CHAPTER I
INTRODUCTION

1 Introduction

An organism living on or in another living organism (host) part or all of its nutrients from the host is called as parasite or, parasites are living organisms which receive nourishment and shelter from another organism. Parasitism is defined as an intimate and obligatory relationship between two heterospecific organism during which parasites are metabolically dependent on host (Cheng, 1999). The host provides food and shelter for parasite without compensation (Craig and Faust, 1943). In most cases parasites damage or cause disease in the host. The parasites remain closely associated with their hosts biologically and ecologically. No one is free from parasite in any country. The intestinal parasites of man are cosmopolitan in distribution.

Parasites are easily transmitted from individuals to individual i.e., animal to animal, animal to man and man to man through a wide range of means.

The intestinal parasites of man are cosmopolitan in distribution, posing serious health problem in the developing countries where disease ignorance and poverty are interlocked. Owning to their ubiquity and despite their high rate of infection in these regions, physician and public health authorities show little interest in their control (WHO, 1981). In Nepal, particularly in rural area, open air defecation is common that facilitates parasites to invade individual. The risk of infection of such parasite is increased due to conservative traditions and cultural behaviours.

1.1 Brahman Community

Hindu is the religion of Brahman community with mother tongue Nepali. They follow arrange marriage. In the survey, all the respondents were found to be dependent on aato, rice, pluse, potato and green sag as daily diet. Also they are be found to be habituated of chewing tobacco. Various surname of Brahman community are Neupane, Paudel, Gyawali, etc.

1.2 Magar Community

Mostly Hindu is the religion of Magar community. But some people are Christian in Magar community. In the survey all the respondents were found to be relying on aato, pluse, rice, potato, and green sag as daily diet. They use buff, pork, chicken, pigeon, etc. Also they are found to be habituated taking alcoholic drink, smoking, tobacco, etc. Smoking is regarded as the most essential for Magar community, after taking dinner or working or at the exhausted time they smoke; whenever they like smoking is pretending for resting at the time of land. They usually use bhagai marriage. Various surnames of Magar community are Dangal, Aslami, Singali, Thapa, Kala, Regami, Khasu, Gaha etc. Mother tongue of Magar community is 97.72% Nepali and 2.18% Magar language.

1.3 Intestinal parasites

The intestinal parasites are those parasites which inhabit the intestinal region of the host and get nourishment from there. The intestinal parasites are generally the Protozoan and Helminthes.

1.3.1 Intestinal Protozoan parasites

Protozoan parasites consists of a single cell like unit which is morphologically and functionally complete (Chatterjee, 2001). They

cause serious health problems for human. Some common intestinal protozoan parasites are: *Entamoeba histolytica*, *Giardia lamblia*, *Entamoeba coli*, *Isospora*, *Trichomonas hominis, Balantidium coli, Cyclospora, Cryptosporidium,* etc.

1.3.1.1 *Entamoeba* and Amoebiasis

Amoebiasis is second leading cause of death from parasitic disease world wide (Stanley, 2003). In developing world, amoebiasis causes some 450 million infections per annum about 50 million incidents and about 100,000 deaths (Symth, 1996). *Entamoeba histolytica* is a potent pathogen secreting proteinous histolysis which dissolves host tissues. Killing host cells on contact and engulfing RBCs *Entamoeba histolytica* lives in the mucous and sub-mucous layers of the large intestine of human. It has 3 stages in its life cycle i.e. Trophozoites, Precystic and Cystic stage. Trophozoite is irregular and not fix in shape and size ranges 18-40 μm in diameter. It is round or slightly ovoid in shape. It is transitory stage. Cystic stage is round and surrounded by highly retractile membrane, cystic wall. Size varies from 5 to 20 μm. Initially the cyst is a nucleate but the mature cyst is quardrinucleate, which is infective stage. The transmission of the parasite is through faecal oral route. Infection of *E.histolytica* commonly results into amoebiasis characterized by abdominal pain, mucus in stool, weakness, dehydration, malaise, loss of appetite, etc.

1.3.1.2 *Giardia* and Giardiasis

Giardia lamblia is found world wide. It inhabits the small intestine of man. The trophozoites and cysts are present in the duodenum, jejunum and upper ileum. It occurs in two stages trophozoite and cyst. Trophozoite is a pear shaped disk with a broad rounded anterior end and a

tapering posterior end. It measures 9μm to 21μm in length. Cyst is the infective stage of the parasite. It is oval or ellipsoidal in shape and measures 8μm -12μm in length. A thick cyst wall surrounds the cyst. It consists of 4 nuclei. No intermediate host is required to complete it life cycle. Giardiasis is caused by *G.lamblia*. Giardiasis is characterized by disturbance of intestinal functions, diarrhoea, leading to mal-absorption of fats and carbohydrates.

1.3.2 Intestinal Helminthes Parasites

The World Health Organization (WHO) estimated that more than one billion people are chronically infected with intestinal helminthes (WHO, 1998).

The helminthes parasites are multicellular, bilaterally symmetrical, triploblastic animals. They belong to the Phyla Platyhelminthes and Nemathelminthes. They are endoparasites of intestine and blood of human body and cause different diseases. Most helminthes parasites come under the heading of intestinal infection. Many parasitic helminthes require one or more intermediate hosts.

The aim of present study is to record the prevalence of *Hymenolepis sps, Ascaris lumbricoides, Trichuris trichiura, Hookworm, Strongyloides stercoralis, Enterobius vermicularis, Taenia sps,* in the study area.

1.3.2.1 *Ancylostoma* and Ancylostomiasis

Ancyclostomiasis is caused by *Ancylostoma duodenale*. It is commonly called the hook worm. Hook worm must be classified as one of the most destructive human helminth parasites with estimation of some 900 million cases world wide (Crompton, 1989). The adult worm lives in the

intestine of man, particularly in the jejunum less often in the duodenum and rarely in the ileum. The adult worms are some what cylindrical in shape, are slightly constricted interiorly and have a cervical curvature. The cervical curvature gave its name Hook worm. The large conspicuous buccal capsule is lined with a hard substance provided with six teeth, four hooks on ventral side and two knob like on dorsal side. The male measures 8mm-11×0.4mm while female is 10-12mm×0.6mm (Craig and Faust 1943). The male bears copulatory bursa at posterior end. Fertilized eggs when discharged are usually unsegmented and ovoid or elliptical, with blunt rounded ends, and have an average measurement of 60/40 microns. A single female worm can lay 25,000 to 30,000 eggs per day. Adult worm in the human intestine, particularly in the jejunum, less often in the duodenum and rarely in the ileum, has been estimated to live about 3-4 years. They suck blood, lymph; bites on mucous membrane and tissue fluid from the lining of the intestinal wall. The characteristic symptoms of Ancyclostomiasis are gastrointestinal disturbances, anemia and nervous disorders. Patients appear pale they complain of dizziness, ringing in the ears and headache, nausea and vomiting are frequent.

1.3.2.2 *Trichiuris* and Trichuriasis

Trichuris trichiura commonly called Whip worm. Trichuriasis is caused by *Trichiuris trichuria*. It is found world wide. The adult worm lives in the large intestine of man particularly the caecum and also in the vermiform appendix. The adult worm resembles a whip like structure. The anterior 3-5th is very thin and hair like and posterior 2-5th is thick and stout. The male measures 3 to 4 cm in length. Its caudal extremity is coiled ventrally. The female measures 4 to 5 cm in length. The caudel extremity is either shaped like a "comma" or an arc. The worm is oviparous. The eggs are colour brown, barrel-shaped with mucous plug at

each pole. No intermediate host is required to complete its life cycle. Man is infected when the embryonated eggs are swallowed with food or water.

In heavy infestations, the patient often complains of abdominal pain, mucous diarrhoea, often with blood streaked stool, loss of weight, and appendicitis, Prolapse of rectum, etc.

1.3.2.3 *Hymenolepis* and Hymenolepiasis

Hymenolepis nana is commonly called as dwarf tapeworm. Hymenolepiasis is caused by *Hymenolepis nana*. It is found cosmopolitan. The adult worm lives in the small intestine of man. It is also found in rodents, especially in mice and rats. It is small and thread like worm measuring 10 cm to 40 cm in length. It consists of a scolex a long neck, and nearly 200 proglottids. Scolex is globular and has 4 suckes and a short rostellum armed with 20 to 40 hooklets. The strobila contains nearly 200 proglottids or segments. Eggs are colourless, oval or spherical in shape with two distinct membranes. The outer membrane is thin and colourless and inner embryophore encloses an oncosphere with pairs of hooklets. The infection occurs through ingestion of food contaminated with eggs of *H. nana*.

Hymemolepiasis occurs more commonly in children. Most infections are asymptomatic. In heavy infections, symptomatology include irritability, diarrhoea and abdominal pain, sleep disorders, anal pruritus and nasal pruritus. Rare symptoms includes anorexia, nausea and vomiting.

1.3.3.4 *Ascaris* and Ascariasis

A. lumbricoides, commonly called as round worm, is the most common intestinal nematode of the human. It is caused by *A. lumbricoides.* The adult worms live in the small intestine, particularly in the jejunum

and middle part of the ileum. They are elongated, cylindrical with tapering ends.

The anterior end is thinner and more attenuated than the posterior end. The worm has a small mouth which is surrounded by 3 lips. The male measures about 15 to 25 cm in length. The tail of the male is curved. The genital pore opens into the cloaca. The female measures about 25 to 40 cm in length. Fertilized eggs are round and oval in shape and 60×75 μm in length by 40 to 50 μm in breadth. Eggs are surrounded by thick smooth translucent shell with an outer albuminous coat. In heavy infection shows symptoms such as fever, coughing, blood- tinged sputum etc. become evident. Abdominal discomfort, vitamin A deficiency, allergic manifestation and intestinal obstruction, Jaundice, ulcers, appendicitis, liver abscess are the symptoms which become evident in long times.

1.3.3.5 *Enterobius* and Enterobiasis

Enterobius vermicularis is commonly known as thread worm or pinworm or seatworm. It is cosmopolitan in distribution, being found all over the world. The adult worms live in the caecum and vermiform appendix of human beings. It is small and white in colour. It is more or less spindle-shaped and resembles a short piece of thread. Sexes are separate. In both male and female, a pair of cervical alae is present at the anterior extremity. The male measures 2 to 4 mm in length. The posterior third of the body is curved and sharply truncated. The female measures about 8 to 12 mm in length. The posterior extremity is straight and drawn out into a long, tapering and finely pointed tail. The eggs are colourless, i.e. not bile stained. It is surrounded by transparent shell. It measures about 50 to 60 μm in length No intermediate host is required. Enterobiasis is caused by

Enterobius vermicularis . It is irritation by the gravid females around the anus. The migrating females often enter into the female genital tract and female urethra causing inflammation. These worms may even enter into the peritoneal cavity through the fallopian tubes.

1.3.3.6 *Strongyloides* and Strongyloidiasis

Strongyloides stercoralis is found world-wide. It is also called as the dwarf thread worm. The parasitic female inhabits the mucosa of the small intestine, especially duodenum and upper jejunum of man. The parasitic female measures 2.5 mm in length. Males are shorter and broader than females. Eggs are small, oval, transparent and very thin shelled and contain larva ready to hatch. Infection occurs by the entry of filariform larvae which penetrate directly through skin when comming in contact with soil. The infection with these parasites can also be transmitted via breast milk (stephension *et al.*, 2000). If the parasite invade lung it produces symptoms like pneumonia i.e., fever, cough, blood in sputum etc. when established inside intestine produce symptoms such as abdominal pain, anorexia, vomiting, nausea, diarrhoea with mucous, blood and emaciation.

CHAPTER II

OBJECTIVES

2.1 General Objective

The general objective of the study is to determine prevalence of intestinal parasites among Brahman and Magar Community at Rimuwa VDC of Gulmi district.

2.2 Specific Objectives

a) To know the health and education status of the community in the study area.
b) To study the prevalence of intestinal parasites in Brahman and Magar of different age group.
c) To compare intestinal parasites infection rate among Brahman and Magar communities.
d) To make the people of study area aware of parasites and their effect in human health.
e) To explore the specific parasite of Brahman and Magar
f) To co-related parasitic infections in relation to the socio-economical and environmental aspects.

2.3 Significance of the Study

This study will be help to know the relationship in relation to parasitic prevalence between Brahman and Magar community and Rimuwa VDC. It helps us to know the intestinal parasitic infection among people of study area. It helps the policymaker and other NGOs, INGOs, or any interested researches to continue their work for welfare of the community.

CHAPTER III
MATERIALS AND METHODS

3.1 Study Area and Population

Gulmi is famous for coffee and beautiful place in hill of Nepal. Administratively district is divided into 79 VDCs and no municipality. The total population of Gulmi is 2,96,654 in which 1,33,771 are males and 1,62,883 are females. Gulmi occupies 1,149 sq. km. area. The total Brahman population in Nepal is 2896477 and the total Magar population in Nepal is 1622427. The total population of Rimuwa VDC is 2710 in which 1455 are Magar and 483 are Brahman and remaining are other casts (CBS Census, 2001). The total population of Rimuwa VDC is 2,710 in which 1,148 are males and 1,562 are females. The out of total population of Rimuwa VDC, 2,651 speak mother tongue Nepal, 58 speak mother tongue Magar and 1 other (Central Bureau of Statistics, Census, 2001).

The study population was selected in the survey of Rimuwa VDC. The present study was carried out among Brahman community of ward No. 9 and Magar community of ward no. 5 and 8.

3.2 Sample Size

Stool samples were randomly collected and examined from 250 people. Among them 100 samples were from ward no. 9 which is inhabited by Brahman community. 100 and 50 samples were collected respectively from ward no. 5 and 8 which is inhabited by Magar community. Total 250 samples were taken from Rimuwa VDC.

3.3 Survey Study

The study area was visited and the drinking waters condition, the sanitation measure, poverty, hygiene and educational condition and activity in their free time were noticed. The meetings with different personal were conducted to get various information about the study area as well as the various traditions and activities of the people. The type and condition of the latrine and the source of water supply were observed very carefully.

3.4 Questionnaires

During stool sample collection an interview was taken from the people of Rimuwa VDC. The questionnaire was translated in Nepali Language to take proper information.

3.5 Sample Collection

They were oriented to collect 5 gm stool from initial, middle and end portion of stool early in the morning with the help of clean vial provided with clean stick. They were instructed to avoid contamination of stool with urine or soil. Immediately after collection 2.5% $K_2Cr_2O_7$ solution was put in the vials containing stool for preservation of the parasite present in the stool. Vials were kept in the ice box for safe transportation upto the laboratory in health center of Johang for further processing that is slide preparation and identification.

3.6 Materials

3.6.1 Equipments

1. Compound microscope
2. Refrigerator
3. Sample vials
8. Cover slip
9. Glass Slides
10. Applicator Sticks

4. Hot air oven
5. Cotton
6. Dustbin Filter Paper
7. Forceps
11. Gloves
12. Trays
13. Mask

3.6.2 Chemicals

1. Normal Saline
2. 2.5% $K_2Cr_2O_7$
3. Detol Soap
4. Iodine Solution
5. 10% formaline

3.7 Laboratory Work

3.7.1 Microscopic Examination

All the necessary equipments and materials were collected in working table with safe precautions. Both unstained and stained preparation was used in the study.

3.7.1.1 Unstained smear preparation of stool

A portion of stool sample was picked up with a wooden applicator and emulsified with freshly prepared normal saline on a clean glass-slide. A clear cover slip was placed over it and excess of fluid was removed with the help of filter paper. The resulting smear should not be thick and its consistency should be such as to allow newsprint to read through it.

3.7.1.2 Stained smear preparation of stool

Stained preparation was required for identification and the study of nuclear characters of protozoan cysts and trophozoites. The iodine stained preparation was used for this purpose.

Stained smear was prepared in the similar manner as prepared in unstained smear preparation. Here lugols iodine solution was kept instead of normal saline solution.

3.8 Data Analysis and Interpretation

All data as well as laboratory finding were analyzed according to their age, sex, feeding habit, ethnic group and infection rate as a whole age. Thus analyzed data was interpreted by representing with table, bar-diagram and drawing graphs of suitable data.

CHAPTER IV
REVIEW OF LITERATURE

Sharma (1965) reported that the round worm infestation is very common in some parts of our country. He studied 976 stool samples and found 40% roundworm infestation in Bhaktapur areas.

Gongol (1972) studied a case of roundworm infestation in gall bladder.

Soulsa (1975) carried out a survey of the prevalence of intestinal parasites in Pokhara and found very high incidence. he observed that dirty finger nails might play in important role in the transmission of intestinal parasites.

Acharya (1976) reported that the intestinal infestions like giardiasis, amoebiasis, ascariasis, ancylostomiasis, fascioliasis and taeniasis were common in Nepal.

Khetan (1980) carried out the study of the incidence of parasitic infestation in Narayani zone. Stool examinations of 2073 patients were done between the years 1977-1980. Out of total samples 1522 stool samples had worm infestation, of which 458 samples had Ascaris, 591 had hookworm, 203 had trichuris, 175 had *G. lamblia* and 83 had other infestations.

Nepal and Palfy (1980) reported about a study of prevalence of intestinal parasites in the Mahanchal Panchayat. Out of 225 examined stool samples, 95.3% were positive. The most common parasites were roundworm (63.5%) followed by hookworm (34.2%), *E. histolytica* (28.8%) and *G. lamblia* (28.4%).

Bol and Roder (1981) reported the soil transmitted nematodes in Lalitpur district. They observed *A. lumbricoides, Necatar americanus, A. duodenale, T. trichiura and S. stercoralis* the soil transmitted nematodes.

Gurbacharya (1981) observed that the infection by soil transmitted helminth in Bhaktapur and Panchkhal area were higher than any other type of parasite.

Suguri *et al.*, (1985) surveyed to find the helminthes infections, in 737 Nepalese people living in the Gandaki, Dhaulagiri, Lubing and Sagarmatha zone of Nepal and in 26 Japanese living in Kathmandu from February to April in 1975, employing the so called thick smear method. the overall helminth infection rate was found 86.8% including roundworm (50.3%), hookworm (44.1%), whipworms (47.6%) pinworms (1.2%) and Taenia sp. (0.1%). The positive rate was the lowest in Bhairahawa (53.8%) and the highest in Darbang (98.8%). In Namche Bazar, round worm infection rate was the highest (70.3%) and that of hookworms was the lowest (0.2%).

Rai and Gurung (1986) collected 200 stool samples and examined by direct smear technique over a period of 16 days. The incidence of roundworm was the highest (35%) followed by hookworm (14%). The overall infection rate was 69% and the result showed that the infection was more common in girls than the boys.

Geollman (1988) carried out an extensive disease survey in Patan Hospital General out Patient Clinic from December 1986 through November 1987. A total of 79,404 people were seen during the period and the incidence of the related infections diseases were as follows: Amoebic diseases 1.7%, Giardiasis 2.7%, Ascariasis 3.5% hookworm infection 0.85% and other parasites 0.7%.

Gupta and Gupta (1988) collected 285 stool samples in Kirtipur. Among them 192 (67.36%) was found to be positive for intestinal parasite. Out of 192 positive stool samples, 49 (25.52%) cases were infected with protozoan parasite, 9.12% by *G. lamblia* and 9.47% by *E. histolytica*. Out of 192 stool samples, 15 (80.72%) were positive helminth parasite, *A. lumbricoides* (40%), *T. trichiura* (25.26%), *A. duodenale* (4.56%), *H. nana* (2.46%) and *T. solium* (0.55%).

Houston and Schwarz (1990) studied about helminth infections among peace corps volunteers station in various rural regions of Nepal indicated 14% were positive for Hookworm, 3% for whipworm and 82% for roundworm infections.

Williams-Blangero *et al.*, (1993) studied helminth infection in Jiri, concluded that roundworm, whipworm and hookworm were endemic in Nepal and represent the major health problem for the population.

Sherchand *et al.*, (1997) carried out stool survey on intestinal parasites in rural village of Dhanusha district, Southern Nepal. Out of 604 children of aged 0-9 years, examined 63.1% were found positive for at least one intestinal parasite. Hookworm infection superseded all the parasites by showing positively of 11.6%. Other parasites found were *A. lumbricoides, T. trichiura, E. vermicularis, S. stercoralis, H. nana, E. histolytica, E. coli, G. lamblia, Cryptosporidium* and *Cyclospora* etc.

Navitsky *et al.,* (1998) examined faecal specimens from 292 pregnant women (age 15 to 40 years) and 129 infants (age 70 to 140 days) for helminth eggs by the Kato-Katz method. These stool specimens were collected from Sarlahi district in Southern Nepal. Infection among pregnant women was found to be 78.8% hookworm, 52.2% *A. lumbricoides* and 7.9% *T. trichiura.*

Rai *et al.,* (1999) studied *Ascaris*, Ascariasis and its recent scenario in Nepal had suggested *Ascaris* as leading human parasite and also reported as major causes of public health problem. The study reported that over 75% people were infested by *A. lumbricoides* in rural areas, where as hospital based study in Kathmandu over a period of one decade also shown a static annual prevalence with mean of approximately 35%.

Rai *et al.,* (2001) studied the intestinal parasite infection in rural hilly area of western Nepal, Achham district. The stool test revealed 76.4% prevalence of intestinal parasites in the children of the district.

Toma *et al.,* (2001) studied on *strongyloides* infection conducted by faecal examination and subsequent treatment of the population on a model Island (Kume Island) in Okinawa, Japan for 5 years from 1993 to 1997. More than 1200 persons, accounting for 17% to 20% of the person and subjected, received faecal examinations each year. The positive rate in 1993 was found to be 9.7%.

Amin (2002) studied on seasonal prevalence of intestinal parasites in the United States during 2000. One third of 5,792 fecal specimeus from 2,896 patients in 48 states and the district of Columbia tested positive for intestinal parasites during the year 2000. Multiple infections with 2-4 parasitic species constituted 10% of 916 infected cases. *Balstocystis hominis* infected 662 patients (23% or 72% of the 916 cases). Its prevalence appears to be increasing in recent years. Eighteen other species of intestinal parasites were identified, *Cryptosporidum parvum* and *Entamoeba histolytica/Entamoeba dispar* ranked second and third in prevalence, respectively.

Nuchprayoons *et al.,* (2002) studied a total of 6231 Thais. Evidence of parasitic infections was found in 557 (8.94%) cases. The parasites were

most prevalent in males (57.3%), and in the age group > 15-30 years old people (11.1%). The parasite prevalence rates in the West, East, South and Central regions were 10.6%, 8.9%, 7.7% and 4.92% respectively. The parasites most commonly identified were *Strongyloides stercoralis* (33.39%), while Giardiasis was the most common protozoan infection (14.36%).

Oyelese *et al.,* (2002) studied to determine the prevalence of intestinal helminthic and protozon infections. During a three-years period in two succeeding decades (1998-90 and 1996-98). During the two periods, 4223 (65.1%) of 6504 and 2279 (63.1%) of 3641 clinical specimens were respectively, positive for intestine parasites.

Rai *et al.*, (2002) studied intestinal parasites among school children in a rural hilly area of Dhading district, Nepal. A total of 423 school children were included and 254 (60%) of them were found to be positive for intestinal parasite. *A. lumbricoides* was the most common (69.6%) parasite detected followed by hook worm (19.2%) whip worm (5.9%) *G. lamblia* was only protozoan parasite detected in this study (5.2%) where as Dalit had significantly higher prevalence (74.1%).

Siddiqui *et al.,* (2002) studied on the prevalence of human intestinal pathogenic parasites. Out of 263 residents, 185 tested for intestinal parasites and 88 (47.5%) has pathogenic parasites. The distributions of parasites were *Giardia lamblia* 50% and *Entamoeba histolytic* 48.86%.

Alves *et al.,* (2003) studied on intestinal parasite infections in a semiarid area of Northeast Brazil. A total of 265 stool specimens were collected and examined by spontaneous sedimentation. Approximately 57% of specimens were infected with at least one parasite species. *Entamoeba*

coli (35.8%). *Endolimax nana* (13.6%), *Hymenolepis nana* (9.4%) and Hookworm (9.4%) were the most frequently observed parasites.

Fontes *et al.,* (2003) conducted study of 1020 students. Out of these 983 (92%) showed positive results for at least one species of parasite. Six months after treatment, a sample of 383 students (37.5%) were revaluated and 347 (90.6%) presented positive results.

Romanenko (2003) performed a study of 301 stool samples subjected to the formalin-ether concentration method for the detection of helminth ova and protozoan cysts. The overall positive rate was 64.5% and that of male and female were 56.6% and 72.5% respectively. The highest infected helminth was *Ascaris lumbricoides* (51.2%), followed by *Trichuris trichiura* (27.6%), Hookworm (8.0%) and *Enterobius vermicularis* (0.3%). The protozoa infection status revealed that *Entamoeba coli* was the most frequent (15.0%). *Iodoamoeba buetschlii* and *Entamoeba histolytica* were found but few. The multiple infection more than two parasites was 29.6% and double infection with *Ascaris lumbricoides* and *Trichuris trichiura* was most common.

Sirivichayakul *et al.,* (2003) conducted a study on the prevalence of intestinal parasitic infection in institutionalized and non-institutionalized Thai people with mental handicaps. It was found that the prevalence of infection was much higher in institutionalized (57.6%) than in non-institutionalized people (7.5%). The common parasites found in institutionalized people were *Trichuris trichiura* (29.7%) *Entamoeba coli* (23.1%) *Giardia intestinalis* (8.0%) *Hymenolepis nana* (7.8%) and *Entamoeba histolytica/dispar* (7.1%).

Adedayo *et al.,* (2004) performed a retrospective study by of stool samples at the parasitology unit of the medical laboratory services of

Princes Margaret Hospital, Dominica, in January-December 1999. Parasites were found in 393 out of 3,752 stool samples (10.47%). The main parasites were *Entamoeba coli*, 14% (51/3, 752), Hookworm, 1.5% (56/3,752), *Giardia lamblia* 1.4% (51/3,752), *Strongyloides stercoralis* 1.0% (37/3,752), *Ascaris lumbricoides* 0.8% (28/3,752), and *Trichuris trichiura* 0.9% (3,752).

Hamze *et al.,* (2004) determined the prevalence of intestinal parasites in the North of Lebanon between 1997 and 2001. They analyzed the parasitology records of 17126 patients and evidence of parasitic infections was found in 5713 (33.35%) cases. There was no significant difference in prevalence for males or females for any of the parasites. The most prevalence parasites were *Entamoeba coli* (38.45%). *Ascaris lumbricoides* (37.14%), *Giardia intestinalis* (15.39%), *Entamoeba histolytica* (4.57%) and *Taenia sp*. (3.3%).

Minvielle *et al.,* (2004) studied to relate personal data, socio-cultural and environmental characteristics, and the presence of symptoms/signs with the frequencies of *Giardia sp* and *Blastocystis hominis* among a rural population in Buenos Aires provinee, Argentina. Of the surveyed population (350), 3.7% were infected with only *Giardia sp.* Or 22.9% with *Blastocystis hominis*, and 2.3% were infected with both protozoa. The frequency of infection according to sex; 6.1% of males were infected and 1.6% of female by *Giardia sp.*, 26.7% and 19.5% by *Blastocystis hominis* and 2.4% and 2.2% by both parasites, respectively.

Parajuli *et al.,* (2004) studied on the prevalence rate of intestinal parasite in Mushar community in Chitwan district. A total of 183 stool samples were examined of which (77.05%) were positive. Female had higher prevalence (79.2%) than male (74.4%). *A. lumbricoides had* higher

prevalence (48.8%) followed by *A. duodenale* (39.94%)., *T. trichiura* (22.4%). *E. histolytica* (15.3%), *S. sterecoralis* (8.19%), *G. lamblia* (7.65%), *H. diminuta* (4.37%), *H. nana* (2.73%) and *Taenia sp*. (1.63%).

Garg *et al.,* (2005) reported the prevalence of helminthes and protozoa as well as demographic risk factors associated with these infections among 533 refugees seen at the Santa Clary country, California, refugees clinic between October 2001 and January 2004. Stool parasites were identified fro 14% of refugees, including 9% found to have one or more protozoa and 6% found to have at least one helminth. Most common protozoan infections were *Giardia lamblia* (6%) and *Dientamoeba fragilis* (3%) and hookworm (2%0. Protozoa were more frequent in refugees < 18 years of age (OR: 2.2[1.2-4.2]) where Africa (OR: 5.9 [1.6-21.6]) when compared with refugees from Eastern Europe and the middle East.

Ghimire *et al.,* (2005) conducted a study to determine the prevalence of the intestinal parasites and to evaluate the types of intestinal parasites and haemoglobin concentrations in the people of two areas of Nepal. The cross-sectional descriptive type of study was conducted from April 2005 to October 2005 in Kirtipur, Kathmandu and Gunjanagar VDC, Chitwan, Nepal. The total prevalence of intestinal parasites was 42.0% in which the prevalence of males and females was 35.2% (58/165) and 46.8% (110/235) respectively with statistically significant (P< 0.05, 95% CI).

Wongjindanov *et al.* (2005) performed a survey for the current rate of *Giardia lamblia* infection in three different districts in two provinces of Thailand, Surin and Samut Sakhon, in March 2002, October 2003, and March 2004. Out of 3,358 healthy individuals for rural Surin province, 75 cases (2.2%) were found positive or *G. lamblia*. 30 of which were below 10 years of age. By comparison, 656 individuals from sub-urban Samut Sakhon province volunteered and 43 (6.5%) were positive of *G. lamblia*.

Other intestinal parasites, both helminthes and protozoa, were also identified from these two groups, Hookworm, *Enterobius vermicularis*, *Strongloides stercoralis*, *Trichuris trichiura*, *Taenia sp.*, *Entamoeba histolytica*, *Entamoeba coli*, *Endolimax nana*, and *Blastocystis hominis*.

E.L. Shazley et al., (2006) studied intestinal parasites in Dakahlia governorate. The intestinal helminthes in a descending order of abundance were: *S. mansoni* (5.3%), *Fasciola sp.* (4.8%), *H. heterophyes* (4.2%), *Hymenolepis nana* (3.9%),, *Trichostrongylus sp* (2.6%), *A. lumbricoides* (1.8%), *Strongyloides strecoralis* (1.5%), *H. diminuta* (1.4%), *T. saginata* (1.1%), *E. vermicularis* (1.1%), *T. trichura* (0.7%) and lastly *A. duodenale* (0.1%). The intestinal protozoa in a descending order of abundance were *Blastocystis hominis* (22.4%) *G. lamblia* (19.6%), *E. hisolytica/E. dispar* (19%), *Iodamoeba butschlii* (16%), *Cryptosporidum parvum* (14.3%), *E. coli* (9.7%), *Isospora hominis* (7.7%), *Endolimax nana* (6.9%), *E. hartmani* (5.9%), *Dientamoeba fragilis* (5.1%), *Trichomonas hominis* (4.2%), *Cyclospora cayetanensis* (4.2%), *Microsporidia spores* (3.2%), *Enteromonas hominis* (1.3%). The results were discussed.

Spinelli *et al.*, (2006) evaluated the prevalence of intestinal parasites in 277 healthy subjects in the city of Mamuras Albania Sou. The overall prevalence of intestinal parasites were 183/277 (66.06%). In particular, pathogenic protozoan or helminthes were found in 67 subjects (24.18%), including *Trichuris trichiura* in 34 (12.27%), *Fiardia intestinalis* in 31 (11.19%), *Hymenolepis nana* in 5 (1.8%) and *Ascaris lumbricoides* in 3 (1.08%).

Agbolade *et al.*, (2007) studied intestinal helminthiases and schistostomiasis among school children in an urban centre and some rural

communities in southwest Nigeria. Intestinal helminthes and schistosomiasis among school children were investigated in an urban and some rural communities of Ogun State Southwest Nigeria. Faecal samples of 1,059 subjects (524 males, 535 females) aged 3-18 years were examined using direct smear and brine concentration methods between June 2005 and November 2006. The pooled prevalence of infection was 66.2% *Ascaris lumbricoides* showed the highest prevalence (53.4%) (P<0.001) followed by Hookworms (17.8%), *T. trichiura* (10.4%) *Taenia sp.* (9.6%), *Schistosoma mansoni* (2.3%), *S. stercoralis* (0.7%), *Schistosoma haematobium* (0.6%) and *E. vermicularis* (0.3%). The prevalence of *A. lumbricoides*, Hookworms, *Taenia sp., S. mansoni* and *S. stercoralis* in the urban centre were similar (p>0.005) to those in the rural communities. The fertile and infertile egg rates of *A. lumbricoides* in the urban centre and the rural communities were 13:1 and 3.7:1, respectively. Each helminth had similar prevalence among both genders (p>0.05). The prevalence of *A. lumbricoides* increased significantly with age (P<0.001). The commonest double infections were Ascaris and hookworms while the commonest triple infections were Ascaris, hookworms and Trichuris. The study demonstrates the need for urgent intervention programmes against intestinal helminthiases and schistosomiasis in the study area.

Chandrasena *et al.*, (2007) studied intestinal parasites and the growth status of internally displaced children in Sri Lanka. The growth status and intestinal parasitic infections among a group of children displaced by war in Sri Lanka was investigated. There was a high prevalence of growth retardation (wasting stunting and underweight being 41%, 28% and 69.9% respectively) and intestinal parasitic infections (40.2%) among the study population provision of adequate food, purified drinking water, Sanitation and broad-spectrum anthelmintics is recommended.

CHAPTER V

RESULT

This study was conducted in Brahman and Magar community of Rimuwa VDC Surveillance study and stool sample collection were done from 250 community people. Among them 100 stool samples were from ward no.9 in Brahman community, 100 stool samples were from ward no. 8 and 50 stool samples were from ward no. 5 in Magar community.

The result of the present study is divided into two parts.

a. Result of stool test
b. Result of survey analysis

5.1 Result of stool test

5.1.1 General prevalence of the intestinal parasites

Out of 250 stool samples tested, 70 were found to be positive for one or more type of intestinal parasites. Therefore, the prevalence of intestinal parasites was found to be 28%.

In Comparison between two ethnic groups, Magar community had maximum prevalence 30% followed by Brahman community 25%.

Table No. 1: Overall prevalence of intestinal parasites in two ethnic groups

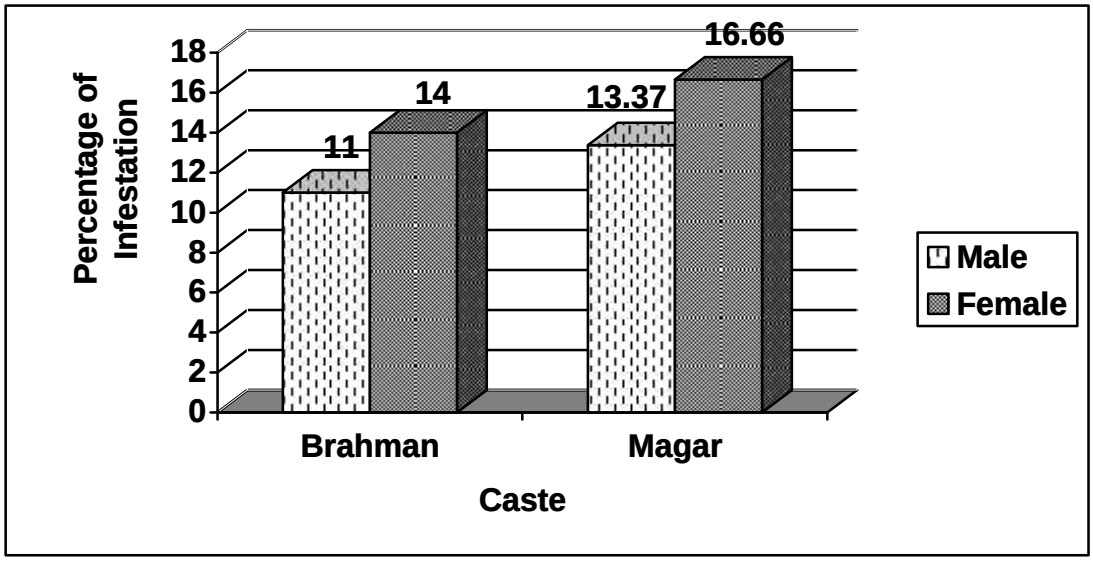
S.N.	Ethnic groups	Total samples	Positive No.	Positive %
1	Brahman	100	25	25%
2	Magar	150	45	30%
	Total	250	70	28%

Out of 150 stool samples collected from Magar community, 30% samples were recorded as positives. Likewise out of 100 stool samples collected from Brahman community, 25% samples were found to be positive. This result reveled that prevalence rate of Magar community was more than Brahman community.

Table No.2: Sex-wise prevalence of intestinal parasite in two ethnic groups

S.N.	Ethnic Groups	Total Samples	Positive case				Total +ve No.	Total +ve %
			M	%	F	%		
1	Brahman	100	11	11	14	14	25	25
2	Magar	150	20	13.33	25	16.66	45	30
	Total	250	31	12.4	39	15.6	70	28

Figure No. 1: Percentage of Sex-wise prevalence of intestinal parasite in two community

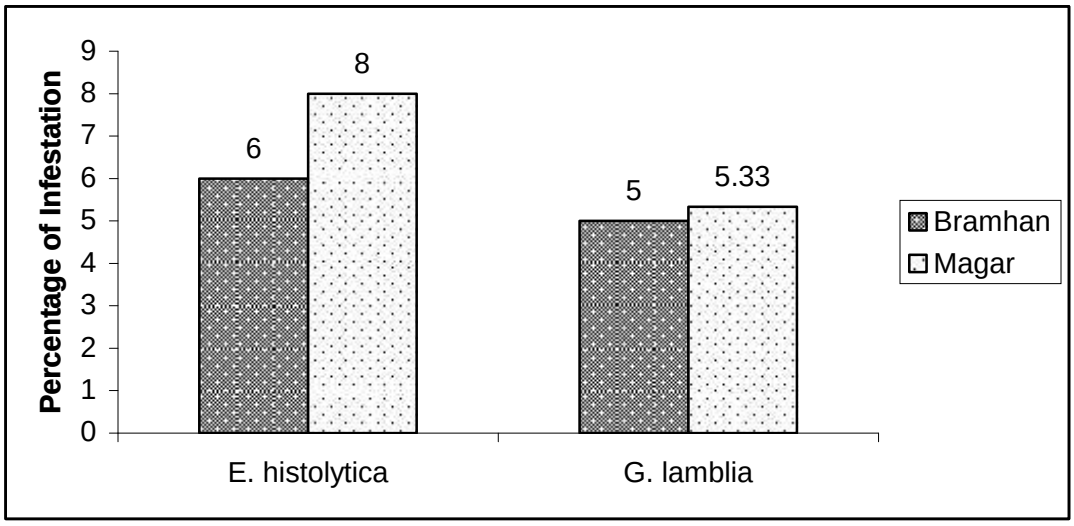


Regarding the sex-wise prevalence of intestinal parasites in two ethnic groups females were found to be more infective 39 (15.6%) than the male 31 (12.4%).

Table No. 3: Overall Prevalence of Protozoan infections in two ethnic groups.

S.N.	Parasite	Ethnic Group					
		Brahman		Magar		Total	
		No.	%	No.	%	No.	%
1.	*Entamoeba histolytica*	6	6	12	8	18	7.2
2.	*Giardia limblia*	5	5	8	5.33	13	5.2
Total		11	11	20	13.33	31	12.4

Figure No. 2: Overall Prevalence of Protozoan infections in two ethnic groups

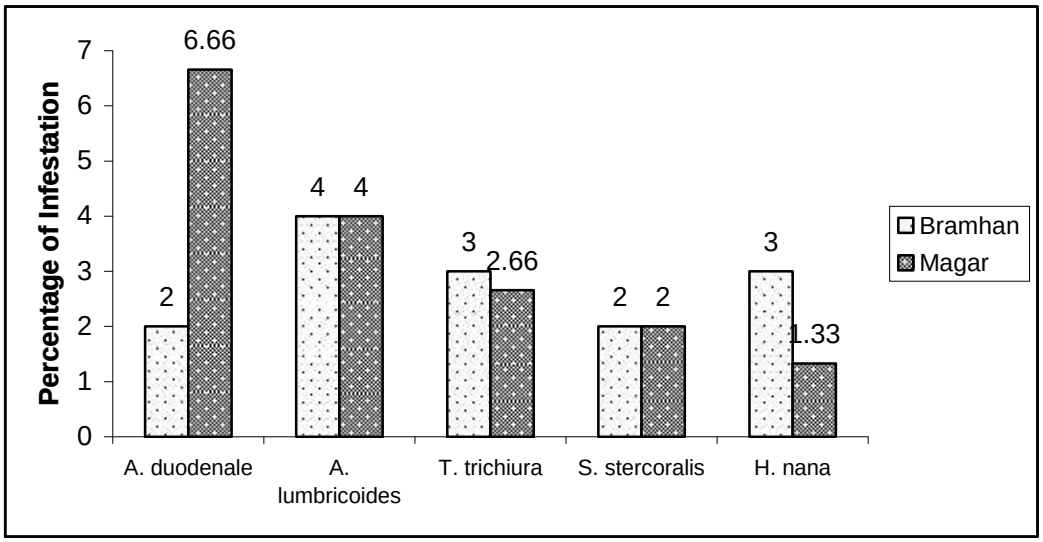


Prevalence rate of intestinal protozoan parasite showed minimum (5%) in Brahman and maximum (8%) in Magar community. Table No.3 revealed that maximum prevalence of *Entamoeba histolytica* was recorded as higher in Magar community (8%) than Brahman community (6%) where as maximum prevalence of *Giardia lamblia* was to be found in Magar community (5.33%) than Brahman community (5%).

Table No. 4: Overall Prevalence of helminth infections in two ethnic groups

S.N.	Parasite	Ethnic Group					
		Brahman		Magar		Total	
		No.	%	No.	%	No.	%
1.	*Ancylostoma duodenale*	2	2	10	6.66	12	4.8
2.	*A. lumbricoides*	4	4	6	4	10	4
3.	*T. trichiura*	3	3	4	2.66	7	2.8
4.	*S. stercoralis*	2	2	3	2	5	2
5.	*H. nana*	3	3	2	1.33	5	2
Total		14	14	25	16.65	39	15.6

Figure No 3: Overall Prevalence Percentage of helminth Infections in two ethnic groups



Among 5 different helminth parasite, prevalence rate of *A. duodenale* and *S stercoralis* were found to be minimum i.e. 2% while prevalence rate of *A. lumbricoides* was recorded as maximum i.e. 4% in Brahman community. Likewise, infection rate of H. nana was found to be minimum i.e. 1.33% while infection rate *A. duodenale* recorded as maximum i.e. 6.66% in Magar community.

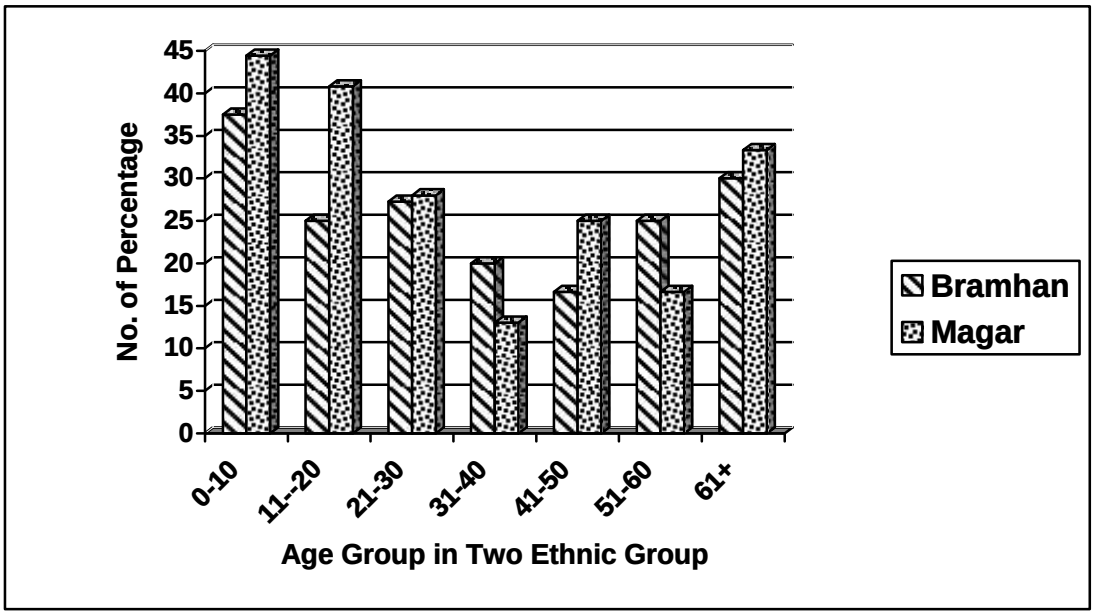
Table No.5: Prevalence of specific intestinal parasites of Brahman and Magar Community

S.N.	Parasite	Ethnic Group					
		Brahman		Magar		Total	
		No.	%	No.	%	No.	%
1.	*E. histolytica*	6	6	12	8	18	7.2
2.	*G. lamblia*	5	5	8	5.33	13	5.2
3.	*Ancylostoma duodenale*	2	2	10	6.66	12	4.8
4.	*A. lumbricoides*	4	4	6	4	10	4
5.	*T. trichiura*	3	3	4	2.66	7	2.8
6.	*S. stercoralis*	2	2	3	2	5	2
7.	*H. nana*	3	3	2	1.33	5	2
	Total	25	25	45	29.98	70	28

Table No. 6: Age-wise infection of intestinal parasites in two ethnic groups

S.N.	Age Groups in Two Ethnic Groups	Brahman			Magar		
		Total	+ve	%	Total	+ve	%
1	0-10	8	3	37.5	9	4	44.44
2	11-20	20	5	25	49	20	40.81
3	21-30	22	6	27.27	25	7	28
4	31-40	20	4	20	23	3	13.04
5	41-50	12	2	16.66	20	5	25
6	51-60	8	2	25	12	2	16.66
7	61+	10	3	30	12	4	33.33
	Total	100	25	25	150	45	30

Figure No.4: Age-wise prevalence percentages of intestinal parasites in two ethnic groups



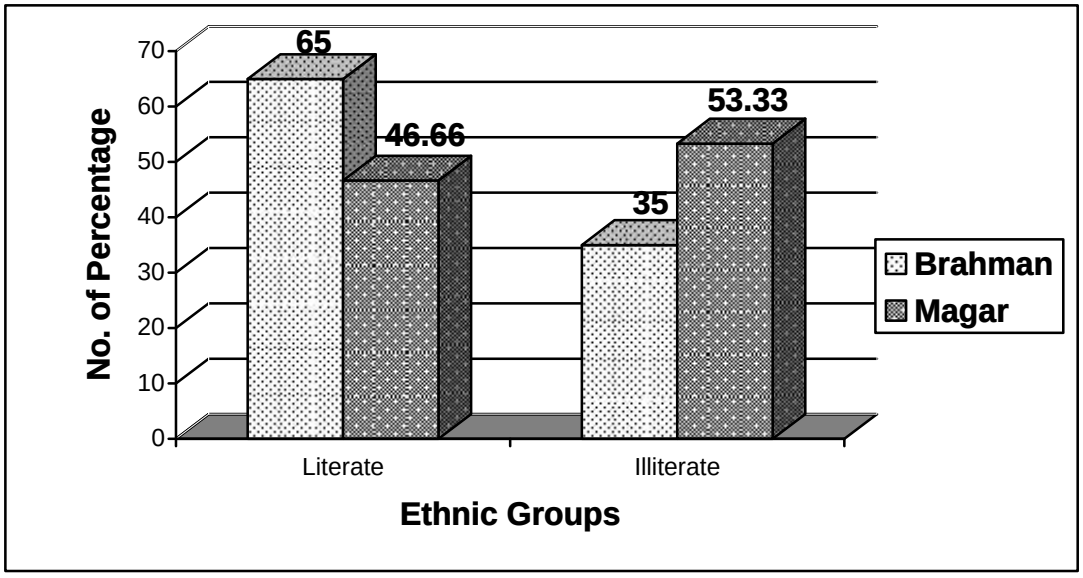
The whole study population was divided into 7 age group, prevalence found to be higher i.e. 37.5% in age group 0-10 years old while prevalence rate was recorded as lower in age group 41-50 years old in care of Brahman community. Like as infection rate of intestinal parasites was found to be higher in 44.44% in age group 0-10 while prevalence rate recorded as lower 13.04 in age group 31-40 in case of Magar community. At last that table showed that prevalence rate of intestinal parasites were minimum in age group 41-50 and 31-40 in both Brahmin and Magar community.

Table No. 7: Literacy status in two ethnic groups

S.N.	Ethnic Group	No. of Respondents	Literate		Illiterate	
			No.	%	No.	%
1	Brahman	100	65	65	35	35
2	Magar	150	70	46.66	80	53.33
	Total	250	135	54	115	46

Classification of literate and illiterate on the basis of able to read and write.

Figure No. 5: Percentage of literacy and illiteracy status in two ethnic groups



This figure shows 65% literate and 35% illiterate in Brahman community and 46.66% literate and illiterate 53.33% in Magar community. Literate rate of Brahman community is higher than Magar community.

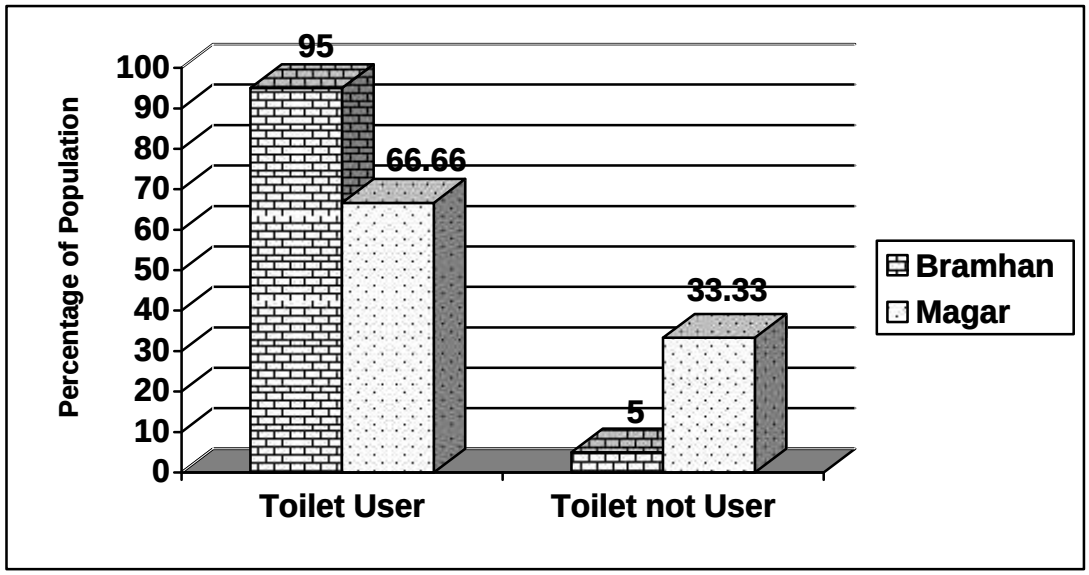
Table No. 8: Sex-wise literacy status in two ethnic groups

S.N.	Ethnic Group	No. of Respondents	Literate		Illiterate	
			M	F	M	F
1	Brahman	100	40	25	15	20
2	Magar	150	45	25	30	50
	Total	250	85	50	45	70

Table No. 9: Way of defecation in two ethnic groups

S.N.	Ethnic Group	No. of Respondents	Toilet		Toilet not User	
			No.	%	No.	%
1	Brahman	100	95	95	5	5
2	Magar	150	100	66.66	50	33.33
	Total	250	195	78	55	22

Figure No. 6: Way of defecation in two ethnic groups



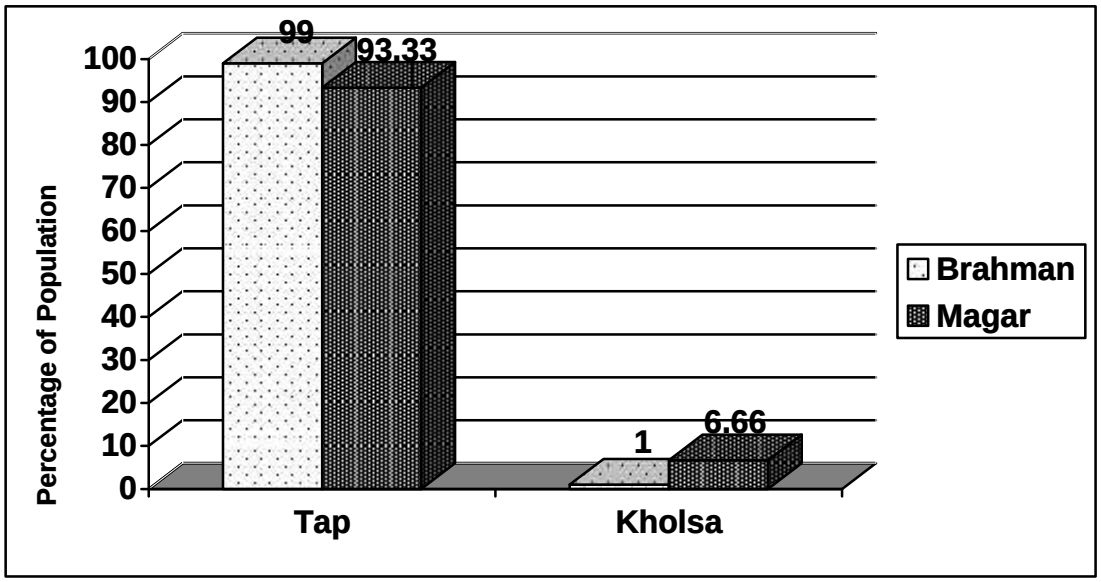
This figure shows that Magar community use toilet 66.66% for defecation while as Brahman community use toilet 95% for defecation.

So, there was less chance of contamination of soil and vegetable with parasite near surrounding.

Table No. 10: Water consuming practice in two ethnic groups

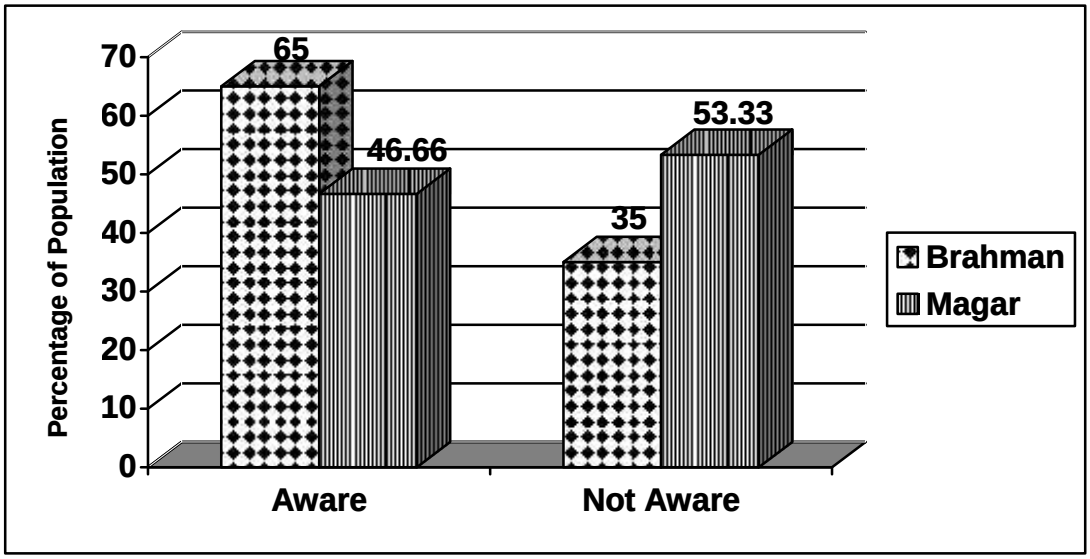
S.N.	Ethnic Group	No. of Respondents	Tap		Kholsa	
			No.	%	No.	%
1	Brahman	100	99	99	1	1
2	Magar	150	140	93.33	10	6.66
	Total	250	239	95.6	11	4.4

Figure No. 7: Percentage of water consuming practice in two ethnic groups



Out of 100 respondents 99% respondents utilized water from the tap and 1% from kholsa in Brahman community. While as 93.33% and 6.66% from kholsa in Magar community. This result shows that Brahman community is more using of tap than Magar community.

Figure No. 8: Percentage of awareness status in two ethnic groups

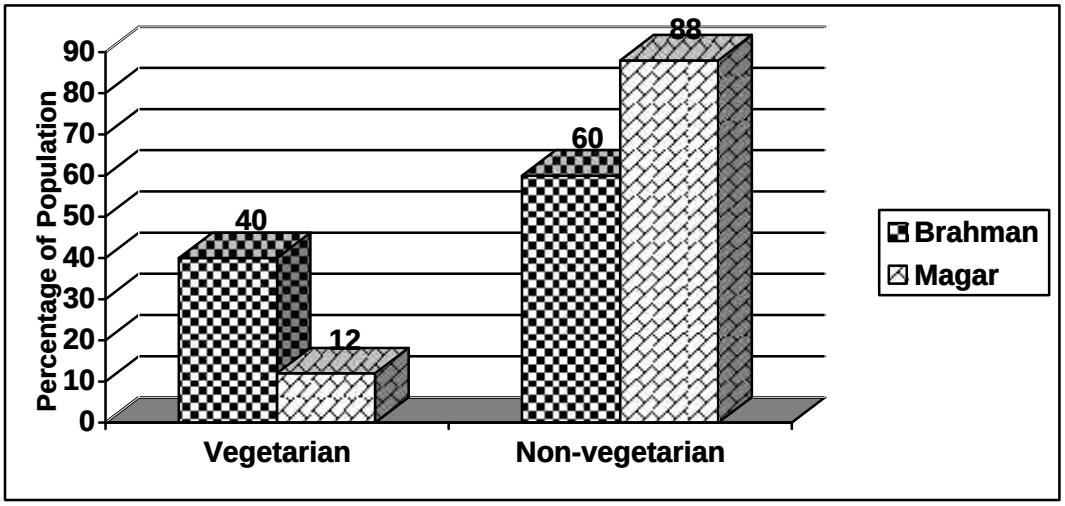


This figure shows that Brahman communities were more aware than Magar community. So, Magar community is more effective from parasites than Brahman community.

Table No. 11: Feeding habit of two community

S.N.	Community	No. of Respondents	Vegetarian		Non-vegetarian	
			No.	%	No.	%
1	Brahman	100	40	40	60	60
2	Magar	150	18	12	132	88
	Total	250	58	23.2	192	76.8

Figure No. 9: Percentage of feeding habit of two community



Out of 100 respondents, 40% respondents were vegetarian 60% respondents were Non-vegetarian in Brahman community. Like as out of 150 respondents, 88% respondents were non-vegetarian and 12% respondents were vegetarian. Therefore, non-vegetarian respondents were more in Magar community than Brahman community. So, helminth infection in Magar community was more than Brahman community.

5.1.2 Socio-economic and Environmental Aspects

Low socio-economic status shows low education, low hygiene, low employment outside their homes, ignorance, poverty and not being aware of their health, they used to go Dhami or Jhakri at time of illness because they are available near by the village.

Most of the Magar people believes in traditional healer or, Dhami/Jhakri for treatment of illness. Some Brahman people have low socio-economic status also believe in traditional healer for treatment of illness whereas people with low socio economic status have been found highly infected by intestinal parasites. Magar community was to be found habituated of alcoholic, drink, smoking of cigarette, tobacco, bear, Jaad etc. But not using in Brahman community. They are habituated tobacco only. Where tropical and sub-tropical region there is mostly infection of intestinal parasites.

CHAPTER VI
DISCUSSION AND CONCLUSION

6.1 Discussion

The study showed that 28% of people in both Brahman and Magar community were infected by different types of intestinal parasites where 25% were Brahman and 30% Magar. Over all positively was 70 (28%) among 250 stool samples tested. These positivity was found among seven kinds of intestinal parasites. They are *Entamoeba histolytica* (7.2%), *Giardia lamblia* (5.2%), *Ancylostoma duodenale* (4.8%), *Ascaris lumbricoides* (4%), *Trichiuris trichiura* (2.8%), *S. stecoralis* (2%) and *H. nana* (2%).

The Prevalence of intestinal parasites in female was more (14%) than male (11%) in Brahman community while as infection rate of intestinal parasites in female was more (16.66%) than male (13.33%) in Magar community. The study revealed that females were more infected than males in both communities. This high prevalence rate of female might be due to exposure to outer environment and usual contact with infected soil, water, foods, faeces, feet and hands. Magar community use vacure, tarul and other roots of plant. The wild fruit associated with this community are bhakamblo, daikamblo, pear, orange etc. They eat these fruits and tubers without properly washing and cooking. The mode of feeding offorded large number of protozoan parasites along with infective stage of helminthes parasites in Magar community. But feeding mode of Brahman is slightly standard than that of Magar. Therefore, parasitic infection was found to be high in Magar than Brahman.

Almost all Magar community was found to have built their dwellings clustered together on side of Jungle. They have little land but not fertile.

So it is not sufficient for bearing large household expanses. The literacy rate of Magar was lower (46.66%) than Brahman (65%). Due to high illiteracy concern towards sanitation is very low in Magar community than Brahman. Regarding sanitary condition of study area, Magar Community used toilet (66.66%) but Brahman community used toilet (95%). Some Magar community used open field at the bank of river for defecation. This mode of defecation is responsible for contamination of soil and vegetables as well as near by water stream also. The contamination of soil, vegetables and water contribute greatly for the parasitic infestation. Due to open field defecation practice, Magar community revealed high prevalence rate than Brahman community people of Magar community visit field and forest with barefoot to collect grass, fire wood and working purpose. This land had already contaminated by parasites, so that increased the chance of infection from *A. duodenale* and other parasites. But Brahman are more aware than Magar. In this way infection rate of intestinal parasite was found to be higher in Magar than Brahman.

The result showed that 93.33% of Magar and 99% of Brahman used the water from tap: but 6.66% Magar and 1% Brahman consumed water from Kholsa.

Majority of Brahman community used water from tap while majority of Magar community used water from tap but some Magar community used water from Kholsa. So, there is more chance of infection by protozoan parasites to Magar community than Brahman community. This study also depicted that the rate of infection of Protozoan Parasites in Magar community was higher than Brahman community.

6.2 CONCLUSION

At last the result of this study summarized that life standard of Magar community was very poor than Brahman community. Socio-economic condition, socio-cultural factors and behavioural factors in between Magar and Brahman community was found to be different. So, prevalence rate of intestinal parasites in Magar community was more than Brahman community. It was seen that both community were suffered from intestinal parasites due to low literacy status and lack of awareness towards health and sanitation.

At last, simple trible; nomadic life style and lack of health education and lack of technical knowledge governed towards poverty. Poverty and social discrimination result high illiteracy which in turn is responsible for lack of awareness in health, hygiene, poor sanitary status and unhygienic primitive food habit in both community. Thus these are found to be contributing factors for these parasites to be endemic with high prevalence in both community. In this way extensive study is necessary for the determination of epidemiological and etiological aspects that cause the high prevalence of intestinal parasites in both community of present study.

CHAPTER VII
RECOMMENDATIONS

From the present study, the following recommendations are suggested.

a) Workers should be inspirited to use gloves and boots during the work in field.

b) People should be encouraged for sanitary improvements.

c) The hands should be washed throughly with soap and warm water after using the bathroom and before eating.

d) Drinking water must be purified by filtration and boiling.

e) Improved personal hygiene, community hygiene and food hygiene.

f) Treatment of infected persons immediately.

g) Public health education in the school level must be made compulsory.

h) Good established sanitary toilet should be in every home.

i) Mass awareness by various communications like as radio, television, paper, poster, film, projector, announcement and various programme.

j) Most of the people believes on Dhami, Jhankri (traditional healers) for treatment of illness which should be discouraged.

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ANNEX

Questionnaire for Baseline Health Survey in Rimuwa VDC, Gulmi

1. Name: .....
   Age: Sex : Locality:
2. Occupation:
3. Family Type:
   Joint [ ] Separate [ ] Number of Family members [ ]
4. Had you suffered from any types of intestinal parasite ?
   Yes [ ] No [ ]
5. Did you use any medicine?
   Yes [ ] No [ ]
6. Walking with barfoot:
   Yes [ ] No [ ]
7. Nail Cutting habit:
   Regularly [ ] Sometimes [ ] Never [ ]
8. Washing Hands:
   Before food [ ] Yes [ ] No [ ] By .....
   After toilet [ ] Yes [ ] No [ ] By .....
9. Fruits and Salad eating after:
   Washing [ ] Without washing [ ]
10. Family Health Condition:
    Excellent [ ] Good [ ] Bad [ ]
11. What type of food habit you have?
    Vegetarian[ ] Non-vegetarian [ ] Both [ ]
12. Do you use separate water supply for Drinking, washing, cooking and other purpose?
    Yes [ ] No [ ]

13. Is it Purified?

Yes [ ] No [ ] Don't Know [ ]

14. What types of water supply?

Tap water [ ] Tub well [ ] River water [ ] Kholsa [ ]

15. If literate?

Primary Level [ ] Lower Secondary Level [ ]

Sec. Level. [ ] H.S.L. [ ]

Normal read [ ] Read and Write [ ]

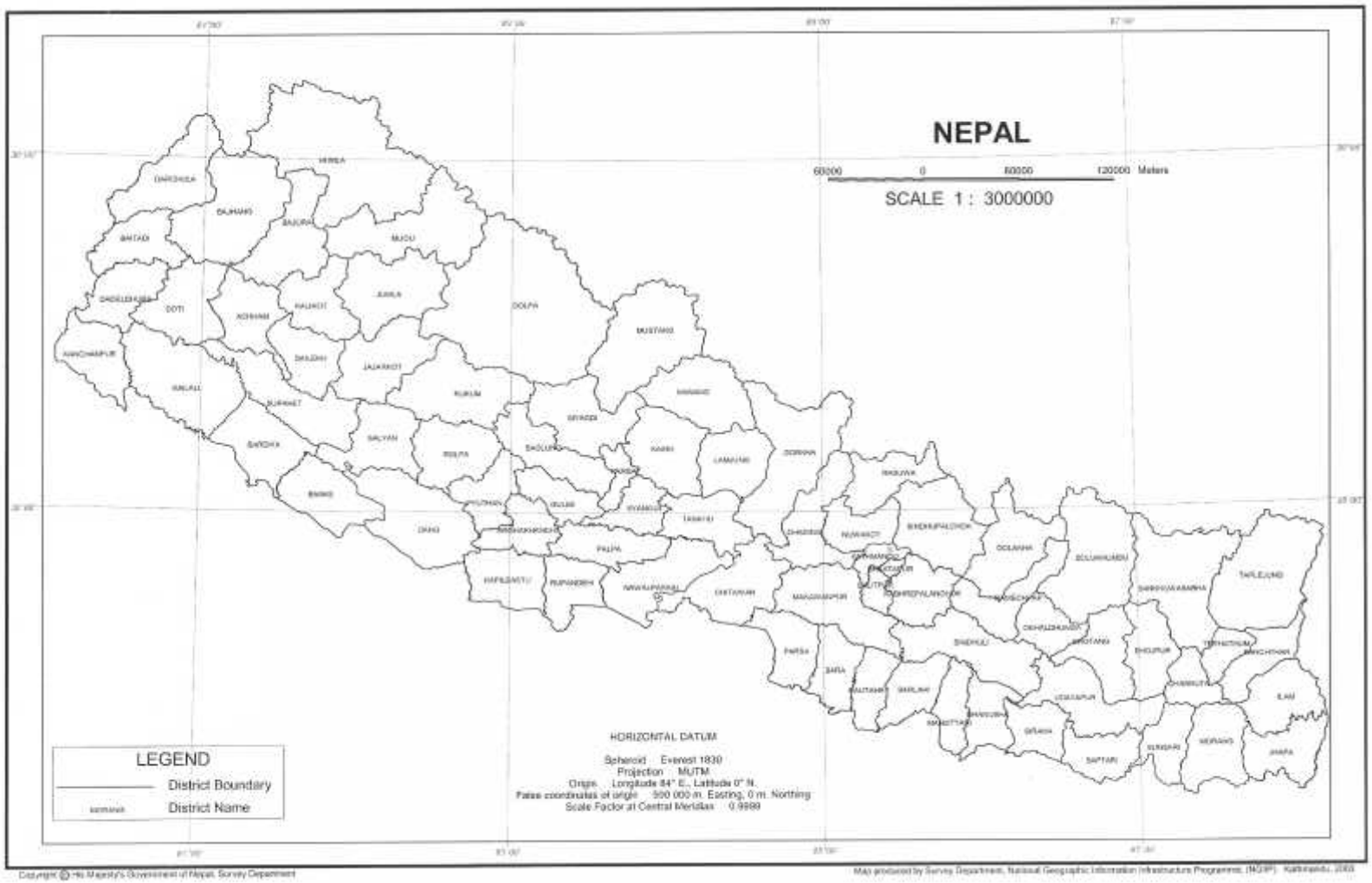
16. Are you literate?

Yes [ ] No [ ]

17. Sanitation:

System Toilet [ ] Open [ ] other [ ]

Types Disposal [ ] Saftety tank [ ] Drain [ ]


NEPAL
60000 0 60000 120000 Meters
SCALE 1 : 3000000
LEGEND
District Boundary
District Name
HORIZONTAL DATUM
Spheroid Everest 1830
Projection MUTM
Origin Longitude 84° E., Latitude 0° N.
False coordinates of origin 500 000 m. Easting, 0 m. Northing
Scale Factor at Central Meridian 0.9999
Copyright © His Majesty's Government of Nepal, Survey Department
Map produced by Survey Department, National Geographic Information Infrastructure Programme, (NGIIP), Kathmandu, 2003

epal, Survey Department

SCALE 1 : 375000

7500 0 7500 15000 Meters

LOCATION MAP

HORIZONTAL DATUM

Spheroid Everest 1830
Projection MUTM
Origin Longitude 84° E., Latitude 0° N.
False coordinates of origin 500 000 m. Easting, 0 m. Northing
Scale Factor at Central Meridian 0.9999

Map compiled from National Topographic Database at scales 1:25 000 and 1:50 000. Internal administrative boundaries are not demarcated on the ground. Map produced by the Survey Department, National Geographic Information Infrastructure Programme, (NGIIP). Kathmandu, 2003

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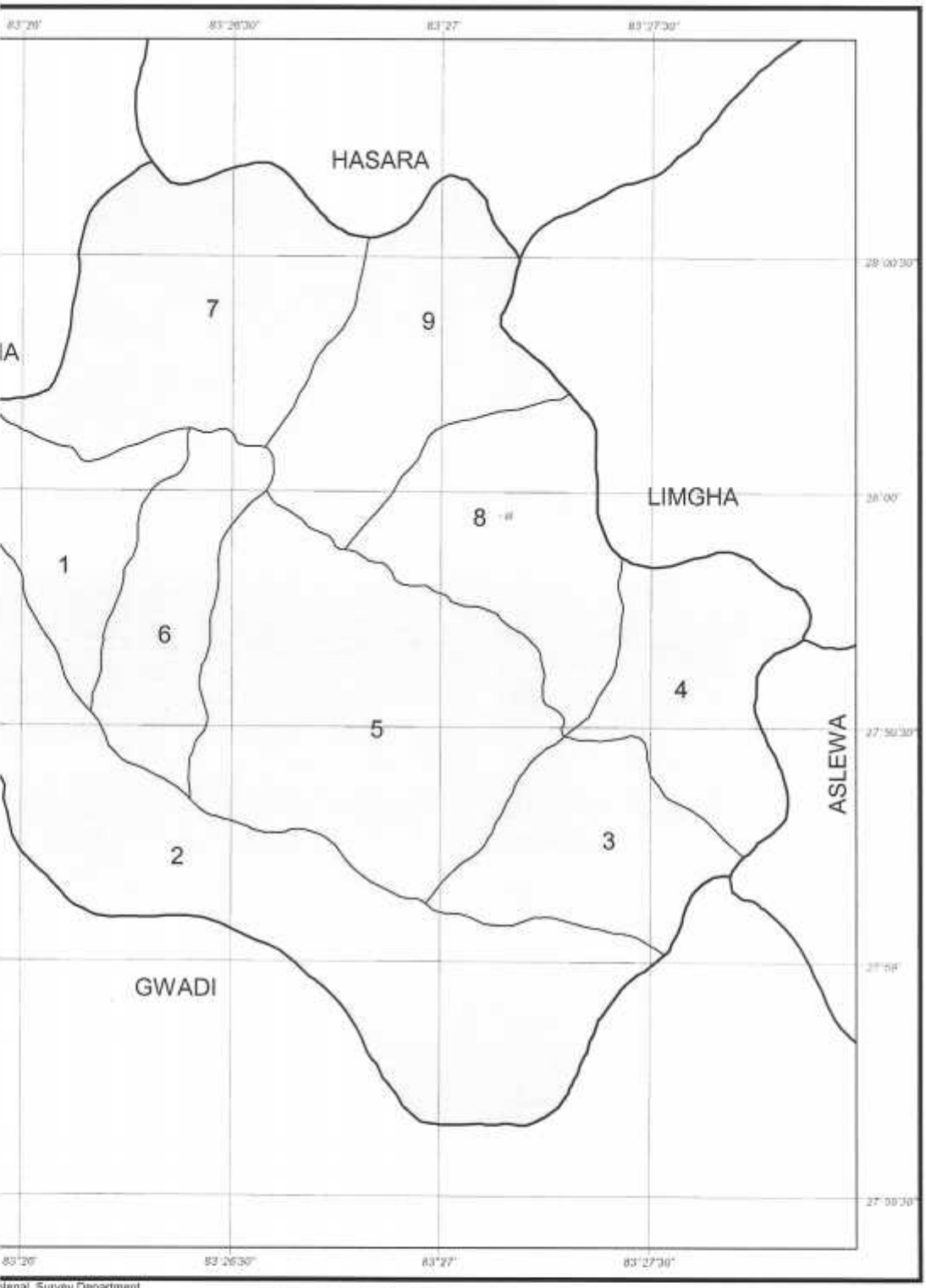

Nepal, Survey Department

SCALE 1 : 25000

500 0 500 1000 Meters

HORIZONTAL DATUM

Spheroid Everest 1830
Projection MUTM
Origin Longitude 84° E., Latitude 0° N.
False coordinates of origin 500 000 m. Easting, 0 m. Northing
Scale Factor at Central Meridian 0.9999

Map compiled from National Topographic Database at scales 1:25 000 and 1:50 000. Internal administrative boundaries are not demarcated on the ground. Map produced by the Survey Department, National Geographic Information Infrastructure Programme, (NGIIP). Kathmandu, 2003

GULMI DISTRICT
VDC Location Map

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