I

INTRODUCTION

Health is wealth. Good health makes an individual happy and leads him in the path of progress and prosperity. So, healthy citizen is the backbone of the nation. Health of citizen is the determining factor of progress of a country. Parasites are a major enemy of people living in underdeveloped country like Nepal. It often causes debility and fatal diseases. People are more susceptible to parasitic infection due the unhygienic condition of environment, illiteracy, ignorance and malnutrition.

Parasites are those living organisms which depend on other living organisms for food and shelter. There are different types of parasites such as ectoparasites, endoparasites, facultative parasites, temporary parasites, permanent parasites, obligatory parasites etc. Intestinal parasites are endoparasites. The intestinal parasites of man are cosmopolitan in distribution. They bring very serious health problems in country like Nepal where diseases, ignorance and poverty are interlocked.

The human intestinal parasites mainly include nematodes, cestodes and protozoans. Most commonly found nematodes are *Ascaris, Trichuris* and *Enterobius*. Food borne cestodes like *Taenia, Hymenolepis* etc. are also noticeable. Protozoa like *Entamoeba, Giardia* etc. cause a large number of food borne outbreaks each year leading to dysentery like illness that can be fatal. Intestinal parasitic infections are major causes of morbidity and mortality among school aged children of developing countries (WHO, 1987). There is a strong association between giardial infection and under nutrition of many primary school children (Loewenson *et al.*,

1986). It is because of dirty fingers and nails which might play an important role in the transmission of intestinal parasites (Soulsa, 1975).

Kathmandu valley has wide range of cultures and traditions. It contains highly developed to remote places. People from city areas are more educated and are more health conscious than those of rural areas. People living in village areas of Kathmandu district are troubled by parasitic infections due to their poor health habits. Communicable diseases such as diarrhoea and dysentery influence a very depressing health. These are the major source of death and sickness especially among children and infants in Nepal.

There are many factors for parasitic infections. The major factors are low economic status, illiteracy, unhygienic behaviour and water pollution. The increased water pollution is one of the major public health issues in Nepal. Diarrhoeal parasitic infections of gastro-intestinal tract are the result of water pollution. Diarrhoea (10%) is the disease caused by contaminated water in Nepal (DoHS, 1998 and SAEHN, 2002). Children were found to be infected more frequently than adults (Rai *et al*., 1994). Intestinal infections like giardiasis, ascariasis, amoebiasis, ancyclostomiasis, fascioliosis and taeniasis are common in Nepal (Acharya, 1979).

Significance of Study

In the 21st century, the world has stepped a tremendous change in various fields. But some parts of Nepal are still in the conservative and unhygenic traditional aspects which play a major role in increasing the parasitic infection. The present survey may play tremendous role to get the dream of state by creating awareness to the people living at Mulpani. Such type of survey has not been done before in that area to enlighten the

awareness related to intestinal parasite. The children as well as parents of that area do not know about the route of transmission of parasitic disease. Heavy infection affects on growth of the host, weakens the body causing death. The death rate is higher in young ones than in old. Communicable diseases such as diarrhoea and dysentery influence a very depressing health. These are the major source of death and sickness especially among children and infants.

Because of the lack of awareness about sanitation children of the rural area are more infected than adult. They play in soil and dirty places. Most children eat their food without washing their hands. This help to transmit the parasite. Infants are infected by carelessness of the parents. Another point of the parasitic infection in lower age people is due to low resistance power. The infection rate of different intestinal parasites may differ in different communities or castes of people since they have different traditional habit and habitat.

Acute Diarrhoeal Diseases (ADD) outbreaks cause morbidity and mortality in high scale in many districts of Nepal. Previous records showed that the main cause of these ADD outbreaks is due to unsafe drinking water. The Ministry of Health, DoHS and EDCD established a mechanism for minimizing outbreaks (EDCD, 2002-2003).

The study of intestinal parasites in children of Mulpani VDC of Kathmandu district has been undertaken to find the prevalence of infection on the basis of age, sex, source of drinking water, caste etc Awareness was also brought regarding intestinal parasites. This will help in minimizing different intestinal diseases. This also promotes the school authority to carry out such programmes each and every year in the near future. Moreover, the present study might help the future investigators to advance the knowledge and carry out various researches in the rural communities about the intestinal parasites.

II

OBJECTIVES

General Objective

- Prevalence of intestinal parasitic infections among children of Mulpani VDC of Kathmandu district.

Specific Objectives

- To study the prevalence of different intestinal parasites among children of "Ananda Bhairab Lower Secondary School."
- To know the level of public awareness i.e. knowledge, attitude and practices (KAP) of children about intestinal parasites.
- To bring awareness against intestinal parasitic infections.
- To aware the children to develop hygienic habits.
- To develop the recommendations for future planning regarding control of intestinal parasites.

III

LITERATURE REVIEW

Human Intestinal Parasitic Infections in Global Context

Al Ballaa *et al.*, (1993) determined the prevalence of pathogenic intestinal parasites among preschool children in Saudi Arabia through a randomized multi stage sampling of 800 school children. The over all prevalence of intestinal parasite among children screened was 18.4%. Out of the 1461 children positive for parasites, 183 (12.5%) had mixed parasitic infection. Prevalence among preschool children was highly associated with older age, rural resistance and non municipal water supply, in adequate latrine type, low level of parental education, abdominal pain and diarrhoea.

Alo *et al.*, (1993) determined the prevalence of intestinal helminthiasis among students of Government Secondary School, Government Area of Adamawa State, Nigeria, between January and July 1991. Out of 200 students between the age group 10-32 years old examined, 86 (43.0%) were in infected.

Hassan *et al.*, (1994) surveyed 4 primary and 2 secondary schools at Kafr Hakeem, El-Mansuria and Barkash villages in Imbaba district. Urine and stool specimens of 791 students were examined. Results revealed Amoebiasis (22.4%), *Hymenolepis nana* (6.2%), *Ancylostoma duodonale* (5.7%), Ascariasis (1.5%) and Enterobiasis (1.1%). There was no statistical difference between primary and secondary school students regarding the rate of infection.

Kappu *et al.,* (1994) examined 216, 257 stool specimens by the state diagnostic laboratories in 1987 and found 20.0% positivity. Percentages were highest for protozoans. The most commonly identified helminthes were nematodes: hookworm (1.2%) and *Ascaris lumbricoides* (0.8%)

Kightinger *et al.,* (1995) conducted an epidemiological study of intestinal nematodes with 1,292 children up to 11 years age, living in the Ranomafana rain forest of southeast Madagascar. Faecal examinations revealed prevalence of 78% for *Ascaris lumbricoides*, 38% for *Trichuris trichiura*, 16% for hookworm and 0.4% of *Schistosoma mansoni.*

Hadju *et al.,* (1995) studied the prevalence and intensity of helminth infections and nutritional status in urban slum school children (276 boys and 231 girls), in Ujung Pandang, Indonesia. Prevalence of *Ascaris*, *Trichuris* and hookworm was 92%, 98% and 1.4% respectively. 91% children had both *Ascaris* and *Trichuris* infections. About half of the *Ascaris* and *Trichuris* infected children (46% and 58%) had moderate infections. Stunting was seen in 55% of the children, while wasting was observed in 10%.

Saite *et al.,* (1996) surveyed for intestinal parasites by using thin smear and floating method for faecal examination in residents in Caazapa Department, Paraguay. Out of the 608 samples of residents in Boqueron, a community of Caazapa Department, 343 (56.5%) were found positive. The most prevailing parasite was *Nectar americanus* (27.9%) followed by *E. coli* (19.8%), *Giardia lamblia* (12.7%), *Ascaris lumbricoides* (4.8%) and other. The infection rate with *G. lamblia* and *A. lumbricoides* were conversely more frequent in children than in adults.

Soresen *et al.,* (1996) studied 1614 children of the age group 3-12 years and 246 women of the age group 18-44 years in Sri Lanka. 89.7% of children and 86.2% of women had one type of nematode infection. 77% of children and 69.5% of women were infected by *Ascaris*, likewise 69.4% of children and 56.5% of women had *Trichuris* and 23.2% of the children and 41.4% of the women had hookworm.

Pegelow *et al.,* (1997) examined stool specimens of children aged 8-10 years from ten schools located in the rural district Sukaraja, West Java, Indonasia. Four nematodes (Hookworm taken as one species), two cestodes and nine protozoan species, were detected, but no trematode infection was observed. Among helminthes, soil transmitted nematode infections were predominant. *Trichuris trichiura* with a prevalence of 76% being the most common infection, followed by *A. lumbricoides* (44%), Hookworm and *Enterobious vermicularis* were found in 9% and 3% respectively.

Kobayashi *et al.,* (1997) studied the intestinal infection of 128 children in Khammovane Province, Southeastern Sao, Paulo, Brazil. Prevalence of helminthes infection was 77.3% in children under 6 years age group, 88.5% in the age group 6-10 years and 81.8% in the age group above 11 years. The parasites were *Ascaris* 48.4%, *Trichuris* 43.8%, hookworm 37.5% and *Opisthorchis viverrini* 37.5%.

Mafiana *et al.,* (1998) conducted a study to determine the prevalence of soil transmitted helminthes parasites in children of Abeokuta, the capital city of Ogun State Nigeria. Stool samples of 1060 children were observed. The result revealed 64%, *Ascaris*, 14.5% *Ancylostoma* and 21.9% *Trichuris*.

Machado *et al.,* (1998) examined a total of 900 stool samples from 300 children aging from 4 months to 7 years, randomly selected in ten nursery schools from September 1994 to December 1995 both by the Baermann-movaes and Lutz methods in the city of Uberlandia, State of Minas Gerais, Brazil. Thirty nine children (13%) were found to be infected by *S. stercoralis* 64.1% were boys and 35.9% were girls followed by *G. lamblia* (78.83%), *A. lumbricoides* (4%), *H. nana* (6.7%), Hookworm (6%) *E. vermicularis* (4%), *Hymenolepis diminuta* (4%) and *T. trichiura* (0.7%) from 265 (88.4%) infected children, (64.5%) were mono infected, (27.2%) were infected by two parasites and 8.3% had ample specific parasite burden.

Paul *et al.,* (1999) carried out a study to determine the prevalence and intensity of intestinal helminth infections. The children were between 7-13 years of age and belonged to lower socioeconomic status. Stool samples collected were processed by modified formalin ethyl acetate sedimentation technique. 177 children were infected with one or more of the intestinal parasites viz; *A. lumbricoides*, *T. trichiura* and hookworm. The overall prevalence of infection was 82%, *A. lumbricodes* was the most common infection with a prevalence of 75% followed by *T. trichiura* (66%) and Hookworm (9%).

Lee *et al.,* (2000) examined stool and cello-tape anal swab carried out in August 1997 on handicapped people at an institution located in Chorwongun, Kangwon-do, Korea. Out of 112 stool samples, 3 cases of *T. trichiura* and 1 case of *E. vermicularis* infections were found and *E. coli* (25%), *E. histolytica* (1.8%), *Endolimax nana* (21.4%), *I. butschii* (1.8%) and *G. lamblia* (0.9%). Out of 165 cello-tape anal swab samples, the prevalence rate of *E. vermicularis* was (20.6%).

Toma *et al.,* (2001) studied on *Strongyloides* infection conducted by fecal 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 fecal examinations each year.

Amin *et al.,* (2002) conducted an investigation to determine the prevalence of intestinal parasites in the United States. Prevalence of infection was lowest in winter, gradually increased during the spring, reached peaks of 36-43% between July and October and gradually decreased to 32% in December. In single infections, pathogenic protozoa caused asymptomatic sub clinical infection in 0.31% of the cases and nonpathogenic protozoa unexpectedly caused symptoms in 73-100% of the cases.

Farook *et al.,* (2002) carried out a study to determine the intestinal helminthes infections among tribal population of the Kottar and Achankovil areas in Kerla (India). Out of total 258 stool samples examined, 60 shows ova of one or more intestinal helminthes. Hookworm infection was found to be predominant (58.82%) in Achankovil and remaining (41.1%) was due to only roundworm, whereas in Kottar area roundworm infection predominated (74.41%) followed by hookworm (18.6%) and other type (6.97%).

Botero *et al.,* (2003) assessed a preliminary study of prevalence of intestinal parasites in immuno compromised patients with and without gastrointestinal manifestation. A bettery of tests was performed on each individual to identify the presence of parasites with saline solution and by concentration, culture and special staining. No significant differences were found among the frequencies of potentially pathogenic and

opportunistic parasite which were 32.4% (36/111) and 9% (10/111) respectively. The most frequently encountered are *Cryptosporidium* sp, *Mierosporidium* sp and *Strongyloides stercoralis.*

Rim *et al.,* (2003) carried out the study to determine the prevalence of intestinal parasitic infections on a national scale among primary school children in Laos. From May 2000 to 2002 June, examined once with the cellophane thick smear technique. The cumulative egg positive rate for intestinal helminthes was 61.9%. By species, the rate of *Ascaries lumbricoides* was 34.9%, hookworm 19.1%, *Trichuris trichiura* 25.8%, *Taenia* sp 0.6% and *Hymenolepis* sp 0.2%, *Opisthorchis viverrino* was 10.9%.

Saksirisampant *et al.,* (2003) put forward the study about intestinal parasitic infections among children in an orphanage in Pathum Thani Province. During investigation, *Blastocytlic hominis* was found at the high prevalence (45.2%). The infection caused by *Giardia lamblia* was 37.7% and *E. histolytica* was 3.7%. Other non pathogenic protozoa were found.

Kurpad *et al.,* (2003) carried out the survey to determine the intestinal parasites that increase the dietary lysine requirement in chronically undernourished Indian. After the eradication of intestinal parasites, there was a significant ($P<0.001$) improvement in 24-h leucine balances, which were positive at both lysine intakes. On the basis of the 24-h indicator amino acid balance approach, it appears that the higher lysine requirement observed in persons with chronic under nutrition.

Wiwanikit *et al.,* (2003) studied platelet parameter in subjects infected with hookworm. Out of 100 subjects, hookworms were identified in stool

of six cases, giving an infection rate equal to 6%. The platelet parameters of the subjects showed a statistically significant lowering of mean platelet volume (MPV) in the subjects with hookworm infection.

Benicio *et al.,* (2004) carried out the prevalence and risk factors in the city of Sao, Paulo, Brazil during the evaluation of wheezing conditions in early childhood. The prevalence of recent wheezing wasl2.5%, 93% of children with wheezing was also reported to have medical diagnosis asthma. Recent wheezing was associated with low per capita income, poor quality housing, day-care attendance and infection with intestinal helminthes.

Deepmaia *et al.,* (2004) investigated on the prevalence of intestinal parasitic infections in human population of Darbhanga region of Bihar. In the epidemiological survey of intestinal parasitic infection, out of 2553 stool samples examined 920 (36.03%) were found to be positive for protozoan parasites. 1162 (15.52%) for helminthes and 471 (18.45%) for mixed infection. In overall infection, males and even those of 21-30 years age group showed higher prevalence rate (55.55%) than in females (44.45%).

Singh *et al.,* (2004) studied on helminthic infections of the primary school going children in Manipur. Out of 1010 stool samples collected from the primary school going children between the age group 5-10 years, 248 (24.5%) were positive for various helminthes. Among the positive cases, 110 (26.3%) were from urban area and 138 (23.4%) from the rural areas of-Manipur. Maximum number of parasitic infections was found in the age group 5-6 years. 27% *Ascaris lumbricoides*, 19.6% *T. trichiura*, 2.18% *H. nana*, 0.99% hookworm, 0.09% *S. stercoralis*.

Nithikathkul *et al.,* (2005) evaluated the impact of health educational programme on the prevalence of enterobiasis in school children in Thailand. The study showed a decrease in infections among children who received supplementary education. This decrease was significant in comparison to the decrease shown among children who received medical treatment only. The study therefore showed that educating high risk individuals played a key role in the prevention of enterobiasis.

Duran *et al.,* (2005) conducted an investigation on the distribution of intestinal parasites in students of the Mustafa Kemal University School of Health. In their study, the prevalence of intestinal parasites in female students (aged from 16-18 years) in the Mustafa Kemal University, out of 142 fecal samples and 136 cellophane tape preparation, 65 (45-77%) fecal samples were positive. *Blastocystis hominis* in 63 samples (96.92%) and *Giardia intestinalis* in 63 samples (3.08%). *Enterobius vermicularis* was found in 9 (6.61%), out of 136 cellophane tape preparations.

Aydin and Juncer, (2005) conducted the study on distribution of intestinal parasites in children from the Nisam Primary School in Hakkari. In this study, out of 114 stool samples i.e. 60 male and 54 female students, 66 (57.8%) samples were found positive. *Giardia intestinalis* (28.9%), *Blastocystic hominis* (23.6%), *Entamoeba coli* (12.2%) and *Ascaris lumbricoides* (6.14%) were most prevalent parasites.

Human Intestinal Parasitic Infections in Context of Nepal:

Several works regarding human intestinal parasites at different places of Nepal have been done. Some are given below:

A random sample study of patient in Bhaktapur was conducted to ascertain the incidence of roundworm infection by Sharma (1965). A total

of 976 samples were taken for over 5 years period. Among them 430 cases were males, 317 cases were females and 220 were children of both sexes under 12 years of age.

Nepal and Palfy, (1980) examined 225 stools. Only 4.4% of the samples showed the presence of more than one parasite. 3.1% of the samples had up to five parasites.

Shrestha, (1983) study in Bhaktapur district showed 99% stools were positive for the eggs of soil transmitted helminthes. Similarly from the Panchkhal area 41% stools were positive for the eggs of helminthes. During stool test Kato-Katz method was followed.

Rai *et al.,* (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 infection rate was 69% and the result showed that the infection was more common in girls than the boys.

Rai *et al.,* (1991) presented the paper to show the prevalence of various intestinal parasites in Kathmandu valley, Nepal. The overall prevalence of intestinal parasites was 30.9%. There was no significant difference in the prevalence between two sexes. Intestinal parasites were more common among children than in adult.

Rai *et al.,* (1994) studied status of intestinal parasites at T.U. Teaching Hospital. The positive rate of intestinal parasites was seen to be varying from 29.1% to 44.2%. Children were found to be infected more frequently than adults.

Sherchand *et al.,* (1997) studied the intestinal parasitic infection in rural areas of southern Nepal, Dhanusha district. Out of 604 children aged between 0-9 years examined, 63.1% were found positive for one or more intestinal parasites.

Nishimura, (2000) interviewed 1000 mothers of the children with diarrhoea in Kanti Children Hospital. Mothers younger than 20 years, 20-30 years and more than 30 years were 4%, 75% and 21% respectively. Among them 1% never gave breast milk, 11% gave only for few days, 34% stopped breast feed before 5th month and 13% of mothers still were only breast feeding up to 7 months.

Rai *et al.,* (2000) investigated the contamination of soil with helminth eggs in Kathmandu valley and outside of valley in Nepal by centrifugal floatation technique using sucrose solution. Out of 156 total samples, 122 were taken from Kathmandu valley and 34 samples from outsides of valley. The overall soil contamination rate was 36.5%. The prevalence was uniform in Kathmandu valley (36.3%) and outside of the valley (35.3%). In Kathmandu valley, soil contamination rate was higher (48.3%) during wet season compared with that observed in dry season (33.3%) but without significant difference ($P>0.05$). Altogether 5 species of nematodes were recorded and 2 species of cestoda. *A. lumbricoides* was prominent in Kathmandu valley while *Trichostrongylus* was the commonest one in outside of valley.

Rai *et al.,* (2001) studied the intestinal parasitic 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.

Shrestha, (2003) examined 115 stool samples from different part of Bhaktapur. She showed 3.1% of the samples were infected by five different spp. of intestinal parasites. *Ascaris,* hookworm and *Giardia* were the common parasites.

Sawal, (2005) examined 250 stools samples in Dhulikhal hospital 29% samples were positive for parasites. 29% had hookworm, 21% had *Ascaris,* 9.9% had *Trichiura,* 8.5% had *Giardia* and 4% had *E. histolytica.*

Table 1: Infection of Diarrhoea Diseases in five Different Years

1999/00	2000/01	2001/02	2003/04	2004/05
713463	787567	816481	949630	921901
3.12%	3.35%	3.38%	3.87%	3.68%

Source: Epidemiology and Disease Control Division, Teku

Table 2: Infection of Intestinal Worms in five Different Years

1999/00	2000/01	2001/02	2003/04	2004/05
651308	66329	666362	659582	611072
2.85%	2.82%	2.76%	2.73%	2.44%

Source: Epidemiology and Disease Control Division, Teku

Manandhar, (2006) examined 224 stool samples from children in Bhaktapur. Out of which 33.48% were found positive for the intestinal parasites. 62% *Ascaries*, 6.66% *Trichiura*, 6.66% Hookworm, 1.33% Hymenolepis, 6.66% *Giardia*, 10.66% *Entamoeba* and 2.66% *Cyclospora*.

IV

MATERAILS AND METHODS

Study Area:

"Ananda Bhairab Lower Secondary School" lies in Mulpani VDC at ward no.3 Out of 58 village development committee in Kathmandu District, Mulpani VDC lies in the eastern part of this district.

Introduction of Kathmandu district:

Kathmandu district lies in Bagmati zone, which is situated in Central Development Region and is surrounded by Dhading, Nuwakot, Sindhupalchok, Kabhrepalanchok, Bhaktapur, Lalitpur and Makawanpur district. It is the capital of Nepal. It carries a lot of historical and religious places. Among them, Pashupati Nath, Swayambu Nath and Budhnilkantha are the famous religious places. Shivapuri National Park also lies in this district.

Kathmandu district has a Kathmandu metropolitian city, Kirtipur municipality and 58 Village Development Committee. The total area covered by this district is 395 sq. km. It has various climates with the variation of deviation or geographical features.

According to the Central Bureau of Statistic (2001), the total population of Kathmandu district is 1,081,845; among them 576,010 are male and 505,835 are female. There are 235,387 households. The major populations are Hindus. The main castes are Brahmin, Chettri, Newar, Magar, Bhote and others. Most people of city area depend on business and job. The people living in village area depend on agriculture. As this

district contains many villages, most people depend on agriculture rather than other professions.

Introduction of Mulpani VDC:

Mulpani VDC is one of the underdeveloped and rural areas in Kathmandu district. It lies toward the eastern side of Kathmandu city. The total population of this VDC is 5880; among them 2919 are males and 2961 are females. There are 1498 households. This VDC has an area of 3 sq. km. The main castes are brahmin, chettri, newar, bhote, magar and others. Most of the people are illiterate here. Farming and agricultural labour are livelihood job of these people. Because of illiteracy, unhygienic living habit, poor socioeconomic condition and conservative thinking, they are suffering from different kinds of parasitic infection.

"Ananda Bhairab Lower Secondary School" lies in ward no.3 of Mulpani VDC. This is the only lower secondary school in ward no.3. It is the government school. Most of the students studying in this school are from the poor families. This is the school from where I studied my first alphabet.

The study was divided into two parts. First part was questionnaire surveillance study and second part was stool sample collection for examination of intestinal parasites of children from nursery to class eight.

Sample Size: Total sample size of the present study is 232 out of 245 students.

Sample Collection:

On the first day, the set of prepared questionnaires were asked to the students and then a vial for stool sample collection was provided to each of them.

- Survey Study: The same day, the structured questionnaire was filled from each respondents regarding sanitary, illiteracy, hygienic condition, source of water and awareness about parasites.

The next day, the stool samples were collected from them. Immediately after collection, potassium dichromate was added in the vials containing stool for preservation.

Equipments and chemicals:

- Compound microscope, glass slides, cover slips, cotton or filter paper, gloves, needle, sticks, vials.
- Potassium dichromate, normal saline, iodine solution.

Examination of Faecal Samples:

Macroscopic Examination:

Firstly, the faecal samples were examined by naked eyes for the worms of helminth parasites (adult worm of *Ascaris, Trichuris,* hookworm and other intestinal flukes) or a part of it (segments of *T. solium* and *T. saginata*)as well as mucous, blood and consistency.

Microscopical examination of the stool:

- **Unstained preparation of stool smear:** A portion of stool was taken with the help of small stick and emulsified with normal saline on a clean glass slide and cover slip was placed over it and excess of fluid was removed with the help of filter paper.
- **Stained preparation of stool smear:** Stained preparation was necessary for the identification and the study of the nuclear character. The iodine stained preparation was used for this purpose.

- **Method of observation:** Both stained and unstained preparations were first examined under the low power of microscope under 10X objective. Observation was made starting from one end of the slide to another. Objects were centered and focused under the high power for detailed diagnosis.

V

RESULTS

The study was conducted among children of "Ananda Bhairab Lower Secondary School" of Mulpani VDC. The study was performed among 232 children from nursery to class eight. The result of the present study is divided into two categories.

1. Results of stool examination.
2. Results of questionnaire survey analysis.

1. Results of Stool Examination:

1.1. General Prevalence of Intestinal Parasites of School

Out of 232 students, 62 (26.72%) were found to be infected with one or more types of intestinal parasites. This survey revealed that the students were remarkably infected.

Table 1: General Prevalence of Intestinal Parasites of School

Name of school	Total no. of samples examined	No. of +ve cases	+ve%
Ananda Bhairab Lower Secondary School	232	62	26.72

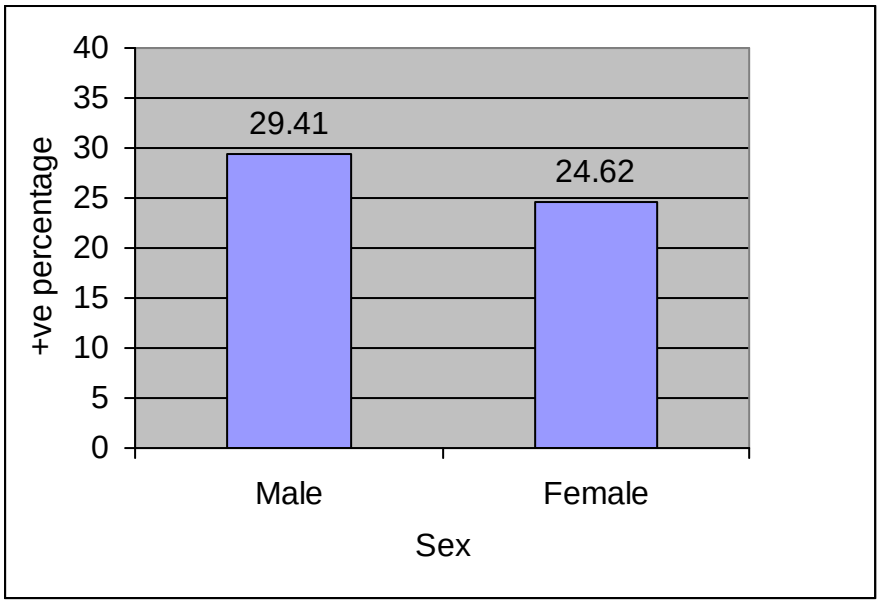
1.2 Sex-wise Prevalence

Out of 232 stool samples examined, 102 were of male children and 133 of female children. Out of 102 male stool samples examined, 30 (29.41%) were found to be positive. Likewise out of 130 female stool samples examined, 32 (24.62%) were found to be positive for intestinal parasites. Hence, the infection rate was found higher in male children than female (Table 2, Fig. 1). Statistically, the difference in sex-wise prevalence of parasites was found insignificant ($\Re^2$ = 0.671, p>0.05)

Table 2: Sex-wise Prevalence of Intestinal Parasites

Sex	Total samples examined	+ve cases		-ve cases	
		No.	%	No.	%
Male	102	30	29.41	72	70.59
Female	130	32	24.62	98	75.38
Total	232	62	26.72	170	73.28

Fig 1: Sex-wise Prevalence of Intestinal Parasites



1.3 Sex and Caste-wise Distribution of Intestinal Parasites

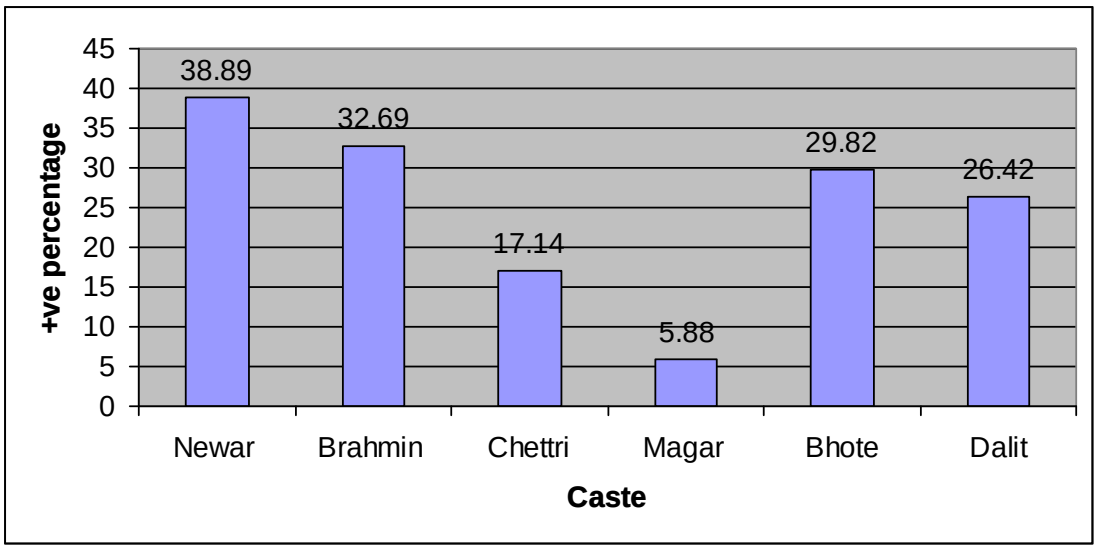
Table 3 shows that in Newar community male children (71.43%) were more infected than female children (18.18%). In Brahmin community, female children (33.33%) were more infected than male children (31.82%). In Chettri community, female children (20%) were more infected than male children (13.33%). In Magar community also female children (11.11%) were more infected than male (0%). In Bhote community male children were more infected than female children (23.08%). In Dalit community, female children (26.47%) were more infected than male (26.32%).

In overall, Newar children (38.89%) were found more infected than other castes followed by Brahmin (32.69%), Bhote (29.82%), Dalit (26.42%) Chettri (17.14%) and Magar (5.88%).

Table 3: Sex and Caste-wise Distribution of Intestinal Parasities

Caste	Newar		Brahmin		Chettri		Magar		Bhote		Dalit	
Total examined	18		52		35		17		57		52	
	+ve cases		+ve cases		+ve cases		+ve cases		+ve cases		+ve cases	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	5	71.43	7	31.82	2	13.33	0	0	11	35.48	5	26.32
Female	2	18.18	10	33.33	4	20.22	1	11.11	6	23.08	9	26.47
Total	7	38.89	17	32.69	6	17.14	1	5.88	17	29.82	14	26.42

Fig 2: Caste-wise Distribution of Intestinal Parasites



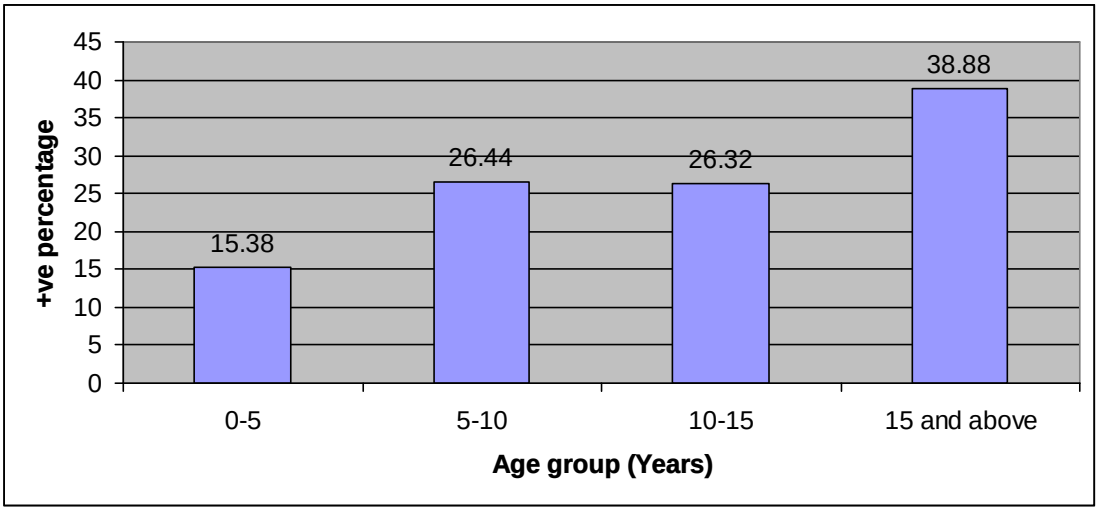
1.4 Age group-wise Prevalence

Table 4 and Fig. 2 reveal that, the distribution of intestinal parasites was maximum (38.88%) in 15 years and above age group and minimum (15.38%) in 0-5 years age group. Statistically, no significant difference regarding parasitic infection was found in different age-groups (χ^2=2.227, P>0.05**).**

Table 4: Age-wise Prevalence of Intestinal Parasites

Age(years)	No. of Samples	+ve cases	
		No.	%
0-5	13	2	15.38
5-10	87	23	26.44
10-15	114	30	26.32
15 and above	18	7	38.88
Total	232	62	26.72

Fig 3: Age-wise Prevalence of Intestinal Parasites



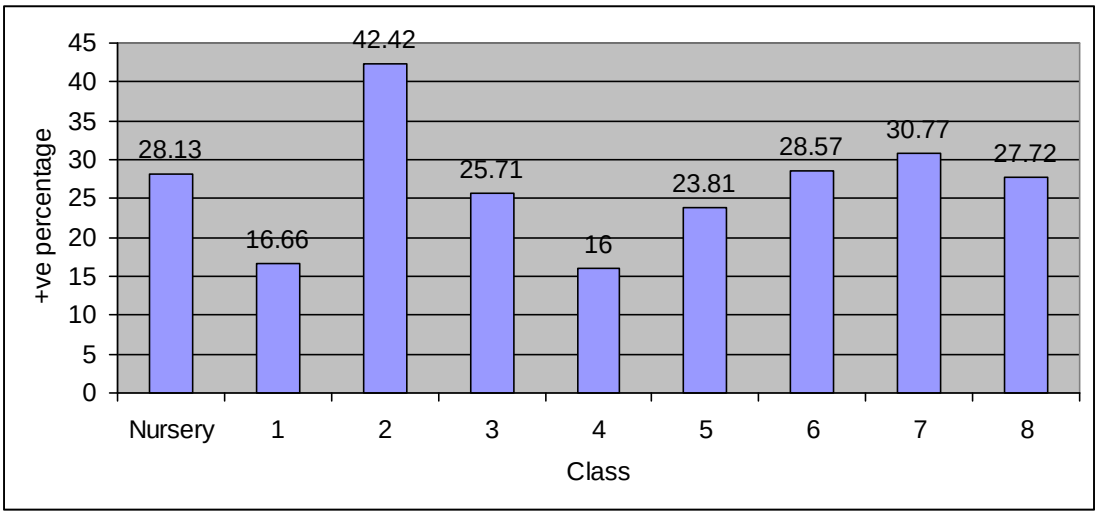
1.5 Class-wise Prevalence

The distribution of intestinal parasites was maximum (42.42%) in class 2 and minimum (16%) in class 4(Table 5 and Fig. 3). Statistically, no significant difference was found among children of different classes on prevalence of parasitic infection ($\Re^2$=7.46, P>0.05).

Table 5: Class-wise Prevalence of Intestinal Parasites

Class in school	No. of Samples	+ve cases	
		No.	%
Nursery	32	9	28.13
1	30	5	16.66
2	33	14	42.42
3	35	9	25.71
4	25	4	16.00
5	21	5	23.81
6	21	5	28.57
7	13	4	30.77
8	22	6	27.72
Total	232	62	26.72

Fig 4: Class-wise Prevalence of Intestinal Parasites



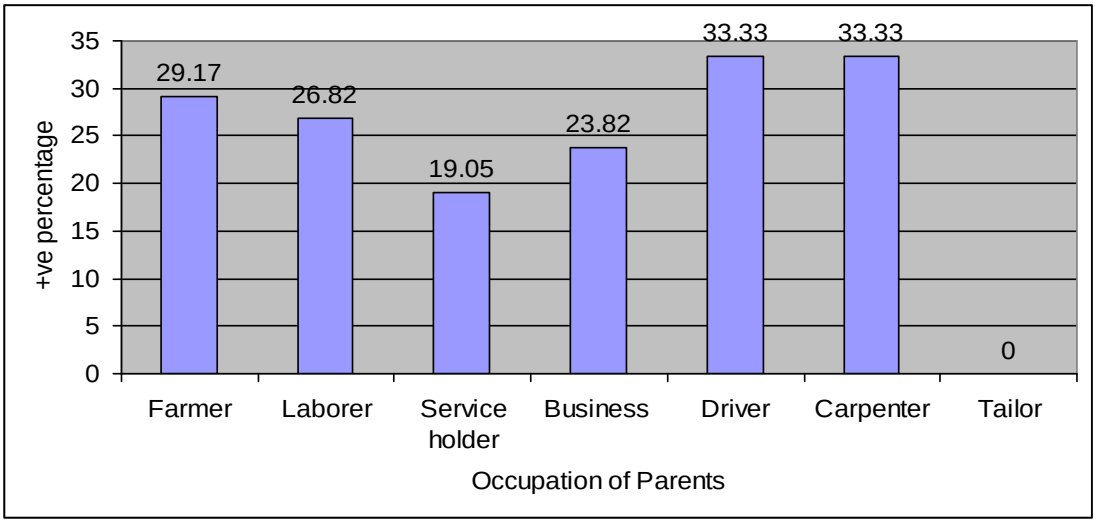
1.6 Parent's Occupation-wise Prevalence

The prevalence of parasitic infection was found to be maximum (33.33%) in children of those families whose parents are driver and carpenter and minimum infection (19.05%) was found in children of those family whose parents are service holders (Table 6 and Fig. 4). Statistically, no significant difference was found in the prevalence of intestinal parasites of the children according to their parent's occupation (χ^2=2.317, p>0.05).

Table 6: Parasitic Infection in Relation to Occupation of their Parents

Occupation of parents	No. of samples	+ve cases	
		No.	%
Farmer	96	28	29.17
Laborer	82	22	26.82
Service holder	21	04	19.05
Business	21	05	23.81
Driver	06	02	33.33
Carpenter	03	01	33.33
Tailor	03	00	00.00
Total	232	62	26.72

Fig 5: Parasitic Infection in Relation to Occupation of their Parents



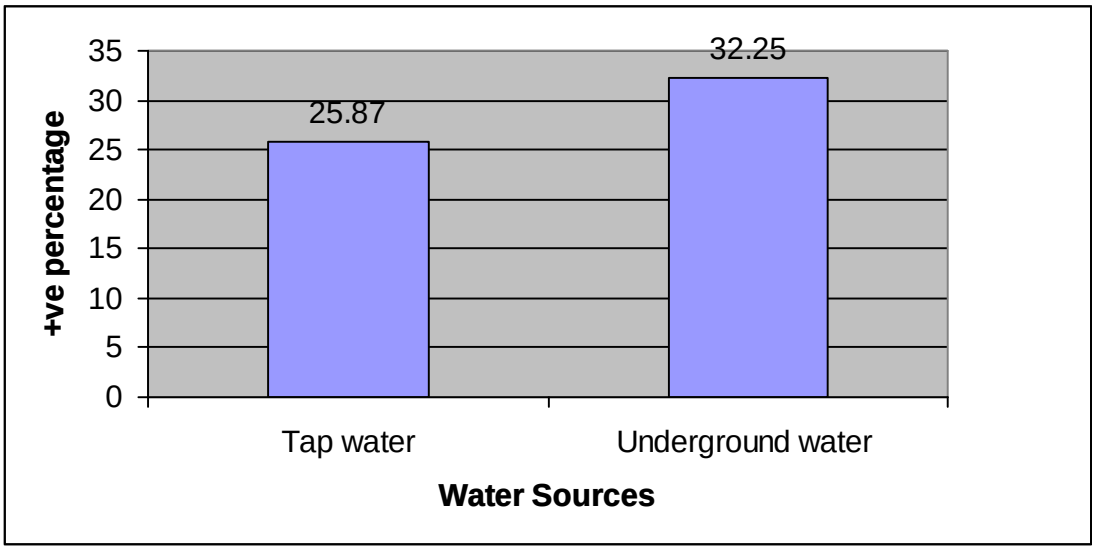
1.7 Prevalence of Intestinal Parasites on the Basis of Drinking Water

Table 7 and Fig. 5 reveal that the distribution of parasitic infection was found maximum (32.25%) in underground-water consuming children, whereas tap-water consuming children were found less infected (25.87%). Statistically, no significant difference in parasitic infection rate was found among different drinking water source users (¡ ² = 0.56, P>0.05).

Table 7: Prevalence of Intestinal Parasites on the Basis of Drinking Water

Water sources	Observation no.	+ve cases	
		No.	%
Tap water	201	52	25.87
Underground water	31	10	32.25
Total	232	62	26.72

Fig 6: Prevalence of Intestinal Parasites on the Basis of Drinking Water



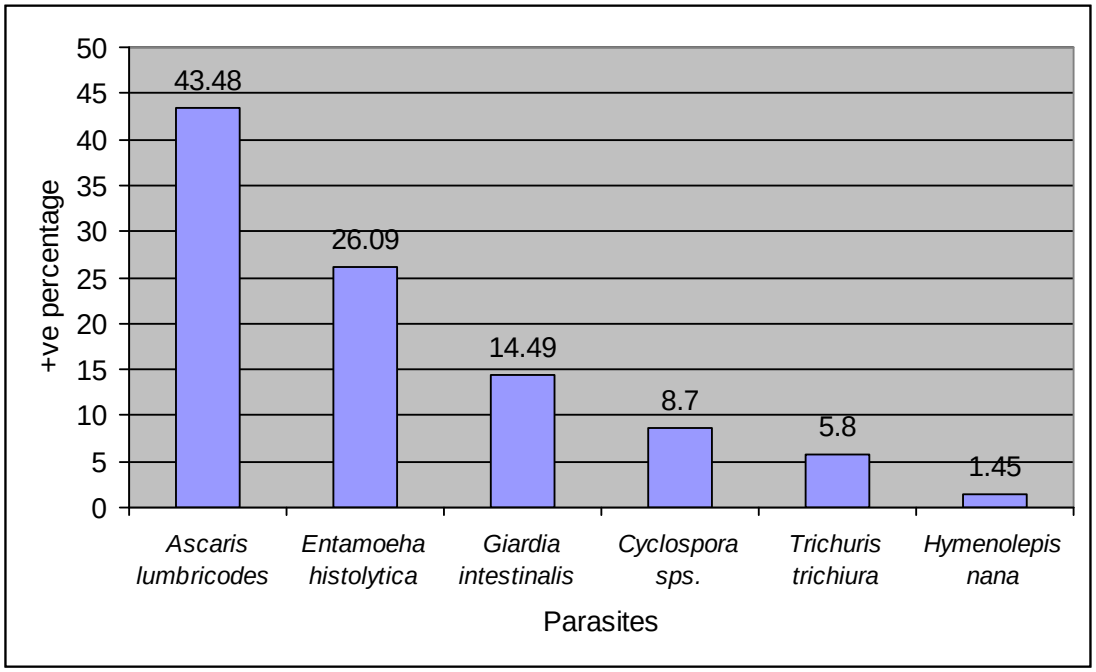
1.8 Prevalence of Specific Intestinal Parasites

Tabel 8 and Fig. 6 reveal the infection rate of specific intestinal parasites in 62 positive samples. 30 (43.48%) were infected with *Ascaris*, 18(26.09%) with *Entamoeba histolytica*, 10(14.49%) with *Giardia*, 6(8.71%) with *Cyclospora* sps., 4(5.810%) with *Trichuris trichiura*, and 1(1.45%) with *Hymenolepis nana.*

Table 8: Infection Rate of Specific Intestinal Parasites

Parasites	Total infected cases		No. of Infected	
	No.	%	Male	Female
Ascaris lumbricodes	30	43.48	13	17
Entamoeha histolytica	18	26.09	08	10
Giardia intestinalis	10	14.49	05	05
Cyclospora sps	6	8.70	04	02
Trichuris trichiura	4	5.80	02	02
Hymenolepis nana	1	1.45	01	00
Total	69	100	33	36

Fig 7: Infection Rate of Specific Intestinal Parasites



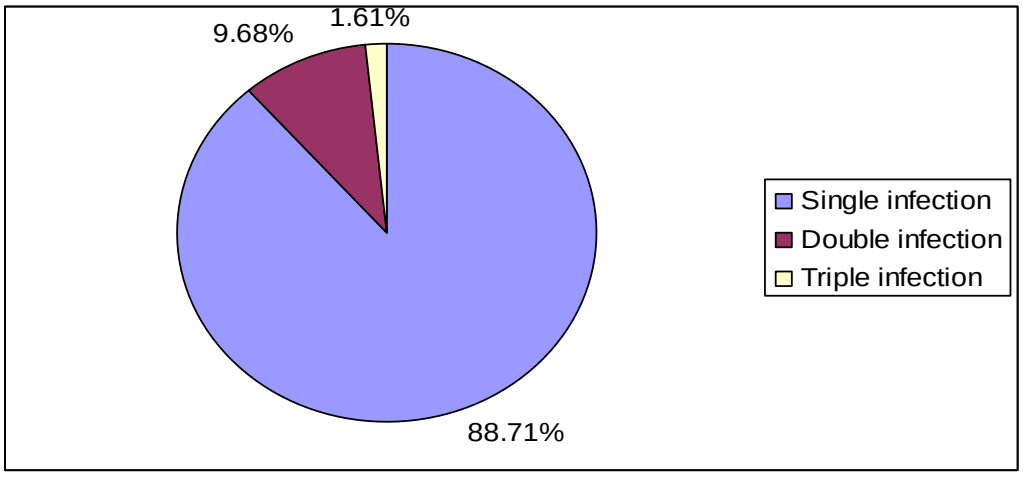
1.9 Parasitic Concurrent Infection among Children

Single infection was found more than double and triple type of infections. Out of 62 positive cases, 55(88.71%) children were infected with single species of parasite, 6(9.68%) were infected with double species of parasites and 1(1.61%) was infected with triple species of parasites. In double infections, maximum infections were of *Entamoeba+Giardia*. In triple infection *Entamoeba+Cyclospora+Ascaris* was found.

Table 9: Parasitic Infection Pattern among Infected Children

Parasitic infection	Total infection cases	
	No.	%
Single infection	55	88.71
Double infection	6	9.68
Triple infection	1	1.61
Total	62	100

Fig 8: Diagrammatic Representation of Parasitic Infection Pattern among Children



2. Results of Questionnaire Survey Analysis:

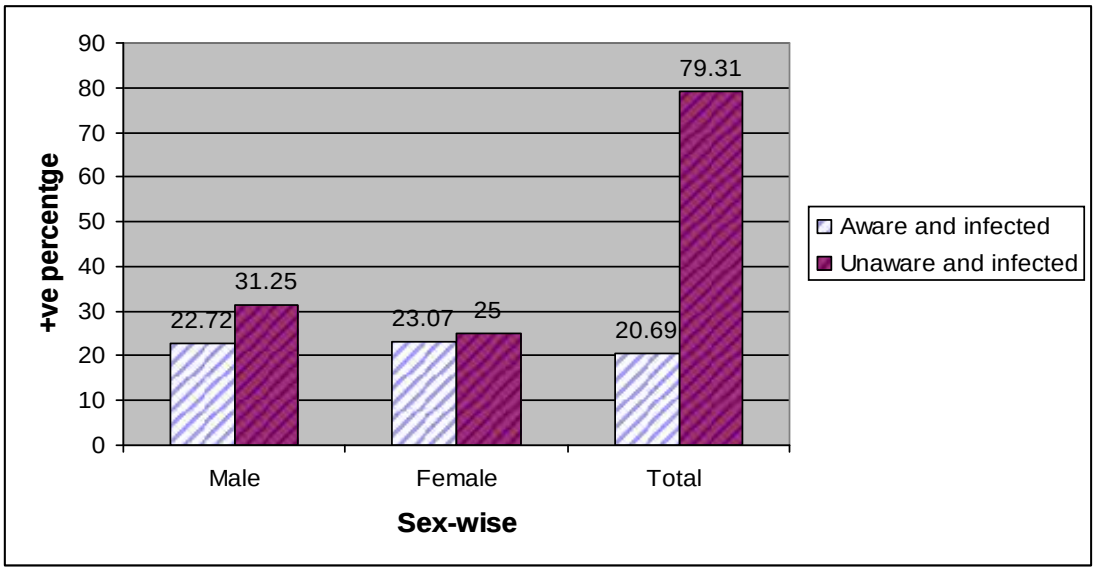
2.1 Knowledge of Interviewed Children Regarding Parasites

Questions about the knowledge of transmission and prevention were asked. Table 10 revealed that most of the students (79.31%) were unaware of intestinal parasitic worms. Only 20.69% students were aware of intestinal parasitic worms. Male students were more aware (21.57%) than female students (20.00%). Statistically, there was no significant difference in parasitic infection rate among awared and unawared children (¡ ^{2} = 4.287, P>0.05).

Table 10: Knowledge of Parasites among Children an their Infection Rate

Sex	Interviewed No.	Awared				Unawared			
		No	%	Infected No.	%	No	%	Infected No.	%
Male	102	22	21.57	5	22.72	80	78.43	25	31.25
Female	130	26	20.00	6	23.07	104	80.00	26	25
Total	232	48	20.69	11	22.92	184	79.31	51	27.72

Fig 9: Knowledge of Parasites among Children and their Infection Rate



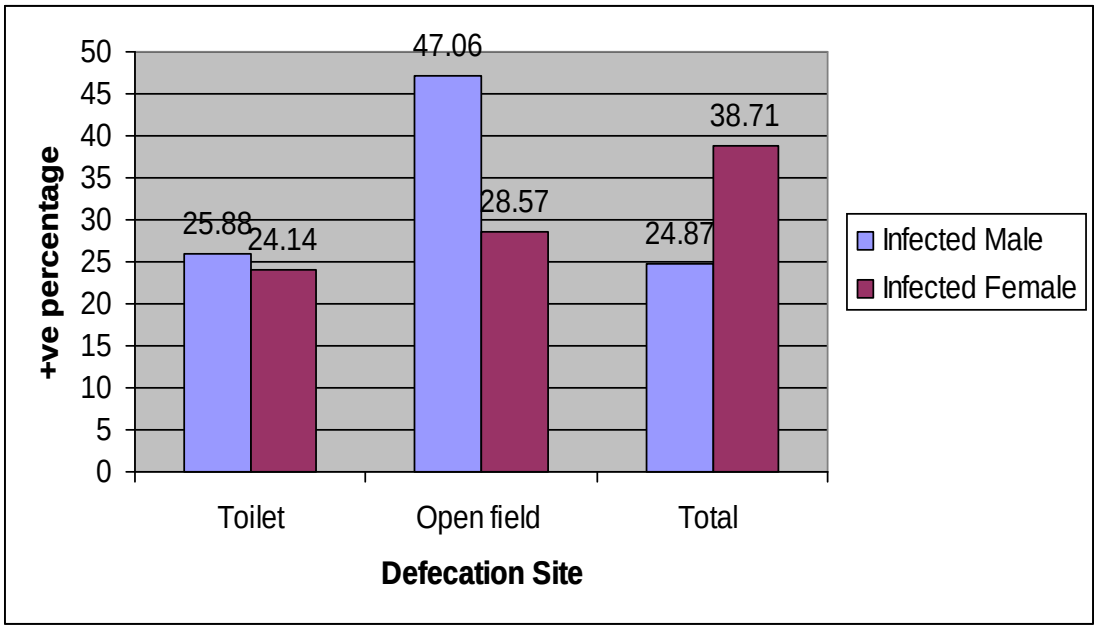
2.2 Way of Defecation

The analysis of questionnaire showed that out of 232 children interviewed, 201(86.63%) children were using toilet and 31(13.63%) children preferred open field or near by bushes for night soil disposal. In toilet user, 22 (25.88%) males and 28 (24.14%) females were infected. In open field user, 8 (47.06%) males and 4 (28.57%) females were infected.

Table 11: Way of Defecation and Infection Rate

Sex	Interviewed No.	Toilet user				Open field			
		No.	%	Infected	%	No	%	Infected	%
Male	102	85	83.33	22	25.88	17	16.66	8	47.06
Female	130	116	89.23	28	24.14	14	10.75	4	28.57
Total	232	201	86.63	50	24.87	31	13.36	12	38.71

Fig 10: Way of Defecation and Infection Rate



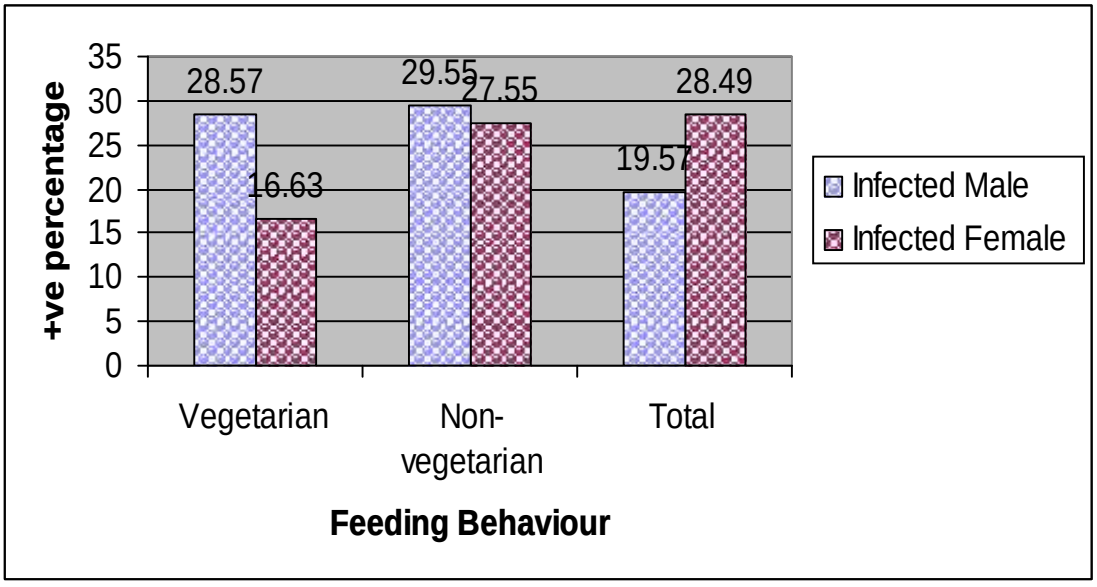
2.3 Feeding Behaviour

The analysis of questionnaire showed that 46(19.82%) children were vegetarians and 186(80.17%) were non-vegetarians. Female children were more vegetarians (24.61%) than male children (13.72%). Out of 14 male vegetarians, 4 (28.57%) males were infected. Females who were vegetarian and infected with intestinal parasites were 5 (16.63%). Infected non-vegetarian male and female were 26 (29.55%) and 27 (27.55%) respectively.

Table 12: Prevalence of Intestinal Parasites on the Basis of Feeding Behaviour

Sex	Interviewed No.	Vegetarian				Non-vegetarian			
		No.	%	Infected	%	No.	%	Infected	%
Male	102	14	13.72	4	28.57	88	86.27	26	29.55
Female	130	32	24.61	5	16.63	98	75.38	27	27.55
Total	232	46	19.82	9	19.57	186	80.17	53	28.49

Fig 11: Prevalence of Intestinal Parasites on the Basis of Feeding Behaviour



VI

DISCUSSION AND CONCLUSION

Intestinal parasites cause serious health problem in society. Unhygienic feeding behavior, illiteracy and conservative thinking cause the transmission of parasitic diseases. Prevalence is higher in the economically deprived regions of the world especially in the developing countries (Gupta *et al.*, 2004).

Analysis of surveillance data showed that out of 232 children of Mulpani VDC, 62 (26. 72%) were harbouring different kinds of intestinal parasites. The remarkable prevalence was found because of low grade personal hygiene, poor environmental sanitation and low education which help in the transmission of parasites. Rai *et al.*, (2001) found 76.4% prevalence of intestinal parasites in children of Accham district in far-western region of Nepal.

The present study shows that out of 232 children, 184 (79.31%) were not aware of the parasitic worms. Only 48(20.69%) were aware about parasitic worms. This result shows that knowledge of parasitic infection is very poor in the children of all communities. Comparatively male students were more aware (21.57%) than female students (20.00%). While analyzing the awareness about intestinal worms among Magars of Teendobate VDC, Gaire (2000) reported 26.22% awareness.

In the present study, sex-wise prevalence of intestinal parasites of students from "Ananda Bhairab Lower Secondary School" was done. The result showed that comparatively males 30 (29.41%) were more infected than females 32 (24.62%). Statistically, there was no significant difference in prevalence of parasites in between two sexes (x^2 =o.671,

p>0.05). It is because of equal possibilities of transmission of parasites among them due to over dispersal of parasites in all the communities. Rai *et al*., (2001) showed that parasites were distributed in males (76.5%) and in females (76.3%) in rural hilly area in western Nepal (Accham). This result is in agreement with the present study.

Among the different castes, Newar children (38.89%) had the highest prevalence followed by other castes like Brahmin (32.69%), Bhote (29.82%), Dalit (26.42%), Chettri (17.14%) and Magar (5.83%). This prevalence may be because of the illiteracy, poor hygienic condition and lack of knowledge of parasitic infection as well as mode of transmission. The prevalence was significantly related to economic status, education, housing conditions, drinking water and their personal hygiene which is supported by De Silva *et al.*, (1996).

In the present study, school children were categorized into 4 groups i.e. (0-5), (5-10), (10-15) and above 15 years. Among these groups, the prevalence of parasites was found highest (38.88%) among age group above 15 years and minimum (15.38%) in 0-5 years age group. The prevalence of intestinal parasites in (5-10) and (10-15) year age group was 26.44% and 26.22% respectively. While analyzing the infection rate in different age group among Magar in Tindobate VDC, Syangja, Gaihre (2000) reported minimum infection in (1-8) year age group and maximum infection in (9-15) year age group. Sherchand *et al*., (1997) showed that the parasitic infection was the highest (30.81%) in the age group (6-9) years. But Rai *et al.*, (1991) found highest (42.14%) as a whole in the age group 10-15 years.

The prevalence rate of intestinal parasites was the highest (42.42%) in the students of class 2 and minimum (16.00%) in the students of class 4.

This kind of infection distribution is due to the carelessness, playing in dirty places and haphazard feeding habits. Present findings indicate that there was no significant difference among children of different classes in prevalence of parasitic infection ($\Re^2$=7.64, p>0.05).

The highest prevalence (33.33%) was found in those children whose parents are driver and carpenter. This may be due to the reason that most of them are uneducated. So, there do not have any knowledge of parasitic infection and are unable to care properly their children from parasitic infection. These parents may follow unhygienic feeding habits which may be imitated by their children and become victim of parasitic infection. The minimum infection (19.05%) was found in children of the family whose parents are service holder. This may be due to reason that most of these parents are educated and have knowledge about means and mode of intestinal parasitic transmission. So, they follow hygienic feeding habits and teach their children the healthy hygienic habits like cutting their nails, washing hands with soap after toilet and before meal. They prohibit their children to play in dirty places and walk with bare foot. So, these conditions prevent their children being infected from the intestinal parasites. Statistically, no significant difference was found in the prevalence of intestinal parasites of the children according to their parents occupation ($\Re^2$=2.317, p>0.05).

Present findings indicate that there was no significant difference in parasitic infection rate among different drinking water sources user ($\Re^2$=0.56, p>0.05). It was found that the prevalence was maximum (32.25%) in underground water consuming children whereas tap water consuming children were found less infected (25.87%). In underground water, the commonly used sources are well and Kuwa. Most of the well

and Kuwa are open and people use mostly bucket to draw water from these sources. The bucket used to draw water may not be clean and may be contaminated with eggs of different intestinal parasites. In this way, well and Kuwa may be contaminated. This may be the reason that underground water consuming children were more infected than the tap water consuming children.

Ascaris had the highest prevalence rate (43.48%) followed by *Entamoeba histolytica* (26.09%), *Giardia* (14.49%), *Cyclospora* (8.71%), *Trichuris trichiura* (5.81%) and *Hymenolepis nana* (1.45%). The prevalence rate of helminths was higher than protozoans. It is in an agreement with the report published by WHO (1993), according to which infections by soil transmitted helminthes has been increasingly recognized as an imported public health problem, particularly in developing countries.

Out of 62 positive cases there were 55 (88.71%) having single infection, 6 (9.68%) double infection and 1 (1.61%) triple infection. The most common double infection was (*Entamoeba+Giardia*) and (*Ascaris+Trichuria*). (*Ascaris+Entamoeba+Cyclospora*) were found in triple infection. This also showed that *Ascaris* was highly influenced among children. So, this finding also coincides with the report presented by Rai *et al.*, (1994), according to which the annual rate of the positivity for soil transmitted helminthes (i.e. *A. lumbricoides*) had the highest prevalence rate than others (i.e. *T. trichiura* and Hookworm).

In the present study, (86.63%) children use toilet and only (13.36%) children use open field as defecation place. But Rai *et al.*, (2001) had reported from rural village else where in Nepal that over 80.0% of households had no toilet.

Since the development of a country is dependent on the health status of the children. Government as well as other health conscious people should give more emphasis on the parasitic disease of children. It may be assumed that similar situation might be prevailing in other places of our country, which are yet to be investigated. Thus, extensive study is needed for the determination and control of intestinal parasites whole over our country.

VII

RECOMMENDATIONS

- Public health education in the school curriculum must be made compulsory.
- Awareness and control programme for intestinal helminthes parasites should be lunched by different organizations.
- Habit of defecating on open field, on the bank of river etc should be prevented and human night soil should be managed properly.
- People should avoid walking bare foot.
- Consumption of raw or undercooked meat, unwashed fruits, vegetables and washing with contaminated water should be prevented.
- Well- established sanitary toilet should be build up in each and every home.
- Basic health education programme should be conducted time to time in schools for raising awareness towards the parasitic infections, prevention and control.
- The research work on the prevalence of intestinal parasites and prevention should be encouraged.

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ANNEX

Questionnaire

It is requested to all the guardians of concerned children to fill the following question papers of concerned children in order to achieve the success in the program of "Study of prevalence of intestinal parasitic infections among children".

1. S.N.....

2. Name of children.....

   i) Class..... ii) Age..... iii) Sex.....

   iv) Qualification of father.....

3. School's type: Government/Boarding.

4. Where do you defecate?

   i) Field ii) Near water resources iii) Toilet

5. From where do you get drinking water?

   i) Tap ii) Well iii) River iv) Spring

6. How do you use water for family?

   i) Direct tap water ii) By boiling iii) By adding potash

7. How do you wash your hand?

   i) With soap ii) With ash iii) With soil

8. When do you wash your hand?

i) Before meal ii) After meal iii) After toilet iv) All above

9. Do you cut your nail regularly? Yes No

If yes, when do you cut?

i) Once a week ii) Twice a week iii) Once a month

10. Do you have any domesticated animals? Yes No

If yes, what have you kept ?

i) Hens ii) Ducks iii) Dogs iv) Goats

v) Cows vi) Buffalo vii) Pigs viii) Cats

11. What types of food habit you have?

i) Vegetarian ii) Non-vegetarian

12. If non-vegetarian, which meat frequently you take?

i) Pork ii) Chicken iii) Buffalo iv) Mutton v) Fish vi) Beef

13. How do you prepare your meat to eat/

i) Raw meat preparation ii) Sekuwa masu iii) Half cooked

iv) Boiled v) Well cooked

14. How do you clean the vegetables and fruits?

i) Rubbing on clothes ii) Tap/Kholsa/Well water

iii) Without washing

15. Have you taken deworming tablet before? Yes No

If yes, when? i) Don't know ii) Three months before

iii) Six months before iv) One year before

16. Have you suffered by diarrhoea/dysentery worms? Yes No

If yes, when? i) One week before ii) One month before

iii) Six months before iv) Now v) Don't know

17. How do you treat in case of infection?

i) Traditional methods ii) direct taking medicine

iii) Consult doctors

18. Do you know the causes of worm infection? Yes No

If yes, what are they? .....

19. Do you know the symptoms of worm infection? Yes No

If yes, what are they?.....

20. Do you know the cause of diarrhoea? Yes No

If yes, what are they?.....

21. Do you know the methods of prevention of worm infection? Yes No

If yes, what are they?.....