I

INTRODUCTION

Malaria is one of the world's most public health concerns. It is the infectious disease caused by single celled parasite belonging to the genus *Plasmodium* which includes over 125 species infecting reptiles, birds and mammals. Malaria parasites infecting human belong to 4 species, *Plasmodium vivax*, *Plasmodium falciparum, Plasmodium malariae* and *Plasmodium ovale* (Arora and Arora, 2005).

Out of four species only *P.vivax* and *P.falciparum* have been reported to infect the people of Nepal till the date. The parasites take up residence in the victim's blood cells. The definite diagnosis of malaria is made by the identification of malarial parasites in peripheral blood film (Park, 2000).

The parasites usually are transformed from infected to non-infected people via the bite of female *Anopheles* mosquito. In context of Nepal only four species of *Anopheline* mosquitoes are capable of transmitting human malaria parasites which are *A.minimus*, *A.fluviatilis*, *A.annularis, A.maculatus*. The incubation period varies with parasitic species and more over with temperature. At the common tropical temperature, the incubation period has been found for-

P.falciparum - 7- 27-days (depending upon vector species).
P.vivax - 8 - 31 - days (depending upon vector species).
P.malariae -28 - 37- days.
P.ovale - 8 - 31- days

Malaria is thought to kill between 1.1 and 2.7 million people worldwide each year of which about 1 million are children under the age of 5 years in Africa and south of the Sahara. Malaria is Africa's leading cause of under – five

mortality (20%) and constitutes 10% of the continent's overall disease burden. In Africa more than 12 billion US $ of national GDP has been spending every year to control Malaria, even though it could be controlled for a fraction of that sum (RBM, 2003).

The areas of Ajodhya hills of district Purulia West Bengal (India) has been endemic for malaria since long time. In1997and 1998 the district contributed 2.4% (9932 out of 79811) and 10% (13248 out of 130288) malaria cases respectively resulting 9.45% (7 out of 74) and 5.5%(4 out of 72) deaths respectively in the state. Annual blood examination rate of the district was 10.4% in 1997 and 5% in 1998. (Mukhopadhya *et al.,* 2000)

Malaria has been a major public health problem in Bangladesh also. Approximately 88% of the 128 million populations are at risk of malaria. Majority of malaria cases are reported from 13 out of the total 64 districts in the country. The cases recorded were 68,594 in 1997; 60,023 in 1998; 63,723 in 1999; 55,599 in 2000 and 55,646 in 2001. (WHO; SEARO, 2002)

South Africa had adapted the using of DDT in 1996. Until then the total number of malaria cases was below 10,000 and there were seldom more than 30 deaths per year. But in 2000, there were 65,000 cases of malaria and 458 death due to this. There were 89 deaths by malaria recorded in 2004. It was thought that the malaria disease cannot be fully eradicated without the operation of malaria controlling programmes by neighboring countries. The Global Fund assists these countries to fight against malaria by using DDT and achieving the millennium goal to halt and begin to reverse malaria case by 2015. (British Broadcasting Corporation News, 2005)

In the context of Nepal the first documented epidemiological survey was done in 1925 by Major Phillips of Indian Military service in Makwanpur Valley and Chitwan. The mortality rate in children was estimated at about 43% among Phadies (Hill People) and 17% among Tharus (Tribal of the Terai areas) (Bista *et al*., 2002).

According to Vector Borne Disease and Control Training Center, in Nepal approximately 61.6 million (74%) are at malaria risk distributed over 65 districts in 5 development region. Out of 22.5 million populations during 1995 to 1999 less than 10000 malaria cases have been reported annually and population of *P. falciparum* ranged between 5.6 to 12.8%. The bordering districts of Nepal are main contributor of malaria.

The risk of malaria is present throughout the year below approximately 4000ft. elevation in the Terai districts. The 13 districts which are mostly malaria affected are Nawalparasi, Sindhuli, Kavre, Morang, Jhapa, Ilam, Bake, Bardia, Kanchanpur, Dadeldhura & Kailali. The Global fund is supporting these districts to free from malaria.

An outbreak of malaria has gripped the southern VDCs of Nawalparasi district in 2006. According to the Nawalparasi District Health Office, Paklihawa, Triveni, Jamuna and other VDCs showed rise in the number of malaria patients in July and August. Five patients were found catching dangerous malaria in between July and August in Paklihawa VDC. Despite the efforts to tame the disease through launching of various programmes in the district malaria is raising in boardering VDCs. (Nepal Malaria, www.flue trackers.com)

In 2007, out of 27.5 million population of the country, 22.8 million are at malaria risk in Nepal. Out of that, 7 million reside in forests and forest fringes and inner Terai and plain cultivated area are at moderate risk of malaria and around 15.6 million in hill areas and are at low risk of malaria. Malarious areas of the country have been stratified into five eco – epidemiological strata. From 1996 malaria cases have remained below 1000 annually. *P. falciparum* proportion was 10 to 13 in 1996 and 1997 because of the outbreak in 1996 in Kanchanpur and Nawalparasi in 1997. Malaria incidence in the last 5 years has stabilized at around 8000 to 9000 cases annually. In 2000, there were 7616 cases with 7.4% of *P. falciparum* cases. Monthly distribution of malaria indicated that the disease is prevalent throughout the year with main concentration during the monsoon season. Even *P. falciparum* is found

throughout the year. In (1998 – 1999) altogether 47000 clinical malaria cases with 8900 (in 1999) confirmed malaria cases were recorded with morbidity rate due to malaria estimated at 0.35% for the area at malaria risk. The highest morbidity rate (API – 7.3%) was in Kabhreplanchowk district where 29% of the total country confirmed malaria cases were recorded in 1999. In the Mahadevsthan VDC of the district, maximum 45 cases were concentrated. In Kanchanpur district the reported malaria cases keep on declining, however, the probable malaria cases are going up continuously with 20,737 in 1998 to 63,933 in 2002. (SEARO – 2007).

The burden of malaria can be reduced significantly using existing preventive and treatment measures. The international community has set their clear targets to reduce the malaria burden. In this course, in1955 WHO launched worldwide malaria eradication programme which were continued till 1970 but become unsuccessful. After that the UNDP, UNICEF, the World Bank and WHO agreed to share their funds, experts and resources to tackle those targets. As a result in1998 "Roll Back Malaria" RBM and under this Millennium development goal programme came worldwide with special focus on Africa. These programmes keep the objectives of halving the global burden of malaria by 2010 (Malaria News 03-2007 Tanzania, 03-2007 Ghana). Nepal has also adopted RBM project and in 1997 EWARS was established. These works are being conducted by the Epidemiology and Disease Control Division, Ministry of Health, Nepal.

Significance of the study

The present study was aimed to seek the relationship between risk factors and disease burden and the comparison of malaria cases attending government and private health facilities, so as to assist the control of malaria.

II

OBJECTIVES

General objectives:

The general objective of the study is to analyze the situation of malaria cases from the suspected patients visiting government and private health facilities at 3 VDCs (Kalyanpur Jabdi, Itari Parsahi and Bishnupur Pra. Ra.) of Siraha district.

Specific objectives:

- To analyze the prevalence of clinical and conformed malaria cases.
- To compare the number of malaria cases visiting government and private health facilities.
- To know the diagnostic tools used by the government and private health facilities.
- To know the treatment given by the government and private health facilities.
- To make people aware about malaria at those 3 VDCs.

III

LITERATURE REVIEW

Malaria continues to be a major burden and reason of the rate of mortality throughout the developing world. It is a very old disease. It was probably originated in Africa and came to South East Asia with the accompany of human migration to the Mediterranean shores. The word malaria is derived from the Italian word, mala - aria or “bad air ". It was also known as roman fever. It was in 1880 that Laveran, a French army surgeon in Algeria, first saw and described malarial parasite in the red blood cells of man. He gave the name O*scillaria malariae* in 1881 in which it is known to include the three principal *Plasmodia* of man and was the first to describe crescentic gametocytes. Although Richards, in1882, confirmed the observations of Laveran, they were not accepted generally until 1885 because of the belief that the disease was bacillary etiology due to the *Bacillus malariae* of Klebs and Crudeli (874). In 1891, Grassi and Feletti initiated the studies of avian *Plasmodia* which led to the disclosure of the sporogonic cycle and the transmission of malaria by mosquitoes. In 1885 Ross observed the exflagellation in the stomach of mosquitoes. In 1898, by name, Bastianelli and Grassi discovered the zygote of the parasite of human malaria in *Anopheline* mosquitoes and demonstrated the transfer of infection from man to man by the mosquitoes. Between 1948 -1955, the pre erythrocytic cycle of the malarial parasites of man and mammals were demonstrated by Shortt and his co-workers. In the last three decades there have been many significance made on malaria disease. So there are great potential to make a major contribution to control of this disease.

Malaria in global context

Shrivastava *et al*., (2000) studied the malaria receptivity using Geographical Information System (GIS) as a tool in Nadiad Taluka, Kheda district, Gujarat India. The district comprises 100 villages with unstable malaria and periodic epidemic. The composite map of 13 stratification classes was prepared. Stratification classes 1-12 fell in non-irrigated tracts and exhibited 95% matching of areas of high receptivity as revealed by Geographical Information System (GIS) annual malaria parasite incidence (API). Stratification class 13 an irrigated area, showed poor matching but the ground verification established low receptivity of the area. Thus the study revealed that high malaria in villages of Nadiad is mainly due to high water table, soil type irrigation and water quality.

Onwujekwe *et al*., (2000) studied the willingness To Pay (WTP) for the retreatment of mosquito nets with insecticides in 4 communities of South Eastern Nigeria; found most households were willing to pay for annual ITN treatment in all four communities. The proportion of those willing to pay ranged from 79 to 91% WTP amounts ranged from $ 0.05 to $ 5.26. The median from the aggregated data from the four communities was $ 0.21. Multivariate analysis showed that many explanatory variables were statistically significantly related to WTP for ITN retreatment.

Klun *et al.,* (2001) studied the efficacy of optically inactive 1-[3 - cyclohexan - ylcarboxyl] piperidine and 1- [3-cyclohexene-1- ylcarboxyl]-2 methyl piperidine are repellants against blood feeding arthropods. Pure stereoisomer's of these compounds were synthesized and characterized for use in bioassays. Initial laboratory tests with the malaria vector *Anopheles stephensi*. Liston showed that this species was repelled differentially by the stereoisomer's of 1-[3-cyclohexen -1- ylcarboxyl]-2-methyl piperidine. Two stereoisomers were twice

as repellants as the other stereoisomer. These results indicate that stereoisomerism influences repellants efficacy in this class of compounds.

Lell *et al.,* (2001) surveyed the body temperature follows a circadian rhythm with a low around 6 a.m. and a peak about 12 hours later. The effect of endogenous oscillation is unknown obtained hourly measurements of the rectal temperature of the 66 children with *P. falciparum* malaria. Even at febrile temperature, the temperature followed a clear circadian rhythm. 33 (50%) had fever above 30^0c at 6 pm on the first day compared to only 9 (14%) at 6 am the next morning. This considerable difference was also found on the 2^{nd} of observation since in clinical practice antipyretics are often given above a certain fever threshold the time of day should be taken into account when antipyretics are applied.

Guenther *et al.*, (2002) estimated the frequency of renal dysfunction in falciparum malaria in total of 108 adult patients. It was found that using sensitive markers 55% patients have a reduced Glomerular Filtration rate (GFR).

Suwonkerd *et al.,* (2003) studied the variation and density of malaria vectors in two areas i.e. Transmission Area (TA) and Non Transmission Area (NTA) of Chiang Mai province, Northern Thailand from 1977 to 1989 and 1990 to 1999. The result revealed that there were no significant differences in density of the main malaria vectors *Anopheles minimus* Sensu Latue and *A. dirus* S.L. between areas (TA & NTA). However, the change in the density of *A. minimus* from the first to the second period was significantly different.

Wernsdorfer *et al.,* (2003) studied and cleared the association between man and malaria dates to prehistoric eras coming from Africa along the Nile Basin, man and malaria reached Central Europe probably during the last interglacial - and disappeared during the last glacial period. But it returned again with favorable climate for malarial parasites and during the medieval period until the 20^{th} century most of the countries of the Central Europe were endemic for malaria except Leoh tenstein. *P. vivax* and *P. malariae* were responsible for

most of the infections. *P. falciparum* occurred only on the North Sea Coast and southern part of Central Europe. The main malaria vectors were *Anopheles merseae*, *A.maculipennis* and *A. atroparvus*, regionally also a *A. claviger.* The discovery of the malaria parasites and the education of the transmission of the disease produced on understanding of the disease and its control. During the pre war and inter-war eras malaria receded in Central Europe, but during the wars and their after month, malaria came back in force. Improved control methods led finally in 1962 to the eradication from the last part of Central Europe.

Singh *et al.,* (2003) studied the usefulness of the intradermal smear test in the diagnosis of malaria. One hundred cases of suspected malaria (having received no prior anti malarial) were investigated. Both peripheral blood film (PB) and intradermal smears (IDS) were simultaneously prepared and patients placed on ant malarial therapy. The slides were repeated for the next 2 days. At admission 70 cases were positive on PBF - 59 were *P. falciparum* and 11 were *P. vivax* (Pv) where as surprisingly 62 cases were positive on IDS at admission 61- were PF. One was Pv. IDS identified two more cases of PF (P value not significant) but failed to identify any new cases of PV (P-value NS). On subsequent days IDS positivity for PF was higher than for PBF ($P< 0.05$ for day 1 and $P<0.001$for day 2). However, the PV yield was poor for any further statistical evaluation-on subsequent days, they concluded that IDS is simple, easy to perform requires no infrastructure compared to PBF and is a helpful diagnostic tools in cases where malaria is strongly suspected but peripheral blood slides are repeatedly negative due to prior use of ant malarial therapy. IDS may be added to routine PBF in malaria (especially Pf).

Frevert and Ute (2004) studied the biology of liver stage malaria infection caused by sporozoites. Experimental observation showed that sporozoites entry into the liver parenchyma involves a complex cascade of events from binding to extra cellular matrix proteoglycons via passage through Kupffer cells and transmigration through several hepatocytes until the final host cell is found. By choosing the liver as their initial sites for replication, *Plasmodium* sporozoites can exploit the tolerogenic properties of this unique immune

organ to invade the host's immune response.

Abeku *et al.,* (2004) investigated the implementation of a district base surveillance and epidemic monitoring system using a network of sentinel sites in four pilot districts of Kenya and Uganda. They applied potential use of weather monitoring as well as disease surveillance for effective early warning. Malaria epidemics have long been known to recur in the African high lands. Efforts to develop a system of early warning and detection for epidemics are outlined.

Roberts, David and Thomas, Williams (2004) studied the haemoglobinopathies having celebrated role in the study of human genetics as the first example of balanced polymorphisms described in human population. Over the last 50 years considerable evidence has been provided to show that these traits do confer protection from malaria. More recently the underlying mechanisms of protection have been examined. This short reviews summarizes these studies and where possible shows how the putative mechanisms of protection may be linked to redox process.

Matta *et al.,* (2004) studied the knowledge about malaria attitude and health seeking behavior of fever patients attending medicine out patients of Department at Safdarjang Hospital, New Delhi from Jun to August 2003. They applied cross sectional survey comprising 200 fever cases with pre structured and pre tested questionnaire. Data on socio-demographic profile, history of fever, health seeking behavior etc were recorded. Results about 83% of fever cases did not approach the doctor even after three days of one set of fever symptom, 25.5% tried self medication and 20.5% approach the chemists for treatment. Knowledge about cases and prevention of malaria was found to be inadequate in the study subjects. They concluded that the knowledge about malaria is poor even in persons residing in urban localities and proper health education is required for successful control of malaria. Information, education and communication activities are indicated to create awareness among the community.

Das *et al.,* (2004) studied epidemiologically and entomologically in forest fringed villages and a Tea Estate in Sonitpur district in Assam to assess the malaria situation. Thick and thin blood smears are prepared by collecting blood samples and stained with Giemsa were used for malaria parasite detection. Mosquitoes were collected by elight traps and hand catch methods. 48% SPR, 49.1 Pf % was recorded from the study villages children between 10 to 14 years were most suffered. Per trap night a density of mosquitoes in human dwellings was 204.3 and in cattle sheds--908.7 *Anopheles minimus* accounted for 20.7% of total malaria vectors. The results showed high malaria risk in the study villages. High vectors density with high parity rate, poor socioeconomic condition, lack of awareness, poor sanitation and congenial atmosphere for mosquitoes proliferation are aggravating the malaria situation are more complex in the study area.

Kambili *et al.,* (2005) studied the two previous reviews of New York Hospital experience with 110 cases of malaria from 1968 to 1990. They extended these studies to include 59 cases of malaria seen from 1991 to 1999 and analyzed trends over the past 30 years. *P. falciparum* remains the most common species 38 (64%) of the 59 cases, with the majority of them 34 (89%) of 38 cases being acquired in Africa. Of the 59 cases, 22 (37%) were immigrants living in the United States who visited their countries of origin. Only 5 (8%) of 59 patients reported using chemoprophylaxis. This presents marked decrease from the previous reviews. None of the immigrants of their children used chemoprophylaxis. Diagnosis was prompt and patients responded well to therapy. Complication of malaria was low and no deaths were reported, as was the case in the previous reviews. The low use of chemoprophylaxis particularly among immigrants is a major concern.

Rogier *et al.,* (2005) studied the isolation of *P. falciparum* collection before during and after 1999 a malaria epidemic in Dijibouti and showed that despite of high prevalence of resistant to chloroquine, the epidemic cannot be

attributed to sudden increase in drug resistant of local parasite population.

Baruah *et al.,* (2005) studied the Impregnated bed nets as an alternative of DDT residual spray in Sonapur area during 1988 to combat malaria and death due to it. It was observed that after two years regular use of impregnated bed nets brought down the annual parasite incidence (API) significantly. But remarkable impact of these bed nets was observed on the feeding behavior of the principal vectors *Anopheles minimus*. After three years of continuous use of these bed nets, the house resting adult mosquitoes were collected during 1990 and 1991and showed that *Anopheles minimums* was hill in the rooms where these nets were used or hanged. But from the rooms other than bed rooms of these houses a total of 588 *Anopheles minimus* and 71 *Anopheles fluviatilis* mosquitoes were collected during early mornings from 0600 h to 0900 h. The anthropophilic index was found to be 4% 3% in *Anopheles minimus* in comparison to 99% at the time of inception of bed nets strategy. Where as in case of *Anopheles fluviatilis* anthropophilc index was found to be 25.4%.

Talusina *et al.*, (2006) studied the controversial subject of mutant *P.falciparum* resistant malaria spreads in different 6 Ugandan populations with varying prevalence of chloroquine resistance (CQR) malaria transmission intensity, multiplicity of parasites clones and CQ used for each population. They determined the wild and mutant allele frequency at codons 76 and 86 of the pfcrt and pfindr 1 genes respectively. The highest frequency (median = 16.3%, range: 0.0 – 70.4%) of infection with two pure mutants (no wild genotype in either gene), adjusted for clone multiplicity had been observed at the extremes of malarial transmission intensity. The spread of mutant linked to CQR in *P. falciparum* commences with the pfcrt – 76 gene mutation followed later by the pfmdr – 86 gene mutations that modulate higher CQR. Such spreads occurs faster at the extremes of the transmission spectrum and could explain why mathematical model have previously generated conflicting results with respect to malaria transmission intensity and spread of CQR.

Humer *et al.,* (2007) studied the improvement of the accuracy of malaria diagnosis with rapid antigen detection diagnostic tests (RDTs) in sub Saharan Africa. They applied cluster sample survey between March and May 2006 in government and mission health facilities in 4 sectional districts in Zambia. Results revealed that 17% of the 104 health facilities surveyed had functional microscopy, 63% had RDTs available and 73% had one or more diagnostic available. Of patients with fever (13.1% - 42.5%) treated in health facilities with malaria diagnostic were tested and 44.6% had positive tested results. Of patients with negative blood smears results (36.7% - 80.2%) were prescribed an ant malarial drug as were 35.5% (95% CI, 16.0% - 55%) of these with a negative RDT results. Of patients with fever who did not have diagnostic tests done. 65.9% were also prescribed antimalarials. In facilities with altimeters - lumefantrine in stock, this ant malarial was prescribed to a large proportion of febrile patients with a positive diagnostic tests results (blood smears 75% [95% CI, 51.7% - 98.3%] : RDT, 70.4% [95%CI, 39.3%100%] but also to some of these with a negative diagnostic test results blood smear 30.40% (95% CI, 8.0% - 52.9%) RDT 26.7% [95% CI, 5.7% -47.7%].

Tuno *et al.,* (2007) studied the intra specific variation in diving activity among *Anopheles gambiae* Giles, *A. arabiensis* Patton and *A. funestus* Giles (Diptera: Culcidae). The result reveled that former two species occur sympatrically in temporal and shallow water bodies, while the later occur in permanent deeper water bodies. *A. funestus* was the most tolerance of submergence, but the larvae tended to halt their descent before reaching bottom by attaching onto a wall. The difference in diving behavior between *A. funestus* and the two species in the *A. gambiae* complex may be an adaptation to their contrasting breeding sites, because the former species must spend considerable energy to surface in its typical breeding sites. Both *A. gambiae* and *A. arabiensis* reached the bottom and crawled along the substrate but *A. gambiae* voluntarily crawled more often than *A. arabians.*

Geounuppakul *et al.,* (2007) operated the programme of an empowerment to enhance women's ability to prevent and control malaria in the community Chiang Mai province – Thailand. The women's groups in the intervention

village created following plans which were crucial for malaria prevention.

(1) A family protection plan.

(2) Providing malaria education to community members.

(3) A mosquito control campaign.

(4) Scaling up insecticides impregnated nets.

(5) Malaria control among foreign laborers.

Ueno *et al.,* (2007) surveyed the vertical and seasonal distribution of *Anopheles* in Ilha comprida, South Eastern Brazil from September 2001 to September 2002. Using CDC light traps baited with dry ice were placed fortnightly from 17:00 to 22:00 at one six and 12 meters high. Results reveled that 55226 mosquitoes were caught: 1341 *A. bellator* (24% of culicidae), 278 at one meter, 261 at six meter and 802 at 12 meters height. Following the same sequence, *A. cruzii* was represented by 452, 4032 and 4420 adults, totalizing 5904 mosquitoes (10.7%). There was a positive correlation between densities of both species and daily maximum temperatures, and between density of *A. bellator* and thermal amplitude. The density was higher for both species at tree canopy. At the three levels the density of A. cruzii was higher.

Wiwanitkit, (2007) studied the rate of malarial infection among foreigners in a tertiary hospital of Thailand in the past decade (1956 – 2005) by scrutinizing the available published and unpublished reports. According to this study, two main groups of travelers, migrant workers from the nearly countries, who bring malaria from the endemic area in their country and new cases as the travelers from the western countries, who expose to malaria during their traveling in Thailand can be identified.

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Lautze *et al.,* (2007) studied the effect of large dam on malaria risk in the Koka reservoir in Ethiopia. Frequency of malaria diagnosis was correlated with distance of residence from the margin of the Koka reservoir. Malaria cases rates among of the people living within 3 kilometers of the reservoir are about 1.5 times as great as for those living between 3 and 6 kilometers from the reservoir and 2.3 times as great for those living 6 – 9 kilometers from the reservoir. Proximity to the reservoir is associated with greater malaria case

rates in period of more intense transmission. *P. falciparum* is most prevalent in communities located close to the reservoir and *P. vivax* in more distant villages. The presence of the reservoir, coupled with inter annual climatic variations, explains more than half of the regions variability in malaria case rates.

Davies *et al.,* (2007) studied the Implication for Pyrethroids resistance in *Anopheline* and other neopteran species, reported the complete CDNA sequence of the *Anopheles gambiae* voltage – gated sodium channel (VGSC) a subunit isolated from mature adult mosquitoes. Several insecticides used in mosquitoes control (including DDT and synthetic Pyrethroids) target the VGSC. Isolation of the sodium channel CDNA for *A. gambiae* : (1) allow prediction of likely single nucleotide polymorphisms that may arise at residence < 1014 to cause resistance to insecticides; (2) define *A. gambiae* exon usage in key areas of the VGSC portion that are known (from previous studies in a range of different pest species) to have roles in attending insecticides susceptibility and in generating resistance; and (3) is a critical first step towards development of refined malaria control strategies and of new diagnostics for resistance monitoring.

Olusegun *et al.,* (2008) surveyed the verticular fibrillation in 5 year old child in the rapeutic dose of quinine dyhydrochloride infusion for acute malaria in Sub Saharan Africa. *P. falciparum,* resistant to the anti malarial drugs now causes most of the infections. Although there is increasing use of artemisinin based combination therapy in many African nations, Quinine still remains a commonly used drugs for severe and chloroquine resistant malaria, cardio toxicity associated with quinine has been largely reported. However, this was often more common with toxic doses. All the laboratory investigations done were within normal limits except for positive blood films for malarial parasites. However pre treatment electrocardiographic evaluation of the patient was not carried out.

Penali *et al.,* (2008) studied the single - day three - dose treatment with fixed dose combination artesunate / Sulphamethoxypyrazine / Pyramethamine to

cure *P. falciparum* malaria. Two hundred and twenty one patients presenting with uncomplicated *P. falciparum* malaria were randomly assigned to either one of two dosing schemes. Treatment efficacy was assessed using the current 28 days World Health Organization protocol, success being determined by either absence of recrudescence and parasitemia on a day 28.Both treatments regimens were highly efficacious, with a success rate of 100% (111/ 111) for the 3 days therapy and 99% (109 / 110) for the 24 hour therapy. Only one patient in the 24 hours therapy group showed the treatment failure. No serious adverse events or significant laboratory abnormalities were seen.

Giha *et al.,* (2008) surveyed the biomodal transmission of cerebral malaria and severe malarial anemia and reciprocal co – existence of sexual and asexual parasitemia in Eastern Sudan, from the beginning of October to the end of December (malaria season) in the years 2000, 2001 and 2003, 99 patients with severe malarial anemia (SMA) and 54 patients with cerebral malaria (CM) were identified. There was marked variation in the incidence of SMA and CM over three years, in the heavy season of 2003, CM peaked at the beginning of the season and declined within a month at a time that a SMA reached the peak. At diagnosis the rate of gametocitemia had inclined from 10% - 100% from the beginning to the end of the season. During follow up gametocitemia was more associated with SMA than with CM. Paradoxically, the late occurring SMA was associated with early gametocitemia (day 7) and the opposite was true in CM.

Cine *et al.,* (2008) investigated the prevalence of chloroquine of *P. malariae* in Madagascar. The findings confirmed that *P. malariae* is the third leading cause of malaria, accounting for 1.1% of all malarial infections. They also demonstrate that chloroquine currently recommended for the home management of presumed malaria in children under the age of 5 years and commonly used by adults remains highly effective in patients with uncomplicated *P. malariae* infection.

Kargo, M and K.S. Baboo (2008) studied the recently changed treatment

policy for malaria from the falling chloroquine to the more effective artemisinin combination therapy (ACT) in Zambia. A study was conducted to find out if the community accepted the new treatment policy, as a prediction of its success. Following high levels of acceptability, it was not surprising to see high levels of compliance and subsequent reduction in case of severe malaria and deaths.

Malaria in context of Nepal

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 slide fluctuation between 2, 500 to 4,000 cases lasting for 7 – 8 years (1963 – 1971). The cases started rising from 1972 and in 1973 and 1974 the number of cases reached to 14,000 due to the epidemic in west region. The year 1977 could contain malaria in between 10,000 and 13,000 cases annually.

MOH, VBDRTC, (1999) showed that since 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 step rise to 29,388 cases in 1984 which again escalated to 42,321 in 1985. After 1985, the cases in 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 8,498 in 1998.

Bista and Banerjee, (2000) reported 42,321 and 22,323 malaria cases in 1985 and 1989 respectively. *P. falciparum* cases reduced at the same rate as the total malaria cases, but after 1988 the reduction of the former, especially indigenous *P. falciparum* cases was slightly accelerated.

Bista and Banerjee, (2000) surveyed during 1994 to 1995, 54.67 and 54.77 prevalence rate of malaria cases was detected, out of them 72.02 and 63.13 incidence rate were imported from India. Among the 26 bordering districts of

Nepal, Kanchanpur and Kailali of the far western, Bardia of mid western, Nawalparasi of western, Dhanusha and Mahottari of central and Morang and Jhapa of the eastern regions are the main contributor of malaria cases. The total malaria cases of 26 bordering districts constituted 64.44% of the total malaria cases in 1997.

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 were monitored by in – vitro and in – vivo method respectively. A resistance of 63.2% was recorded to Chloroquine by in vitro test. Out of 84 in vitro tests, 32 cases showed a resistance of 38% at S / RI and RJI level. Therapeutic efficacy monitoring has revealed rate treatments failures among recipients of S / P treatment. The current first time treatment of microscopically diagnosed *P. falciparum* is S / P in Nepal.

Chowdhury, (2002) found a new rapid method of staining blood cells and parasites of malaria 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 required costly reagents. Moreover the beginners viz, medical students make errors like understanding over staining and precipitation of stain leading to difficulty in identification of cells. To alleviate these problems and to help the workers of malaria eradicating programme, this rapid and simple method has been devised to stain blood cells and malaria parasites within 50 seconds.

DOHS, (2002) found the total number of *P. vivax* higher (78.1%) than *P. falciparum* (20.1%) during the last three years period (1999 – 2001) in Morang district. The mixed cases were reported only in 1999, which accounted to about 3.4% of the total infection. The number of malaria cases reported from 1999 to 2001 was 145, 98 and 44 respectively in that place.

Sivakoti, (2003) the prevalence rate *of P. falciparum* was higher than *P. vivax* in the Bhutanese Refugee Camp from 1996 to1998. The mixed infection

during the same period was 0.35%. In contrast, the prevalence of *P. vivax* was higher than *P. falciparum* among the people of Jhapa district from 1996 to 1998. The mixed infection during the same period was higher (1.17%) than that of refugees. The analysis of species wise positivity of malaria among the refugees of Sanischare Camp during three years (998 – 2000) revealed that the total number of *P. falciparum* was higher than *P. vivax* in 1998 and 1999. But in 2000, total number of *P. vivax* was higher than *P. falciparum*. The total number of positive case was maximum in 1999 (91 positive cases), followed by 2000 (75 positive cases) and was the least in 1998 (61 positive cases). The mixed infection was reported in 1999 which contributed to 2.19%.

Joshi, (2004), Reported 66 patients (21.56%) suffered from malaria out of 306 total samples in Kanchanpur district.

Sahu, (2006) surveyed the prevalence of malaria epidemiologically visiting Health Post and Jansewa Clinic at Mahendra Nagar VDC of Sunsari district during October 2004–September 2005. Out of 250 blood samples from suspected cases only 10 were found to be infected with malaria, i.e. slide positivity rate was found to be 4%.

SEARO, (2007) investigated during 2007 total 4219 laboratory confirmed cases were reported out of them 1391 (33%) as *P. faciparum* cases were reported showing a decline of 2% and 7.7% respectively. However *P. falciparum* proportion is on rise. No major epidemics or outbreaks have been reported during the period. 12 districts namely Jhapa, Morang and Ilam in East–region, Dhanusha, Mahottari, Sindhuli and Kabhre in Central region, Nawalparasi in West region, Bardia in Mid West region and Kailali, Kanchanpur and Dadeldhura in Far–Western region are the most affected districts where malaria transmission is high. The total population of these districts are around 6 million (34%) and contributing around 90% of the total confirmed malaria cases in the country.

In eastern Terai, according to the District Public Health office (DPHO), the threat of malaria is large and more than 300 cases have been detected since

March in a single district of Morang. There have been distributed 400000 long lasting insecticidal nets and been the Epidemiology Centre (One world. net)

IV

METHODS

Study Area:

The study was carried out in the government health facilities and private health facilities of Kalyanpur Jabdi VDC, Bishnupur Pra. Ra.VDC and Itari Parsahi VDC of Siraha district. Siraha is bordered with Saptari in East, Dhanusha in West, Udaypur and Sindhuli in North and India in South. These 3 VDCs are characterized by different ethnic groups comprising Brahmin, Kayastha, Rajput, Danuwar, Dhanuk, Yadav, Sahu, Mochi and many other downtrodden castes. Majority of people are under the line of poverty and uneducated. Agriculture is the main source of economy. Most of the houses are made up of bamboos with thatched roof adjacent with cattle sheds. The annual rain fall ranges from 1300 to 2600 mm and the relative humidity varies 65% to 90%. The temperature varies from 30^0C to 40^0C. The people come to both the government health center and private health clinics for their treatment.

Study population:

A total of 450 suspected malaria patients from Kalyanpur Jabdi (150), Bishnupur Pra. Ra. (150) and Itari Parsahi (150) having fever for 2 or 3 days, anemia, headache, splenomegaly, hepatomegaly attending both government and private health facilities were included for the study.

Questionnaire survey:

The question was asked verbally to each patient who attended both government and private health facilities. The microscopic results of

government Health facilities included Kalyanpur Health Post, Itari Parsahi sub Health Post and Bishnupur Pra. Ra. Sub Health Post. While in private health facilities RDTs (antigen detector) was used for positive cases of malaria and after taking history were recorded on the printed set of questionnaire. The questions were about their general information i.e. name, age, sex, education, occupation, economic status, and knowledge about malaria etc.

Data collection:

The data collection was based on the primary data taken by questionnaire survey, microscopic results of malaria of government Health and Sub Health Posts and RDTs of private health clinics since August 2007. The secondary data were taken from published or unpublished sources.

Data analysis:

The collected data were presented and analyzed using appropriate statistical tools.

Study period:

The study was carried out from August 2007 to October 2008.

List of Photographs

PLATE – 1

A. Kalyanpur Health Post, Siraha

B. Visiting Government Health Post.

PLATE – 2

C. Interviewing patients in private clinics.

D. Interviewing patients in their houses.

V

RESULTS

The study was carried out among the people visiting government and private health facilities at Kalyanpur Jabdi, Bishnupur Pra. Ra. and Itari Parsahi VDCs of Siraha district during August 2007 to October 2008. Altogether 450 respondents were interviewed and the information regarding the malaria cases in both facilities were collected.

- **General prevalence of malaria**

During the study period of one year altogether 209 suspected cases of malaria was found in government health facilities. Among these suspected cases no confirmed malaria was observed. Whereas 241 suspected malaria cases were found in private health facilities. Out of which 14 (5.80%) positive cases of malaria were observed. These private health facilities has been runned by CMA and HA.

- **Age wise prevalence of malaria in private health facilities at 3 VDCs**

A total of 79 suspected malaria cases from Prathmic Upachar Kendra of Kalyanpur VDC, 7 (8.86%) cases were found to be positive for malaria, the maximum patients (n=20) were from (11-20) years and minimum (n=7) were from (1-10) years age group. Among the positive malaria cases, the maximum 3 (25%) cases were from (41-50) years age group while no any positive cases were recorded from 31-40 years age groups.

A total 78 suspected malaria cases from Upachar Kendra of Itari Parsahi VDC runned by the Curety Medicine Assistant, 4 (5.12%) positive cases were observed for malaria. The maximum patient (n=18) from (1-10) years age group and minimum (n=6) from (41- 50) years age group.

Similarly a total of 84 suspected malaria cases were observed from Upachar Kendra of Bishnupur Pra. Ra. VDC runned by the Curety Medicine Assistant, 3 (3.57%) cases were observed positive for malaria.

Table- 1 Age wise prevalence of malaria in private health facilities at 3 VDCs

Age (Years)	Prathmic Upachar Kendra at Kalyanpur Jabdi VDC			Upachar Kendra at Itari Parsahi VDC			Upachar Kendra at Bishnupur Pra. Ra. VDC		
	No. of total suspected cases	Malaria positive cases		No. of total suspected cases	Malaria positive cases		No. of total suspected cases	Malaria positive cases	
		No.	%		No.	%		No.	%
(1-10)	7	1	14.28	18	1	5.55	19	0	0
(11-20)	20	1	5	15	1	6.66	18	0	0
(21-30)	16	1	6.25	16	0	0	15	0	0
(31-40)	8	0	0	10	0	0	14	2	14.28
(41-50)	12	3	25	6	1	16.66	12	0	0
>50	16	1	6.25	13	1	7.69	6	1	16.66
Total	79	7	8.86	78	4	5.12	84	3	3.587

- **Sex wise prevalence of malaria in private health facilities at 3 VDCs.**

Out of 73 suspected malaria cases from Prathmic Upachar Kendra of Kalyanpur Jabdi VDC, maximum 5 (10.41%) cases were positive from 48 male, whereas the minimum 2 (8.0%) cases from 25 females were observed positive for malaria.

Out of 89 suspected malaria cases from Upachar Kendra of Itari Parsahi VDC runned by Curety Medicine Assistant, 4(4.49%) positive cases from 61 male and no any infections of malaria was observed in 28 female.

Out of 79 suspected malaria cases from Upachar Kendra of Bishnupur Pra ra VDC, maximum 2 (4.25%) positive cases from 47 male and minimum 1(3.25%) positive case from 32 female were observed for malaria.

Table-2. Sex wise prevalence of malaria in private health facilities at 3 VDCs

Sex	Prathmic Upachar Kendra at Kalyanpur Jabdi VDC			Upachar Kendra at Itari Parsahi VDC			Upachar Kendra at Bishnupur Pra. Ra. VDC		
	No. of total suspected cases	Malaria positive cases		No. of total suspected cases	Malaria positive cases		No. of total suspected cases	Malaria positive cases	
		No.	%		No.	%		No.	%
Male	48	5	10.41	61	4	6.55	47	2	4.25
Female	25	2	8	28	0	0	32	1	3.12
Total	73	7	9.58	89	4	4.49	79	3	3.79

- **Malaria in relation to literacy rate in private health facilities at 3 VDCs**.

Out of 73 suspected malaria cases from Prathmic Upachar Kendra of Kalyanpur VDC runned by Health Assistant, 7(9.58%) were positive for malaria. Among these positive cases, 6 were of *P. vivax* and 1 case of *P. falciparum.* The maximum 3(13.63%) positive cases from illiterate and minimum 1 from SLC and higher education were observed respectively.

Out of 84 suspected malaria cases from Upachar Kendra of Itari Parsahi VDC, 4(4.76%) positive cases of *P. vivax* were observed. The maximum 2 positive cases from illiterate and minimum 1 from both under SLC and adult education were observed.

Similarly out of 84 suspected malaria cases from Upachar Kendra of Bishnupur Pra ra VDC runned by Curety Medicine Assistant, 3 positive cases were observed. The maximum 2(7.69%) cases from illiterate and minimum 1 from under SLC. were observed respectively. The positive cases were confirmed by antigen detector.

Table- 3. Malaria in relation to literacy rate in private health facilities at 3 VDCs.

Lteracy rate	Prathmic Upachar Kendra at Kalyanpur Jabdi VDC			Upachar Kendra at Itari Parsahi VDC			Upachar Kendra atBishnupur Pra. Ra.VDC		
	No. of total suspected cases	Malaria positive cases		No. of total suspected cases	Malaria positive cases		No. of total suspected cases	Malaria positive cases	
		No.	%		No.	%		No.	%
Illiterate	22	3	13.63	24	2	8.33	26	2	7.69
Adult education	7	0	0	11	1	9.09	12	0	0
Under SLC	19	2	10.52	27	1	3.70	28	1	3.57
SLC	17	1	5.88	16	0	0	15	0	0
Higher education	8	1	16.66	6	0	0	3	0	0
Total	73	7	9.58	84	4	4.76	84	3	3.57

- **Prevalence of malaria on the basis of occupation in private health facilities at 3 VDCs.**

Out of 75 suspected malaria cases from Prathmic Upachar Kendra of Kalyanpur VDC, 7(9.93%) were positive for malaria. Among them 6 positive cases were of *P. vivax* and 1 positive case of *P. falciparum.* The maximum 3(4%) positive cases from farmers and minimum 1 from businessmen and labors were observed.

Out of 85 suspected malaria cases from Upachar Kendra of Itari Parsahi VDC runned by Curety Medicine Assistant. The 4 (4.70%) positive cases of malaria were observed. These positive cases were observed from farmers and from job holders.

Similarly out of 81 suspected malaria cases from Upachar Kendra of Bishnupur Pra. Ra. runned by Curety Medicine Assistant. The 3 (3.70%) cases were found positive for malaria. The highest from labors and lowest from others. All positive cases were confirmed by antigen detector RDT.

Table- 4. Prevalence of malaria on the basis of occupation in private health facilities at 3 VDCs.

Occupation	Prathmic Upachar Kendra at Kalyanpur Jabdi VDC			Upachar Kendra at Itari Parsahi VDC			Upachar Kendra at Bishnupur Pra. Ra.VDC		
	No. of total suspected cases	Malaria positive cases		No. of total suspected cases	Malaria positive cases		No. of total suspected cases	Malaria positive cases	
		No.	%		No.	%		No.	%
Farmer	19	3	15.78	18	1	5.55	24	1	4.16
Businessmen	17	1	5.88	10	0	0	12	0	0
Job holder	6	0	0	7	0	0	2	0	0
Labors	5	1	20	2	1	50	2	1	50
Others	28	2	7.14	48	2	4.18	41	1	2.43
Total	75	7	9.33	85	4	4.70	81	3	3.70

- **Prevalence of malaria in relation to the use of different preventive measures adopted by the respondent.**

In relation to different preventive measures, majority of patients registered in government and private health facilities of 3 VDCs, 344 used bed nets, followed by 79 making smoke to repel the mosquitoes and 27 patients used domestic pest and lotion. The highest cases of positive % in those patients using domestic pest and lotion 11.11% and lowest 2.32% using bed nets. The use of preventive measures in relation to malaria in government and private health facilities are significant **(χ^2= 10.2264, P>0.05 at d.f. 4)**

Table-5. Prevalence of malaria in relation to the use of different preventive measures adopted by respondents.

Preventive measure	No. of total suspected cases		Malaria positive cases			
	Gov	Pvt	Gov		Pvt	
			No.	%	No.	%
Bed net	155	189	0	0	8	2.32
Smoke	38	41	0	0	3	3.79
Pest/ Lotion	16	11	0	0	3	11.11
Total	209	241	0	0	14	3.11

- **Comparative analysis of age wise prevalence of malaria**

At Kalyanpur Jabdi VDC, out of 150 suspected malaria cases, 71 cases were from Kalyanpur Health Post having no infection among all age groups. While out of 79 cases, 7 (8.86%) were observed to be positive from private health facilities. The maximum number of positive cases were observed from (41-50) years 3 (4%) and minimum 1(1.26%) followed by (1-10) years, (11-20) years, (21-30) years and >50 years age groups. While no infection was found among (31-40) years age group.

At Itari Parsahi VDC, out of 150 suspected malaria cases, 72 cases were from government sub Health Post having no infection among all age groups. While out of 78 cases, 4(5.12%) cases were observed to be positive from private health facilities. The number of positive cases 1 was observed from the age group (1-10) years, (11.20) years, (41-50) years and >50 years respectively.

At Bishnupur Pra. Ra. VDC out of 150 suspected malaria cases, 66 cases were from government Sub Health Post having no infection among all age groups. While 3(3.57%) cases were observed to be positive out of 84 cases from private health facilities. The maximum 2(2.38%) positive cases from the (31- 40) years age group and minimum 1(1.19%) case from > 50 years age group. There was no significant relationship between the age and the disease in government and private health facilities **(¡ ^{2}= 9.4514, P>0.05 at d. f. 15)**

Table 6: Comparative analysis of age wise prevalence of malaria

Age (years)	VDC Kalyanpur Jabdi						VDC Itari Parsahi						VDC Bishnupur Pra.Ra.						Total
	No. of total suspected cases (n=150)		Malaria positive cases (n=7)				No .of total suspected cases(n=150)		Malaria positive cases (n=4)				No. of total suspected cases (n=150)		Malaria positive cases(n=3)				
	Gov	Pvt	Gov	%	Pvt	%	Gov	Pvt	Gov	%	Pvt	%	Gvt	Pvt	Gvt	%	Pvt	%	
(1-10)	7	7	0	0	1	14.28	13	18	0	0	1	5.55	13	19	0	0	0	0	77(2.59%)
(11-20)	22	20	0	0	1	5	14	15	0	0	1	6.66	12	18	0	0	0	0	101(1.98%)
(21-30)	12	16	0	0	1	6.25	10	16	0	0	0	0	11	15	0	0	0	0	80(1.25%)
(31-40)	11	8	0	0	0	0	11	10	0	0	0	0	11	14	0	0	2	14.28	65(3.07%)
(41-50)	8	12	0	0	3	25	6	6	0	0	1	16.6	9	12	0	0	0	0	53(7.54)
>50	11	16	0	0	1	6.25	18	13	0	0	1	7.69	10	6	0	0	1	16.66	74(9.05%)
Total	71	79	0	0	7	8.86	72	78	0	0	4	5.12	66	84	0	0	3	3.57	450(3.11%)

- **Comparative analysis of sex wise prevalence of malaria**

In relation to sex, at VDC Kalyanpur Jabdi, out of 150 suspected malaria cases, 51 males visited government Health Post having no infection while 48 males visited private health facilities having 5(10.41%) positive cases for malaria. Similarly 26 females visited government Health Post having no infection while 25 females visited private health facilities having 2(8.0%) positive cases for malaria.

At Itari Parsahi, out of 150 suspected malaria cases, 38 males visited government Health Post having no infection while 61 males visited private health facilities having 4(6.55%) positive cases and 23 females visited government Health Post having no infection and 28 visited private clinics having also no infection.

At Bishnupur Pra. Ra. VDC, out of 150 suspected malaria cases, 42 males visited government Health Post having no infection while 47 males visited private health facilities having 2(4.25%) positive cases for malaria and 29 females visited government Health Post having no infection while 32 visited private health facilities having 1(3.12%) positive cases for malaria. Malaria infection was found to be insignificantly related with sex in the government and private health facilities **(¡2 = 1.7129, P>0.05 at d.f. 3)**

Table 7: Comparative analysis of sex wise prevalence of malaria

Sex	VDCKalyanpur Jabdi						VDC Itari Parsahi						VDC Bishnupur Pra.Ra.						Total
	No. of total suspected cases (n=150)		Malaria positive cases (n=7)				No. of total suspected cases(n=150)		Malaria positive cases (n=4)				No. of total suspected cases (n=150)		Malaria positive cases(n=3)				
	Gov	Pvt	Gov	%	Pvt	%	Gov	Pvt	Gov	%	Pvt	%	Gov	Pvt	Gov	%	Pvt	%	
Male	51	48	0	0	5	10.41	38	61	0	0	4	6.55	42	47	0	0	2	4.25	287(3.83%)
Female	26	25	0	0	2	8	23	28	0	0	0	0	29	32	0	0	1	3.12	163(1.84%)
Total	77	73	0	0	7	9.58	61	89	0	0	4	4.49	71	79	0	0	3	3.79	450(3.11%)

- **Prevalence of malaria on the basis of socio-economic status.**

Out of 450 clinical cases, the majority of cases were suspected from moderate economic status i. e. 294 cases of which 180 suspected malaria cases were from private health facilities having 5(2.77%) positive cases while 114 from government Health Posts and sub Health Posts having no infection. But higher malaria infection was found among poor classes i.e. 9(14.75%) cases out of 61 patients from private health facilities and 95 visited government sub Health Posts having no infection. The prevalence of malaria was found to be significantly dependent on the socio-economic status in government and private health facilities **(¡ ^{2}=30.0210, P<0.05 at d.f. 3)**

Table 8: Prevalence of malaria on the basis of socio-economic status aspect

Economic status	No. of total suspected cases (n=450)		Malaria				Total
	Gov	Pvt	No. of positive cases(n=14)				
			Gov	%	Pvt	%	
Poor	95	61	0	0	9	14.57	156(5.76%)
Moderate	114	180	0	0	5	2.77	294(1.70%)
Total	209	241	0	0	14	5.80	450(3.11%)

- **Malaria in relation to religion**

Religion wise distribution of the population showed Hindu to be 400 and Muslim 50. Among Hindu population 214 suspected malaria cases were from private health facilities at those 3 VDCs having 13(6.07%) positive cases and 186 from government Health Posts and sub Health Posts having no infection. Among 50 Muslim populations 27 were registered in private health facilities having 1(3.70%) positive cases while 23 were registered in government Health Posts and sub Health Posts having no infection. There was insignificant relation between malaria infection and religion in the government and private health facilities **(¡^{2}= 2.0498, P>0.05 at d.f. 3)**

Table 9: Malaria in relation to religion

Religion	No. of total suspected cases(n=450)		Malaria				Total
	Gov	Pvt	No. of positive cases(n=14)				
			Gov	%	Pvt	%	
Hindu	186	214	0	0	13	6.07	400(3.25%)
Muslim	23	27	0	0	1	3.70	50(2.0%)
Total	209	241	0	0	14	5.80	450(3.11%)

- **Comparative analysis of malaria in relation to literacy rate**

In relation to literacy rate at Kalyanpur Jabdi, out of 150 suspected malaria cases, 77 were registered in Kalyanpur Health Post having no infection while 73 registered in private health facilities having 6(8.21%) positive cases *P.vivax* and 1(1.36%) of *P. falciparum.* Among these positive cases, high in Illiterate and Under SLC and low in SLC and Higher education were observed.

At Itari Parasahi VDC, out of 150 suspected malaria cases, 66 were registered in sub Health Post having no infection while 84 registered in private health facilities having 4(4.76%) positive cases of malaria. Among these positive cases high in Illiterate and low in Adult education and Under SLC.

At Bishnupur Pra.Ra. VDC, out of 150 suspected malaria cases, 66 were registered in sub Health Post having no infection while 84 registered in private health facilities having 3(3.57%) positive cases of malaria. Among these positive cases high in Illiterate and low in under SLC. The malaria and the literacy rate was found to be insignificantly related in government and private health facilities **(¡2=12.8983, P>0.05 at d.f.12)**

Table 10: Comparative analysis of malaria in relation to literacy rate

Literacy rate	VDCKalyanpur Jabdi						VDC Itari Parsahi						VDC Bishnupur Pra.Ra.						Total
	No. of total suspected cases (n=150)		Malaria positive cases (n=7)				No. of total suspected cases(n=150)		Malaria positive cases (n=4)				No. of total suspected cases (n=150)		Malaria positive cases(n=3)				
	Gov	Pvt	Gov	%	Pvt	%	Gov	Pvt	Gov	%	Pvt	%	Gov	Pvt	Gov	%	Pvt	%	
Illiterate	29	22	0	0	3	13.63	30	24	0	0	2	8.33	28	26	0	0	2	7.69	159(4.40%)
Adult education	8	7	0	0	0	0	6	11	0	0	1	9.09	4	12	0	0	0	0	48(2.83%)
Under SLC	23	19	0	0	2	10.52	20	27	0	0	1	3.70	22	28	0	0	1	3.57	139(2.87%)
SLC	14	17	0	0	1	5.88	6	16	0	0	0	0	10	15	0	0	0	0	80(1.25%)
Higher education	3	8	0	0	1	16.66	4	6	0	0	0	0	2	3	0	0	0	0	24(16.66%)
Total	77	73	0	0	7	9.58	66	84	0	0	4	4.76	66	84	0	0	1	1.19	450(3.11%)

- **Prevalence of malaria on the basis of occupation**

During study various occupational group individuals were included. At Kalyanpur Jabdi VDC, out of 150 suspected malaria cases, 75 were registered in Kalyanpur Health Post having no any infection while 6 (8.0%) positive cases of *P.vivax* and 1 positive case (1.33%) were found from 75 suspected malaria cases from private health facilities, the highest 3 (15.78%) positive cases in Farmers and lowest in Businessmen 1 (5.88%) positive cases, Labors 1 (20%) positive case and no any positive cases among Job Holders.

At Itari Parsahi VDC, out of 150 suspected malaria cases, 65 were registered in sub Health Post having no any infection while 85 cases from private health facilities having 4 (4.70%) positive cases were observed. The highest positive cases among other groups 2 (4.16%) (Children, Students and House wives) and lowest 1 (5.55%) in Farmers, Labors and no any infection were observed among Job Holders.

At Bishnupur Pra. Ra. VDC, out of 150 suspected malaria cases, 69 were registered in sub Health Post having no infection while 81 cases were registered in private health facilities having 3 (3.70%%) positive cases comprising Farmers, Labors, others (Children, Students and House wives) and no infection were observed among Businessmen and Job Holders. There was no relation between disease and the occupation in government Health Post and private health facilities **(¡ ^{2}= 21.2702, P>0.05 at d.f. 12)**

Table 11: Prevalence of malaria on the basis of occupation

Occupation	VDC Kalyanpur Jabdi						VDC Itari Parsahi						VDC Bishnupur Pra.Ra.						Total
	No. of total suspected cases (n=150)		Malaria positive cases (n=7)				No. of total suspected cases(n=150)		Malaria positive cases (n=4)				No. of total suspected cases (n=150)		Malaria positive cases (n=3)				
	Gov	Pvt	Gov	%	Pvt	%	Gov	Pvt	Gov	%	Pvt	%	Gov	Pvt	Gov	%	Pvt	%	
Farmer	18	19	0	0	3	15.78	25	18	0	0	1	5.55	24	24	0	0	1	4.16	128(3.90%)
Business men	14	17	0	0	1	5.88	5	10	0	0	0	0	3	12	0	0	0	0	61(1.63%)
Job holder	6	6	0	0	0	0	2	7	0	0	0	0	1	2	0	0	0	0	24(0)
Labors	11	5	0	0	1	20	5	2	0	0	1	50	4	2	0	0	1	50	29(10.34%)
Others	26	28	0	0	2	7.14	28	48	0	0	2	4.16	37	41	0	0	1	2.43	208(2.40%)
Total	75	75	0	0	7	9.33	65	85	0	0	4	4.70	69	81	0	0	3	3.70	450(3.11%)

- **Visiting rate of patients in government and private health facilities**

At Kalyanpur Jabdi VDC, out of 150 suspected malaria cases, 76 cases (50.66%) visiting government health facilities and 74 cases (49.33%) visiting private health facilities. At Itari Parsahi VDC, out of 150 suspected malaria cases, 69 cases (46%) visiting government health facilities and 81cases (54%) visiting private health facilities. Similarly at Bishnupur Pra. Ra. VDC, out of 150 suspected malaria cases, 64 cases (42.66%) visiting government health facilities and 86 cases (57.33%) visiting private health facilities. The visiting rate of patients and malaria infection was insignificant in government and private health facilities**(X^2=4.6270, P>0.05 at d.f. 6).**

Table 12: Visiting rate of patients in government and private health facilities.

VDCs	No. of suspected cases(n=450)				Malaria positive cases(n=14)				Total
	Gov		Pvt		Gov		Pvt		
	No.	%	No.	%	No.	%	No.	%	
Kalyanpur Jabdi	76	50.66	74	49.33	0	0	7	9.45	150(4.66%)
Itari Parsahi	69	46.00	81	54.00	0	0	4	4.93	150(2.66%)
Bishnupur Pra. Ra.	64	42.66	86	57.33	0	0	3	. 3.48	150(2.0%)
Total	209	139.32	241	156.66	0	0	14	18.76	450(3.11%)

- **Use of diagnostic tools at 3 VDCs**

It was observed that the total 209 cases were from government Health Post and sub Health Posts conformed by Slide Test method while 241 cases were from Private Clinics conformed by antigen detector of RDTs (Kits) for malaria infection.

Table 13: Use of diagnostic tools at 3 VDCs

Health Facilities	VDCKalyanpur Jabdi				VDC Itari Parsahi				VDC Bishnupur Pra.Ra.			
	No. of total suspected cases (n=150)	Use of diagnostic tools	Positive cases	%	No. of total suspected cases (n=150)	Use of diagnostic tools	Positive cases	%	No. of total suspected cases (n=150)	Use of diagnostic tools	Positive cases	%
Government Health Posts	76	Slide test	0	0	69	Slide test	0	0	64	Slide test	0	0
Private Clinics	74	RDTs	7	9.45	81	RDTs	4	4.93	86	RDTs	3	3.48

- **Name of drugs and their companies prescribed by government and private health facilities.**

Most of the cases were observed in the government health facilities were prescribed Chloroquine and Amoxicillin of the National, Manoj and Nepal CRS Companies of Nepal. In some cases Paracetamol and Ciprofloxacilin of other Indian Companies were also prescribed. In private health facilities, the private practitioners prescribed the drugs for malaria in most of the cases were Primaquine, Sulphadoxine, Amoxicillin and Ciprofloxacilin of the Glaxo, Ranbaxy, Curex and Sipla Pharmaceuticals of Indian Companies and Deurali Janta of Nepalese Company.

VI

DISCUSSION AND CONCLUSION

Out of 450 samples of 3 VDCs (Kalyanpur Jabdi, Itari Parsahi and Bishnupur Pra.Ra.). 209 cases were observed from government health facilities having no infection while 241 cases were from private health facilities having 14(5.80%) positive cases from malaria. This positivity represents 3.11% of the total samples. This positivity rate was in less than the Shivakoti (2003) estimation (3.94%) in Bhutanese Refugee Camp. The positivity rate of this study also showed less than Shahu (2006) (4%) in Sunsari district. This was because of large samples size 450 than Shahu (2006). Likewise WHO (2007) Nepal branch reported 3.11% positive cases, showed similarity with this study. In the present study the observed cases in private health facilities were diagnosed by the Rapid Diagnostic Test (RDTs) method. All positive cases from private health facilities were 13 cases (2.88%) of *P. vivax* except 1 case (0.22%) of *P. falciparum* among 450 samples. Whereas Bardia District Hospital (2007/2008) reported infection rate of 9.16% of *P. falciparum* and 87.5% of *P. vivax*. Likewise WHO (2007) reported 32.97% of *P. falciparum* and 67.03% of *P. vivax.* Thus the present study showed somewhat similarities with the positivity rate of *P. vivax* and different in the case of *P. falciparum*. This was because of observation of 450 samples both in government and private health facilities. In the present study there was no prevalence of malaria found in the government health facilities. This was might be due to the problems like there was no proper facilities of lab, experts and sending blood slide to the district lab take more time to confirm the malaria parasite. While the private practitioners were observed to use antigen detector (RDTs) method to confirm malarial parasites instantly. So the all positive cases were of malaria infection observed from private health facilities comparatively. In the present survey infection of *P. vivax* was 92.85% and *P. falciparum* 7.14% from private health facilities indicating wide range of distribution of *P. vivax* in the study areas as quoted by Ghimire (2002) that *P. vivax* has the widest distribution throughout the tropics, subtropics and temperate. Whereas *P. falciparum* was generally confined to the tropics. Similarly Sherchand (2002)

also states that *P. vivax* is the predominant species of most of the malarious region of Nepal and the ratio of occurrence of it in the comparison of *P. falciparum* is 10:1.

In this study the majority of observed cases were in (11-20) years age group at 3 VDCs (n=101) 22.44% having 2 positive cases (1.98%) followed by (21-30) years age group (n=80) 17.77%, 1- 10 years (n=77)17.11%, (31-40) years (n=65)14.44%, 41-50 years (n=53)11.77% and >50 (n=74) 16.66%. Majority of the infected population (41-50) years 7.14% and minimum from (21-30) years 1.25%. Whereas Shahu (2006) reported majority of infected population from (31-40) years 7.69% and minimum from (21-30) years 1.35%. That showed similarity with this study in the minimum infected age group but different in the maximum infection was due to (41-50) years age group might visit to the malarial endemic areas by means of different economic pursuit. Whereas Shivakoti (2003) reported that the age group (30-40) years contributed to the maximum number of cases (39.99%) the least infection rate (0.03%) was observed in age group (50-60) years. The maximum number of positive cases were contributed by the age group (30-40) years might be due to their free movement in malarial endemic areas: Assam and Bengal in economic pursuit.

Likewise in Bangladesh, maximum percentage at 95% confidence interval 10.32% (5.98 – 14.7) among (0-10) years age group while minimum above 50 years 1.30% (0.58% - 2.80%). It might be due to (0-10) years age group were mostly exposed for malaria than > 50 years age group. This result shows difference with the present study.

The least infection was found in the age group (21-30) years were very aware people belonging to this age group. The people of this age group might keep themselves away from the mosquito bite by using mosquito net regularly and wearing proper cloth ensuring that the body is properly covered.

The sex wise comparative analysis of malaria positive cases during the study showed that 63.77% cases occurred in males and 36.22% in females. In which 23.11% males 17.33% females visited the government health facilities

having no infection. While 34.66% males visited private health facilities having maximum number 11 positive cases(2.44%) in the total, 18.88% females visited having least number of infection 0.22%. Whereas Shahu (2006) reported 60% males and 40% females, 5.33% infection among males and 2.00% among females at Mahendra Nagar VDC of Sunsari district. Similarly Shivakoti (2003) reported 85% males in Bhutanese Refugee Camp. This can be explained due to male morbidity to malarial areas by means of economic pursuit, practice of norms and social behavior.

The result indicated that the malaria infection was more in poor people. The main reason behind that was they had low income and didn't pay much attention towards their surroundings and environment.

Similarly the maximum malaria infection was found among Hindu population (2.88%) and least infection among Muslims (0.22%). Likewise Shahu (2006) reported 4% malaria infection was among Hindu and no infection was among Muslims at Mahendra Nagar VDC of Sunsari district. It may be so because Hindu population is more in those areas.

From the survey done among the people of study areas the result revealed that the awareness of malaria was highest in literate people. It was found that maximum number of positive cases were from Illiterate (1.55%) and Under SLC (0.88%) and minimum from Adult Education (0.22%), SLC (0.22%) and Higher Education (0.22%) of total samples. Similarly Shahu (2006) reported the maximum infection among Illiterate and Under SLC level at Mahendra Nagar VDC of Sunsari district. Hence it can be showed that education plays a key role in building of positive attitude towards common infections, mode of diseases transmission of society and its adverse impacts in society due to malaria.

The results reveal that majority of malaria infection among Farmers 5 cases (1.11%) and labor 3 cases (0.66%). Similarly Shahu (2006) reported malaria infection among Farmers 5 cases and labors 2 cases at Mahendra Nagar VDC of Sunsari district. It shows similarities of this present study. Hence it can be explained that large number of population depends upon agriculture and low socio-economic status in the study areas.

The present comparative study of malaria revealed that at VDC Kalyanpur Jabdi out of 150 suspected malaria cases the visiting rate of patients in the government health facilities were higher than that in the private health facilities, i.e. 76 cases (50.66%) in government and 74 cases (49.33%%) in private health facilities. At VDC Itari Parasahi out of 150 suspected malaria cases the visiting rate of patients were observed higher in the private health facilities 81 cases (54%) and low (46%) in the government health facilities. Similarly at VDC Bishnupur Pra. Ra. out of the visiting rate of patients was higher in private health facilities 86 cases (57.33%) and low 64 cases (42.66%) in government health facilities. Whereas World Malaria Report (2008) showed that in South East Asia region the visiting rate of patients in government was 23.75% and in private Clinics was 76.25%. This also shows similarity with the present study in the higher rate of visiting of patients to the private clinics than that in the government. Hence, it might be explained due to the 24 hours health services provided by the private clinics.

In the present study the diagnostic tools were observed to be slide test preparing by blood smear in the government while in private clinics K39 strips were observed to use as diagnostic tools for malaria diagnosis. Whereas Janakpur Zonal Hospital showed K39 strip using for malaria conformation. Hence, it can be explained that RDTs method was easy to confirm malaria so it was highly used.

In the present study it was observed that the malarial cases which were registered in the government health facilities. Most of the cases were prescribed Chloroquine and Amoxicillin of Manoj, National and Nepal CRS Company. In some cases prescribed Paracetamol and Ciprofloxacilin of other Indian Companies. While in private health facilities, most of the cases were prescribed Primaquine, Sulphadoxine, Amoxicillin and Ciprofloxacilin of Lomus, Glaxo, Curex, Deurali Janta and Sipla Pharmaceuticals. Similarly Nepal adopted the first line treatment for malaria in 2004, for unconfirmed malaria Chloroquine and Primaquine while for conformed malaria AL for *P. vivax* Chloroquine and Primaquine have been proposed. Thus the present study shows that both government and private health facilities flow the first line treatment adopted by Nepal.

VII

RECOMMENDATIONS

The findings based on the present study showed that malaria is still problem in tropical region including Kalyanpur Jabdi, Itari Parsahi and Bishnupur Pra. Ra. of Siraha district. So there should be some measures to be undertaken in order to eradicate malaria. The following recommendations have been made on the basis of the results for effective control of malaria in the study areas.

1. People's awareness programmes should be conducted time to time in relation to prevent and control mosquitoes and mosquitoes borne diseases.
2. Government health staffs should be encouraged with facilities.
3. Private clinics and private practitioners should be trained to make aware people visiting them.
4. Insecticides bed nets should be distributed to the local people.
5. Health staffs of government health facilities should be motivated to keep records in detail about patients before giving anti malarial drugs.
6. Effective insecticides should be sprayed at the certain time interval especially in summer season.
7. Researchers should be encouraged financially by the government and nongovernmental organizations.
8. Private Clinics should be undertaken regular supervision by the government.

VIII

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IX

ANNEX-I

Questionnaire for base line health survey for malaria at government and private health facilities of VDC Kalyanpur Jabdi, Itari Parsahi and Bishnupur Pra. Ra. of Siraha District.

ID NO: ---------- Date: ----------

1. Name of interviewee…… Religion .....Village/Ward.....

Sex: male ☐ female ☐ Age…….

2. Education:

A. Literate ☐ B. Illiterate ☐ C. Adult education ☐

If literate

a. Primary ☐ b. Lower sec ☐ c. Secondary ☐

d. Higher Sec ☐

3. Occupation:

a. farmer ☐ b. business ☐ c. Job holder ☐

d. Student ☐ e. Labor ☐ f. house wife ☐

4. Living Standard

a.Poor ☐ b. Moderate ☐

5 Immigration ☐ b. Emigrations ☐

6.Infected by:

a. *P. vivax* ☐ b. *P. falciparum* ☐

7. Common Symptoms:

a. Chill ☐ b.Headache ☐ c.Muscle Pain ☐

8. How Long.....

9 Diagnosis:

a. Slide Test in; Gov ☐ Pvt ☐

b. Strip Test in; Gov ☐ Pvt ☐

10. Symptoms: .....

11. Medicine Used:

a. Name ☐ b.Company ☐ c. How Long ☐

d. Effect ☐

12. Improvement:

a. Yes ☐ b. No ☐

13. Treatment Strategy:

a. Continued ☐ b. Discontinued ☐

14. Awareness:

a. Yes ☐ b. No ☐

15. Suggestion.....

16. Replyer's Health Condition:

a. Healthy ☐ b. Unhealthy ☐

17. Vector Control:

a. By Net ☐ b.Spray Medicine ☐ c. Smoke ☐ d. Pest /Lotion ☐

e. Sanitation ☐

18. Environmental Condition:

a. Clean ☐ b. Dirty ☐ c. Vegetation ☐ d. Canal ☐

e. Ditches ☐

19. Name of FCHW.....

20. Signature of respondent's…….

21. Surveyer's Signature.....