INTRODUCTION

Parasites are those organisms, which live inside the individuals of another species (the hosts) remaining closely associated biologically and ecologically. During their stay parasites derive nourishment, shelter and protection from the host. In another words it is an association in which an animal, the host, is injured to some degree through the activity of the parasite. In such condition the parasites are called pathogens and the condition that results from the damage is called disease.

Nepal, like most of the developing countries presents a very depressing health statistics which results due to wide range of communicable diseases which are caused due to presence of intestinal parasites in the body. These are the major cause of sickness and death especially among the children and infants in our country.

The intestinal parasites are generally the protozoans and helminthes. Protozoa are unicellular animals that occur single or in colonies. Each Protozoan is a complete unit capable of performing the physiological functions which in higher organisms are carried on by specialized cells. They cause serious health problem for human. Some common intestinal protozoan parasites are: *Entamoeba histolytica*, *Giardia lamblia*, *Entamoeba coli*, *Isospora, Trichomonas hominis*, *Balantidium coli*, *Cyclospora, Cryptosporidium* etc.

The helminth 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 helminth parasites come under the heading of intestinal infection. Many parasitic helminthes require one or more intermediate hosts. The World Health Organization (WHO) estimated that more than one billion people are chronically infected with intestinal helminthes (WHO, 1998).

The relative importance of the major groups of helminthes may be roughly judged by Stoll's (1947) estimation that 'there exist in the world today among some 2200 million people, 72 million nematode infections' (Chandler, 1961). These numbers have decreased in the successive decades; as a matter of fact they are probably too low now. Some common intestinal helminth parasites are: *Ascaris lumbricoides, Trichuris trichiura, Acylostoma duodenale, Strongyloide stercoralis, Taenia slium, Taenia saginata, Hymenolepis nana, Enterobius vermicularis* etc. (Detail in Annex-1).

Parasites in the digestive tract generally cause the digestive disorder. Some protozoan parasites are responsible for the diarrhea as well as dysentery and many cause the abdominal pain and mucosal bloody defecation. Helminth parasites dwell in the lumen of the intestine and feed on the epithelial lining mucosa and sub-mucosa of the intestine which lead to the intestinal ulcer. This also causes the abdominal pain and bloody defecation.

Most probably the infection rate of the intestinal parasite in Nepal is more due to some major but common factors such as:

- Poor sanitary conditions and lack of clean drinking water facility may lead to amoebic infection (Smith, 1962)
- Tape worm (Cestode) infection may take place while consuming uncooked and not properly cooked buffalo and pig meat.
- Tick, louse and fleas carried by the domestic ducks, hen, dogs and cats may transmit various types of diseases.
- Intestinal nematode parasites may be transmitted through food and water contamination.
- While working and walking in field with bare foot, the larvae of some nematodes may invade or penetrate the skin and cause the infection (hookworm infection).

Intestinal parasitic diseases are ranked among twenty most fatal infections in tropical countries of Asia, Africa and Latin America in 1977-1978 (Davis, 1980). Fifty different species of intestinal parasites can infect human being. The five important groups of intestinal parasites are, round worm, hook worm, tape worm, *Amoeba* and *Giardia*. Round worms infect 1×10^8 people and kill 20000 people per year, hook worms infect 9×10^8 people killing 60000 people per year, 4×10^8 people get infected by *Amoeba* killing 30,000 per year, 2×10^8 people get infected by *Giardia* killing 70,000 per year and 9×10^7 people get infected by tapeworm and kill 50,000 per year (WHO, 1981).

In Nepal, particularly in rural area open air defecation is common that facilitates parasites to invade into individual. The risk of infection of such parasite is increased due to poor sanitary condition, lack of awareness about such parasites and their transmission measures, lack of proper drinking water supply, personal hygiene, carelessness, cultural behaviors etc. Hot and humid climate during rainy season in tropical and subtropical region accelerates the infection rate.

Intestinal parasites caused 5119 mortality (death) of people due to symptomatic diarrhea and cholera in Nepal during 12 months (2001/2002) of period (National Population Census, 2001).

Significance of Study

Chovar, the present study area, is located at the southern part of Kathmandu city, the capital of the country. Infection of the intestinal parasites is very common in the community of Chovar, where the water supply is not so good. Economic status and socio-cultural activities accelerate the infection rate. Foods and drinking water are contaminated by infective protozoan (unicellular and microscopic) parasites and eggs of helminth parasites, due to which the parasites reach in the digestive tract of human beings where they can reproduce and increase in number very easily. Infective larvae of some types of hook worms are transmitted by penetrating the soft parts of the body (generally

through the soft skins of legs). So chances of the infection of the hookworm are greater to the farmers who work in fields with bare feet.

Awareness about intestinal infection and distribution of medicine to positive cases during present study on "***An integrated approach to the control and prevention of intestinal parasitic infection in Chovar***" is quite new and different which will also help community people to overcome the effect. The area is not even provided with a single health post and the most of people believe on superstition and traditional method of treatment of gastro-intestinal discomforts. The present study helped to aware and treat the community people against the intestinal parasitic infection

OBJECTIVES

General Objective

To find the status of intestinal parasitic infections and to control and prevent such infection by performing awareness and deworming programs in children of Chovar area of Kirtipur Municipality.

Specific Objectives

- To find the status of intestinal parasitic infection in children of Chovar area of Kirtipur Municipality, according to sex-wise, age-wise, feeding habit-wise and rate of concurrent infection.

- To assess the knowledge, attitude and practice in study population in relation to transmission of intestinal parasites.

- To obtain possibilities of control and prevention of parasitic infection through awareness and deworming programs.

LITERATURE REVIEW

History of Parasitology

Up to the middle of the seventeenth century knowledge of parasitology was limited to recognition of the existence of a few common external parasites such as lice, fleas and few internal parasites like tapeworms, *Ascaris*, pinworms and guinea worms. However, they were considered as natural products of human bodies. Even Rudolphi and Bremser also supported this idea (Chandler and Read, 1961).

In Linnaeus' time, people thought that internal parasites were originated from accidentally swallowed free living organisms (Chandler and Read, 1961).

During the later half of 17th century Francesco Redi, grandfather of parasitology stated that maggots developed from eggs of flies. At the same time, Leeuwenhock perfected microscopes and discovered *Giardia* in his own stool and other protozoan in rainwater, saliva etc. (Chandler and Read, 1961).

Rudolphi (Linnaeus of Parasitology) classified all the parasites known up to his time. In 1773, Muller discovered cercaria larvae but as protozoan.

In 1782, Dubini discovered human hook worm. Similarly, Leoss (1898) made the discovery of penetration of the skin by hookworm larvae.

Lambl, in 1859, first discovered the parasite *Entamoeba histolytica.*

In 1865 Leuckart first worked out the life cycle of *Enterobius vesmicularis* .Later, Losch, in 1875 proved its pathogenic nature.

In 1876 Normand first reported *Strongyloides stercoralis.* Schoudinn, in 1903, differentiated pathogenic and non pathogenic types of amoebae.

In 1916 Stewart experimentally proved tissue migration of *Ascaris* where as Ranson 1920, Stewart 1921 and Vokogawa 1923 conclusively demonstrated that only one host is required for *Ascaris.*

From the middle of twentieth century, the works on parasites regarding different aspects; i.e. distribution, life cycle, pathogenesis, treatments and controls became fast and went wide spread. For this, especially World War I and II were responsible, that accelerated interest in parasitology, especially the therapeutic aspects (Parajuli, 2003).

Human intestinal parasites have been studied by many workers. Some recent studies on human intestinal parasites are as follows:-

LITERATURE REVIEW IN THE CONTEXT OF WORLD

Macpherson *et al.,* (1999) carried out a cross sectional point prevalence study of intestinal protozoan and helminthes in school children aged 6-12 years of age in three schools in St. George's Parish, Gronada. A total of 315 samples were collected and examined. The specific prevalence was 36% of *G. lamblia,* 12% of *E. histolytica,* 0.41% Hookworm, 1.3% of *E. vermicularis,* 5.3% of *T. trichiura* and 1.4% of *A. lumbricoides.* Protozoa was found to be common than helminthes, due to easy availability of wide spectrum of antihelminthics than antiprotozoal.

Paul *et al.,* (1999) carried out a study to determine the prevalence of intensity of intestinal helminthes infections. The children were between 7 to 13 years of age and belonged to lower socio-economic 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 lumbricoides* was the most common infection with a prevalence of 75% followed by *T. trichiura* of 66% and hookworm of 9%.

Ludwig *et al.,* (1999) worked on correlation between sanitation condition and intestinal parasitosis in the population of Assis, State of Sao Paulo. A total of 18366 stool samples were collected from six sanitary centers of Assis during 1990 to 1992. The general prevalence of enteroparasites was 25.3%. The most frequently found enteroparasites were *G. lamblia* 3.7%, *A. lumbricoides* 5.5% *T. trichiura* 2.7% and *H. nana* 1.97%. In Marialues, a low income neighborhood, the prevalence was 17%, 13.1%, 5.9% and 4.2% respectively. The age group 3-12 years showed the largest number of infected individuals.

Needham *et al.,* (1999) studied the epidemiology of soil transmitted nematode infection in Ha Nam Province, Vietnam. Altogether 177 households were visited and stool samples of 543 individuals with aged 1-33 years, were examined. The prevalence of helminthes found were *A. lumbricoides, T. trichiura* and Hookworms.

Habbari *et al.,* (2000) worked on the association between the geohelminthic infection and raw waste water reuse for agricultural purposes in Beni - Mellal, Morocco. In a randomly selected sample of 1343 children, 740 of them were from five communities using raw waste water for agriculture and 603 were from four control communities that do not practice waste water irrigation. Ascariasis prevalence was found to be approximately five times higher among children in wastewater-impacted regions compared to control regions. Contact with waste water and contact with wastewater irrigated land and public water supply were found to be associated with higher infection rates. *Trichuris* rates did not show a statistically significant difference between the waste water impacted and the control regions.

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. A total of 112 stool samples (78 males and 34 females) revealed 3 cases of *T. trichiura* and 1 case of *E. vermicularis* infection. The overall prevalence rate was 35.7%. More than two different kinds of parasites were found in 42% of the positive stool samples (17 cases). The inflection rates for protozoan cysts were as follows; *E. coli* (25%), *E, histolytica* (1.8%), *Endolimax nana* (21.4%), *I. butschlii* (1.8%) and *G. lamblia* (0.9%). In cello tape and anal swab examinations (165 samples), the prevalence ratio of *E. vermicularis* was 20.6%.

Zhang *et al.,* (2000) investigated the prevalence and intensity of geohelminthes infections caused by hookworm, *Ascaris* and *Trichuris* in two rural Yunnan villages. In Liuku, a village of Lisu indigenous people in Lushui Country, there were an overall geohelminth prevalence of 72% (48%, 43% and 16% for hookworm infection, ascariasis and trichuriasis respectively). The prevalence of ascariasis was greatest among pre-school and school aged children, whereas the prevalence of trichuriasis was greatest among teenagers and the prevalence of hookworm increased until the age of 10-15 years and then remained high throughout adulthood. In Linger, a village of Han Chinese, located in Puer Country, there was an overall geohelminth prevalence of

77% (38%, 60% and 36% for hookworm infection, ascariasis and trichuriasis respectively). The difference in prevalence for hookworm and ascariasis were statically significant.

Lee *et al.,* (2000) carried out a survey on the intestinal parasites of the school children in Kaohsiung Country. This study was conducted among school children from September to December 1999. The overall infection rate in 305 children was 17%. The most common intestinal parasite detected were *A. lumbricoides*, Hookworm, *T. trichiura, H. nana* and *G. lamblia.* The male had highest infection rate (24%) than females (11%). The infection rate of aboriginal and non-aboriginal children was 17% and 14% respectively. Grade 1 and Grade 6 had the highest infection rate (21%) out of 302 tape perianal examination revealed 25% prevalence.

Chukiat *et al.,* (2000) studied on *H. nana* infection in Thai Children. Stool examination was performed on 2,083 Thai Children from orphanages and primary school. *H. nana* infection was found only in children from orphanages with a prevalence of 13.12%. Males had statistically significant higher prevalence of infections than females.

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%.

Sofia *et al.,* (2001) worked on intestinal parasitic infections in the University Campus of Aligarh. Faecal samples of 3695 persons complaining for diarrhea, dysentery, abdominal pain and other bowl disturbances were examined. Out of total samples, 2152 samples (58.24%) were found to be positive for *E .histolytica, A.* Lumbricoides, *G. lamblia.*. Among them, *E. histolytica* showed highest prevalence rate (37.55%) followed by *G. lamblia* (14.95%), while *A. lumbricoides* showed the least infections rate (5.71%).

Smith *et al.,* (2001) conducted a cross sectional survey between January and March 1998 in four rural community in Honduras, Central America. He examined the prevalence and intensity of *Ascaris lumbricoides* and *Trichuris trichiura* infections

among 240 faecal specimens of 62 households. The overall prevalence of *A. lumbricoides* and *Trichuris trichiura* was 45% and 38% respectively. The most intense infections of *A. lumbricoides* and *T. trichiura* were found in children aged 2-12 years old.

Janakiram *et al.,* (2001) worked on prevalence of intestinal parasitic infections among patients attending Adichumchanagiri Hospital and Research Center, B. G. nagar, Mondya, Karnataka. Total of 4133 stool samples were collected from OPD patients suffering from diarrhea and other gastro intestinal disturbance during August 1994 to July 1999. Out of 4133 stool samples examined 599 (14.49%) were positive for either protozoan (7.79%) or helminthes (6.7%) parasite. Majority of them, 97.98% was detected with single type pathogen and rest 2.02% with more than one pathogen. The species wise prevalence of intestinal parasite was *G. lamblia* 4.66%, *E. histolytica* 4.13%, Hookworm 5.03%, *A lumbricoides* 0.44%, *H. nana* 0.15% *T. trichiura* 0.07% and *E. vermicularis* 0.12%.

Uchoa *et al.,* (2001) conducted a parasitological survey of children from five community day-care centers from Niterio City, Rio de Janeiro, Brazil in 1999. Of 218 stool samples of children surveyed, 120 (55%) had positive samples for intestinal parasites. The most frequently found protozoan parasite was *G. lamblia* (38.3%) followed of *E. coli* (26.6%) *Endolimax nana* (17.5%), *E. histolytica* (11.6%) and *Blastocystis hominis* (2.5%). The most common helminthes parasite was *A. lumbricoides* (30%) followed by *T. trichiura* (26.6%), *H. nan*a (0.8%) *and E. vermicularis* (0.8%). Monoparasitism was found in 57.5% of positive cases.

Rao *et al.,* (2002) studied worm infection and anaemia, a public health problem among tribal pre-school children of Madhya Pradesh. Total samples of 985 from pre-school children were collected from Jabalpur district. The result revealed that 48% of them had intestinal parasitic infections. Common parasites observed among them were *H. nana* 16%, Hookworm 28.26%, *A lumbricoides* 34% and *E. histolytica* 7.0%. High prevalence of anaemia 36.7% was also observed among such high prevalence of intestinal parasite and anaemia could be due to indiscriminate defecation, low socio economic status, ignorance and low standard of personal hygiene.

Hiroshi *et al.,* (2002) studied on the prevalence and intensity of *A. lumbricoides* in 492 children from five rural villages in the Northern Area of Pakistan. The overall prevalence of *A. lumbricoides* was 91%. The most intense of *A. lumbricoides* infections were found in children aged 5-8 years.

Fernandez *et at.,* (2002) carried out a comparative study of the intestinal parasites prevalent among children living in rural and urban setting in and around Chennai. A total of 324 stool sample were collected and examined. Out of 125 specimens tested from the rural location, the overall prevalence of intestinal parasite was 91%. *A lumbricoides* was the most common helminthes parasite detected 52.8% followed by *T. trichiura* 45.6%, *A duodenale* 37.6% where as *G. lamblia* (16%) was the most common protozoan parasite detected followed by *E. histolytica* 4.0%. In contrast under urban setting out of the 199 stool samples tested the positivity rate was 33%. *G. lamblia* was the most common parasite detected 22.6% followed by *E. histolytica* 10.6%. Other intestinal parasites, such as *T. trichiura* 2.01%, *H. nana* 1.01%, 0.5% of *E. vermicularis* and *A. lumbricoides* 0.5% were found to have much lower prevalence in comparison to the rural area.

Mirdha *et al.,* (2002) studied on *Hymenolepis nana* a common cause of pediatric diarrhea in urban slum dwellers in India. The prevalence of intestinal parasitic infection was studied for a period of 5 years (April 1996, April 2001). Among urban slum dwellers, parasitological examinations were performed on 939 faecal specimens. Collected on a household bases. The total prevalence of pathogenic parasite was 33.6%. The most common intestinal were recovered on following prevalence rate *H nana* 9.9%, *A lumbricoides* 3.5%, *G. lamblia* 3.4% and *E histolytica* 3.7%.

Kaur *et al.,* (2002) determined the parasitic causes of diarrhea in children in Delhi by the direct smear technique; stool specimens of 127 children were examined for intestinal parasites. In 59 cases (46.5%) intestinal helminthes and protozoa were demonstrated. *A. lumbricoides* was observed in 1 (0.8%) case, while *T. trichiura* was found in 3(2.4%). Protozoan parasites included *G. intestinalis* and *E. histolytica* in 14(11%) cases each, *Balantidium coli* in 3 (2.4%) cases and *Cryptosporidium sp*. in 24(18.9%) patients. Mixed infection was not seen in any of the cases.

Alakpa *et al.,* (2002) conducted a cross sectional laboratory based study in Lagos Metropolis State in South Western Nigeria during March 1999 to April 2000. In total 1109 stool samples were collected during the period of Study. 11 (0.99%) were confirmed to be positive to *Cyclospora cayetanensis* oocysts. Other parasites were also detected including *Cryptosporidium, Entamoeba, Ascaris, Trichuris, Strongyloides* sp. and hookworm.

Crame *et al.,* (2002) carried out a study on intestinal parasites among wayampi Indians from French Guiana. A total of 138 wayamp from an isolated Amerindian population from upper Oyopock with traditional social and cultural specificities below the age of 15 years were collected and examined. The revealed the 92% of overall prevalence. The most common parasites were 50% of hookworm, 17% of *E histolytica,* 16% of *S. stercoralis* and 13% of *H. nana* and very few *A. lumbricoides* and *T. trichiura* were also recovered. *H. nana* was frequent in children.

Muth *et al.,* (2003) and the National Malaria Centre (NMC) carried out a parasitological survey of school children in rural and in Semi urban areas to access intestinal helminthes infections in school children in the central part of Cambodia during the period January to December 1998. In the rural areas, there were four schools in Stung Treng Province (all situated along Mekong River), five schools in Kratie Province (around rubber plantations), six schools in Kampong Chhnang Province (along Tonle Sap lake) and in the semi urban areas, three schools in Beng Tumpon Commune and five schools in Chhar Ampeou Commune (Mean Chey District) were selected for study. By Kato Katz technique, the prevalence of soil-transmitted helminthes infections in school children in both the rural and urban areas were high. The infection rate was between 10-40% for *A. lumbricoides,* 2-17% *Trichuris* and 5-65% for hookworm.

Buchy (2003) worked on intestinal parasites in the Mahajanga region West Coast of Madagascar. A total of 401 stool and 112 sera samples were collected from OPD patients of Mahajanga's Hospital during November 1996 to January 1997. The examination of stool specimens revealed 67.6% prevalence. The frequency of protozoa was higher 47.7% than helminthes 23.4%. The specific prevalence was *H. nana* 2.5% and *Taenia saginata* / *Taenia solium* 0.57%. Out of 112 sera examined 50% of sera contained antibodies (anti *A. lumbricoides* and anti *S. stercoralis).*

Bong-Jin *et al.,* (2003) carried out small state survey to investigate the status of intestinal protozoa and helminthes infection of inhabitants in Roxus City, Mindoro, the Philippines. A total 301 stool samples were collected. The overall positive rate was 64.5% and that of male and female were 56.6% and 72.5% respectively. The highest infected helminthes was *A. lumbricoides* (51.2%) followed by *T. trichiura* (27.6%) hookworm (8.0%) and *E. vermicularis* (0.3%). The protozoan infection status revealed that *E. Coli* was the most frequent (15.0%). *Iodomoeba buetschlii* and *E. histolytica* were found but few. The multiple infection more than two parasites was 29.6% and double infection with *A. lumbricoides* and *T. trichiura* was common. The intestinal helminthes infections were highly prevalent in this area.

Miller *et al.,* (2003) examined the presence of intestinal protozoan and helminthes infections and their associations with clinical signs and symptoms in children in Trujillo, Venezuela. The point prevalence of protozoan infection was 21% for *G. lamblia,* 1.0% for *E. histolytica / disper,* 4% for *E. coli,* 16% for *Blastocystis hominis* and 89% for *Cryptosporidium*. Prevalence of helminthes infection was 11% for *Ascaris* 11% for *T. trichiura* 0.0% for *S. stercoralis* and 2% for *H. nana.*

Chukiat *et al.,* (2003) studied the prevalence of intestinal parasitic infection by stool examination 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 *T. trichiura* (29.7%), *E. coli* (23.1%), *G. lamblia* (3.0%), *H. nana* (7.8%) and *E. histolytica / disper* (7.1%).

Singh H. Lokhendra et al., (2004) studied on helminthes infestation of the primary school going children in Manipur. Out of 1010 stool samples collected from the primary school going children between age group of 5-10 years showed 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 numbers of parasitic infections were found in 5-6 yrs age group, 27% *Ascaris lumbricoides,* 19.6% *Trichurus trichiura,* 2.18% *Hymenolepis nana,* 0.99% Hookworm and 0.09% *Strongyloides stercoralis*.

Deepmala *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 infections, 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 infections. In over all infections, males and even those of 21-30 yrs age group showed higher prevalence rate (55.55%) than females (44.45%).

Benicio *et al*., (2004) during the evaluation of wheezing conditions in early childhood; prevalence and risk factors in the city of Sao Paulo Brazil. The prevalence of recent wheezing was 12.5%, 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.

Gulay Gubbol Doran *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 to 18 years) in the Mustafa Kemal University, out of 122 fecal samples and 136 cellophane tape preparation, 65 (45.77%) fecal samples were positive, *Blastocystis hominis* in 63 (96.92%) samples and *Giardia intestinalis* in 6 ((3.08%) samples. *Enterbius vermicularis* was found in 9 (6.61%) out of 136 Cellophane tape preparations.

Nithikathkul *et al*., (2005) evaluated the impact of health educational program on the prevalence of Enterobiasis in school children of Thailand. The study showed a decrease in infections among children who received supplementary education. The 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 Enterbiasis.

Cheng, Huey-Shinn and Lian-Chen Wang (2005), studied 464 psychiatric patients. During their examination 8.4% were found to be infected with one or more intestinal parasite species; 6.3% single infection, 1.5% double infection and 0.6% triple infections. Significantly higher prevalence were found among the males, unmarried

patients, those with lower education, institutionalized for more than three years, sent by social workers to the hospitals.

Abdulalim Aydin and Oguz Jancer (2005) conducted the study on distribution of intestinal parasites in children from the 23 Nisam primary schools in Hakkari. In this study, out of 114 stool samples (60 males and 54 female), 66 (57.8%) samples were found positive. *Girdia intestinalis* (28.9%), *Blastocytic hominis* (23.6%) *Entamoeba coli* (12.2%) and *Ascaris lumbricoides* (6.14%) were found most prevalent parasites.

LITERATURE REVIEW IN NEPAL CONTEXT

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 area.

Sharma *et al.,* (1971) carried out a study on intestinal parasites among auxiliary health worker's student is Kathmandu. They examined 80 stool specimens of which 10 did not show any infestation, the rest 70 were suffering from different types of infestations. The commonest infestation found was roundworm *(Ascaris lumbricoides).* The second commonest infestation was hookworm (*A. duodenale).* Other infestations were *E. histolytica, G. lamblia* and *T. trichiura. E. vermicularis* was found in only one case. In some cases, mixed infections were also seen.

Gongal (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 an important role in the transmission of intestinal parasites.

Acharya (1979) reported that the intestinal infestations 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%).

Integrated Family Planning and Parasite Control Project, IFPPCP (1980), examined 11,699 samples from June 1979 to 1980. Out of these, 10,385 (89%) cases showed positive results in Bhaktapur and Panchkhal area. The infection rate of the *Ascaris* (66.5%) was the highest followed by hook worm (38%), *T. trichiura* (20%). The infestation by other types of parasites was around 2%.

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

Integrated Family Planning and Parasite Control Project (1981), examined 5,532 stool samples in Panchkhal area in which 4148 (70%) were positive. The hookworm infection was highest followed by *T. trichiura* and *Ascaris*. In Bhaktapur, 586 stools were examined in which 525 (92%) were found positive.

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

Integrated Family Planning and Parasite Control Project, IFPPCP (1982) examined 4696 stool samples in Panchkhal area, of which 3475 (74%) stools were positive. The infection rate of *Ascaris* was 37%, hookworm was 47% and *T. trichiura was* 7.3%.

Integrated Family Planning and Parasite Control Project (IFPPCP) (1983) examined 1772 stool samples of school children in Panchkhal area of which 704 (75%) samples were positive of *T. trichiura* followed by 259 (37%) of hookworm and 136 (19%) of *A. lumbricoides.* During the same period a total of 310 stool samples from Bhaktapur were examined out of which 786 (97%) had worm infestations.

IFPPCP (1984) examined 416 stool samples of school children of Panchkhal. Out of which 112 (27%) cases were positive. The common intestinal helminthes were *A. lumbricoides* 22 (29%), hookworm 53 (47%) and *T. trichiura* (53 (47%). In Bhaktapur the project examined 412 stool samples of which 295 (72%) were positive.

IFPPCP (1985) examined 25260 stool samples of students from 46 schools of Kathmandu valley out of which 22626 (86%) were found positive. The infection by *A. lumbricoides* was 15423 (68.16%) followed by *T. trichiura* 8104 (35.8%), *Giardia*, 2491 (11%), hookworm (6.7%) and tapeworm 220 (0.97%).

Suguri *et. al.,* (1985) conducted 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 helminthes infection rate was found 36.8% 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 2000 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 most 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 disease. 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 wee infected with protozoan parasite, 9.12% by *G. lamblia* and 9.47% by *E. histolytica* Out of 192 stool samples, 155 (80.72%) were positive for helminthes 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 helminthes 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.

Rai *et al.,* (1991) showed the prevalence of various intestinal parasites in Kathmandu Valley, Nepal. The overall prevalence of parasites was 30.9%. There were no significant differences in the prevalence between two sexes. Intestinal parasites were more common among children below 15 years than in adult more than 15 years. *A. lumbricoides* was the common parasite followed by hookworm, *Taenia sp. E. vermicularis* and others. Among protozoan parasites, *G. lamblia* was the most common followed by *E .histolytica.*

Gianotti (1993) surveyed, in 1990, a total 137 cases from Kathmandu valley and 22 cases from Solukhumbu in children. He reported *Ascaris* 11.2%, *Trichuris* 9.8% *Giardia lamblia* 5.9%, *E. histolytica* 5.3%, hookworm 3.3%, *H .nana* 0.5% and *T. solium* 0.5% in Kathmandu valley cases, but in Solukhumbu cases *Ascaris* 22%, *G. lamblia* 31.8%, and *E. histolytica* 9.1%.

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

Rai *et al.,* (1994) studied the status of soil transmitted helminthes infection in Nepal during 1985-1992. Averages of 6537 fecal samples were examined each year. The annual rate of the positivity for soil transmitted helminthes ranged from 18-36.6%. *A. lumbricoides* has the most common prevalence than the hookworms and others.

Sherchand *et al.,* (1996) carried out study on intestinal parasites from Kathmandu area of Nepal and reported 28.1% parasitic load among subjectively healthy children (HC) and 38.8% parasitic load among healthy adults. Where as 62.7% total parasitic load was recorded among children with abdominal discomfort. *H. nana* was recorded as most common tapeworms associated with patient having abdominal discomfort. Among protozoan parasites prevalence of *Giardia* was highest among the sick children. In healthy children the prevalence of mixed parasite infection was 2.1% and 7% in healthy adults, while 13.3% prevalence was found in sick children and 11.5% in sick adults.

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 a positivity 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.

Navisky *et al.,* (1998) examined faecal specimens from 292 pregnant women (age 15 to 40 years) and 129 infants (age 70-140 days) for helminthes eggs by the Kato-Katz method. These stool specimens were collected from Sarlahi district in Southern Nepal among pregnant women was found to be 78.8% hookworm, 52% *A. lumbricoides* and 7.9% *T. trichiura.*

Rai *et al.,* (1999) *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.,* (2000) investigated the contamination of soil with helminthes eggs in Kathmandu valley and outside valley in Nepal. Out of 156 total samples, 122 were taken from Kathmandu valley and 34 samples from outside valley. The overall soil contamination rate was 36.5%. The prevalence was uniform in Kathmandu valley (36.3%) 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 (*A. lumbricoides, Toxocara* sp., *T. trichiura, Capillaria* sp. *& Trichostrongylus* and 2 species of cestoda (*H. nana* and *H. diminuta). A. lumbricoides* was prominent in Kathmandu valley while *Trichostrongylus* was the commonest outside of valley.

Shrestha (2001) studied on intestinal parasitic infestations in healthy school children of Lalitpur district. Stool samples of 515 healthy urban and rural school children of 7-12 years age groups were collected. Among them 81.94% of children were found to be infected with parasites. Among them prevalence of *A. lumbricoides* was found to be highest (73.45%) in rural and (71.66%) in urban children. But *T. trichiura* was

found to be higher among children of urban area 37.91% where as that of rural was 27.27%, 78.36% and 84.07% male and 92.45% and 73.72% of female children from the urban and surely respectively were found to be infested with the protozoan and helminthes parasites.

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.

Tai-Soon *et al.,* (2001) investigated the states of intestinal infections in two rural villages in Chitwan district, Nepal, in 1999. Stool examination was performed with a total 300 specimens from school children by formalin-ether sedimentation technique. The prevalence rate of intestinal parasite infections in the surveyed areas was 44.0%. The prevalence rate in Jerona was slightly higher than that of Chitrasar. The prevalence rate of intestinal parasite infections in female was slightly higher than male without statistically significant difference. *E. coli* was the most commonly found protozoan parasite (21.0%) followed by *G. lamblia* (13.7%) and other (5.3%). Hookworm was the most prevalent intestinal helminthes (13%) followed by *T trichiura* (3%) and others (5%). 43 specimens (14.3%) showed mixed infections.

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 hookworm (19.2%), whipworm (5.9%). *G. lamblia* was only protozoan parasite detected in this study (5.2%) where as Dalit had significantly higher prevalence (74.1%).

Chaudhari (2003) carried out a study in machchhegaun VDC from February 2002 to January 2003. A total of 306 samples were examined, among which 76.6% positive with at least one kind of parasite. The prevalence of parasite was higher in male (86.5%) than female (70.0%). Highest prevalence rate was for *A. lumbricoides* (43.4%) followed by *T. trichiura* (22.5%), *G. lamblia* (16.1%), *C. cayetanensis* (7.2%), *E. histolytica* (2.5%), *C. parvum* (1.7%), hookworm (1.7%), *E. coli (*1.7%*), I. butschlii (*1.2%), *H. nana* (0.8%), *E. vermicularis* (0.4%) and *E. nana (0.4%).*

Karki *et al.* (2004) conducted a study among Magars in Barangdi VDC of Palpa from July 002 to June 2003. A total of 157 samples were examined, and the total prevalence was 66.88%. The highest prevalence rate was found to be due to A**.** *lumbricoides* (50.32%), followed by hookworm (24.2%), *T. trichiura* (17.2%), *Taenia sp.* (828%), *H. nana* (6.37%) and *S. stercoralis* (1.91%).

Parajuli (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 (48.08%) followed by *A.* d*uodenale* (34.94%), *T. trichiura* (22.4 %), *E. histolytica* (15.3%), *S. stercoralis* (8.19%), *G. lamblia* (7.65%), *H. diminuta* (4.37%), *H. nana* (2.73%) and *Taenia sp.* (1.63%).

Jha (2004), carried out stool examinations in girls of different ethnic groups of Kirtipur Municipality. Out of 373 stool samples, 152 (40.75%) were infected by the intestinal parasites. Prevalence was highest in Pode (71.75%) followed by Newar (39.40%) and least in Brahman (21.79%) and was statistically significant ($P< 0.05$). Eight different types of intestinal parasites were recorded during the study. Ascariasis supplanted all the parasites by showing a positivity of 23.06%. Other helminthes parasites were *Trichuris trichiura* (7.51%), hookworm (0.27%), *Strongyloides stercoralis* (0.27%) and *Hymenolepis nana* (0.27%). *Giardia lamblia* was the most commonly found protozoan parasite (13.4%) followed by *Entamoeba histolytica* (8.58%) and *Cyclospora cayetanensis* (0.27%).

Maharjan (2004), a study on intestinal parasites was carried out in children's of age group 3-12 years of different ethnic group of ward no. 4 and 'Pode–community' in ward no. 17 in Kirtipur municipality, Kathmandu. Out of 312 stool samples 45.83 % of children were infected by different kinds of intestinal parasites. Among positive samples prevalence rate in male was 55.94% and 49.83% in female. The prevalence of *Ascaris lumbricoides* was found to be 24.04%, *Trichuris trichiura* 8.33%), *Hymenolepis nana* (0.32%) and *Strongyloides stercoralis* (0.32%) in helminthes while *Giardia lamblia* (19.55%), *Entamoeba histolytica* (7.69%) and *Cyclospora cayetanensis* (0.64%) in protozoan parasites.

MATERIALS AND METHODS

Study Area

Kirtipur, meaning the city of glory, is a small town in the Kathmandu Valley, about five kilometers south-east of the capital Kathmandu. Kirtipur, also known as Kipu or Kyapu, is one of the oldest settlements in the valley, and is recorded as an ancient capital of Nepal (Shokoohy 1994). It is one of the five municipalities in the valley. It is located at 27^0 38' 37" to 27^0 41' 36" N and 85^0 14; 64" to 85^0 18' 00" E at the altitude of 4500 feet above from sea level. Kirtipur, at present has 19 wards and covers 1787 hectares. It is bordered by the Bagmati River to the east, Machchhegaun Village Development Committee to the west, Kathmandu Metropolitan City (KMC) to the North and Chalnakhel Village Development Committee to the south (Shrestha, 2003).

Chovar, one of the historical and naturally a beautiful place is situated on the southern end of the Kathmandu valley extending between $27^0$38' North latitude to $85^0$17' East longitude at the altitude of 1350m. above from the sea level.

The survey was conducted with prepared questionnaire (Annex-1) to obtain descriptive information on people's behavior and knowledge towards the intestinal parasitic infection. Interviews were conducted. Participants were selected by door to door visit in ward number 13 and 14 of Chovar area.

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Study Population

The study area covers most of the area of ward no. 13 and ward no. 14 of the Kirtipur Municipality. There are all together 321 houses and 1454 people in ward no. 13 among which 726 are males and 728 are females. Similarly, there are 447 houses and 2136 people (1072 males and 1064 females) in ward no. 14. Among them, about 20 - 25 % are children. 04-12 years grouped children of the area come under the study population. 179 children of the area are randomly selected and stool sample from each was collected and examined. Further more the parents of the children were asked

various questions for the questionnaire administration (Central Bureau of Statistics, Census 2001). .

Climate

The well defined, four seasons of the area are spring (March-May), summer (June-August), autumn (September-November) and winter (December – February). The annual average temperatures are maximum 25.8^0 C and minimum 12.1^0C. The annual average precipitation is 1407 mm and annual average relative humidity is 88%.

Demography

The 2001 census gave a total population of 40,835 individuals with 21,686 males and 19,149 females in 9487 households i.e. an average household size of 4.3 persons and a male to female ratio of 1:13.

This region has different ethnic groups comprising Newar, Brahman, Chhetri, Pode, Damai etc. But Kirtipur is predominantly inhabited by Newar (Shrestha *et al.,* 2003.) The sources of living are agriculture as well as animal husbandry, government service, small scale business, work in cottage industry, house constructing works etc.

About 33.6% households are involved in agriculture only, 0.72% have livestock only and 0.75% have poultry only. While 9.73% have both land and livestock, 3.14% have land and poultry, 0.21% had livestock and poultry and 2.25% have land, livestock as well as poultry. While 49.6% have no land, livestock and poultry (CBS 2002) and they have other sources of income like Government service, private service and business etc. some of them are driver, painter, sweeper, carpenter, mechanics, mason, tailor and teacher etc.

Regarding literacy, 19.37% people and of which 31.66% female are illiterate while 4.43% people and of which 4.71% females can read only. 67.54% as a whole and 54.47% females can read and write both (CBS, 2002). But present study population is young generation so most of them are literate.

Sanitation and Drainage

The people of Kirtipur still to a lesser extent do practice open air defecation. The presence of latrine in a compound didn't guarantee that all people living there always used it. During survey, it was found that many children were defecating on either sides of street especially in newar community. In spite of such practices the town was relatively clean (Chitrakar, 1994). But the sanitary condition of the town had greatly deteriorated with the increase in density of population, the change in lifestyle of the people were also changing (Chitrakar, 1994).

To dispose of rain water and domestic water, the traditional brick and stone paved streets were originally provided with channels on either side to give surface drainage and carry storm water to ponds. Some households also had a pit in the vegetable garden for waste water from the kitchen.

During survey, it was found that most of the houses in Brahman community, had cattle which were kept either outside the house or within the house in adjacent room. Dogs, cats and rabbits were mostly kept within the house.

Investigation was carried out in two wards representing three different ethnic groups with their different social behaviors.

Sample Size

Total number of population in ward no. 13 is 1454, among them 319 are children. Similarly, total number of population in ward no. 14 is 2136, among them 556 are children. Hence 179 is the 20.46% of the children of the study area. Stool samples were collected and examined from 179 children (single sample from each). Among them 88 were from ward no. 13 and 91 from ward no. 14 in which 100 were Newars, 63 were Chhetries and 17 were Brahmins.

Plate:1
Temporary Toilet (Pit hole) in Chobhar Area

Plate:2
Stool Sample Collection

Plate:3
Arrangement of Questionnaire

Plate:4
Stool Examination

Plate:5
Examination of Symptomatic Respondent

Plate:6
Medicine Distribution

Plate: 7
Pamplet Displayed before Sample Collection

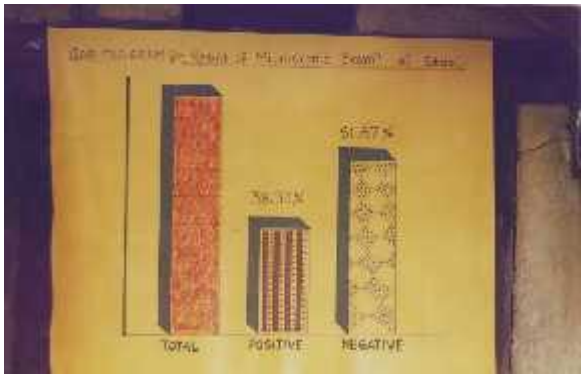

Plate: 8
Result Displayed during Medicine Distribution

Plate: 9
Poster Displayed during Awareness Programme

Plate: 10
Gathering of Children during Awareness Programme

Plate:11
Poster Displayed during Awareness Programme

MATERIALS AND METHODS

Materials

Equipments and Materials

I. Sampling vials
II. Slides
III. Cover slips
IV. Electric microscope
V. Refrigerator
VI. Gloves
VII. Cotton
VIII. Bamboo Sticks (Emulsifier)
IX. Forceps
X. Tray
XI. Dustbin

Chemicals

i. 2.5% Potassium dichromate
ii. Normal saline
iii. Iodine solution.

Methods

The entire study was divided into two parts:

i. Surveillance study by questionnaire method
ii. Stool sample collection and examination for intestinal parasite

) Surveillance Study by Questionnaire Method

The study area was visited and the drinking water supply, the sanitation measures, the vegetables and fruits supplying sources and the activity of the children in their free time were noticed. The meetings with various personal were conducted to get different information about the study area as well as the various activities and

traditions of the people. The sources of water supply, the type, and condition of the latrine and the water ditches where vectors can breed were observed very carefully. Similarly, the distance between the latrine, water resources and the house were also noticed.

The survey study helped to set the questionnaire as to cover all the required aspects. The questionnaire was pre-tested by the local people. The questionnaire was translated in Nepali language so that the respondent could understand the questions very clearly since most of them do not understand the English language.

) Stool Sample Collection and Examination

Respondents were interviewed individually and were provided sterile stool sample collecting vials with detail instruction required for stool collection. The vials with stool sample were collected by visiting the houses in very next morning.

Ensuring Good Conditions of Sample

To ensure the good condition of the stool sample the following precautions were applied;

- The vials were cleaned with detergent and kept in antiseptic solution for hours and dried.
- The labeled vials were distributed without any preservatives.
- Immediately after collection, the physical appearance (i.e. color, consistency and presence of worms and segments) of stool sample was noted and 2.5% potassium dichromate solution was added in stool sample for preservation of the parasites present.
- The vials were arranged in such a way that it could be carried in to the laboratory of Central Department of Zoology T.U. for further processing, slide preparation, examination and identification.

Data Collection

The primary data were collected by questionnaire method and by examining the collected stool samples from the interviewed individuals. For this study population was provided with sterilized vials a day before for the collection of stools. They were

instructed in the proper way to introduce the faecal matter inside the vials. The obtained data from the examination of stool samples were edited, coded, classified, tabulated and analyzed. Analysis was done by representing with the table, bar diagram, pie chart on the basis of findings like prevalence rate, age, hygienic behavior, feeding behavior and awareness. The significant difference was calculated by |χ^2-test

Secondary data were collected from schools where Family Planning Association of Nepal conducted School Health Programs in May, 2003 and from different journals, reports and published matters. (Annex-2)

Laboratory Work (Stool Examination)

All the laboratory works were done in the Parasitology laboratory of Central Department of Zoology, Tribhuvan University, Kirtipur.

After collection, the stool samples were examined microscopically under electric microscope. But all the samples collected in a day was not examined on that day so, Potassium Dichromate (2.5%) was added to the remaining samples as preservatives and were kept in refrigerator but were not allowed to freeze.

♦ Macroscopic Examination

The collected samples were examined for their physical appearance by naked eye on the same day.

♦ 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 be read through it.

♦ Preparation of Normal Saline

8.5 gm of sodium chloride salt was dissolved in 1000 ml of distilled water to prepare 0.85 gm percentage of normal saline solution.

♦ 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 Lugol's iodine solution was kept instead of normal saline solution.

♦ Preparation of Iodine Stain Solution

2.0ml of Potassium iodide salt was dissolved in 100ml of distilled water, 1.0mg of iodine crystal were slowly added. The solution was then filtered and kept is a stupider bottle of amber color.

♦ Preparation of Potassium Dichromate Solution

25 gm of potassium dichromate salt was dissolved in distilled water to make 1000 ml of solution. Thus prepared solution was used for stool sample preservation as well as temporary mount of stool smear for examination.

♦ **Microscopic Examination**

Both stained and unstained stool smears were first examined under the low power of microscope from one end of the slides to another. Objectives were centered and focused under the high power for detail diagnosis of smear.

Cysts of protozoan parasites and eggs of helminthes parasites were observed under the microscope. Occasionally, the trophozoites of protozoan parasites were observed. Larval stages of hook worm were also observed in stool smear.

Stool samples were examined by direct smear technique. The normal saline (0.85%) and iodine solution were used for examination of the stool samples to identify Protozoan trophozoites, cysts, helminthes eggs and larva.

Fresh stool was examined by using normal saline and iodine solution while preserved stools were examined in Potassium Dichromate and iodine solution. For the preparation of slide, a drop of normal saline or iodine solution or 2.5% Potassium Dichromate was taken on the clean glass slide, then small amount of stool was added

to the slide with the help of sticks and cover slip was placed over them and excess of fluid was removed with the help of filter paper.

♦ Observations and Identification

The prepared slides were first examined under the low power (10x objectives) for the presence of helminthes eggs and for identification of helminthes eggs and larva and identification of protozoan trophozoites and cysts, it was examined under high power (40x objectives) of microscope. Identification of trophozoites, cysts, eggs and larval stages of parasites were done on the basis of Medical Laboratory Manual.

Data Analysis & Interpretation

Thus obtained data from survey study as well as laboratory work were edited, coded, classified, tabulated and analyzed. Analysis of data was done on the basis of age, sex, feeding habit, ethnic group and infection rate (single and double) etc of the children.

Thus analyzed data was interpreted by representing with table, bar-diagram, pie-chart and drawing graphs of suitable data. The significant difference was calculated by X^2-test.

Treatment

All the positive cases were informed about the type of infection they were carrying. Appropriate anti-parasitic treatment was arranged at temple area of Adinath under the supervision of MBBS doctor.

Secondary Data and Their Sources

Family Planning Association of Nepal is conducting school health programme every year during endemic season of human intestinal parasite where stool examination and distribution of medicine is done. Panga Secondary School, Ujwal Shishu Niketan and Puspa Sadan Boarding School of Kirtipur area are participating their children in such programmes in welfare of the student. Beside this, private pathology laboratory (Saraswoti Pathology Laboratory) of Kirtipur is also providing some facilities to its patients.

According to the data give by Family Planning Association, in Panga Secondary School, infection of intestinal parasite in children was more in 1996 and 1999 A.D. but the infection rate fell down during next years. Males were found more infected than females. The school children were found highly infected by Ascariasis(23.15%) followed by Giardiasis (15.50%). Average infection was found to be 50.82%.

Similarly in Ujwal Shishu Niketan**,** a secondary school in Kirtipur area, the rate of infection of intestinal parasite was found to fall down every year. Here *Ascaris* was found to be dominant intestinal parasite (18.36%) followed by *Giardia* (6.96%). The average infection was 32.77%.

In Puspa Sadan Boarding Secondary High School, during 1998 A.D., the infection rate of intestinal parasite was the highest (88.88%) which decreased during the next years. Male children were found more affected than female children. *Ascaris* (22.67%) was found as the dominant intestinal parasite among the school children and the dominancy was followed by *Giardia* (19.84%). The average infection rate was 60.94 %.

Patients visiting the pathology laboratory for stool examination are often symptomatic, hence according to data from Saraswoti Pathalogy, a local pathology in Kirtipur, the Giardisis (258.31%) and Amoebiasis (18.16%) infection rate was found to be more. Ascariasis is asymptomatic (rarely symptomatic), hence people do not often visit pathology laboratory for stool examination. Hence the result shows low infection (4.50%) of Ascariasis. The average infection rate was 51.86%. (Detail Table in Annex-2)

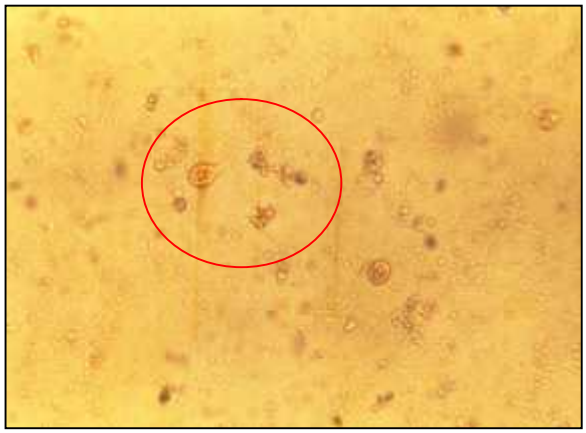

Plate: 12
Trophozoite of *G.lamblia.*

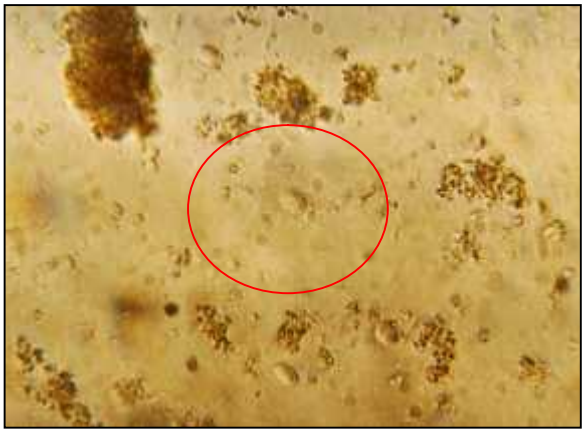

Plate: 13
Cyst of *G .lamblia.*

Plate: 14
Cyst of *E. histolytica*.

Plate: 15
Oocyst of *Cyclospora*.

Plate: 16
Unfertilized egg of *Ascaris*.

Plate: 17
Fertilized egg of *Ascaris*.

Plate:18
Egg of *A. duodenale.*

Plate: 19
Larva of *A. duodenale*.

Plate: 20
Egg of *Trichuris*.

Plate: 21
Larva of *strongyloides.*

RESULTS

The present study entitled *"An Integrated Approach to the Control and Prevention of Intestinal Parasitic Infection in Chovar, Kirtipur Municipality"* was conducted at Kirtipur Municipality ward no. 13 and 14.There are altogether 321 households and 1454 people in ward no. 13 and 447 households and 2136 people in ward no. 14 (Population Census 2056 B.S.). Among them about 30% are children. Surveillance study, stool samples collection and examination (single sample from each) were done in 176 children (88 from ward no. 13 and 91 from ward no. 14) in which 100 were Newar, 63 were Chhetri and 17 were Brahmin. The result of the study is as follow:

The result of present study is divided into two categories.

A) Result of Stool Examination
B) Result of Survey Analysis

A. Results of Stool Sample Examination

- **General Prevalence of the Intestinal Parasites**

The examination of stool sample collected from all 179 respondents in which 73 were found to be positive for one or more types of intestinal parasites. Hence, the prevalence of intestinal parasites was found to be 40.78%. Among the positive cases prevalence percentage of intestinal parasites was found to be little higher in males (54.79%) than that in females (45.21%). Statistically, no significant difference was found in sex-wise prevalence of parasitic infection ($\chi 2 = 5.66$, $P > 0.05$).

Table No. 1: General Prevalence of Intestinal Parasites

	Total No. of Samples Examined	Positive Cases(No.)	Positive %
Male	79	40	54.79
Female	100	33	45.21
Total	**179**	**73**	**40.78**

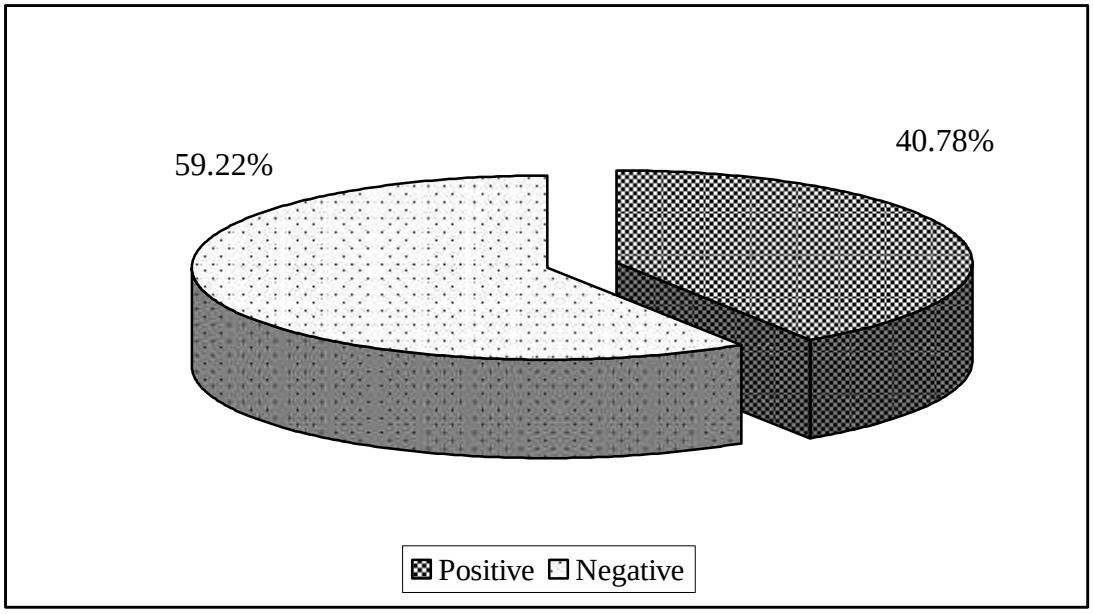

Figure No. 1: General Prevalence Of Intestinal Parasites

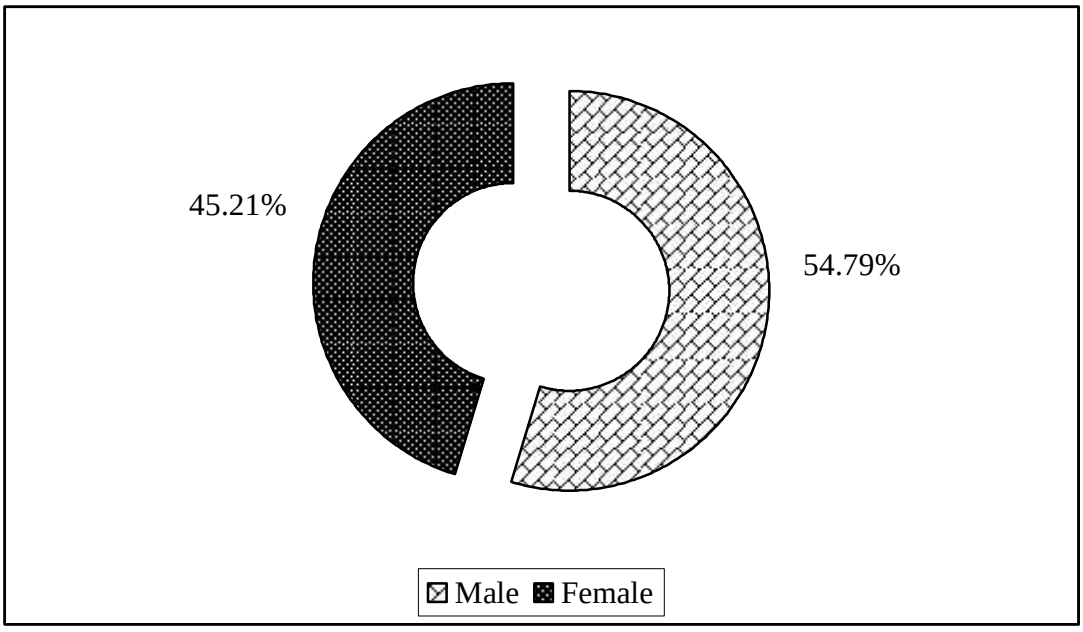

Figure No. 2: Sex-wise Prevalence of Intestinal Parasites

) Age and Sex-wise Prevalence of Intestinal Parasites

Regarding sex-wise prevalence of intestinal parasites, 10 male children i.e. 50.63% were found to be infected and 33 female i.e. 33% were infected. The children from 3 to 12 years of age were categorized into five groups. The highest prevalence of intestinal parasites (69.56%) was found to be in the age group 9-10 years in male children whereas 10-12 years age-group in female children (36.36%). Similarly, the least prevalence of intestinal parasitic infection was found in 10-12 years age group in males (31.25%) whereas 5-6 years age group in female (8.33%). Statistically, no significant difference was found in the prevalence of parasitic infection in different age groups ($\chi 2$ =10.02, P>0.05).

Table No. 2: Age and Sex-wise Prevalence of Intestinal Parasites

Male Children				Female Children			Total		
Age group (Yrs.)	**No. of samples examined**	**No. of positive samples**	**+ve (%)**	**No. of samples examined**	**No. of positive samples**	**+ve (%)**	**No. of samples examined**	**No. of positive samples**	**+ve (%)**
3-4	9	3	33.33	8	1	12.5	17	4	23.59
5-6	11	5	45.45	12	1	8.33	23	6	26.08
7-8	20	11	55.00	22	11	50.0	42	22	52.38
9-10	23	16	69.56	14	4	28.5	37	20	54.05
10-12	16	5	31.25	44	16	36.36	60	21	35.00
Total	**79**	**40**	**50.63**	**100**	**33**	**33.00**	**179**	**73**	**40.78**

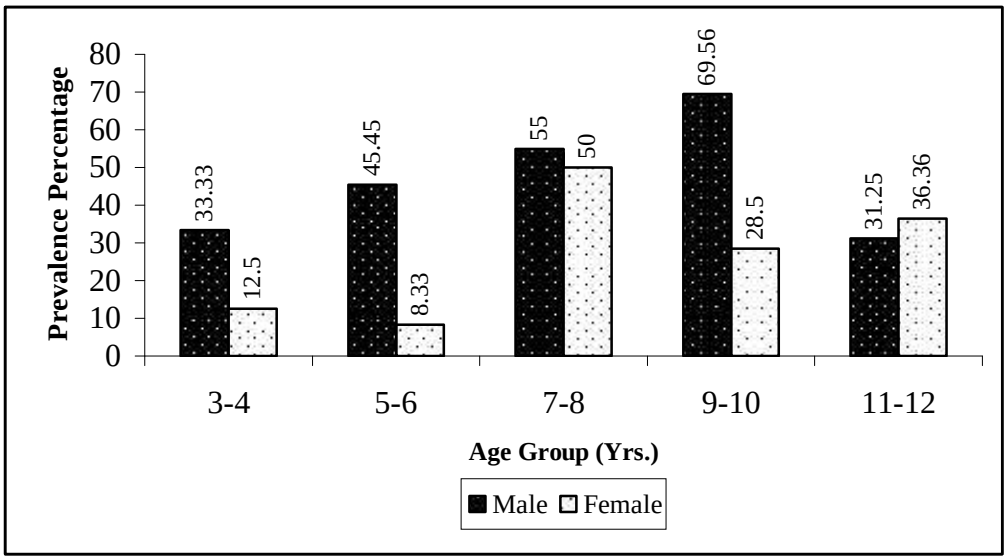

Figure No. 3: Age and Sex-wise Prevalence of Intestinal Parasites

) Prevalence of Specific Parasites

Out of a total 176 samples, 61 samples had infection with single species of intestinal parasites and 12 samples had double species of intestinal parasites. The prevalence of single species intestinal parasitic infection was found to be higher than that of double species intestinal parasitic infection. No triple or further multiple infection was found.

) Single Species Intestinal Parasitic Infection

The table no. 3(A) shows that in case of single species parasitic infection, *Ascaris lumbricoides* is the most prevalent helminth parasite in male children with 42.85% and in female children with 16.53%. Similarly *Giardia lamblia* is the most prevalent protozoan parasites with 28.56% and 15.38% in male children and female children respectively. The least prevalent parasites are hook worm and *Cyclospora* in both sexes. Statistically, significant difference was found between two sexes in single parasitic infection ($\chi 2 = 9.55$, $P<0.05$).

Table 3(A) : Sex-wise Prevalence of Single Species Intestinal Parasitic Infection

S. N	Name of parasite	Male (n = 79)		Female (n = 100)		Total (n = 179)	
		No. of Positive case	+ve %	No. of Positive case	+ve %	No. of Positive case	+ve%
1.	*Entamoeba histolytica*	4	11.42	2	7.69	6	9.83
2.	*Giardia lamblia*	10	28.56	4	15.38	14	22.95
3.	*Ascaris lumbricoides*	15	42.85	16	61.53	31	50.82
4.	*Trichuris trichiura*	3	8.57	3	11.53	6	9.83
5.	*Cyclospora* sps.	1	2.85	0	0	1	1.64
6.	*Strongyloide stercoralis*	0	0	0	0	0	0
7.	Hookworm	2	5.71	1	3.84	3	4.91
	Total	**35**		**26**		**61**	

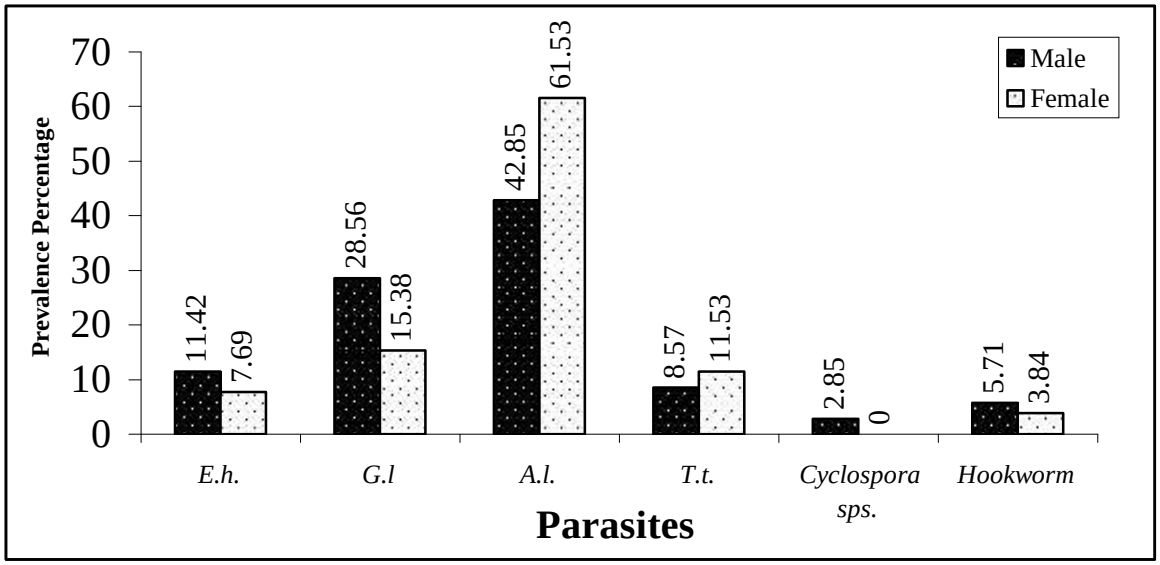

Figure No. 4: Prevalence of Single Species Intestinal Parasites

Sex-wise Prevalence of Double Species Intestinal Parasites

Among 73 positive cases, 12 had infection with two types of parasites. *Ascaris lumbricoides* and *Trichuris trichiura* with 60% in male children and *Giardia lamblia* and *Ascaris lumbricoides* with 42.85% in female children were most prevalent. Statistically, significant difference was found between two sexes in infection with double species of parasites ($\chi 2 = 66.78$, $P<0.05$).

Table No. 3 (B): Sex-wise Prevalence of Double Species Intestinal Parasite

S. N.	Name of parasite	Male (n = 79)		Female (n = 100)		Total (n = 179)	
		No. of Positive case	%	No. of Positive case	%	No. of Positive case	%
1.	*Giardia*+ Hookworm	1	20	0	0	1	8.33
2.	*Ascaris + Trichuris*	3	60	1	14.28	4	33.33
3.	*Giardia + Ascaris*	0	0	3	42.85	3	25
4.	*Cyclospora + Ascaris*	1	20	1	14.28	2	16.67
5.	*Giardia + Entamoeba.*	0	0	1	14.28	1	8.33
6.	*Giardia + Trichuris*	0	0	1	14.28	1	8.33
	Total	**5**		**7**		**12**	

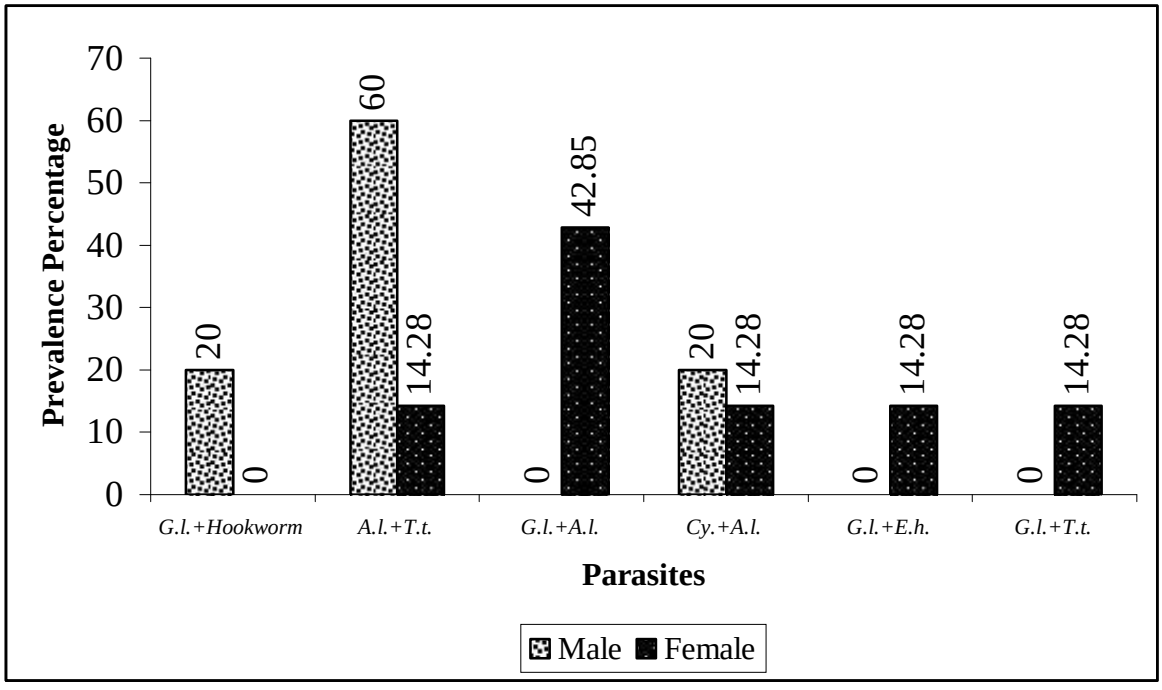

Figure No. 5: Prevalence of Double Species Intestinal Parasite

) Ethnic group-wise Prevalence of Intestinal Parasites

Out of 179 stool samples collected, 100 (55.86%) were from Newar, 62 (34.64%) were from Chhetri and 17 (9.5%) were from Brahmin. The study showed that Newar community has the highest prevalence of intestinal parasites (51%) than in Chhetri and Brahmin with prevalence of 30.64% and 17.64% respectively. Statistically, no significant difference was found in the prevalence of parasitic infections among different ethnic groups ($\chi 2 = 10.75$, $P > 0.05$).

Table No. 4: Ethnic-wise Prevalence of Intestinal Parasites

S.N.	Ethnic Group	Total no. of Samples Examined	No. of Positive Samples	Positive %
1.	Newar	100	51	51
2.	Chhetri	62	19	30.64
3.	Brahmin	17	3	17.64
	Total	**179**	**73**	

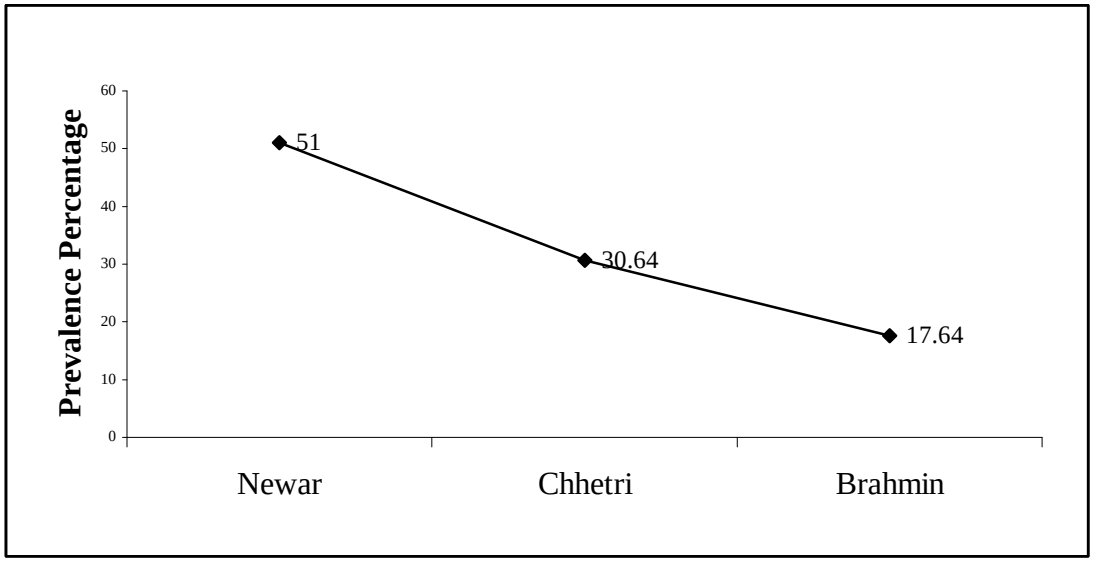

Figure No. 6: Ethnic-wise Prevalence of Intestinal Parasites

) Prevalence of Intestinal Parasites in Relation to Food Habit

Most of the children in the study area were found to be non-vegetarian (i.e. 89.3%). Only 10.1% children were found to be vegetarian. Higher prevalence was noted from non-vegetarian children with 44.09% infection than that of vegetarian children (i.e. 11.11%). Statistically, parasitic infection was found significantly different in relation to food habit ($\chi 2 = 7.28$, $P<0.05$).

Table No. 5: Prevalence of Intestinal Parasite in Relation to Food Habit

S.N.	Foot habit	No. of Sample	Positive No.	Positive %
1.	Non-vegetarian	161	71	44.09
2.	Vegetarian	18	2	11.11
	Total	**179**	**73**	**40.78**

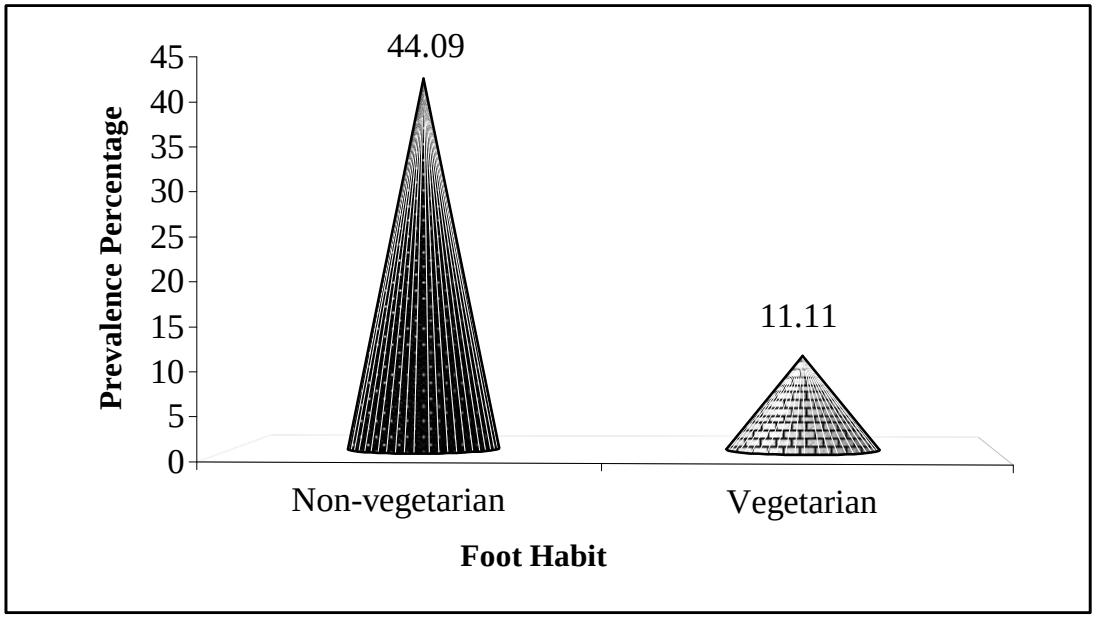

Figure No. 7: Prevalence of Intestinal Parasite in Relation to Food Habit

B. Result of Questionnaire Survey Analysis

The interview was carried out with the help of questionnaire in 179 children whose stool examinations were performed. The results from the questionnaire survey analyses are as follows:

) Respondent's View Regarding KAP towards Worm Infection

The surveillance study revealed that 67.04% children had ideas about causes of worm infection. Similarly, 57.54% children had ideas about symptoms, 66.48% had ideas about preventions and 70.45% had ideas about controls. Prevalence of intestinal parasite was found to be more in those children who had no ideas about various KAP than those children having knowledge.

Table No. 6: Respondent's View Regarding KAP towards Worm Infection

SN	Category	Positive response	+ve %	Prevalence No.	Prevalence %	Negative response	-ve %	Prevalence No.	Prevalence %
1	Cause	120	67.04	52	43.33	56	32.96	42	75.00
2	Symptom	103	57.54	60	58.25	76	92.46	53	69.74
3	Prevention	119	66.48	46	38.66	60	33.52	40	66.67
4	Control	127	70.45	49	38.56	52	29.05	36	69.23

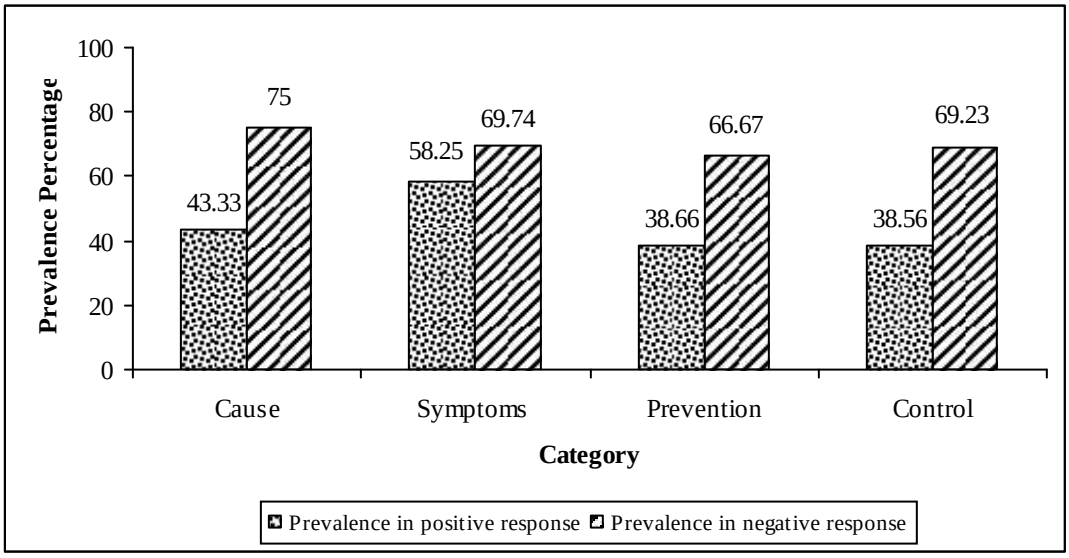

Figure No. 8: Prevalence of Parasitic Infection According to KAP towards Worm Infection

) Ways of Defecation

Out of 179 respondents, maximum (89.94%) use toilet for defecation and 10.06% use open place. Prevalence of intestinal parasite is higher (66.67%) in those respondents who use open places for defecation than those who use toilets (37.89%). Statistically, parasitic infection was found significantly different in toilet users and others (Open place users) ($\chi 2 = 5.56$, $P<0.05$).

Table No. 7: Ways of Defecation

S. N.	Category	Total No. of Respondents	Respondent %	Prevalence no.	Prevalence %
1	Toilet	161	89.94	61	37.89
2	Open places	18	10.06	12	66.67
	Total	**179**		**73**	

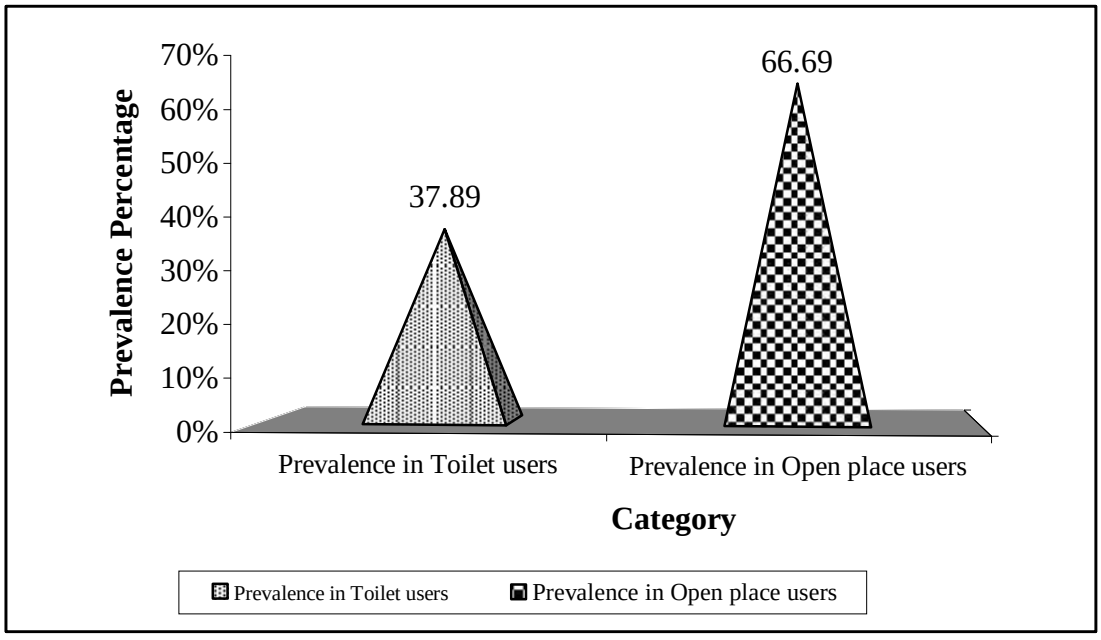

Figure No. 9: Prevalence According to Ways of Defecation

) Types of Drinking Water

All the respondents use tap water for drinking purpose. Regarding consumption of drinking water, out of 179 respondents, 77.65% were found to use direct tap water while 8.94% were found to use boiled water, 2.24% were found to use chemically treated water and only 11.74 were found to use filtered water. Prevalence of intestinal parasites is higher (89.04%) in those respondents who use direct tap water for drinking purpose than those who use boiled, chemically treated and filtered water with prevalence of 2.74%, 1.37% and 11.17% respectively. Statistically, there is significant difference among different types of water user for drinking purpose in the prevalence of parasitic infection ($\chi 2 = 13.55$, $P<0.05$).

Table No. 8: Drinking Water

S.N.	Category	No. of Respondent	Respondent %	Positive No.	Prevalence %
1	Direct tap water	139	77.65	65	89.04
2	Boiled water	16	8.94	2	2.74
3	Chemically treated water	4	2.24	1	1.37
4	Filtered water	20	11.17	5	6.85
	Total	**179**		**73**	

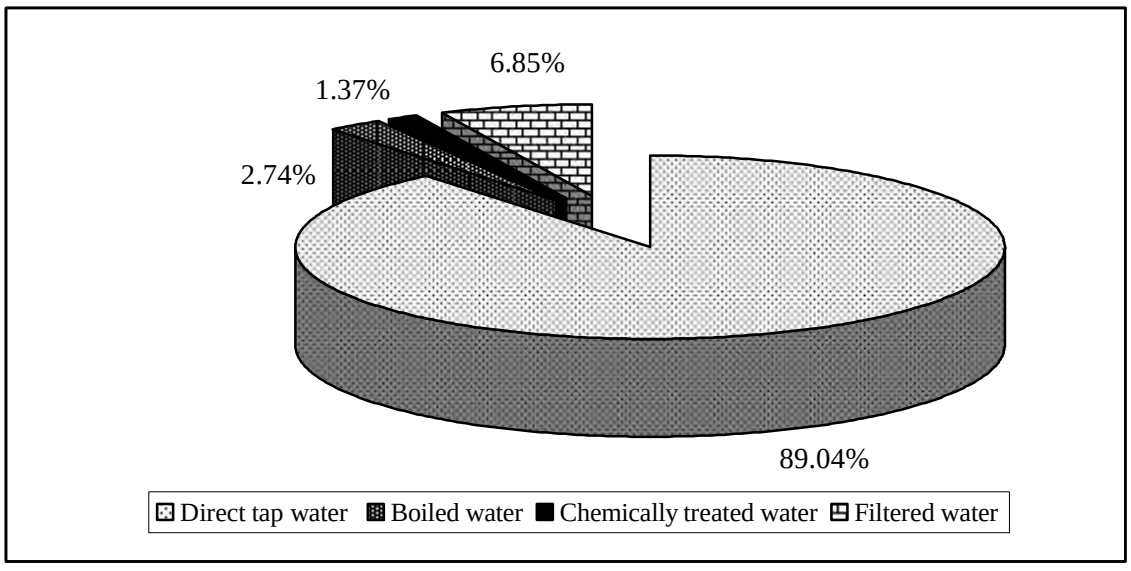

Figure No. 10: Prevalence According to Types of Drinking Water

Methods of Cleaning Vegetables and Fruits

Regarding cleaning of vegetables and fruits, maximum respondents (89.94%) clean by tap water, 5.59% clean by rubbing with clothes and only 4.47% use other water resources (tube well, well, pond water etc.). Prevalence of intestinal parasite in those respondents who use clothes and other water resources (tube well, well, pond water etc.) was found to be 10.96% and 8.22% respectively and those who use tap water for cleaning vegetables and fruits was found to be 80.82% prevalent. Statistically, significant difference was found among groups adopting different methods for cleaning vegetables and fruits. ($\chi 2 = 11.37$, $P<0.05$).

Table No. 9: Methods of Cleaning Vegetables and Fruits

S. N.	Category	No. of Respondent	Respondent %	Prevalent No.	Prevalence %
1	Washing by tap water	161	89.94	59	80.82
2	Rubbing buy clothes	10	5.59	8	10.96
3	Washing with water from other resources	8	4.47	6	8.22
	Total	**179**		**73**	

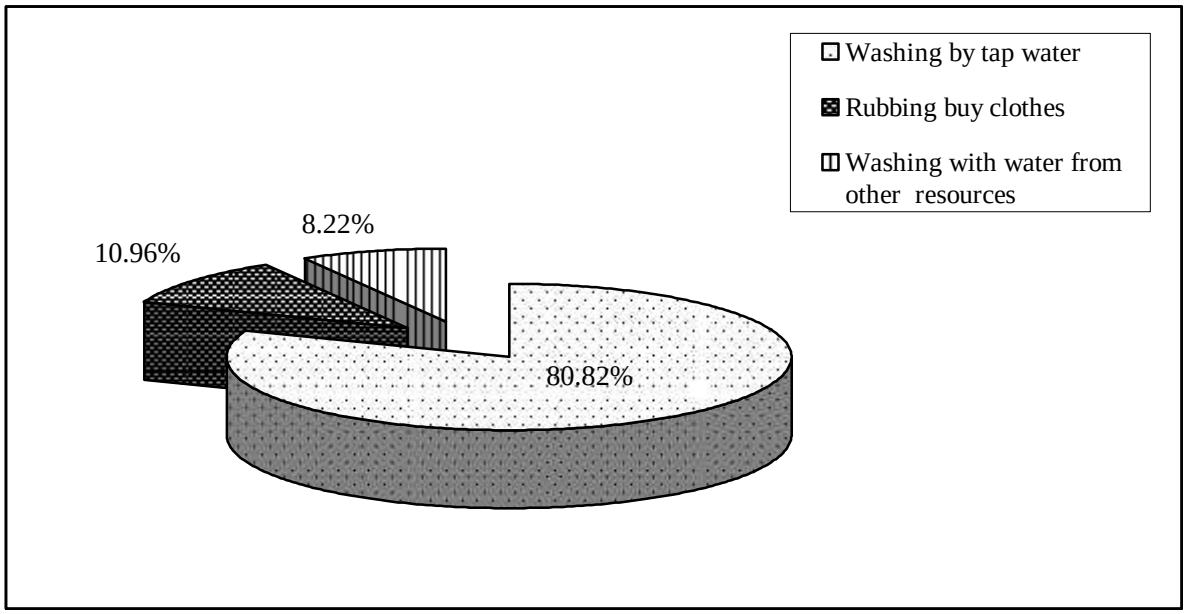

Figure No. 11: Prevalence According to Methods of Cleaning Vegetables and Fruits

) Method of Cleaning Hands

The surveillance study revealed that, maximum respondents (67.03%) use only water to clean their hands while 29.61% use soap water. Similarly, 2.24% use ash water and 1.12% use other methods (rubbing with clothes, mud water etc.) to clean their hands. Prevalence of intestinal parasite is higher (83.33%) in those respondents who use only water for cleaning hands than those who use ash water and soap water with prevalence of 75% and 37.27% respectively. Statistically, significant difference was found in parasitic infection among groups using different methods for cleaning hands ($\chi 2 = 12.08$, $P<0.05$).

Table No. 10: Methods of Cleaning Hands

S.N.	Category	No. of Respondents	Respondents %	Prevalence No.	Prevalence %
1	Only water	12	6.70	10	83.33
2	Soap water	161	89.94	60	37.27
3	Ash water	4	2.24	3	75.00
4	Others	2	1.12	0	0
	Total	**179**		**73**	

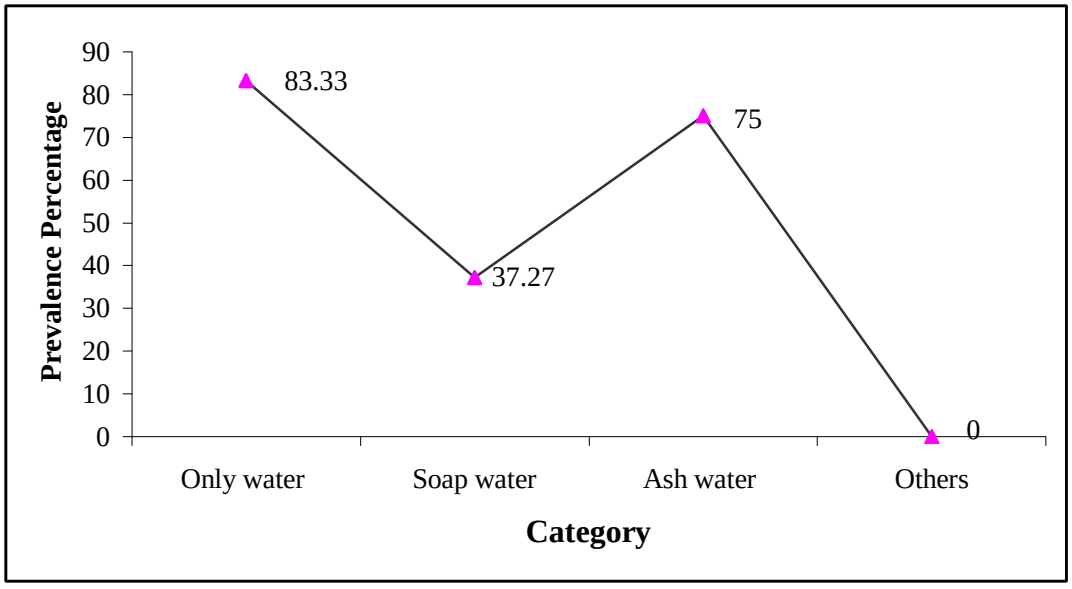

Figure No. 12: Prevalence According to Methods of Cleaning Hands

J Condition for Cleaning Hands

Out of 179 respondents, 38.55% respondents wash their hands after / before every work while 26.26% wash their hands before meal, 23.46% wash after defecation and 11.73% wash after working in fields. Prevalence of intestinal parasites is higher (90.47%) in those respondents who wash their hands only after working in fields than those who wash before meal, after defecation and after / before every occasion with prevalence of 27.66%, 47.62% and 30.43% respectively. Statistically, parasitic infection according to conditions of cleaning hands is significantly difference ($\chi 2 = 20.10$, $P<0.05$).

Table No. 11: Conditions for Cleaning Hands

S.N.	Category	No. of Respondents	Respondents %	Prevalence no.	Prevalence %
1.	Before meal	47	26.26	13	27.66
2.	After defecation	42	23.46	20	47.62
3.	After working in field	21	11.73	19	90.47
4.	All of above	69	38.55	21	30.43
	Total	**179**		**73**	

Figure No. 13: Prevalence According to Conditions for Cleaning Hands

) Habit of Cutting Nails

Regarding habit of cutting nails, maximum (73.19%) respondents cut their nails once a week while 22.90% respondents cut nails twice a month. Similarly 2.79% cut nails once a month. Prevalence of intestinal parasite is higher (100%) in those respondents who cut nails randomly than those who cut once a week, twice a month, and once a month with prevalence of 22.06%, 60.97%, and 80% respectively. Statistically, the prevalence of parasitic infection on the basis of habit of cutting nail was found to be significantly different was ($\chi 2 = 17.15$, $P<0.05$).

Table No. 12: Habit of Cutting Nails

S. N.	Category	No. of Respondents	Respondents %	Prevalence No.	Prevalence %
1	Once a week	131	73.19	42	32.06
2	Twice a month	41	22.90	25	60.97
3	Once a month	5	2.79	4	80.00
4	Others	2	1.12	2	100.00
	Total	**179**		**73**	

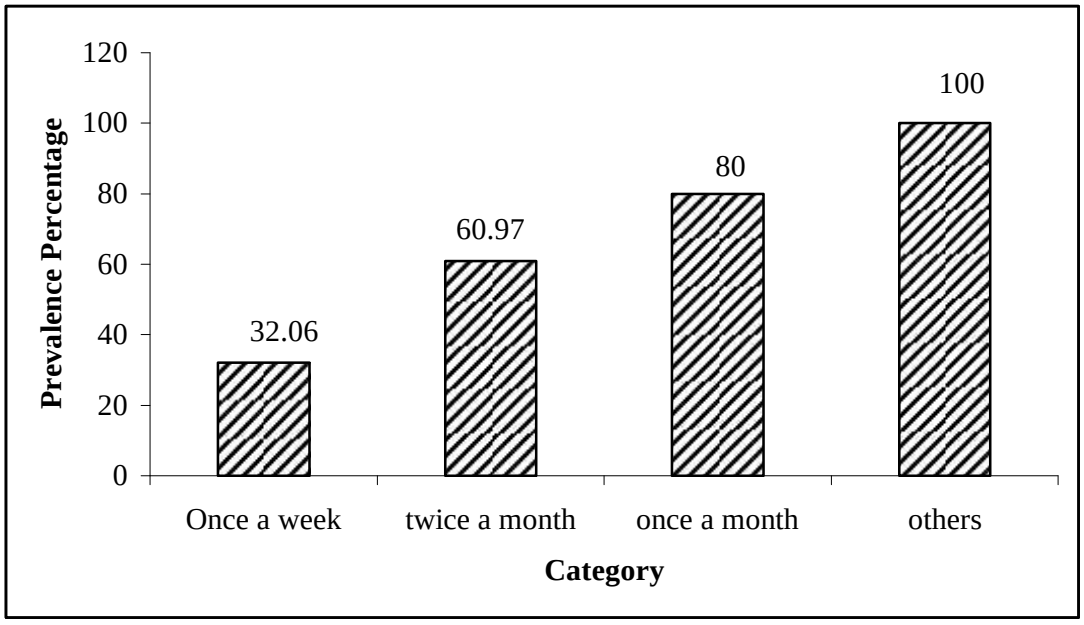

Figure No. 14: Prevalence According to Habit of Cutting Nails

J Types of Domestic Animals with Respondents

Only 115 (64.24%) of the respondent residing in the present study area owned domestic animals with them. According to interview among 115 respondents, 43 (24.02%) have more than one type of animals/birds. Surveillance study had shown that cattle, poultry, dogs and cats were the major domestic animals reared by the people of that area. Prevalence of intestinal parasite is higher (31.51%) in those respondents who keep more than one type of birds / animal with them and least prevalence in those who keep ducks and goat as domestic animals with prevalence of 2.74% in each. Statistically, the prevalence of parasitic infection on the basis of types of domestic animals with respondents was found to be significantly different ($\chi 2 = 30.42$, $P<0.05$).

Table No. 13: Types of Domestic Animals with Respondents

S. N.	Category	No. of Respondents	Respondents %	Prevalence No.	Prevalence %
1	Hens	24	13.41	5	6.85
2	Ducks	11	6.14	2	2.74
3	Dogs	19	10.61	15	20.55
4	Cats	5	2.79	3	4.11
5	Goats	7	3.91	2	2.74
6	Cows/Buffalos	6	2.79	3	4.11
7	More than one type of animals / birds	43	24.01	23	31.51
8	No domestic animals / birds	64	35.75	20	27.40
	Total	**179**		**73**	

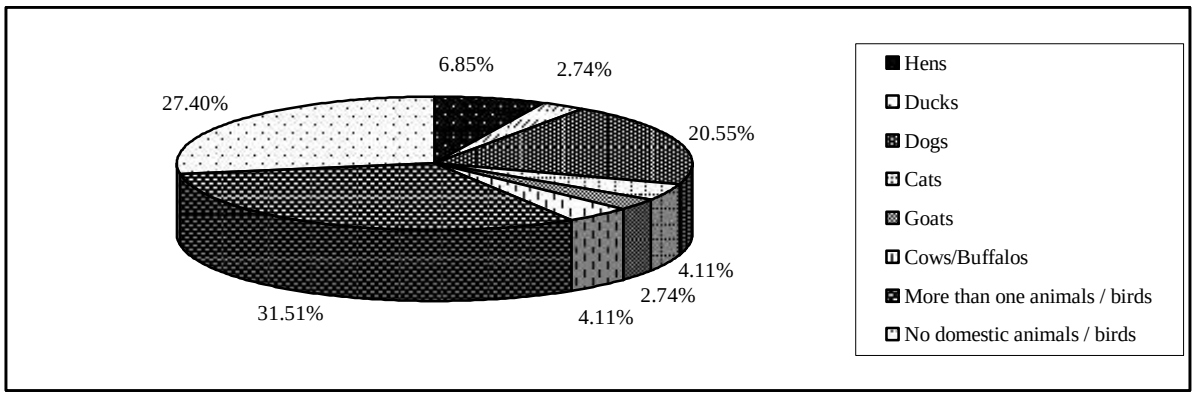

Figure No. 15: Prevalence According to Types of Domestic Animals with Respondents

Food Habit (Meat)

According to interview, maximum respondents i.e. 161 (89.94%) were non-vegetarian. Among 161 non-vegetarian respondents, 24.02% consume more than one type of meat. While only 10.05% respondents are vegetarian. Buff is mostly consumed meat (26.81%) and fish is least consumed (0.56%). Prevalence of intestinal parasite is higher (i.e.55.81%) in those respondents who consume more than one types of meat and least prevalence in those who consume only fish with no prevalence of intestinal parasite. Statistically, the prevalence of parasitic infection on the basis of food habit (meat) respondents was found to be significantly different ($\chi 2 = 22.77$, $P<0.05$).

Table No. 14: Food Habit (Meat)

S. N.	Category	No. of Respondents	Respondents %	Prevalence No.	Prevalence %
1	Buff	10	26.81	18	37.5
2	Mutton	30	16.76	8	26.67
3	Chicken	37	20.67	14	37.83
4	Fish	1	0.56	0	0
5	More than one type of meat	43	24.02	24	55.81
6	Others	2	1.12	0	0
7	No	18	10.05	9	50
	Total	**179**		**73**	

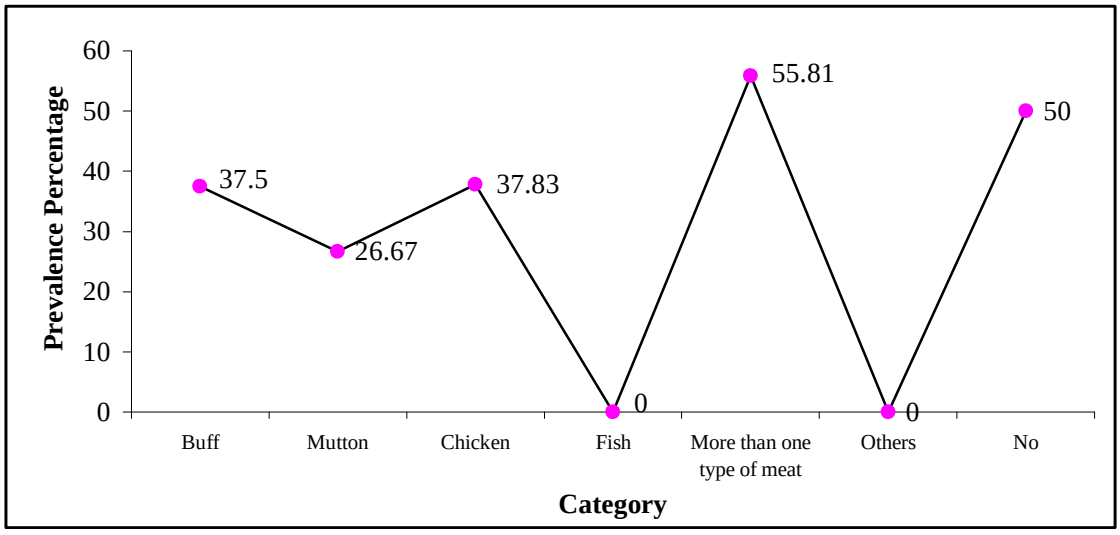

Figure No. 16: Prevalence According to Food Habit (Meat)

) Experience of Intestinal Parasitic Disease

Surveillance study had shown that maximum 75.42% respondents had already been suffered from intestinal parasitic disease (diarrhea/ dysentery/ worm). Prevalence of intestinal parasite was not found in those respondents who experienced intestinal parasitic diseases in recent time (one or two weeks before). Prevalence percent is higher in those who experienced such diseases more than a year ago with prevalence of 85.71%. Statistically, the prevalence of parasitic infection on the basis of experience of intestinal parasitic disease was found to be significantly different ($\chi 2 = 48.66$, $P<0.05$).

Table No. 15: Experience of Intestinal Parasitic Disease

S. N	Category	No. of Respondents	Respondents %	Prevalence No.	Prevalence %
1	One week before	12	6.70	0	0
2	Two week before	10	5.58	0	0
3	One month before	16	8.94	1	6.25
4	three month before	24	13.40	6	25.00
5	Six month before	26	14.52	10	38.46
6	One year before	33	18.43	22	66.67
7	More than one year before	14	7.82	12	85.71
8	Don't know	44	24.58	23	52.27
	Total	**179**		**73**	

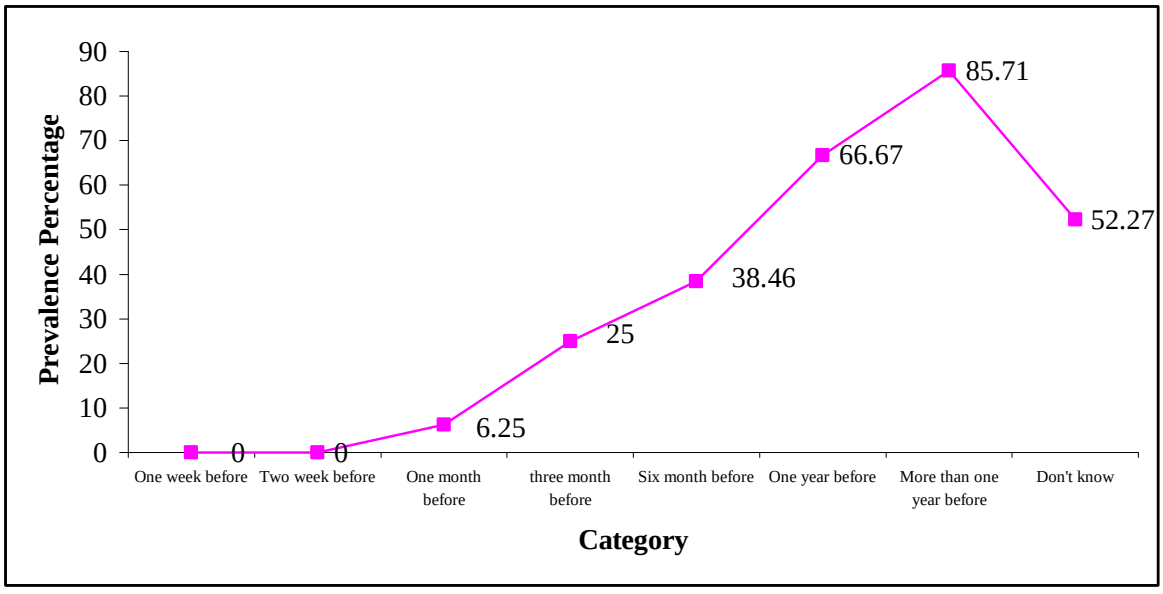

Figure No. 17: Prevalence According to Experience of Intestinal Parasite

Deworming Tablets

Out of 179 respondents, 92.74% respondents know about deworming tablets while 7.26% do not know about that. Among them 62.02% have consumed the tablets before six months of times. Prevalence of intestinal parasite was not found in those respondents who have taken deworming tablets in recent time (one week before, two weeks before or one month before). Prevalence percent is higher in those who consumed the tablets before more than six months ago while lesser in those who consumed the tablets before less than six months. Statistically, the prevalence of parasitic infection on the basis of consumption of deworming tablets in previous time was found to be significantly different ($\chi 2 = 54.11$, $P<0.05$).

Table No. 16: Deworming Tablets

S. N.	Category	No. of Respondents	Respondents %	Prevalence No.	Prevalence %
1	One week before	3	1.67	0	0
2	Two week before	9	5.96	0	0
3	One month before	15	8.38	0	0
4	Three month before	35	19.55	8	22.85
5	Six month before	49	27.37	18	36.73
6	One year before	42	23.46	30	71.43
7	More than one year before	8	4.47	6	75.00
8	Don't know	13	7.26	11	84.61
	Total	**179**		**73**	

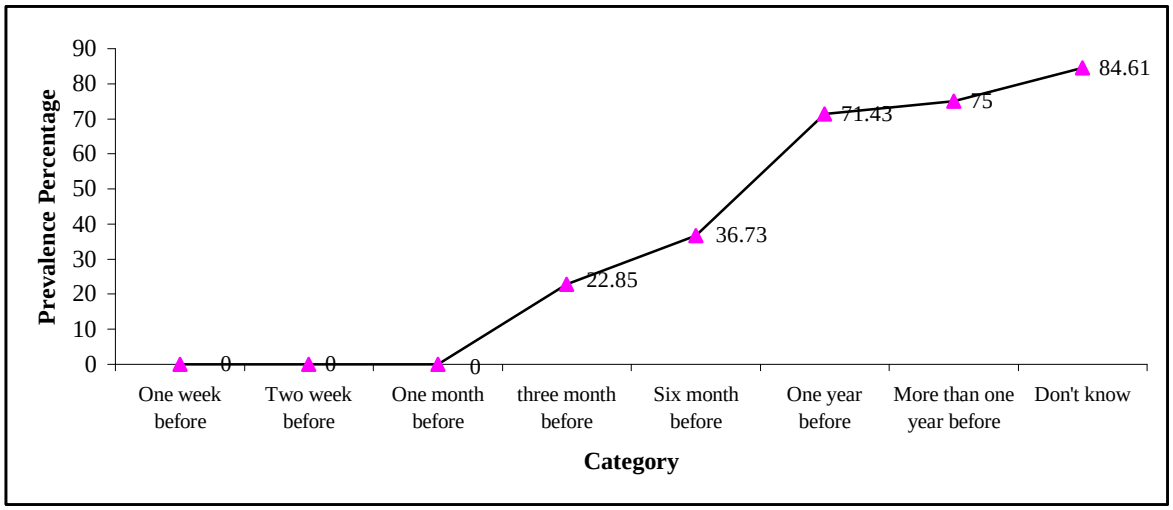

Figure No. 18: Prevalence on the basis of Consumption of Deworming Tablets in Previous Time

) Treatment Methods

Regarding treatment method against intestinal disorder, surveillance study revealed that most of them visit doctor for treatment (86.03%) while some of them took medicine directly without check up (8.94%). But few (5.03%) still believe on traditional method (Dhami, Baidhya etc.). Prevalence of intestinal parasite is more (i.e. 77.78%) in case of those respondents who believe in traditional methods of treatment than in those who take direct medicine and visit doctor with prevalence of 62.5% and 36.36% respectively. Statistically, the prevalence of parasitic infection on the basis of treatment method was not found to be significantly different ($\chi 2 = 9.41$, $P > 0.05$).

Table No. 17: Treatment Methods

S.N.	Category	No. of Respondents	Respondents %	Prevalence No.	Prevalence %
1	Direct taking medicine	16	8.94	10	62.5
2	Doctor	154	86.03	56	36.36
3	Traditional method	9	5.03	7	77.78
	Total	**179**		**73**	

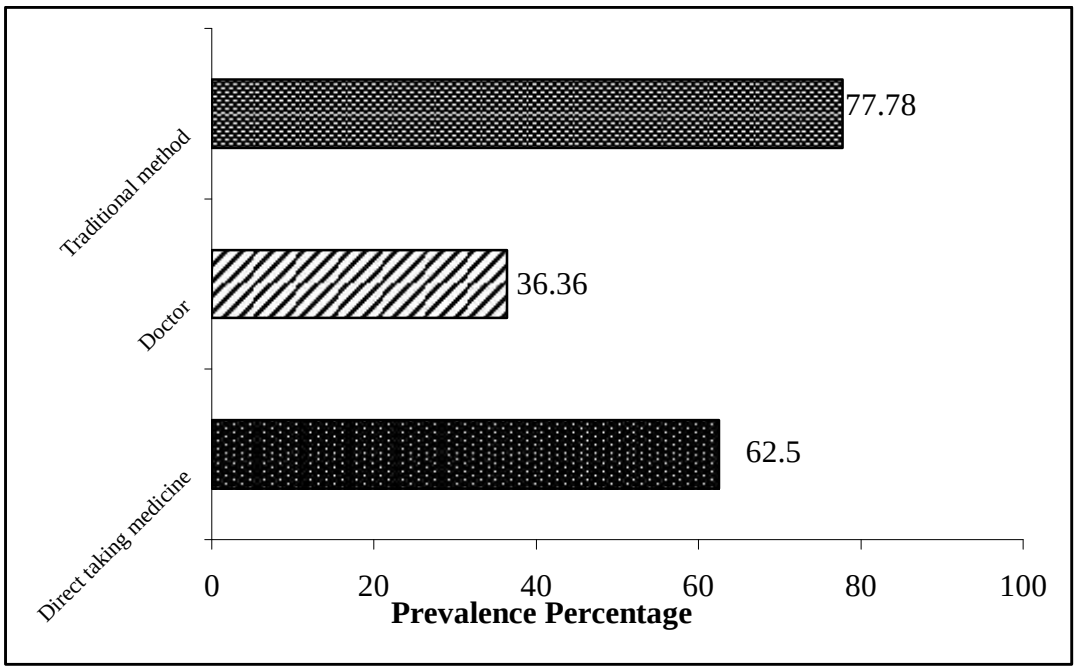

Figure No. 19: Prevalence According to Treatment Methods

) Knowledge about Medicine (Plant Products)

Out of 179 respondents, 75.42% respondents do not know about medicinal plants but some 24.58% know about that products. Prevalence of intestinal parasite is higher (47.40%) in those respondents who don't know about medicinal plants to care such diseases than in those who know about it with prevalence of 20.45%. Statistically, the prevalence of parasitic infection on the basis of knowledge about medicine (plant products) was found to be significantly different ($\chi 2 = 9.96$, $P<0.05$).

Table No. 18: Knowledge about Medicine (Plant Products)

S.N.	Category	No. of Respondents	Respondents %	Prevalence No.	Prevalence %
1	Know	44	24.58	9	20.45
2	Don't know	135	75.42	64	47.40
	Total	**179**		**73**	

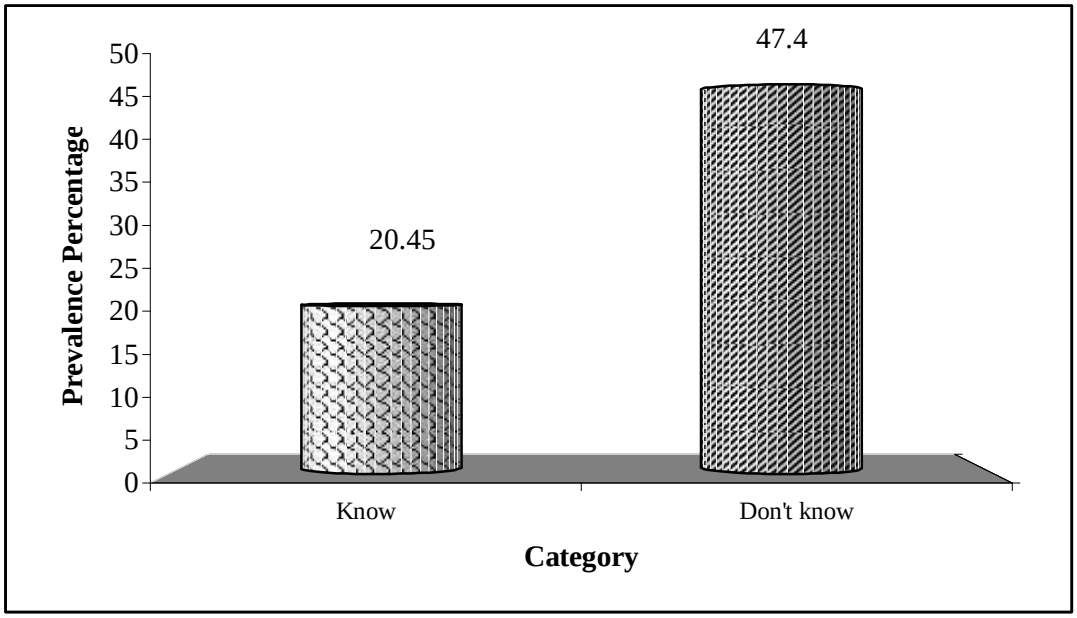

Figure No. 20: Prevalence According to Knowledge about Medicine (Plant Products)

Table No. 19: Different types of plant products used as medicine against intestinal discomfort according to respondents:

S. N.	Local Name	Scientific Name	Part of plant Used	No. of Respondents
1.	Bakena	*Melia azedarachi*	Seed	19
2.	Raddish	*Raphanus sativus*	Seed	2
3.	Jai	*Avena sativa*	Leaf	1
4.	Timur	*Zanthoxylum armatum*	Seed	3
5.	Sil Timur	*Zanthoxylum oxyphyllum*	Seed	2
6.	Tite Phapar	*Fagopyrum tataricum*	Seed	4
7.	Gurans	*Rhododendron arboreum*	Flower (Dry)	1
8.	Kimu	*Morus alba*	Root	1
9.	Neem	*Azadirachta indica*	Leaf	5
10.	Hing	*Ferula assafoetida*	Fruit	3
11.	Tite paate	*Artemisia vulgaris*	Leaf	3
	Total			**44**

Among 179 respondents, 44 respondents mentioned the names of various plants as anti-helmintic (Table no. 19). *Zanthoxylum oxyphyllum* (Sil Timur) and *Artemisia vulgaris* (Tite paate) are mentioned in *Medicinal Plants in Nepal* (Bulletin of the Department of medicinal plants No.3, Ministry of Forest and Soil Conservation, Nepal,1982). Similarly, *Melia azedarachi* (Bakena) is mentioned in *Medicinal Plants in Nepal* (Chaudhary). The remaining plants mentioned by respondents in the presents study are not found mentioned or

published in any type of book or bulletin. Some respondents mentioned the name of Black Salt and Cow Dung Ash as anti-helmintic which also has no evidence to prove.

Medicinal Plants in Nepal (Bulletin of the Department of medicinal plants No.3, Ministry of Forest and Soil Conservation, Nepal,1982) has suggested many plants and their products that can be used as anti-helmintics (Annex-5).

DISCUSSION AND CONCLUSION

Intestinal parasites are cosmopolitan in distribution and causing serious health problem in society due to poverty, lack of knowledge, illiteracy and conservative thinking. *Ascaris lumbricoides, Trichuris trichiura* and hookworms are the major helminth parasites where as *Giardia lamblia* and *Entamoeba histolytica* as the major protozoan parasites (Warren and Mahmou 1984, Walsh 1986). In Nepal, about 4.8% of people died due to cholera and diarrhea (CBS 2002). Morbidity because of intestinal parasites has always been on important public health problem in tropical regions (Sherchand *et al.*, 1996).

Analysis of Surveillance data shows that out of 179 children of Chovar, 73 (40.78%) were harboring different kinds of intestinal parasites. Where *54.79%* were male children and 45.21% were female children. Present finding indicates that there is no significant difference in prevalence of parasites in between the two sexes (χ^2 = 5.66, P > 0.55). It is because of equal possibilities of transmission of parasite among them due to over dispersal of parasites in all the communities. This finding is also supported by Rai *et al.,* (2002), Chaudhary (2003), Maharjan (2004) and Manandhar (2007).

The present prevalence of parasites is found highest (69.56%) in the age group 9-10 years in male children where as in the age group of 10-12 years in female children (36.36%), which is similar with the report given by Rai *et al.*, (1991) according to which intestinal parasites were more common among children below 15 years than in adults (above 15 years).

Present study indicates that there is no significant difference in prevalence of intestinal parasites in different age groups (χ^2 = 10.02, P > 0.05). It is due to possibility of transmission of disease in all age groups but the highest attack rate occurs among children above 18 months. There is no apparent immunity to infection and re-infection can occur among all ages (Connar *et al.*, 1993 and Manandhar 2007).

Regarding the protozoon parasites, the prevalence of *Giardia lamblia* is the highest (22.95%), followed by *Enatmoeba histolytica* (9.89%) and *Cyclospora* sp. (1.64%) which resembles with finding of Chaudhary (2003) and Maharjan (2004). Chaudhary reported 11.4% of *Giardia lamblia,* 5.8% of *Enatmoeba histolytica* and 7.6% of *Cyclospora* sp. while Maharjan found. 19.55% of *Giardia lamblia*, 7.69% of *Enatmoeba histolytica* and 0.64% of *Cyclospora* sp. It may be due to utilization of food and water contaminated with cyst of protozoan parasites. Similarly, FPA school health program, *Giardia lamblia* was the most prevalent intestinal protozoan parasites, followed by *Enatmoeba histolytica* in school children of Kirtipur area (Annex-3). As these protozoan parasite transmit very easily through contaminated food and water. The prevalence rate during endemic season are found to be maximum.

Similarly, the present study shows that *Ascaris lumbricoides* is most prevalent helminthes parasite (50.82%), followed by *Trichris trichuira* (9.83%) Hookworms. This result is supported by findings of Gupta et al., (1988) in Kirtipur where prevalence of *Ascaris lumbricoides* was found to be 40% followed by *Trichris trichuira* (25.26%), Hookworm (4.56%) and *Hymenolepis nana* (2.46%). Similar result was obtained by Maharjan (2004) where prevalence of *Ascaris lumbricoides* was found to be (24.04%), followed by *Trichris trichuira* (8.33%), Hookworm (0.32%) and *Hymenolepis nana* (0.32%).

In the present study among the positive samples, 83.56% are found with prevalence of single species infection where *Ascaris lumbricoides* and *Giardia lamblia* are found to be the most dominant helminthes and protozoan parasites respectively. Similarly, 16.44% are found with prevalence of double species infection but no triple or further multiple infection is found. This result resembles with Fujita *et al.,* (1993), Maharjan (2004) and Manandhar (2007).

Among the different ethnic groups, Newar community has the highest prevalence of intestinal parasites (51%) than in Chhetri (30.64%) and Brahmin

(17.64%). It may be due to different cultural behaviour. But statistically, there was no significant difference in the prevalence of parasitic infection among different ethnic groups ($\chi^2 = 10.75$, $P > 0.05$). This result coincides with the result of Jha (2004).

The World Health Organization noted that human behaviour may influence the prevalence and intensity of intestinal infections (WHO, 1981). So, the human behaviour such as open-air defecation and cultural practices such as growing vegetables in faecally polluted gardens were found to be contributing factors in transmission of parasites. Polluted water, infected meat (raw) and barefooted are also conductive to the transmission (Sherchand, 1995 and Shield, 1987).

During surveillance study, it is found that 77.65% of the respondents use direct tap water for drinking even in endemic seasons. While 11.17% use filtered water, 8.94% use boiled water and 2.24% use the water by treating with chemicals. Prevalence of intestinal parasite is found to be highest (89.04%) in those respondents who use direct tap water for drinking purpose. So difference in the prevalence of intestinal parasites in children according to type of drinking water is significant ($\chi^2 = 13.55$, $P < 0.05$). Drinking direct tap water during endemic seasons accelerates the infection rate due to maximum chances of contamination and transmission (Sherchand *et al.,* 1997 and 2001).

Regarding the use of toilets, 89.94% had got toilet while 10.06% used open places for defecation. Prevalence of intestinal parasite is higher (66.67%) in those respondents who use open places for defecation. Presence of a toilet in a house did not assure that all people use it, especially children preferred to defecate on open places. Conditions and cleanliness of the toilet directly affects on the contamination. So, difference in prevalence of intestinal parasites of the children according to way of defecation place is significant ($\chi^2 = 5.56$, $P < 0.05$). Open air defecation promotes the infection rate (Sherchand *et al.,* 2001).

From the interview, it is found that only 38.55% use to wash their hands properly after every occasion such as after defecation, after working in field

and before meal. While remaining respondents do not give more priority in washing/cleaning hands. The prevalence of intestinal parasites is highest (90.47%) in those who wash their hands only after working in field and least (27.66%) in those who wash their hands before meal. Respondents who use soap and water to wash their hands have got least (38.27%) prevalence of parasite infection. So, difference of intestinal parasitic of the children according to their personal hygiene is significant ($\chi^2 = 12.08$, $P < 0.05$). According to Olsen *et al.*, (2001), households without soap had a 2.6 times higher risk of being infected with parasites.

Regarding behaviour of cutting nails, prevalence of intestinal parasite is highest (100%) in those children who do not cut nails regularly as it helps in acceleration of prevalence rate of parasites. 64.24% households contain domestic animals. Among them the prevalence of intestinal parasites is higher (31.51%) in those who keep more than one type of bird/animal with them and least prevalence in those who keep ducks and goats as domestic animals with prevalence of 2.74% in each. Domestic animals serve as the reservoir or primary host of certain intestinal parasites and also create unhygienic condition which help the vectors to survive and also transmit the parasites. The prevalence of parasitic infection on the basis of types of domestic animals with respondents is found to be significantly difference ($\chi^2 = 30.42$, $P < 0.05$).

Prevalence of intestinal parasites is directly affected by feeding habit of people. In the present study among 179 children, 161 are non-vegetarian and 18 are vegetarian, among them 71 (44.09%) and 2 (11.11%) respectively are found positive to intestinal parasites. So, difference in prevalence of intestinal parasites of the children according to food habit is significant ($\chi^2 = 7.28$, $P < 0.05$). The present study shows higher prevalence rate in non-vegetarians due to higher percentage of non-vegetarian respondents. But according to Chaudhary (2003), there was not significant difference in prevalence of intestinal parasites in vegetarian and non-vegetarian.

The present study tries to know the methods of treatment on intestinal discomfort. Among 179 respondents 154 (86.03%) like to visit to doctor for treatment while some of them (8.94%) take medicine directly without check up and few (5.03%) still believes on traditional methods of treatment by Dhami and Vaidhyas. Among them the prevalence of intestinal parasites found to be highest (77.78%) in those who believe in traditional methods of treatments. So, the prevalence of parasitic infection on the basis of treatment method is not found to be significantly different ($\chi^2 = 9.41$, $P > 0.05$).

The present study shows that some respondents (24.58%) know about traditional medicinal plants that used in abdominal discomfort. But maximum (75.42%) don't know about such products. Prevalence of intestinal parasite is higher (47.42%) in those respondents who don't know about medicinal plants to care such disease than those who know about it with prevalence of 20.45%. So the prevalence of parasitic infection on the basis of knowledge about medicinal plants is found to be significantly different ($\chi^2 = 9.9.69\%$, $P < 0.05$).

Taking anti-helminthes drugs in certain interval of time (3 months or 6 months) decrease the more percent of helminthes infection. Only a few people in the present study are used to take anti-helminthes drugs at certain interval of time, but most of others do not remember their last time of consuming such drugs. When the parasitic infections lead to symptomatic, they use to take drugs by consulting or without consulting experts. Stool examinations and drugs distribution program by Integrated Family Planning, School Health Program in some of the schools in the area helped to reduce a few percentage of infection but not satisfactorily. It could help, if such program could be conducted in each child of every school in an interval of every six months.

Typical traditions and cultures in Newar community help to harbor intestinal parasite in them. According to present study only 10.05% of respondents are vegetarians, remaining all (89.64%) are non - vegetarians and like to consume different meat varieties. All the Newar community children, except a few

regularly or most frequently consume the buffalo meat (buff) which is cheaper than other types of meat. Meat is must in their every type of traditional feasts and festivals. They prepare different types of meat varieties such as *Kachila, Chhengula, Chhwela, Sekuwa* etc. Among the above *Kachila* and *Chhengula* are consumed without cooking while other items are consumed half cooked. Consumption of such meat adds to the infection rate of intestinal parasites.

As soon as the laboratory works were completed, stool examination reports were prepared for every stool samples for treatment programme. Anti-protozoan and anti-helminthes drugs were distributed with the help of a medical physician. All together 24.8 gm of Albendazole, 102 gm of Metronidazole and 6 gm of Thaibendazole were distributed.

During survey and treatment programme different pamplets and informative slips were distributed among the community people to promote the awareness. People visited in treatment center during treatment programme were given various information and ideas about the cause and prevention measure of gastrointestinal parasitic diseases. They were also suggested to examine the stool in the interval of every six months.

Since the children are the backbone of the nation. If we want to develop our country, we need to build up the children with good health. So, control measures of intestinal parasitic disease should be undertaken in time. Hence, extensive study ii needed for the determination of epidemiological and etiological factors that cause the high prevalence of intestinal parasite in the present study area and other region of Kirtipur.

RECOMMENDATIONS

From the present research work, the following recommendations are extracted for efficient prevention and control of intestinal parasites:

- Public health education must be made compulsory in the text book of the primary and lower secondary subject.
- People should be made aware about their feeding behaviour and use of boiled water for drinking purpose.
- Basic health education programmes should be conducted time to time in communities for raising awareness towards the parasitic infections, prevention and control.
- Children should be forced to use safe sanitary clean latrine for defecation.
- People should avoid walking bare foot.
- Farmers should be inspirited to use boots and gloves during working in field.
- Awareness programmes on sanitary improvements including personal hygiene and environment sanitation should be organized.
- The research works on the prevalence of intestinal parasites and prevention should be encouraged.
- Further study should be done regarding medicinal plants that can be used as anti-helmintics and anti-protozoan parasites.

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ANNEX – 1

Introduction of 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.

A. Intestinal Protozoan Parasites

Protozoa are unicellular animals that occur singly or in colonies. Each Protozoan is a complete unit capable of performing the physiological functions which in higher organisms are carried on by specialized cells (Belding, Third Edition). They cause serious health problem for human. Some common intestinal protozoan parasites are: *Entamoeba histolytica*, *Giardia lamblia*, *Entamoeba coli*, *Isospora*, *Trichomonas hominis*, *Balantidium coli*, *Cyclospora*, *Cryptosporidium* etc.

a) Entamoeba histolytica

History:- *Entamoeba histolytica* was first discovered by Lamb (1859) and Losch (1875) proved its pathogenic nature.

Geographical Distribution:- World-wide but more common in the tropics and sub-tropics.

Habitat:- Trophozoites of *Entamoeba histolytica* live in the mucous and sub-mucous layers of the large intestine of human.

Morphology:- *Entamoeba histolytica* has 3 stages in its life –cycle.

a) Trophozoite stage- It is irregular and not fix in shape and size ranges 18 - 40 ⇑m in diameter. It is feeding stage.

b) Precystic stage- It is smaller in size varying from 10 -20 ⇑m in diameter. It is round or slightly ovoid in shape. It is transitory stage.

c) Cystic stage- It is round and surrounded by highly retractile membrane, cystic wall. Size varies from 5 to 20 ⇑m. Initially the cyst is uninucleate but the mature cyst is quadrinucleate, which is infective stage.

Mode of Infection;- Faecal oral route transmission of *Entamoeba histolytica* from human to human is through the ingestion of food or drinks contaminated with quadrinucleated cysts.

Amoebiasis- Infection of *Entamoeba histolytica* commonly results in amoebiasis. Amoebiasis is of two types:

Invasive amoebiasis – When clinical symptoms result, the disease is referred to as invasive amoebiasis. Possibly only about ten percent of infections result in invasive amoebiasis (Smyth 1996).

Non-invasive amoebiasis- A high percentage of individuals infections with *Entamoeba* show no symptoms of disease. This condition is referred as non-invasive amoebiasis and sometimes also called luminal 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 100000 deaths (Smyth 1996). *Entamoeba histolytica* is a potent pathogen secreting proleinases that dissolve host tissues; killing host cells on contact and engulfing RBCs. *Entamoeba histolytica* trophozoites invade the intestinal mucosa causing amoebic colitis. In some cases, amoeba breaches the mucous barrier and travels through the portal circulation to the liver where they cause abscesses (Stanley, 2003). Intestinal amoebiasis is characterized by abdominal pain, mucous in stool, weakness, dehydration along with malaise, loss of appetite etc

.*b) Giardia lamblia*

History- *Giardia lamblia* was first discovered by Leeuwenhock in 1681 while examining own stool.

Geographical Distribution- It is world wide in distribution.

Habitat- It is confined in its distribution to the small intestine particularly the duodenum and upper part of Jejunum occasionally invading the bile ducts.

Morphology- It exists in two forms, trophozoite and cyst.

Trophozoite- It is a 'tear drop' shaped with convex dorsal surface and concave ventral one (Smyth, 1996). The ventral surface possesses two depressions called adhesive discs which make contact with the intestinal cells of the host. Its size is 14⇑m long by 7⇑m broad. It is feeding phase.

Cyst- The fully formed cyst is oval in shape with thick wall and measures 12 ⇑m broad. It is infective phase.

Mode of infection- Cysts are passed in the faeces. Transmission is through faecal-oral route i.e. *Giardia* cysts passed in the faeces of one person result in a new infection when swallowed by another person.

Giardiasis:- The resulting infection of *Giardia lamblia* is usually referred to as giardiasis. It is recognized as one of the most common agents for diarrhea world-wide. Giardiasis is also known as flagellate diarrhea. *Giardia lamblia* has world-wide distribution with an incidence of 1-30%. In the USA it is now considered to be the most common intestinal parasite of man and the leading cause of diarrhea due to protozoan infection in human (Smyth, 1996). Children seem especially susceptible and mass infections occasionally break out in kindergartens or day-care centers (Smyth, 1996). It is also the most frequently reported intestinal parasite in Britain (Knight & Wright, 1978). Giardiasis is characterized by disturbance in intestinal functions, leading to malabsorption of

fats, persistent looseness of bowels and mild steatorrhoea. Toxin produced by the parasites can cause allergic manifestation, fever, anaemia as well as enteritities and sometime chronic cholecytopathy.

The intermittence of the *Giardia* cycle and medications may cause temporary disappearance of cysts from stools, thus giving false and negative results (Boghdadi *et. al*, 1996).

c) Cyclospora cayatanensis

Cyclospora cayatanensis is an emerging human pathogen associated with gastro-intestinal disease. The epidemiology and biology of the parasite are poorly understood and numerous outbreaks of cyclosporiasis have been recorded from around the world since 1990.

History:- *Cyclospora cayatanensis* was first reported in the medical literature in 1979 in Papua New Guinea as an oocyst like body found in three patients with intestinal infection cases began being reported more often in the middle 1980s. In the last several years, outbreaks of cyclosporiasis have been reported in the United States and Canada. In 1991, Schlim *et al.,* reported the largest series (55 patients) from CIWEC Clinic Travel Medicine Centre in Kathmandu, Nepal.

Morphology- *Cyclospora cayatanensis* is a coccidian protozoan parasite measuring 8 – 10 ⇑m in diameter.

Mode of Infection: *Cyclospora* is spread by people ingesting water or food contaminated with infected stool. Human excrete unsporulated cysts or oocysts into the environment. During sporulation, the sporant divides into two sporocysts, each containing two sporozoites. Sporocysts excyst in the gastro-intestinal tract and invade small intestinal epithelial cells. *Cyclospora* infection affects both immuno-competent and immuno-compromised individuals, the latter potentially more severely.

Cyclosporiasis- *Cyclospora* infects the small intestine (bowel) and usually causes watery diarrhea, with frequent (sometimes explosive) bowel movements, other symptoms can include loss of appetite, substantial loss of weight, bloating, increased gas, stomach cramps, nausea, vomiting, muscle aches, low-grade fever and fatigue. Some people who are infected with *Cyclospora* do not have any symptoms.

B. 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 relative importance of the major groups of helminthes may be roughly judged by Stoll's (1947) estimation that 'there exist in the world today among some 2200 million people, 72 million nematode infections' (Chandler, 1961). These numbers have decreased in the successive decades; as a matter of fact they are probably too low now.

a) Hymenolepis nana

History:- This helminthes species was discovered by Bilharz in 1851 in the small intestine of a native boy in Cairo Grassi and Rovelli (1887, 1892) first worked on the life cycle and demonstrated that no intermediate host was required (Craig & Faust, 1943).

Geographical Distribution:- The worm is practically cosmopolitan in its distribution but is more common in warmer than in colder climate.

Habitat:- The abode of the adult worm is the small intestine of human.

Morphology:- *Hymenolepis nana* is also known as dwarf tapeworm, as the entire worm is small, measuring up to 25mm to 40 mm in length by a maximum of 1 mm diameter. Scolex is rhomboidal with four hemispherical suckers and a short rostellum armed with 20-30 spines in one ring. Proglottids are 200 in numbers. Eggs are oval or spherical in shape with two distinct membranes. The outer membrane is thin and colorless and inner embryophore encloses an oncosphere with three pains of lancet-shaped hooklets.

Mode of Infection:- The first infection occurs through ingestion of food contaminated with eggs of *Hymenolepis nana*..

Hymenolepiasis:- The clinical symptoms are restless, irritability, abdominal pain and diarrhea.

b) Ascaris lumbricoides

History:- This worm was observed and reported as a parasite of man by many ancient people (Craig & Faust, 1943). It has undoubtedly been one of man's most faithful and constant companion form time immemorial (Chandler, 1961).

Geographical Distribution:- *Ascaris lumbricoides* is the most cosmopolitan and most common of all helminthes. It flourishes is warm moist climates or in moist temperate regions where personal hygiene and environmental conditions combine to favor embryonation of the eggs in polluted soil.

Habitat:- The adult worm lives in the small intestine of human beings.

Morphology- It is elongated, cylindrical nematode, tapering bluntly at the anterior end and somewhat more attenuated at the posterior end. Lateral lines can easily be seen. The head is provided with conspicuous lips. Sexes are separate. The size of male is 15 to 25 cm in length with a maximum diameter of 3 to 4 mm and female is 25-40 cm in length with diameter of 5 mm.

Mode of Infection:- Faecal-oral route infection occurs by the ingestion of food or water contaminated with embryonated eggs of the parasite.

Ascariasis:- *Ascaris lumbricoides* is an important parasite of human, it often occurs in high levels in population living under conditions of poor hygiene (Smyth, 1996). It has been estimated that there are about 1000 million cases of ascariasis worldwide; with average prevalence in the range of 32-60% (Cromption *et al.,* 1989). In some surveys of children between the ages of six and twelve years, the infection rate was as high as 90%. The infection results in malnutrition and relation of growth in children but other symptoms associated with both the larval (tissue) and adult (intestinal) stages include pneumonitis, asthma, diarrhea, nausea, abdominal pain and anorexia.

c) Trichuris trichiura

History:- This worm was first described by Linnaeus in 1771. The life cycle was first studied by Grassi (1887) and letter by Fulleborn (1923) and Hagegawa (1924). (Craig and Faust, 1943). It is also known as whipworm.

Geographical Distribution:: It is cosmopolitan in distribution but is more common in the warm moist regions of world. The whipworm infection is more or less co-extensive with ascariasis.

Habitat:- The adult worm lives in the large intestine particularly the caecum and also found in the vermiform appendix.

Morphology:- They are so called whip-worms, a term derived from the whip like form of the body. The anterior three-fifth of body is very thin and hair like and the posterior two-fifth is thick and stout. Male measures 3-4 cm in length with ventrally curved tail. Female measures 4-5 cm in length with arc or comma shaped. Eggs are brown in color with the size about 50 ⇑m in length by 25⇑m in breath, bassel shaped with a mucous plug at each pole.

Mode of Infection:- Human is infected by swallowing embryonated eggs with food or water.

Trichuriasis:- This species is a much more common human parasite than is generally appreciated and it is reported to infect up to 800 millions people throughout the tropical and temperate areas (Smyth, 1996). There is now evidence that children are especially prone to intestinal disorder like loss of appetite, abdominal pain, nausea, vomiting emaciation, dysentery with blood tinged mucous, acute appendicitis and prolepses of rectum. Trichuris cause dysentery, rectal prolapx, anaemia, poor growth and clubbing of the fingers constitute an important public health problem (Stephenson et al., 2000).

c) Ancylostoma duodenale

History:- The parasite was first discovered in 1838 by an Italian physician Angelo Dubini. The pathogenesis and mode of entrance of the larvae into human was worked out by Looss in 1898.

Geographical Distribution:- It is widely distributed in all tropical and sub-tropical countries extending from parallel 36^0 North to parallel 30^0 South.

Habitat:- The adult worm lives in the small intestine of human, particularly in the jejunum, less often in the duodenum and rarely in the ileum.

Morphology:- It is commonly known as hookworm. The adult worms are somewhat cylindrical in shape, are slightly constricted anteriorly and have a cervical curvature. The large conspicuous buccal capsule is lined with a hard substance provided with six teeth, four hooks on ventral side and two knobs like on dorsal side. A male measure 8-11 mm x 0.4 mm while female is 10-12 mm x 0.6 mm (Craig and Faust, 1943). Male bears copulatory bursa at posterior end.

Eggs are oval or elliptical in shape measuring 65⇑m x 40⇑m colorless with a thin transparent hyaline shell membrane.

Mode of Infection:- Infection occurred by the entry of filariform larva, the infective stage through the penetration of skin. *Ancylostoma duodenale* can

infect man successfully by oral, transmammery and (probably) transplacental routes (Smyth, 1996).

Ancylostomiasis;- Hookworm must be classified as one of the most destructive of human helminthes parasites with estimates of some 900 million cases worldwide (Crompton *et al.,* 1969). Hookworms were essentially blood suckers and can cause severe blood loss (i.e. hookworm anemia). They insidiously undermine the health of their hosts causing stunting of growth and general laziness accompanied by acute mental distress (Smyth, 1996)

d) Strongyloides stercoralis

History:- *Strongyloides stercoralis* was first found by Normand in 1876 in the faeces of French colonial troops.

Geographical Distribution:- It is worldwide in distributed. It is adapted to warm climate but it has been reported sporadically in temperate regions (Craig and Faust, 1943).

Habitat:- Adult *Strongyloides stercoralis* are largely localized in the duodeno-jejunal region.

Morphology:- In the parasitic phase, the females are readily discovered but not the male. The parasitic female measures 2.5 mm in length and 40 -50 ⇑m in diameter. Males are shorter and broader than females. Eggs are thin shelled, transparent and oval and measures 50⇑m x 30⇑m.

Mode of infection:- Infection occurs by the entry of filariform larvae which penetrate directly through skin coming in contact with soil. *Strongyloides* can undergo ‘autoinfection’; this infection has been reported to last more than 30 years in untreated human. Also, infection with these parasites can be transmitted via breast milk (Stephenson *et al.,* 2000).

Strongyloidiosis:- *Strongyloides stercoralis* is the fourth most important intestinal nematode infection, but its impact is much less widely appreciated

than those of *Ascaris*, *Trichuris* or hookworm infections. *Strongyloides stercoralis* is symptomatic in around 50% of cases, with diarrhea, abdominal pain, nausea and vomiting being the common gastrointestinal symptoms (Milder *et al.*, 1981, Nonaka *et al.*, 1998).

ANNEX - 2

QUESTIONNAIRE

Question Schedule for Baseline Health Survey in Kirtipur Area. Questions are made in such a way that the questions could be asked to parents or guardians about their children.

Name: _____ _____ _____ Age/Sex: _____
Profession of Father: _____
No. of Family Members: _____

School Type: Government/ Boarding/ Child Care Centre

1. Where do your children defecate?
   a. Toilet b. Open place c. Near Water Resources
   d. Others: _____
2. Where do you get your drinking water for family?
   a. Tap c. Well c. River
   d. Pond e. Others: _____
3. How do you drink your water?
   a. Direct Tap water c. Boiling Well c Filtered.
   d. Using Germicides (Chlorine) e. Others: _____
4. How do you clean the vegetables and fruits?
   a. By rubbing on clothes b. Washing Tap/ Well/ River/ Pond
   c. Without washing
5. What do use to clean your hands?
   a. Water only b. Soap & Water c. Ash & Water
   d. Clay & Water e. Others: _____
6. When do you wash your hands?
   a. Before cooking food b. Before meal c. After meal
   d. After defecation c. After working in field
7. Does your child cut nail regularly?
   a. Yes b. No
8. When?
   a. Once a week b. Twice a week c. Once a month
9. Domestic animals in house?
   a. No b. Hens c. Ducks d. Dogs e. Cats
   f. Goats g. Sheep h. Cows i. Buffalo j. Poultry
10. Does your child eat meat?
    a. Yes b. No
11. If yes, what type of meat he takes frequently?
    a. Buff b. Chicken c. Mutton
    d. Pork e. Others
12. Has your child been suffered by diarrhea/ dysentery/ worms?
    Yes b. No
13. If yes, When?
    a. Once week before b. Two weeks before c. One month before
    d. Two months before e. Three months before d. Six month before

14. Has your child taken deworming tablets?
    Yes b. No
15. If yes, When?
    a. Once week before b. Two weeks before c. One month before
    d. Two months before e. Three months before d. Six month before

KAP – concerning questions:

16. Do you know the causes of diarrhea? Yes No
    If yes, what are they?
    _____
    _____
17. Do you know the causes of the worm infection? Yes No
    If yes, what are they?
    _____
    _____
18. Walking & working in bare feet may cause worming, do you know this?
    a. Yes b. No
19. Do you know the symptoms of worm infection? Yes No
    If yes, what are they?
    _____
    _____
20. Do you know the methods of prevention of worm infection? Yes No
    If yes, what are they?
    _____
    _____
21. Do you know the methods of worm control? Yes No
    If yes, what are they?
    _____
    _____
22. Do you know or use the traditional medicine for deworming? (Any Plant / Plant parts)
    _____
    _____

ANNEX - 3

SECONDARY DATA

Annual report of prevalence of intestinal parasitic infection in National Level given by Epidemiology and Disease Control Division, Teku, Kathmandu, Nepal shows the following data:

Infection of diarrhea Diseases in Last Five Years

Year	**2000/01**	**2001/02**	**2002/03**	**2003/04**	**2004/05**
Prevalence No.	713463	787567	816481	949630	921901
Prevalence %	3.12 %	3.35%	3.38%	3.87%	3.68%

Infection of Intestinal Helminthes Parasites in Last Five Years

Year	**2000/01**	**2001/02**	**2002/03**	**2003/04**	**2004/05**
Prevalence No.	651308	663629	666362	659582	611072
Prevalence %	2.85%	2.82%	2.76%	2.73%	2.44%

Prevalence of Intestinal Parasite in School Children reported by Integrated Family Planning Association of Nepal, School Health Program in Kirtipur Area.

Panga Secondary School

Year	**2002/05/02**		**2003/05/21**		**Total**	**%**
Total stool examination	Male	Female	Male	Female		
	108	84	95	83	370	
Ascarislumbricoides	19	12	18	16	65	17.56
Richuris trichiura.	10	5	4	6	25	6.75
Ancylostoma	0	0	0	0	0	0.00
Hymelopis nana	0	1	0	1	2	0.54
S . stercoralis	0	0	1	0	1	0.27
Giardia lamblia	7	7	9	5	28	7.56
E. histolytica	6	4	0	1	11	2.97
Total	42	29	32	29	132	35.62
%	**38.88**	**34.52**	**33.68**	**34.93**		

According to the data in above table, infection of intestinal parasite in children was more in 2002 A.D. but the infection rate fell down next year. There is no significant different in infection in males and females. The school children were found highly infected by Ascariasis(17.56%) followed by Giardiasis (7.56%). Average infection was found to be 35.62%.

Ujwal Shishu Niketan

Year	2002/05/06		2003/05/22		Total	%
Total stool	Male	Female	Male	Female		
examination	113	98	122	102	435	
Ascaris lumbricoides	31	12	23	13	79	18.16
Trichuris trichiura	1	3	11	5	20	4.59
Ancylostoma	0	0	1	0	1	0.23
Hymenolepis nana	3	2	3	0	8	1.84
S. stercoralis	0	0	0	0	0	0.00
Giardia lamblia	8	7	8	7	30	6.89
E. histolytica	0	0	2	4	6	1.38
Total	43	24	48	29	144	33.10
%	**38.05**	**24.48**	**39.34**	**28.43**		

According to the data in above table, the rate of infection of intestinal parasite was found to be fall down next year. Here, *Ascaris* was found to be dominant intestinal parasite (18.16%) followed by *Giardia* (6.89%). The average infection was 33.10%.

Puspa Sadan Boarding High School

Year	2000/03/07		2003/05/22		Total	%
Total stool	Male	Female	Male	Female		
examination	111	76	143	108	438	
Ascaris lumbricoides	54	22	20	18	114	26.02
Trichuris trichiura	16	5	6	9	36	8.22
Ancylostoma	0	0	0	0	0	0.00
Hymenolepis nana	6	2	1	0	6	1.37
S. stercoralis	0	0	0	0	0	0.00
Giardia lamblia	16	15	13	6	50	11.41
E. histolytica	0	0	6	2	8	1.82
Total	92	44	46	35	217	49.54
%	**82.88**	**57.89**	**32.16**	**32.40**		

During 1998 A.D., the infection rate of intestinal parasite was the highest (88.88%) the rate decreased in the next years. Males were found more affected than females. *Ascaris (*26.02%) was found as the dominant intestinal parasite among the school children and the dominancy was followed by *Giardia* (11.41%). The average infection rate was 49.64%.

Saraswoti Pathalogy Laboratory

Total stool examinations	**2056 BS**	**2057 BS**	**2059 BS**	**Total**	**%**
	115	107	422	644	
Ascaris lumbricoides	12	8	9	29	4.50
Trichuris trichiura	3	1	2	6	0.93
Ancylostoma	3	1	3	7	1.08
Hymenolepis nana	5	2	2	9	1.39
S. stercoralis	1	1	1	3	0.49
Giardia lamblia	5	30	128	163	25.31
E.histolytica	19	18	80	117	18.16
Total	48	61	225	33.4	51.86
%	**41.73**	**57.00**	**53.31**	**51.86**	

Patients visited in pathology laboratory for stool examination are often symptomatic, hence the Giardiasis (25.31%) and Amoebiasis (18.16%) infection rate was found to be more. Ascariasis is asymptomatic (rarely symptomatic), hence people do not often visit pathology laboratory for stool examination. Hence the result shows low infection (4.50%) of Ascariasis. The average infection rate was found to be 51.86%.

ANNEX- 4

TREATMENT

Medicine Distribution

Metronidazole

S. N.	Name of Parasite	Infection Type	No. of Children with Infection	Required Drugs Per Child	Total
1	*E. histolytica*	Single infection	6	6000 mg	36,000 mg
2	*E. histolytica*	Double infection	1	6000 mg	6,000 mg
3	*G. lamblia*	Single infection	14	3000 mg	42,000 mg
4	*G. lamblia*	Double infection	6	3000 mg	18,000 mg
					102,000 mg

Thaibendazole

S. N.	Name of Parasite	Infection Type	No. of Children with Infection	Required Drugs Per Child	Total
1	Hook worm	Single infection	3	1500 mg	4500 mg
2	Hook worm	Double infection	1	1500 mg	1500 mg
					6000 mg

Albendazole

S. N.	Name of Parasite	Infection Type	No. of Children with Infection	Required Drugs Per Child	Total
1	*A. lumbricoides*	Single infection	31	400 mg	12,400 mg
2	*A. lumbricoides*	Double infection	9	400 mg	3,600 mg
3	*T. trichiura*	Single infection	6	800 mg	4,800 mg
4	*T. trichiura*	Double infection	5	800 mg	4,000 mg
					24,800 mg

ANNEX – 5

Name of some of medicinal plants used against intestinal helminth and protozoan parasitic infections: (Source: *"Medicinal Plants in Nepal"*, Bulletin of the Department of medicinal plants No.3, Ministry of Forest and Soil Conservation, Nepal, 1982)

S. N.	Local Name / Common Name	Scientific Name	Parts of Plant Used
1.	Bethe	*Chonepotium alnum*	Whole plant
2.	Sil Timur	*Zanthozylum oxyphyllum*	Fruit
3.	Rohini (Sindhure)	*Mallotus phillippinensis*	Glands & hairs of fruit
4.	Supari (Areca nut)	*Areca catechu*	Nuts
5.	Anaar (Pomegranate)	*Punica granatum*	Bark of root & stem
6.	Amba (Guava)	*Psidium guajava*	Leaf Decoction
7.	Amala (Emblic Myrobolam)	*Emblica officinalis*	Dry fruit
8.	Akash Beli (Dodder)	*Cuscuta reflexa*	Seed
9.	Aank Gaint Milk-weed	*Calotropis gigantea*	Whole Plant
10	Amp (Mango)	*Mangifera indica*	Bark
11	Intrajow (Covessi bark)	*Halarrhena antidysenterica*	Bark & Seed
12	Isabgol (Ispaghula)	*Plantago major*	Seed
13	Unue (Male Fern)	*Dryopteris felix*	Rhizome
14	Okhar (Wal nut)	*Juglans regia*	Barks & Leaves
15	Ole (Stanleys's Wash-tub)	*Amorphophalus campanulatus*	Tuber
16	Kapur (Camphor)	*Cinnamomum camphora*	Whole plant
17	Kamal (Indian Lotus)	*Nelumbium nucifera*	Flower & Root
18	Karela (Bitter cucumber)	*Momordica charantia*	Fruit & Leaves
19	Kasur (Bulrush)	*Scirpus kysoor*	Tuber
20	Kauso (Cow hage)	*Mucuna prurita*	Pod
21	Kadmero (Ratmaonti)	*Litsea monpetala*	Bark
22	Kanukpa	*Evodia fraxinifolia*	Fruit

23	Karonda (Caraunda)	*Carissa carandas*	Root
24	Kalo Haledo (Haledo)	*Curcuma longa*	Fresh juice
25	Galeni	*Leea robusta*	Root
26	Chichindo (Snake gourd)	*Trichosanthes anguina*	Fruit
27	Chiraita (Chiretta)	*Swertia chirata*	Whole Plant
28	Chilaune	*Schima wallichii*	Bark
29	Chulesi	*Melastoma Malabathricum*	Whole plant
30	Jyamir (Lemon)	*Citrus limon*	Juice of ripe fruit