I
INTRODUCTION

Nepal is a Himalayan Kingdom. The climate varies from cool summers and severe winters in the north to subtropical summers and mild winters in the south. Nepal is a developing country and parasites are a major invader of people in developing country. Like other developing countries, intestinal parasitic infection is a major health problem in Nepal. These infections are the most common infections among school aged children, and they tend to occur in high intensity in this age group. So, epidemiology surveys on the intestinal parasite infections are important in this country because they reflect sanitary conditions of the schools and produce basic data for the control of parasitosis among school children in the future.

The World Health Organization (WHO) estimates that over one billion of the world's population is chronically infested with soil transmitted helminthes. The high prevalence of these infections is closely correlated to poverty, poor environmental hygiene and impoverished health services.

Intestinal parasitic infection is a major cause of morbidity and mortality of children in developing countries (WHO, 1987). There is a strong association between giardial infection and under nutrition in many primary school children (Loewenson et al., 1986). Also, dirty fingers and nails play an important role in the transmission of intestinal parasites (Soulsa, 1975). However, intestinal parasitic infection rate in school children was found to be decreased in the past few years according to data from Family Planning Association, school Health program. But

the falling rate of infection is not satisfactory, since the program conductors are giving interest only in stool examination and curative measures. The program could be effective if the children are given awareness about the preventive measures of such parasites.

Principally, intestinal parasitic diseases are preventable diseases. But the prevalence of intestinal parasitic diseases is not expectedly declined due to human behaviors like walking barefoot, poor sanitation and feeding behaviors, low socio-economic status, illiteracy and lack of awareness.

Basically, children of the rural area are more infected than adult because of the lack of awareness about sanitation. They spend most of the time playing in soil and dirty places which help to transmit the parasites. The infection rate of different intestinal parasites may differ in different communities or castes of people since they have different traditional habit and habitat. In certain rural areas, prevalence has been found to be over 90 % (Estevez et al., 1983 and Rai et al., 2000)

In Nepal, the outbreaks of Acute Diarrhoel Diseases (ADD) occur frequently in many districts. WHO estimates globally, in every eight seconds a child dies of water related diseases. Every year more than five million human beings die due to unsafe drinking water, unclean domestic environments and improper excreta disposals. Cope these outbreaks, the Ministry of Health, DHS and EDCD established a mechanism for minimizing outbreaks (EDCD, 2002-2003).

Significance of Study

Intestinal parasitic infections have always been an important public health problem in the tropical and sub-tropical areas particularly in developing countries like Nepal. Some parts of our country are still in the conservative and unhygienic traditional aspects.

Biratnagar is known for agriculture, commerce and industry. The culture of Biratnagar is the blend of Indian and Nepalese cultures. So, it is well known for its unique cultures and traditions. Cultures and traditions express originality of

citizens, but are not good to follow bad traditional activities which do not allow going in the path of development. Communicable diseases such as diarrhoea and dysentery influence a very depressing health. These are the major source of death and sickness especially among children and infants in our country. Biratnagar is mostly hot, so this is also one of the reasons that people living here are suffering from these diseases. Hundreds of small and medium sized industries directly or indirectly pollute the water. Increased water pollution is one of the major public health issues in Nepal. Diarrhoea due to the parasitic infection, gastro-intestinal tract diseases is the result of water pollution. Intestinal infections like giardiasis, ascariasis, amoebiasis, ancylostomiasis, fascioliasis and taeniasis are common in Nepal (Acharya, 1979). Among these, ascariasis becomes as leading human parasite and also reported as major causes of public health problem (Rai et al., 1999).

The main aim of this survey is to create awareness to the people as well as children living in these places. Children are the backbone of nation. The development of mental and physical aspects of children means the development of nation. In Nepal, children are found to be infected more frequently than adults (Rai et. al. 1994). Dwindling health of children, to some extent, is due to impulsiveness of people who only give attention to stool examinations and curative measures but not to awareness about preventive measures of parasites. Although Biratnagar is sub-municipality, Jatuwa village is rural in case of health, education, sanitation and awareness. Children were found playing in and around dirt and dust area in their free time. So, the importance of the present study was realized and the study of intestinal parasites in children of Jatuwa village of Biratnagar has been done for the first time to find the prevalence of infections on the basis of age, sex, occupation and to give the idea about the preventive measures of such parasites which help to aware the children towards intestinal diseases. Moreover, the present study might play a role to help the future investigators to advance this knowledge and throw light on different problems faced by rural communities.

Hence, the present study was done to get the prevalence rate of intestinal parasites in children which included stool examination, free treatment and awareness program.

II

OBJECTIVES

General objectives

The general objective of the study was to determine the prevalence of parasitic infections among children of “Gurukul Madhyamic Vidhyalaya”of Jatuwa village (Biratnagar-18) and also to bring awareness regarding feeding habit, personal hygiene and sanitation to control prevalence of intestinal infections.

Specific objectives

- To study the age, caste and sex-wise distribution of intestinal parasites among children of “Gurukul Madhyamic Vidhyalaya”.
- To study the intestinal parasitic symptoms in relation to socio-economic condition, feeding habit, hygiene and sanitation and make them aware regarding tidy habits.
- To bring awareness against intestinal parasitic infections.
- To provide the medicines by consulting medical officer for infected children.
- To facilitate the approach of regular examination of intestinal parasites.

III

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 tape worms, pinworms and guinea worms. They were considered as natural products of human bodies.

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

During the latter half of 17^{th} century Francesco Redi, "Grandfather of Parasitology" stated that maggots developed from eggs of flies. At the same time, Leeuwenhoek perfected microscopes and discovered *Giardia* in his own stool and other protozoan in rainwater, saliva etc.

Rodolphi (Linnaeus of Parasitology) classified all the parasites known up to his time.

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.

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

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

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

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

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

Kobayashi et al., (1997) studied the intestinal infection of 128 children in Khammovane Province, Southeastern Sao Paulo, Brazil. Prevalence of helminthes infection was 77.3% in children under 6 years age group, 88.5% in the age group

6-10 years and 81.8% in the age group above 11 years. The parasites were *Ascaris* 48.4%, *Trichuris* 43.8%, hookworm 37.5% and *Opisthorchis viverrini* 37.5%.

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

Ludwig et al., (1999) worked on correlation between sanitary 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* (8.7%), *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.

Paul et al., (1999) carried out a study to determine the prevalence of intensity of intestinal helminthes infections. The children were between 7-13 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. trichuria* and hookworm. The overall prevalence of infection was 82%. *A. lumbricoides* was the most common parasite with a prevalence of 75% followed by *T. trichiura* of 66% and hookworm of 9%.

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) 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.

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%.

Smith et al., (2001) conducted a cross sectional survey between January and March 1998 in four rural community in Hondurus, 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 *T. 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.

Fernandez et al., (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 samples 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 helminth 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* (22.6%) was the most common parasite detected followed by *E. histolytica* (10.6%). Other intestinal parasites, such as *T. trichiura* 2.01%, *H. nana* 1.01%, *E. vermicularis* 0.5% and *A. lumbricoides* 0.5% were found to have much lower prevalence in comparison to rural area.

Rao et al., (2002) studied worm infestation 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 26%, *A. lumbricoides* 34% and *E. histolytica* 7.0%. High prevalence of anaemia (86.7%) was observed among such high prevalence of intestinal parasite and anaemia could be due to indiscriminate defaecation, low socio-economic status, ignorance and low standard of personal hygiene.

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% overall prevalence. The frequency of protozoa was higher 47.7% than helminthes 23.4%. The specific prevalence was *H. nana* 25% and *Taenia saginata* / *Taenia solium* 0.75%. Out of 112 sera examined 50% of sera contained antibodies (anti *A. lumbricoides* and anti *S. stercoralis).*

Kim 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 helminth 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%). *Iodamoeba butschlii*

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 helminth infections were highly prevalent in this area.

Miller et al., (2003) examined the presence of intestinal protozoan and helminth infection 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 helminth infection was 11% for *Ascaris*, 11% for *T. trichiura* and 2% for *H. nana*.

Saksirisampant et al., (2003) worked on intestinal parasitic infections among children in an orphanage in Pathum Thani Province, Thailand. Stool samples were collected during a cross-sectional study in April 2001. A total of 106 pre-school orphans (60 males and 46 females), aged 10-82 months recruited for the study. There were 86 individuals (81.1%), 45 males and 41 females, infected with at least one parasite. Most of the parasites identified were protozoa. *Blastocystis hominis* was found at the highest prevalence (45.2%) whereas *Giardia lamblia* (37.7%), *Entamoeba histolytica* (3.7%), *Trichomonas hominis* (39.6%), *Entamoeba coli* (18.8%) and *Endolimax nana* (3.7%). The only one case of helminth parasite detected was *Strongyloides stercoralis* (0.9%).

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 infection, out of 2553 stool samples examined, 920 (36.03%) were found to be positive for protozoan parasites, 1162(15.52%) for helminthes and 471(18.45%) for mixed infection. In overall infection, males and even those of 21-30 years age group showed higher prevalence rate (55.55%) than females (44.45%).

Singh et al., (2004) studied on helminthic infection of the primary school going children in Manipur. Out of 1010 stool samples collected from the primary school going children between age group 5-10 years, 248(24.5%) were positive for various helminthes. Among the positive cases, 110(26.3%) were from urban area

and 138(23.4%) were from the rural areas of Manipur. Maximum number of parasitic infection were found in 5-6 years age group having 27% *Ascaris lumbricoides*, 19.6% *T. trichiura*, 2.18% *H. nana*, 0.99% hookworm, 0.09% *S. stercoralis.*

Avetisyan et al., (2004) studied on epidemiological surveillance of parasitic diseases in the Republic of Armenia State-of-the art. An analysis of many years' official statistics on the number of individuals infected with intestinal helminthiases and a retrospective analysis of those in 1986-2004 were made to study the current epidemiological laws on intestinal helminthiases. The infection rate of ascariasis, trichocephaliasis, enterobiasis, taeniasis, and mixed infections were 4.0±0.4, 1.2±0.2, 25.9±1.0, 0.2±0.08, and 0.8±0.2% respectively. Those of intestinal helminthiases were higher in rural areas than those in urban areas and in Yerevan.

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

Culha et al., (2005) conducted an investigation on the distribution of intestinal parasites in students of the Mustafa Kemal University School of Health. In their study, the prevalence of intestinal parasites in female students (aged from 16-18 years) was investigated. For this reason, 142 fecal samples and 136 cellophane tape preparations were examined. One or more parasites were found in 65(45.77%) fecal samples. *Blastocystis hominis* in 63(96.92%) and *Giardia intestinalis* in 2(3.08%) samples. *Enterobius vemicularis* was found in 9(6.61%) out of 136 cellophane tape preparations.

Goz et al., (2005) conducted the study on distribution of intestinal parasites in children ranging from 6-14 yrs old coming from the 23 Nisam Primary School

in Hakkari. In this study, a total of 114 stool samples i.e. 60 male and 54 female students were examined. One or more intestinal parasites were found in 66(57.8%). *Giardia intestinalis* (28.9%), *Blastocystis hominis* (23.6%), *Entamoeba coli* (12.2%) and *Ascaris lumbricoides* (6.14%) were most prevalent parasites.

Ulukanligil et al., (2006) conducted a study to find the results of a control program carried out on school children for intestinal parasites in Sanliurfa Province, Turkey between the years of 2001 and 2005. This presents a school-based deworming program. It began with baseline studies in 2001 which indicate that intestinal helminth infection was endemic among school children with a prevalence of 80% in Shantytown schools and 53% in apartment district schools. *Ascaris lumbricoides* was the most frequently detected helminth (45%), followed by *Trichuris trichiura* (25-30%) and *Hymenolepis nana* (10-15%) and *Taenia* sp. (5%).

Celik et al., (2006) determined the incidence of intestinal parasites among primary school children in Malatya. Parasitic infection was observed in 415(22.5%) out of 1838 students and the highest rate of 10.6% was that of *Enterobius vermicularis*. The rates of *Giardia intestinalis*, *Entamoeba coli*, *Blastocystis hominis*, *Taenia* sp., *Hymenolepis nana*, *Trichomonas hominis*, *Ascaris lumbricoides* and *Iodamoeba butschlii* were found to be 8.5%, 1.9%, 1.4%, 0.3%, 0.1%, 0.1%, 0.05%, and 0.05% respectively. Thus, it seems that there is a relationship between socio-economic condition and the rate of intestinal parasites.

El. Shazly et al., (2006) carried out a study on the reflection of control programs of parasitic diseases upon gastrointestinal helminthiasis in Dakahlia Governorate, Egypt. The study area included Mansoura city as an urban area and Gogar village as a rural area. One thousand individuals were randomly selected from each area. Stool examination, perianal swab and urine examination revealed that the incidence in Mansoura city was in a descending order. *Heterophyes heterophyes* 6.4%; *Enterobias vermicularis* 3.9%; *Hymenolepis nana* 2.2%; *Schistosoma mansoni* 0.5%; *Trichostrongylus colubriformis*; *Strongyloides*

stercoralis and *Fasciola* sp. were recorded as 0.2% of each. *Taenia saginata, Ascaris lumbricoides* and *Trichocephalus trichuris* were recorded as 0.1% each. Neither *Ancylostoma duodenale* nor *Hymenolepis diminuta* was recorded. In Gogar the parasitic infection was *H. heterophyes* 4.5%; *E. vermicularis* 4.1%; *H. nana* 3.3%; *S. mansoni* 1.6%; *T. colubriformis* 0.9%; *S. stercoralis* 0.5%; *Fasciola* sp. 0.4%; *T. saginata, A. lumbricoides, H. diminuta, A. duodenale* and *T. trichuris* were recorded as 0.1% of each.

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

Wongstitwilairoong et al., (2007) studied on intestinal parasitic infections among pre-school children (aged 3 months to 5 Years) in Sangkhlaburi, a rural district in the west of Thailand. Stool specimens were collected from October 2001 through October 2002. A total of 472 pre-school children, 233 males and 239 females, 236 children with diarrhea and 236 asymptomatic children were recruited for the study. There were 107 individuals (22.7%), 41 diarrheal and 66 asymptomatic children, infected with intestinal parasites. The most frequent parasites identified in cases and controls were *G. lamblia* and *Cryptosporidium* spp. Eighteen specimens (3.8%) showed mixed parasitic infections.

Agbolade et al., (2007) determined intestinal helminthiases and Schistosomiasis among school children in an urban centre and some rural communities of Ogun State, Southwest Nigeria. Out of 1059 (524 males, 535 females, aged 3-18 yrs) faecal samples, prevalence of infection was 66.2%. *Ascaris lumbricoides* showed the highest prevalence (53.4%) followed by hookworms (17.8%), *Trichuris trichiura* (10.4%), *Taenia* sp. (9.6%), *Schistosoma mansoni* (2.3%), *Strongyloides stercoralis* (0.7%), *Schistosoma haematobium*

(0.6%), and *Enterobius vermicularis* (0.3%). The prevalence of *A. lumbricoides*, hookworms, *Taenia* sp., *S. mansoni*, and *S. stercoralis* in the urban centre were similar ($p>0.05$) to those in the rural communities. The commonest double infections were *Ascaris* and hookworms, while the commonest triple infections were *Ascaris*, hookworms and *Trichuris*.

Ngrenngarmlert et al., (2007) carried out a study to determine the prevalence of intestinal parasitic infections among school children from eight schools located in Phuttarnonthon District, Thailand during November 2004 to December 2004. Out of 1920 students (7-12 yrs old) stool samples, 242(12.6%) were infected with one or more of 10 intestinal parasitic species. 214(11.1%) were single infections whereas 28(1.5%) were mix infections. *Blastocystis hominis* (6.2E %), *G. lamblia* (1.7%), *Entamoeba coli* (1.5%), *Endolimax nana* (1.0%), *Entamoeba histolytica* (0.3%), hookworm (0.3%), *T. trichiura*, *Taenia* spp. and *Strongyloides stercoralis* (<0.1%). Protozoan infections was significantly higher than helminth infections ($p<0.05$).

Wani et al., (2007) worked on prevalence of intestinal parasites and associated risk factors among school children in Srinagar City, Kashmir, India. Stool samples were collected from four middle schools. Out of the 514 students surveyed, 46.7% had 1, or more, parasites. Prevalence of *Ascaris lumbricoides* was highest (28.4%), followed by *Giardia lamblia* (7.2%), *Trichuris trichura* (4.9%), and *Taenia saginata* (3.7%).

Musa et al., (2007) carried out an epidemiological survey to collect baseline data on the prevalence of intestinal parasites among school children in Tripoli district, Libya. A sample of 486 school children aged from 5 to 14 years old were collected. The results revealed that 14.6% of children were infected with at least one intestinal parasite. Double infections were in 2% of them. *Giardia lamblia* was the common parasite, followed by *Enterobius vermicularis* and then *Ascaris lumbricoides*. This was a preliminary approach to clarify the status on intestinal parasites.

Literature Review in the Context of Nepal

There are several works which are done by several workers in the topic of human intestinal parasites in Nepal. Some of them are as follows:

Sharma (1965) carried out a random sample study of patient in Bhaktapur to ascertain the incidence of roundworm infection. A total of 976 samples were taken for over 5 years period. Among them 430 cases were males, 317 cases were females and 220 were children of both sexes under 12 years of age.

Gongol (1972) studied a case of round worm 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.

Nepal and Palfy (1980) reported about a study of prevalence of intestinal parasites in the Mahanchal Panchayat. Out of 225 examined stool samples, 95% 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 hookworm (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.

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.

Shrestha (1983) surveyed study in Bhaktapur district showed 99% stools were positive for the eggs of soil transmitted helminthes. Similarly from the

Panchkhal area 41% stools were positive for the eggs of helminthes. During stool test Kato-Katz method was followed.

Estevez et al., (1983) examined 40 stool samples in a remote area of western Nepal and 36 (90%) of which were positive. The infection rate of hookworm was 83.3% followed by roundworm (52.8%) and whipworm (5.5%).

Suguri et al., (1985) conducted to find the helminth infections, in 737 Nepalese people living in the Gandaki, Dhaulagiri, Lubing and Sagarmatha zone of Nepal and in 26 Japenese living in Kathmandu from February to April in 1975, employing the so called thick smear method. The overall helminth 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 hookworm was the lowest (0.2%).

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

Gupta and Gupta (1988) collected 285 stool samples in Kirtipur. Out of 192 (67.36%) positive stool samples, 49 (25.52%) were infected with protozoan parasites, 9.12% by *G. lamblia* and 9.47% by *E. histolytica* and remaining 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) studied about the prevalence of various intestinal parasites in Kathmandu Valley, Nepal. The overall prevalence of intestinal parasites was

30.9%. There was no significant difference in the prevalence between two sexes. Intestinal parasites were more common among children (below 15 yrs) than in adults (more than 15 yrs). *A. lumbricoides* was the most common parasite followed by hookworm, *Taenia* spp., *E. vermicularis* and others. *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. In Kathmandu Valley cases, 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%. But in Solukhumbu cases, *Ascaris* 22%, *G. lamblia,* 31.8% and *E. histolytica* 9.1%.

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

Sherchand et al., (1997) carried out stool survey on intestinal parasites in rural area of southern Nepal, Dhanusha district. Out of 604 children (0-9 yrs) examined, 63.1% were found positive for at least one intestinal parasite. Hookworm (11.6%) was the most common parasite.

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 infected by *A. lumbricoides* in rural areas, whereas hospital based study in Kathmandu over a period of one decade also shown a static annual prevalence with mean of approximately 35%.

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

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

Shrestha, (2001) studied on intestinal parasitic infections 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.

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%) whereas Dalit had significantly higher prevalence (74.1%)

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

Chaudhari (2004) 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. lambia* (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%)

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. duodenale* (34.94%), *T. trichiura* (22.4%), *E. histolytica* (15.3%), *S. stercoralis* (8.19%), *G. lambia* (7.65%), *H. diminuta* (4.37%), *H. nana* (2.73%) and *Taenia* sp. (1.63%).

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

Infection of Diarrhoea Diseases in five Different Years

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

Infection of Intestinal Worms in five Different Years

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

Source: Epidemiology and Disease Control Division, Teku

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

Karki (2007) examined 232 stool samples from children of Lower Secondary School of Mulpani VDC, Kathmandu.Out of these, 26.72% were found positive for intestinal parasites. 43.48% *Ascais lumbricoides*, 26.09% *Entamoeba histolytica*, 14.49% *Giardia intestinalis*, 8.70% *Cyclospora* sps., 5.80% *Trichuris trichiura* and 1.45% *Hymenolepis nana*.

IV

MATERIALS AND METHODS

Equipments, Materials and Chemicals

Compound microscope, Refrigerator

Sampling vials, slides, cover slips, gloves, sticks, needle, cotton or filter paper.

2.5% Potassium dichromate, normal saline, iodine solution

Methods

The field work as well as the laboratory work was performed in Magh 2064 B.S. to Chaitra 2064 B.S.

The entire study was divided into two parts;

I. Surveillance study and stool sample collection

II. laboratory work

Study area and study population

Biratnagar is the second largest city which is located in Koshi zone and district Morang on the southern Terai belt of Nepal near the south eastern border with India. Biratnagar is located at 26º28'60" N 87º16'60" E.

This sub-municipality is divided in 22 wards including 33,678 households. The total population is 1, 66,674 among which males are 87,664(52.59%) and females are 79,010(47.41%). The annual growth rate is 3.36. Among the total population 41.96% of people are service holder, 16.46% industry worker, 13.99% businessman, 12.02% agricultural and 14.57% others (Central Bureau of Statistics, Census 2001).

Biratnagar is known for agriculture, commerce and industry. It is an important transit place for export and import of goods through second largest Indo-Nepal boarder, Jogbani. Hundreds of small and medium sized industries operate freely including chemical, edible oil, steel, rice mill, liquor, soaps factories, among others, covering large portion of Biratnagar area. The Koshi Tappu Wildlife Reserve and Koshi barrage are the impressive sight of Koshi

zone. It is also famous for being a political heartland. The weather of Biratnagar is mostly hot and temperature ranges from 8 to 39ºC. The culture of Biratnagar is the blend of Indian and Nepalese cultures.

Introduction of "Jatuwa" village

Jatuwa village is a small area which lies in ward no. 18 of Biratnagar. Approximately 70% people belong to Yadav caste and remaining 30% to other castes such as Gupta, Sah, Thakur, Brahman, Chhetries etc.

Jatuwa is derived from the word "Jotaha (Ploughing)" which is done by the majority of Yadav group. The main livelihood jobs of these people are farming and agricultural labour. This place is mostly dominated by Yadav group so we will find the places starting with Yadav word such as Yadav chowk, Yadav welfare society, Yadav sports club and many more.

The economic status of people of this area is very poor. So, this area is backward in health, education, hygiene and sanitation. The great irony is that below 20% people of this area is literate even though there are reputed educational institutes such as Birat Science College, Degree College and Gurukul Madhyamic Vidhyalaya. So, the factors such as illiteracy, unhygienic living habit, poor socioeconomic condition and conservative thinking are responsible for different kinds of parasitic infection.

Gurukul Madhyamic Vidhyalaya is the only one secondary school in this village. It is the semi-government school and is also run by the fund from 'Aarya Samaj'. Although, this school is being run by the fund and each and every facilities are there, the students do not show keen interest to education. Students do not get time to read and write because they have to help their parents in works such as grazing of live stocks, working in farming with them etc. Their parents don't give priority to education due to lack of knowledge. So, the parent's oriented programs should be held time to time in community to raise their thoughts.

Plate :1 A Vision of the Study Area

Plate : 2 Vials Containing Stool Samples

Plate: 3 Preparation of Stool Smear

Sample size

The stool samples were collected and examined from children between 5-15 years old. 220 stool samples were collected randomly out of 278 students (from 5-15 years).

Sample collection

One day the respondents were provided sterile stool sample collecting vials with detail instruction required for stool collection. The next day, stool samples were collected and a set of prepared questionnaire were asked to the students. After collection of vials, potassium dichromate was put in them containing stools as preservative and were kept in refrigerator of lab but were not allowed to freeze.

Laboratory work

All the laboratory works were done in “Maa Kankalini Diagnostic Centre Hospital Chawk, Biratnagar” under the supervision of experts of lab.

Macroscopic Examination

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

Microscopic Examination

Stool samples were examined by direct smear technique. The chemical required were normal saline (0.9%), iodine solution and potassium dichromate (2.5%) for examination of the stool samples to identify Protozoan trophozoites, cysts, helminthes eggs and larva.

Both unstained and stained preparations of stool smears were done. For the preparation of a slide, a drop of normal saline was taken on the clean glass slide. Then small amount of stool was added to the slide by the help of sticks and cover-slip was placed over them. Excess of liquid was removed with the help of filter paper or cotton. For stained preparation of stool smear, iodine solution was used.
The prepared slides were first examined under the low power (10x objectives) of microscope for the presence of helminthes eggs. Then they were examined under high power (40x objectives) of microscope for identification of helminthes eggs, larvae and protozoan trophozoites and cysts. For the further confirmation, stool samples were examined by the experts of “Maa Kankalini Diagnostic Centre”.

Later, with the prescription of Doctor, medicines were distributed to required children according to the reports of stool examination.

Data Analysis

The data obtained from the examination of stool samples and from survey were edited, coded, classified, tabulated and analyzed. Analysis was done by representing with the table, bar diagram, pie chart. The significant difference was calculated by χ^2-test and ANOVA.

Plate: 4 Microscopic Examination of Stool Smear

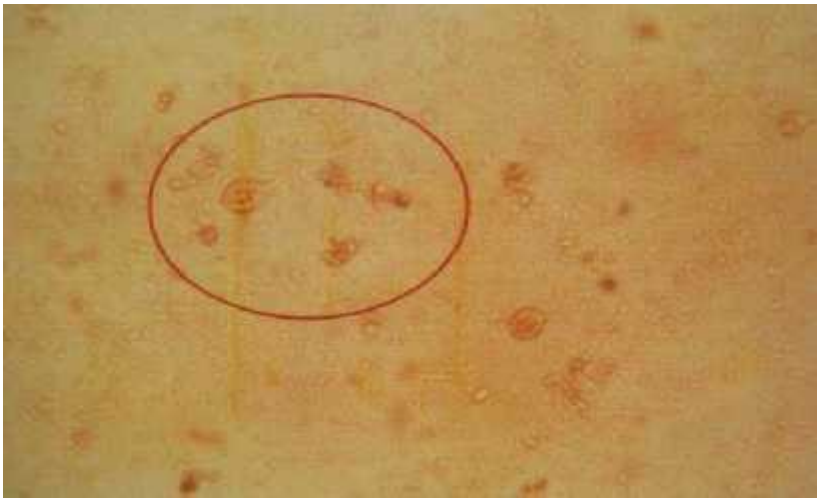


Plate: 5 Trophozoite of *Giardia Lamblia* (400 X)

Plate: 6 Cyst of *E: histolytica* (400 X)

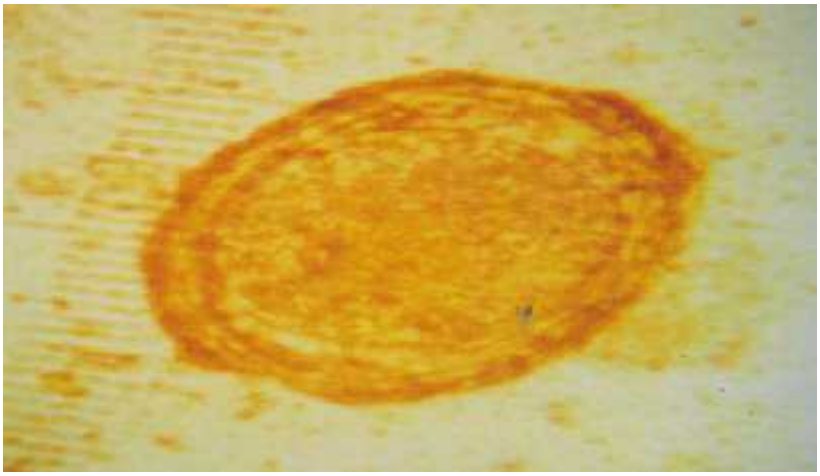


Plate: 7 Fertilized egg of *A. lumbricoides* (400 X)

Plate: 8 Unfertilized egg of *A. lumbricoides* (400 X)

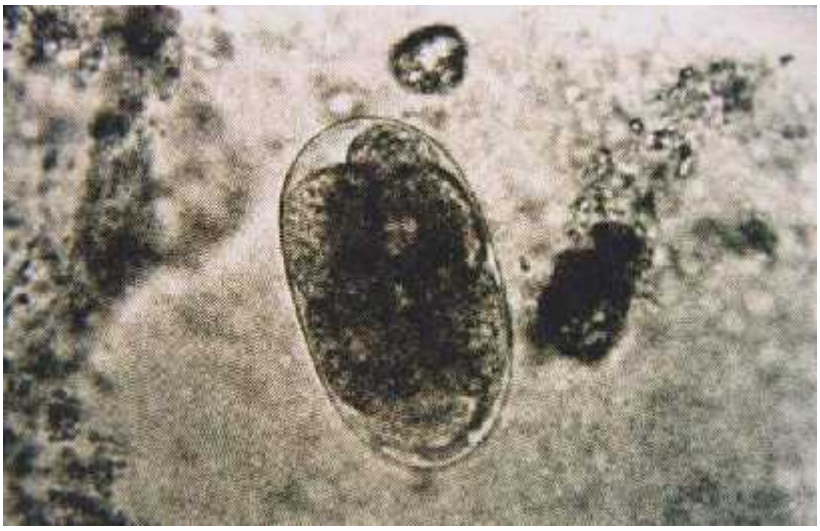


Plate: 9 Egg of *Ancylostoma duodenale* (400 X)

Plate: 10 Egg of *Trichuris trichiura* (400 X)

Plate: 11 Medicines Distribution

V

RESULTS

Surveillance study and stool samples collection and examination were done in 220 children of "Gurukul Madhyamic Vidhyalaya"of Jatuwa village (Biratnagar-18). The total no. of children in the school from age 5-15 was 278. The study was performed among 220 school children in two ways:

I. Stool examination

II. Surveillance analysis on sanitary, illiteracy, hygienic condition, source of water, awareness about parasites etc.

RESULTS OF STOOL EXAMINATION

) General Prevalence of the Intestinal Parasites of the School Children

Out of 220 students, 45(20.5%) were found to be infected with one or more types of intestinal parasites.

Table 1: General Prevalence of Intestinal Parasites of the School Children

Name of the School	Total No. of Samples Examined	No of Positive Cases	Positive %	Negative %
Gurukul Madhyamic Vidhyalaya	220	45	20.5	79.5

) Caste-wise Prevalence of Intestinal Parasites

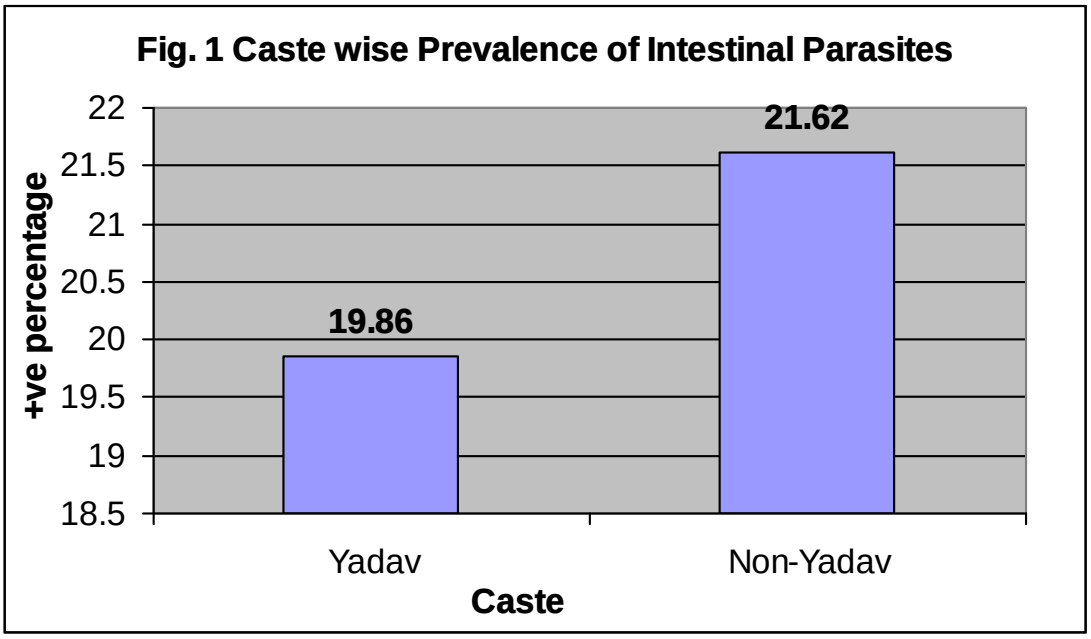
Out of 220 stool samples collected, 146 (66.36%) were from children of Yadav groups where as 74 (33.63%) were from children of Non-Yadav groups (such as Gupta, Sah, Thakur, Mandal, Tharu etc)

Among Yadav community, 29 (19.86%) out of 146 were found to be positive for intestinal parasites whereas among Non-Yadav community, 16(21.62%) out of 74 were found to be positive. This study showed that the children of Yadav community were less infected than the children of Non-Yadav community.

Statistically, the difference in caste-wise distribution of intestinal parasites of the children was found insignificant (χ^2=0.093, p>0.05).

Table 2: Caste-wise Prevalence of Intestinal Parasites

S.N.	Caste	Total No. of Samples Examined	No. of Positive Samples	Positive %
1	Yadav	146	29	19.86
2	Non-Yadav	74	16	21.62
Total		**220**	**45**	**20.5**



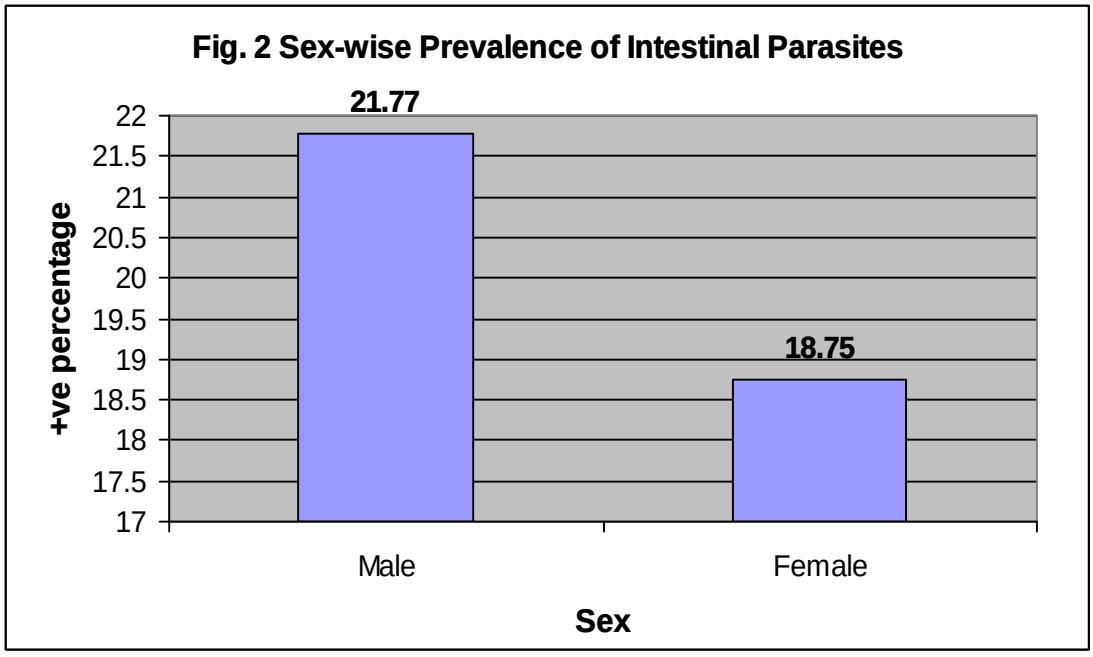
) Sex-wise Prevalence of Intestinal Parasites

Out of 220 examined stool samples, 124 were of male children and 96 of female children. Out of 124 male stool samples examined, 27(21.77%) were found to be positive. Likewise out of 96 female stool samples examined, 18(18.75%) were found to be positive for intestinal parasites. Hence, the infection rate was found higher in male children than female children.

Statistically, the difference in sex- wise prevalence of parasites of the children was found insignificant (χ^2=0.304, p>0.05).

Table 3: Sex-wise Prevalence of Intestinal Parasites

S.N.	Sex	Total No. of Samples Examined	No. of Positive Samples	Positive %
1	Male	124	27	21.77
2	Female	96	18	18.75
Total		**220**	**45**	**20.5**



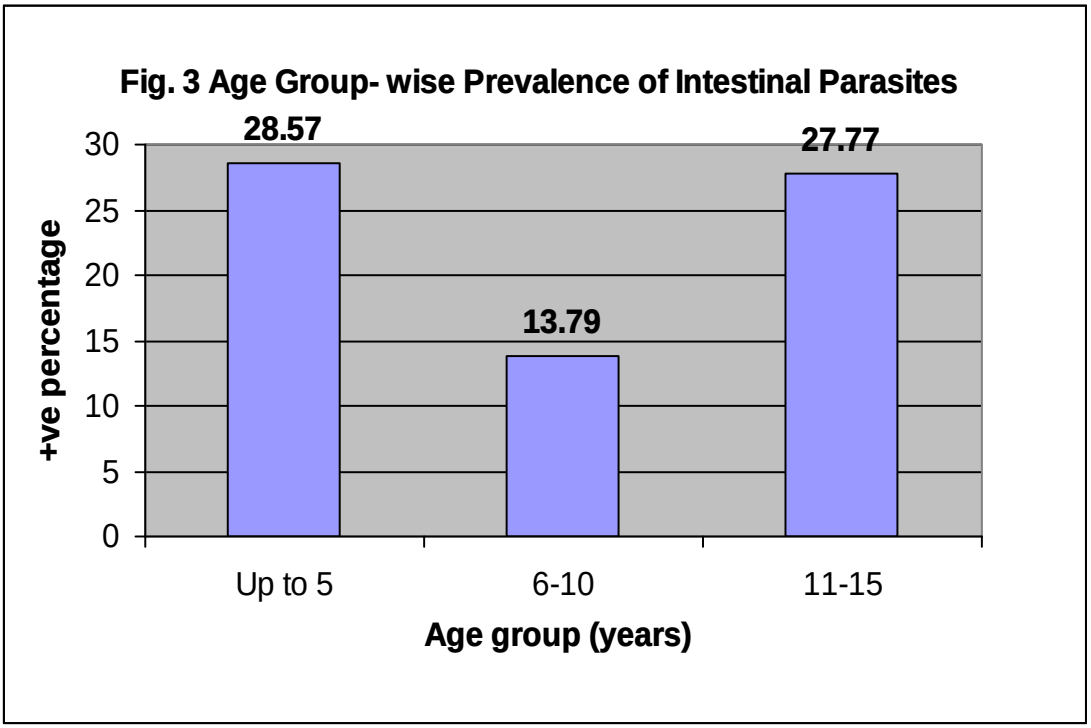
) Age Group-wise Prevalence of Intestinal Parasites

There was age limit for study population i.e.5-15 years old. The entire study is categorized into three age groups. The prevalence of parasitic infection was approximately equal in age group of 5 yrs (28.57%) and 11-15(27.77%) followed by age group 6-10(13.79%).

Statistically, no significant difference regarding parasitic infection was found in different age groups (χ^2=6.7, p>0.05).

Table 4. Age Group-wise Prevalence of Intestinal Parasites

S.N.	Age (Years)	Total No. of Samples Examined	No. of Positive Samples	Positive %
1	5	14	4	28.57
2	6-10	116	16	13.79
3	11-15	90	25	27.77
Total		**220**	**45**	**20.5**

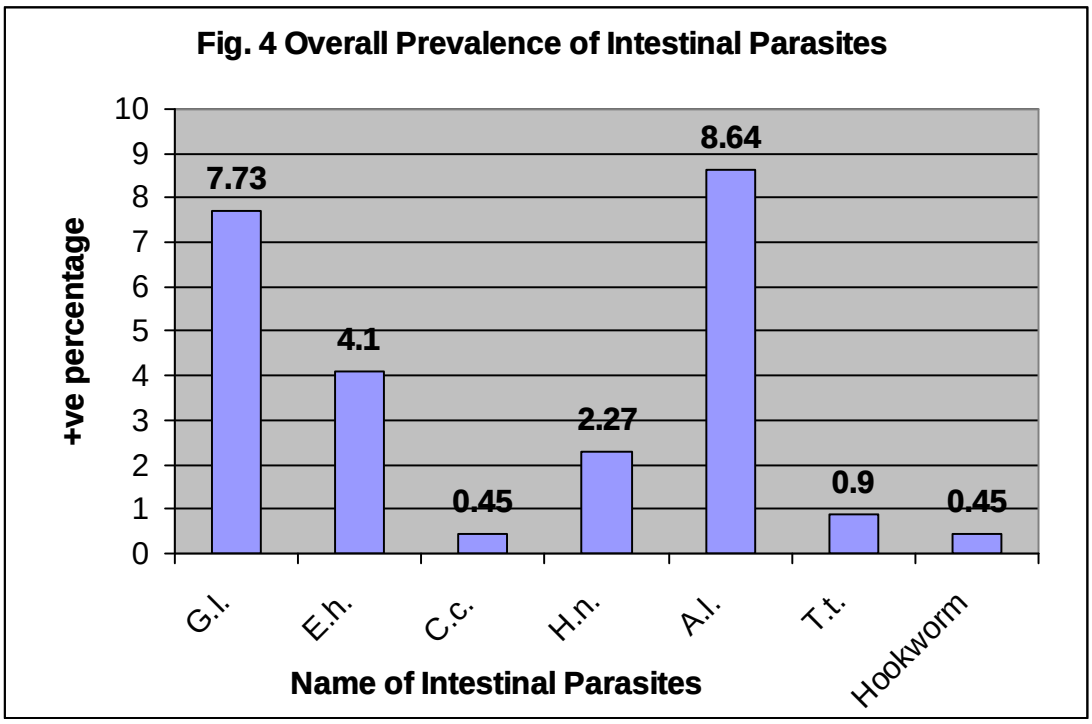


) Prevalence of Specific Intestinal Parasites

Overall prevalence showed that the infection of *Ascaris lumbricoides* was found to be maximum, 19(8.64%) followed by *Giardia lamblia*, 17(7.73%) then *Entamoeba histolytica*, 9(4.10%) and *Hymenolepis nana*, 5(2.27%). Double cases of *Trichuris trichiura*, 2(0.90%) was found whereas single cases of *Cyclospora* and hookworm were found.

Table 5. Prevalence of Specific Intestinal Parasites in Total

S.N.	Parasites	Total Infection	% Infection in Total 220
1	*G. lamblia*	17	7.73
2	*E. histolytica*	9	4.10
3	*Cyclospora*	1	0.45
4	*H. nana*	5	2.27
5	*A. lumbricoides*	19	8.64
6	*T. trichiura*	2	0.90
7	hookworm	1	0.45



⟩ Intensity of Infection

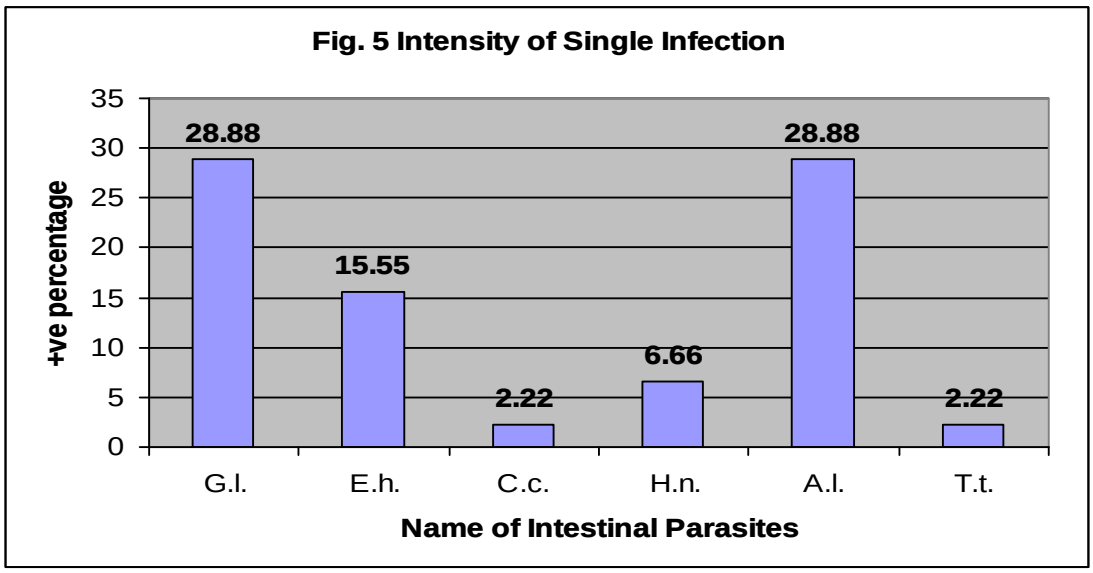
The infection of single parasite was more common than double and triple species infection. Out of total 45 positive cases, there were 38(84.44%) single infections while 5(11.11%) double and 2(4.44%) with triple infections.

⟩ Intensity of Single Infection

Out of 38 positive cases, the intensity of *G. lamblia* and *A. lumbricoides* was equal with 13(28.88%) cases followed by *E. histolytica* with 7(15.55%) cases, *H. nana* with 3(6.66%) cases whereas *Cyclospora* and *T. trichiura* - single case.

Table 6. Intensity of Single Infection

S.N.	Parasites	No	% Out of Total +ve Cases (45)	No of Infected Male	No of Infected Female
1	*G.lamblia*	13	28.88	7	6
2	*E. histolytica*	7	15.55	3	4
3	*Cyclospora*	1	2.22	1	-
4	*H. nana*	3	6.66	3	-
5	*Ascaris*	13	28.88	8	5
6	*T.trichiura*	1	2.22	1	-
Total		**38**	**84.44**	**23**	**15**

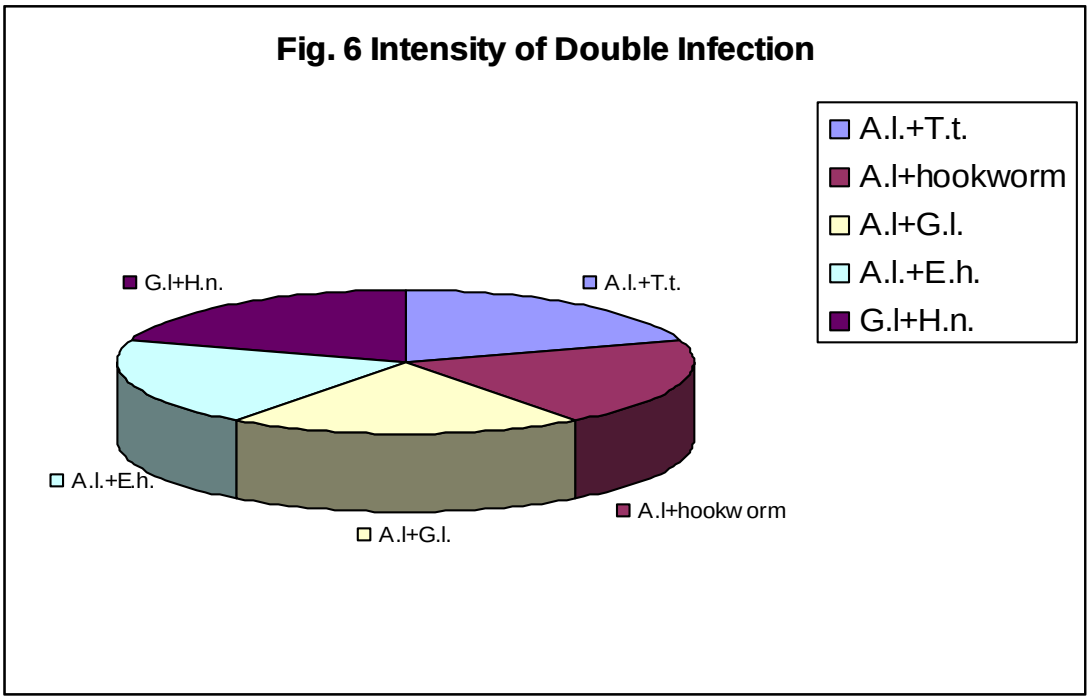


⟩ Intensity of Double Infection

Altogether 5 cases were found as double infection out of 220 stool samples examined.

Table7. Intensity of Double infection

S.N.	Parasites	No.	% Out of Total +ve Cases(45)	No. of Infected Male	No. of Infected Female
1	*A. lumbricoides+T. trichiura*	1	2.22	-	1
2	*A. lumbricoides+* hookworm	1	2.22	1	-
3	*A. lumbricoides+G. lamblia*	1	2.22	-	1
4	*A. lumbricoides+ E. histolytica*	1	2.22	-	1
5	*G. lamblia+H.nana*	1	2.22	1	-
Total		**5**	**11.11**	**2**	**3**

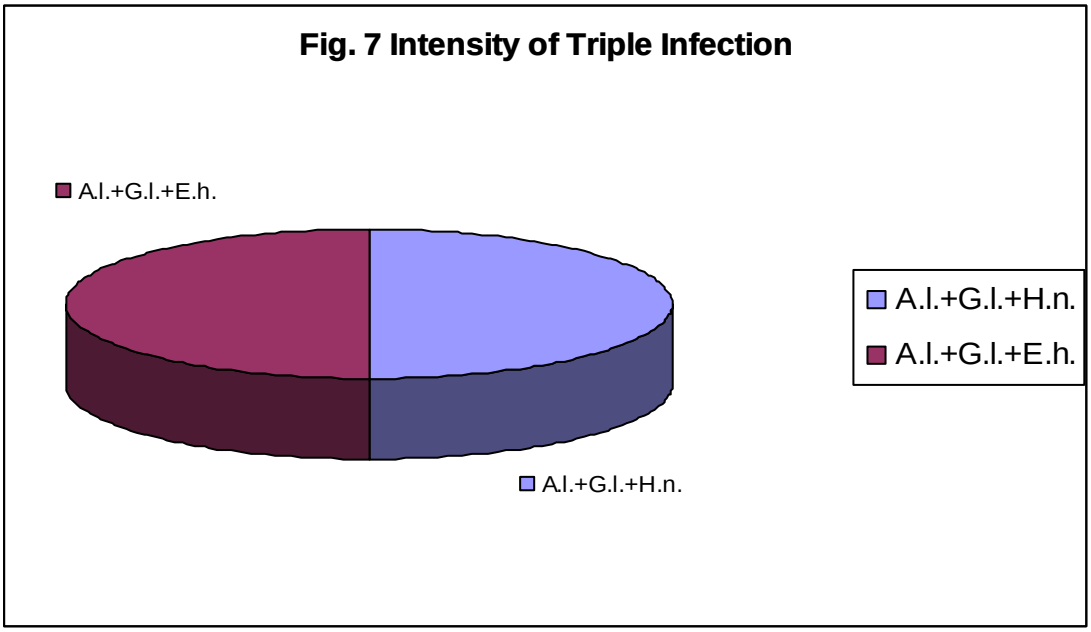


J Intensity of Triple infection

Only 2 cases were found as triple infection out of 220 stool samples examined. *Ascaris* and *G. lamblia* were common with *H.nana* and *E. histolytica.*

Table 8. Intensity of Triple Infection

S.N.	Parasites	No.	% Out of Total +ve Cases(45)	No. of Infected Male	No. of Infected Female
1	*A.lumbricoides+G.lamblia+ H.nana*	1	2.22	1	-
2	*A.lumbricoides+G.lamblia+ E. histolytica*	1	2.22	1	-
Total		**2**	**4.44**	**2**	**-**



RESULTS OF SURVEY ANALYSIS

Interview was also carried out in the same population of children whose stool examination was done. For this a set of prepared questionnaire were asked to the children. The results from the survey analysis are as follows:

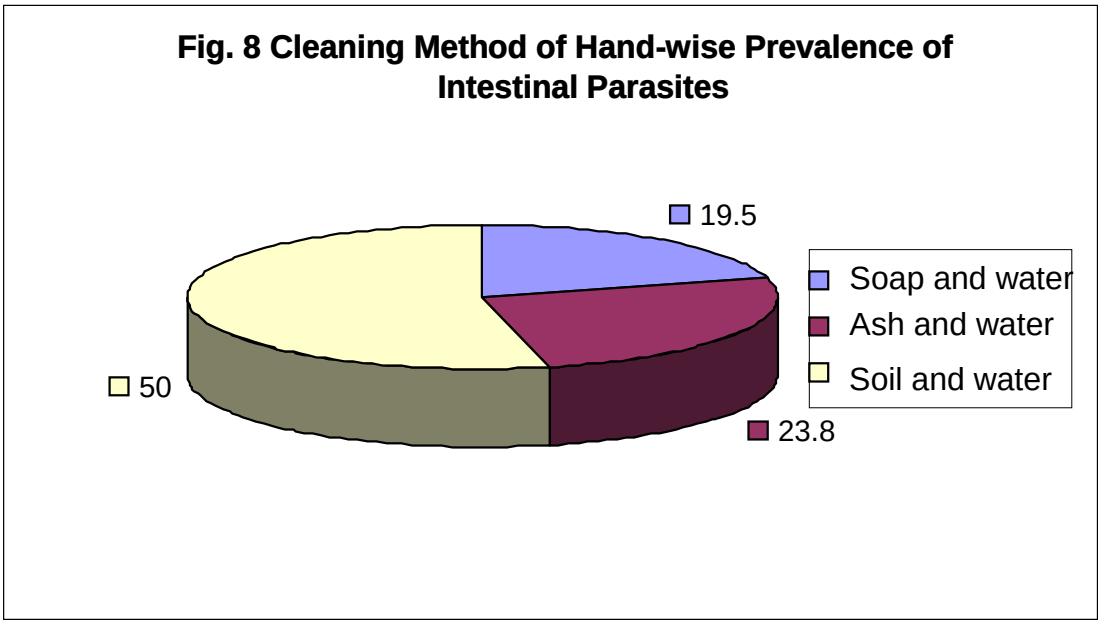
) Cleaning Method of Hand-wise Prevalence of Intestinal Parasites

The prevalence of parasitic infection was found to be maximum 50% in those children who used soil as cleaning agent to clean hands.

Statistically, difference in the prevalence of intestinal parasites of the children according to method of cleaning of hands was insignificant (χ^2=2.40, p>0.05).

Table 9. Cleaning Method of Hand-wise Prevalence of Intestinal Parasites

S.N	Methods	No. of Respondents	No. of Positive Samples	Positive %
1	Soap and water	195	38	19.5
2	Ash and water	21	5	23.80
3	Soil and water	4	2	50.0
Total		**220**	**45**	**20.5**



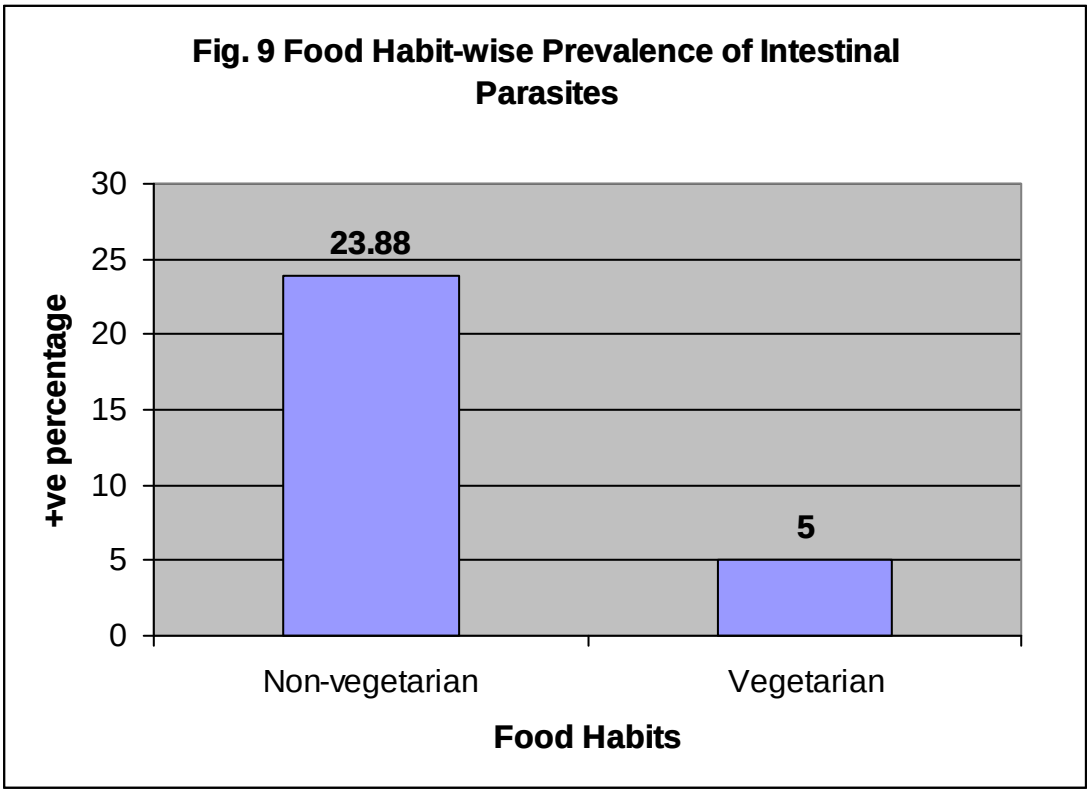
) Food Habit-wise Prevalence of Intestinal Parasites

Out of 220 interviewed children, 180 were non-vegetarian and only 40 were vegetarian. Among 180 non-vegetarian children, 43(23.88%) were infected with intestinal parasites whereas among 40 vegetarian children, 2(5%) were infected with intestinal parasites. It shows non-vegetarian are at high risk of intestinal parasites.

Statistically, the difference in the prevalence of intestinal parasites of the children on the basis of food habits was found insignificant (χ^2=7.175, p>0.05).

Table 10. Food Habit-wise Prevalence of Intestinal Parasites

S.N.	Food Habits	No. of Respondents	No. of Positive Samples	Positive %
1	Non-vegetarian	180	43	23.88
2	Vegetarian	40	2	5
Total		**220**	**45**	**20.5**



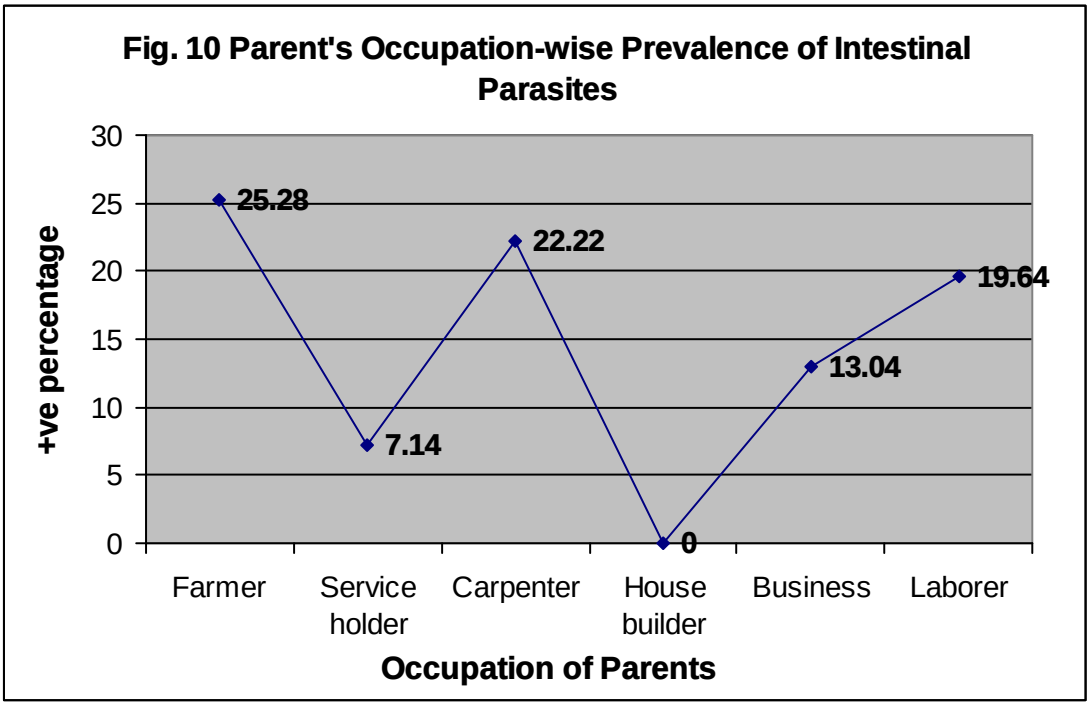
) Parent's Occupation-wise Prevalence of Intestinal Parasites

The prevalence of parasitic infection was found to be maximum 25.28% of those families whose parents are farmer and minimum 7.14% of those families whose parents are service holder.

Statistically, difference in the prevalence of intestinal parasites of the children according to their parents' occupation was insignificant (χ^2 =4.67, p>0.05).

Table 11. Parent's Occupation-wise Prevalence of Intestinal Parasites

S.N.	Occupation of Parents	No. of Respondents	No. of Positive Samples	Positive %
1	Farmer	87	22	25.28
2	Service holder	14	1	7.14
3	Carpenter	36	8	22.22
4	House builder	4	00	00
5	Business	23	3	13.04
6	Laborer	56	11	19.64
Total		**220**	**45**	**20.5**



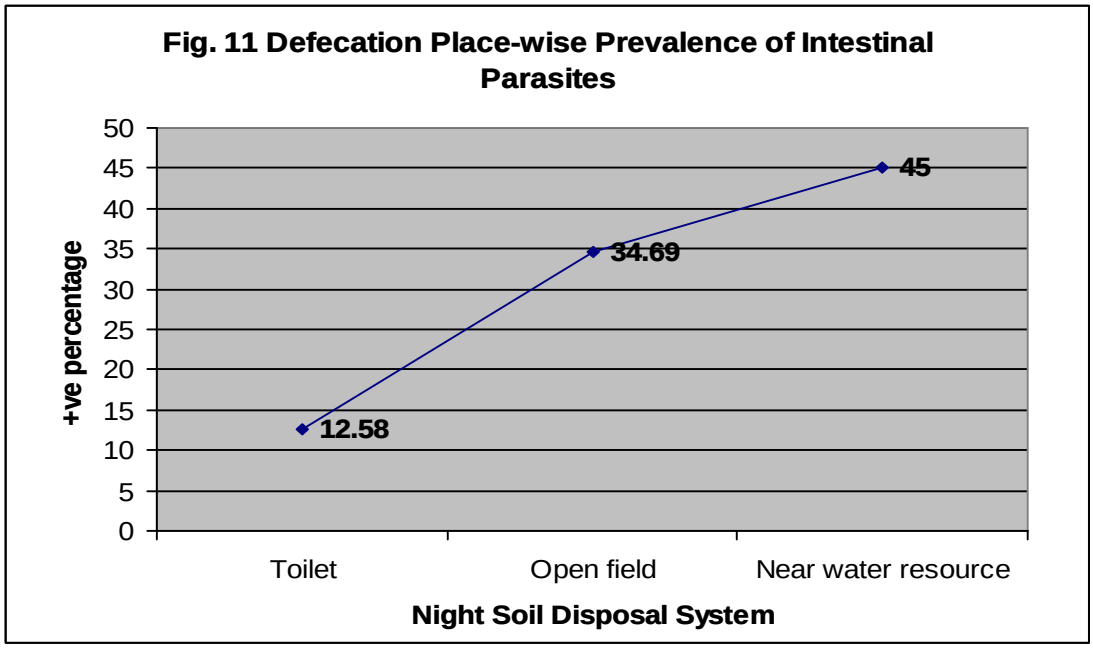
) Defecation Place-wise Prevalence of Intestinal Parasites

The prevalence of parasitic infection was found maximum 9(45%) out of 20 children who used to defecate at places near by water resource and minimum infection 19(12.58%) out of 151children who used safe toilet as defecation place.

Statistically, the difference in the prevalence of intestinal parasites on the children on the basis of defecation place was significant (χ^2 =19.26, p<0.05).

Table 12. Defecation Place-wise Prevalence of Intestinal Parasites

S.N.	Night Soil Disposal System	No. of Respondents	No. of Positive Samples	Positive %
1	Toilet	151	19	12.58
2	Open field	49	17	34.69
3	Near water resource	20	9	45
Total		**220**	**45**	**20.5**



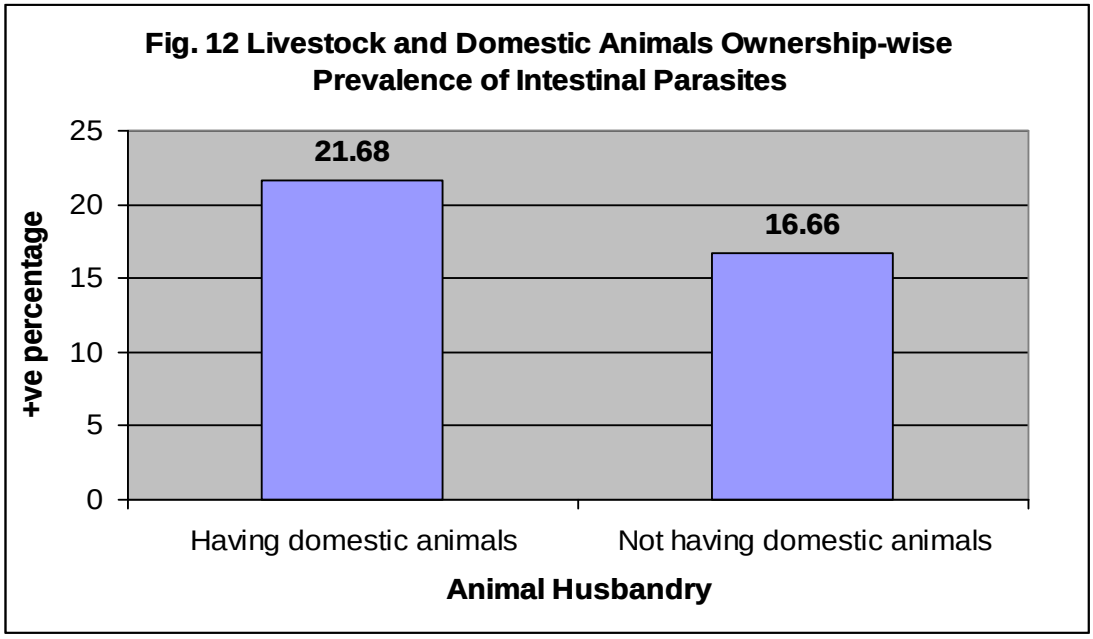
) Livestock and Domestic Animals Ownership-wise Prevalence of Intestinal Parasites

Out of 220 interviewed children, most of them 166 had livestock and domestic animals mainly buffaloes, cows, goats, ducks, hens and dogs. The prevalence of parasitic infection was found 36(21.68%) out of 166 in those children who had the livestock and domestic animals while 9(16.66%) out of 54 was found in those children who didn't have the livestock and domestic animals.

Statistically, the difference in prevalence of intestinal parasites of the children on the basis of livestock and domestic animals ownership was found insignificant (χ^2 =0.63, p>0.05).

Table 13. Livestock and Domestic Animals Ownership-wise Prevalence of Intestinal Parasites

S.N.	Situation	No. of Respondents	No. of Positive Samples	Positive %
1	Having domestic animals	166	36	21.68
2	Not having domestic animals	54	9	16.66
Total		**220**	**45**	**20.5**



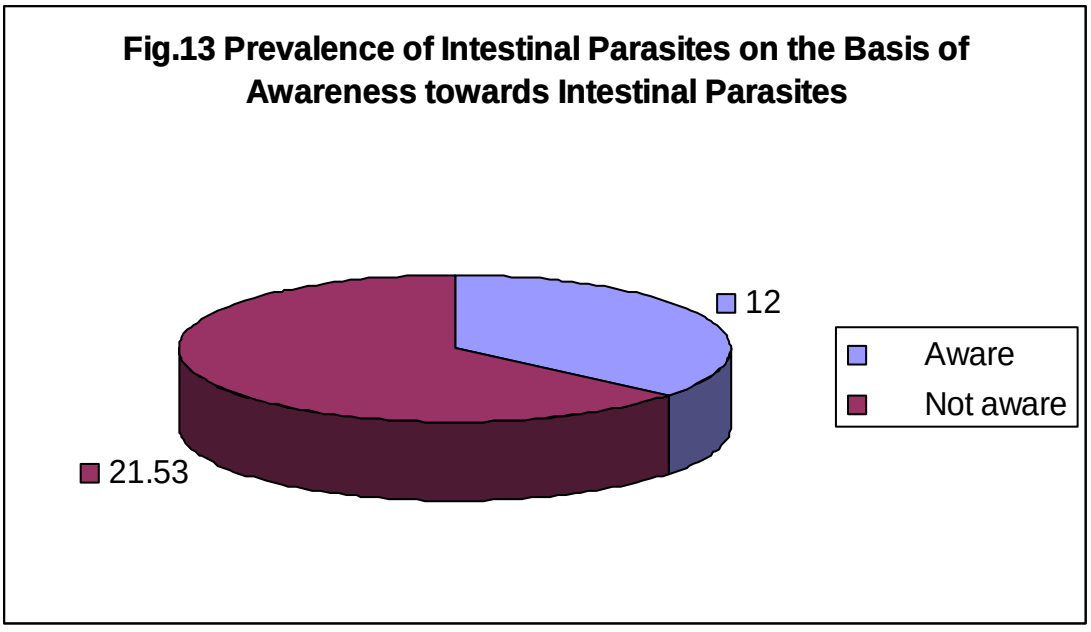
- **Prevalence of Intestinal parasites on the Basis of Awareness towards Intestinal Parasites**

From survey analysis, it was found that the awareness towards intestinal parasite was poor. Out of total 220 children, only 25 showed keen interest towards intestinal parasites whereas 195 were unknown of it. Only 3(12%) out of 25 were infected with intestinal parasites who were aware of it whereas 42(21.53%) out of 195 were infected with intestinal parasites who were unknown of it.

Statistically, the difference in prevalence of intestinal parasites of the children on the basis of awareness towards intestinal parasites was found insignificant (χ^2 =1.24, p>0.05).

Table 14. Prevalence of Intestinal parasites on the Basis of Awareness towards Intestinal Parasites

S.N	Category	No. of Respondents	No. of Positive Samples	Positive %
1	Aware	25	3	12
2	Not aware	195	42	21.53
Total		**220**	**45**	**20.5**



Treatment Method-wise Prevalence of Intestinal Parasites

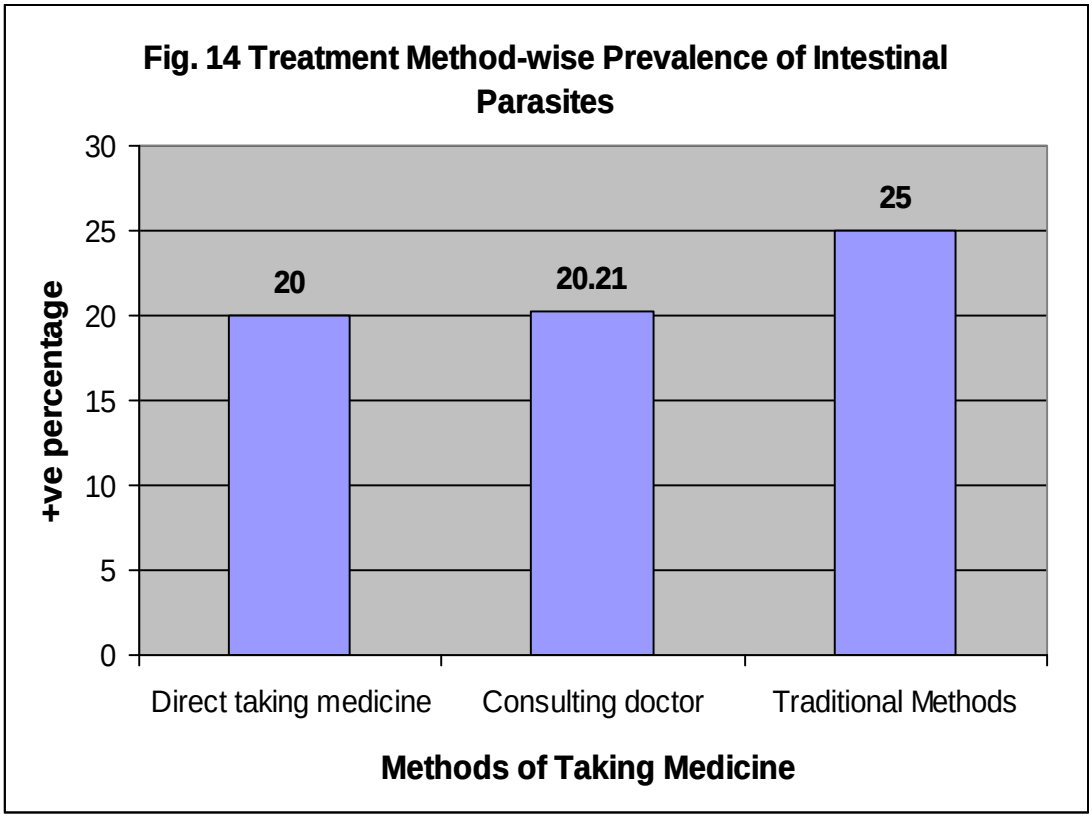
From survey analysis, it is found that most of children 208 believe in medical treatments while a few children (12) believe in other traditional methods

of treatments, such as Dhami, Baidhya etc. So, maximum intestinal parasitic infection 3(25%) out of 12 was found in children who believed in traditional methods for treatment of intestinal parasites.

Statistically, the difference in prevalence of intestinal parasites of the children on the basis of treatment method was found insignificant (χ^2 =0.16, p>0.05).

Table 15. Treatment Method-wise Prevalence of Intestinal Parasites

S.N	Category	No. of Respondents	No. of Positive Samples	Positive %
1	Direct taking medicine	20	4	20
2	Consulting doctor	188	38	20.21
3	Traditional Methods	12	3	25
Total		**220**	**45**	**20.5**



VI

DISCUSSION AND CONCLUSION

Nepal is a small, impoverished country with infectious diseases including intestinal parasites, being highly prevalent (Rai et al., 2001, 2002). *Ascaris lumbricoides, Trichuris trichura* and hookworm are the major helminthes parasites where as *Giardia lamblia* and *Entamoeba histolytica* are the major protozoan parasites (Warren and Mahmoud 1984, Walsh 1986). The public health burden of these helminthes infection has been consistently underestimated, although school age children are at highest risk and may suffer from nutritional deficits, cognitive impairments, and serious illness and in occasional cases death. In Nepal, about 4.8% of people died due to cholera and diarrhea (CBS 2002). Morbidity because of intestinal parasites has always been an important public health problem in tropical regions (Sherchand et al., 1996)

The present study revealed that out of 220 children of Gurukul Madhyamic School, 45(20.5%) were infected by different kinds of intestinal parasites. This approximately resembles with the findings of Ludwig et al., (1999), Leet et al., (2000), Celik et al., (2006) and Karki (2007) with the percentage prevalence of 25.3%, 17%, 22.5% and 26.72% respectively. Conditions most frequently associated with remarkable prevalence included the water source, defecation site, personal hygiene and some extent of maternal education.

The present study also revealed that the children (19.86%) of Yadav community are less infected than the children (21.62%) of Non-yadav community. This may be due to intake of adequate food, milk and milk products which help in boosting of immunity power towards intestinal parasites by Yadav community.

In concerning of sex-wise prevalence of intestinal parasites of school children, the result showed that comparatively male (21.77%) were more infected than females (18.75%). Statistically, the difference in sex-wise prevalence of parasites was found insignificant. This result resembles with Chaudhari (2004) while dis-resemble with Rai and Gurung (1986) and Tai-Soon et al., (2001) in which the prevalence rate of intestinal parasite infections in female was higher

than male. This may indicate that there is equal possibilities of transmission of parasites among children due to over dispersal of parasites in all the communities.

Regarding the age group, the prevalence of parasitic infection was highest in age group of 5 years (28.57%) followed by 11–15 (27.77%) and 6-10 (13.79%). The reason behind this may be that children of this age are mostly in contact with soil as well as water and also they have the least immunity against intestinal parasites. Rai et al., (1991) found that intestinal parasites were more common among children below 15 years than in adult more than 15 years. So, Sherchand et al., (1997) showed that the prevalence of parasitic infection was 63.1% in the age group (0-9) years. Statistically, no significant difference regarding parasitic infection was found in different age group (χ^2=6.7, p>0.05). Because all age groups can acquire the intestinal parasitic diseases, the highest attack rate occurs among children older than 18 months. There is no apparent immunity to infection and re-infection and can occur in all ages. (Conner et al., 1993)

The positivity of intestinal parasites contain seven types – *G. lambia* (7.73%), *E. histolytica* (4.10%), *Cyclospora* (0.45%), *H. nana* (2.27%), *A. lumbricoides* (8.64%), *T. trichiura* (0.90%) and hookworm (0.45%). These parasites were also reported by Sharma et al., (1971) among auxiliary health worker's student in Kathmandu and Karki, (2007) in school children of Mulpani VDC, Kathmandu.

The prevalence of *Ascaris lumbricoides* was the highest (8.64%) among intestinal parasites. This present study coincides with the study of several workers such as Sharma et al., (1971) in which the commonest infestation found was roundworm, Nepal and Palfy (1980) in which the prevalence rate of roundworm was (63.5%), Rai and Gurung (1986) in which the incidence of roundworm was the highest (35%), Rai et al., (1999) in which *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, Similarly Shrestha (2001), Chaudhari (2004), Manandhar (2006) and Karki (2007) are some of examples having the highest prevalence of *Ascaris. Ascaris lumbricoides* is followed by *H.*

nana (2.27%), *T. trichiura* (0.90%) and hookworm (0.45%) among helminthes in the present study.

Regarding the protozoan parasites, the prevalence of *G. lambia* was the highest (7.73%), followed by *E. histolytica* (4.10%) and *Cyclospora* (0.45%) which resembles with the findings of Khetan (1980) in Narayani zone, the prevalence rate of *G. lambia* was highest (8.5%) than *E. histolytica* (4%). Rai et al., (1991) also reported that *G. lamblia* was the most common followed by *E. histolytica.* Gianotti (1993) reported *Giardia lambia* (5.9%) followed by *E. histolytica* (5.3%) whereas the *Cyclospora* parasite was reported by Chaudhari (2004) from the Machchhegaun VDC.

In the present study among the 45 positive samples, 38(84.55%) were found with prevalence of single species infection where the intensity of *G. lamblia* and *A. lumbricoides* was equal. Similarly, 5(11.11%) were found with prevalence of double species infection and 2(4.44%) with prevalence of triple species infection. In double species infection, *A. lumbricoides* was found in all cases except in one case while in triple species infection, *A. lumbricoides* and *G. lamblia* were found to be most dominant parasites from helminthes and protozoa respectively. The high positivity of *A. lumbricoides* among children in the present study coincides with the study presented by Rai et al., (1994), according to which the annual rate of the positivity for soil transmitted helminthes (i.e. *A. lumbricoides*) had the highest prevalence rate than others
(i.e. *T. trichiura* and hookworm).

The World Health Organization noted that human behavior may influence the prevalence and intensity of intestinal infections (WHO 1981). So, the human behavior such as washing hands with soil is one of the examples. Maximum infection (50%) was found in those children who used soil as cleaning agent. According to Olesen et al., (2001), households without soap had a 2.6 times higher risk of being infected with parasites.

Prevalence of intestinal parasites is also directly affected by feeding habit of people. So, maximum infection (23.88%) was found in non-vegetarian children and only 5% infection was found in vegetarian children. The difference in the

prevalence of intestinal parasites of the children in vegetarian and non-vegetarian was found insignificant. Also, Chaudhari (2004) found that there was not significant difference in prevalence of parasites in vegetarian and non-vegetarian.

Similarly, the highest prevalence (36.11%) was found in those children whose parents are farmer. This may be due to the reason that most of them are uneducated and they don't have any knowledge of parasitic infection. All the time they have to work in field playing with soil and their children are also forced to do work with them and become the victim of soil transmitted helminthes infection. Gurbacharya (1981) observed that the infection by soil transmitted helminthes in Bhaktapur and Panchkhal area were higher than any other type of parasite. Ribeiro et al., (2003) have suggested that "No satisfactory knowledge about soil-transmitted helminthes and "daily contact with soil" were the most important risk factors. Minimum infection (7.14%) was found in those children whose parents are service holder. This may be due to reason that most of these parents are educated and have knowledge about parasitic infection. So, they follow hygienic feeding habits and teach their children the healthy hygienic habit. Also, Karki (2007) observed the minimum infection in those children whose parents are service-holder. Statistically, no significant difference was found in the prevalence of intestinal parasites of the children according to their parent's occupation.

The present study revealed that 68.63% children use toilet and only 31.36% use open field as defecation place. But, Rai et al., (2001) had reported from rural village else where in Nepal that over 80.0% of households had no toilet. So, maximum infection (45%) was found in those children who defecate on open field especially near water resource. Statistically, the difference in the prevalence of intestinal parasites on the basis of defecation place was significant (χ^2 =19.26, $p<0.05$).

The prevalence of intestinal parasites was greater (21.68%) in children having livestock and domestic animals ownership. This may be due to insufficient sanitary facilities, lack of personal hygiene and living nearby livestock and domestic animals, that is, congested housing conditions.

The present study revealed that a significant proportion of the population had lack of awareness about the intestinal parasites. Out of 220 respondents, 195 were found not aware of intestinal parasites among which 21.53% were found with parasitic infection. They don't have the idea of means and modes of intestinal parasitic transmission. They don't know how individuals contract soil-transmitted infection as 145 of the sampled population did not know how individuals contract soil-transmitted infection (Williams-Blangero et al., 1998). Still some villagers have false concept that sweet foods such as sugar, toffee, ice-creams etc are responsible for being infected with intestinal parasites. This result shows that knowledge of parasitic infection is very poor in the children of all communities due to lack of usage of posters and leaflets in villages to increase the public health information and awareness about parasitosis.

Similarly, the present study also tried to know the methods of treatments on intestinal discomfort by respondents.Out of 220 children, most of the children (208) were found to believe in medical treatments among which 20.21% were found with intestinal parasitic infection and only 12 were found to believe in traditional methods such as Dhami, Baidhya etc among which 25% were infected. So, maximum infection was observed in children who believe in traditional methods. It is due to lack of knowledge, attitudes and bad cultures.

Epidemiological surveys on the intestinal parasite infections are important in this country because they reflect sanitary conditions of the community and produce basic data for control of parasitosis in the future. There is urgent need for the improvement of basic health services and infrastructure in the rural areas. It may be assumed that similar situation might be prevailing in other places of our country, which are yet to be investigated. So government as well as other health conscious people should give more emphasis on the parasitic disease of children whole over our country.

VII
RECOMMENDATIONS

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

- People should take care of sanitary improvements including personal hygiene and environmental sanitation.
- Children should be forced to use latrine for defecation.
- Basic health program should be conducted time to time in communities for raising awareness towards the parasitic infections, prevention and control. For this, posters and leaflets should be used extensively.
- People should be made aware about their feeding behaviour and use of boiled water for drinking purpose.
- Public health education in the school curriculum must be made compulsory.
- People should avoid walking barefoot.
- The research work on the prevalence of intestinal parasites and prevention should be encouraged.

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ANNEX-1

QUESTIONNAIRE

Name---------- Age/Sex----------

Caste----------

Occupation of Father---------- Date----------

School Type- Government/ Boarding/ Child Centre Care

1. Where do you defecate?
   a) Toilet b) Open field
   c) Near water resource

2. From where do you get drinking water?
   a) Tap b) Well
   c) Tube well

3. How do you drink water?
   a) Direct tap water b) Boiled
   c) Filtered d) Using germicides

4. How do you wash your hands?
   a) Soap and water b) Soil and water
   c) Ash and water

5. When do you wash your hands?
   a) Before meal b) After meal
   c) After working in field c) All of above

6. Do you cut your nails regularly?

a) Yes b) No

7. Do you have domestic animals in your home?

a) Yes b) No

8. If yes, then what are they?

a) Hens b) Ducks c) Dogs d) Cats

e) Goats f) Cows g) Buffalo h) Poultry

9. Do you eat meat?

a) Yes b) No

10. If yes, which meat do you take frequently?

a) Fish b) Mutton

c) Chicken d) Ducks

e) Others

11. Have you ever been infected by intestinal parasites?

a) Yes b) No

12. If yes, when? ----------

13. Do you know or are you aware of intestinal parasites?

a) Yes b) No

14. Do you know how to prevent the intestinal parasitic infection?

a) Yes b) No

15. How do you treat in case of infection?

a) Direct taking medicine b) Consulting doctor

c) Traditional methods