I

INTRODUCTION

Malaria remains a leading cause of morbidity and mortality world-wide, especially in pregnant women and children, and particularly in tropical Africa, where at least 90% of the malaria deaths occur. Yet malaria is a curable disease and not an inevitable burden. Effective medicines and preventive measures are available. However, these effective and relatively inexpensive interventions reach only a small proportion of the populations in need, mainly because of insufficient financial resources. During the last decade, new medicines and approaches have been developed for malaria case management, for selective vector control and for epidemic detection and control. Malaria has become integrated into other health programmes and partnerships have been increased both internationally and nationally by the Roll Back Malaria (RBM) Initiative instigated by WHO's Director General in 1998. These developments have led to increased global awareness of malaria, and in 2002, the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) started operations.

Malaria is an ancient disease and the name malaria is a misnomer as it has originated from Italian word mala (bad) and ayia (air). Since in earlier days, it was believed to be caused by air. Malaria is caused by parasites of genus *Plasmodium*. These not only infect man but also apes, monkeys, birds and other vertebrate hosts. The four species of *Plasmodium* parasitic to man are *P. virax, P. falciparum, P. ovale* and *P. malariae*. Parasites of the genus *Plasmodium* are responsible for causing disease malaria in both animal and man. There are nearly 120 species of *Plasmodia* occurring in mammals, birds and Lizards (Bruce-chwatt, 1993). The recognition that profound difference exist between the various species has led to the further subdivision into various subgenera (Smyth, 1996). The sixty known species of *Plasmodium* cause malaria in man and other animals. These species are commonly referred to as malaria parasites because of their malaria causing abilities (Kotpal, 1992).

Malaria is a disease with high morbidity rate affecting more and more productive working days of the people which can be considered as great economic loss for a locality or a nation. The *Plasmodium* is transmitted from infected to healthy

person by an infected *Anopheles* female mosquito and affects mainly the RBC and reticuloendothelial system.

Malaria, an ancient disease, has plagued humans throughout history. The Greek Physician Hippocrates described malaria in his writing during early 400s BC. Documents and findings from early civilizations in China, the Middle East and Egypt also show evidence that malaria was known to these culture (Encarta, 2004). Historians believe that malaria was imported to western hemisphere by European explorer. The first recorded, malaria outbreak in western hemisphere occurred in 1493 and the disease was common during the era of European exploration and settlement in America. From the Indus valley in Northern India, Vedic (3500 to 2800 years ago) and Bramanic (2800 to 1900 years ago) scriptures contain many references to fevers some of which are said almost certainly to concern malaria had been imported to by around 3,000 years ago (Carter *et al*.,2002). In ancient Greeks, the disease was known with its typical symptoms of fever, chills and headache. It was treated with various herbs, and even with mantras (black magic). Some of the herbs used for treatment were Cinchona bark, Chiraita, Titepati etc. Cinchona bark has been the most commonly used during the past three centuries (Rana, 2001). The exact cause of malaria was not understood until the closing years of 19th century. In 1880, the French surgeon Charles Alphonse Laveron identified the malaria parasite in the blood of patient. In 1899, Sir Ronal Ross, a British physician, demonstrated that the parasite is transmitted from human to human by female *Anopheles* mosquito.

Malaria in its various forms has been the major across the southern belt of Nepal have been known to harbor virulent forms of malaria, often rapidly fatal for unwary travelers. This fact has contributed to the isolation of Nepal from rest of world, resulting in a slow socio-economic development. The prevalence of malaria up to an altitude of 4000 feet forced valley dwellers to migrate to the inhospitable higher regions in order to escape the ravage of the disease. During the seventeenth and eighteenth centuries, virtually all aspects of life were affected either directly by malaria. Malaria, due to its high morbidity (90% in Teria) has been one of the most important causes of economic deterioration engendering poverty, diminishing quantity and quality of food production, lowering physical and intellectual standards of the nation and hampering prosperity and economic progress in every way. Though it has not been possible to accurately estimate the human and economic loss due to the

disease in Nepal, the economic loss due untimely death of the economically active group was extremely high (Rana, 2001).

There is no documented record about the prevalence of malaria in Nepal during the nineteenth century except for historical description. There were many instances when people from mountainous and hilly areas (non malarious) died in the foothills and forested plain areas (highly malarious) whenever they have had to spend night there. Most of the forested Terai belt, foot hills of the Churia range and inner Terai valleys were known to be death trap due to the high incidence of malaria. However, indigenous ethnic groups of the Tharus, living there for centuries, developed sufficient immunity against malaria. Spleen enlargement rates in those areas were over 90% (Rana, 2001). It seems that even during the earlier days when nothing was known about the cause of malaria, hill people were aware of the season and areas of malaria infection; they used to visit the Terai region when malaria transmission was the lowest. Similarly, people residing in the hills valleys used to farm in the river basin only during the day time and by evening they would go up to the hills. If the hill people had to travel to the Teria areas, they would leave the hill early in the morning and cross the river basin and forested area by daytime and make their night halt in cultivated plain Terai areas, it showed that though the hill people did not know anything about the cause of malaria during those days, they were aware that the disease was contracted at night during non winter season, mainly in the forested areas and river basins (Rana, 2000).

Clinical Features

The main clinical features of malaria vary from mild to severe and complicated according to the species of the parasite, the patient's state of immunity, the intensity of infection and also the presence of concomitant conditions such as malnutrition and other diseases. The diseases tend to be particularly severe in children and pregnant woman. The main clinical manifestations (features) in a typical case are series of:-

i. Febrile Paroxysms: Each paroxysm shows a succession of 3 stages

- The cold stage (lasting to minutes to a hour)
- The hot stage (lasting 1 to 4 hours)
- The sweating stage (lasting 2 to 3 hours)

Thus the total duration of febrile cycle is from 6 to 10 hours, varying with the spices of *Plasmodia*.

ii. Anaemia: Anaemia of microcytic or a normocytic hypochromic type develops as a result of break down of RBCs after a few paroxysms during sedimentation of parasites.

iii. Splenomegaly: Enlargement of the spleen is one of the most important physical sign in malaria.

Necessity of the Study

Malaria is considered as the major health problem throughout the World. The Roll Back Malaria (RBM) project established in 1998 by the newly elected director was one of the most important priorities of WHO. The main objectives of RBM are to reduce the global malaria burden significantly. Through interventions adapted to local needs and strengthening of the health sector with a high political commitment, Nepal has adopted RBM project (Banerijee and Bista, 2000).

The National Health Policy in 1991 integrated malaria control programme into the basic health services. In 1995, WHO called for the implementation of a reliable reporting system capable of early detecting and monitoring new emerging and re-emerging disease. All the cases seen and diagnosed by health institutions were not invested properly and reported due to lack of trained health workers and laboratory services. We need to study human behavior in relation to vector behavior before implementation of any control activities (Sherchand *et al*., 1995).

After analysis of secondary data of Taulihawa hospital from 2059 to 2062, study areas were chosen in Kapilbasti district. The study areas include 33 VDCs and 1 municipality. Even though health personnel from SHP, HP and PHC have to collect blood slides from clinical malaria patients and send to district hospital, it is not strictly followed. Due to lack of manpower even laboratory facilities in HP and SHP, patients have to go to district hospital for laboratory diagnosis. There were slightly higher cases found around the VDCs near the hospital and Kapilbastu municipality. Therefore, study was conducted in Taulihawa hospital, where patients come passively.

II
OBJECTIVES

General Objectives

To find the incidence of malaria in areas (Appendix-4) accessible to Taulihawa hospital, Kapilbastu, Nepal.

Specific Objectives

- To identify the species of plasmodium.
- To determine the incidence of *falciparum* and *vivax* malaria.
- To determine season-wise as well as month-wise incidence of malaria.
- To determine the incidence of malaria among different socio-demographical groups.
- To analyse the level of knowledge, attitude and practice of people about malaria and preventive measures applied to avoid from mosquito bite.

III
LITERATURE REVIEW

The Malaria was named as it (mal aria= bad air) by Italians in mid seventeenth century. Malaria is a serious, sometimes fatal disease resulting from infection with parasites belonging to the genus *plasmodium* which are spread from human through the bite of infected *Anopheles* mosquitoes. There are four main species of *Plasmodium* namely *P. vivax*, *P. falciparum*, *P. ovale* and *P. malariae.* These species cause illness in humans, including fever. *P. falciparum* is associated with significant mortality (WHO and UNICEF, 2003).

Escalante *et al*., (2005) found compelling evidence that *P.vivax* is derived from a species that inhabited macaques in Southest Asia. Their analysis estimates that the exact population of *P.vivax* originated between 45,680 and 81,607 years ago. The phylogeny and the estimated time frame for the origination of current *P.vivax* population are constituent with an "out of Asia" origin for *P.vivax* as homonoid parasite.

In Nepal, malaria has been called by different names Judi-tap (hot-chills) and Judi-bukhara (chills and fever) in the Terai region and Aulo-jwaro (fever of swampy area) and kam-jwaro (shivering fever) in the hilly region (Rana, 2001).

Transmission

There are about 400 species of *Anopheles* mosquitoes through the world, but only some 60 species are vectors of malaria under natural conditions; of these some 30 species are of major importance. *A. minimus* as the main vectors and *A. annualaris, A. maculates* and *A. nigerrimus* as the secondary vectors have mentioned Indo-Chinese (White G.B., 1989).

The majority of the cases were confined forest, fringe forest, Sivalik forest Sivalik foot-hills and Terai in Central Region of Nepal. Transmission was persistent and proportion of *P. falciparum* was high. The fluvi-ecosystem had sub-cosystem viz. Churia-goth ecosystem, Paddy-ecosystem and Riverine-ecosystem where malaria transmission was influenced by the socio-cultural customs and vocational and occupational needs of the population. The vectors responsible for this transmission of

malaria were *A. fluviatilis, A. maculates* complex and *A. Anularis* (Baerjee *et al*., 1991).

Malaria endemic can be grouped into three classes. Stable malaria occurs where a population is continuously exposed to a fairly constant rate of malaria inoculation. Unstable endemic malaria is a class under which a population is subjected to more or less permanent. The main environmental factors having influential impact on malaria transmission are temperature, humidity, rainfall, topography and man made structures. The optimum temperature for the development of malarial parasites in mosquito is between 20^0C to 30^0C. The parasite stops developing below 16^0C and a temperature above 39^0C is lethal to the parasite. A relative humidity of 60% is needed for mosquitoes. At a higher relative humidity, mosquitoes become voracious eater whilst a state of lower humidity discourages the growth. Rainfall, in general, affects them in two ways by increasing the number of breading places and by increasing the relative humidity leading to longer life of the vector. Deforestation and structure such as burrows, pits garden pools, irrigation channels etc lead to an increase in favourable breeding places. (Rana, 2001)

During the last four decades there has been considerable fluctuation in the status of malaria situation in Nepal. During the pre-control era, malaria was hyper/mesoendemic but large parts of the country, particularly southern Nepal were prone to epidemic. The entomological finding of the government has revealed *A. fluviatilis, A. maculates* complex and *A. anmularis* as a proven vector of malaria. Transmission is used to be heavy and perennial in areas where more than one vector was present. Resurgence of malaria has occurred in many countries as a result of failure of eradication programs. Despite years of attempted control, malaria remains a major public health problem in southern Nepal. Both the inner (200 to 500 m high) and outer Terai (less than 200 m high) and near the Indian border are densely forested and they are sparsely populated in parts of malaria (EDCD, 2001).

The main abundance of *A. pseudopuntipennic* was recorded between September and December, being the spring time, the most important period for malarial transmission in the area (Danter *et al.*, 2003).

Yasuoka *et al*., (2007) carried out ecological analysis of vector mosquitoes in Sri Lanka. During the 18-month study period, 14 *Anopheles*, 11 *Culex*, 5 *Aedes*, 2 *Mansonia* and 1 *Armigers* species were collected, most of which are disease vectors

for malaria, filariasis, Japanese encephalitis, or dengue in Sri Lanka and else where in Asia. The density and occurrence of *Anopheles* and *Culex* highest in seepage pools and paddy fields between larval mosquito and aquatic insect species, which are larval mosquito predators, overlapped their niche with both *Anopheles* and *Culex* larvae. This suggests that consorting there aquatic insect species could be effective in controlling mosquito vectors in the study site. Correlations between several climatic factors and mosquito density were also analyzed and weather conditions including higher temperatures, lower relative humidity, and higher wind velocity, were found to affect mosquito or position, propagation, and survival. There findings deepen our understanding of mosquito ecology and will strengthen future mosquito control strategies in rice ecosystem in Asia.

Epidemiology

Malaria epidemics are some of the most serious public health emergencies with which health officials are confronted. Typically, they occur with little or no warning and in areas where the health system is generally unprepared to deal with the problem. They affect highly vulnerable populations with only limited immunity to malaria. In most situations epidemic conditions build up over several weeks, theoretically allowing time for preventive action. Even when an epidemic occurs, several weeks will elapse before it peaks: some effective control is therefore possible in the early stages of its development. The most important factor in reducing the impact of an epidemic is a timely response in which effective control measures are undertaken as soon as the episode has been detected. The longer an epidemic goes undetected without effective control measures, the higher the cost in terms of morbidity and mortality.

1. The malaria burden in the world

At the end of 2004, 107 countries and territories had areas at risk of malaria transmission. Some 3.2 billion people lived in areas at risk of malaria transmission. An estimated 350–500 million clinical malaria episodes occur annually; most of these are caused by infection with *P. falciparum* and *P. vivax*. *Falciparum* malaria causes more than 1 million deaths each year. It also contributes indirectly too many additional deaths, mainly in young children, through synergy with other infections

and illnesses. Patterns of malaria transmission and disease vary markedly between regions and even within individual countries. This diversity results from variations between malaria parasites and mosquito vectors, ecological conditions that affect malaria transmission and socio-economic factors, such as poverty and access to effective health care and preventive services. About 60% of the cases of malaria worldwide, about 75% of global *falciparum* malaria cases and more than 80% of malaria deaths occur in Africa south of the Sahara. *P. falciparum* causes the vast majority of infections in this region and about 18% of deaths in children <5 years of age. Malaria is also a major cause of anaemia in children and pregnant women, low birth weight, premature birth and infant mortality. Malaria contributes synergistically with HIV/AIDS to morbidity and mortality in areas where both infections are highly prevalent, such as in Africa south of the Sahara.

With the exception of Papua New Guinea and focal intense transmission areas in forest of Southeast Asia and the Amazon Basin where malaria burdens may be as severe as in the savannah areas of Africa, malaria transmission in the rest of the world is from low to moderate. In tropical and subtropical areas, the disease burden may be due to both *falciparum* and *vivax* malaria, whereas in the temperate zones only *vivax* malaria is usually transmitted nowadays. In areas of low to moderate transmission, all age groups may be equally at risk. Around 5 million confirmed cases of malaria are reported each year from countries outside Africa south of the Sahara, of which almost 3 million are from India and Pakistan, countries in which the malaria situation has remained more or less unchanged for the 10 last decades (WHO, 2004b). In the Indian sub-continent, over the last two decades, malaria has become more and more common in urban areas such as Mumbai and Madras as a result of increasing adaptation of *Anopheles stephensi* to breeding in artificial containers and lack of environmental hygiene measures to accompany the growth of peri-urban slums. Outside Africa, major epidemics have occurred during the last decade for example in Afghanistan, Azerbaijan, north-west India (Rajasthan), south eastern Turkey, and Tajikistan (WHO, 2004a).

2. Malaria Situation in Nepal

Malaria was major disease (health problem) in Nepal prior to the effective mlaria control project (1954), which was estimated to affect more than 2 lakhs people

per year. Some parts of Tarai and forest fringe particularly Kailali, Kanchapur and Chitwan were popularly known as KALAPANI (black areas). The districts of eastern Terai such as Jhapa, Morang, Sunsari, etc. were the areas at high risk of malaria.

The insect borne diseases control programmed supported by USAID was initiated in Nepal in 1954 as the first attempt to control malaria .During 1956 -1958 similar programme was carried out in Rapti valley by HMG/WHO/USAID to control malaria. Those control programmes were transformed into the malaria eradication programmes in 1958. The malaria eradication programme was the first national public health programme in the country launched with an objective of eradication malaria from the country with in a limited time period. Due to lack of technical, financial, administrative and logistic supports, this objective could not be achieved and the malaria situation deteriorated. Review of the programme objective in 1978 was consequential conversion of eradication programme to control of malaria according to the global malaria control strategy (GMCS) 1992 of WHO adopted by ministerial meeting in Amsterdam. During the years 1987-1988 the control programme was integrated into the basic health services as a component of primary health care from July 1993, the work has been carried out by the epidemiology and Disease control Division (EDCD) under the department of the health services, ministry of health, Nepal.

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 Philliphs 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 Tharus (tribal of the Terai areas). Up to the period, it was further estimated that approximately two million cases of the malaria (40% of the total population) occurred annually and 10-15% among those resulted in death (Bista *et al*., 2002).

3. Malaria Situation in Nepal up to 2001

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 4000 cases lasting for 5-6 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 the western region. The year 1977 could contain in between 10000 and 13000 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 steep rise to 29,388 cases in 1984 which again escalated to 42,321 in 1985. After 1985, the cases in the country stated 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. (VBDRTC Annual Report, 1999).

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 1988 the reduction of the former, especially indigenous *P. falciparum* cases was slightly accelerated (Bista *et al*., 1999). During the last 3 years (1999-2001) in spite of steady increase of population, the number of malaria cases decreased from 8208 in 1999 to 7976 in 2000 and to 6555 in 2001.

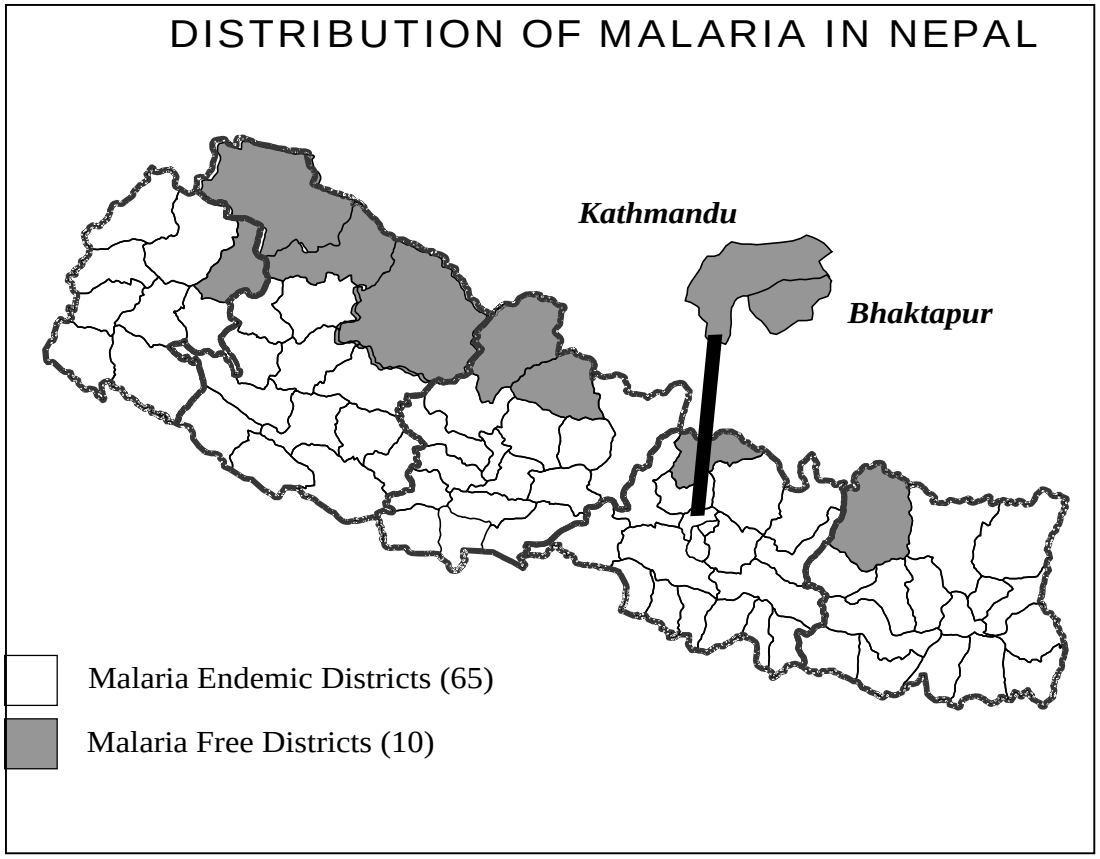
4. Malaria Situation in 26 Bordering Districts

During 1994 to 1995, 54.64 and 54.77 prevalence rate of malaria cases were detected, out of them 72.02 and 63.13 incidence rates were imported from India. Among the 26 bordering districts of Nepal, Kanchapur and Kailali of the western, Dhanusa, Mahottari of central and 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% the total malaria cases in 1997. These districts which have immediate borders with India have importation of malaria cases from India during 1995 to 1998. These imported cases account for 22 to 31 percent of the total cases registered in the country (Bista *et al*., 1999).

With the free open border between the two countries, local cross-border mobility is much common. There are certain entry and exist point (Kakarvitta, Bhadrapur and Jogbani in the eastern, Birguang in the central, Sunauli in the western, Rupediha in the mid-western and Gauriphanta and Banbasa in the far-wastern region)

which have movement of population not only from bordering districts but also from the northern parts of the country (Rana, 1998).

Nepal's problem of cross border disease compounded by the fact is easy access and free movement of population, making transmission of diseases very easy. It should be noted that the border areas that are more suspicious to infectious diseases. Around 94 million people that live in the border areas of Bangladesh, Bhutan, India and Nepal are vulnerable to the emerging cross-border nature of public health. (Panduka, 2002). About 71.6% of the border population reside on malarious risk prone areas of bordering district. 53.96%, 84.08% and 91.2% of positive cases were detected from border district in 2000, 2001 and 2002. (Bista *et al*., 2002).



Map: I

5. National Malaria Situation from 060/61 to 063/064

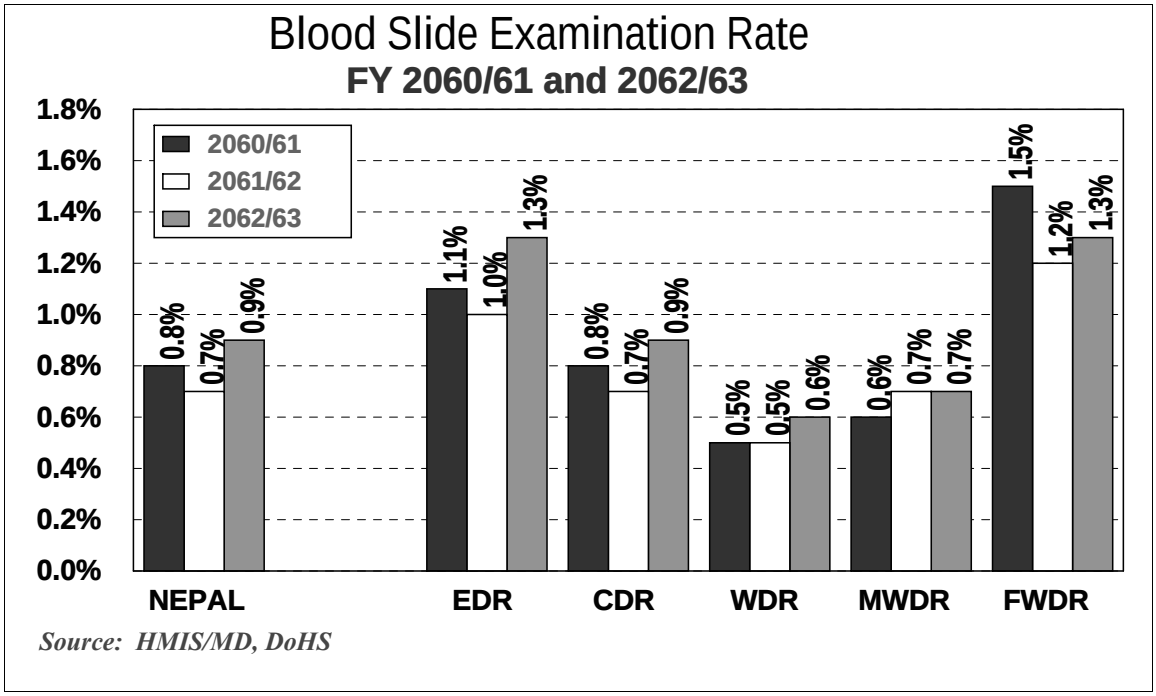
The total numbers of malaria positive cases were 6365 in fiscal year 060/61, 4557 in 061/62, 5691 in 061/63 and 5293 in 063/64. The number of malaria blood slides examined during FY 2062/063 was increased in comparison to previous FY (Table: 2). The imported cases were also increasing. The percentage of *P. falciparam* cases were also increased from 11.75% in 060/61, 24.19 in 062/063 and 24.5 in 063/64. There might be resurgence of *falciparum* malaria. This trend of malaria infection indicated that malaria is becoming public health burden in recent time.

Table 1: Malariometric Indicators, FY 2060/61 to 2062/63

Years	Total Slides Examined	Total Positive Cases	ABER (%)	SPR (%)	API (/1000)	SPR (%)	IND. (%)	IMP (%)	*Pf* (%)	CM
2060/61	148,144	6,365	0.80	4.30	0.36	0.50	84.12	9.80	11.75	56,482
2061/62	135,781	4,557	0.70	3.40	0.25	0.40	77.66	22.33	10.75	52,829
2062/63	170,988	5,691	0.96	3.32	0.32	0.80	79.60	20.40	24.19	74,740
2063/64	137444	5293	0.7	3.9	0.28	0.9	69.28	30.72	24.5	63751

Source: HMIS/MD & Disease Control Section/EDCD, DoHS

Figure 1: Blood Slide Examination Rate FY 2060/61 and 2062/63



Source: HMIS/MD, DoHS

6. Malaria Situation in Kapilbastu in Recent Days

Malaria parasite incidence rate is increasing. Along this the numbers of *P. falciparum* cases are also increasing in recent years (Table: 2). There might be resurgence of *falciparum* malaria in Kapilbastu district. This trend of malaria infection indicated that malaria is becoming public health burden in recent time in the study areas.

Table 2: Malaria Situations in Kapilbastu in the Years 2059 - 063

Indicators	**2059/060**	**2060/061**	**2061/062**	**2062/063**
Malaria Parasite Incidence / 1000	0.06	0.08	0.07	0.1
ABER	0.5	0.6	0.5	0.5
Slide positively Rate	1.3	1.4	1.2	1.3
Number of *Pf* Cases	1	8	5	6
Clinical Malaria Incidence /1000 risk Population	2	2.8	3.2	2.3

Diagnosis

A diagnosis of malaria must precede treatment with antimalarial drugs and is made first on a clinical suspicion of the disease based on fever and other signs and symptoms. A confirmatory diagnosis requires evidence of the presence of parasites.

1. Clinical diagnosis

Determination of a patient's clinical history and symptoms is an acceptable basis for the management of malaria disease. Although the signs and symptoms of malaria, such as fever, chills, headache and anorexia, are generally non-specific, some signs and symptoms, especially in combination, have diagnostic value in specific epidemiological and operational situations. However, it is not possible to apply any one set of clinical criteria to the diagnosis of all types of malaria in all patient populations. Experience has shown that the appropriateness of particular clinical diagnostic criteria vary from area to area according to the intensity of transmission, the prevalent malaria species, the incidence of other causes of fever, the qualifications of the health care staff and the health service infrastructure (WHO, 2000a).

2. Light Microscopy - Confirmatory Diagnosis

Evidence of the presence of parasites can be made by the examination of a stained blood smear by light microscopy or by the detection of parasite products by rapid diagnostic techniques (RDTs). However, in areas with intense transmission, it is of limited value for children and to some extent for adults, as asymptomatic parasite carriers may be common. However, in these areas, the WHO Expert Committee recommended that confirmatory diagnosis is desirable to detect treatment failures, confirm severe disease, and diagnosing complicated malaria during a low transmission season (WHO, 2000a). If light microscopy is available, the diagnosis of uncomplicated malaria should be based on a history of fever and a positive blood slide. Malaria disease may exist despite a negative blood slide but unless the patient has already started treatment and there is a high clinical suspicion of the disease, treatment for uncomplicated malaria should not be given as long as the blood slides are negative (WHO, 2000a).

3. Rapid diagnostic tests (RDTs)

When parasite-based diagnosis is essential, RDTs may be an alternative to light microscopy in situations where normal laboratory services are non-existent or overworked. RDTs are immuno-chromatographic tests that detect parasite specific antigens in a finger-prick blood sample. Some tests detect only one species (*Plasmodium falciparum*), others detect one or more of the other three species of human malaria parasites (*P.vivax*, *P. malariae* and *P.ovale*) (WHO, 2000c; 2003e; 2004c). RDTs are commercially available in different formats, as dipsticks, cassettes or cards.

There was a high degree of agreement (88.6-100%) between RDTs or molecular tests and microscopy. In rural Kenya, with a high incidence of malaria cases the correlations coefficient ranged from 0.94 for RDTs to 0.76 for PCR. Malaria is over estimated if the diagnosis is hared solely on clinical signs. Therefore, laboratory confirmation is essential. Microcopy is a reliable method in rural areas where malaria is prevalent, but RDTS offer a good alternative with the advantage that it is an easy and rapid method. Molecular test are more sensitive but difficult to implement in rural areas. In areas with lower incidence, molecular test detect a

significantly higher number of *plasmodium* infections than RDTS or microscopy. Although implementation of molecular tools can be difficult, the prospect of an easy and cheap detections system makes them promising tools for the near future (Mens *et al*., 2007).

ICT that detects circulating antigens of *P*. *falciparum* malaria in blood was useful in field evaluation for rapid diagnosis of malaria (Yadav *et al*., 1997).

The accumulation of antimalarial antibodies in the human population is related to the degree of malaria endemicity. The study of Sherchand *et al*., (1995) indicated that blood smear positivity was lower than seropositivity. The validity and reliability of these serological methods, ELISA and IFT are more useful tools that can simplify, expedite and assist in the stratification and monitoring of malaria endemicity.

The study by Amerasinghed *et al.*, (2005) suggested that in low tramlines areas, such as Sri Lanka, smaller sample sizes can be used for epidemiological research studies using PCR instead of microscopy to estimate parasite prevalence. This efficiency gain has to be weighed against the higher cost and emplacing of PCR. PCR cannot replace microcopy as the standard diagnostic procedure at the field level. ELISA is not directly comparative with microscopy and PCR but it can also be a woeful tool in malaria epidemiological studies surveys currently implemented by the Sri Lanka government in resonate to local malaria outbreaks can form the bar for valid epidemiological studies and be used for the generation of malaria risk maps if samples ware also analyzed using PCR.

Krause *et al*., (2006) determined the effect of age, sex, chemoprophylaxis, chemoprophylactic regimen, compliance for chemoprophylactic regimen, exposure prophylaxis, country of infection, and year of reporting on the outcome. Of 3935 case-patients, 116(3%) died of malaria. Univariate analysis showed significant association with death for chemoprophylaxis with chloroquine plus proguanil compared to no chemoprophylaxis. The multivariate model showed that patients who had taken chemoprophylaxis were less likely to die compared to those who had not taken chemoprophylaxis, adjusted for patient age ad reporting year. The study demonstrated that chemoprophylaxis significantly reduced fatality rates among non-immune malaria patients and supports the importance of existing guidelines for malaria prevention.

Kleischmidt *et al*., (2007) found that significant overall reduction in prevalence of infection have been observed with 42% fewer infections occurring in 2006 compared with baseline. Nevertheless, there is evidence of considerable heterogeneity in impact of the intervention. Prevalence of infection was significantly associated with spray status of the child house, spray coverage with effective insecticide of the neighborhood of the house, bed net use, and time elapsed since last spray. Careful scheduling of spray coverage is therefore essential to prevalence. This can only be achieved if comprehensive monitoring systems are in place for both the management and evaluation of the intervention.

IV
MATERIALS AND METHODS

Materials Required

i. Clean slides
ii. Sterile lancets
iii. 3% giemsa solution (pH-7.2)
iv. Microscope
v. Methylated sprite
vi. Cotton
vii. Box
viii. Distilled water
ix. Measuring cylinder
x. Lead pencil
xi. Record form or Register

Questionnaires

A simple questionnaire was structured avoiding controversies and difficulties. The questionnaire focused in the clinical history of the patient to study the diagnostic malaria symptoms.

Study Area

Kapilvastu is Terai district of Nepal. It is situated in southern part of western development region of the country. Kapilbastu district is situated at north latitude (27°25”- 27°84”) and east longitude (82°75”- 83°14”). It is bordered with UP of India in southern side. Similarly it is linked with Rupandehi district on east, Arghakhachi on north and Dang on west. The district is crossed by Mahendra highway. Spatial coverage of 1651.3 sq.km area is noted in Kapilbadtu district (Calculated from boundaries delineated by DDC in 2002/2003 on topo sheets of 1:2500 scales). Most part of (38.8%) of district still covered with forest.

Administratively there are 77 VDCs and 1 Municipality in Kapilvastu district where 72930 households have been reported by census 2001with 944 settlements by updated by DDC in topo sheet in 2004. Total population of the district is 481284 (Population Census 2001, DDC Kapibastu)). Out of the population, 48.63% are

female and 51.36% were male. Population of age group 0-15 years was 41.23%. The economically active population was nearly 49.65%. About 81.04% population reported Hinduism as a religion whereas Islam covers about 18.19 % population.

The study areas (Map 2) include 33 VDCs and 1 municipality. The population of 33 VDCs was 182043. The total population of the study areas was 210213 with 108945 male populations and 101268 female populations. Among them population of Niglihawa VDC was the highest (10,076). The population of Kapilbastu Municipality was 27170. The population of Muslim community was higher (48836) to other caste in the study areas. Other castes were Yadav (24,090), Chamar/Harizon (13,748), Kurmi (13,092), Duhad/Pashwan (9,094), Brahmin/Chhetri (13,044) Tharu (11,493). Other remaining castes included Kami, Damai, Kahar, Chai, (75,816) (Population Census 2001, DDC Kapibastu). The study areas are mostly swampy and cultivated. Among 33 VDCs, 6 VDCs (Somadiha, Baidauli, Rangapur, Pipara, Bijuwa, and Hathihawa) are bordering VDCs. Khunuwa is border checkpoint.

Health Services:

The services are overlaid unto the settlement to see its accessibility. The emerging awareness in health services in the country has been reflected by its response found in the availability of health services in all the VDCs. Kapilvastu district has all type of health services centers. Altogether 80 health services facilities in the district are established as of year 2004. Out of total health facilities, are 66 sub-health posts, 7 health post, 3 primary health centers, 2 hospitals, and an ayurvedic hospitals and an ayurvedic clinic.

Accessibility of Hospital

Accessibility buffers of the hospital created in aerial distance of 2 km interval. The percentage distribution of settlements accessibility buffers to hospital is as follows:

Table 3: Accessibility of Hospital

Arial Distance	Accessible Settlements	
	No	**%**
Within 2 km	22	2.30
Within 4 km	79	8.36
Within 6 km	174	18.43

Hospitals are located in Kapilvastu MP and Bahadurganj VDC. Some settlements of surrounding are having hospital services facilities within 6 km aerial distance. The accessibility analysis shows that about 18.43% settlement that is only about 18% population on average are having hospital facilities within 6 km aerial distance that about 2 and half an hour walking distance depending upon level of terrain.

Tools Used in the Study

a. Data Collection Technique

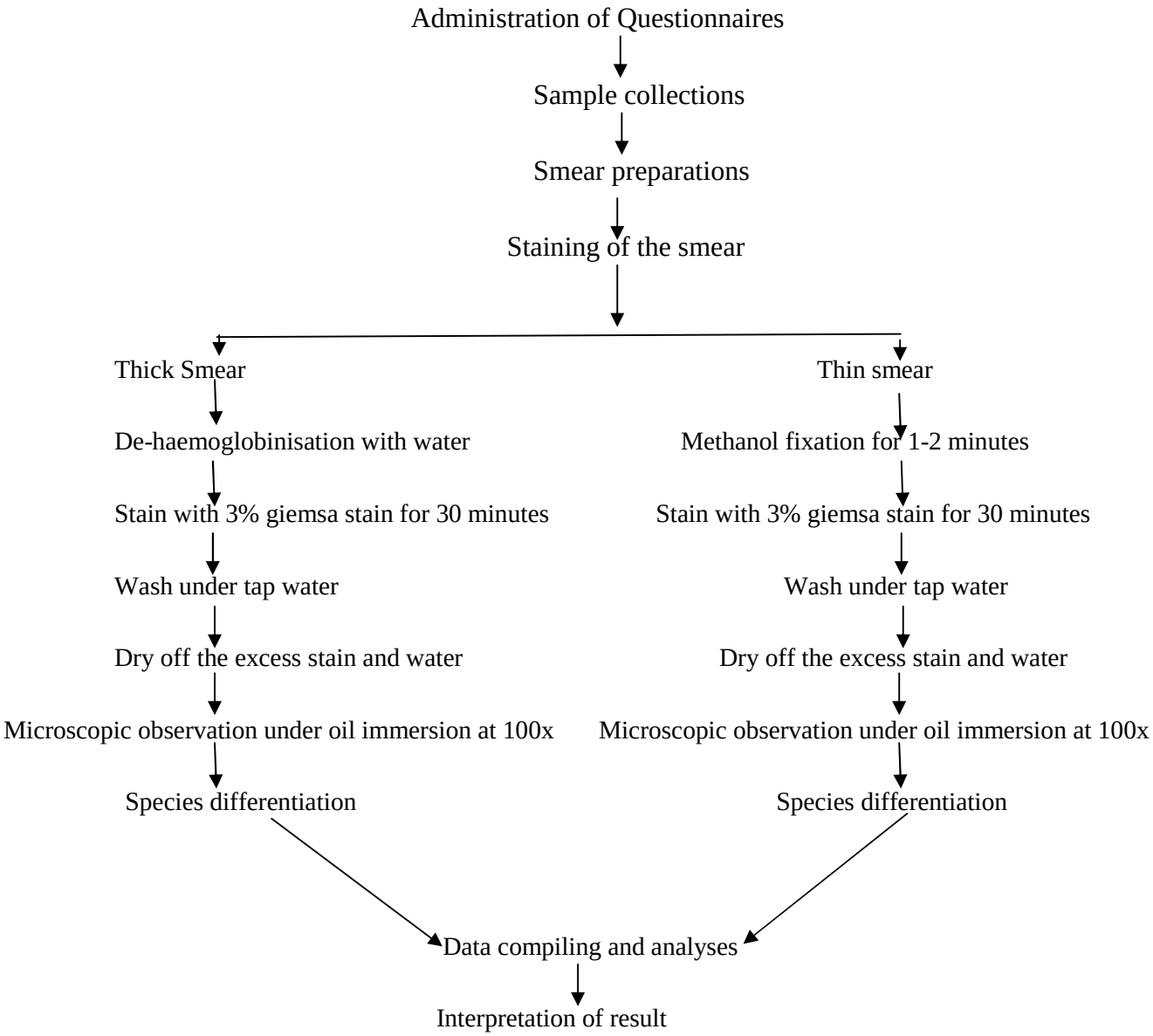
The study populations are the inhabitants of all ages and both sexes of the catchments area of hospital, who passively came to the hospital. Altogether 705 blood slides were collected from clinically suspected patients of malaria by medical personnels (Doctor, Health Assistant, Staff Nurse, AHW, and ANM) on the basis of chief complaint of patient having fever with chills and rigor or sweating or headache or muscular pain/malaise. Patients having fever with clinical anaemia or spelenomegaly and pyrexia of unknown origin were also included. The slides were stained with giemsa stain and diagnosed through microscopy. 109 cases were found positive for malaria among total cases examined. After laboratory diagnosis, name of patient, age, sex, and date of collection and result of examination were noted in a hospital register. Clinically suspected cases were interviewed in structure questionnaires where literacy, knowledge, attitudes and practice about malaria were assessed for the positive cases.

Primary data has been collected from August 2006 to July 2007.

- Total number of population of study area (210213) has been taken from District Development Office, Kapilbastu.

- Annual reports of the malaria among the general population of have been collected from DoHS, Teku. This data has been used to compare the malaria cases of Kapilbastu district and study area.
- The questionnaires survey was carried out with the prepared questionnaire to find out the knowledge, attitude and socio-cultural consequences related to the malaria among the existing population (Appendix 1).
- Date of collection of blood slides, name, age, sex, caste and address of patient, clinical signs and result of examination were noted in a register.

Research Design



b. Preparation of thick and thin blood films on the same slide

The following steps are required to preparing both thick and thin blood smears.

- Use a convenient location where the patient is comfortable. Select the third finger from the thumb by holding the patients left hand with palm upwards and the big toe can be used with infants.
- Clean the finger of patient with an alcohol swab or spirit to remove grease from the finger.
- Prick the finger with an unused sterile lancet, using a quick rolling action.
- Apply gentle pressure to the finger to derive the first drop of blood and wipe it away with a dry piece of cotton wool.
- Place a drop of blood on the middle of the clean slide by holding the slide only by the edges for the thin film. Apply further pressure to derive more blood and collect three small drops on the slide about 1cm from the drop meant for the thick film.
- Apply pressure with cotton soaked in sprit on the pricked finger to stop bleeding.
- A second slide, the spreader, having a very smooth edge is than brought in contact with the surface of the slide held at an angle of 30-45 from the horizontal. After the lower edge of the spreader is pushed steadily down the surface of the slide, drawing the blood behind it, till the smear is formed. Thin smears are one blood cell in thickness.
- Join the drops of blood quickly and spread them using the corner of the spreader to male an even, circular thin film.
- Protect the slide from insects and allow it to dry.
- Write the identification code on the slide.
- Fill out the record form or register,
- Keep the slide in a slide box and leave one night to dry it.

c. Staining the blood films

The following steps are involved in staining the blood films:

- Fix each thin blood film by dabbing it gently with a pledged (small piece) of cotton wool dampened with methanol. Avoid methanol, coming into contact with the thick film, other fixation may take place.
- Place the slide, back to back, in a staining trough, making sure that all thick films are at one end of the trough.
- Prepare a 5% solution of giemsa stain by adding 5ml. of giemsa stain solution to 95 ml. of buffered water.
- Pour the stain gently into the trough until the slides are totally covered. Avoid pouring the stain directly on the thick films.
- Leave the slides in the stain for 30-45 minutes.
- Pour the clean water gently into the trough to float off the scum on the surface of the stain. Repeat this two to three times.

d. Examination of blood film for malaria parasite

Malaria parasite takes up giemsa stain in a special way in both thick and thin blood films. The thin film consists of a single layer of red blood cells and is always used as label to identify the parasite of malaria or other morphological characters of the parasite which are not visible in thick film preparation. The thick is made up of large number of de-haemoglobinized red blood cells. Any parasites present are more quickly seen under the microscope in thick smear as they are concentrated in a smaller area than in thin film for routine examination, thick film is followed by thin film if necessary. A drop of immersion oil was kept in the film and examined under the 100x objective lens. Staining of slides and examination were carried out in Taulihawa hospital. Cross checking and final confirmation of slides had been done by Mr. Prem KumarYadav, medical lab technologist of the hospital.

e. Recognition of the malaria parasite

The Malaria parasite stained by taking up giemsa stain in both thick and thin blood films can be recognized by observing the shape and color of stain of chromatin and cytoplasm of the parasite.

i. The chromatin (part of the parasite nucleus) is usually round in shape and stains deep red.

ii. Cytoplasm varies in shape from ring shape to a totally irregular shape. It always stains blue but the shade of blue may vary between the *plasmodium* species.

e. Identification of different stages of the parasite in its developmental stage

i. The tropozoite stage

It is also called the ring stage, although it takes the form of an incomplete ring. It does not stain, but has a colour of its own, which may range from pale yellow to dark brown or black.

ii. The schizont stage

The parasite starts to reproduce asexually at this stage and there are several phases at this stage varying from parasite with chromatin pieces to parasites with a number of chromatic dots and definite cytoplasm.

iii. The gametocyte stage

It is a sexual stage in which the parasites have become either male or female that takes place in the stomach of female *Anopheline* mosquito. Gametocytes may either round or banana-shaped depending upon the species.

f. Data analysis

The total number of cases, incidence rate, species seasonal variation, and the distribution of malaria among different castes, sexes, age groups were analyzed. The analysis facilitated the comparison of malaria in Kapilbastu district and nation.

g. Ethical consideration

The study started after the written permission was granted from EDCD. I took permission from DHO Kapilbastu. I introduced myself as microbiologist. Verbal consent was taken from the patient or patient guardian.

V
RESULTS

The research work was completed within 1 year duration (August 2006- July 2007). The study has been divided into 2 parts:

1. Result based on the microscopic examination and
2. Results based on questionnaire analysis.

õ **General Incidence of Malaria Cases**

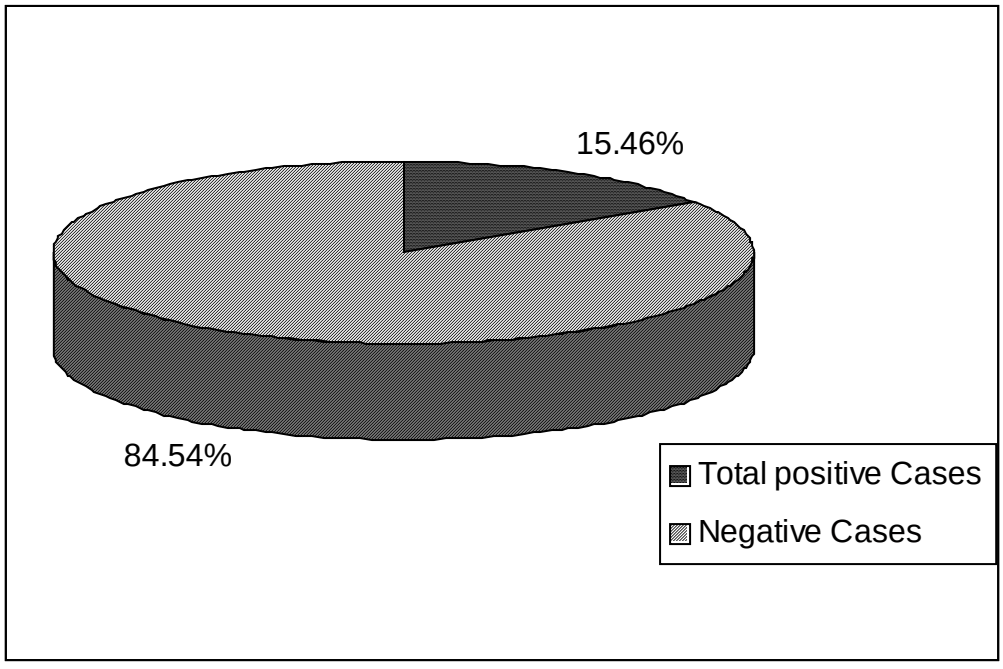
Among 705 slides, only 109 cases were found positive for malaria. The incidence of malaria during study period in the study area was 0.5185/1000 population. The SPR was 15.46%.

Table 4: General Incidence of Malaria Cases

Total Population	BSE	Total positive Cases	Negative Cases	SPR (%)	Incidence/ 1000 population
210213	705	109(15.46)	596(84.54)	15.46	0.5185

(The figure in the parenthesis indicates the percentage out of total positive cases.)

Figure 2: General Incidence of Malaria Cases



õ **Species-wise Incidence of Malaria**

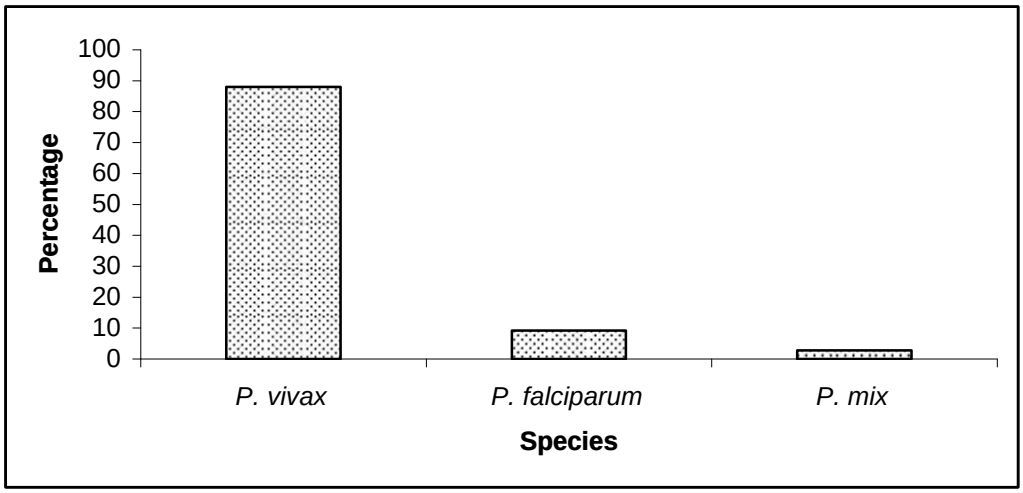
Out of total 109 cases, malaria due to *P. vivax* were 96(88.07%) while *P. falciparum* and *P.* mix were 10(9.2%) and 3(2.73%) respectively. 3 *P. falciparum* cases in winter and 5 in spring were found. In summer and autumn, *P .falciparum* cases were not recorded. The highest numbers of *P. vivax* cases were found in summer. The *P.* mix cases were recorded only in spring season.

Table 5: Species-wise Incidence of Malaria

Species	***P. vivax***	***P. falciparum***	***P.* mix**
Total Positive Cases	96(88.07)	10(9.2)	3(2.73)

((The figure in the parenthesis indicates the percentage out of total positive cases.)

Figure 3: Species-wise Incidence of Malaria



õ **Type-wise Incidence of Malaria**

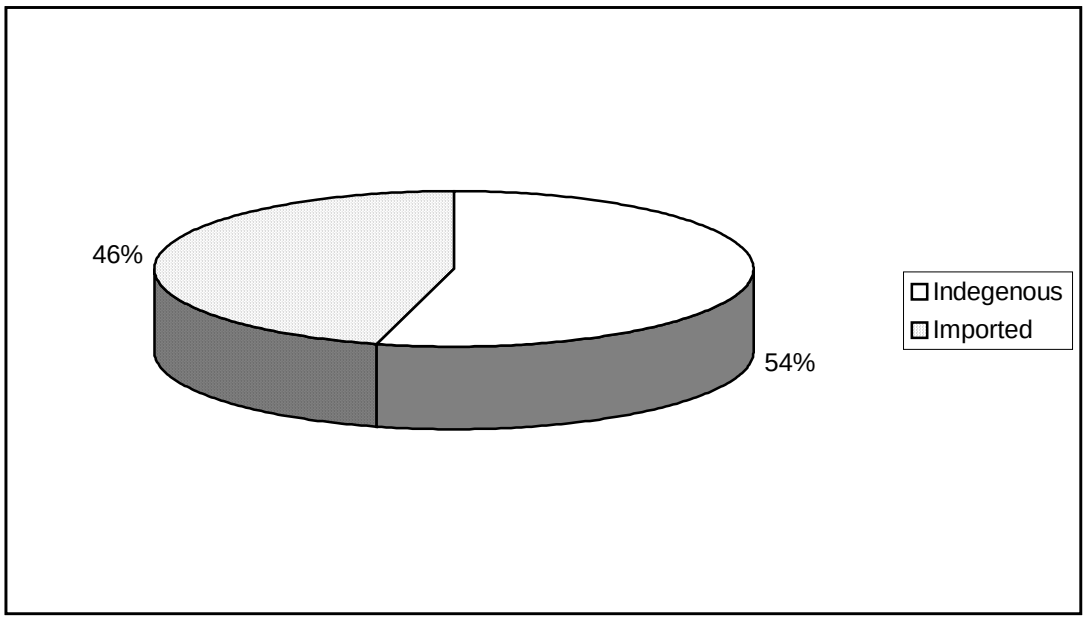
The imported cases contributed 59(54.12%) while 50(45.88%) cases were indigenous.

Table 6: Type-wise Incidence of Malaria

Type	Imported	Indigenous
Total positive cases	59(54.13)	50(45.87)

((The figure in the parenthesis indicates the percentage out of total positive cases.)

Figure 4: Type-wise Incidence of Malaria



õ **Sex-wise Incidence of Malaria**

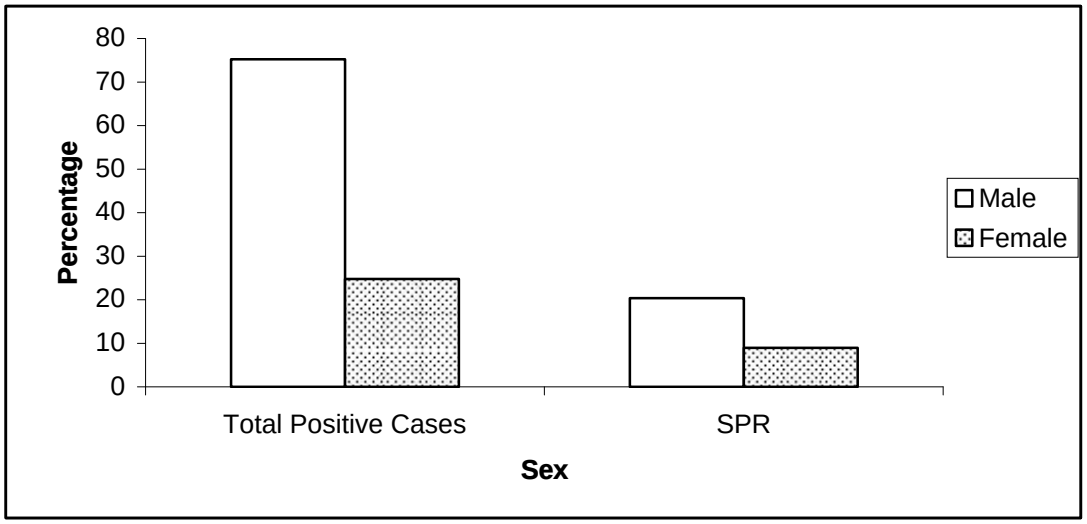
Out of 705 slides, only 109 cases were found positive for malaria. Among them, males were 82(75.23%) and females were 27(24.77%). The incidence of malaria in male population in the study areas was 0.76/1000 greater than females 0.27/1000. The SPR was higher in males (20.35%) than in females (8.94%). Statistically, gender-wise the incidence of malaria was found to be significantly different ($\Re^2$ = df = p > 0.05) (Appendix 6a).

Table 7: Sex-wise Incidence of Malaria

Sex	Total Population	BSE	Total Positive Cases	SPR (%)	Incidence/ 1000 population.
Male	108945	403	82 (75.23)	20.35	0.76
Female	101268	302	27 (24.77)	8.94	0.27
Total	210213	705	109 (100)	15.42	0.52

(The figure in the parenthesis indicates the percentage out of total positive cases.)

Figure 5: Sex-wise Incidence of Malaria



õ **Age-wise Incidence of Malaria**

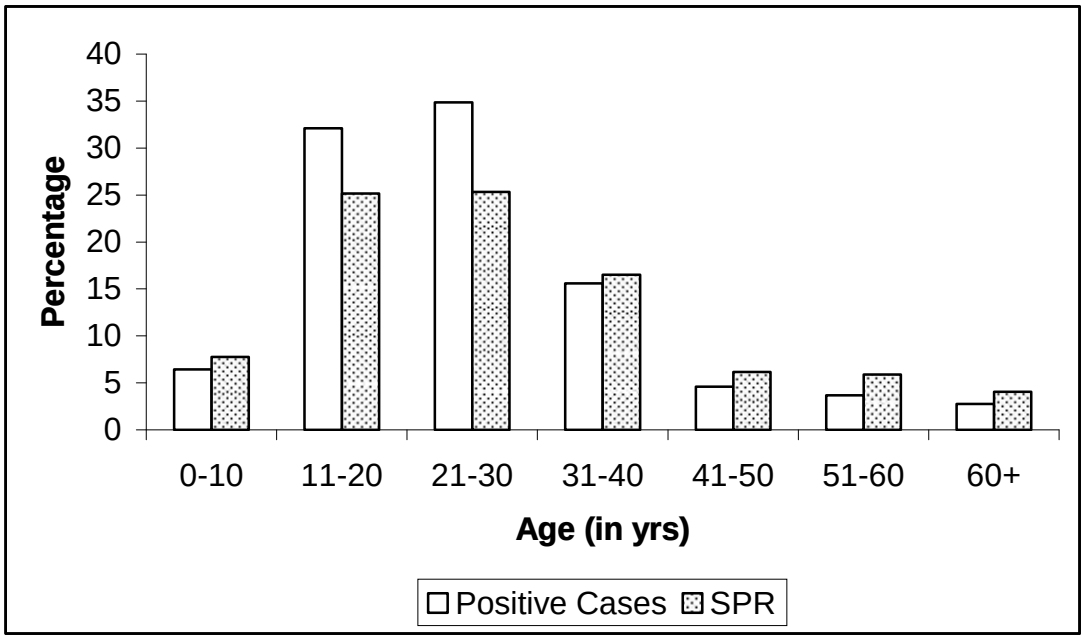
The most cases 38(34.86%) were found in age group 21-30 years and the least cases 3(2.75%) in the age group >60 years. The incidence rate was the highest 1.17/1000 in age group 21-30 years and lowest 0.12 in 0-10 years. SPR was the highest 25.33% in age group 21-30 years and the lowest 4.05 in >60 years age group. Statistically, age group 21-30 years has the highest weighted mean, i.e. 0.08832 (Appendix 6b).

Table 8: Age-wise Incidence of Malaria

Age (in yrs)	Total population	BSE	Positive cases	SPR (%)	Incidence rate
0-10	58694	90	7 (6.42)	7.77	0.12
11-20	49609	139	35 (32.11)	25.17	0.7
21-30	32373	150	38 (34.86)	25.33	1.17
31-40	24668	103	17 (15.6)	16.5	0.69
41-50	18994	81	5 (4.59)	6.17	0.26
51-60	12354	68	4 (3.67)	5.88	0.32
>60	13521	74	3 (2.75)	4.05	0.22
Total	210213	705	109	15.46	0.52

(The figure in the parenthesis indicates the percentage out of total positive cases.)

Figure 6: Age-wise Incidence of Malaria



õ **Month-wise Incidence of malaria**

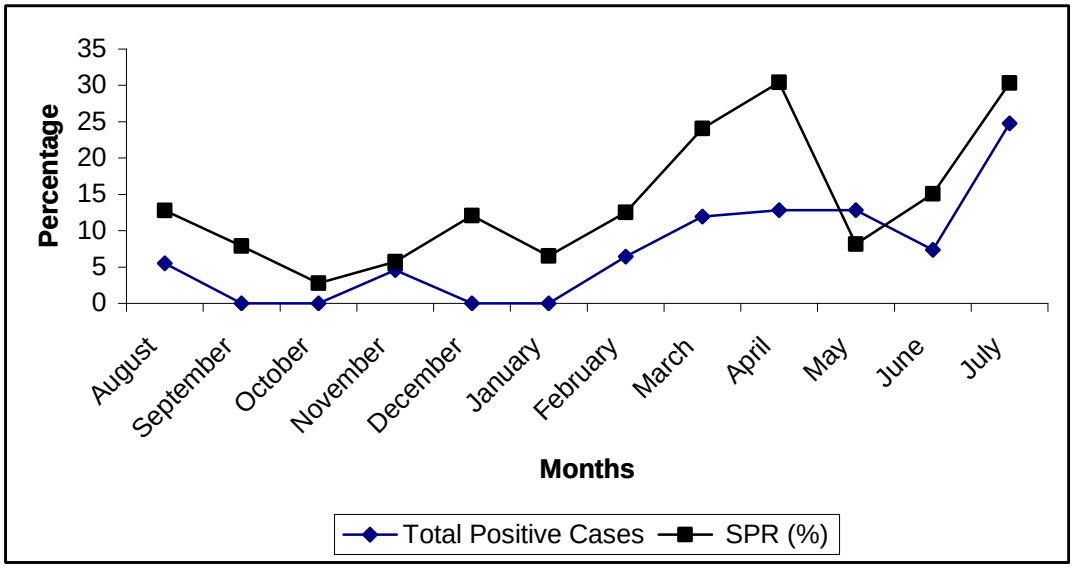
In the month-wise distribution of malaria, the most cases were found in July (27/24.77%) and the least in October (2/1.83%). The percentage of slide positivity rate was the highest in April (30.43%) and then in July (30.34%). The lowest percentage of slide positivity rate was in October (2.78%).

Table 9: Month-wise Incidence of Malaria

Month	BSE	Total Positive Cases	SPR (%)
August	47	6 (5.5)	12.77
September	38	3 (2.73)	7.89
October	72	2 (1.83)	2.78
November	87	5 (4.59)	5.75
December	58	7 (6.42)	12.07
January	46	3 (2.73)	6.52
February	56	7 (6.42)	12.5
March	64	13 (11.93)	24.07
April	46	14 (12.84)	30.43
May	49	14 (12.84	8.16
June	53	8 (7.34)	15.09
July	89	27 (24.77)	30.34
Total	705	109 (100)	15.46

(The figure in the parenthesis indicates the percentage out of total positive cases.)

Figure 7: Month-wise Incidence of Malaria



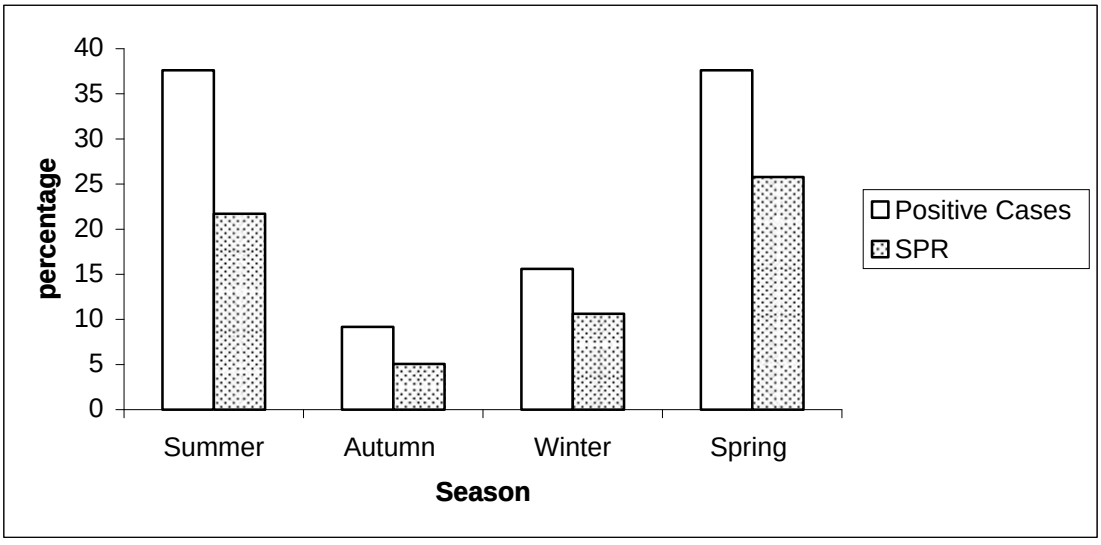
õ **Season-wise Incidence of Malaria**

The highest number of positive cases 41(37.6%) were found in summer and spring seasons followed by 17(15.6%) in winter and the least 10(9.2%) cases were recorded in Autumn season. Statistically, the incidence of malaria was found to be significant different in seasons of the year ($\Re^2 = \chi^2_{cal} = 25.51$, 3df = $p > 0.05$) (Appendix 6d).

Table 10: Season-wise Incidence of Malaria

Season	BSE	Positive Cases	SPR (%)
Summer	189	41(37.61)	21.7
Autumn	197	10(9.07)	5.07
Winter	160	17(15.6)	10.62
Spring	159	41(37.61)	25.78
Total	705	109	15.46

Figure 8: Season-wise Incidence of Malaria



õ Caste-wise Incidence of Malaria

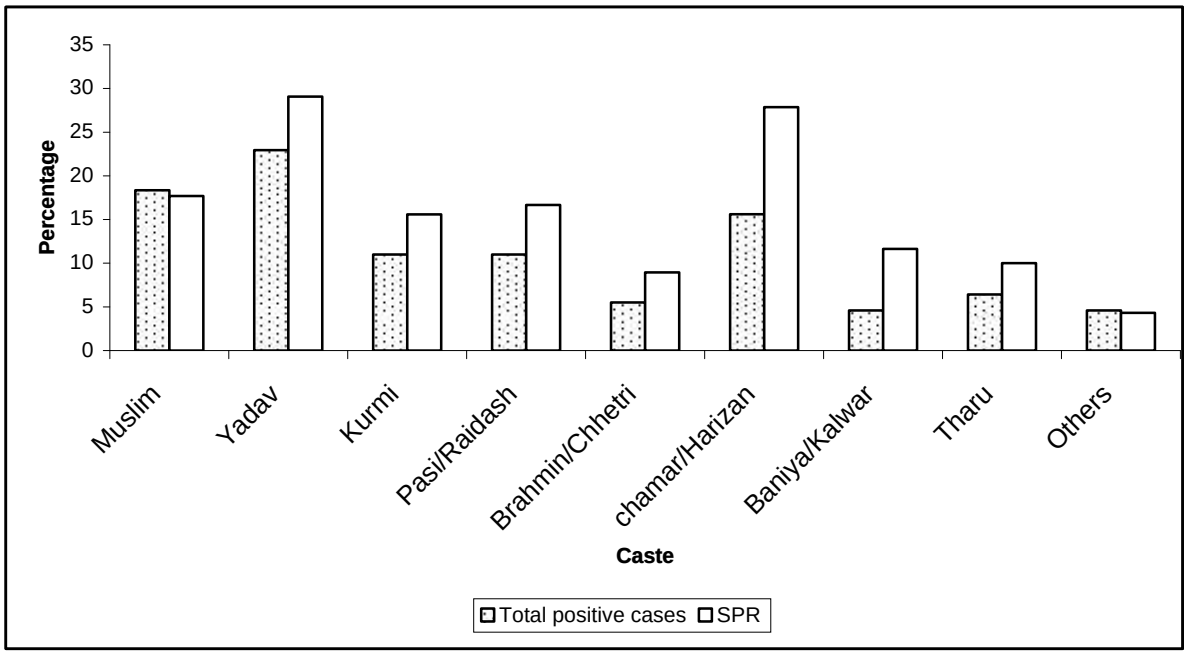
Although the slide positivity rate was the highest (25.37%) in Brahmin/Chhetri, malaria was more prevalent in Baniya/Kalwar 2.27/1000. SPR was the least in Tharu (7.14%) while API was the least in Muslim (0.41/1000). Statistically, the incidence of malaria was found to be significantly different in different castes group (χ^2_{cal} = 64.779, 8df = 15.507, p > 0.05) (Appendix 6c).

Table 11: Caste-wise Incidence of Malaria

Cast	Total Population	BSE	Total Positive Cases	SPR	Incidence Rate
Muslim	48836	113	20 (18.35)	17.7	0.4
Yadav	24090	86	25 (22.94)	29.07	0.365
Kurmi	13092	77	12 (11.0)	15.58	0.5
Pasi/Raidash	9094	72	12 (11.0)	16.67	0.1
Brahmin/Chhetri	13044	67	6 (5.5)	8.95	0.66
Chamar/Harizan	13748	61	17 (15.6)	27.87	1.3
Baniya/Kalwar	3086	43	5 (4.59)	11.63	0.36
Tharu	11493	70	7 (6.42)	10.0	2.23
Others	68391	116	5 (4.59)	4.31	0.435
Total	210213	705	109 (100)	15.46	0.52

(The figure in the parenthesis indicates the percentage out of total positive cases.)

Figure 9: Caste-wise Incidence of Malaria



õ Municipality/VDCs-wise Incidence of Malaria

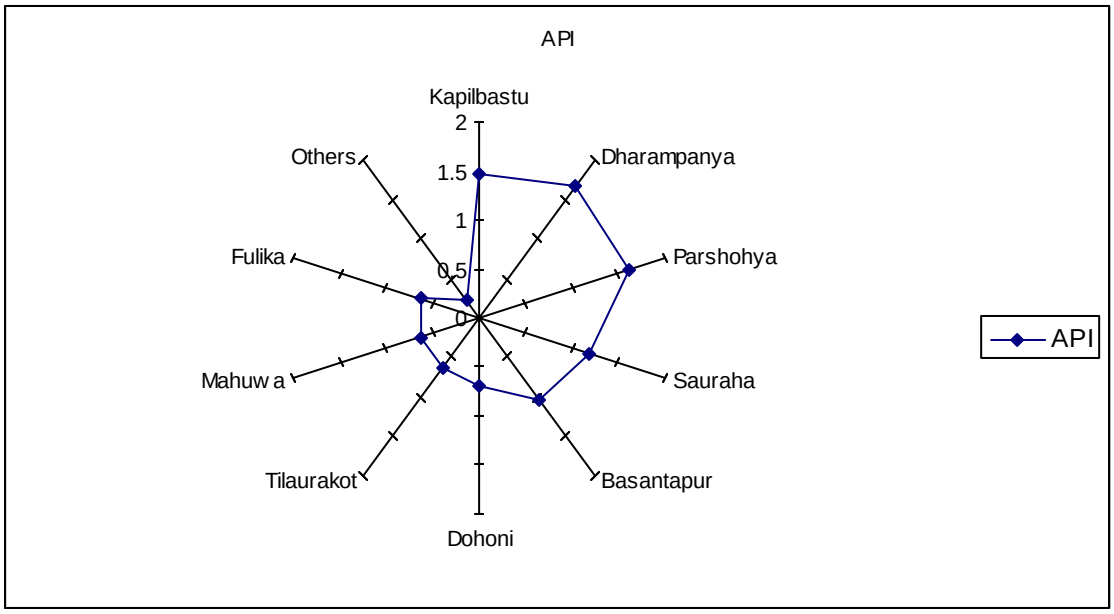
In the study areas, API was the highest 1.47/1000 in Dharampaniya VDC, 1.68/1000 in Kapilbastu municipality and the least 0.63/1000 in Fulika. The SPR was the highest in Dohoni (22.72%) and the lowest (12.2%). in Kapilbastu municipality.

Table 12: Municipality/VDCs-wise Incidence of Malaria

Municipility/ VDCs	Population	BSE	Positive Cases	SPR (%)	Incidence Rate/1000 pop.
Kapilbastu	27170	327	40 (36.7)	12.2	1.47
Dharampanya	4166	34	7 (6.42)	20.6	1.68
Parshohya	3696	28	6 (5.5)	21.42	1.62
Sauraha	3401	26	4 (3.67)	15.4	1.18
Basantapur	2870	16	3 (2.75)	18.75	1.05
Dohoni	5812	19	4 (3.67)	21.05	0.69
Tilaurakot	7791	31	5 (4.59)	16.15	0.64
Mahuwa	4666	17	3 (2.75)	17.64	0.64
Fulika	6300	21	4 (3.67)	19.04	0.63
Others	144960	186	33(30.27)	17.74	0.23
Total	210832	705	109	15.46	0.52

(The figure in the parenthesis indicates the percentage out of total positive cases)

Figure 10: Municipality/VDCs-wise Incidence of Malaria



õ **Chief Complaints and Clinical Signs of Patients**

After laboratory diagnosis of malaria, the chief complaints and clinical signs were recorded from patients. All cases were febrile. Out of total 109 positive, 6 cases had continuous fever and rest had intermittent fever. Among 109 positive cases, 87 cases complaints of chills and rigors. Out of total 109 positive, 83 cases complained of headache. Out of total positive cases, 63 cases said that they sweat. Among 109 positive cases, 73 cases had got maliase/bodyache. Clinically 29 cases were anemic among 109 positive cases. Spleen of 34 cases was found to be enlarged.

Table 13: Chief Complaints and Clinical Signs of Patients

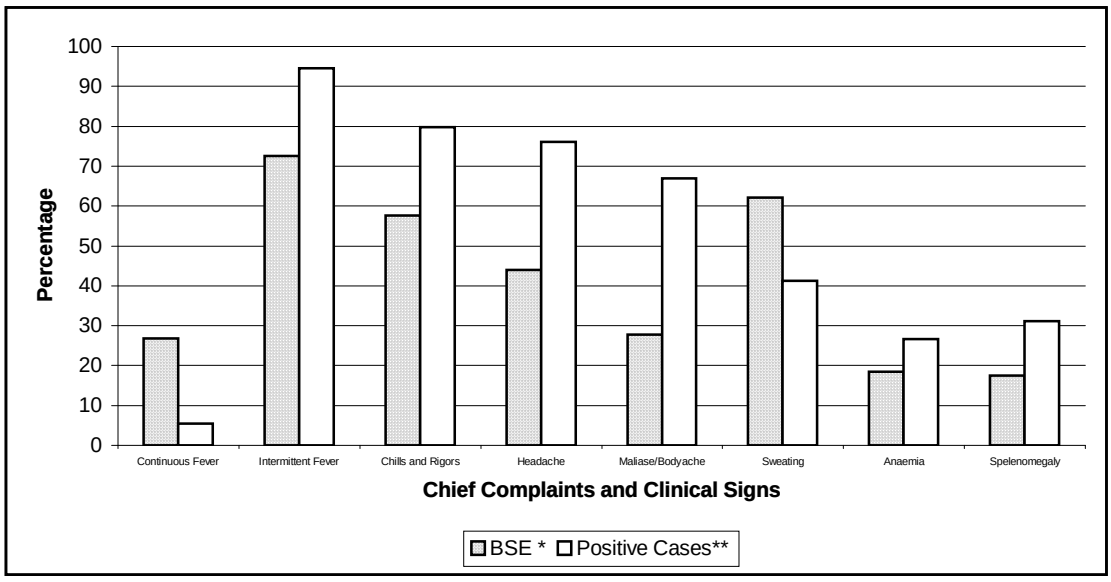
Chief Complaints and Clinical Signs	BSE *	Positive Cases**
Continuous Fever	189(26.8)	6(5.5)
Intermittent Fever	516(72.62)	103(94.5)
Chills and Rigors	406(57.59)	87(79.82)
Headache	310(44)	83(76.15)
Maliase/Bodyache	196(27.8)	73(66.97)
Sweating	438(62.13)	45(41.28)
Anaemia	130(18.44)	29(26.6)
Spelenomegaly	123(17.45)	34(31.2)

Note: All cases were febrile.

*****(The figure in the parenthesis indicates the percentage out of total BSE.)

****** (The figure in the parenthesis indicates the percentage out of total positive cases.)

Figure 11: Chief Complaints and Clinical Signs of Patients



õ **Literacy and Occupation**

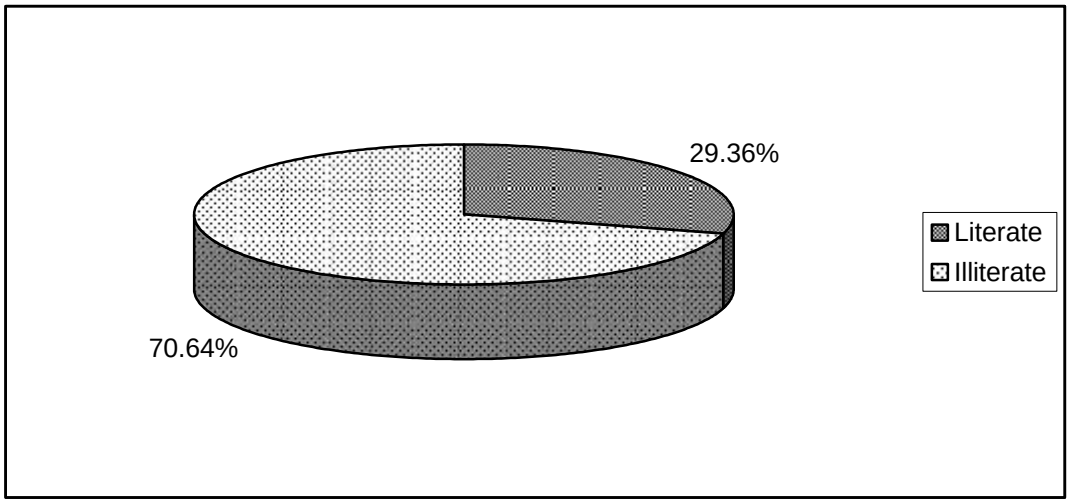
Among 109 cases, only 32(29.36) patients were literate and rest 77(70.64) were illiterate.

Table 14: Literacy of Patient

Education Status	BSE	Positive Cases
Literate	413	32 (29.36)
Illiterate	292	77 (70.64)
Total	705	109 (100)

(The figure in the parenthesis indicates the percentage out of total positive cases.)

Figure 12: Literacy of Patients



õ **Awareness of Malaria Transmission**

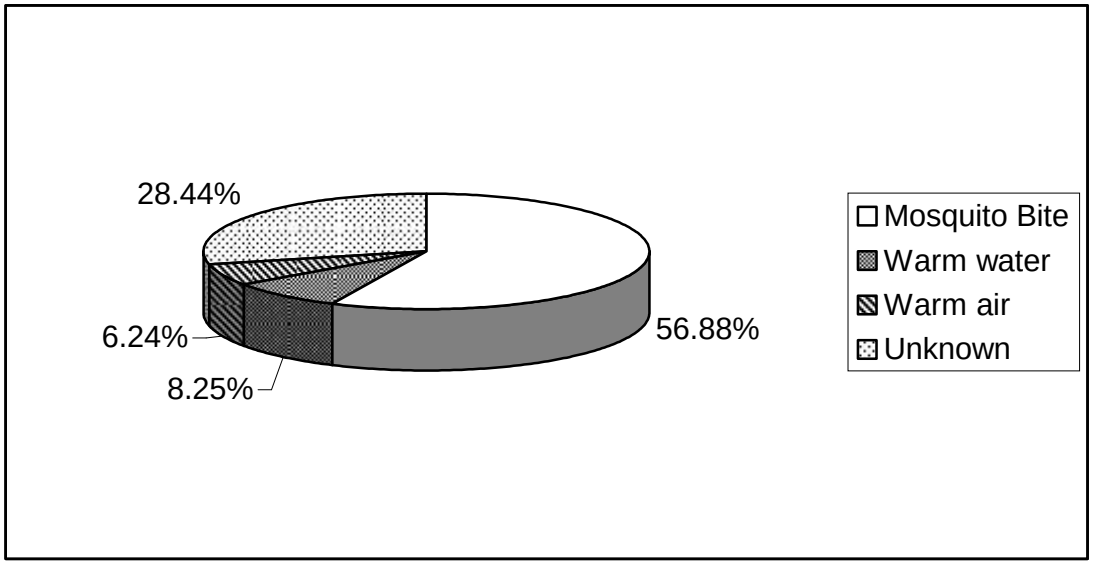
Out of 705 respondents, 62(56.88%) replied that the malaria was caused by mosquito bite. 9(8.25%) cases said that the disease was caused by polluted warm water and 7 (6.24%) replied the disease was caused by warm air. 31(43.12) cases were unknown about the disease.

Table 15: Awareness of Malaria Transmission

Awareness of malaria transmission	**BSE**	**Positive Cases**
Mosquito bite	470	62 (56.88)
Warm water	43	9 (8.25)
Warm air	36	7 (6.24)
Unknown	56	30 (28.44)
Total	705	109 (100)

(The figure in the parenthesis indicates the percentage out of total positive cases)

Figure 13: Awareness of Malaria



õ Preventive Measures against Mosquito Bite

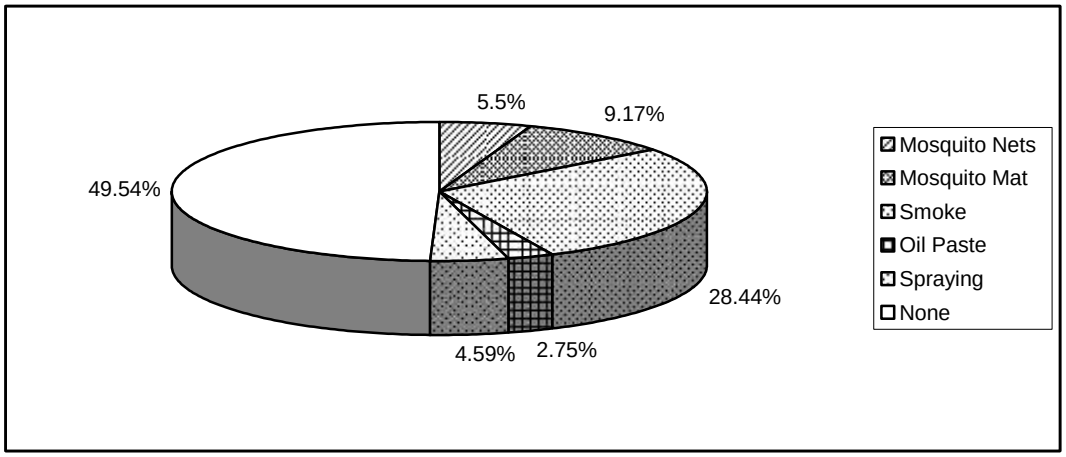
The number of mosquito bed-net user were 6(5.5%) among total positive cases while 31(28.44%) used to burning of weeds, grasses, leaves to prevent from mosquito bite. 10(9.17%) used mosquito-mat. Some 3(2.75%) had applied oil or paste. 5(4.59%) had practiced of spraying. The highest number 54(49.54%) did not use any method to prevent from mosquito bite.

Table 16: Preventive Measures against Mosquito Bite

Preventive Measure	BSE	Positive Cases
Mosquito Nets	186	6 (5.5)
Mosquito Mat	103	10 (9.17)
Smoke	152	31 (28.44)
Oil Paste	30	3 (2.75)
Spraying	56	5 (4.59)
None	188	54 (49.54)
Total	705	109 (100)

(The figure in the parenthesis indicates the percentage out of total positive cases.)

Figure 14: Preventive Measures against Mosquito Bite



VI
DISCUSSION AND CONCLUSSION

The study was aimed to find out the incidence of malaria in areas accessible to Taulihawa hospital from the patience coming to hospital passively. Catchments areas of hospital included 33 VDCs and 1 municipality. The population of the study area was 210213. Kapilbastu is Terai border district, malaria endemic zone and comes under stratum II of the government epidemiological classification and has got moderate receptivity. Microscopy is an established, relatively simple technique that is familiar to most laboratories in endemic country. The microscopy diagnosis is sensitive, informative, and cost supportive. In most settings, the procedure consists of collecting a finger prick blood sample, preparing a thick blood smear (in some settings a thin smear is also prepared) and examining the smear through a microscope (with a 100x oil immersion objective) for the identification of malaria parasites. Thin film examination was carried out to identify species of malarial parasites (WHO 1999). This method requires personnel that are well trained in the morphological differentiation of *Plasmodium* species for accurate diagnosis.

Total 705 blood slides were prepared from clinically suspected as malaria patients on the basis of chief complaints of febrile illness with chills and rigor or sweating or headache or muscular pain/malaise. Fever with clinical anaemia or spelenomegaly and pyrexia of unknown origin were also included. Stained the slides with giemsa stain, checked through microscopy and diagnosed as *Plasmodium* species. Among 705 slides examined, only 109 cases were found positive for malaria.

The incidence of malaria in the study area during the year was 0.52/1000 population. The API of district during the year was 0.3/1000 and nation was 0.28/1000. The secondary data showed that API was 0.08 in fiscal year 060/61, 0.07 in 061/62 and 0.1 in 062/63(Table: 1). This indicates that the incidence is increasing leading to disease burden.

With laboratory diagnosis of malaria, the chief complaints and clinical signs were recorded from patients by interviewing. All cases were febrile. Among 109 positive cases, 6 cases had continuous fever and rest had intermittent fever. Out of 109 positive cases, 87 cases complained of chills and rigors. Among total positive

cases, 83 cases complained of headache. Out of total positive cases, 63 cases said that they sweat. Clinically 29 cases were anaemic out of total positive cases. Spleen of 34 positive cases was found to be enlarged.

Bell *et al*., (1997) found that a history of fever alone was not a good indicator of Parasitaemia. Most precautions, including bed-nets, window screen and personal precaution were of little benefit. Many patients had a good knowledge of malaria transmission and mosquitoes, but this did not translate into a lower rate parasitemia.

Mean values for hemoglobin leukocyte and platelet counts in the vivan malaria group were found to be significantly lower. Anemia and thrombocytopenia were also observe in malaria group while not in control group ($P<0.05$, $P<0.0001$). Mean red cell distribution width values were found to be significantly higher in the malaria group ($P<0.0001$). Their finding indicated that routinely used laboratory findings such as low hemoglobin, leukocyte or platelet counts and especially high red cell distribution width values could present a more supportive clue in the diagnosis of *vivax* malaria in endemic areas (Koltas *et al*., 2007).

Literacy of positive cases was only 29.36% out of total positive cases. Only 62% of total positive cases (109) were aware that the malaria was caused by mosquito bite. Only 11.92% respondents used mosquito-net. 5.5% practiced of spraying. 6.42 % used oil to avoid mosquito bite and 47.10% did not use any method. However, awareness was high among positive cases; preventive measures applied by positive cases were poor. They might have ignored the mosquitoes bite.

Yoda *et al*., (2007) showed on the study that the project reduced malaria incidence significantly on Lombok. However, the effects were not a clear on Sambawa. Poor socio-economic status and lack of school education were important related factors. Therefore, health education or behavioral change communication was an essential component of malaria control.

Only 109 slides were found positive for malaria. Among them, males (82/75.25%) were more infected than that of female (27/24.77%). The study showed that the malaria was more prevalent in male 0.77/1000 population than in female 0.27/1000 population. The previous study showed the hundred percent of the cases have occurred in males and no positive cases of malaria have been reported from

females (Upreti, 1998). Das *et al.,* (2007) found higher rate of infections over all malaria incidences was higher among the males (SPR=43.2%) than in females (SPR= 34.5%) Although the causation of malaria is independent of sex, the higher number of male were more infected due to the out door exposure and frequent visiting to the malaria endemic areas of Nepal and India mostly in Mumbai which is notorious for malaria endemic. This study is also supported by increasing number of imported cases 43(39.44%). The imported cases were mostly males. Over the last 5 years data has revealed that a significant proportion of malaria cases are imported (Table 1). This along with increasing trend of *Pf* cases indicates more attention for cross border monitoring of malaria cases in the country.

Among 109 positive cases, malaria due to *Pv* was 96(8.25%) while *Pf* and *P.* mix were 10(9.2%) and 3(2.73%) respectively. The secondary data revealed that *Pf* cases were 5 in FY 061/62, 6 in 062/63 and 10 in 064/65. This is important to note that proportion of *Pf* during the FY 2062/63 has shown an increasing trend indicating the resurgence of *falciparum* malaria.

The study concluded showing its incidence among all the ages and both sexes. The most infections (25.33%) were found in age group 21-30 years and the least (4.05%) in >60 years. The API was also the highest in age group 21-30 years and the lowest in age group 0-10 years. Das *et al.,* (2007) recorded slide positivity rate (SPR) was 39% with predominance of children between 5 and 14 years. In present study, out of total positive cases, 4(3.67%) children of age <5 years were found to be infected indicating a serious public health burden. As in the previous years, the majority of cases (80 %) were among people > 15 years of age. Similar pattern of age group distribution was also observed in all 5 regions. However, a noticeable number of cases in <1 year age group were recorded from Far-western region indicating intense local transmission in the districts of that region (Annual report DoHS 2062/063).

The older people get developed the infection immunity, permunition leading to low rate of infection. The highest rate of infection among the productive age group indicates the possibility of the productivity and morbidity of the disease.

The season-wise distribution of malaria cases showed a peak in summer and spring season 41(37.6%) followed by 17(15.6%) in winter and the least in Autumn 10(9.2%).The maximum number of positive cases during summer and spring season

might be due to presence of favourable condition in this season for the mosquito to survive and breed . In month-wise incidence of malaria, the maximum numbers of positive cases (27) were in July followed by April and May (14). The least were recorded in November, January and September (3). Higher percentage of slide positivity was in April and then July which might be due to the auspicious environment for mosquitoes breading so that the transmission of malaria was augmented. The low percentage of slide positivity in October was due to adverse environmental condition for mosquitoe breeding. Another reason was increase number of patients with similar symptoms like malaria.

Data showed that all the caste were susceptible to malaria infection. The incidence of malaria was highest in Baniya/ Kalwar population (2.27/1000). However, indigenous ethnic groups of the Tharus living there for centuries developed sufficient immunity against malaria. Spleen enlargement rates in those areas were over 90% (Rana, 2001). In the study areas, the incidence of malaria in Dharampaniya VDCs (1.68/1000) was the highest. But SPR was the highest in Parshohiya VDC (21.42%).

Haines Andy *et al.,* (2007) found that there is renewed interest in the potential contribution of community health workers to child survival. Community health workers can under take various tasks, including case management of childhood illness (e.g. pneumonia, malaria, and neonatal sepsis) and delivery of preventive intervention such as immunization, promotion of healthy behavior and mobilization of communities. Several trial show substantial reduction in child mortality, particularly through case management of ill children by these types of community health intervention, however, community health workers are not a panacea for weak health system and will need focused tasks, adequate remuneration, training, supervision, and the active involvement of the communities in which they work. The introduction of large-scale programmes for community health workers requires evaluation to document the impact on child survival and cost effectiveness and to elucidate factors associated with success and sustainability.

IX
RECOMMENDATION

1. Conventional or giemsa stained smears still remains as the gold standard diagnostics test for the diagnosis of malaria. All the clinically suspected malarias should be confirmed by microscopy in laboratory.

2. The malaria exerts tremendous socioeconomic impact for the reasons of absenteeism at work and is associated with severity and high mortality and other residual consequences. So behavioral change and communications for improved and early treatment seeking and compliance at all levels should be practiced.

3. Different diagnostic test should be performed alternatively. Test like RDTs can provide quick result and hence prompt treatment can be accessed.

4. The study had a very few participation of infants and absence of pregnant woman, a highly vulnerable group. Therefore the study seeks for future studies targeting this group that can have exploratory findings.

5. Since the emergence of *Pf* in recent years possibly indicates the resurgence of malaria because of the resistance to the drug, both in vivo and in vitro test for monitoring the therapeutic efficacy of drug has to be carried. The entomological survey has to be done at the regular interval of time.

6. Over the last 5 years data (Table: 1) has revealed that a significant proportion of malaria cases are imported harbingering more attention for cross border monitoring of malaria cases in the country.

7. Malaria microscopy training is to be provided.

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