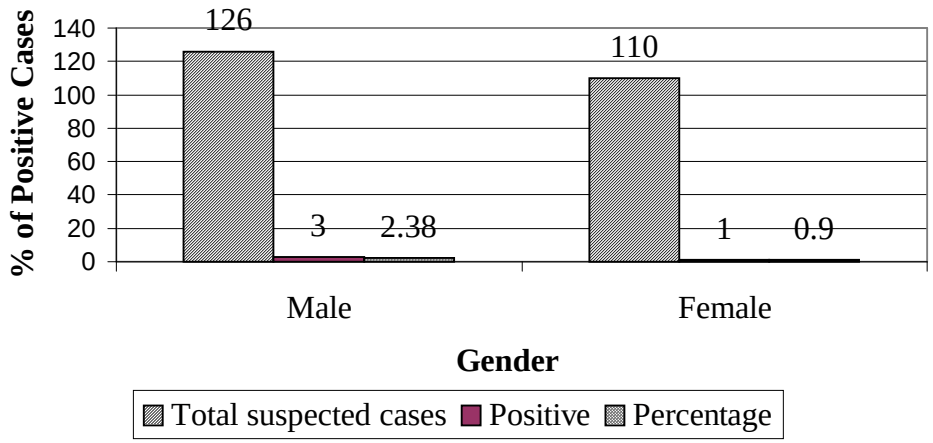
5. Sex-wise Prevalence of Malaria

Regarding sex-wise prevalence of malaria, among 4 positive cases, 3(2.38%) were male (1 from Government Hospital and 2 from Private Clinics) and only 1 (0.90%) female from Private Clinics.

Table No. 5: Sex-wise Prevalence of Malaria

Sex	Total		
	Total observed cases	Positive	Percentage
Male	126	3	2.38
Female	110	1	0.90

Figure No. 5: Sex-wise Prevalene of Malaria



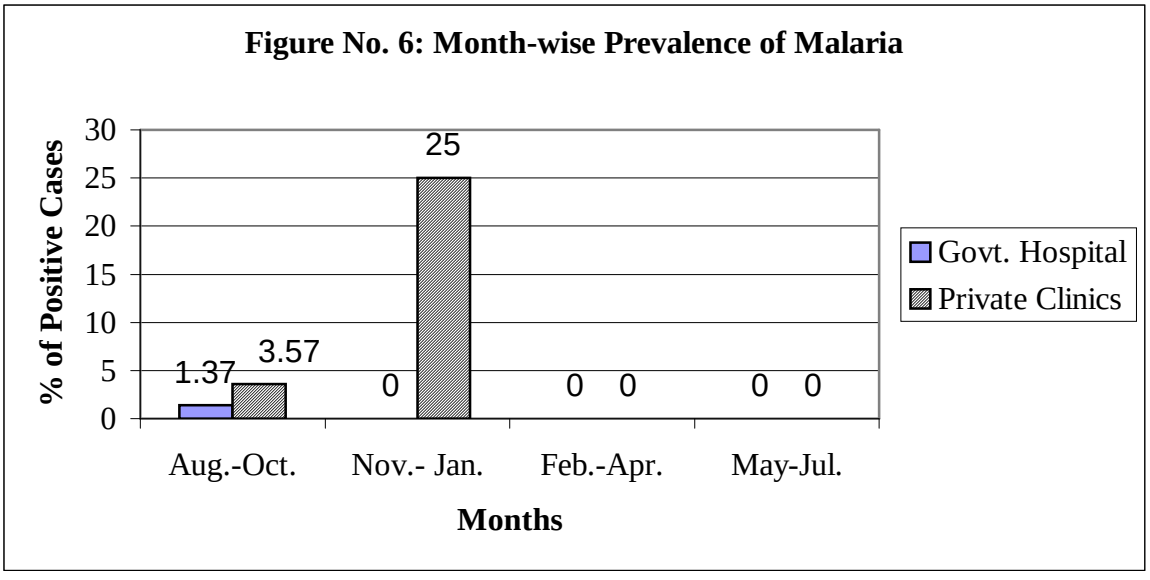
6. Month-wise Prevalence of Malaria

From the study, table 6 shows that 3 positive cases were recorded during Aug.- Nov. Among them only one (1.37%) from Government District Hospital and 2 (2.57%) from Private Clinics. Remaining one (25.00%) case observed in Nov.-Feb. which was from Uttarpradesh India in Private Clinics.

Table No. 6: Month-wise Prevalence of Malaria

Month	Government hospital			Private Clinics		
	Total observed cases	Positive cases	%	Total observed cases	Positive	Percentage
Aug.-Oct.	73	1	1.37	56	2	3.57
Nov.- Jan.	27	0	0.00	4	1	25.00
Feb.-Apr.	10	0	0.00	3	0	0.00
May-Jul.	62	0	0.00	1	0	0.00

Figure No. 6: Month-wise Prevalence of Malaria

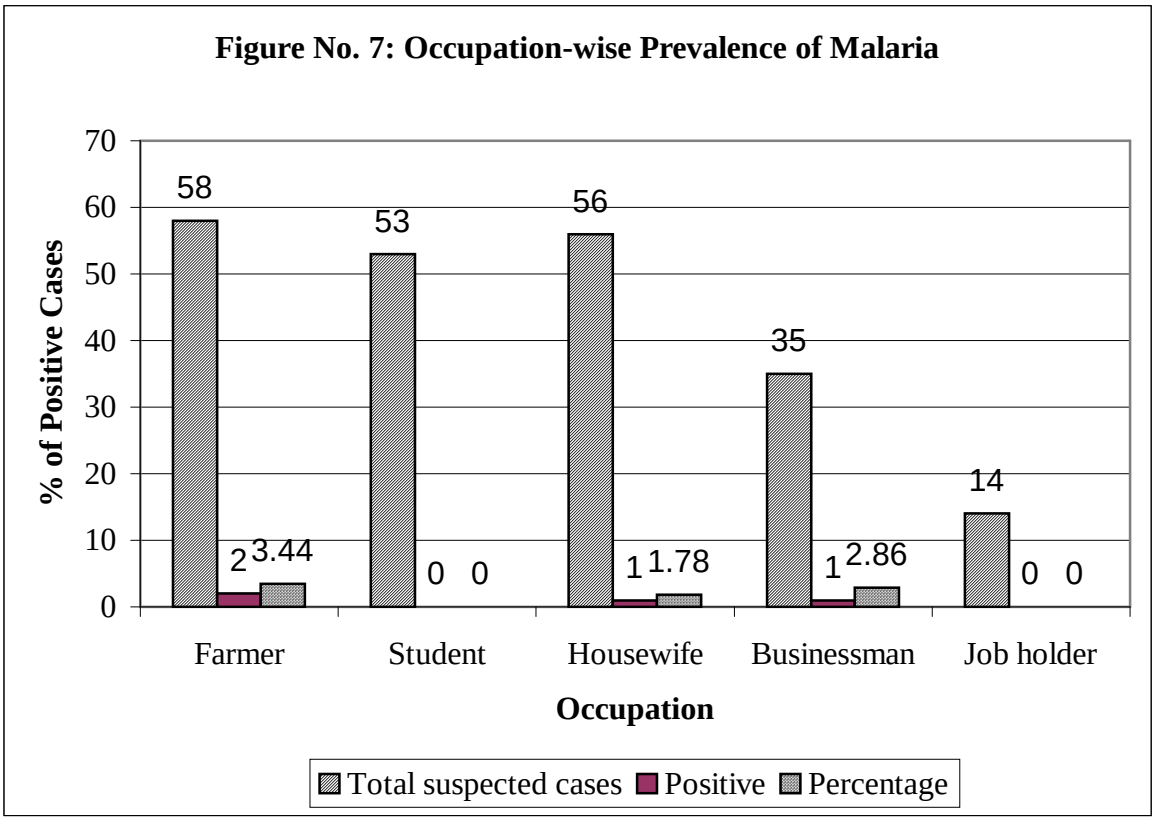


7. Occupation-wise Prevalence of Malaria

During the study, various occupational groups were included. Majority of them were farmers and a few of them were job holders and businessmen. In total, the highest no. of malaria infection was observed among farmers 2 (3.44%) followed by 1 (2.86%) from businessman and 1 (1.78%) from housewife.

Table No. 7: Occupation-wise Prevalence of Malaria

Occupation	Total		
	Total observed cases	Positive	Percentage
Farmer	58	2	3.44
Student	53	0	0.0
Housewife	56	1	1.78
Businessman	35	1	2.86
Job holder	14	0	0.0



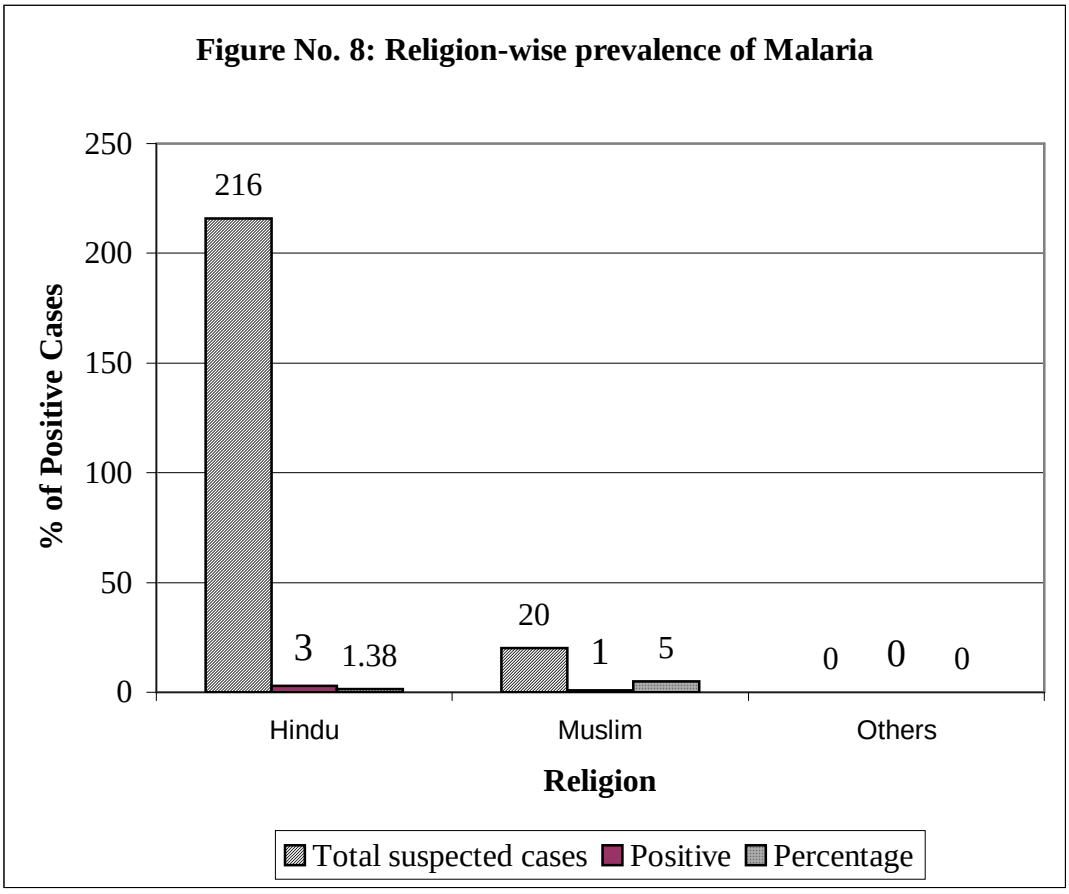
8 Religion-wise Prevalence of Malaria

Maximum positive cases were seen in Hindu with 3 (1.38%) cases, and 1(5.0%) in Muslim.

Table No. 8: Religion-Wise Prevalence of Malaria

Religion	Total		
	Total observed cases	Positive	Percentage
Hindu	216	3	1.38
Muslim	20	1	5.0
Others	0	0	0.0

Figure No. 8: Religion-wise prevalence of Malaria



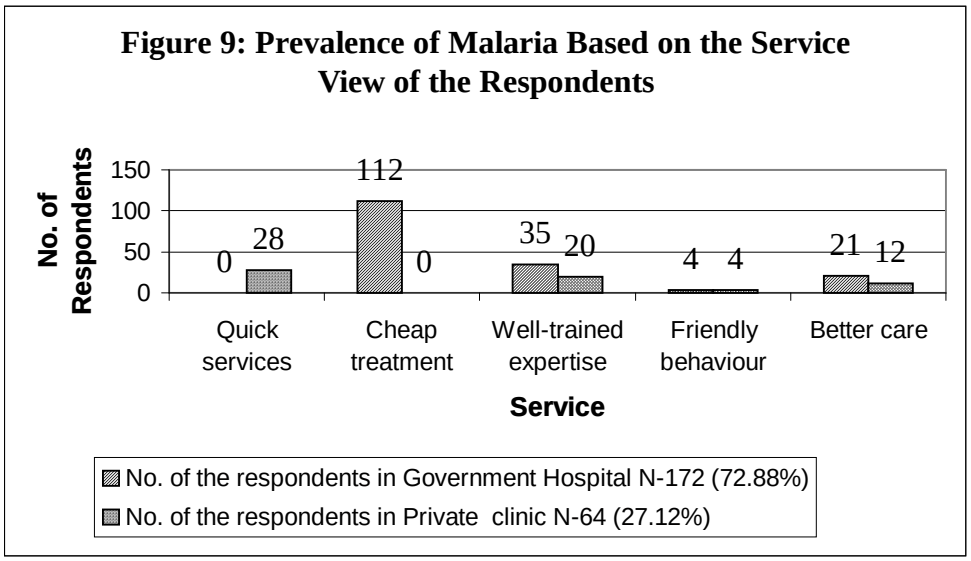
B. Respondents' View, Diagnosis and Treatment

9. Respondents' View Regarding Health Services

This study revealed that 172 (72.88%) people visited Government District Hospital for treatment. Among them 112 (65.12%) respondents visited government for cost effective (cheap) treatment, 35 (20.35%) for well trained expertise, 4(2.32%) for friendly behavior, 21(12.21%) for better care and nobody for quick service. Whereas 64 (27.12%) respondents visited Private Clinics for treatment. Among them 28 (43.75%) respondents care for quick service, 120 (31.25%) for well trained expertise, 4 (6.25%) for friendly behaviour, 12 (18.75%) for better care and nobody for cheaper treatment.

Table No. 9: Prevalence of Malaria Based on the Service Provided to the Respondents

S.N.	Services	No. of the respondents Visiting Government Hospital N-172 (72.88%)	No. of the respondents visiting Private clinics N-64 (27.12%)
1	Quick services	0 (0%)	28 (43.75)
2	Cost effective (cheaper)	112 (65.12%)	0 (0%)
3	Well-trained expertise	35 (20.35%)	20 (31.25%)
4	Friendly behaviour	4 (2.32%)	4 (6.25%)
5	Better care	21 (12.21%)	12 (18.75%)



10. Diagnostic Tools

In Government District Hospital, the malarial parasite were diagnosed through thick and thin blood smears and by immunological test (by kits) only for *Plasmodium falciparum.* In Private Clinics, malaria is diagnosed through immunological test for *Plasmodium vivax* and *Plasmodium falciparum* both. Blood slides having only thin smear was examined for RDT positive cases only.

11. Mode of Treatment

The way of treatment was found to be satisfactory in both Government District Hospital and Private Clinics. They treated the malaria patient after diagnosis. The cost in both clinics were quite different, NRs.25 in Government District Hospital only for diagnosis and medicines were provided free of cost whereas NRs. 200 only for diagnosis with extra charge for medicine in Private Clinics. Medical persons in the GDH use Chloroquine only for *Plasmodium vivax* and Coartem for *Plasmodium falciparum* patient. In Private Clinics Chloroquine and Primaquine were administrated to the patients regardless the species of *Plasmodium.* They recommended Chloroquine as an initial dose of 1 gm (600 mg base) followed by an additional 500 mg (300 mg base) after 6-8 hrs and a single dose of 500 mg on each of two consecutive days for adult patient was in both clinics.

The dosage for infants and children:

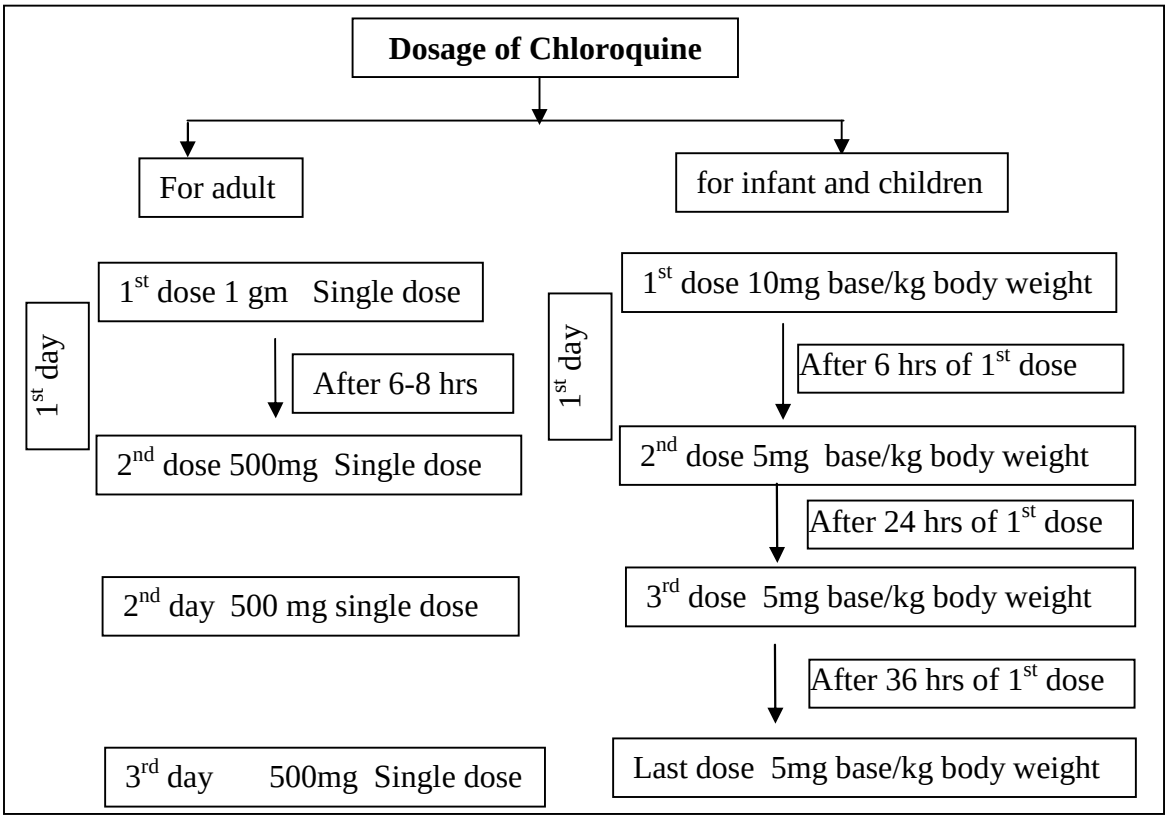
First dose: 10 mg base/kg body weight

Second dose: 5 mg base/kg body weight after 6 hrs of first dose

Third dose: 5 mg base/kg body weight after 24 hrs of first dose.

Last dose: 5 mg base/kg body weight after 36 hrs of first dose.

(According to Government and Private Clinics, Nawalparasi).



Coartem (Artemethar - Lumefautrin) is a preferred medicine for *P. falciparum* patient. It is provided according to the body weight twice daily for three days in GDH but not available in Private Clinics.

C. Knowledge, Attitude and Practice (KAP)

12. Analysis of Malaria Related Knowledge, Attitude and Practices (KAP) of Survey Population by Questionnaire.

Table No. 10: Knowledge of Respondents Towards Malaria

	No. of Total Respondents (N) = 236 in both GDH and PCs
Knowledge about malaria	
- Yes	77(32.62)
- No	159 (67.37)
Knowledge of signs and symptoms	
- Fever with chills	63 (26.69)
- Vomiting	4 (1.69)
- Headache	8 (3.38)
- Diarrhoea	1 (0.42)
- Nausea	0 (0.0)
- Didn't know	160 (67.79)
Knowledge of malaria transmission	
- Bites of mosquito	64 (27.11)
- Housefly	4 (1.69)
- Contamination of water and food	9 (3.81)
- Didn't know	159 (67.37)
Knowledge of preventive measures	
- Mosquito net	45 (19.06)
- Smoking	17 (7.20)
- Mosquito coil	8 (3.38)
- Spraying medicine	7 (2.96)
- Change in mosquito breeding site	0 (0.0)
- Didn't know	159 (67.37)
Knowledge of mosquito habitat	
- House corner	31 (13.13)
- Grassy area	8. (3.38)
- Shaddy places	28 (11.86)
- Dirty water	10 (4.23)
- Didn't know	159 (67.37)

A high proportion (67.37%) of the respondents were unknown about malaria and (32.62%) were known about the disease.

Majority of the respondents i.e. 160 (67.79%) did not know any signs and symptoms of the disease. Out of the respondents who replied any one symptom are 26.69% fever and chills, 1.69% vomiting, 3.38% headache and 0.42% diarrhoea.

When asked about knowledge of mode of transmission, maximum respondents did not know about transmission (67.37%). Among them who had knowledge about malaria transmission, replied that malaria is transmitted by the bit of mosquito 27.11% by housefly 1.69% and by contamination of water and food 3.81%.

Respondents were asked about protective measures. It was known that 19.06% used bed net, 7.20% used smoke, 3.38% used mosquito coil and 2.96% sprayed medicine.

When asked about knowledge of mosquito habitat, 67.37% respondents answered "did not know". From the questionnaire survey it was obtained that 13.13 % respondents answered that mosquito lives in house corner, 3.38% in grassy area, 17.86% in shaddy place and 4.23% in dirty water.

13. Attitude of Respondents Towards Malaria

Table No. 11: Attitude of Respondents towards Malaria

Attitude of respondents	No. of total respondents (N) = 236 (Both in GDH and PCs)
Buying medicine from a nearby medical store	51 (21.61)
Consulting medical doctors	160 (67.79)
Consulting traditional healers (quack's, dhami, Jhankri etc.)	17 (7.20)
Not a serious disease	8 (3.38)

After asking about attitude towards malaria, most of them (67.79%) answered that they would consult a medical doctor. A few (21.61%) respondents would buy medicine from nearby medical store, 7.20% would consult a traditional healer

(quacks, dhami, Jhankri etc) and a very few respondents (3.38%) thought that it is not a serious disease.

14 Practices of Respondents Towards Malaria

Table No. 12: Practices of Respondents Towards Malaria

Practices of respondents	No. of respondents (N) = 236 (Both in GDH and PCs)
Use of bed nets	
- Yes	152 (64.41)
- No	84 (35.59)
Sleeping habit	
- Indoor	113 (47.88)
- Outdoor	4 (1.69)
- Both	119 (50.42)

When questioned about the use of bed nets, it was found that 152 (61.41%) respondents were bed-net user but 84 (35.59%) never used it.

Of the total respondents, 113 (47. 38%) always sleep indoor, 4 (1.69%) sleep outdoor and 119 (50.42%) sleep both indoor and outdoor.

Photo 1: Interview with the Patient

Photo 2: Pricking the Finger for Blood Collection

Photo 3: Withdrawing the Blood

Photo 4: Preparing Blood Film for Malarial Parasite

Photo 5: Microscopic Examination of Blood smear

Photo 6: Researcher with Lab Technicians (from right Ashok Kumar Sharma, Kaladhar Poudel, Keshab Raj Gupta, Sangam Adhikari & Dipak Raj Pnthi)

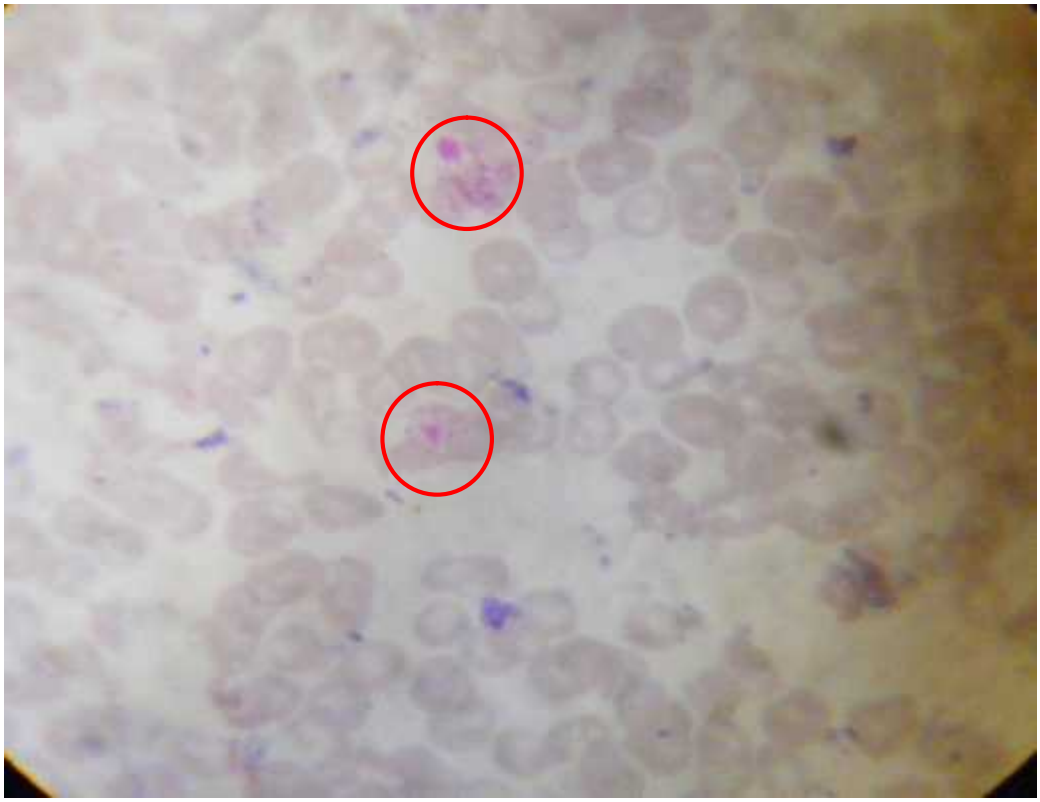


Photo 7: Trophozoite of *Plasmodium vivax*

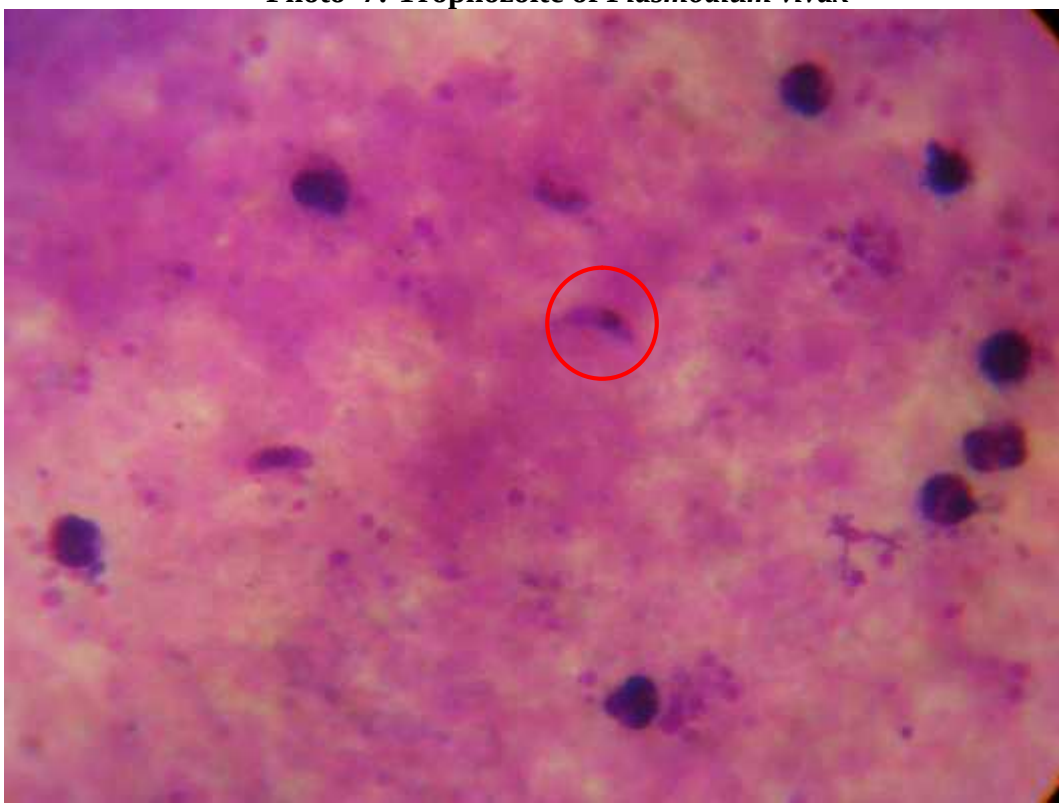


Photo 8: Gametocyte of *Plasmodium falciparum*

VI

DISCUSSION AND CONCLUSION

Out of 236 blood sample collection and examination, 4 were found positive for malaria. This represents 1.69% slide positivity rate of the total number of samples. The prevalence rate in 2006 was 7.46 and 4.22 in 2007 recorded by (DoH, Nawal parasi) was high than this result, this is because the study area is situated in low risk area (DoH, Nawal parasi). In this area there is lack of breeding sites except a few lake and drainage. The ponds and ditches of the town are cleaned in a regular basis.

Out of total 4 positive cases, 3 cases (75%) of *P. vivax* and only one case (25%) of *P. falciparum* were identified. Maximum positivity of *P. vivax* was reported by Sivakoti (2003) in Bhutanese refugee camp. Ghimire (2002) states that *P. vivax* has the widest distribution extending throughout the tropics, subtropics, and temperate zones. Sherchand (2002) also mentioned that *P. vivax* is the predominant species in most of the malarious area of Nepal by a factor of 10.1 ratio between *P. vivax* and *P. falciparum. P. vivax* is more common than *P. falciparum*. Similarly a study carried out in three wards of Kavre district in (2000) showed that percentage of *P. vivax* was higher (69.2%) than *P. falciparum* (30.7%) Karkee (2001).

The total number of *P. vivax* cases was higher (78.1%) than *P. falciparum* cases (20.1%) during last 3 years study period (1999-2001) in Morang district; the mixed (3.4%) were reported only in 1999 (DoH, 2002).

The analysis of the species-wise positivity of malaria among the refugees of Sanischare camp during 3 years (1998-2000) revealed that the total number of *P. falciparum* was higher than *P. vivax* in 1998 and 1999. But in 2000, the total number of *P. vivax* was more than *P. falciparum* (Sivakoti, 2003).

The clinic wise distribution of malaria was recorded that high suspected cases (172) but low positive case (1) in Government District Hospital where as low suspected cases (64) and high positive cases (3) in Private Clinics in study area due to lack of doctor in Private Clinics in last 6 months and in Prithbi-chandra District hospital, the doctor referred patient for blood examination.

It is observed that maximum respondents like to go for treatment in Government District Hospital (72.88%) than in Private Clinics (27.12%). Among them the

respondents who were interested towards Government District Hospital (65.12%) responded that they like to go there for cheap treatment followed by (20.35%) for well-trained expertise, (2.25%) for friendly behavior, (12.21%) for better care and nobody for quick service. Whereas in Private Clinics, maximum respondents (43.75%) went there for quick service, (31.25%) for well trained expertise, (6.25%) because of friendly behaviour, (18.75%) for better care and nobody for cheap treatment.

In this study, majority of the observed cases were from 21-30 years age group (n-55) followed by 11-20 years age group (n-52), 31-40 years age group (n-48) and others.

Sivakoti reported that the age group 31-40 yrs contributed to the maximum number of cases (39.9%) and least infection rate (3.03%) was observed in age group 50-60 years. The maximum infection was observed in Yadav community was found to be 20.88% in age group 21-30 years while maximum prevalence of Malaria parasites in Tharu community was reported as 7.14% in age group 11-20 years (Chatrubedi, 2007). The total number of positive cases contributed by age group 21-30 years and 31-40 years might be due to their free movement in malaria endemic areas of Indian States like Utter Pradesh, Maharastra and Others also in Economic Pursuit and this age groups were not only hard worker in field but also more active in evening time.

The sex-wise analysis of malaria positive cases during the study period showed that 75% of the cases had occurred in males and 25% of the cases had occurred in female. This result is similar to the result of Shahu (2006) where he reported that 80% positivity in males and 20% in females in Sunsari district. Similar was the result as obtained by Sivakoti (2003) in Bhutanese Refugees camp where he reported 85% positive in males and 15% in females because maximum mobility and hard work was done by males in endemic area than in females.

Regarding moth-wise distribution of malaria maximum blood slide examination showed a peak in Aug-Nov. (73) in PCD Hospital and 56 in PCs. In this month maximum positivity (3) was seen. One in PCD Hosptial and another two in PCs. The highest percentage of blood slide examination and maximum positivity in Aug-Nov. because drain, ditches, ponds, puddles fulfill with water which provide suitable breeding ground for mosquitoes. Another one positive case was recorded in winter season because this one was imported from India and his Village is situated near the

sugar factory. We know that surrounding of mills facilitated for the mosquito breeding and infection also due to suitable temperature and dirtiness. Maximum positivity was recorded in Aug-Sep by Shahu (2006) and the same is also supported by Chaturbedi (2007).

Among 4 positive case 3 were from Hindu and only one cases observed in Muslim because pressure of Hindu (94:70%) population is high than in Muslim (3.35%) population (DoH- Nawalparasi, 2007). So there were maximum possibility for infection in Hindu community than in the Muslim and other community.

The result revealed that the majority of malaria was in farmer among 4 positive cases 2 were farmer where 1 in PCD hospital and another 1 in PCs and other two found in Housewife and Businessman in PCs because of lack of proper awareness towards malaria and its transmission. The positive cases were from illiterate and under SLC level, that education plays an important role in building up of positive social attitude towards common infection and mode of transmission in society.

Questionnaire survey among 236 respondents in both clinics namely PCD Hospital and 3 Private Clinics regarding malaria related KAP showed that, (32.62%) respondents were familiar with few symptoms of the disease. Among the respondents, (27.11%) know that it is transmitted through bites of mosquito. The same result was recorded the knowledge about mosquito breeding site in both clinics which was 31.39% and 35.93% in PCD Hospital and PCs respectively. The respondents had little idea about knowledge regarding mosquito breeding site. Seventy five percent positive case was seen in those respondents who never used bed nets and same 75% cases had both (indoor and outdoor) sleeping habit.

After the study, it has been concluded that poverty, literacy, age, occupation lack of knowledge regarding vector, outdoor and indoor sleeping without bed nets and other are the main responsible factors for the further spread of malaria.

VII

RECOMMENDATIONS

The findings based on the present study showed that the malaria is major public health problem in headquarter of Nawalparasi and surrounding villages. The following recommendations have been made on the basis of results for effective control of malaria in Nawalparasi.

- Public awareness programs should be conducted regularly in relation to prevention and control of mosquito and mosquito borne disease.
- People are to be motivated not to take anti-malarial drugs without blood examinations.
- Insecticides and insecticide impregnated bed-nets should be distributed to all suspected areas.
- Cases should be detected and treated immediately.

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ANNEX - 1

QUESTIONNAIRE

Name…….
Age……

Address…….

ward no……

Village……

1) What is your educational statue?

   a) Literate ( ) b) Primary ( ) c) Lower secondary ( )

   d) Secondary ( ) e) Higher secondary or above ( )

2) What is your occupation?

   a) Student ( ) b) Farmer ( ) c) Service ( )

   d) Business ( ) e) House wife ( )

3) Do you know about Malaria?

   a)Yes ( ) b) No ( )

   If yes, what are the symptoms?

   a) Fever with chills

   a) Regular ( ) b) Irregular ( )

   c) Shoulder pain ( ) d) Back pain at the leg ( )

   e) Vomiting ( ) f) Headache ( )

   g) Diarrhea ( ) h) Nausea ( ) i) Didn't know ( )

4) Do you know about malaria transmission?

   a) Yes ( ) b) No ( )

   If yes, what are the routes ?

   a) Mosquito biting ( ) b) Housefly ( )

   c) Contaminated water and food ( ) d) Contact with infected person ( )

   e) Didn't Know ( )

5) Where do you sleep?

   a) Indoor ( ) b) Out door ( ) c) Both ( )

6) Do you use mosquito net?

   a) Yes ( ) b) No ( )

7) Do you know how to avoid mosquito biting?

   a) Mosquito coil ( ) b) Electric vaporizer ( ) c) Smoking ( )

   d) Mosquito net ( ) e) Change the mosquito habitat ( )

f) Spraying medicine ( ) g) Didn't know ( )

8) Do you know about mosquito habitat?

a) Yes ( ) b) No ( )

If yes, what are these?

a) House corner ( ) b) Dirty water ( ) c) Shady places ( )

d) Grassy area ( ) e) In soil ( ) f) Didn't know ( )

9) Which health center do you prefer?

a) Governmental ( ) b) Private Clinics ( )

and why?

a) Better facility ( ) b) Better care ( )

c) Cheap treatment ( ) d) Quick service ( )

10) Can you give me your opinion, about service provided by this health center?

a) Quick service ( ) Slow service ( )

b) Cheap ( ) Expensive ( )

c) Friendly behavior ( ) Unfriendly ( )

d) Availability of well trained expertise ( )

e) Better care ( )

11) How were you diagnosed as a malaria patient ?

A) With the help of only symptoms ( )

B) Blood examination ( )

a) Thick blood smear ( ) b)Thin blood smear ( )

c) Thin and thick blood smear ( )

C) Immunological test ( )

12) What is the result of blood diagnosis?

A) Positive ( ) B) Negative ( )

If positive, what are the causative agent?

a) *P. vivax* ( ) b) *P. falciparum* ( )

13) Did you take malaria during diagnosis?

a) Yes ( ) b) No ( )

14) Which drugs are you having for treatment?

Name of the drugs……

Dose…….

15) Since how long have you been taking malaria drugs?

Days…….

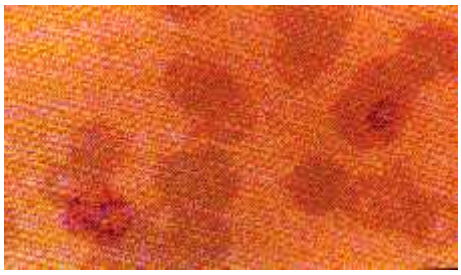
16) Are the malaria drugs freely available?

a) Yes ( ) b) No ( )

ANNEX-2

AN INTRODUCTION OF *Plasmodium vivax*

Early trophozoites (ring forms) of *Plasmodium vivax*



Late trophozoite and mature schizont of *Plasmodium vivax*

Source: Medical Parasitology, 2007

Classification

Kingdom:	Protista
Phylum:	Apicomplexa
Class:	Aconoidasida
Order:	Haemosporida
Family:	Plasmodiidae
Genus:	*Plasmodium*
Species:	*P. vivax*

Plasmodium vivax is a protozoal parasite and a human pathogen. The most frequent and widely distributed cause of recurring (tertian) malaria, *P. vivax* is one of four species of malarial parasite that commonly infect in humans. It is less virulent than *Plasmodium falciparum*, the deadlist of the four, and seldom fatal. *P. vivax* is carried by the female *Anopheles* mosquito, since it is the only sex of the species that bites.

Epidemiology

P. vivax is found mainly in Asia, Latin America, and in some parts of Africa. *P. vivax* can cause death due to splenomegaly (a pathologically enlarged spleen), but more often it causes debilitating – but non-fatal – symptoms.

Biology

P. vivax can reproduce both asexually and sexually, depending on its life cycle stage.

Asexual forms:

- Immature trophozoites (Ring or signet-ring shaped), about 1/3 of the diameter of a RBC.
- Mature trophozoites: Very irregular and delicate (described as *amoeboid*); many pseudopodial processes seen. Presence of fine grains of brown pigment Malarial Pigment or hematin is probably derived from the haemoglobin of the infected red blood cell.
- Schizonts (also called meronts): As large as a normal red cell; thus the parasitized corpuslce becomes distended and larger than normal. There are about sixteen merozoites.

Sexual forms: Gametocytes: Round. The gametocytes of *P. vivax* are commonly found in the peripheral blood at about the end of the first week of parasitemia.

Life Cycle

The incubation period for the infection usually ranges from ten to seventeen days and sometimes up to a year. Persistent liver stages allow relapse up to five years after elimination of red blood cell stages and clinical cure.

Human Infection

The infection of *Plasmodium vivax* takes place in human when an infected female *Anopheles* mosquito sucks blood from a healthy person. During feeding, mosquito injects saliva to prevent clotting of blood and along with the saliva, thousands of Sporozoites are inoculated into human blood and reproduce asexually giving rise to thousands of merozoites(*Plasmodium* daughter cells) in the circulatory system including liver.

Liver Stage

The *P. vivax* sporozoite enters a hepatocyte and begins its exoerythrocytic schizogony stage. This is characterized by multiple rounds of nuclear division without cellular segmentation. After a certain number of nuclear divisions, the parasitised cell will segment and merozoites are formed.

There are situations where some of the sporozoites do not immediately start to grow and divide after entering the hepatocyte, but remain in a dormant, hypnozoite stage for weeks or months. The duration of latency is variable from one hypnozoite to another and the factors that will eventually trigger growth are not known. This explains how a single infection can be responsible for a series of waves of parasitaemia or "relapses". Different strains of *P. vivax* have their own characteristic relapse pattern and timing.

Erythrocytic Cycle

P. vivax preferentially penetrates young red blood cells (reticulocytes). In order to achieve this, merozoites have two proteins at their apical pole (PvRBP-1 and PvRBP-2). The parasite uses the Duffy blood group antigens (Fya and Fyb) as receptors to penetrate red blood cells. These antigens do not occur in the majority of humans in West Africa

The parasitised red blood cell is up to twice as large as a normal red cell and Schüffner's stippling (also known as Schüffner's dots or Schüffner's granules) is seen on the infected cell's surface, the spotted appearance of which varies in color from light pink, to red, to red-yellow, as coloured with Romanovsky stains. The parasite within it is often wildly irregular in shape (described as "amoeboid"). Schizonts of *P. vivax* have up to twenty merozoites within them. It is rare to see cells with more than one parasite within them. Merozoites will only attach to immature blood cell (reticulocytes) and therefore it is unusual to see more than 3% of all circulating erythrocytes parasitised.

Sexual Stage

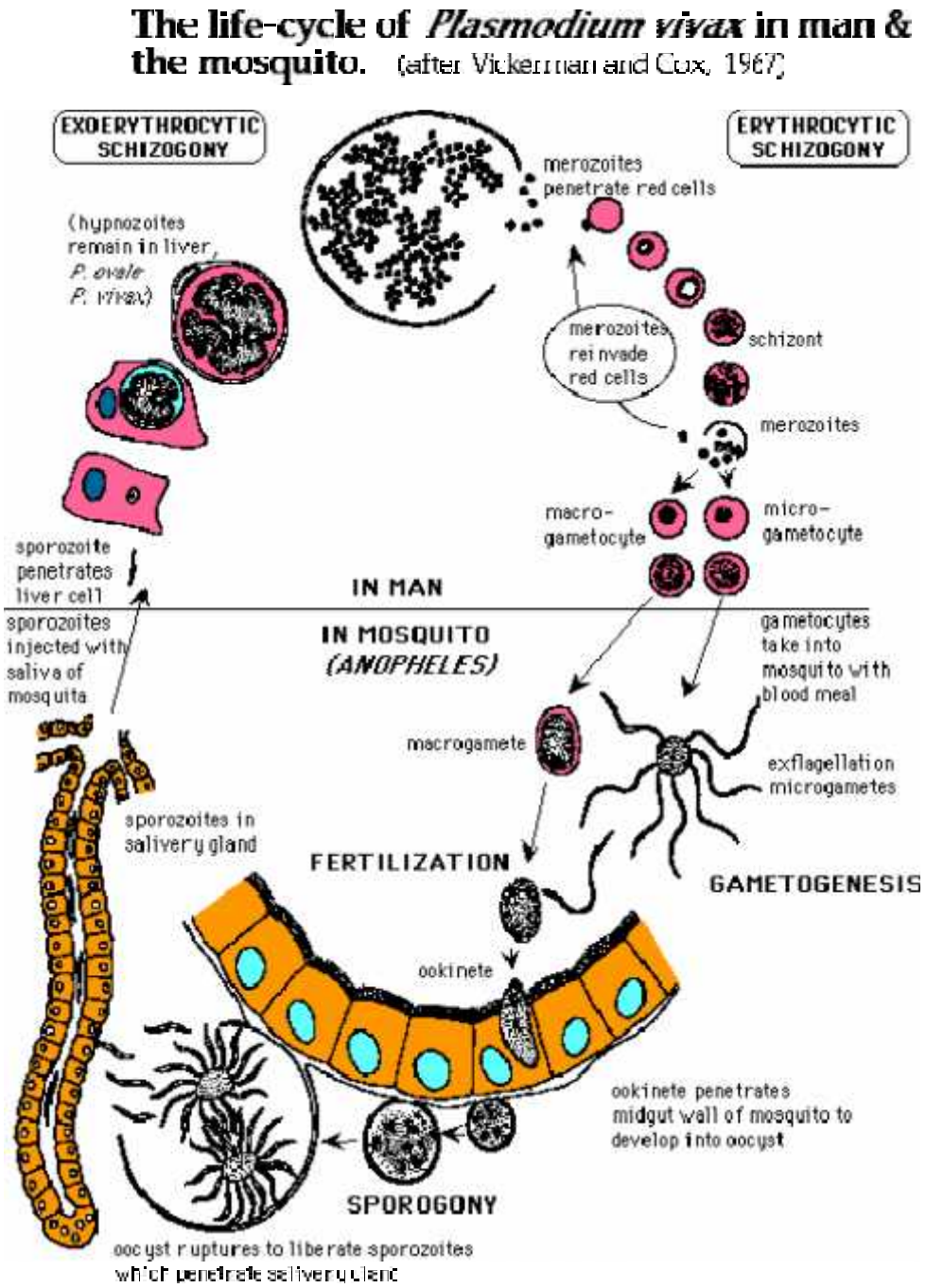
The sexual stage includes following processes by which *P. vivax* reproduces sexually:
i) Transfer to mosquito ii) Gametogenesis

a) Microgametes
b) Macrogametes

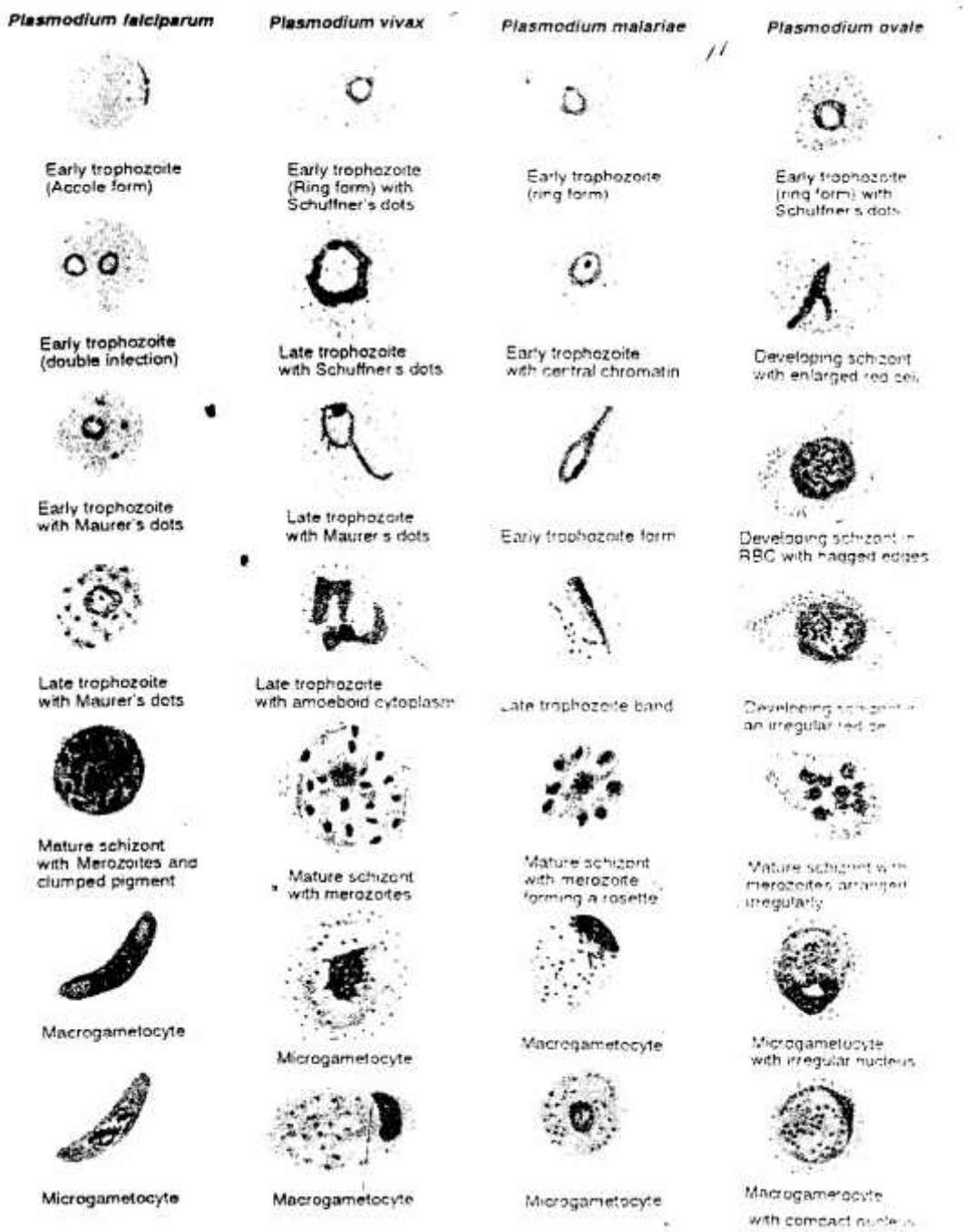
iii) Fertilization iv) Ookinite v) Oocyst vi) Sporogony

Mosquito Stage

The sexual cycle of the parastie starts in the human host by the formation of gametocytes which are transferred to the female *Anopheles* during its blood meal from an infected person. The gametocytes mature, achieve fertilization and multiply in the stomach wall of the mosuite producing about 1,000 oocyst. The oocyst brusts into the mosquito's body cavity and finally invade the salivery glands. This sexula cycle takes about 9-30 days depending on the temperature and the species of the parasties.



Different Stages of four species of Plasmodia during their developmental stages



Causes

Malaria is caused by infection with a parasite called *Plasmodium* that is transmitted by mosquitos.

Malaria parasite

There are four different types of *Plasmodium* parasite infecting humans.

- *Plasmodium falciparum* - this is the only parasite that causes malignant malaria. It causes the most severe symptoms and results in the most fatalities.
- *Plasmodium vivax* - this causes benign malaria with less severe symptoms than *P. falciparum. P. vivax* can stay in our liver for up to three years and can lead to a relapse.
- *Plasmodium ovale* - this causes benign malaria and can stay in our blood and liver for many years without causing symptoms.
- *Plasmodium malariae* - this causes benign malaria and is relatively rare.

P. falciparum is responsible for about three-quarters of reported malaria cases. Most of the other cases of malaria are caused by *P. vivax* with just a few caused by the other two species. It's possible to get infected with more than one type of *Plasmodium* parasite.

Each parasite causes a slightly different type of illness.

Symptoms

The first symptoms of malaria are like having the flu. One may have

- a headache, aching muscles, tummy ache, weakness or lack of energy.

A day or so later, temperature rises up to 40°C and one may have.

- a fever, shivers , mild chills , a severe headache , a loss of appetite, vomiting, diarrhoea

Symptoms can appear any time after being bitten by a mosquito carrying the malaria parasite. However, it takes at least six days for symptoms to appear.

The time it takes symptoms to appear can vary with the type of parasite that the mosquito was carrying.

- If bitten by a mosquito carrying the *P. falciparum* parasite, symptoms usually appear within three months of being bitten.
- If bitten by a mosquito carrying the *P. vivax, P. ovale* or *P. malariae* parasite, symptoms can appear a year or more after being bitten. This is because the parasite can lay dormant in liver and become active months later. These parasites may also cause repeated symptoms.

Complications

If infected with *P. falciparum*, malaria can progress to a more severe form (also called complicated malaria). One may have symptoms including:

- low blood sugar levels, severe anaemia, jaundice, fluid on the lungs (pulmonary oedema), acute respiratory distress syndrome, kidney failure, spontaneous bleeding, state of shock (circulatory collapse), fits (convulsions), paralysis, coma

Severe malaria can affect the brain and central nervous system and can be fatal.

Symptoms of severe malaria can appear within hours or days of the first symptom of malaria.

Complications are likely to be more severe in pregnant women, children and the elderly.