I

INTRODUCTION

Malaria is one of the most important tropical diseases, remaining widespread throughout the tropics, but also occurring in many temperate regions. Malaria has become a global problem. More than half of the world's population in 102 countries is exposed to malaria and is responsible for over 300 to 500 clinical cases and more than a million deaths each year. Previously extremely widespread, malaria is now mainly confined to Africa, Asia and Latin America. It exerts heavy toll of illness and death-especially amongst children and pregnant women. It also poses a risk to travelers and immigrants, with imported cases increasing in non-endemic areas (WHO,2002).

Malaria is an infectious disease caused by minute parasitic Protozoa of the genus *Plasmodium*, which infects human and insect hosts alternatively. The genus *Plasmodium* belongs to the sub-phylum Sporozoa and phylum Apicomplexa. There are four identified species of this parasite causing human malaria, namely *Plasmodium vivax*, *Plasmodium falciparum*, *Plasmodium ovale* and *Plasmodium malariae.* They are pigment producing intracellular parasites of vertebrates, with one habitat in red cells and in cells of other tissues. Transmission in humans is by the bite of blood sucking infected female Anopheles mosquitoes of various species. The *Plasmodium* does not possess any special organ of locomotion. Malaria caused by *P. falciparum* is the most lethal.

Malaria is the devastating disease, producing annually 600 million new infection and 3 million deaths each year. The burden of this disease falls heaviest among children below age 5-in sub-Saharan Africa. It accounts for up to one third of all hospital admissions and up to a quarter of all death of children under the age of 5. There are up to 800,000 infantile mortalities and a substantial number of miscarriage and very low birth weight babies per year due to disease. The estimated annual direct and indirect cost of malaria in Africa alone in more than US$ 2000 million.

Malaria can be cured if promptly diagnosed and adequately treated. Numerous epidemiological and ecological factors play a vital role in determining the effect of malaria on human health and in the intensity of disease transmission. The

immunological status of a person also has bearing on the severity of the disease (WHO, 2000).

The problem of controlling malaria is aggravated by inadequate health structures and poor socio-economic condition. The situation becomes more complex over the last few years with the increase in resistance to the drugs normally to combat the parasite that causes the disease. Treatment and control have even become more difficult with the spread of insecticide-resistant strains of mosquito vector. This is how malaria is spreading in a new area causing the increased number of cases each year. Health education, better management, better control tools and concret action are needed to limit the burden of the disease. In patients with malaria, prompt and accurate diagnosis is the key of effective disease management (EDCD, 2003).

The topography of Nepal divides the country into 3 regions: the mountain, the hill and the tarai (plain). It is further classified into five strata, according to their malariogenicity and receptivity, based on the prevalence of vectors and their efficiency in transmitting the disease. There are 3 regions of tarai with High receptivity, Moderate receptivity and Low receptivity and 2 regions of hill with low receptivity and very low or no receptivity (EDCD, 2001).

The massive outbreak of malaria in early seventies in Parsa district of Central region and Nawalparasi, Rupandehi and Kapilvastu district in Western region resulted because of resistance of the vector *A. annularis* against DDT. Similar outbreak were reported during eighties in far Western region with smaller outbreak in Central region in 1985 to 1988. In all the years the cases were all above 15,000 escalating to as high as 42231 in 1985. In 1987 and 1988 malaria control programme in all districts was integrated into the basic health services as a component of primary health care at district/ health post level. The decade of nineties also experienced the periodic malaria outbreak in Central and Far Western region reporting 29,000 cases in 1991. Again with great effort especially due to continued indoor residual spraying in mainly epidemic areas where brought down to 9700 by 1995. Over the same period due to influx of refugees from Bhutan (during 1993) the country had to take up additional 1600 (51% *Plasmodium falciparum*) malaria cases in 1994 and 1461(43%*plasmodium falciparum*) cases in 1995 (annual report, EDCD-2001).

Sherchand (1996) in his study of resurgence of malaria in southern Nepal revealed that ignorance of people's beliefs regarding behaviour towards the disease, results in the development of inappropriate control programmes that are not designed according to local condition and needs. The extension of urban areas lead to epidemics in the peripheries of the growing cities. Mass migrations of non-immune populations into endemic areas for political reasons further complicate matters. It has been predicted that climate change might cause some modifications to the present global distribution of malaria (Hay *et al*., 2000).

Malaria is less seen in socio economically developed societies and countries. Population movements from malarious areas and vice versa may cause epidemic outbreaks. Occupation like fishing in coastal regions, forest cutting and mining in malarious areas may make the host more susceptible to malaria infection. Immunity to malaria in human is acquired only after repeated exposure over several years and infants both of immune parents are generally protected during the first three to five months by maternal Ig G.

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/meso endemic but large parts of the country, particularly Southern Nepal were prone to epidemics. The entomological finding of the government has revealed *Anopheles fluviatilis, A. maculates complex and A. annularis* as proven vectors 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. Malaria, despite years of attempted control, remains a major public health problem in Southern Nepal. Both the inner (200 to 500m high) and outer Tarai (less than 200m high and near the Indian border) are densely forested, and are sparsely populated in parts as a result of malaria. The malariometric indicators of Nepal, 1963-2002 (EDCD) had shown *P.vivax* as leading cause of malaria followed by *P. falciparum. P. vivax* is the predominant species in most of the malarious area of Nepal by a factor of 10:1 ratio. However, *P malariae* and *P. ovale* has not yet been reported. *P. vivax* is more common than *P. falciparum* as a cause of malaria in many parts of the tropics out side Africa.

Significance of the study

Among the many health problems prevalent in Nepal, malaria is one of them. It is the fifth major infectious disease in Nepal. Out of total district it is endemic in 65 districts and 13 districts are rated as malaria priority districts.

World Bank in 1990 reported that 7% population of the country is in absolute poverty (Chhetri 1997). Poor economy, health education and sanitation have resulted high incidence of parasites in the country. So the study of the parasite infection is critical.

Malaria disease is a preventable disease. But the prevalence of malaria has not declined as per the expectation. So the high prevalence of the malaria parasite might be indication of human behaviours like walking and working without cloths, sleeping outside, illiteracy, low socio economic status and lack of awareness.

So it is very crucial to learn the human activities in terms of parasitic infection and to be aware about it as well as to spread awareness. This work has the target of showing the relationship between human activities and malarial parasitic infection and controlling this in the days to come.

II

OBJECTIVES

2.1 General

To determine the prevalence of malaria in Kapilvastu District with special reference to Somdiha V.D.C.

2.2 Specific

- To determine species-wise prevalence of malaria.
- To determine prevalence of malaria of the study area in different seasons.
- Age and sex wise prevalence of malaria.
- To compare ward-wise malaria situation.

III

LITERATURE REVIEW

3.1 Historical background

Malaria, an ancient disease, has plagued humans throughout history. The Greek Physician Hippocrates described malaria in his writing during early 400s B.C. Documents and finding 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 Americas. From the Indus valley in northern India, Vedic (3500 to 2800 years ago) and Brahmanic (2800 to 1900 years ago). Scriptures contain many reference to fevers some of which are said almost certainly to concern malaria. There is a description about periodic fever in Artha Veda. Hence, way interfere that 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).

In the past, malaria was thought to be caused by foul gases emanating from marshes. Hence, the disease was named malaria (Italian; mala=bad; aria=air) meaning "bad air". In 1716, Lancisi established a connection between aboundance of mosquitoes and malaria. In 1880, a French doctor, Char Laveran, discovered the malaria parasites *Plasmodium* in human blood. In 1885-1886, Golgi studied the erythrocytic schizogony of malaria parasite in man. In 1897, Ronald Ross discovered the oocysts of *Plasmodium* in the stomach of female anopheles mosquitoes. In 1898, Ross worked out the lifecycle of avian malaria parasite (*P. vivax)* in mosquitoes while Grassi, Bignami *et al* demonstrated the lifecycle of human malaria parasite (*P. vivax*). In 1902, Ronald Ross was awarded the Nobel Prize in medicine and physiology. In 1948, E. Short worked out the pre-erythrocytic schizogony of *P. vivax* in liver cells. In

1966, P.C.C. Graham wrote a detailed monography of malaria parasites, while their find structure was reviewed in 1969 by M. Rudzinska (R.L. Kotpal, 2002).

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 by female anopheles mosquito. Both Laveran and Ross were awarded Noble Prize for contribution on Physiology and Medicine.

The emerged concept of DDT drew the interest of world community and concept of malaria control came in front in 1948. By 1951 WHO was actively involved in malaria control projects mainly in Asia. The initial results of malaria cases were extremely encouraging. By 1955 the number of cases world wide had dropped by at least a third. In momentous decision, the WHO assembly in 1955 urged the member states to take malaria eradication as international objectives. But during 1973-1978 there was resurgence of malaria. The 31st WHO assembly in 1978 reaffirmed the malaria eradication as ultimate goal and control as an immediate objective to the goal. The wheel had turned full-circle from control to eradication and back again to control (Williams, 1988).

Roll Back Malaria was launched in 1998 with the declared objective of halving the global burden of malaria by 2010. Its founding partners – the UNDP, UNICEF, the World Bank and WHO- agreed to share their expertise and resources in a concerted effort to tackle malaria worldwide, with a particular focus in Africa. Since the launch of Roll Back Malaria, international spending on malaria has more than trebled to a current figure of US$ 200 million a year. Comprehensive strategic plans to tackle malaria have been developed in more than 30 endemic African countries and significant additional resources secured to implement these plans from the new GFATM. The RBM has succeeded in raising global awareness of malaria, generating increased resources and achieving consensus on the tools and priority interventions required to control the disease (RBM, 2003).

The first attempt to control malaria in Nepal was initiated in 1954 through the insect borne disease control programme, supported by USAID. In 1958, the malaria eradication programme in the country was launched with an objective of eradicating malaria within limited time period. Due to various reasons this objective could not be achieved and consequently the malaria eradication programme reverted to malaria

control in 1978. The prevailing ecological, epidemiological and socio-economic factors suggested changes in the malaria control program and as a result the strategies of malaria control were revised in accordance with the Global Malaria Control Strategy (GMCS) 1992 of WHO adopted by ministerial meeting at Amsterdam (DoH, 2001-2002).

Although effective treatment is available, the disease sometimes becomes difficult to diagnose and delayed treatment may have ever consequences. Malaria is generally confined to the tropics and sub-tropics, but the geographical distribution of the four parasite species varies largely.

3.3 Epidemiology

At present, about 100 countries or territories in the world are considered malarious, almost half of which are in Africa, south of the Sahara. Although this number is considerably less than it was in the mid-1950s (140 countries or territories), more than 2400 million of the world's population are still at risk. The incidence of malaria worldwide is estimated to be 300-500 million clinical cases each year, with about 90% of these occurring in Africa, south of the Sahara—mostly caused by *P. falciparum*. Malaria is thought to kill between 1.1 and 2.7 million people world-wide each year, of which about 1 million are children under the age of 5 years in Africa, south of the Sahara. These childhood deaths, resulting mainly from cerebral malaria and anaemia, constitute nearly 25% of child mortality in Africa. Fatality rates of 10-30% have been reported among children referred to hospital with severe malaria, although these rates are even higher in rural and remote areas where patients have restricted access to adequate treatment. Deaths from malaria in countries outside Africa, south of the Sahara, occur principally in non-immune in people who become infected with *P. falciparum* in areas where diagnosis and treatment are not available (WHO 20th technical report). Malaria is Africa's leading cause of under-five mortality (20%) and constitutes 10% of the continent's overall disease burden. It accounts for 40% of public health expenditure; 30-50% of inpatient admissions, and up to 50% of outpatient visits in areas with high malarial transmission. Malaria has been estimated to cost Africa more than US$ 12 billion every year in lost GDP, even though it could be controlled for a fraction of that sum (RBM, 2003).

3.4 Global Situation of Malaria

Malaria affects more than 2400 million people, over 40% of the world's population, in more than 100 countries in the tropics from South America to the Indian peninsula. The tropics provide ideal breeding and living conditions for the *Anopheles* mosquito, and hence this distribution. Every year 300-500 million people suffer from this disease, 90% of them in sub-Saharan Africa, two third of the remaining cases occur in six countries- India, Brazil, Sri Lanka, Vietnam, Colombia and Solomon Island (WHO, 2000).

There were 912 reports of malaria among persons in the United States with a date of onset between January 1, 2002 and December 31, 2002. The infecting species of *Plasmodium* was identified in 753 (82.6%) of these cases. Nine hundred ten (99.8%) of the 912 cases were imported, 591 (64.9%) of the 910 cases were in U.S. residents (includes both civilians and military personnel) who acquired the infection outside the United States. Of the 591 cases, 395 (66.8%) were acquired in Africa, 63 (10.7%) in the Americas and 99 (16.8%) in Asia (Desai *et al.,* 2002).

Between January 1999 and September 2003, a total of 4,801 patients with travel-related malaria were reported within the 16 Tropnet Europe network. Within the surveillance period 4,801 cases of imported malaria were reported. *P. falciparum* was leading number followed by *P. vivax*. European travelers and immigrants were the largest patient groups, but their proportion varied among the reporting countries. The main regions of infection in descending order were the Indian subcontinent, Indonesia, South America, Western and Eastern Africa, as a group accounting for more than 60% of the cases. All 16 TropNet Europe countries reported *P.vivax* malaria. However, the number of cases varied strongly between countries. Germany (24.3%), Spain (15.5%) and the UK (12%) reported from most cases, whereas reports form Switzerland (1.8%), Poland (1.6%), Finland (1%), Ireland (1%) and Portugal (0.3%) were scarce (Mulberger *et al*., 2004)

It is estimated that 1.2 billion people out of the 1.4 billion people of **SEA Region** live in Malarious areas. In 1995, malaria cases in the region were estimated to be 21.9 million, with almost 32,000 deaths. India accounts around 85% of the total reported cases in the region in the same year. During 1996 also, India contributed

83% of total malaria cases in SEA Region. Thus around 80% of reported cases in the region of being contributed by India (Lal *et al.,* 1997).

India is the second largest country in the world with over 1 billion people of diverse socio-cultural backgrounds. Out of total population 1027 million in 2001, 973.1 million in 2000 resides in malarious areas. Malaria is the health problem in forest related areas, particularly in the North East—states, Bihar, Orissa, Gujarat, Maharastra and Madhya Pradesh. The cases reported were 2,222,748 in 1998; 2,284,713 in 1999; 2,019,066 in 2000 and 1,972,586 in 2001. The *P. falciparum* infection was 46.3%, 50.0%, 51.6% and 47.5% in respective year from 1998 to 2001. Total number of death due to malaria were 666 in 1998, 1057 in 1999, 946 in 2000 and 938 in 2001. The number of estimated death is very alarming (WHO, SEARO, 2002).

The Dynamics of Malaraia Burden in **India** is inclined to resurgence of malaria which is accompanied by resistance of the mosquito vector to insecticides and resistance of the parasite to chloroquine, with the number of cases remaining over 2 million (WHO,SEARO, 2002).

The population of **Indonesia** was 203 million in 2000. Of the total population, 149.7 millions reside in malarious areas. Malaria is a health problem in forest related areas of the outer islands, particularly in the eastern part of Indonesia. Approximately 1.5 million cases are detected annually. In 1997, the parasite incidence range from 0.12 per thousand population in Java and Bali to around 40 per thousand population, under 10 years of age in the outer islands. In 1998, there were malaria outbreaks in the highland of Iran Jaya, and resurgence in Central Java. There were 200,544 lab confirmed cases reported in 2001 resulting into 68 deaths. Together with these statistics, the rate of *PF* infection was 41.9% in (WHO, SEARO, 2002).

Of the country's total population 658,000 in 1998, population residing in malarious areas of **Bhutan** were 427,000. The outbreaks of 1999 reported 12,237 cases of malaria with 16 deaths but the cases reported in 2001 were 5982 with 25 deaths (WHO, SEARO, 2002).

Malaria has been also a major public health problem in **Bangladesh**. Approximately 88% of the 128 million populations are at risk 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. The percentage of *P.f.* Infections were 61.7%, 70.3%, 69.3%, 71.0% and 71.0% in the respective years form 1997 to 2001. The deaths recorded were 469,528, 552,484 and 470 among these respective years. The problem has been intensified due to resistance in some foci of *P. falciparum* to Chloroquin and SP combination since in 1993. The Vector resistance to DDT and Malathion have been found (WHO, SEARO, 2002).

Malaria is not a public health problem in **Maldives**. There is no indigenous transmission since 1984. The population of the country in 2000 was 270,101 but the population residing in Malarious areas was 0. However, 10-15 laboratories confirmed imported cases (mostly from the neighboring countries like Sri Lanka, India and Pakistan etc.) are being reported every year. As conceptualized by WHO, malaria eradication in Maldives was achieved with elimination of Anopheles vectors, rather than elimination of the parasites and country has remained free of malaria for the last 19 years (since 1984) with only some imported malaria cases every year. Therefore Maldives is not engaged under RBM process (WHO, SEARO, 2002).

Malaria in **Thailand** is forest-related with disease being prevalent along the international borders whereas in the central plain areas, malaria transmission has been eliminated for about two decades. In the forest the parasite formula is *P. falciparum* 51, *P. vivax* 48, *P malariae,* and *P ovale* is rare 1. During the past five years (1997-2001), the numbers of reported cases fluctuated. In 2000, malaria transmission areas covered 3.87 million or 6.7% of the country's population i.e. 6789 villages or 9.85% of the total villages. A total of 149586 cases were reported, of which Thai cases were 91703(61.3%) and foreign national cases were 57883 (38.7%). In the year 2001, the number of cases decrease by 20% when compared with the corresponding period of 2000 (WHO,SEARO, 2002).

Out of 19.3 million population of Sri Lanka, 9.3 million resides in malarious areas. During the year 2001, there has been a very significant reduction in the number of malaria patients recorded as compared to the previous years. From January-August 2001, 50116 confirmed malaria patients were detected from a total number of 925893 blood smears examined (*P.v. 81.3%, Pf-18.7%*). During the previous year, approximately 200000 confirmed patients were recorded. Around 50% of patients

were from the districts of the North-East Province, which had many serious obstacles to malaria control due to the conflict situation (WHO, SEARO, 2002).

3.5 Malaria Situation in Nepal

Malaria in its various forms has been the cause of mortality in Nepal throughout the ages. This fact has contributed to the isolation of Nepal from the rest of the 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 ravages of the disease. During the seventeenth and eighteenth centuries, virtually all the aspects of life were affected either directly or indirectly by malaria which has been one of the most important causes of economic deterioration engendering poverty diminishing quantity and quality of food production lowering physical and intellectual standard of the nation and hampering prosperity and economic progress in every way (Rana, 2001).

In the decade of (1960) sixty had high proportion of *P. falciparum* at the beginning (more than 35%) and was down to around 8% by 1970. The major events in 1960's was the incrimination of *A. minimus* and *A. fluviatilis* responsible for transmission of malaria in tarai belt and *A. willmori* as a vector responsible for transmission of malaria at an altitude of 6500 ft. in Mugu district of Mid-western region. During early seventies there was massive outbreaks in Kapilvastu, Nawalparasi and Rupandehi of Western Region and Parsa district of Central Region. The number of cases increased to 9375 in 1973 and to 14647 in 1974. The resurgence was due to resistance of *A. annularis* against DDT. The effort directed to change the insectide from DDT to Malathion, Ficam and larviciding with abate controlled the epidemic in Western Region and the cases were reduced to 10123 by 1976. By the time the epidemics were controlled the cases started increasing almost all over the country and by 1980 increases again to 14148. However, during the first half of the decade the percentage of *P. falciparum* increased with the increase of case but in the

later half the same percentage of *P. falciparum* decreased in spite of gradual increase in case (EDCD, 2002).

The decade of 1980s had massive epidemics in Far-Western Region with smaller epidemics in Central Region in 1985 to 1988. In all the years the case were well above 15,000 annually escalating to as high as 42231 in 1985. Proportion of *P. falciparum* was also very high (18 to 19% in 1984 and 1985). By the end of the decade the cases reduced to 22000. The decade of 90s also experienced periodic epidemic resulting into 29000 cases in 1991 in Central and Far Western Region. Again, efforts like regular IRS (Indoor Residual Spraying) in epidemic prone areas reduce the cases to 9700 in 1995 (EDCD, 2001).

Upto the 1950s (before the malaria eradication activities undertaken) it was estimated that approximately 2 million cases of malaria (40% of the total population) occurred annually and 10-15% among those resulted in death. Though it has not been possible to accurately estimate the human and economic loss due to the disease in Nepal, the economic loss due to untimely death of the economically active group was extremely high.

In Nepal, out of total population (23.2 million) of Nepal, approximately 17.3 million people are at risk of malaria infection and it is the fifth major infectious disease in Nepal. Out of total 75 districts, it is endemic in 65 districts and 12 districts are rated as malaria priority districts. The disease is more prevalent in Southern terai districts bordering with India. Malaria epidemic is the major cause of death, reduction in the agricultural productivity, hinders traveler and tourism. Thus, affecting novel investment (*Parajuli et al;* 2003). In the mean time the parasites are becoming resistant to commonly used anti malarial drugs. The vectors of the disease, the mosquitoes are also becoming resistant to the insecticides. This is how malaria is spreading in a new area each year. This is the main cause for the increased number of cases each year (Annual Report, EDCD, 2003). The malaria situation in Nepal from 1996 to 2003 is shown in the table.

Malaria Situation in Nepal from 1995-2003

Year	Approximately population at risk (in million)	Total examined	Positive	*pv*	*pf*	*Pf* %
1996	15225411	204355	9020	8069	951	10.4
1997	15619053	160293	8957	7807	1150	12.8
1998	16344287	175879	8498	7978	520	6.12
1999	15361979	132044	8959	8317	632	6.94
2000	15295571	156370	7981	7145	836	10.4
2001	13215972	126962	6393	6131	424	6.38
2002	16147782	183519	12786	10621	2165	16.93
2003	17.3 million	194901	9394	8177	1192	13.03

(Source: Annual report on malaria, EDCD, 2003 & Bista *et al.*, 2002)

The problems of controlling malaria is aggravated by inadequate health structure and poor socio economic conditions. The situation has been more complex over the last few years with the increase in resistance to the drugs normally used to combat the parasite that causes the disease. Treatment and control had even become more difficult with the spread of insecticide–resistant strains of mosquito vectors. Health education, better case management, better control tools and concerted action of need to limit the burden of the disease (annual report, EDCD, 2002).

IV

MATERIALS & METHOD

4.1 Materials required

i. Clean sides
ii. 3% Giemsa solution
iii. Methylated spirit
iv. Slide box
v. Measuring cylinder
vi. Ball point pen
vii. Record form or Register
viii. Sterile lancets
ix. Microscope
x. Cotton
xi. Distilled water
xii. Lead pencil
xiii. Antimalarial drugs

4.2 Method

Study area

Kapilvastu is situated in the cultivated plain tarai belt (WHO 1987). It spreads in the area of 1738 km^2 and surrounded by Rupendehi in east, Arghakhachi in North, Dang in West and in South it is adjoined with UP of India. The population of Kapilvastu district is 481,976.

This district includes 77 V.D.C. and one municipality. Here most of the people speak Avadhi and majority of them follow Hinduism (81.6%) while minor groups are Muslim (18.17%), Buddhist (0.68), Tharu (9.99%) and Magar (0.61%) etc. There are 78 healthpost in this district, per healthpost include 1679 people (Kapilvastu Society, 2006).

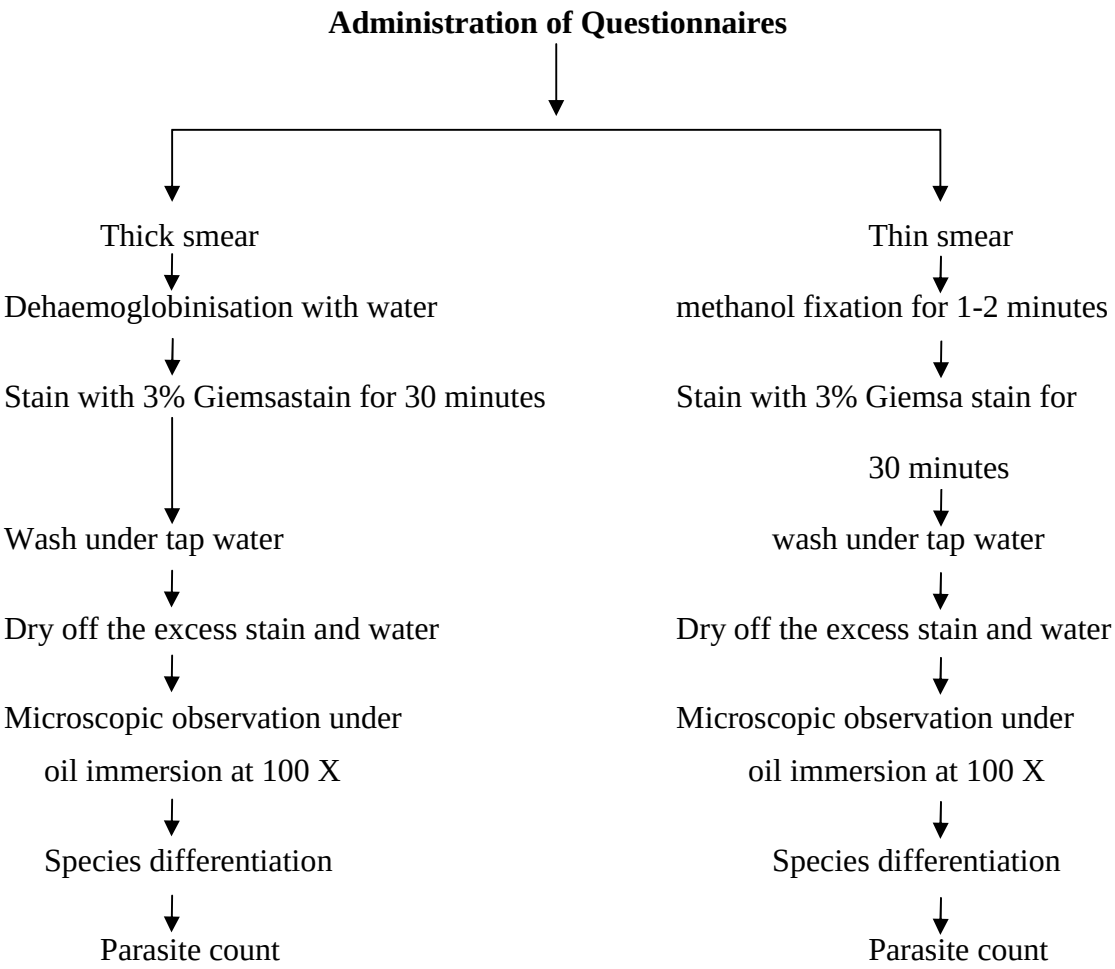
Somdiha V.D.C. is situated in Kapilvastu district including 5019 population of which 2583 were male and 2436 were female (according to census 2001).

Study population

Blood specimens were collected from 290 persons who visited health post and sub health post. Individuals who had a presumptive diagnosis of clinical malaria was based on fever (38^0C) or history of fever in the last 48 hours.

Exclusion criteria were the failure to given comment, history of fever before 48 hours and it the cause of the fever was due to other diseases rather than malaria in case it is clinical proven. Individuals that had been treated for malaria in the previous four weeks were also excluded from the study.

Research Design



Specimen collection

Diagnosis of malaria is usually made by examining a patient's blood under the microscope to detect malaria parasites in Red Blood Cell. The different species of *Plasmodium* can be distinguished by their appearance under the microscope.

A few drops of peripheral blood were collected from the 290 malaria suspected individuals by finger prick method. This blood was used to prepare one thick and one thin smear on the same slide. The smears were prepared at the time of blood collection.

Sample processing

After withdrawing the blood from the patient, thick and thin smears were prepared on the slide. Taking 2 or 3 drops of blood and spreading in an area of 10mm, thick smears were prepared 10mm away from the edge of the slides. A single drop of blood was taken for thin smear. It was uniformly spread bringing the spreader at an angle of 30-45° on the slide and pushing the spreader steadily down the surface of the slide drawing the blood behind till the smear is formed. The smears were air dried, kept on the slide box and dispatched to Om Pathology, Gorakhpur, and U.P. India for confirmation.

a. Preparation of thick and thin films on the same slide.

The thick smear of correct thickness is the one through which newsprint is barely visible. This allows the red blood cells to be hemolyzed and leukocytes and any malaria parasites present will be only detectable elements. However, due to the hemolysis and slow drying, the plasmodia morphology can get distorted, making differentiation of species difficult. Thick smears are therefore used to detect infection, and to estimate parasite concentration. However to make a thin smear air drying is recommended for 10 minutes. After drying, the thin smear should be fixed in methanol. This can be done by either dipping the thin smear into methanol for 5 seconds or by dipping the thin smear with a methanol soaked cotton ball. While fixing the thin smear, all care should be taken to avoid exposure of the thick smear to methanol.

b. Staining of the blood smears

The thin films were fixed by dipping it into 200ml container containing methanol making sure that the alcohol does not touch the thick films. The slides were placed in staining rack ensuring that thick films are placed at one end of rack. 3% Giemsa solution was poured in the slides for 30 minutes. The stain was washed under tap water. The slides were kept with the film side downward in the drying rack and observation was done under 100 X oil immersions.

Questionnaires

A set of questionnaire was structured in a simple way and as brief as possible. The controversial and sensitive issues were also avoided. The questionnaire included the name, gender, age, address and verbal consent of the malarial suspected patients. It also included the clinical history of patients to study the diagnostic malarial symptoms. Patients who denied to replay the clinical features of malaria were excluded from the study. Method of specimen collection was also indicated in the questionnaire. Questionnaire was administered to each malaria suspected people and attendents of those people. The records were subsequently analyzed at the later stage

V

RESULTS

The study was based on symptomatic people who visited Health Post and Jan Swasthya Sewa Kendra clinic at Somdiha VDC during April to Sept. 2007. These cases mostly belonged to Somdiha VDC of Kapilvastu district.

The result of the present study is presented in two ways:

(i) Result of blood examination for malarial parasites.

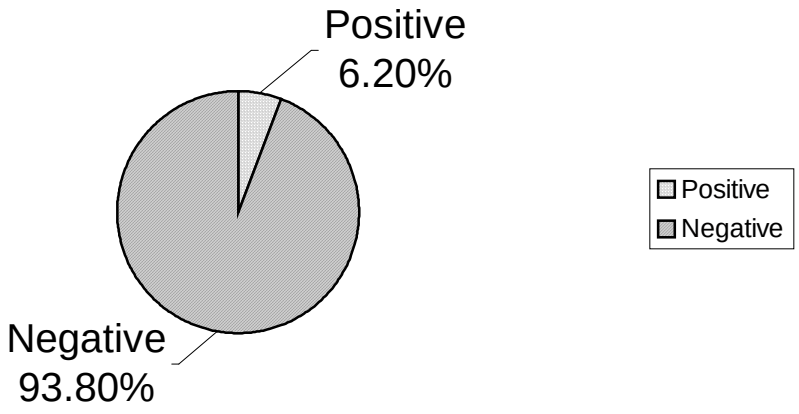
(ii) Result of survey analysis regarding malaria.

5. Result of Blood Examination for Malaria

5.1 General Prevalence of the Malaria Parasite

Among 290 blood samples from malaria suspected cases colleted during Apr. to Sept. months, only 18 were found to be infected with malaria i.e. the slide positivity rate was found to be 6.20%.

Figure 1: Prevalence



of Malaria

5.2 Species-wise Prevalence of Malaria

Species-wise prevalence showed that all the 18 positive slides had *P. vivax* species. No *P. falciparum* case was found.

Table 1: Species-wise Prevalence of Malaria

S.N.	Total positive samples examined	Positive samples	
		P. vivax	*P. falciparum*
1	18	18	0

5.3 Sex-wise Prevalence of Malaria

Regarding sex-wise, malaria situation in Somdiha VDC, males were found to be more infected 14 (8.05%) than the female 4 (3.45%) (Table no. 2) .

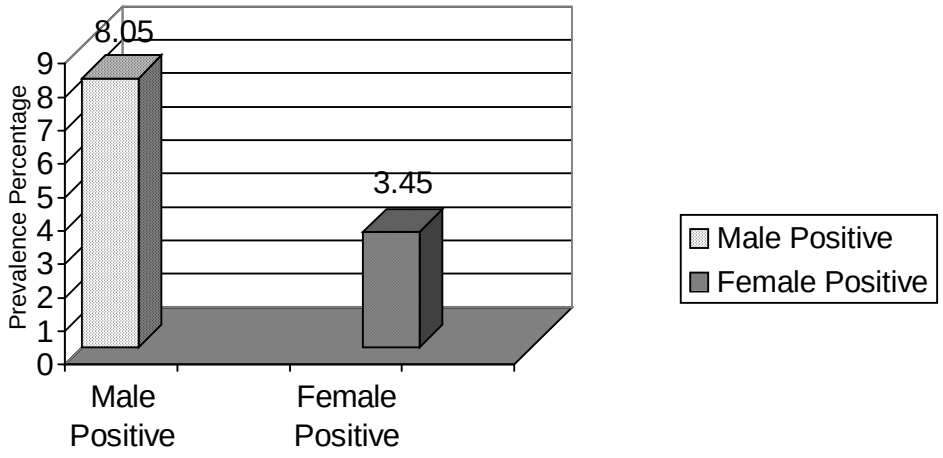
Statistically, the malaria ratio of males to females is nearly 7:2. There was significant difference in the occurrence of malaria in males and females (¡ $^{2}_{cal}$ X2.527, P<0.05).

Table 2: Sex wise prevalence of Malaria

No. of	Total slide examined	Total slide examined	Total

slides	Male		Positive malaria		Female		Positive malaria			
	No.	%	No.	%	No.	%	No.	%	No.	%
290	174	60	14	8.05	116	40	4	3.45	18	6.20
Total			14				4		18	6.20

Figure 2: Sex wise prevalence of Malaria



Sex-wise prevalence of malaria

5.4 Age-wise Prevalence of Malaria

The entire study population was categorized into eight age groups. In these age-groups 0 to 10 years, microscopy detected no *P. vivax* and no *P. falciparum* infections. In the age group 11 to 20 the result of microscopy detected 3 (6.25%) *P. vivax* and no *P. falciparum* infections. The maximum number of malaria cases were found in the age group 21 to 50, which is the productive age. In the age group 51 to 80 years, microscopy detected that there were no malaria patients.

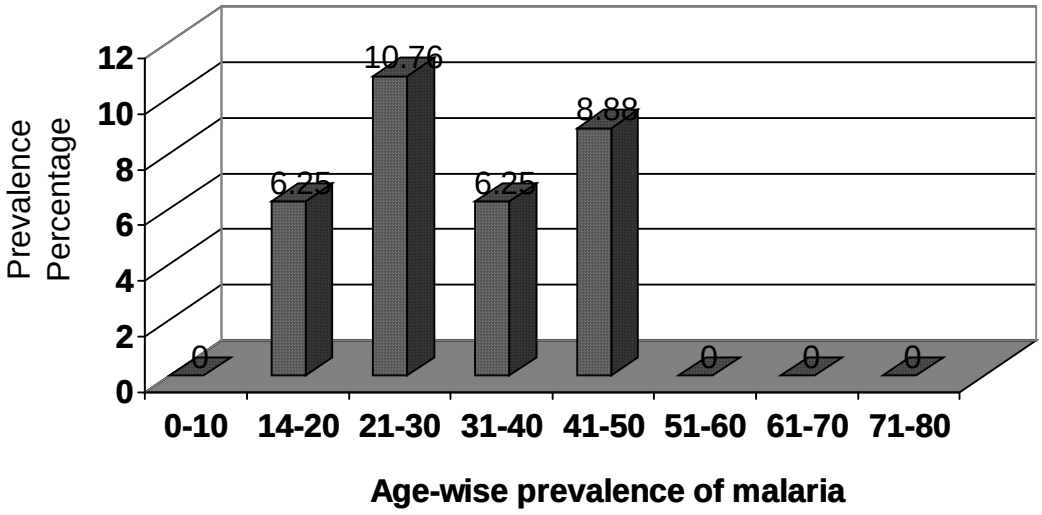
Statistically, age-wise difference in the prevalence of malaria was found to be significant (¡ $^{2}_{cal}$ X5.9492, P>0.05).

Table 3: Age-wise prevalence of malaria

S.N.	Age group	Total samples examined	Positive samples	
			No.	%

1	0 – 10	16	0	0.00
2	11 – 20	48	3	6.25
3	21 – 30	65	7	10.76
4	31 – 40	64	4	6.25
5	41 – 50	45	4	8.88
6	51 – 60	28	-	0.00
7	61 – 70	17	-	0.00
8	71 – 80	07	-	0.00
	Total	290	18	6.20

Figure 3: Age-wise prevalence of malaria



5.5 Distribution of Malaria during different Months

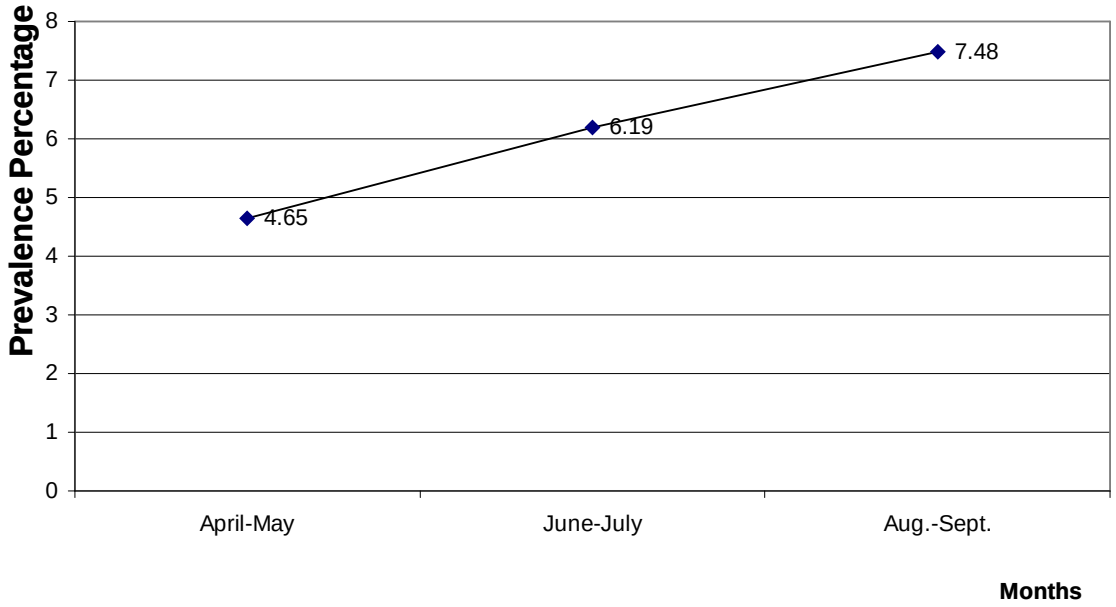
The entire six months study was categorized into three groups. Month-wise prevalence rate of malarial parasite was found to be higher in Aug.-Sept. (7.48%) followed by 6.19% during Jun-Jul and the lowest (4.65%) during Apr.-May (Table no. 5).

Table 4: Month-wise prevalence of Malaria

April – May 2007	June – July 2007	Aug. – Sept. 2007	Total

Total Slides	Positive		Total Slides	Positive		Total Slides	Positive		Total slides	Positive	
	No.	%		No.	%		No.	%		No.	%
86	4	4.65	97	6	6.19	107	8	7.48	290	18	6.21

Figure 4: Month-wise prevalence of malaria



5.6 Ward-wise Prevalence of Malaria

The entire study showed that there were no malaria case from ward no. 1, 2, 5 and 6.

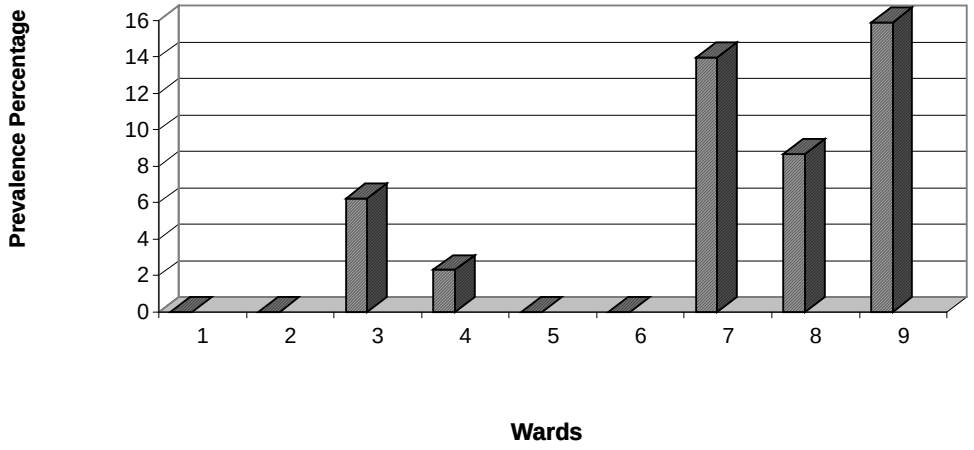
Malaria confirmed patients were only reported from ward no. 3, 4, 7, 8 and 9. Maximum cases were reported from ward no. 7 and 9.

Statistically, significant difference was found between ward no. 3, 4, 7, 8 and 9 (¡ $^{2}_{cal}$ X 29 , P>0.05).

Table 5: Ward-wise prevalence of Malaria

Ward No.	Total suspected cases	Positive slides	%
1	25	-	0.00
2	27	-	0.00
3	32	2	6.25
4	43	1	2.32
5	26	-	0.00
6	27	-	0.00
7	43	6	13.95
8	23	2	8.69
9	44	7	15.9
Total	290	18	

Figure 5: Ward-wise prevalence of malaria



5.7 Use of Bed-nets (for preventive measures of malaria) and Malaria Positivity in Somdiha VDC

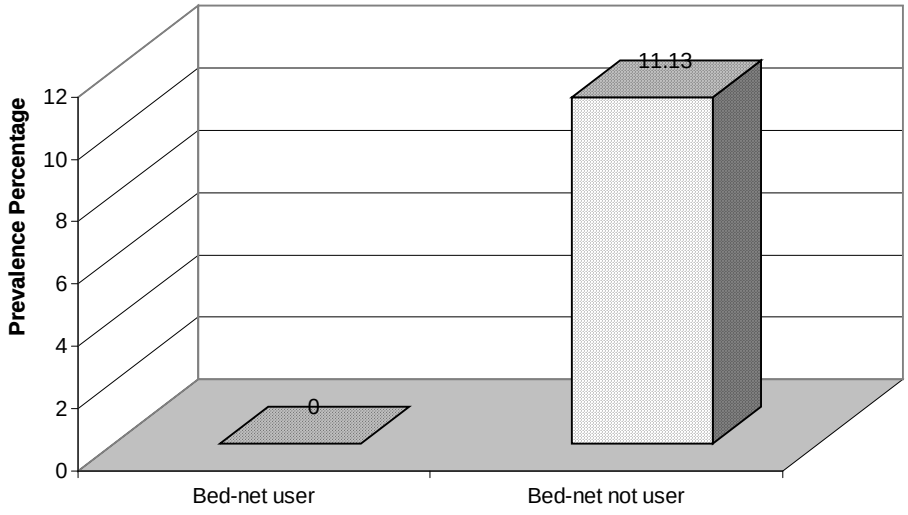
Out of 290 respondents, 134 (46.20%) were Bed-net users whereas, 156 (53.79%) respondents were not Bed-net non-users and they are mostly from ward no. 3, 4, 7, 8 and 9. All malaria positive cases were found in bed net non-users 18(11.13%). Respondents not using bed-nets were higher. So the malaria infections occur in only not Bed-net non-users (Table no. 6, Figure 6).

Statistically, the significant difference was found in the Bed-net user and not Bed-net user (¡ $^{2}_{cal}$ X16.428 , P>0.05).

Table 6: Use of Bed-nets and Malaria Positivity in Somdiha VDC

Examined samples	Bed-net user				Bed-net not user			
	No.	%	Malaria +ve		No.	%	Malaria +ve	
			No.	%			No.	%
290	134	46.20	0	0	156	53.79	18	11.13

Figure 6: Use of Bed-nets and Malaria Positivity in Somdiha VDC



5.8 Literacy Condition and Malaria Positivity

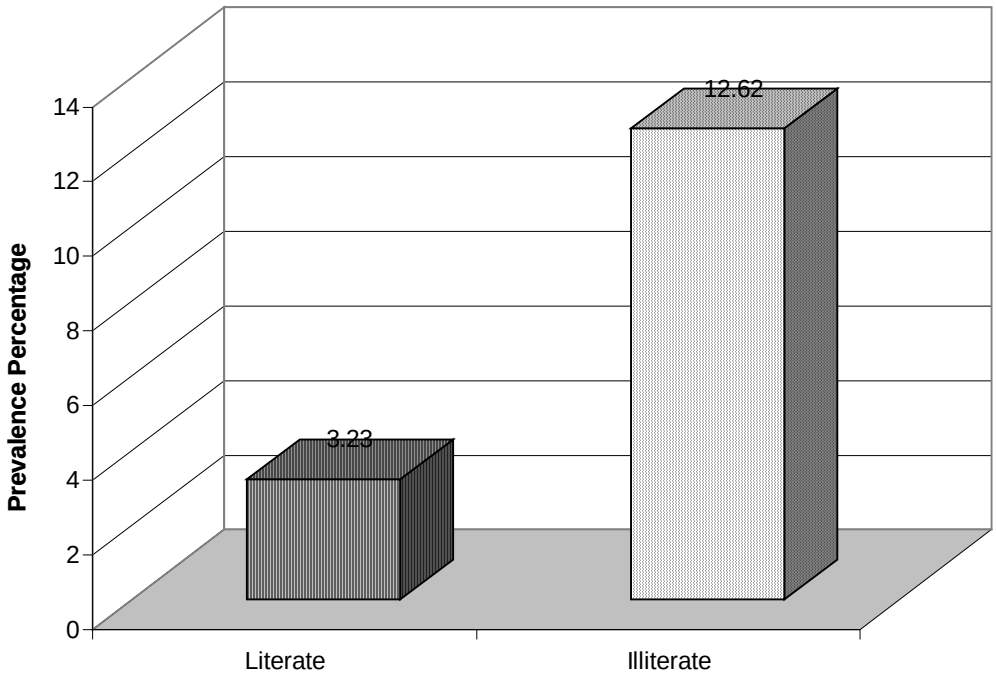
Out of 290 suspected cases 187 (64.48%) were literate whereas 103 (35.52%) were illiterate. Table no. 8 shows that malaria prevalence is higher in illiterate people (12.62%) than literate people (3.21%) (Table no. 7, figure no. 7).

Statistically, there is significantly difference between literate and illiterate people (¡ $^{2}_{cal}$ X9.6115, p>0.05).

Table 7: Literacy condition in Somdiha V.D.C.

Total sample	Literate				Illiterate			
	No.	%	Malaria +ve		No.	%	Malaria +ve	
			No.	%			No.	%
290	187	64.48	5	3.23	103	35.52	13	12.62

Figure 7: Percentage of literacy and illiteracy condition in Somdiha V.D.C.



VI

DISCUSSIONS

Ever since the discovery of malaria parasites by Leveran in 1880 in blood films, microscopic diagnosis is established and recommended as "gold standard" method for laboratory confirmation of malaria. In Nepal malaria has traditionally been diagnosed microscopically by examining (Giemsa) stained blood films and it is the most widely used diagnostic tool in health centers of both rural and urban area (annual report, EDCD 2002).

The first documented epidemiological survey dates back to 1925 by Major Philips of Indian Military Service in Makwanpur and Chitwan-valley. Out of 889 children examined, 712 or 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 that period it was further estimated that approximately two million cases of malaria (40% of the total population) occurred annually and ten to fifteen percent among those resulted in death (EDCDa, 2003).

In the present survey, a total of 18 positive cases were detected out of 290 slides. The SPR came to be 6.20% in Somdiha V.D.C. .The national figure of SPR is 4.85% in 2003, for Bhutanese refugee camps 14.89% in 2000 and for Kapilvastu district 2.24% in 2001 (EDCD, 2002). In an active surveillance of this kind, the SPR is certainly influenced by samples which were random based on fever or history of fever and by time.

In Somdiha VDC malaria was found to be more infected in males than in females. This can be explained due to male mobility to malarious areas in economic pursuit and practice of norms, usual contact with bite of mosquitoes. The hundred percent of the cases have occurred in male and no positive cases of malaria have been reported from female (Upreti, 1998).

In the age group 0-10 and 51-80 years, the study shows that no one is caused by malaria infection. In case of 0-10 years there is no any case of malaria infection due to immunity that has been taken through mother's milk, care by their parents. In

case of 51-80 years, according to my study it shows they are as independent population and they mostly prefer to live in the home, where mosquitoes density are negligible. Maximum prevalence of malaria parasite was found to be 10.76% in age group 21-30 years. Because they are investing their maximum time with grazing animals, doing their works out of the door. This study was found to be very much similar as EDCDb (2003).

The study of month wise prevalence of malaria showed that maximum patient was in Aug-Sept. 8 (7.48%) while lowest in Apr.-May 4(4.65%). The highest cases recorded in Aug-Sept. is because in these months there is high rainfall due to this mostly the surrounding is covered by water everywhere which increased the number of mosquitoes.

Bed-net is one of the important things which can easily protect us from the bite of mosquitoes. The use of Bed-nets for malaria in endemic areas is one of the basic preventive tools as described by WHO recommendation. Malaria has been a major killer in Africa but the uses of bed-net have saved the lives (Roll back malaria). In the present study it showed the malaria positivity rate is maximum in those houses where they are not using bed-nets and other mosquito killing agents. But the positivity rate is low in those houses where the people are regularly using bed-nets and other mosquito killing agents like Sal leaf, Neem leaf and black berry (Jamun) tree bark. The highest percentage of slide positivity in such houses may be due to use of irregular bed-nets and ignorance of malaria and its vectors.

There is lack of health education and awareness programme regarding health in Somdiha V.D.C. There is also high illiteracy (12.62%). Only 3.23% people are literate. Maximum cases were reported from illiterate people.

VII

CONCLUSION

From the study following conclusions have been drawn.

- Oute of total 290 blod films (thin and thick films) examined, 18 were found to be positive for malaria parasites, which accounts 6.20% positivity.
- Maximum positivity was recorded from the age group 21-30 years (10.76%), male positivity was dominant (8.05%) and 7.48% cases positivity was recorded between August to September.
- *P.vivax* was found to be the only prevalent species of malaria-parasite in the study area.
- This study suggests that public awareness programme and distribution of insecticide impregnated mosquito nets are prime requirements to minimize the malaria cases.

VIII

RECOMMENDATIONS

After the field study and observations done along with the discussions with the local resident citizens, recommendations for the efficient control of malaria in the Somdiha VDC of Kapilvastu district are mentioned as follows:

- Behavioural changes and communication for improved and early treatment should be provided.
- Awareness program and health education should be provided for control of malaria.
- Treated nets should be distributed among the people living in endemic areas.
- Repellent cream and mosquito-net should be used by the people to protect themselves from mosquito bites.
- People are motivated not to take anti malarial drugs without blood examination.
- Spraying of insecticides in the endemic area as well as adjacent area.
- Cases should be detected and treated promptly.
- People should avoid sleeping outside and in animal shelters.
- Long sleeves and trouser should be worn outside the house.

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