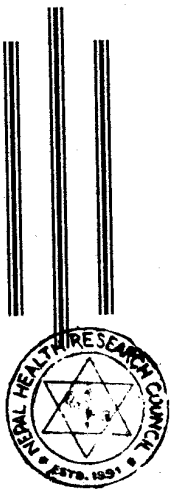
SOCIO-BEHAVIORAL EPIDEMIOLOGY AND ECOLOGICAL DETERMINANTS OF MALARIA OUTBREAK IN KANCHANPUR DISTRICT



FINAL REPORT

(NOVEMBER 2003)

SUBMITTED TO

NEPAL HEALTH RESEARCH COUNCIL

NHRC

RAMSHAH PATH, KATHMANDU

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Krishna Bahadur Chand
Principal Investigator

Abbreviations

ABER	:	Annual Blood Examination Rate
An	:	Anopheles
API	:	Annual Parasite Incidence
CBS	:	Central Bureau of Statistics
CSM	:	Clinically Suspected malaria
DDT	:	Dichloro Diethyl Trichloroethane
DPHO	:	District Public Health Office
EDCD	:	Epidemiology and Disease Control Division
ELISA	:	Enzyme Linked Immuno Sorbent Assa
FWDR	:	Far western Development Region
ICT	:	Immuno Chromotography Test
INGO	:	Inter-national Non Governmental Organization
MOH	:	Ministry of Health
NGO	:	Non Government Organization
NMCP	:	National Malaria Control Programme
P	:	Plasmodium
PCR	:	Polymerase Chain Reaction
PF	:	Plasmodium Falciparum
PV	:	Plasmodium Vivax
RBCs	:	Red Blood Cells
RBM	:	Roll Back Malaria
SEAR	:	South east Asia Region
SPR	:	Slide Positive Rate
VBDRTC	:	Vector Borne Disease Research and Training Center
VDCs	:	Village Development Committees
WHO	:	World Health Organization

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Chapter I

Introduction

1.1 Nepal

Nepal is a landlocked country, situated in the southern slopes of Himalayan mountains between the China in the north, and India in the south, east and west. It is located in between 26°22' and 30°27' north latitudes and, 80°04' and 88°12' east longitudes, with a total surface area of approximately 147,181 Sq. Km. and elevation ranges from 90 to 8848 meters from the sea level. The average length is 885 km east to west and average breath is 193 km. north to south.

Geographically, the country is divided in the three regions; mountains, hill and terai accomodating 7.3, 44.3 and 48.4 percent of population respectively (CBS, 2001). There are five development regions and 75 administrative districts. Districts are further divided into small units called Village Development Committee (VDC) and municipality.

The country is the home place of natural beauty with traces of artifacts. The northern range (Himalayan) is covered with snow over the year where the highest peak of the world, the Mount Everest stands. The middle range (hill) is captured by gorgeous mountains, high peaks, hills, valleys and lakes. The southern range (terai) is the gangetic plain of alluvial soil and consist of dense forest, national parks, conservation areas and wildlife reserves. The temperature and rainfall differ from place to place. During the summer season, temperature is exceeding 40°c in terai are recorded while it may be less than 28°c in the middle section. In winter months, the average maximum and minimum temperatures in the terai are 23°c and 4°c respectively. In the geographic diversity and varied climatic conditions 23.2 million people of the 60 caste/ethenic groups accommended in the country.

The total population of Nepal is 2,31,51,423, out of which 1,15,63,921 are males and 1,15,87,502 are females comprising in 4,25,372 household (CBS, 2001). The economy of Nepal is heavily dependent on agriculture, the population involved in agriculture is 81.1 percent, and non-agriculture sector is 18.9 percent. The main sources of foreign exchange earnings are the carpets, industries, tourism, jute, tea, finished leather, cardamom etc.

Health services in the country are arranged into a hierachy of management, under the Department of Health Services (DHS), of the Ministry of Health (MOH). The private sector provides a significant proporation of health care. In rural areas, this is predominantly by

traditional healers and in urban areas pharmacies and doctors. NGOs/INGOs make contribute to health care services. There is high morbidity due to various diseases including the high prevalence of communicable diseases and malnutrition. The principal cause of high level of morbidity are skin diseases, parasitic infections, diarrhoeal disease, Acute Respiratory Infections (ARI), and complication of the pregnancy and child birth (VBDRTC, 2001).

Malaria in its various forms has been the cause of morbidity in Nepal throughout the ages. Malaria constituted one of the most important causes of economic misfortune engendering poverty, intellectual standards of the nation, hampering prosperity and economic progress in every way. Out of 66 malarious district, the 26 districts are bordered with India with the free open border between two countries; local cross-border mobility is very common. There are certain entry /exit points which have high movement of population not only from bordering districts but also from the northern parts of the country. The exact magnitude of population movement between the border is difficult to estimate due to the common free border between Nepal and India and also the people from countries do not have to submit any travel documents for crossing the border.

1.2 Kanchanpur District

Kanchanpur district of Nepal is located in the Far Western Development Region (FWDR). The district is the zonal headquarter of Mahakali zone. It is located in between 80°03' to 80°33' east longitudes and 28°33' to 29°08' north latitudes. The eastern and western boundaries are linked with Kailali and Dadeldhura districts respectively whereas the western and southern boundaries are with Uttranchal and Uttar Pardesh of India. The total area is 1610 Sq. Km. and elevation ranges from 170 to 190 meters from the sea level. It is one of the terai district of Nepal. The average maximum and minimum temperature records are 12°c to 26°c respectively.

The total population of the district is 3,77,899 out of which 1,91,910 are males and 1,85,989 are females comprising in a total of 60,158 household (CBS, 2001). Administratively, the district is divided into 19 VDCs and a Mahendranagar Municipality. The two of the famous VDCs of Nepal i.e; Dodhara and Chandani lie across Mahakali river (Sharada river) in the westren part of the district.

At present, there are one government zonal hospital, 3 PHCC, 8 HP and 10 SHP. Health Facilities Region comes under the District Public Health Office (DPHO), Kanchanpur.

The present study is carried out in the wards – 2,4 and 1,3 of Krishnapur and Jhalari VDCs respectively. The wards are located in the north east part of the district and northern part of Mahendra highway. The region has mostly inhabited by ethnic groups – Chhetri, Tharu and Brahmin. Major occupations are paddy cultivation and livestock farming. Besides , a few engaged on business, governmental and non-governmental services and labour in India for their livelihood. Jhalari and Krishanpur sub health posts are main curing sites in the both of respective VDCs which are far by 25 and 35 km from the centre respectively. it is the highly malarious district. Health infrastructure is fairly developed and accessbility varies with the localities and acceptability of program is also very high. Prevalence of *Plasmodium falciparum* and drug resistance is high. The area is highly vulnerable due to the economic pursuits. The climate is conductive throughout the year for mosquito proliferation and the area has persistent transmission. Data from DPHO Kanchanpur shows VDCs region to be a highly risk area.

Although most of the studies on malaria have extensively been carried out from the different countries of the world but in Nepal, the situation is still complicated and information about the disease is limited. The present study attempts to determine socio-behaviour of residents and, influence of housing and peripheral conditions with respect of malaria epidemiology.

1.3 Malaria and Plasmodium

1.3.1 General Account

Malaria is the disease of clinical importance caused by single – celled protozoan parasites of the genus *Plasmodium*. The parasites belonging to this genus posseses a life cycle which shows an alternation of generation accompanied by an alternation of host and infection is transmitted from person to person by inoculation of *Anopheline* mosquitos.

1.3.2 Etiological Agent and Geographical Distribution

Parasites of the genus *Plasmodium* are responsible for the disease malaria in both animals and human beings. There are nearly 120 species of *Plasmodium* occurring in

mammals, birds and lizards (Bruce-Chwatt, 1993). But the following four species of Malaria parasite only infect on human beings.

- *Plasmodium falciparum (P.falciparum)* : occurs throughout the Tropical Africa, and parts of Asia, the Western Pacific, South and Central America, Haiti and Dominican Republic.
- *Plasmodium vivax (P.vivax)* : almost; absent from Africa but is the predominent malaria parasite in Asia and South and Central America.
- *Plasmodium malariae (P.malariae)*: found worldwide but has very patchy distribution.
- *Plasmodium ovale (P.ovale)* : occurs mainly in the Tropical West Africa and rarely in the Western Pacific.

Malaria is widespread in the tropics, occurs in the sub-tropical and temperate regions. It is among the most important cause of death and illness in Africa , especially among children and pregnant women. Travelers, tourists and immigrants may be at high risk (Rozendaal, 1999). In Nepal both forms : vivax and falciparum malaria are reported. Districts- Solukhumbu, Kathmandu, Lalitpur, Rasuwa, Mugu, Humla and Bajura have very low – grade of malaria transmission. The four districts Bhakatpur, Manag, Mustang and Dolpa are transmission free areas. The remaining 66 districts are in ***malarious*** areas (EDCD/VBDRTC, 2001).

1.3.3 Historical Outline

It is assumed that the evolutionary history of mammalian plasmodia stated with the adaptation of coccidia of the intestinal epithelium to tissues of the internal organ and then free blood cells and that the disease originated in Africa and spread to other warmer parts of the world. Finding of fossil of mosquitos description of malaria like fever in the ancient religious books and high host specificity suggest a long association between the human and four particular species of plasmodia since pre-historic era.

Hippocrates in 5th century BC was the first physician to discard superstitious cause and to describe in detail the clinical picture of malaria. It was early thought that there was an etiological relationship between fevers and swamps. Italians referred to the bad air in fever producing marshy areas as *malaria*, from which the name malaria is derived. The most important event in the history of malaria took place towards the end of the 19th century.

In 1880 that Laveran, a french army surgeon in Algeria, first saw and described malaria parasites in the RBCs of man. In 1891, Romanowski in Russia developed a new method of staining blood films. In 1894, Manson hypothesized that mosquitos transmit malaria. It was confirmed in 1897 by Ronald Ross who while working on hypothesis in Secunderbad (India) found malaria parasites of man growing as cysts on the stomach wall of *Anopheline* mosquitos. In 1998, the Italian scientist Bignami, Bastianelli and grassi described the life cycle of malaria parasites in Anopheline mosquito. In 1990, Manson and his colleagues by experiments with woman volunteers near Rome in London, confirmed the mosquito-malaria transmission theory.

Long before the discovery of real caugative agents, treatment of fevers was started using "peruvian bark" at the beginning of the 17th century. The bark of the tree was named *Cionchona* by Linnaeus in 1735 and the alkaloids quinne was isolated from it in 1820 by Pelletier and Caventou in France. During the 20th century much research was devoted to malaria control which was revolutionished by the discovery of insecticidian properties of DDT in 1939 by Paul Muller in Switzerland. DDT was synthesized by Zeidler in Germany in 1874. In 1994, the first field tests were carried out in Italy. In 1945, Venezeula and Guyana become the first countries where malaria control on a large scale was instituted (Bruce-Chwatt, 1993).

1.4 MALARIA EPIDEMIOLOGY

1.4.1 LIFE CYCLE AND TRANSMISSON

Malaria parasites enter in the human body via the bite of a malaria carrying mosquitos of the genus *Anopheles*. The parasites invade the liver via the blood stream and multiply. During this period, the victim does not fell ill. After about 9 days or longer, depending on the species, the parasites (called merozoites) enter the blood stream, invade the Red Blood Cells (RBCs), and again multiply. A few days after the appearance of the first symptom, some merozoites develop into gametocytes, the sexual stage of life cycle.

Anopheles mosquitos that feed on a person gametocytes in the blood become infected and the parasites undergo another phage of reproduction in the insect. As the end of this process a new generation of malaria parasites called sporozoites, migrate to the salavary glands of the mosquito where they remain until the insect bites a person and injects the sporozoites then invade the liver and the cycle is repeated. The cycle in mosquito usually lasts 9 and 12 days.

Malaria can also be transmitted accidentally by the transfusion of blood containing malaria parasites, or through contaminated needles or syringes. During the pregnancy, fetuses can become infected with parasites from the blood of the mother (Rozendaal, 1999).

Clinical symptoms

Malaria begins as an influenza-like-illness with attacks of fever eight days or more after the bite of an infected mosquito. Cycles of the fever, shaking chills, drenching sweats and headache may develop. The frequency and severity of the fever depends on the malaria species involved but it usually lasts 2-3 days. The attacks of fever coincide with waves of parasite multiplication and the destruction of RBCs. Long lasting infection often result in enlargement of liver and spleen.

Malaria caused by *P.falciparum* does not show this cyclic pattern. It is the most severe type of malaria and if untreated may progress to shock, kidney and liver failure, coma, or death. Death is often due to parasitized RBCs blocking the narrow blood vessels in an organ. If blood vessels of the brain are affected (the condition is called cerebral malaria). Prompt treatment is essential to prevent the damage to the brain and any other organ. *P.vivax, P.malariae* and *P.ovale* are generally not life threating but death may occur in the very young children, old and sick people.

With *P.vivax* and *P.ovale* malaria, the interval between the attack of fever is typically two days. *P.falciparum* malaria, the interval are irregular, usually about 36-40 hours but shorter intervals are also common. The duration of first attack may last from a week to month or longer. Attacks of illness after an interval of weeks or more is called relapses, do not occurs in *P.falciparum* but are common in *P.vivax* and *P.ovale* infections. Relapses may occur at irregular interval for upto two years with *P.vivax* and for up to five years with *P.ovale.* Infections with *P.malariae* may persist for upto fifty years with periods of fever returning at intervals (Rozendaal, 1999)

1.4.2 Malaria a Global Problem

A report in 1935, indicated that there was an estimated 100 million malaria cases and 1 million deaths annually in the Indian sub-continent (Sinton, 1935). According to wernsdorfer and wernsdorfer (1988) malaria comes under "the ten biggest killer" and "ten most common infections". Equally important is the problem of malaria morbidity. It debilitates communities and affects productivity. The economic impact of malaria is

expected to be relatively greater (WHO 1997) estimated the members of clinical malaria cases and of anti malarial resistance in SEAR is 6% and 30% respectively in relation to global figure.

In the Republic Korea, malaria disappeared rapidly since 1970s. However, malaria re-emerged with the first occurrence of the patient in 1998 near the Demilitarized Zone (DMZ), the border between South Korea and North Korea. Therefore, the number of cases increased exponentially year after year, totaling 6,142 cases by the end of 1998. There emerging malaria characteristically revealed a combination type of short and long incubation periods with dominance of the long type (Chai,1999). About more than half of the country's population of Bhutan is at risk of malaria. The malaria situation started to worsen from 1990 onwards with peak in 1994. *P.falciparum* percent ranged from 31.5% to 51% (Zangpo and Wangen UK, 2000). Annual malaria incidence in India has been fluctuating around 2 to 3 million cases and there has been an increased trend in *P.falciparum* proporation. A sharp increase in registration of cases and deaths due to malaria from 1994 was due local outbreaks in various parts of the country. Approximately 88% of the 128 million people in Bangladesh are at malaria risk. *P.falciparum* is by far the most predominant species (Bangali, 2000). At present, about 100 countries or territories in the world are considered Malarious almost half of which are in Africa, South of the Sahara. More than 24,000 million of the world's population are at risk. The incidence of malaria worldwide is estimated to be 300-500 million cases each year, with about 90% of these occurring in Africa and mostly caused by *P.faciparum.* Malaria is thought to kill between 1.1 and 2.7 million people worldwide each year (WHO, 2000).

1.4.3 Malaria : A National Problem

Malaria was highly prevalent in the days of old in Nepal. The epidemics of the plains hardly ever reached the Himalayas, and the terai region of Nepal was notorious as a malaria region (Hodgson, 1857). " The Nepalese profess that owal sets in Nuwakot at the same as it does in the terai viz 15th march. It probably commences about a month later, the great festival in honour of Devi at Devi Ghat does not take place till the middle of April, and thousand of persons from Nepal are always present with impunity. The Nepalese account for this by saying that through the intervention of the deity, the awal is "suspended" to all who go to worship her during the time of festival lasts. But that it sets in again as soon as the

festival is over ... They say that the day after the festival closes the goddess lets out the sprit of the savage and destroying monarch of the forest, who disguised as the "awal" fever seizes and feed upon all those whom he finds trespassing upon his domain, the Jungles."

He noted the immunity of local tribes of Nuwakot such as Darris, Kumhals, Manjhis, Bramus and Danwar, for he wrote "The tribes inhabit with impuring the lower and hottest valleys in Nepal, just as the tharus do the terai Nepal" (Old filed, 1880). The prevalence of disease is generally related to environmental factors and seasonal weather trends and human activities such as migration, settlement, agriculture and exploitation of natural resources. Because of this broad spectrum of contributing factors, it has been suggested that malaria control would benefit from inter-sectoral effort, although it has never been clear now how such an initiative could be implement in Nepal, nearly 13 million people (64%) of the total population are at risk of contracting malaria (EDCD, 1995).

The overall malaria situation in 1997 showed that 8957 positive cases from 1,60,293 slide collected; two deaths were reported. *P.falciparum* cases (1150 cases) were highest in western region (63%), followed by far western region (14%), eastern region (12%), central region (8%) and mid western region 2% (VBDRTC, 2001)

In Nepal, over 20% of new cases are now belived to be falciparum malaria. The statistics of National Malaria Control Programme (NMCP) indicate that Annual Parasite Index (API) is approximately 20,000 new cases each year (EDCD, 1999). During 1995 to 1999 less than 10,000 malaria cases have been reported annually. There was focal outbreaks of malaria in 1996 and 1997 in far western and western region, in which a few VDCs were affected (Population 13,000 – 17,000) through a high preponderence of *P.falciparum* (over 65%) and a few deaths were reported. Among the 26 bordering districts of Nepal, Kanchanpur, Kailali, Bardia, Nawalparasi, Dhanusha, Mahottari, Morang and Jhapa are the main contributors of Malaria cases. The total malaria and *P.falciparum* cases of 26 bordering districts constituted 64.44% of the total malaria and 90.60% of the total *P.falciaparum* cases of the country in 1997. Importation of malaria cases from India during 1995 to 1998 has been around 22 to 31% of the total cases registered in the country. Out of total *P.falciparum* cases about 35.30 are imported from India. A few severe cases along with the malaria deaths were reported during 1995 to 1996 (Bista and Banerjee, 2002).

1.5 Rationale

Malaria is a re-emerging disease in many parts of the world. It is epidemic to over 100 countries, and is responsible for approximately 110 million of clinical episodes and between 1-2 million deaths annually (Evans *et al* 1994) It is estimated that 1.2 billion people out of 1.4 billion population of the South East Asia Region (SEAR) lay in malarious areas (Rafei, 1998).

In Nepal, disease control section of EDCD is responsible for malaria control programme. The programme exists in 66 districts. Still the people there are suffering from malaria mortality and morbidity. This may be due to the lack of awareness, religious and cultural beliefs, socio-economic conditions, migration or ecological disbalance.

Malaria is a disease, which has a direct impact on productivity of people due to work losses, reducing work capacity and increasing economic burden. In such condition, in a developing countries there appears a vicious cycle of poverty. It has a negative impact on economy in general. this situation needs to be corrected timely. Thus, the existing situation of the disease and its associated socio-cultural aspects, state of migration shout be find out. In recognization of the fact that malaria is a major public health problem, WHO has recognized "Roll Back Malaria (RBM) initiative ". This is a social movement for better health, which has to draw its extension through improved health sector development (both public and private). Nepal has also supported by RBM initiative . This would facilitate main streaming of malaria control into the health system, integrate its implementation through provision of health care to the poor in a package delivery care combined with other health programs.

Prevention and case management are two domains that are needed to be analyzed at health services delivery level. There is still a need to ensure appropriate priority and effective action to address malaria. For the health sector development with a new emphasis on the health led development, it will require new ways of working and changes in the way resources are used.

Malaria control is everybody's business and everybody should contribute. It requires the partnership of community members and the involvement of those engaged in education and the environment in general, in water supply, a sanitation and community development in particular.

It is not an easy task. Malaria often occurs in remote areas, with poor housing and lack of basic services, crowding, migration rapid and uncontrolled urbanization, war and civil disturbances compound the difficulties. Scare resources have to be used to deal with emergencies. In many countries, the majority of cases of malaria are diagnosed and treated in the home or by private sector practitioners, often incompletely and with irritional regimens. This speaks of the spread of parasites resistance to anti-malarial drugs and thus posses another major problem (WHO, 1998).

This cause for an existing situation analysis at grass root level to find out why there is a problem to achieve the success and what would be done to improve the health services delivery and other conditions related to malaria prevention and case management.

Although small sample size, the study will attempt to find out the prevalence of malaria and associated factors in the community where the study was carried out. These information will help the district program managers and other concerned organizations to support the program in an effective way, thus help in the prevention and control of malaria.

CHAPTER II

OBJECTIVES OF THE STUDY

2.1 General objectives:

To find out the socio-behavioural epidemiology and ecological determinants of malaria out break in Kanchanpur district.

2.2 Specific Objectives

- To identify the Socio- behaviour of residents.
- To study the preventive and sanitary practices.
- To study the Knowledge, Attitude and Practices (KAP) of residents.
- To identity the role of causal factors in relation to malaria transmission.

Chapter III

Literature Review

A vast volume of literature exists in malaria as the disease continues to survive with new threats for more than a century since its first scientific elucidation. Major researches efforts have been directed towards malaria chemotherapy, malaria immunology and vaccines, malaria molecular biology etc. in recent years. The portion of the work and vaccines, malaria molecular biology etc. in recent years. The portion of the work and reports related to the malaria epidemiology have been mentioned here.

3.1 Mararia Research in Global Perspectives

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

Less than 25% of persons suffering from malaria seek formal treatment in the most of the sub-saharen Africa in a study of 465 children less than 5 years, some *et al* (1997) found 45.90% (209 cases) positive for malaria. There was a tendency for low percentage of blood smear positive for malaria in children whose mother were reported using mosquito nets or insecticide sprays.

In the base parasitological survey of 3605 school children, Albonico *et al* (1997) found malaria parasites in 61 children.

Yadav *et al* (1997) found the ICT circulating antigens of detects falciparum malaria in blood and useful in field evaluation for rapid diagnosis of malaria.

Kochar *et al* (1997) described 532 cases of severe and complicated malaria admitted to hospital during out break of malaria between sep. and dec. 1994, of which mortality rate was 11.05%. Ignorance about the severity of this disease and lack of transportation including other environmental changes were responsible for the out break.

Mohaptra *et al* (1998) carried out an investigation of a malaria epidemic in Tamulpur primary health centre, Nalberi district of Assam, India in April 1995 and found that children between 3 and 12 years of age who were treated and who recovered clinically from fever

during the epidemic were instrumental in the progression of the epidemic by acting as *P.falciparum* gametocyte reservoirs.

By an 18 months study of malaria in a population of 1875 residents in 423 houses in an epidemic area in southren Sri Lanka, Gunawardena *et al* (1998) found the risk of malaria to be 2.5 fold higher in residents of poorly constructed houses than those living in a house of good construction type.

The relapse pattern study of Adak *et al* (1998) suggests the existance of both tropical and temperate zone types of *P.vivax* in the population of Delhi characterised by district incubation period and possible existance of *P.vivax* sub-population characterised by primary long incubation period.

Charles *et al* (1998) reported 143 cases of pregnant woman infected by P. falciparum In French Guyana. The consequences of the fetus in this area, where the maternal premunition rate is low, are serious: the rates of prematurity, hypotrophy and still birth are three times higher among the pregnant women infected by malaria. The consequences for the fetus are all much serious if the infestation is repeated or prolonged at closer one is to delivery and if perity is low.

Rubio *et al* (1999) found an increase in confirmed cases of malaria by the use of new PCR – based method. From Aug. 1997 to July 1998, a total of 192 whole blood samples and 71 serum samples from 168 patients were received from the hospitals of Spanish National health system. Most of the patients came from West - Central African countries (85%). This molecular method showed; that more sensitivity and positivity than microscopy, detecting 12.4% more samples than microscopy and 13% of mixed infections undectable by Giemsa stain *P.falciparum* was the main species detected with 68% of the total positive malaria case, followed by *P. malariae* (29%), *P.vivax* (14%) and *P.ovale* (7%) including mixed infection in all cases. The use of the infections in all cases the use of seminested multiple –PCR permitted confirmation of origin of the infection and the plasmodium species involved and confirmation of the effectiveness of drug treatment. *P.falciparum* infection induced by transmission has been detected.

Purnomo *et al* (1999) reported an exceptional finding from blood slides collected in a remote area in the Western half of the new Gnninne Islands (Irian, Jaya, Indonesia). One adolescent patient was found patiently co-infected with four non-human malaria species.

Muentener *et al* (1999) surveyed on heterogenicity in the type and avaibility of national data of industrialized country. The total incidence of malaria infections in Europe increased from 6840 in 1955 to 7244 in 1985, with peak of 8438 in 1989. The principal importing countries were France, Germany, Italy and UK. Among the imported species of malaria parasite, *P.falciparum* was identified in an increasing proportion, the case totaling rates ranging from 0 to 3.6%.

Malria has become extint in Israel and imported cases are rare. Zaamir *et al* (1999) reported an Israeli tourist in Kenya infected with falciparum malaria complicated by severe metabolic acidosis, renal failure and adult respiratory distress syndrome.

Ejov *et al* (1999) identified a total of 101 patient with severe and complicated malaria by screening of the cases admitted to hospital with primary diagnosis of falciparum malaria. Adult patients with severe malaria were 2-8 times more likely to die than the child patients. The inseeking treatment and severing of the illness before admission. In a view of this, they consider the malaria mortality could be reduced by improving peripheral facilities for the management of severe malaria and providing appropriate education to communities without stepping up vector control activities.

Mishra *et al* (1999) reported a case of ovale malaria in a child from Delhi. Urban area ecotypes caused by *P.ovale* has never been before in India.

Arez *et al* (1999) presented a parasitological, molecular and longitudinal analysis of an isolated outbreak of malaria, which occurred on the Santiago Island and *P.falciparum* was the only species detected by PCR.

Poinsignon (1999) reported a case of *P.falciparum* infection observed in Paris and presumbly acquired in Guadelupe, a french caribbean island where malaria has been considered to be eradicated since 1970.

Wagbatsowa and Ugbeida (1999) carried out a cross-sectionall study on 254 randomly selected community health officers in training at the university of Benin Teaching Hospital and School of Health Technology in Benin city, Edo state, Nigeria using a pre-disigned questionnaire. Only 26.8% and 18.01% identified the adult mosquito correctly. The knowledge of the subjects on the biology of mosquito and their role as a maalria vector was poor.

3.2 Malaria Researches in National Perspective

The prevalence of the disease in Nepal and vector biology of mosquito has been studied by different researchers. Malaria has great impact on social, economic, education, health sectors.

According to Banerjee (1991), the mortality of cases were confirmed to forest, sivalik foot-hills and inner terai in central region of Nepal. Transmission was persistent and proporation of *P.falciparum* was high. The fluvi-ecosystem had sub-ecosystem viz churia growth ecosystem, paddy ecosystem and reverine ecosystem where malaria transmission is influenced by socio-cultural, customs, Vocational and occupational needs of the population. The vectors responsible for this transmission of malaria were *Anopheles fluviatilis, An maculatus* and *An annularis*.

Sherchand *et al* (1996) found out that people incorporate modern and traditional elements into their concepts of disease and treatment strategies, poor socio- economic status of people, low literacy rate, poor health service management, absence of voluntary agencies are major obstacle to community involvement in malaria. Although it was generally recognized as significant disease, the significance of stagnant water as breeding ground for mosquitos was not widely recognized.

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

Hospital based study by sherchand *et al* (1998) suggest that the patients with central nervous system manifestation i.e. elephantiasis and meningitis must be meticulously diagnosed with high index suspicion for malaria. Medical officers are trained to recognized as clinical malaria by symptom which is characterised of "vivax proxysm", there is a need to retrained medical officers so as to detect as well as treat severe from of malaria mostly occuring with falciparum malaria.

Sherchand *et al* (1999) compared the dipstick, parasite f- test to thick blood film examination in rural areas of southren Nepal. While the study confirms that parasight - f is easy to perform in field conditions, the unpredictable cross-reactivity with *P.vivax* may render it difficult to use, in situation where *P.vivax* is dominent species. However, the

possibility of diagnosis of falciparum malaria and the positivity of prenting the development of severe malaria out weight this advnatage.

Bista and Banerjee (2000) presented some data of *P.falciparum* to chloroquine. During 1979 to 1990, a total of 178 and 84 *P.falciparum* cases were monitored by invitro and invivo methods respectively. A resistance of 63.20% was recorded to chloroquine by invitro test. Out of 84 invitro test, 32 cases showed a resistance of 38% at S/R I and R II level. No resistance was found to mefloquine and sulfadoxine/pyrimethamine. However, In Kanchanpur and Nawalparasi outbreak of *P.falciparum* (1996 to 1997), therapeutic efficacy monitoring has revealed late treatment failures among the recipents of S/P treatment. The current first line treatment of Microscopically disgnosed *P.falciparum* was S/P in Nepal.

CHAPTER IV

Methodology

4.1 Materials:

Glass slide

Cotton

Lancet

Marker pen

Staining rack

Dropper

Absorbent paper

Slide box

Field diary

4.2 Reagents:

Absolute methanol

Giemsa stain

Distilled water

Immersion oil

4.3 Preparation of Thick and Thin Blood Films on Same Slide

- The tip of middle finger of left hand was prinked by sterilized lancet.
- Four drops of blood were placed; one half of an inch on the slide and one drop of blood on the other one-inch right end of the slide. The former was made thick film and later was made thin film.
- The blood for thick film was spreaded with the corner of another slide to form an area of a inch-square.
- The next portion of 'blood drop' was spreaded by spreader (another glass slide) helding of 45^0 and pushed opposite direction of thick film.
- Both the films were allowed to dry at room temperature for about half an hour.
- The thin film was fixed with methyl alcohol after drying.
- The thick film was dehaemoglobinised.
- The slide was numbered on the opposite side of blood films with marker pen.

4.4 Staining of Films

- Slides with smears were placed on a staining rack
- Each thin smear was rinsed by dropping 3-4 times in the giemsa buffer
- Each thick smear was left in the giemsa for 5 minutes
- Each slide removed individually and drained briefly onto the absorbent paper.
- Stained slides were washed gently on distilled water.
- The smears were allowed to dry upright in a rack
- After drying the stained smears were examined under the 100 X oil immersion
- Result was noted.

4.5 Sampling

Out of 2150 household of study area, 215 household were selected by taking 10% sample size. The selection of household was done by constructed random numbers, which have been given in the annex - 1. The frame work of sampling is given in the following table.

Table no - 1 frame work of sampling

Household	Krishnapur		Jhalari		Total
	Ward no - 1	Ward no - 3	Ward no - 2	Ward no - 4	
Total	735	350	530	535	2150
Selected	74	35	53	53	215

4.5.1 Construction of Random Numbers

Before survey, random number tables for each respective ward were selected separately. The random numbers were generated mechanically in scientific calculator (fx - 82 super). The "population size" for Krishnapur - 1,3 and Jhalari - 2,4 wards were 735,350,530,535 and identified household with random numbers were 1 to 74, 1 to 35, 1 to 53 and 1 to 53 respectively. Starting from the first numbers and moving row-wise we picked out the digital numbers one by one. Repeated numbers and numbers greater than population size were ignored. With the help of selected numbers, the corresponding households to the numbers were identified from the ward wise population record of Jhalari and Krishnapur VDCs. The survey was conducted over family members of identified household with structured questionnaire.

4.6 Pre-testing the questionnaire

To improve or modify in the light of the drawbacks, pre-test questionnaire was done in the similar locality.

The assigned guide made final correction after approval.

4.7 Orientation

Four local health personnel with field experience were selected for enumerator. Enumerators were identified about the data collection, completeness, same process during interview for each respondent and note same as the answer, process and rapport building techniques of sample selection in case. Practice was done on answering the questionnaire and other format during orientation.

Each enumerator had provided on map of locality name list and record of related ward.

4.8 Data Collection

In the first part, primary data was collected from house visit of the respondents. During house visit, needed informations were collected through the structured written questionnaire schedule (in Nepali language). In case of respondent less than 15 years, the information were taken from his/her parents. Questions asked to the local people during survey is given in annex – 2 . The blood samples were collected from the symptomatic suspects of malaria and examined. In order to get the deeper understanding on the subject of study, Focus Group Discussion (FGD) was done to collect the information. A total of four FGD were conducted in each respective ward.

In the second part, the search and review of the slide positive malaria cases were done from the record of EDCD, DPHO, VBDRTC, Health posts, sub-health posts and hospital to establish prevalence of malaria in selected wards.

4.9 Reliability and validity

Questionnaire preparation and pre-testing was done under the closed guideline to assigned expert guide of NHRC. Pre - testing activity was conducted in the similar field to avoid misinformation, misinterpretation and field side correction were made. Selection of the trained and experienced interviewer were performed from the local health institution especially health background. Direct supervision was carried out by researchers (i.e. principal investigator and co-investigators). If any item of the questionnaire were found

blank, next day it was corrected returning to same respondent. Probing questions technique was made during data collection.

4.10 Exclusive Criteria

Respondents who had no possibility of presence during the data collection period (9days), uncooperative cases and who do not want to give consent were excluded in this study.

4.11 Ethical Consideration

Approval letter was taken from Nepal Health Research Council (NHRC) Kathmandu prior to departure for field. To whom it may concern letter was taken from DPHO Kanchanpur. Verbal permission was taken from local authority (CDO), Chairman of concerned VDCs, local health institution and from each respondent usually one day before to collect data (in children below 15 years verbal consent was taken from related guardians) and respondent identify was ignored.

4.12 Data Processing

4.12.1 Editing

The data were edited everyday after data collection. The purpose of data collection was for timely detection of errors and omission to make sure that data were accurately filled, was consistent, uniform and complete. By this, data were corrected timely and ensured to be well arranged to facilitate coding and tabulation

4.12.2 Coding

Coding was done in order to facilitate analysis.

4.12.3 Classification

Classification of data was done according to attributes such as education, occupation, literacy etc.

4.12.4 Tabulation

Tabulation of raw data was done to summarize it and to display it in a well- arred manner, easy to handle, in statistical form. Dummy tables were filled to summarize Epi-info-6 version computer program was used for tabulation of data. Calculator was also used as per need.

4.13 Data analysis and Interpretation

After editing, coding and classifying data were analysed to detect the abstract form from the findings. To achieve such information's statistical tools such as percentage, bars, frequency, chi-square test and odds ratio were used. Using Epi-info-6 version programme did these.

4.13.1 Expected outcome

This study tried to find out socio - behaviour of the local people in the study area as well as ecological causes for malaria outbreak. The findings of this study will ultimately helpful to develop and evaluate by contributing malaria control programme.

4.14 Limitation of the Study

Although this study tried to find out socio - behaviour and ecological determinants of malaria outbreak in 2001 in Jhalari 2,4 Krishnapur 1,3 wards but due to limitation of time and expert Entomologist, the specific vector biology and ecology were not included. Regarding the response of respondents towards mosquito is not wholly fulfill the ecology. Further the finding of this study could not be generalized to other malarious areas. Because, small variation either in environmental condition or in elements of human behaviour or socio - economic aspects in a given geographical area may be all important in determining the ecological pattern of malaria and are known to influence the degree of endemicity. Less is known about the role of ecological parameter in malaria outbreak in Nepal.

4.15 Study Duration

The study has been carried out April 2002 to November 2003.

Chapter V

Study Findings

5.1 Descriptive Findings

Study was carried out in two phases 1) Descriptive & 2) Cross-sectional. The former : especially the total surveyed household of the selected wards in Krishnapur and Jhalari VDCs. The total number of respondents identified for survey was two hundred and fifteen. Their characteristics were as following.

Demographic characteristics of respondents

The following table shows ward wise distribution of age groups and sex in Krishnapur and Jhalari VDCs. Krishnapur VDC had 109(50.70%) respondents out of 215 and Jhalari had 106(49.30%). Out of 109, 74 (87.84% male and 12.16 female) and 35 (91.43% male and 9.37% female) were respondents from Krishanpur 1 & 3 wards respectively. Similarly out of 106, 53 (84.91% male and 15.09%) female) and 53 (96.23% male and 3.77% female) were respondents from Jhalari 2 & 4 wards respectively. Ratio of male to female; 8.77% female and least 6.45% were in 45-54 yrs age group and least 6.45% were 15-24 yrs age group.

According to table 92.25% respondents were engaged in agriculture. In Jhalari – 4 and Krishnapur – 1, none of the sexes were in business. Only 5.3% male; respondent had business. In jhalari – 2 & Krishanpur – 3, only 4.23% and 1.62% male respondents were busy in governmental and non-governmental services, and job in India.

The literate status of Jhalari was higher (73.58%) than Krishnapur (60.32%), sex wise distribution of literacy was varying only 5.52% female were literate whole 94.48% males were literate. Among males, 70.98% were literate while among females 36.36% were literate males the educational level was 12.41% S.L.C., 2.19% inter, only 1 (0.72%) had bachelor level in Krisnapur – 3. None of the female had educational level S.L.C. and above.

Table No 2

DEMOGRAPHIC CHARATERISTICS RESPONDENTS IN PERCENTAGE

Characterstics	Krishnapur (n=109)						Jhalari (n=106)					
Age groups (in yrs)	Ward no- 1 (n=74)			Ward no - 3 (=35)			Ward no - 2 (n=53)			Ward no - 4 (n=53)		
	Male (65)	Female (9)	Total(74)	Male (32)	Female (3)	Total(35)	Male (45)	Female (8)	Total(53)	Male (51)	Female (2)	Total(53)
15-24	10.78	33.34	13.51	30.13	0.00	2.86	8.89	0.00	7.55	1.96	0.00	1.89
25-34	9.23	11.11	9.46	9.37	66.67	14.28	8.89	12.50	9.43	11.76	0.00	11.32
35-44	26.14	22.22	25.68	25.00	0.00	22.86	22.22	25.00	22.64	21.57	0.00	20.76
45-54	27.69	22.22	27.03	31.25	33.33	31.43	20.00	12.50	18.87	35.29	50.00	35.85
55-64	20.00	11.11	18.75	18.75	0.00	17.14	2.22	25.00	22.64	15.69	0.00	15.09
65 & above	6.15	0.00	5.40	12.50	0.00	11.43	17.78	25.00	18.87	13.73	50.00	15.09

2. Occupation

Agriculture	94.03	100.00	94.60	84.38	100.00	85.72	90.91	100.00	92.45	96.08	100.00	96.22
Business	0.00	0.00	0.00	6.25	0.00	5.71	2.27	0.00	1.89	0.00	0.00	0.00
Service	2.99	0.00	2.70	9.37	0.00	8.57	4.55	0.00	3.77	1.96	0.00	1.89
Job in India	1.49	0.00	1.35	0.00	0.00	0.00	2.27	0.00	1.89	0.00	0.00	0.00
Study	1.49	0.00	1.35	0.00	0.00	0.00	0.00	0.00	0.00	1.96	0.00	1.89

3. Education level

Primary	65.12	25.00	61.70	47.37	100.00	50.00	94.28	100.00	94.60	92.50	100.00	92.68
Lower secondary	6.98	50.00	10.64	15.79	0.00	15.00	2.86	0.00	2.70	0.00	0.00	0.00
Secondary	0.00	25.00	2.13	5.26	0.00	5.00	0.00	0.00	0.00	2.50	0.00	2.44
S.L.C.	25.58	0.00	23.40	21.06	0.00	20.00	0.00	0.00	0.00	5.00	0.00	4.88
Inter	2.32	0.00	2.13	5.26	0.00	5.00	2.86	0.00	2.70	0.00	0.00	0.00
Bacholer	0.00	0.00	0.00	5.26	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
Master	–	–	–	–	–	–	–	–	–	–	–	–

4. Literacy Level

Literate	64.18	57.14	63.51	59.38	33.33	57.14	79.55	22.22	69.81	78.43	50.00	77.36
Illiterate	35.82	42.86	36.42	40.62	66.67	42.86	20.45	77.78	30.19	21.57	50.00	22.64

5.1.1 Knowledge of malaria

The study showed that 205 (95.35%) respondents had knowledge about malaria but only 10(4.65%) had very poor knowledge, which is relatively very low. If they know about malaria, stated by the respondents as symptoms were chill with fever 183 (89.27%) headache 6 (2.93%), in appetite 3 (1.46%) and dizziness 13 (6.34%)

Table no 3 – Respondent's views regarding symptoms of Malaria

S.N.	Category	Positive response	Percentage
1	Chill with fever	183	89.27
2	Headache	6	2.93
3	In appetite	3	1.46
4	Dizziness	13	6.34
Total		205	100

Similarly survey of local people found that 202(93.95%) had replied only human beings suffer from malaria, 5 (2.33%) animals and 8(3.72%) both animals and human beings.

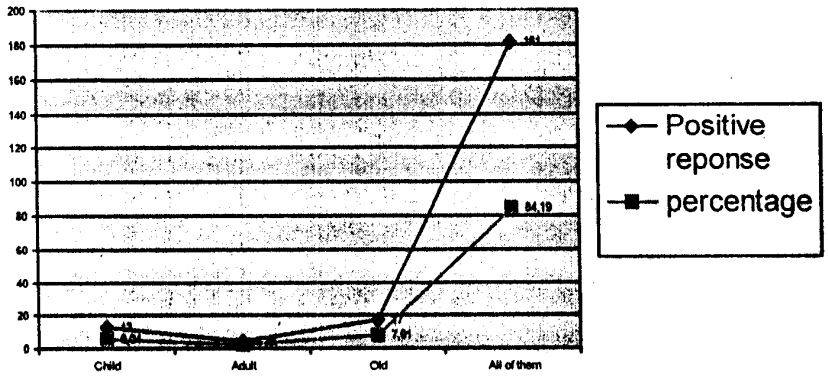
5.1.2 Vulnerable stage of malaria

The survey revealed that 181 (84.19%) respondents had knowledge about vulnerability of Malaria to all stage of life. (i.e. child, adult and old. 13 (6.04%), 4 (1.86%), 17 (7.91%) replied as vulnerable to child, adult and old respectively.

Table no. 4 Respondent's view about vulnerable stage of malaria

S.N.	category	Positive response	Percentage
1	Child	13	6.04
2	Adult	4	1.86
3	Old	17	7.91
4	All of them	181	84.19
Total		215	100

Graph 1. Vulnerable stage of malaria



5.1.3 Prevalence of malaria in the geographic region

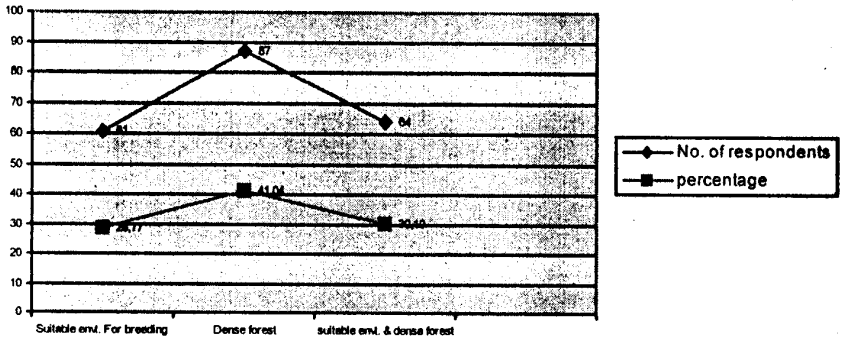
According to 212 (98.60%) respondents the prevalence of malaria is greater in terai. While 3 (1.40%) respondents said about its equal prevalence in of three Geographic regions; mountain, hill and terai.

Out of 212, 61 (28.77%), 87 (41.04%), 64 (30.19%) peoples had viewed in about malaria prevalence greater in terai due to suitable environment for breeding of mosquito vector, dense forest and both respectively

Table no. 5 Respondent's views regarding malaria prevalence in terai

S.N.	Category	No of respondents	Percentage
1	Suitable envt. for breeding	61	28.77
2	Dense forest	87	41,04
3	Suitable envt. & dense forest	64	30.19
Total		212	100

Graph 2. Causes of malaria prevalence of terai



5.1.4 Staying habit and mosquito

Out of 215 respondents, 141 (65.58%) were found to be stay outside the house till late evening in summer season. Of them, 72 (51.06%) were aware to mosquito bite and usually wear protective clothings on the body and, 69 (48.99%) were unaware and stay outside without wearing protective clothing on the body.

Of 141 respondents, 133 (94.33%) were nuisance from mosquitos and remaining 5.67% were not.

Table no. 6 Respondent's views regarding mosquito nuisance

Response	No. of respondent	Percentage
Yes	133	94.33%
No	8	5.67%
Total	141	100%

The findings showed that staying habit outside of the house till late evening without wearing protective clothes against mosquito bite might responsible for malaria out break in endemic areas.

5.1.5 Medical aspect of Malaria

To confirm the malaria among human suspects, microscopic examination of blood films are most important and significant way. Out of 215 respondents, 202 (93.95%) were found to be well familiar with this technique while remaining 13 (6.05%) did not have any knowledge; about it.

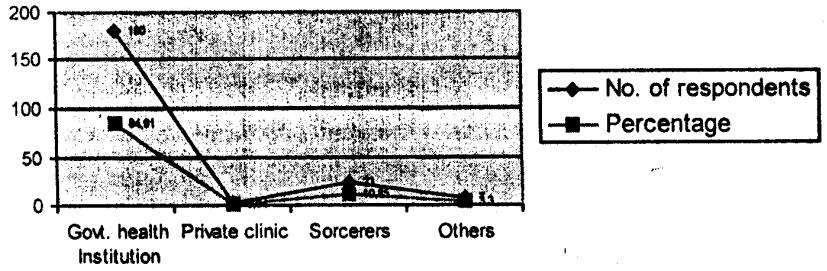
Regarding the "cure" of malaria 212 (98.60%) had good knowledge on curative only 3 (1.40) respondents were unknown whether it is curable or not.

The survey showed that out of 212 respondents 180 (84.91%) were throughout as malaria treated in Government Health institutions, 2 (0.94%) private clinics, 23 (10.85%) traditional healers (sorcerers), and 7 (3.30%) believed on others (i.e. Indian hospitals, herbal & Wizard etc)

Table no. 7 Respondent's views regarding malaria treatment

S.N.	Category	No. of respondents	Percentage
1	Govt. Health Institution	180	84.91%
2	Private clinics	2	0.94
3	Sorcerers	23	10.85
4	Others	7	3.30
	Total	212	100

Graph 3. Respondent's views regarding malaria treatment



The above table revealed that a higher proportion of respondents; had feelings of malaria treatment in Govt. health Institutions. Respondents also found to be believed on sorcerers, herbal and wizard treatment. These traditional beliefs might be causes for high prevalence of malaria in this region.

5.1.6 Mosquito and Malaria

A total of 215 interviews with structured questionnaire were conducted in study area. Questions were structured with mosquito habits and knowledge of respondents as malaria vector. About 96% respondents had knowledge of malaria transmission by the bite of mosquito. 50.70% respondents replied all mosquitos transmit malaria whereas 45.11% said certain mosquito and 4.19% were unknown.

In a question of place where mosquitos lay egg about 0.94% answered on fresh water, 87.44% in polluted water and 11.62% in fresh polluted and running water.

Regarding the mosquito active, time and season, relatively higher proportion i.e. 46.05% respondents said to be active in the evening near sunset and 54.42% both in summer and rainy seasons.

Table no. 8 Respondent's views for Mosquitos active time and season.

A. Respondent's views for Active time

Active time

SN	Time	No. of respondents	Percentage
1	Morning	7	3.26
2	Evening	99	46.05
3	Night	28	13.02
4	Midnight	81	37.67
Total		215	100

B. Respondent's views for mosquito for active season

Active season

SN	Seasons	No. of respondents	Percentage
1	Summer	20	9.30
2	Rainy	77	35.81
3	Summer & rainy	117	54.42
4	Midnight	1	0.47
Total		215	100

It is quiet evident that Anopheles mosquitos are active between sunset and sunrise. Each species has specific peak biting hours and there are also variations in their preference for biting indoors or outdoors larval habits vary species to species. The most preferred breeding sites are pools seepages slow running streams and rice field. The above table concluded the most biting habit of malaria vector. More over the activeness was found in summer and rainy season along the more emphasis was given on rainy season. In this period the vector multiply rapidly on the available suitable environment for breeding and peak of malaria and seasonal out breaks are reported in these seasons.

5.1.7 Preventative and Sanitary Practices

Preventative and sanitary practices of malaria of the study area include use of bed net, smoking, management of dirt and excreta. About 90% respondents were found to be following protective practices out of 215.

Of 202 respondents, bed nets were used by a higher proportion i.e. 103(50.99%) bed nets and smoking by 57(28.22%). Sanitary practices, smoking, bed nets and chemical spray along with smoking and all of above practices were followed by 6(2.97%),15(7.43%), 9(4.45%) & 12(5.94%) respondents respectively.

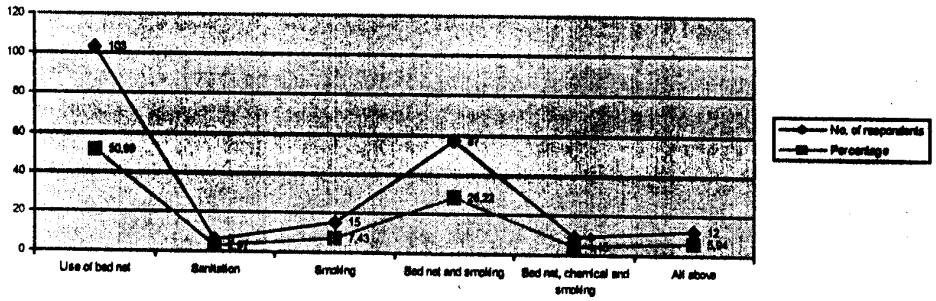
Table no. 9 Preventative Practices followed by respondents against mosquitos bite

SN	Category	No of respondents	Percentage
1	Use of bed net	103	50.99
2	Sanitation	6	2.97
3	Smoking	15	7.43
4	Bed net and smoking	57	28.22
5	Bed net, chemical and smoking	9	4.45
6	All above	12	5.94
Total		202	100

Out of 194 respondents 181(93.30%) were used bed nets along other protective device to protect from mosquitos completely remaining 13(6.70%) were bed net unusers, which they had.

Regarding the causes of available bed nets misused were found to be habit, un nuisance from mosquito feeling uncomfortable to sleep if used.

Graph 4. Preventative and sanitary pratices followed by respondents against mosquitos bite



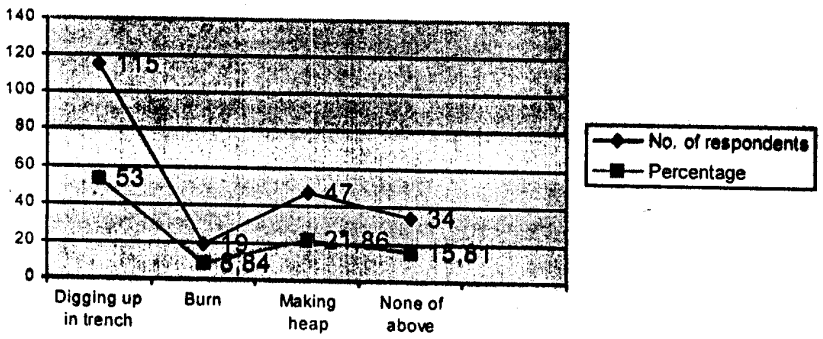
5.2 Management of dirt

To protect from the mosqutos and other insect vectors, management of dirt is important. In the study area a highest proportion of respondents i.e. 115(53.49%) were found to be managing digging up in trench 19(8.84%) burn, 47(21.86%) making heap and 34(15.81%) unaware in management.

Table no. 10 Respondent practices for management of dirt

SN	Category	No of respondents	Percentage
1	Digging up in trench	115	53.49
2	Burn	19	8.84
3	Making heap	47	21.86
4	None of above	34	15.81
Total		215	100

Graph 5. Management of dirt



From the above table it can be concluded that unaware toward management of dirt and ways of management by making heaps are not appropriate to protect from mosquitos . These ways accelerate to mosquito to make active and support for rapid multiplication thus might be causes of malaria endemic.

5.2.1 Management of excreta.

By the field study, only 75(34.88%) respondents had found poor toilet, which were mostly crude 94.67%. The frequent urination and exertion were in appropriate sites. They were found to be used field 39 (27.86%), drain 45 (32.14%), home garden 37 (26.43%) and stream site 19 (13.57%).

Table no. 11 Respondents habit of management of excreta.

SN	Site of excretion	No of respondents	Percentage
1	Field	39	27.86
2	Drain	45	32.14
3	Home garden	37	26.43
4	Stream	19	13.57
Total		140	100

Overall, the habitual practices of sanitary measures were found poor. Improper management of dirt, excreta, crude and open latrines, keeping dirt on heaps and frequent urination and excretion are absolutely of their ignorance and illiteracy which all hamper to terrestrial & aquatic ecosystem so pollute to environment badly.

5.3 Observation

5.3.1 Housing condition and malaria

Housing condition of respondents was examined in respect to number of houses, type of houses (huts or concrete) net in window a door, no of bed-nets sanitation around the house and condition a distance of animal shed from the house. Out of 215, respondents, only 3.76% had concrete houses and 96.24% poor housing condition living on huts. Which walls were made of wood, thatch and roof by dry grass, mud tiles.

Table No. 12 Description of Household

Variables	Krishnapur VDC, Ward No 1 & 3	Jhalari VDC, Ward No 2 & 4	Total
Total no. of house	109	106	215
% Of huts	99.08	93.40	96.24
% Of concrete house	0.92	6.60	3.76
Average no. Peoples per house	6.85	7.55	7.20
% Of household with per bed net	91.74	90.57	91.15
% Of household who do not use nets year round	8.26	9.43	8.85
Average no of nets per houses only houses with nets	4.07	3.76	3.91
Total no. Of sheds	103	104	207
% Of huts shed	100	98.08	99.04
% Of concrete shed	0	1.96	1.96

99.08% houses in Krishnapur were huts and 0.92% were concrete while 93.40% & 6.60% houses in Jhalari were huts & concrete respectively. The average number of people living per houses was 6.85 and 7.55 in Krishnapur and Jhalari respectively. 91.74% household had bed nets & 8.26% never use bed net year round in Krishnapur. Similarly, 90.57% household had bed nets and 9.43% never use bed net in Jhalari. The average

numbers of nets per house (only houses with nets) were 4.07% and 3.76% in Krishnapur & Jhalari.

The numbers of sheds were less than the number of houses. A total of 207 animal sheds, 103 were in Krishnapur and 104 in Jhalari. All the sheds were huts in Krishnapur while 98.08% in Jhalari were huts and only 1.96% was concrete.

5.3.2 Distance of animals shed from the house

Ownership of domestic animals and distance of animals shed were observed to find out the living conditions, sanitary and preventative measures in relation to malaria.

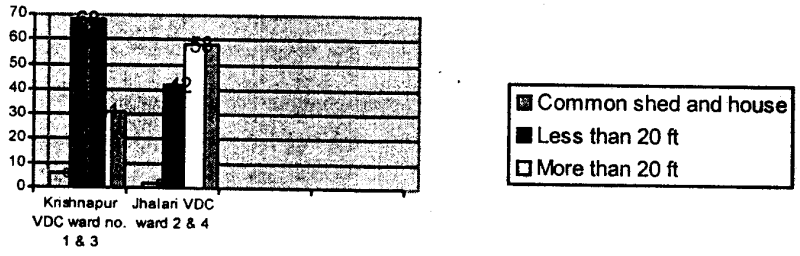
Table no.13 distance of animals shed from the house

Distance	Krishnapur VDC ward no. 1 & 3	Jhalari Ward no 2 & 4	Total
Absent	4 (3.67%)	4 (3.77%)	8 (3.72%)
Common shed and house	6 (5.50%)	2 (1.89%)	8 (3.72%)
Less than 20 ft	68 (62.39%)	42 (39.62%)	110 (51.16%)
More than 20 ft	31 (28.44%)	58 (54.72%)	89 (41.40%)
Total	109 (100%)	106 (100%)	215 (100%)

A Total of 109 respondents in Krishnapur, 6 (5.50%) had attached shed along with house, 68 (62.39%) had shed apart less than the distance 20 ft 31 (28.44%) had shed apart more than the distance of 20 ft and 4(3.67%) houses had not animal shed.

Out of the 106 respondents in Jhalari 2 (1.89%) had attached shed along the house, 42 (39.62%) had shed apart less than the distance of 20 ft 58 (54.77%) had shed apart the more than distance of 20 ft and 4(3.77%) houses had not animal shed.

Graph 6. Distance between cow shed and hosue



5.3.3 Peri – domiciliary environment

Peri – domiciliary environment of the household of all total 215 respondents were observed in respect of peri – domiciliary surface of water collection, presence of catchments areas and presence of bushes around the households as they increase mosquitos breeding.

Table no. 14 Peri – domiciliary environment

Peri – domiciliary environment	No. of household observed in VDC, 1 & 3 Krishanpur	Percentage	No. of household observed in Jhalari VDC 2 & 4	Percentage
Satisfactory	42	38.53	42	39.62
Unsatisfactory	67	41.47	64	60.38
Total	109	100	106	100

109 respondents in Krishnanpur VDC, 42 (38.53%) had satisfactory peri-domiciliary environment while 42 (38.53%) had unsatisfactory peri – domiciliary environment.

Similarly, of 106 respondents in Jhalari VDC, 42 (39.62%) had satisfactory peri-domiciliary environment while 64 (60.38%) had unsatisfactory peri-domiciliary environment.

'Overall, both the satisfactory and unsatisfactory peri – domiciliary environment were observed and higher proportion of respondents were living under unsatisfactory environment condition.

5.4 Status of Malaria in Kanchanpur district

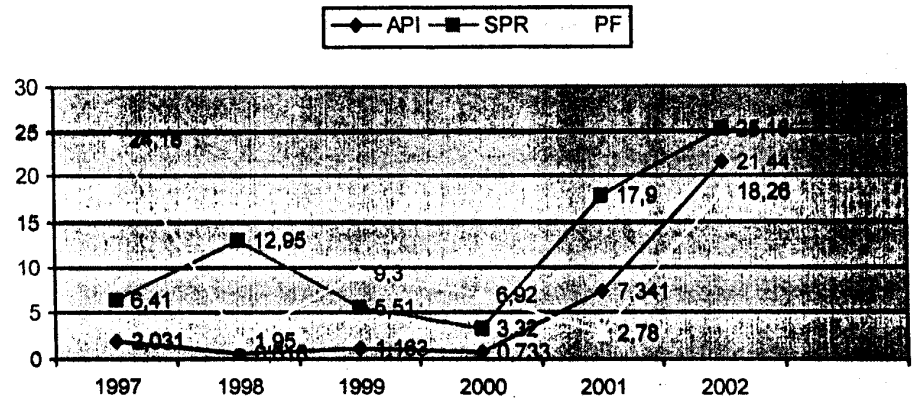
Table 15: Status of malaria in Kanchanpur District 1997 to 2002

SPR/ 100	Population	Sl. Col.	Total +ves	PV	PF	API/ 100	ABER/ 100		PF %
1997	268772	8524	546	414	132	2.031	3.17	6.41	24.18
1998	331590	1583	205	201	4	0.618	0.48	12.95	1.95
1999	342183	7219	398	361	37	1.163	2.11	5.51	9.30
2000	354474	7823	360	242	18	0.733	2.21	3.32	6.92
2001	367249	15058	2696	2621	75	7.341	4.10	17.90	2.78
2002	377899	32197	8102	6623	1479	21.44	8.52	25.16	18.26

Source DPHO record 1997-2002

Graph 7 : Malaria situation of Kanchanpur District 1997 to 2002

Graph 7. Malaria situation of Kanchanpur District 1997-2002



Source: DPHO record 1997-2002.

The trend, of malarial in the Kanchanpur district is in growing condition since 2001. We can observe API, which was 0.0618/1000 in 1998, has gone up 21.44/1000 in current year 2002. ABER is also increasing order since 1998. SPR has peculiar increase up to 25.16/100. SPR increasing since 2000. This claims there were more positive cases remaining undiagnosed in the communities. PF% is in remaining position i.e. 18.26/100. It means percentage of plasmodium falciparum malaria had increased about nine times than last fiscal year 2001. Record of district shows, there were three deaths by malaria in than particular district.

Table 16: malaria positive of Kanchanpur 2059/060 (2002)

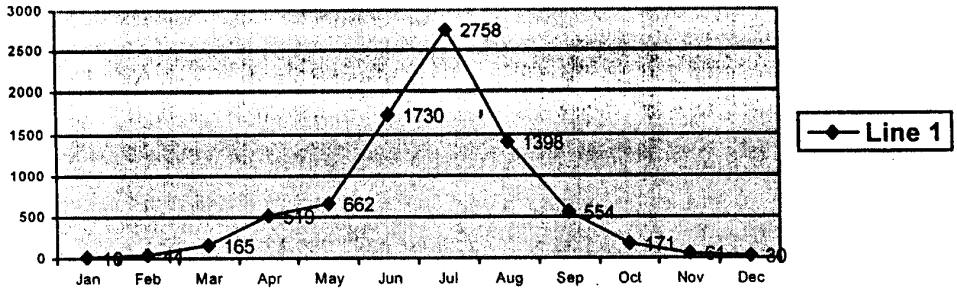
SN	VDCs	Population	Sl.Col.	Positives	PF	CM	API/1000	ABR/1000	SPR/100	PF%
1	Baise Biwa	11490	231	5	2	229	0.43	2.01	2.16	40
2	Beldandi	14815	160	32	3	258	2.16	1.08	20.00	9.38
3	Chandani	16875	163	4	1	88	0.24	0.97	2.45	25.00
4	Daijee (HP)	22681	2164	1011	152	1075	44.55	9.54	46.72	15.03
5	Dekhatbhuli	16521	159	11	1	227	0.67	0.96	6.92	9.09
6	Dodhara	18556	244	4	2	298	0.25	1.31	1.64	50.00
7	Jhalari	15926	3131	875	405	2119	54.94	19.7	27.95	46.29
8	Kalika	13002	92	3	0	103	0.231	0.71	3.26	0.00
9	Krishnapur	25442	4939	2514	817	101	98.81	19.4	50.90	32.50
10	Laxmipur	11767	97	2	0	95	0.17	0.82	2.06	0.00
11	Mahendranagar	80839	4856	2666	5	2386	32.98	6.01	54.90	0.19
12	Parasan	13523	50	22	0	89	1.63	0.37	44.00	0.00
13	Pipladi (HP)	19734	541	92	19	836	4.66	2.74	17.01	20.65
14	Raikwar Bc	14564	99	5	1	54	0.34	0.68	5.05	20.00
15	Rampur Bil	15484	156	19	4	156	1.23	1.01	12.18	21.05
16	Raureli Bic	9956	64	5	0	63	0.50	0.64	7.81	0.00
17	Shankarpur	6538	28	1	0	28	0.15	0.43	3.57	0.00
18	Shreepur	18618	219	11	1	322	0.59	1.18	5.02	9.09
19	Suda	18061	365	222	23	335	12.30	2.02	60.82	10.36
20	Tribhuwan B	12507	578	7	0	252	0.56	4.62	1.21	0.00
DPHO Clinic			13861	591	43	0			4.26	7.28
Total			32197	8102	1479	9114	21.44	8.52	25.16	18.26

Source: DPHO record 2002.

There was 8120-slide positives malaria in 2002 having API of 21.44 for the district. Mahendranagar municipality had large number of positives (2666) i.e. 32.9% of the district. Krishnapur VDC stands seconds (31.04%) and Daijee stood third (12.48%), 18..26% was PF rate for district, & highest in Dodhara VDC (50%). SPR was highest for Suda (60.84/100) and second for Mahendranagar municipality (54.9/100).

Month wise malaria positives' of Kanchanpur 2002

Graph 8. Month wise positive malaria of Kanchapur 2002

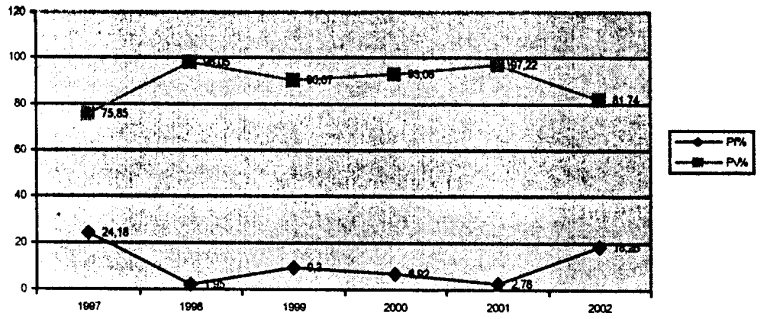


Source : DPHO Kanchanpur 2002

Month wise malaria positives in this year seem typical. It give the shape as normal distribution. Trend is gradually increases from February (44) to peak maximum in July (2758) and falls down as to a level of 30 cases in the month of December. It indicates cases increases as the rain starts in May and declines after rainy seasons in the month of September. More than 72% cases of the total took place around June to August.

Species wise Malaria in Kanchanpur 1997 - 2002 (in %)

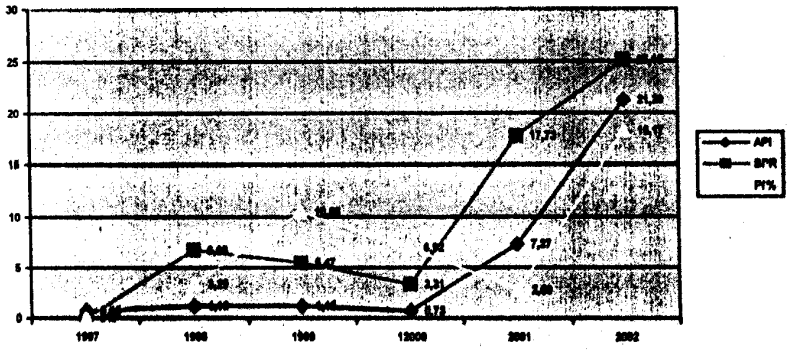
Graph 9. Species wise malaria positives in kanchanpur



Krishnapur VDC

Above table shows total annual malaria positive was 2514 (31% of total) and API of (2002) is too much high (98.81 per thousand) where as in 2001 it was 1.466 per thousand, which is assumed highest up to now recoded in Nepal. Like wise SPR (50.9%) and Pf% (32.5) is also high.

Graph 10. Malaria status of Krishnapur VDC 1997 - 2002

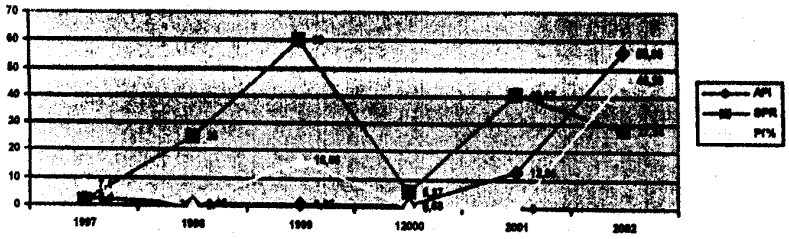


Jhalari VDC

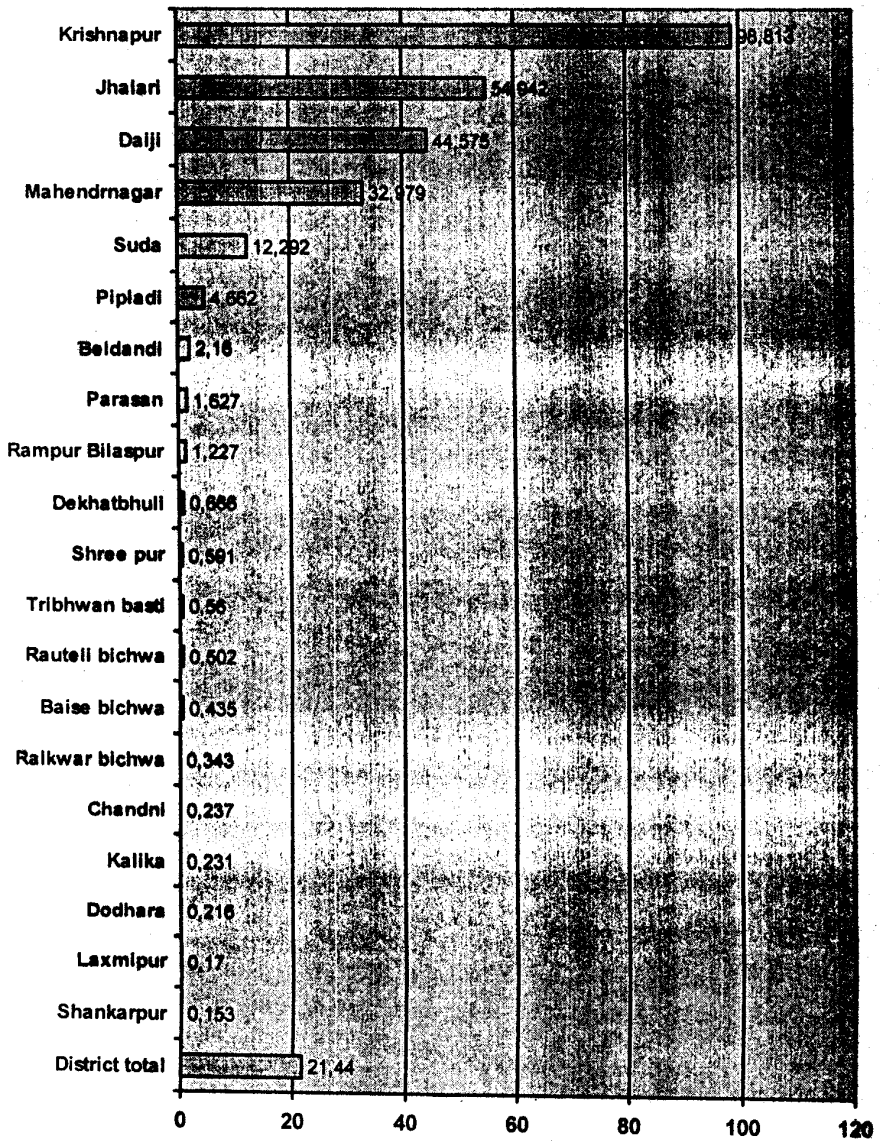
Total Malaria positive were 875 (27.95%) and API of 2002 is about four times higher than last year (2001). The PF% of the VDC is 46.28% last year.

The malaria indicator of these two VDCs were higher than district level and national level.

Graph 11. Malaria status of Jhalari VDC 1997 - 2002



Graph 12. VDC wise Annual Parasite incidence/1000 of Kanchanpur 2002



5.4.1 Malaria situation in the year 2002

To get depth information of malaria out break in the year 2002, the interviews from the participate respondents were taken. Among them, altogether 134 (62.33%) respondents were found to be suffered from malaria in the year 2002, when the malaria outbreak had occurred. 101 (75.37%) persons were found to be contacted at local SHP, 21 (15.67%) at hospital; 3(2.24%) at private clinic and 9 (6.72%) at health camp for treatment, when the initial symptoms of malaria was appeared. All the respondents had, checked their blood in respective health center. From the positive response, it was found that the proportion of falciparum malaria were more i.e. 32.83% in comparison to vivax malaria i.e. 8.21%, 58.96% respondents were unknown which types of malaria they had.

During survey selected respondents also questioned about the movement since 15 days before the first attack of malaria. Peripheral movement at local level was found in all (women had limited movement than men), but about 11% respondents had taken short term (3 – 5 days) journey of India and other districts of nation.

A total of 134 respondents, 90 (67.16%) were slept under the bed net while remaining were non – users and used nets for sometimes

According to respondents, two people in Krishnapur and one person in Jhalari were found to from malaria be died in their family.

5.4.2 Malaria situation during survey

The actual prevalence of malaria cases among the respondents was observed from the surveyed household. Before taking the blood slide, a set of questionnaire was taken from the household of suspect. Information with this regard was received in duration and type of fever, sleeping habit.

A total of 92 suspects were observed in 57 household. The entire suspect was found to be suffered from fever. The reported nature of fever among the suspects was regular, chilling, fever in time interval, sweating, fever with tremors coma etc.

Regarding the sleeping habit, 86 (93.48%) were found to be sleeping inside the house, 3(3.26%) in porch and 3 (3.26%) in roof since 1 month before. 40 (70.18%) were using bed nets while 17 (29.28%) were not.

5.4.3 Prevalence of malaria in Krishnapur VDC

During the study period, a total of 92 blood slides were collected from the study area. Out of total slides were found to be 26% while 20% and 32% were found among males and females respectively.

Table no. 17 Age and Sex wise prevalence of malaria in Krishnapur VDC

Age groups in Yrs.	Male			Female			Total		
	Total slides collected	Positive results	%	Total slides collected	Positive results	%	Total slides collected	Positive results	%
0-9	3	0	0	2	2	100	5	2	40
10-19	7	3	42.86	8	3	37.50	15	6	40
20-29	10	0	0	6	0	0	16	0	0
30-39	5	1	20.0	3	2	66.67	8	3	37.50
40-49	2	0	0	3	0	0	5	0	0
50-59	1	1	100	0	0	0	1	1	100
Total	28	5	17.86	22	7	31.82	50	12	24.0

Age groups of the studied human population were categorized into the difference of 10 years up to 50-59 years. Among the 50 examined blood slides from 1 & 3 wards of Krishnapur VDC, males were 28 and females were 22 while prevalence of malaria was found in 17.86% and 31.82% respectively.

The above table showed that highest prevalence rate among males was found to be in the age group 50-59 Yrs while in females in 0-9 Yrs. The least prevalence rate in males was in the age group 30-39 Yrs while in females it was in 10-19 Yrs.

The prevalence of malaria was not found in the age groups 0-9 Yrs, 20-29Yrs and 40-49 Yrs in males & in females it was in the age groups of 20-29 Yrs, 40-49 Yrs and 50-59 Yrs.

5.4.4 Prevalence of malaria in Jhalari VDC

Table no. 18 Age and Sex wise prevalence of malaria in Jhalari VDC

Age groups in Yrs.	Male			Female			Total		
	Total slides collected	Positive results	%	Total slides collected	Positive results	%	Total slides collected	Positive results	%
0-9	7	3	42.86	1	0	0	8	3	37.50
10-19	5	1	20.0	2	1	50.0	7	2	28.57
20-29	5	0	0.0	7	3	42.86	12	3	25.0
30-39	5	1	20.0	3	1	33.33	8	2	25.0
40-49	2	1	50.0	1	0	0	3	1	33.33
50-59	2	0	0	2	1	50.0	4	1	25.0
Total	26	6	23.08	16	6	37.50	42	12	28.57

Among the 42 examined blood slides in 2 & 4 wards of Jhalari VDC, 26 were from males and 16 were from females while the prevalence was found to be 23.08% and 37.50% in males and females respectively. The highest prevalence was found to be in the age group 40-49 yrs in males and in females. It was from the age groups of 10-19 yrs and 50-59 yrs. The least prevalence in males was reported in 10-19 yrs and 30-39 yrs while, in females it was in the age group of 30-39 yrs. In males, there was not prevalence in the age group 50-59 yrs. while in females, it was in the age groups 0-9 yrs and 40-49 yrs.

5.4.5 Ward wise positivity of Malaria

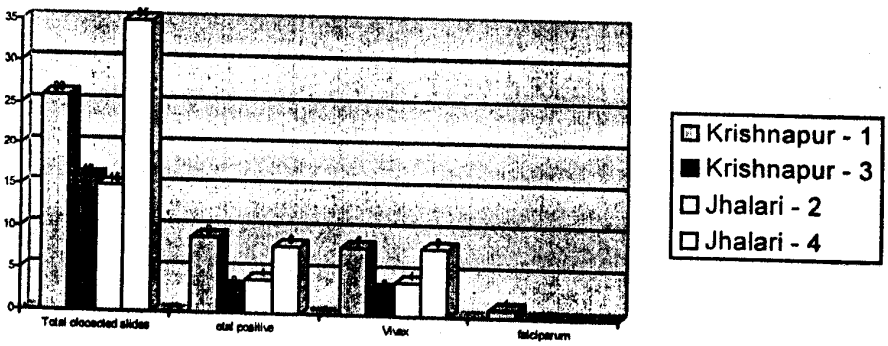
Altogether 92 blood slides were collected from the study area.

Table no. 19 ward wise positivity of malaria

Ward no	Total slides collected	Total positive	Malaria	
			Vivax	falciparum
Krishnapur – 1	26	9	8	1
Krishnapur – 3	16	3	3	–
Jhalari – 2	15	4	4	–
Jhalari – 4	35	8	8	–

Out of 92 collected blood slides, 26 were taken from Krishnapur – 1, 16 from Krishnapur – 3, 15 from Jhalari – 2 and 35 from Jhalari – 4, and the numbers of vivax malaria positive cases were 9,3, 4 & 8 respectively. Only one case of falciparum malaria was reported in Krishnapur

Graph 13. Ward wise positivity of malaria



Overall from the study, blood was examined from 92 suspects. x^2 is calculated to show the significance of malaria prevalence with respect to age & sex.

Out of 92 suspects, 24(26.08%) were malaria positive while 68(73.92%) malaria negative cases among age groups. The distribution of malaria positive of different age group was statistically not significant. (x^2(cal) = 6.003, df=5, cl=95%, x^2(+ab) = 11.1)

It claims that malaria prevalence is not depending upon the age group of individual.

Altogether 92 suspects, 54(58.64%) were males 38(41.31%) were females. Out of 54 males, 11(20.37%) males were found to be positive while positive females were 13(34.21%) out of 38.

The sex wise distribution of malaria positive cases is not statistically significant. (x^2(cal)= 1.572, df=1, cl=95%, x^2(+ab)=3.84)

From the findings, it can be conclude that malaria prevalence is not dependent on the sex and age group of individuals.

5.5 Finding of Focus group discussion

The participants of the focus group discussion in Krishanpur (1 and 3) and Jhalari (2 and 4) VDC's enumerated that they are using bed nets, filling the pits around houses to avoid water logging along with environmental cleanliness. Smoking, protective clothing as method to avoid mosquito to nuisance and personal and family protective measures.

Most of the people in both VDC's like to use bed nets. It will protect them not only by the bite of mosquito but also save them from nuisance of other insects. Respondents of focus group discussion said that most of the people could not afford for procurement of bed nets due to their poor economic.

People in both VDC's us nets during summer and rainy season at night. respondents said that malaria cannot be treated in private clinic but it can treat only in government health center.

Respondents replied the causes of malaria out break in the VDC's are following.

* Lack of sanitation – Dense forest and bush area near the settlement.
* Lack of health education – unaware about malaria.
* Water logging area with in villages, around the settlement.
* High density of mosquitos.

Participants said that health camp should be established at the particular malaria outbreak period. Every malaria suspects should not be delayed in treatment. Spraying of insecticide such as DDT timely may reduce the density of mosquitos. DPHO, NGO and INGO should be accelerated to perform these activities.

Extensive study in malaria out break must be carried out from Government sector and Projects.

Each participants of discussion group want to get rid from malaria and, their cooperation and interest were found to be positive in each malaria controlling activities.

CHAPTER- VI

Discussion

Over the 4 decades, a number of arthropod – borne infections have been recognized for the first time. Some have become of considerable public health importance, some are spreading geographically, and their incidence is increasing. The malaria has an importance recrudescence of several long known. In most instances, the appearance and the resurgence can be associated with ecological changes that have favored increased vector densities. Dam construction, irrigation and other development projects, urbanization, resettlement and deforestation have all resulted in change in vector densities that appear to have enabled the emergence of disease in foci. Greatly increased human travel had spread infections agents, introducing them into areas in which they had been hitherto to absent. It is essential to understand the factors that caused increased vector densities and hence the transmission of disease to prevent the emergence and resurgence of more diseases, as well as to serve as a basis for effective control.

Malaria is a re-emerging disease in many parts of the world. It is epidemic to over 100 countries and is responsible for approximately 110 million of clinical episodes and between 1-2 million deaths annually (Evans et al, 1994).It is estimated that 1.2 billion people out of the 1.4 billion population of the SEAR lay in malaria us areas (Refei, 1998)

Bell et al (1997) found that the history of fever alone was not a good indicator of parasitaemia. Most precautions, including bed-nets, windows screen and personal precautions were little benefits. Some et al (1997) found that there was a tendency for low percentage blood smear positive for malaria in children whose mothers were reported using mosquito nets or insecticide sprays. Yadav (1997), found ICT circulating antigens of detect falciparum malaria in blood and useful in field evolution for rapid diagnosis of malaria. Kocher et al (1997) described ignorance about the severing of malaria and lack of transportation including other environmental changes were responsible for malaria out break.

In a one and half year study Gunawardena et al (1997) found the risk of malaria to be 2.5 field higher in residents of poorly constructed house. Than those living in a house of well construction. Charles et al (1998) reported 143 women infected by *P.falciparum* in frame

Guyana. The consequences of the fetus in this area were material premonition rate is low, are serious.

Rubin (1999) found an increasing confirm cases of malaria by the use of new PCR-based method. This molecular method showed that more sensitivity and positivity than microscopy. Purnomo et al (199) reported an exceptional finding from blood side, collected in aremite area of new Gninne Island (Iran, Jaya, Indonesia). One adolescent parent was found patently co-infected with four known human malaria species. Muentener et al (1999) surveyed on heterogenicity in the type and availability of industrialized country. Ejov et al (1999) identified a total of 101 patients severe and complicated malaria by screening of the cases admitted to hospital with primary diagnosis of faclciparum malaria. Adult patients with severe malaria were 2-8 times more likely to die than the child patients. The inseeking treatment and severing of the illness before admission. In a view of this, they consider the malaria mortality could be reduced by improving peripheral facilities for management of severe malaria and providing appropriate education to communities, with out stepping up vector control activities. Mishra et al (1999) reported a case of ovule malaria in a child from Delhi urban area ecotypes caused by *P. ovale* has never been before in India. Poinsignon (1999) reported a case of *P. falciparum* infection in Paris where malaria has been considered to be eradicated since 1970. Wagbatsowa & Vgbeida (1999) carried out a cross-sectional study on 254 randomly selected household by pre designed questionnaire in Paris. Only 26.8% and 18.1% identified the adult mosquito correctly. The knowledge of the subjects on the biology of mosquitos and their role as a malaria vector was poor.

The present study aims to investigate the socio-behavior, epidemiology and causal ecological factors in relation to malaria transmission in the selected wards of Krishnapur and Jhalari VDCs. The survey was conducted among the 215 randomly selected respondents of the age above to 15 yrs.

6.1 Occupational distribution

Study shows that more respondents are engaged in agriculture farming in both VDCs (92.25%). In the study area, no one of respondent's have single occupation. Directly and indirectly, they have had working practices more than two occupation, either seasonal or time. One can work as a farmer in extra time and service holder in daytime and one student can be a farmer during farming season. It might be excepted that every occupation can get

malaria. Question is that how the exposures exceed than the others. There may be other supporting factors invade malaria. It may depend on the immunity of individual, whether they may work.

6.2 Knowledge of Malaria

Sher chand et al (1998) suggests from a hospital based study that the patients with central nervous system manifestation i.e. elephantiasis and meningitis must be meticulously diagnosed with higher index suspicion for malaria. Medical officers are trained to recognized as clinical malaria by symptom which is characterized of "vivax paroxysm", there is a needed to retain medical officer so as to detect as well as treat severe form of malaria mostly occurring with falciparum .

In our study out of 215 respondents, 205 (95.35%) had good knowledge about malaria. This may be due to their expose to the health facilities during disease course that help to enhanced their knowledge about malaria. It also shows residents are suffering time to time. The positive response of respondents regarding the symptoms of malaria as a fever & chill were 183 (89.27%) which is relatively higher. Symptoms like those that headache, in appetite and dizziness are also associated with the fever. According to study 202 (93.95%) said only human beings are susceptible host of malaria. The negative response regarding cattle, human being and cattle suffered might be cause of annoying habit of mosquito like other dipterians in their felling.

The 181 (84.19%) respondents had knowledge in suffering to all stage of life by malaria. Although vulnerability was supported toward other stages but it is own their rights which stage could be affected during the malaria outbreak period in their family.

As in many findings of EDCD & VBDRTC the highest prevalence of malaria is reported from terai region of the nation where there is suitable environment for breeding completion of life cycles for mosquito vector and, availability of host. This is similar as our findings.

6.3 Staying habit

Habits of staying (down to dusk) during summer season wear also part of our study. 65.58% exposure rate among the out side habited is higher than 30.42% exposés rate inside staying. In calculation of protective measures, out of 141 respondents, 51.06% were using

full clothing and rest wear either half of racked clothing. Long trousers, long sleeved clothing and socks thick energy to stop mosquito betting a should be worn outside after sunset, but it may be hard to follow such advice in a hot climate high colors are less extractive to mosquitos. This may be due to, important recall bias, small sample size. It may have other supporting factors.

6.4 Medical treatment and mosquito vector

According to Banerjee (1991), the mortality of cases were confirmed to forest, Sivalik-foot hills and inner terai of Nepal. Transmission was persistent and proportion of *p. falciparum* was high. The fluvi-ecosystem had Sub-ecosystem viz Churia growth ecosystem, paddy-ecosystem and revering ecosystem where malaria transmission is influenced by socio-cultural, customs and vocational and, occupational needs of the population. The vectors responsible for this transmission of malaria were *anopheles fluviatilis*, *anopheles maculatus* and *anopheles annularis*. Similarly, according to Sher chand (1996) found out that people incorporate modern and traditional elements into their concepts of disease and treatment strategies, poor socio-economic status, low literacy rate, poor health service management and absent of voluntary agencies are major obstacles to community informant in malaria, although it was generally recognized as a significant disease. The significant of stagnant water as a breeding ground was not widely recognized.

These literatures are showing similar to our findings although the specific vector biology is not studied but study done by EDCD & VBRDTC on the same area of our study shows the presence of above *anopheline sps*. Similarly, peri-domiciliary environment of the household of all total 215 respondent's was observed in respect to peri-domiciliary surface of water collection, catchments areas and presence of bushes around the household as they increase mosquitoes breeding. In the average, finding from unsatisfactory environment was higher 60.92% than satisfactory environment 39.08% which suggests that unsatisfactory prei-domiciliary environment is more risk, of malaria direct influence on vector multiplication. The exposés rates of malaria are reported more in unsatisfactory environment, poor socio-economic, paddy-ecosystem, socio- cultural etc as out findings.

6.5 Bed nets

The protective measures (which keeps away mosquitoes) bed net user and other sources 181 (93.30%) respondents were using bed nets out of 194 either directly or indirectly. Further, the number of family members in the household was compared with the number of bed nets in the house. The average number of family member in one house was 7. The average number of bed nets in a house was 4. This puts a question mark against proper use of bed net. This is an encouraging to policy makers to introduce bed net in a community as the intervention for improved vector control. The other favorable factors for malaria out break might be household with bed nets and who do not use bed nets year round. In our study 91.15% house hold were found with bed net and 8.85% were not using it year around. The non-users could be at risk of malaria expose than the household with bed nets.

6.6 Animal Shed

When we observed the animal shed, we categorized shed types of attached, distance by 20ft and 20ft from human dwellings. In some houses human dwelling and animal sheds were sharing at one the distance of animal shed by <20ft from human dwelling were more than the other criteria of observation. In several studies animal shed far from human dwelling is safer than nearer. The excreta of cattle if not managed property favour to make environment for mosquito breeding.

6.7 Prevalence study

Kanchanpur district is one of the border district among 26 districts of Nepal. Ecology is characterized by foothills, forest fringe, riverbeds & irrigation canals conductive for malaria transmission (The wellness site conditioned communicable diseases). This district is stratified as (i) Moderate receptivity with cultivated established region. whole population of the district is at risk. It has history of malaria endemic and in 1985 massive epidemic (5937 cases with 35% pf) in 1996 an episode of focal out breaks in parasan health post (south part) 28% positive were found. The nature of population is migratory from hill, other inner terai, and aboard (India) south and west border is open to flow people without international limitation. Due to more fertile and circuitous field, people from hills and mountains usually settled here with low or no immunity against malaria. As malaria is disease of poor, poorer people become the victim of malaria.

6.8 Annual parasite incidence

API is indicator to measure the malaria. API of year 2002 is 21.44/1000, which is nearly 3 times high of the year 2001 (7.341/1000). It is also higher than national API (0.36/1000) of 2001.6 years trends of the district is in increasing order. It is increasing year to year.

6.9 Slide positive rate

SPR is 25.16% i.e. 50% increased from year 2001 (17.90%). National SPR for 2001 was 5.24%, is too much less than district SPR, Increasing of SPR indicates, there were more positive cases undiagnosed in the community.

6.10 Plasmodium falciparum percentage

PF percentage is 18.26%, which are nearly 9 times more than 2001 (2.78%) of district and more than national Pf % (5.24%). There were three deaths (2 in Krishnapur and 1 in Jhalari) recorded in DPHO register for 2002.

In the study of Sher chand et al (1999) for comparing to the dipstick, parasite-f test to thick blood film in rural areas of southern Nepal. The test is easy to perform in field condition, the unpredictable cross-reactivity with *P. vivax* may render is difficult to use. In a situation where *P. vivax* is dominant species. However, the possibility of diagnosing of falciparum malaria and the positive of printing the development of severe malaria out weight this advantage.

Similarly Bista and BanerJee (2000) presented some data of *P. falciparum* to chloroquine a resistance of 63.2% was recorded to chloroquine by invitro test. No resistance was found to mefloquine and sulfadoxine/pyrimethamine. However in Kanchanpur and Nawalparasi outbreak of *P.Falciparum* (1996 and 1997), therapeutic efficacy monitoring have revealed late treatment failures among the recipients of S/P treatment. The current first line treatment of microscopically diagnosed *P.falciparum* is S/P in Nepal.

Our study shows out of 92 suspects, 24 were malaria positives. The percentage of malaria positive cases were 95.83% PV and 4.17% P.F.. The distribution of malaria cases among the different age group was statistically not significant ($x^2_{(cal)}$ = 6.003, df = 5, d = 95%, x^2+ab = 11.1.)

Similarly, out of 54 males and 38 females, 20.37% males & 34.24% females were found to be positives. The sex-wise prevalence of malaria positive cases is also not statistically significant (x^2_{cal} = 1.572, cl = 95% df = 1, $x^2_{(+ab)}$ = 3.84).

Chapter- VII

Summary and Recommendation

7.1 Summary

Socio- behavioural study was conducted on malaria outbreak wards of Jhalari and Krishnapur VDC (in the year 2002) to find out the causes of outbreak, prevalence of malaria and ecological condition of study area during April. 2003 to November 2003.

Based on finding and discussion it can be conduced that the prevalence of slide positive malaria was found to be 26.09% out of 92 examined blood slides. All of slides were examined by Giemsa Staining technique, the reported prevalence was 26.09% 20.37% (n=54) among males and 34.21% (n=38) among females.

From the observation of available data of DPHO, Kanchanpur, the situation of malaria in the district was some at same up to 2001 and in 2002 the situation became somewhat heaving worsen. Further, the record shows highly populated areas like Krishnapur, Jhalari, Daijee, Suda VDCs and Mahendranagar municipality were higher epidemic communities for malaria. These communities are closely linked to district head quarter adjoining with forest fringe, forest cultivated fertile land, irrigation projects and easily accessible border to India.

Study shows exposure-limiting activities like full clothing, staying indoor during down to dusk and sleeping indoor may reduce the malaria outbreak.

The survey result also revealed that out of 215 respondents, 92.25% were engaged on agriculture. Regarding the treatment pattern of malaria 81.94% were found to be treating at Government Health institutions and remaining 10.85%, 3.30% and 0.94% were depended on sorcerors (Dhami and Jhakri), Others (wizard Indian Hospital/Clinic) and private clinics respectively for treatment when became sick.

Household with bed net were 91.15% on an every the average member in on house was 7. The average number of bed net in a house was 4.

Out of 207 animal shed, 110 (53.14% were built less than the distance of 20 ft. From human dwelling 3.86% had no distance and, shed and human dwelling were common in

3.72% houses. Out of 215 respondents in average 60.92% had unsatisfactory peri-domciliary environment while 39.08% had satisfactory peri domiciliary environment.

Study shows, there is not any clear out factor which cause malaria out break in the communities. It means not only one factor is responsible to support malaria out break. There may be linked multi factor to occur malaria. Among them vector bionomics seems to be needed for further in detail. It might have change it original nature of biting, resting, breeding and proper blood feeding.

7.2 Recommendation

Taking the advantage of field experience, conclusion of this study suggests the following recommendations.

1) Mass awareness programs should be focused on personal protection measures to be launched with community environment.
2) As the newly trained entomologist, including the entomological field technician and vector control assistant are not found to identify specific vector biology. It is recommended that the training course on species identification of mosquitoes and their larvae should be provided by EDCD/VBRDTC.
3) Under reporting of malaria cases may lead to under reporting of malaria out breaks including earlier stages of major in a view of this potentially dangerous effects should be continued to expedite an early warning system in epidemic prone areas.
4) Malaria unit in district Health office should be strengthened the particularly in the high risk malarious areas.
5) Regular socio-behaviour and epidemiological study in Malaria should be conducted throughout the malaria-affected areas of the country, including other parts of Kanchanpur district.
6) Malaria cases are mostly concentrated in less accessible, poorer areas, often without any health facility nearby. The malaria cases in such areas may not be benefited from the malaria control program of the health services unless there is a system of supervision, monitoring and evaluation activities by all the level of health services. Therefore a

sustainable system of supervision, monitoring and evaluation should be established by department of Health services particularly in the most malarious district of the country.

7) Appropriate insecticide spraying should be conducted to reduce the vector densities as well as transmission. Focal spraying should be done in the areas where if cases prevalent. Special attention should be given during rainy season.

8) It may help to prevent malaria if the distance of animal shed kept at a distance more than 20 ft from the human dwelling. For this awareness program should be conducted in the collaboration with VDC/DDC.

9) An awareness program to keep peri-domiciliary environment may be helpful in reducing malaria cases. The district public Health office, together with environment related organization could make the people aware of these things.

10) Most of the people are illiterate so community health education about malaria should be provided in all malarious areas.

This study has been conducted in Jhalari-2, 4 & Krishnapur-1,3- wards of Kanchanpur district. The above recommendations are based on the study. Finding out the single study may not be sufficient in making decision regarding the process of implementation since the situation of the district may be different There fore, it is advised to conduct further more studies in other malarious areas of the districts including other areas of Kanchanpur district.

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Annex: 1

Generated Random Numbers for Selection of Household

Site – Krishnapur – 1 Total Household – 735, Identified Household with Numbers 1 to 74

Random Numbers

871	692	078	413	125	836	174	769	**278**	477
755	552	565	787	681	058	470	188	**062**	834
728	352	255	678	322	201	872	636	**488**	905
771	006	710	888	061	333	722	822	**103**	415
508	627	505	299	333	476	126	282	**591**	791
077	910	106	244	716	980	834	757	**653**	504
007	500	747	886	112	898	565	881	**620**	095
374	300	589	317	359	003	978	634	**818**	274
207	154	298	047	949	239	595	907	**125**	496
756	089	908	786	079	076	719	217	**109**	604
231	149	645	655	364	191	732	466	**292**	203

Household corresponding to the numbers

692	078	413	125	174	278	477	552	565	681	**058**	470
188	062	728	352	255	678	332	201	636	488	**006**	710
061	333	722	103	415	508	627	505	299	303	**476**	126
282	591	077	106	244	716	**653**	**504**	007	500	**112**	620
095	374	300	589	317	359	003	634	274	207	**154**	298
047	239	595	125	496	089	079	076	719	217	**109**	604
231	149	645									

Site – Krishnapur – 3, Total Household – 350, Identified Household with Numbers 1 to 35

Random Numbers

559	132	277	412	117	799	991	854	070	589	**314**	347
542	673	108	189	127	472	480	926	189	659	**791**	356
714	156	650	525	934	134	916	731	335	016	**699**	519
652	473	357	687	868	426	501	082	217	049	**099**	601
185	763	933	190	505	239	689	846	162	400	**868**	617

391	417	330	799	675	713	183	938	749	958	**786**	
833	598	076	751	530	455	238	935	225	805	**866**	
478	765	384	631	649	648	174	450	149	021	**410**	
512	806	179	577	222	729	670	409	257	278	**292**	890
539	063	090	255	240	942	361	989	781	026	**653**	824

Household corresponding to Numbers

132	277	117	070	314	347	108	189	127	156	**134**	335	016
082	217	049	099	185	190	239	162	330	183	**076**	238	225
174	149	021	179	222	257	278	292	063				

Random Numbers

Site – Jhalari –2 Total Household – 530, Identified Household with Numbers 1 to 53

041	544	338	715	631	368	832	063	745	814	**437**	962	618
053	012	710	734	509	666	854	824	853	758	**190**	883	006
898	766	135	140	945	877	068	678	009	072	**416**	291	449
146	163	901	874	147	543	680	144	372	040	**050**	368	
367	394	682	906	930	582	499	366	107	842	**673**	609	
095	657	625	743	741	763	027	128	542	143	**801**	374	
645	031	119	339	346	913	403	133	193	522	**324**	116	
992	843	805	897	761	111	018	335	825	809	**384**	539	
723	672	575	870	251	685	513	936	445	081	**370**	596	

House hold corresponding to Numbers

041	338	368	063	437	053	012	509	190	006	**135**
140	068	009	072	416	291	449	146	163	147	**144**
372	040	050	368	367	394	499	366	107	095	**027**
128	143	374	031	119	339	346	403	133	193	**522**
324	116	111	018	335	384	251	513	455		

Site – Jhalari – 4 Total Household – 535 Identified household with Numbers : 1 to 53

488	809	820	908	501	251	904	703	355	897	009
602	722	106	931	587	524	488	717	894	932	903
665	006	368	459	320	658	504	516	481	835	263
683	193	770	815	821	753	949	583	037	710	105
239	691	858	223	705	394	246	538	152	004	170
533	002	630	177	943	928	633	064	752	850	
620	878	196	942	153	415	915	757	624	239	
723	171	569	339	098	422	699	362	087	744	
185	167	988	622	449	864	347	790	163	812	
960	232	250	620	875	183	881	148	399	128	
477	505	048	800	711	050	650	183	505	393	

Household correspond to numbers

488	501	251	355	009	106	524	06	368	459
320	504	516	481	263	193	037	105	239	223
394	246	152	004	170	533	002	177	064	196
153	415	239	171	339	098	422	362	087	185
167	449	347	163	232	250	183	148	399	128
477	505	048							

Annex – 2

Questionnaire for local people survey

Name of respondent: Sex: Age:
VDC: Ward no:
Total family members: male female
Description of family members

Part – I

Knowledge, Attitude, Awareness and Practices (KAAP) regarding malaria

1) Do you have knowledge about malaria ? a) Yes b) No
If yes, what are the symptoms of malaria ?
a) Chill with fever b) Headache c) An appetite d) Dizziness
2) Which stage is more vulnerable ?
a) Child b) adult c) Old d) All of above
3) In which region prevalence of malaria is more ?
a) Himalayan b) Hill c) Terai d) All of above
If in terai, why ?
a) Suitable environment for mosquito breeding b) dense forest c) both
4) What is the situation of malaria at present in comparison to the past ?
a) Higher than the past b) Lower than the past c) Unknown
5) Do you stay outside the house till late evening in summer ?
a) Yes b) No
If yes, Do you wear protective clothes
a)Yes b) No
If yes, Do mosquitoes bite ?
a) Yes b) No
6) Is Malaria curable ? a) Yes b) No
If yes, from where it can be treated ?
a) Govt. Health Institution b) Private clinic
c) Traditional healers (DHAMI and JHAKRI : sorcerers) d) Others .....
7) What is tested for malaria confirmation ?
a) blood b) sputum c) Unknown
8) What causes malaria ?
a) Mosquito bite b) Polluted water c) Contact with patient
d) Unknown
9) Do all mosquito transmit malaria ?
a) Yes b) No c) Unknown
10) In which time and season mosquito become active ?
a) Evening b) Dawn c) Night d) Midnight
a) Summer b) rainy c) Both a & b d) Midnight
11) Where do mosquitos lay eggs?
a) Fresh water b) Polluted water c) Running water d) All of above
12) (i) Did any one of your family suffer form malaria in the year 2002 ?

a) Yes b) No

If yes go on A of part IV

(ii) Does any one in your family suffer from malaria now a days?

a) Yes b) No

If yes go on B of part IV

Part - II

Preventative and sanitary practices regarding malaria.

1) Have you followed any measures for protection?

a) Yes b) No

If yes, which measure are you following

a) Use bed net b) Sanitation c) Smoking **d) a & c**

e) Bed net, chemical spray & smoking f) Above all

2) Do you use all the bed nets you have?

a) Yes b) No

If no, why?

a) Habitually unused b) Unnuisance from mosquitos c) Uneasy while sleeping

3) How do you manage to dirt?

a) Diging up in trench b) Burn c) Making heap d) None of above

4) Do you have toilet?

a) Yes b) No

If no, where do you go for toilet?

a) Field b) Drain c) Garden d) Stream side

Part – III

Observation

1) Number of houses

Crude Concrete

2) Net on windows and doors a) Present b) Absent

3) Number of sheds

Crude Concrete

4) Total number of beds

Bed nets over the bed a) Yes b) No

5) Shed is a part from the house or not a) Yes b) No

If apart, how far is it? about ... ft.

6) Peri-domicillary environment of the house.

1. Surface water collection around the house
2. Presence of mosquito promiting bushes
   a) Satisfactory (If a & b are negative)
   b) Unsatisfactory (If one is positive)

Part IV(A)

Malaria situation in the year 2002

(Answer this part if there is suffering case in 2002)

Name of respondent

1) Did you suffer from malaria? a) Yes b) No

If yes, where did you contact for treatment?

....

2) Did you check the blood?

a) Yes b) No

If yes, which type of malaria you have?

a) Vivax b) Falciparum c) Unknown

3) Did you go outside from your house since 15 days before the first attack?

a) Yes b) No

If yes, specify

.....

4) Did you sleep under the bed net?

a) Yes b) No c) Sometimes

5) Did anybody die in your family from malaria?

a) Yes b) No

Part IV(B)

Present status of suspects

(Answer this part if there is suffering case at present)

Name of respondent Sex Age

No. of other suspects (If present)

1) How long the fever has gone?

.....

2) How the fever has come?

a) Regular b) With interval c) Chill with fever

d) Fever with tremors e) Others (specify)

3) Where have you been sleeping since 1 month?

.....

4) Are you using bed net while sleeping ? a) Yes b) No

5) Have you checked blood? a) Yes b) No

If yes, is it malaria? a) Yes b) No

Does the fever reappear ? a) Yes b) No

That is all I wish to ask you. Thank you very much for your help. Is there any thing you would like to ask of me now?

Annex- 3

Questionnaire guidelines for focus group discussion

What methods are you using to avoid mosquito nuisance?

How do you protect and your family from mosquito?

Do you like to use bed nets? If yes why?

When do you usually use nets? Frequently of use ?

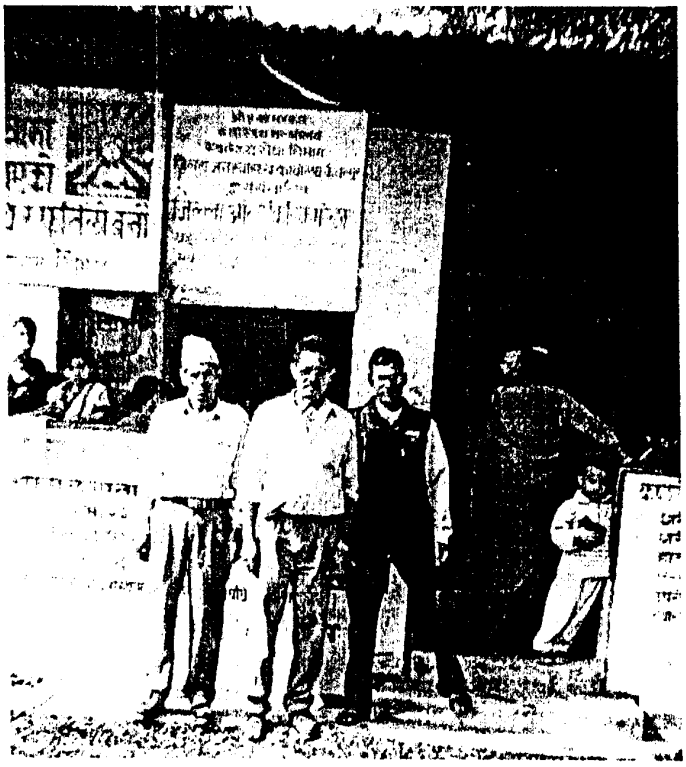
What is the environment of house around?

What measures should be implemented by government for malaria control? in your opinion.

What were the causes of malaria out break in the year 2002 here ?

ANNEX-4

Photographs



Main Malaria clinic and staff of DPHO, Kanchanpur.

Enumerator taking interview with local people.

Enumerator taking interview with Malaria suspects.

Condition of house & cow shed.

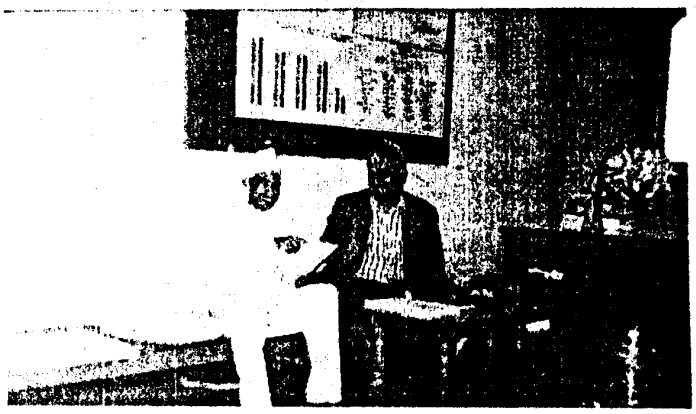
FGD participants in Krishnapur - 1.

FGD paricipants in Krishnapur - 3.

FGD participants in Jhalari-2.

FGD participants in Jhalari-4.

Microscopic examination of slide confirm by lab assistant.



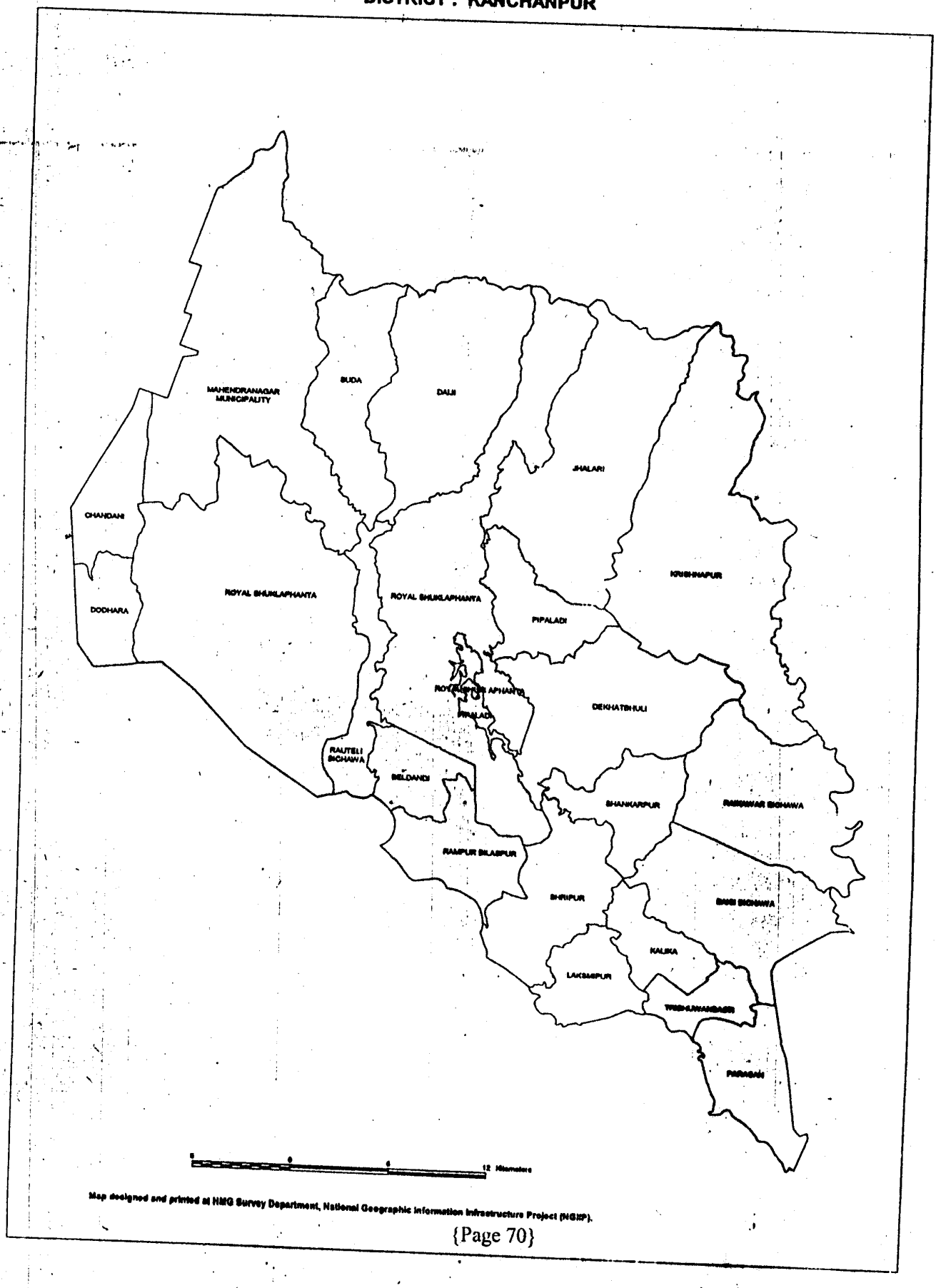
Interaction with District Public Health Officer.

Staining blood slides.

Health care seeking centre of Krishnapur VDC.

Health care seeking centre of Jhalari VDC.

DISTRICT : KANCHANPUR



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