PREVALENCE OF INTESTINAL PARASITES IN CHILDREN ATTENDING OPD OF KANTI CHILDREN HOSPITAL, KATHMANDU

A Dissertation

Submitted in Partial Fulfillment of Requirements for the Master's

Degree of Science

in

Zoology

Parasitology

By

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July, 2009

DECLARATION

I hereby declare that the work presented in this thesis has been done by myself and has not been submitted elsewhere for the award of any degree. All sources of information have been specifically acknowledged by reference to the authors or institutions.

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RECOMMENDATION

This is to certify that Mrs. **BABITA MAHARJAN** has completed her thesis work entitled **"PREVALENCE OF INTESTINAL PARASITES IN CHILDREN ATTENDING OPD OF KANTI CHILDREN HOSPITAL, KATHMANDU"** as a partial fulfillment of the **Master's Degree of Science** in **Zoology** with special paper **Parasitology** under our supervision. To our knowledge her work has not been submitted for any other degree.

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LETTER OF APPROVAL

On the recommendation of supervisor **Prof. Dr. RANJANA GUPTA**, this thesis of Mrs. **BABITA MAHARJAN** is approved for Examination, and is submitted to the Tribhuvan University in partial fulfillment of the Master's Degree of Science in Zoology with Parasitology as a special paper.

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ACCEPTANCE CERTIFICATE

We certify that this thesis presented by Mrs. **BABITA MAHARJAN** entitled **"PREVALENCE OF INTESTINAL PARASITES IN CHILDREN ATTENDING OPD OF KANTI CHILDREN HOSPITAL, KATHMANDU"** is satisfactory in scope and quality as a thesis in the partial fulfillment of Master's Degree of Science in Zoology with Parasitology as a special paper.

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CONTENTS

LIST OF TABLES

PAGE NO.

LIST OF FIGURES

PAGE NO.

LIST OF PHOTOGRAPHS

Plate- 1

a. Kanti Children Hospital
b. Taking Interview
c. Preparation of Slide
d. Microscopical Observations
e. Microphotographing
f. Cyst of *E. histolytica*

Plate- 2

g. Cyst of *G. lamblia*
h. Egg of *Taenia*
i. Egg of *H. nana*
j. Egg of *A. lumbricoides*
k. Egg of Hookworm
l. Egg of *T. trichiura*

ACKNOWLEDGEMENT

I wish to express my sincere gratitude and deep respect to my supervisor **Prof. Dr. RANJANA GUPTA**, Head of Parasitology Central Department of Zoology T.U, Co. Supervisor **Mr. Ashok Bam**, Lecturer of Central Department of Zoology T.U, and my dear teachers **Mr. Janak Raj Subedi**, and **Mr. Pitamber Dhakal** who encouraged, suggested and guided me throughout the completion of this work.

I am highly grateful to **Prof. Dr. VASANTA KUMAR THAPA**, Head of the Department for providing the necessary facilities required for this work and entire members of Central Department of Zoology for their kind co-operation and valuable suggestions throughout the work.

I am grateful to **Dr. Harish Chandra Upreti**, Head of Pathology Department, Kanti Children Hospital for giving me permission to work in that Hospital and **Mr. Jeevan Prashad Parajuli**, Officer Parasitology section for helping me in my laboratory work.

I express special thanks to my friends **Bharati, Jasu, Poornima, Laxmi, Bhim** and **Ramesh** for their kind suggestions.

I gratefully express my deepest gratitude to my father **Mr. BISWA MITRA MAHARJAN**, Mother **Mrs. KAMALA MAHARJAN**, **Sisters** and **brother** for their whole hearted support, inspiration, devotion, encouragement concern and all others to my whole academic career.

I am highly grateful to my husband **Mr. RAJKUMAR MAHARJAN** for his help in field work, laboratory work and computer work as well as for his morale support and love.

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ABSTRACT

Present study was carried out to find out the prevalence of intestinal parasites in children who attended the Kanti Children Hospital in the age group 0-15 years. A total of 300 stool samples were screened and examined by wet mount and Iodine stained method. Among them 109 (36.3%) were found to be infected with one or more intestinal parasites. The intestinal parasites observed during the study were *Entamoeba* 67 (22.3%), *Giardia* 33(11.0%), *Ascaris* 01 (0.33%), *Taenia* 01 (0.33%), *Hymenolepis* 01 (0.33%), Hookworm 01 (0.33%) and *Trichuris* 01 (0.33%). Multiple infections were observed in 5 (1.66%) of the children with a maximum of two species.

The infection of helminth parasites was found very low i.e. 4(1.33%) than protozoan parasites 100 (33.3%) that may be because of antihelminthic programs held by government each year. The higest prevalence rate (72.0%) was found in the age group 12-15 years and the lowest prevalence rate (32.5%) was found in the age group 0-3 years. However, statistically no significant difference was found in infection rate among different age groups of children (χ^2= 22.31, df=4, P>0.05). In case of sexwise prevalence, the infection rate was slightly higher among males (60.6%) than females (39.4%). Difference in the prevalence of intestinal parasites in the two sexes was found to be insignificant (χ^2 = 4.48, df=1, P>0.05).

According to source of drinking water the highest rate (62.38%) of infection was found in tap water consuming children and the lowest rate (3.67%) in Jar water consuming children. Again, infection rate (43.9%) is higher in children who have developed the soil eating habit than in children having no soil eating habit i.e. (32.7%). But there was no significant difference (χ^2 = 4.48, df=1, P>0.05) in prevalence of intestinal parasites with soil eating habit of children. The problem caused by intestinal parasites are due to lack of serious and profound sanitary education policy. The eradication of these parasites requires an improvement in the socioeconomic conditions, basic sanitation and sanitary education, proper hygiene and safe drinking water.

1. INTRODUCTION

The child is the father of the man. The conduct of a child indicates what kind of man he will be in his future life. Habits of childhood form the character of the grown up man. If the child shows the signs of weakness, unhealthiness, it is expected that he will not be a good healthy and active man in future. Children love to play in dirt, and they touch pets, other children, and mysterious mucky things they find in the backyard. They put their hands in their mouths without washing them. They aren't very fond of taking baths. Children are susceptible to a number of diseases and disorders that might be caused by parasites.

Intestinal parasitic disease is the most common infection in children worldwide, particularly in developing countries like Nepal. Thus the public health importance of intestinal parasitic infection continues because of its high prevalence, virtually global distribution and its effects on both nutritional and immune status of child. Intestinal parasitic infections in children are especially problematic because they have negative life long health consequences. These infections can contribute to malnutrition which in turn can result in delayed growth and malnutrition as well as impaired cognitive growth. Parasitic infection is also known to effect the mental development. Many intestinal parasites are also known to cause vitamin A deficiency leading night blindness and keratomalacia. Therefore intestinal parasitic infections directly or indirectly cause various degree of morbidity and less frequently mortality. Therefore in 1947 Stoll correctly stated intestinal parasitoses to be "unremittingly corrosive".

Parasitic infection is one of the major causes of public health and in turn socio-economic problem in the world. The prevalence rate has remained unchanged. In some tropical areas, the prevalence reaches nearly one hundred percent. Twenty five percent of world population is estimated to have been infected with one or more species of soil-transmitted helminthes alone (Rai *et al*., 2002).

In Nepal intestinal parasitic infection remains to be one of the great health and socio-economic problem. However, the reported incidence of parasitic infection has been found to vary considerably from one region to another and from one study population to another with over 90% prevalence in some areas.

It is considered that low economic status is the sole factor for parasitic infections but it is not so, the increased water pollution is one of the major factors for parasitic infection in Nepal. Parasitic infections like diarrhea and dysentery are due to water pollution that influences a very depressing health. These are also the major source of death and sickness especially among children and infants in our country.

Those parasites living in the alimentary tract, especially in intestine of the host is known as the intestinal parasites. They may be protozoan parasites like *Giardia lamblia, Entamoeba histolytica* etc. and helminth parasites like *Ascaris lumbricoides*, *Trichuris trichiura*, *Ancylostoma duodenale*, *Hymenolepis nana*, *Taenia* etc.

The protozoan parasites although being less common are associated with the highest number of mortalities. Children are the major victim of these infections due to poor sanitary and other living conditions. Protozoans are important as causative agents of diarrhea and are one of the major public health problems of the developing countries. Nearly 2 million children die of simple diarrhea each year in developing countries (Wakai, Susumu, 2003). Among protozoans *Entamoeba histolytica* which causes amoebiasis is estimated to cause severe disease in 48 million people, killing 70,000 each year (WHO, 2002).

Helminths refer to worms that live as a parasite in the human body and are a fundamental cause of disease associated with health and nutrition problems beyond gastrointestinal tract disturbances. Globally over 3.5 billion people are infected with intestinal worms of which 1.47 billion are with round worm, 1.3 billion people with hookworm and 1.5 billion with whipworm. About 450 million people are ill as a result of these infections, the majority being children. Each year some 65000 deaths are directly attributable to hookworm infections and other 60000 to *Ascaris lumbricoides*. School children aged 5-15 years suffer the highest infestation rate and worm burden that attributes to poor sanitation and hygiene. About 400 million school-age children are infected with roundworm, whipworm and hookworm worldwide. Multiple infections with several different parasites (e.g. Hookworm, roundworm and amoeba) are common and their harmful effects are often aggravated by co-existent malnutrition or micronutrient deficiencies. The numbers are increasing with cases occurring in all WHO regions. In 2025 more than half of the population in developing countries will be urbanized and, as a consequence a large number of people will live in shanty towns

where *E.histolytica*, *G.intestinalis*, *A.lumbricoides* and *T.trichiura* will find a favorable ground for transmission (WHO,2002). These parasites consume nutrients from children they infect, thus retarding their physical development. They destroy tissues and organs, cause abdominal pain, diarrhea, intestinal obstruction, anaemia, ulcers and other health problems. All of these consequences of infection can slow cognitive development and thus impair learning, physical fitness and growth. Numerous researchers have shown that such illness of children can negatively affect parents and siblings.

1.1 Significance of the Study

Nepal, being developing country the living standard of the people is still low. The socio-economic condition, human habit, education status, environmental sanitation are very low. Due to lack of knowledge about mode of transmission of parasites, their pathogenicity many types of parasitic diseases are reported. The drinking water is also not well treated. It is contaminated with faecal particles of animals and human. The untreated water of river or pond is directly supplied for drinking purpose from their source. In the rainy season, the over flooded water and sewage water are contaminated with supply water. Because of this type of water the people can get more infection by parasites such as *Entamoeba*, *Giardia* etc. that cause many intestinal disorders.

Agriculture is the major occupation of Nepali people. Due to agricultural activities a lot of exposures to the parasites are carried out as people do not wear shoes while working in the field. As people usually have low-income level, cannot afford to have toilet facilities, they defecate in the open field normally near to their working places. This helps in the transmission of parasites such as *Ascaris*, Hookworm, *Trichuris* etc. So, this study would be significant to minimize the prevalence of intestinal parasites in children and continuing such implementation regularly each and every year in the near future. The study would be helpful to spread awareness about intestinal parasites, their mode of transmission, pathogenicity and preventive measures. Again the study would be helpful for new research students and educators for the further study in concerned field.

2. OBJECTIVES

2.1 General Objective

To determine the prevalence of intestinal parasites in children aged 0-15 years attending OPD of Kanti Children Hospital, presenting complaints like diarrhea, dysentery, abdominal pain, vomiting, nausea, anorexia, fatigue, loss of appetite, fullness of abdomen, respiratory infections, anaemia, constipation etc.

2.2 Specific Objectives

- To determine the prevalence of intestinal parasites in relation to age and sex of children.
- To determine the prevalence of intestinal parasites in relation to source and type of drinking water.
- To determine the prevalence of intestinal parasites in relation to soil eating habit of children.
- To know the knowledge, attitude and practices of people about intestinal parasites and their transmission to human and preventive measures.
- To determine the prevalence of intestinal parasites in relation to occupation and literacy of the parents.

3. LITERATURE REVIEW

3.1 History of Parasitology

The history of parasitology is a fascinating one and parasites have been the subjects of some of the most exciting discoveries in the field of parasitic diseases. We now know that many of the important parasites encountered today not only existed but were wide spread in their distribution before written records began, and our early ancestors must have been aware of the presence of the largest and most common worms and of some of the diseases caused by parasites. The subsequent history of human parasitology revolves around early descriptions of a particular disease and the identification of the parasite causing the diseases, not necessarily in this order; the elaboration of the life cycle; and finally, the establishment of the causal relationship between the parasite and the disease.

Because of the small size of protozoa, it was not possible to recognize any protozoa until the invention of the microscope and its use by Antonie Van Leeuwanhoek towards the end of the 17^{th} century. The study of parasitic protozoa only really began two centuries later, following the discovery of bacteria and the promulgation of the germ theory by Pasteur and his colleagues at the end of the 19^{th} century.

Helminthes are large sized parasites. Because of their large size, it is practically certain that our earliest ancestors must have been aware of the common worms such as the roundworm *Ascaris* and the tape worms. Some historians have identified references to helminth worms and their diseases in the Bible, but the relevant passages are open to several inter pretations. Among the Egytian medical papyri, the Ebers papyrus refers to intestinal worms and these records can be conformed by the discovery of calcified helminth eggs in mummies dating from 1200 BC. The Greeks particularly Hippocrates(460-375 BC) knew about worms from humans. Roman physicians including Celsus (25BC-AD 50) and Galen (Galenus of Pergamon, AD 129 to 200) were familiar with the human roundworms. *Ascaris lumbricoides* and *Enterobius vermicularis* and tapeworm. Paulus Acgineta(AD 625

to 690) clearly described *Ascaris*, *Enterobius* and tapeworms and gave good clinical descriptions of the infections they caused.

The science of helminthology really took off in the 17th and 18th centuries following the reemergence of science of scholarship during the Renais-sance period. Linnaeus in 1771 gave accurate descriptions of the helminthic parasites and named six helminth worms, *Ascaris lumbricoides*, *Enterobius* vermicularis, *Gordius medinensis (Dracunculus medinensis), Fasciola hepatica, Taenia solium* and *Taenia lata* (*Diphyllobothrium latum*). Lambl in 1859 first discovered the parasite, *E. histolytica* and Friedrich Losch in 1875 proved its pathogenic nature. Schaudinn in 1903 differentiated pathogenic and non-pathogenic types of amoebae.

Giardia holds a special place in the science of parasitic protozoology because the parasite was the first parasitic protozoan of humans seen by Antonie Van Leeuwenhoek in 1681 interestingly, associated by him with his own loose stools. But his illustrations were not very informative and the first good illustrations of *Giardia* were given by Lambl in 1859.

Ascaris lumbricoides, the large roundworm is one of the worms listed and named by Linnaeus. Ascariasis is an ancient infection and *A. lumbricoides* eggs have been found in human coprolites from Peru dating from 2277 BC and Brazil from about 1660 to 1420 BC. In the old world, there are records of *A. lumbricoides* in a middle kingdom Egyptian mummy dating from 1938 to 1600 BC. Stewart in 1916 and Ranson and Foster in 1917 demonstrated the lung migration of *A. lumbricoides* in the host.

Human hookworm infections have been associated with humans in the old world for over 5,000 years. Hookworms were found in a human in 1938 by the Italian physician Angelo Dubini and the connection between the worms and disease was finally established by Wilhelm Griesinger in 1854. Loss in 1898 established the cutaneous route of infection and the migration through the host of *A. duodenale* and *S. stercoralis*.

Trichinella spiralis was described in humans by Paget in 1835. At the same time Owen described the larval stage of *T. spiralis*. Leuckart between 1855 and 1884 described the life cycles of *T.spiralis*, *T. saginata*, *S. stercoralis* and *Enterobius* vermicularis.

The scientific study of the taeniid tapeworms especially *T. saginata* and *T. solium* of humans can be traced to the late 17th century. Tyson was the first person to recognize the head (scolex) of the tapeworm and his subsequent descriptions of the anatomy and physiology of the adult worms laid the foundations for our knowledge of the biology of the taeniid tapeworms of humans. Georze in 1782 differentiated *T. saginata* and *T. solium* and made the first accurate description of *T. trichiura*.

- Peacock in 1828 discovered *Trichinella* in human flesh and in pigs by Leidy in 1846.
- Donne in 1836 found *Trichomonas vaginalis*
- Busk in 1843 found *Fasciolopsis buski*.
- Bilhartz in 1851 found *Schistosoma haematobium.*
- Gross found the first human amoeba, *Entamoeba gingivalis* in 1849.
- Malmsten in 1856 recognized the first human protozoan parasite *Balantidium coli*.
- Davaine in 1860 found *Trichomonas hominis.*
- Bancroft in 1876 found *Wucheraria bancrofti.*
- Kerbert 1878 found *Paragonimus westermani.*
- Thomas in 1883 gave a detailed description of the life cycle of *F. hepatica*.
- Leishman in 1900 discovered *Leishmania donovani*, the cause of kala-azar.
- Forde in 1901 discovered *Trypanosoma gambiense,* the parasite producing African sleeping sickness.
- Chagas in 1907 detected *Trypanosoma cruzi*, the etiologic agent of American trypanosomiasis.

3.2 Literature Review in the Global Context:

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

In 1966, Lee and Lee studied on case report on human infection of *H. diminuta* in Korea and reported human infection of *H. diminuta* for the first time.

In 1978, Singh and Chib worked on prevalence of intestinal parasite and haemoglobin level in school children in Ambala Cantt. A total of 474 stools samples were collected from the school children and examined for intestinal parasites. 155(32.7%) samples were found to be positive for some parasites. Among intestinal parasites roundworm was found to be most prevalent parasite i.e. 12.7% followed by hookworm 8.4%, *H. nana* 6.1%, *G. lamblia* 5.9%, *E. histolytica* 1.7%, *E. vermicularis* 1.3%, *T. trichiura* 1.1%, *S. stercoralis* 0.4% and 0.2% of tapeworm.

In 1981, Datta collected stool specimens of 2493 pre-school children of lower socio-economic condition. Out of them 17.4% of Giadiasis, 9.6% of Ascariasis, 7.9% of *H. nana*, 2.9% of Amoebiasis, 2.7% of Ancylostomiasis, 2.6% of *E. vermicularis*, 1.4% of *T. trichiura* and 0.9% of *taenia*sis was recorded.

In 1986, Develoux, Mouchet and Labo worked on intestinal parasitic diseases of school children in the republic of Niger. Result showed high prevalence of amoebiasis in all the studied area. Giardiasis is more frequent in dry areas. As for helminthes, *H. nana* was found everywhere.

In 1991, Coskum obtained a total of 531 stool samples from primary school children of age 7-13 years in which 49% were female and 51% of were male. He found 36.9% samples positive for intestinal parasite. 12% of *A. lumbricoides*, 9% of *G. lamblia*, 7.1% *H. nana*, 6% of *E. histolytica* and 2.6% of *T. trichiura* was found.

In 1991, Rodriguez and Calderon obtained 110 stool samples from pre-school children at Tarapota (Peru) and examined for intestinal parasite. 98% had intestinal parasitosis. The most common parasites were *A. lumbricoides* 68%, T.trichiura 44%,

E. vermicularis 28%, *H. nana* 21% and *S. stercoralis* 16%. Monoprasite was present in 44% and biparasite in 42% of total samples.

In 1994, Navarrete and Torres examined a total of 219 coprological samples from primary school children of a coastal region in the province of Valdivia Chile. The most common intestinal parasites were *E. histolytica* 18%, *G. lamblia* 27.9%, *A. lumbricoides* 12.7%, *T. trichiura* 32% *E. vermicularis* 1.6% and *H. nana* 0.4%.

In 1995, Saha *et al.,* examined 221 stool samples from rural community children of Bengal below 4 years of age suffering from gastrointestinal complaints during Nov. 1992 to Apr.1994. The result showed *G. lamblia* 17.2%, *E. histolytica* 8.1%, *E. vermicularis* 12.2%, and *A. lumbricoides* 8.1% were common intestinal parasites. A significantly lower infection rate was observed in children below one year.

In 1999, Macpherson *et al.*, collected a total of 315 stool samples of school children aged 6-12 years of age from three schools in St. George's Parish, Gronada. Protozoans were found to be common than helminthes. 36% of *G. lamblia*, 12 % of *E. histolytica*, 0.41% of hookworm, 1.3% of *E. vermicularis*, 5.3% of *T. trichiura*, and 1.4% of *A. lumbricoides* was recorded.

In 2000, Stephenson, Holland and Cooper performed a study on the public health significance of *Trichuris trichiura*. An estimated 1049 million persons harbour *T. trichiura*, including 114 million preschool- age children and 233 million school-age children, the prevalence of *T. trichiura* is high and may reach 95% in children in many parts of the world.

In 2000, Zulkifli *et al.,* performed a cross- sectional study of the nutritional status and geo-helminth infections among primary school children aged 7-10 years in rural Kelantan. A total of 291 school children were examined but only 183(62.9%) fecal samples were returned for geo-helminthes infection analysis. Among them 127(69.4%) school children were positive for at least one of the 3 geo- helminthes. The most common geo-helminth was *A. lumbricoides* (62.8%) followed by *T. trichiura* (38.9%) and hookworm (12.6%).

In 2001, Hohamann, *et al.,* studied relationship of intestinal parasites to the environment and to behavioral factors in children below 15 years in Bolikhamxay province of Lao PDR. A total of 732 school children were investigated. The three soil-transmitted helminthes, *A. lumbricoides, T. trichiura* and hookworm were found with prevalence rate of 67.14%, 17.49% and 12.83% respectively. Infection rates with other intestinal parasites were negligible. Of the children investigated 56.7% harbored one and 20.45% more than one parasite. Unhygienic behavioral factors were important in increasing the probability of suffering from *T. trichiura* and *A. lumbricoides*.

In 2001, Newmann observed a longitudinal study of *Giardia lamblia* infection in north- east Brazilian children. Of 157 children followed for 3 months, 43(27.4%) were infected with *Giardia*. The organism was identified in 8.8% of all stool samples although found with similar frequency in non- diarrheal (7.4%) and diarrheal stool (9.7%) was more common in children with persistent (20.6%) than acute diarrhea (7.6%).

In 2001, Uchoa *et al.,* carried a survey on intestinal parasitism in day-care centers of Niteroi city, Riode Janairo Brazil. A total of 218 children were surveyed, 120(55%) had positive samples for intestinal parasites. Among protozoans *G. lamblia* was by far the most common species detected in 38.3% of the cases followed by *E. coli* (26.6%), *Endolimax nana* (17.5%), *E. histolytica* (11.6%), and *Blastocystis hominis* (2.5%). For the helminths, *A. lumbricoides* (30%) was the most frequent followed by *T. trichiura* (26.6%), *H. nana* (0.8%) and *E. vermicularis* (0.8%). Monoparasitism was observed in 57.5% of the positive children.

In 2002, Kaur *et al.,* examined a total of 127 children for intestinal parasites. In 59 cases (46.5%) intestinal helminthes and protozoa were demonstrated. *A. lumbricoides* (0.8%) and *T. trichiura* (2.4%) were also observed. *G. intestinalis* and *E. histolytica* were observed in 14(11%) cases each. Mixed infection was not seen in any of the cases.

In 2002, O'lorcain and Holland performed a study in the public health importance of *Ascaris lumbricoides*. The study indicated that *Ascaris* infection can affect mental processing in some school children, poor socio-economic conditions are among the key factors linked with higher prevalence of ascariasis, as are defaecation practices, geophagia, cultural differences relation to personal and food hygiene, occupational necessity, agricultural factors, housing style, school class and gender.

In 2002, Ogliari, Cesar and Passos studied about enteroparasites in student of fifth series of "Colegio Estadual de Terra Boa" Campina Grande do sul, Parana. A total of 202 stool samples were examined. 55.4% were infected by at least one parasite and the most prevalent were *A. lumbricoides*, *T. trichiura* and *E. coli* with 31.2%, 22.3% and 15.8% respectively.

In 2003, Silva *et al.*, collected a total of 187 stool specimens from children living in a developmental centers as well as those attending four day care centers and elementary schools in Uberlandia. Out of them 53(28.3%) were infected with intestinal parasites. The prevalence rates were *G. duodenalis* (38.3%), *E. vermicularis* (13.9%), *H. nana* (9.6%), *A. lumbricoides* (4.3%), *E. coli* (8.5%) and *E. harmoni* (1.1%). Children between two and seven years old presented greater prevalence rate.

In 2003, Oliveira *et al.*, collected a total of 78 stool samples from the individual of landless camping in the rural area of Urban Landia, Minas Gerais, Brazil. 51(65.4%) individuals were found to be infected 23(45.1%) children and 28 (54.9%) adults. Of whom 34(66.7%) were monoinfected, 9(17.6%) were bi-infected and 8(15.7%) were poly-infected.

In 2003, Rim *et al.*, obtained a total of 29846 stool samples of primary school children in Laos and examined for intestinal parasites. 61.9% positive samples were found. By species, the rate for *A. lumbricoides* was 34.9%, hookworm 19.1%, *T. trichiura* 25.8%, *Opisthorchis viverrrini* 10.9%, *Taenia* spp. 0.6% and *Hymenolepis* spp. 0.2%.

In 2003, Wilai observed a total of 106 stool samples from an orphanage in Pathum Thani province. There were 86 individuals (81.1%), 45 males and 41 females, infected with at least one parasite. Interestingly, most of the parasites identified were

protozoans. *Blastocystis hominis* was found at the highest prevalence (45.2%). The infection caused by *G. lamblia* was 37.7% and *E. histolytica* was 3.7%.

In 2003, Tchuente *et al.,* examined a total of 1600 children attending five schools in Loum. Prevalence of *S. haematobium* was 62.8%, *T. trichiura* was 47.7%, *A. lumbricoides* was 65.5% and hookworm was 1.4%. Most children were infected with at least one of these four species.

In 2004, Adedayo and Nasiirao collected a total of 3752 stool samples and examined for intestinal parasites. Parasites were found in 393 stools samples. The main parasites were *E. coli* 1.4%, hook worm 1.5%, *G. lamblia* 1.4% and *S. stercoralis* 1.0%. The result showed intestinal parasites are still endemic in Dominica.

In 2004, Anantaphruti *et al.,* observed the prevalence of soil– transmitted helminthic infection and health behaviors among school children, and community members in a west central border area of Thailand. The intestinal helminth infection rate of the school children was 15.6%. Hookworm infection was the most prominent (9.8%), followed by *T. trichiura* (6.2%) and *A. lumbricoides* (2.2%). The community showed higher prevalence rate and was infected six more types of intestinal helminthes than school children.

In 2004 , Naish, Mc Carthy and Williams studied the prevalence, intensity and risk factors for soil-transmitted helminth infection among school children aged 5-9 years attending a primary school in a South Indian fishing village . 184 (92.6%) of 204 children were infected with one or more soil-transmitted helminth parasites. The predominant parasite was *A. lumbricoides* (91%), followed by *T. trichiura* (72%) and hookworm (54%). The prevalence and intensity of *A. lumbricoides* infection was higher among younger children than older children.

In 2004, Astal determined the prevalence of intestinal parasites in 1370 children in Khan Younis Governorate, Gazatrip. The age of the children was from 6-11 years. The general prevalence of parasites was 34.2%. *A. lumbricoides* seemed to be most common parasite (12.8%) where as *G. lamblia* had a prevalence of 8.0%, *E. histolytica* 7.0%, *E. coli* 3.6% *T. trichiura* 1.6% and *H. nana* 1.0%.

In 2004, Zakai collected a total of 231 stool samples from the school children in Jeddah, Saudi Arabia and examined for intestinal parasites. Of the 231 samples only 22(9.5%) samples had parasites. *G. lamblia* was the most reported parasite. Double infection was seen in only 3 samples.

In 2004, Baldo *et al.,* collected a total of 284 stool samples from children living in residential institutions in Metro Manila the Philippines and examined for intestinal parasites. It was found that 62.0% of the children examined were positive for one or more intestinal parasites. Multiple infections were observed in 34.2% of the children. 47.7% were found to be harboring parasitic protozoa.

In 2004, Chaudhry, Afzal and Malik found prevalence of gastro- intestinal parasites in 15 years old children in Muzaffarabab city. The total infection was 29.26%. Protozoal infection was higher than helminthes infestation. Prevalence of *G. lamblia* (11.8%) was higher than *E. histolytica* (95.9%). *A. lumbricoides* (3.8%) was the most prevalent helminth followed by hookworm (2.4%). Prevalence of all other helminthes namely *E. vermicularis*, *T. trichiura*, *H. nana* and *T. saginata* ranged from 1.0 to 1.7 %. Mixed infection was seen only in 3.1% children. Rural child had higher prevalence of parasites than children living in city but the difference was statistically significant.

In 2004, Ozurk, conducted a study to determine the parasitic infection rate in children in post–disaster situation year after earthquake in Duzce. Two populations living and studying in different socio-economic condition as a result of the earthquake were compared. A total of 326 stool samples were collected from children living and studying in transitory houses and classes and a total of 127 stool samples from children living in normal house and studying in normal school classes. In group (I) *G. lamblia* cysts were obtained in 10.4% and in group (II) 3.1%.

In 2004, Park, *et al.,* carried a survey to observe status of intestinal parasitic infections among children in Bat Dambong, Cambodia. A total of 623 feacal specimens were collected and examined for intestinal parasites. The overall infection rate was 25.7%. The infection rates of helminthes by species were as follows: hookworm 3.4%, *H. nana* 1.3% and Rhabditis 1.3%. The infection rates of protozoans by species were as

follows: *E. coli* 4.8, *G. lamblia* 2.9% and *E. histolytica* 0.8%.

In 2004, Singh *et al.,* collected a total of 1010 stool samples from Pri-school going children between the age group of 5-10 years in Manipur. A total of 248 (24.5%) were positive for various helminthes. Among them *A. lumbricoides* was the most common (19.6%) followed by *T. trichiura* (2.18%) and *H. nana* (0.99%).

In 2005, Barbosa *et al.,* compared the prevalence of intestinal parasitosis in school children from rural zone of the municipality of Uber Landia, stage of Mina Gerais. The overall prevalence rate was 35.0% in 2001 and 38.5% in 2003. *G. lamblia* was the most prevalent species in both years.

In 2005, Kabatereine and Tukahebwe collected a total of 20185 stool samples from school children of 271 schools in Uganda and examined for soil–transmitted helminthiasis. The overall prevalence of *A. lumbricoides*, *T. trichiura* and hookworm was 6.3%, 5.0% and 43.5% respectively.

In 2005, Andy and Ataikiru collected a total of 1351 stool specimens from school children in Ethiope East Local Government Area, Delta State, Nigeria. 739(54.70%) of the subjects were infected by soil transmitted helminths. The overall prevalence by species were *A. lumbricoides* (48.41%), hookworm (29.76%) and *T. trichiura* (17.39%). 174(12.88%) were infected with two or more STHS. Males (60.81%) were generally more infected than females.

In 2005, Astal *et al.,* performed a survey of intestinal parasites among children in Khan Younis governorate, Gaza trip, Palestinian Authority. A total of 1370 stool samples were collected from the child of the age 6-10 years. General prevalence of intestinal parasites was 32.4%. *A. lumbricoides* was found to be the most common parasite (12.8%) followed by *G. lamblia* (8.0%), *E. histolytica* (7.0%), *E. coli* (3.6%), *T. trichiura* (1.6%) and *H. nana* (1.0%)

In 2005, Culha, Campolat and Gulbol collected stool samples from the students of four different special day time nursing home and day centers in Antakya. The prevalence of intestinal parasites was found in 109 students. For this reason 86 faeces

and 109 cellophone tape preparation were investigated. One or more parasites were detected in 18 (20.93%) out of 86 concentrated faecal specimens. Eight (7.40%) *E. vermicularis* were detected in 109 cellophone tape specimen.

In 2005, Culha, Sangum, and Incecik, collected a total of 561 fecal specimens from the children aged between 0-14 presenting at the laboratory of parasitology of the Mustafa Kemal University Medical School. Out of them 104 samples contained one or more intestinal parasites including *G. intestinalis* 4.27%, *E. histolytica* 1.64% and *T. sanginata* 0.53%.

In 2005, Gunduz examined a total of 3216 stool samples of children with gastro-intestinal symptoms associated with socioeconomic conditions in Manisa region. The most common parasite was *G. intestinalis* (40.1%) followed by *E. coli* (10.2%).

In 2005, Hung *et al.,* performed a program to control intestinal helminth infections in an ethnic minority commune in southern Vietnam. Based on the stool surveys, mass treatment of children below 17years showed 28.6% of children were found to be infected. Hookworm being the most common (23%) followed by *T. trichiura* (1.9%), *H. nana* (1.9%) *E. vermicularis* (0.9%), *A. lumbricoides* (0.5%) and multiple kinds of helminthes (0.5%).

In 2005, Uga *et al.,* studied intestinal parasitic infection in school children in a Suburban area of Honoi, Vietnam. Of the 217 school children involved in this study, 166(76%) were positive for at least one of nine species of parasites (six helminthes and three protozoans). Among the helminth parasites, *T. trichiura* (67%), *A. lumbricoides* (34%) and hookworm (3%) were detected. In the case of protozoan parasites *E. coli* (8 %) was the most frequently detected followed by *E. histolytica* (2%).

In 2005, Goz, Aydin and Tuncer performed a study on distribution of intestinal parasites in children ranging from 6-14 years old coming from 23 Nisan Pri. school in Hakkari. A total of 114 stool samples from 60 males and 54 female students were examined. One or more intestinal parasites were found in 66(57.8%) children. *G. intestinalis* (28.9%) and *A. lumbricoides* (6.14%) were most prevalent parasites.

In 2006, Amanda *et al.,* collected a total of 222 stool specimens from school children living in a Suburban community of Porto Alege, RS, Brazil. Among them 102(79.9%) had positive samples for intestinal parasites. The age group from 12-14 years old showed the largest number of infected individuals (58.5%). *T. trichiura* (42/102), *A. lumbricoides* (37/102), *E. coli* (10/102), *H. nana* (6/102) and *E. vermicularis* (5/102) were common parasites observed.

In 2006, Mekhlafi *et al.,* performed a cross-sectional study of the prevalence and distribution of soil-transmitted helminthiases among Orang Asli children living in peripheral selangor, Malaysia. A total of 281 fecal samples were examined. All the children were infected with soil transmitted helminthes. 26.3% of the children infected either with *A. lumbricoides, T. trichiura* or hookworm and 72.6% having mixed infection. The overall prevalence of *A. lumbricoides, T. trichiura* and hookworm were 61.9%, 98.2% and 37.0% respectively.

In 2006, Mucide performed a study on distribution of intestinal parasitic diseases in the Southeast Anatolian region of Turkey. A total of 4470 stool samples were collected and examined for intestinal parasites. 41.8% of men, 44.3% of women and 32.2% of children aged 0-59 months were found positive for intestinal parasites. The most common parasites were *G. intestinalis* (18.1%), *E. coli* (11.8%), *A. lumbricoides* (4.8%), *T. trichiura* (4.5%) and *H. nana* (3.9%).

In 2006, Mustafa carried out a school based deworming program from 2001-2005 which indicated that intestinal helminthes infection was endemic among school children with a prevalence of 80% in shanty town schools and 53% in apartment district schools in Sanliurfa Province, Turkey. *A. lumbricoides* was the most frequently detected helminthes (45%) followed by *T. trichiura* (25-30%), *H. nana* (10-15%) and *Taenia* species (5%). Also school children were very much affected by nutritional deficiencies such as prevalence of stunting (24%), underweight (25%) and an anaemia(45%).

In 2006, Naggar *et al.*, detected protozoal parasites in the stools of diarrhoeic patients using different techniques. A total of 300 children were selected. A total of 180

apparently healthy children were selected. The rate of infection by the enteric

protozoa detected by the four techniques revealed that *G. lamblia* reached (11.0%), *E. histolytica* (33%), *E. coli* 7.3% and *C. parvum* (3%).

In 2006, Soldan, *et al.,* studied intestinal parasitism in Peruvian children and molecular characterization of cryptosporidium species. Fecal samples of 489 children were examined. The general prevalence of intestinal parasitosis was found to be 68%. The most frequent pathogenic enteroparasites were *G. lamblia* (26.4%), *H. nana* (2%) *H. diminuta* (1.6%). Multiple parasitism was frequent, 45.6% of the children presenting two, three and four intestinal parasites.

In 2006, Patel and Khandekar collected a total of 436 students of 9-10 years of age of the Dhahira region of Oman. The prevalence of intestinal infection was 38.7%. The prevalence of protozoan infection was 36% while helminth infection was 9.4%. The prevalence of *E. histolytica* was 24%, *Giardia* species 10.5% and E. coli 1.4%. The hookworm, *A. lumbricoides*, *T.trichiura*, *H. nana*, *Taenia* spp *E. vermicularis* and *S. stercoralis* infections in this study had very low prevalence.

In 2006, Celik *et al.,* observed incidence of intestinal parasites among school children in Malatya. A total of 1833 students were examined. Parasitic infection was observed in 415(22.5%). The highest rate of 10.6% was that of *E. vermicularis*. The rates of *G. intestinalis*, *E. coli*, *Blastocystic hominis*, *Taenia* spp, *H. nana*, *T. hominis*, *A. 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, intestinal parasites are important among primary school children in Malatya and it seems that there is a relationship between socioeconomic conditions and rate of intestinal parasites.

In 2007, Sadaga and Kassem evaluated the prevalence of intestinal parasites and some hygienic factors in primary school children in Perna District, Libya. A total of 1039 stool samples were examined. 31% of total was infected at least one or two parasites. These parasites were *G. lamblia* (12.7%) *B. hominis* (6.7%), *E. histolytica* (6.6%), *E. coli* (3.2%), *E. hartmanni* (1.0%), *E. vermicularis* (0.6%), *A. lumbricoides* (0.1%)and *H. nana* (0.1%).

3.3 Literature Review in Context of Nepal

In Nepal, studies on intestinal parasites both protozoan and helminth parasites are not very old. During last few decades information about intestinal parasites have been reported by various native and foreign workers.

Baczynska was the first man, worked on the helminth parasites of Nepal. In 1914, he gave the earliest report on the helminth parasites of Nepal from Kathmandu. He concluded that human intestinal infection due to various types of parasites is very common in Nepal due to poor sanitation.

Sharma, was the first Nepali, worked on the intestinal parasites of Nepal specially roundworms and their infestations in 1965. He collected a total of 976 stool samples from adults and 820 from children of both sexes in Bhaktapur and examined for intestinal parasites. The result showed that 32% of adult males, 44% of adult female and 49% of children were found to be infected with parasites. This gave the overall incidence of 40% of respondents with the parasites. Among them 40% of *A. lumbricodes*, 2.56% of *T. trichiura*, 1.49% of *A. duodenale*, 1.62% of *G. lamblia*, 0.92% of *Taenia* spp and 6.86% of *E. histolytica* were reported.

In 1971, Sharma and Tuladhar carried out a study on intestinal parasites amongst auxiliary health worker's student in Kathmandu. They found 85.5% of total sample infected by different types of infections. The commonest infection found was *A. lumbricoides* followed by hookworm. The incidence of *T. trichiura* and *E. vermicularis* was very low.

In 1975, Soulsa carried out a survey on the prevalence of intestinal parasites in Pokhara. He found a very high incidence of intestinal parasites.

In 1981, Gurubacharya and in 1983, Shrestha discussed the problem of soil-transmitted helminthiasis in Nepal.

In 1985, Sharma reported 73.92% prevalence of intestinal parasites from primary school.

In 1986, Rai and Gurung collected 200 stool samples from high school level students of Birgunj City. Out of 200 samples different types of parasites were found in 138(69.0%) cases. The parasites found included both helminthes and protozoans. The most prevalent parasite was *A. lumbricoides* (3.5%) and least prevalent parasite was *G. intestinalis* (5%). Mixed infections were also seen.

In 1990, Gianotti collected a total of 209 stool samples of elderly people of Kathmandu valley and a total of 22 stool samples from children of Solukhumbhu region and examined for intestinal parasites. Result showed that 12.0% *Ascaris*, 3.3% *Trichiuris*, 0.5% *H. nana* and 0.5% *T. solium* in case of helminthic infection and *G. lamblia* 8.6%, *E. histolytica* 5.7% in case of protozoa. *Blastocystis hominis* was the most prevalent protozoan present at 24.9% in case of elderly people. Among 22 stool samples examined *G. lamblia* was found most prevalent percentage 31.8% followed by *Ascaris* 35% and tapeworm 4% in case of the children.

In 1995, Rai *et al.*, carried out a survey on status of intestinal parasitoses at TU teaching hospital. A total of 6837 fecal samples were examined. The positive rate of intestinal parasitoses was seen to be varing from 29.1- 44.2%. Children were found to be more infected that adult. Among the helminthes *A. lumbricoides* was the commonest followed by hookworm and whipworm respectively. Among protozoan parasites, *G. lamblia* was the commonest followed by *E. histolytica*.

In 1998, Reddy, Boundhankar and Shina carried out study on intestinal parasites among children at Bharatpur, Nepal. A total of 211 children attending the OPD of Bharatpur hospital were examined. The most prevalent was *A. lumbricoides* (21.8%) followed by *G. lamblia* (13.5%), *E. histolytica* (12.8%), *H. nana* (7.1%), Hookworm (6.2%), *T. trichiura* (5.2%), and *E. vemicularis* (2.8%). Mixed infection was seen in few children.

In 1999, Rai and Rai carried out a study on *Ascaris*, ascariasis and its present scenario in Nepal a hospital-based study. The study showed approximately 35% of case positive for Ascariasis. Investigation has shown a significant impact of ascariasis on various nutritional parameters among Nepalese. Therefore *A. lumbricoides* appears to

constitute on of the major causes of public health problem in Nepal.

In 2000, Chand carried out a study on aetiological agents of diarrhoeal diseases in children in Kanti Children Hospital. A total of 272 stool specimens were examined. The prevalence of intestinal parasites was found 27.94% within total parasitic infestations. Intestinal protozoan were (16.91%) and helminthes (11.0%). *E. histolytica* was found the most prevalent 6.62% followed by *G. lamblia*, *C. parvum* and *cyclospora* 5.88%, 2.94% and 1.47% respectively. Within the helminthic nematodes, *A. lumbricoides* showed as main causative agent constituting 6.62%, hookworm and *T. trichiura* followed as the prevalent rate by 3.31% and 1.10% respectively.

In 2000, Rai *et al.*, performed a study on contamination of soil with helminth parasites eggs in Nepal. Soil contamination is the main cause of helminth infection to man. The prevalence was uniform in Kathmandu valley (36.9%) and outside of the valley (35.3%). A mean of six helminth eggs per sample were detected out of which more than half were embryonated. In Kathmandu valley soil contaminating rate was higher (48.3%) during wet season compared with that observed in dry season (33.3%) but with out significant difference. Altogether five species of nematode (*A. lumbricoides*, *Toxocara* spp, *T. trchiura*, *Capillaria* spp and *Trichostrongylus* spp) and two spp of cestoda (*H. nana* and *H. diminuta*) were recorded.

In 2000, Shrestha collected a total of 872 samples from children aged 0-10 years in Bhaktapur and Kanti Children Hospital and examined for intestinal parasites. The rust showed both protozoan and helminth parasite in stool samples. Among protozoan prasites *G. lamblia* was the most prevalent followed by *E. histolytica* and among helminthes, *A. lumbricoides* was the most prevalent followed by *T. trichiura*, hookworm and *H. nana*.

In 2000, Yong *et al.*, investigated the status of intestinal parasite infections in two villages of Chitwan district, Nepal. A total of 300 stool samples from school children were examined. The total prevalence rate was 44.0%. Females are more infected than males in this study. The most prevalent parasite was *E. coli* (21.0%) followed by *G.*

lamblia (13.7%) and other (5.3%) incase of protozoa. Hookworm (13.0%) was the most prevalent among helminthes followed by *T. trichiura* (3.0%) and others (5.0%). 43(14.3%) and mixed infection.

In 2001, Pradhan carried out a survey on prevalence of intestinal helmihth parsites in Magar and Majhi children of Pragati Nagar VDC of Nawalparasi. A total of 240 stool samples of different age groups and sex of Magar and Majhi children were collected and examined for intestinal parasites. The overall Sintestinal helminth prevalence was 32.08%. The prevalence of *A. lumbricoides* was 18.33%, *T. trichiura* 5.0%, hookworm 5.0%, *Taenia* spp. *0*.83%, *H. nana* 2.92%. The prevalence of intestinal helminth parasites was higher in Magar children (35.50%) than Majhi children (23.94%).

In 2001, Shrestha studied on intestinal parasitic infection in healthy school children on Lalitpur district. Stool samples of 515 healthy urban and rural school children of 7-12 year age group were collected. Among them 81.94% of children were found to be infected with parasites i.e. 73.45% in rural and 71.66% in urban children.

In 2004, Uga *et al.,* detected parasites from diarrhoeal stool samples collected in Nepal. Intestinal parasites were investigated in 396 diarrheal stool samples collected from individuals aged 1 to 68 years. Out of them 193(49%) were positive for some kinds of parasite, altogether 15 species of parasites were detected. *G. intestinalis* was the most common parasite among protozoa whereas *T. trichiura* was the most frequently detected among helminth parasites. Of the total sample 109(56%) had single parasitic infection where as 84(43%) had multiple infections with a maximum of five species.

In 2005, Chandrashekhar *et al.,* conducted a study to estimate the prevalence of intestinal parasitic infestations among school children in Kaski District of Western Nepal. A total of 2091 stool samples were collected from children selected from 11 rural and 8 urban schools. Prevalence of intestinal parasites was 21.3%. There was a significant difference in prevalence between urban (18.7%) and rural (24.1%) school samples. *G. lamblia* (13.2%), *A. lumbricoides* (2.1%) and *E. histolytica* (1.7%) were

the commonest parasites isolated. Also, the result indicated that intestinal parasitic infestation among children is mainly water-borne.

In 2005, Pandey and Panta collected a total of 13724 stools sample and examined for intestinal parasites at Shree Birendra Hospital, Chhauni. Out of total sample, 1369 (9.97%) showed ova, cyst or larva. The most common intestinal parasite was *Giardia* which was positive in 653 (47.69%) cases followed by *E. histolytica* (15.48%), *Ascaris* (14.17%) and the least prevalence was *S. stercoralis* (0.07%). Hence prevalence of protozoa compared to helminths was striking.

In 2005, Rai *et al.,* studied predisposing factors of enteric parasitic infection in school children in a rural area of Kathmandu valley, Nepal. A total of 340 (177 boys and 163 girls) stool samples were detected. Out of them 71.2% had parasitic infection. A total of 9 types of parasites were detected. *T. trichiura* was the most common parasite followed by hookworm and others.

In 2006, Poudyal *et al.,* carried out a survey for the control of the intestinal helminth infection in rural Nepal. A total of 1677 stool samples were collected form school-age children from 25 schools and 1014 samples from 25 communities in rural Nepal. The most common parasites were *A. lumbricoides*, hook worm and *T. trichiura*. Result revealed that the newly enrolled under 6 year old children at the schools were more widely infected with at least one of the three major helminthes than those in the communities.

In 2007, Mukhopadhyay *et al.,* studied intestinal protozoal infestation profile in persistent diarrhea in children below age 5 years in western Nepal a total of 253 children with persistent diarrhea were examined. Out of them 90(35.5%) had protozoal infections. 63(24.9%) had helminthic infections, 32(12.6%) had bacterial infections and 16 had mixed infections. *Giardia lamblia* (67.7%) was the most prevalent followed by *Entamoeba histolytica* (27.7%).

4. MATERIALS AND METHODS

4.1 Equipments and Chemicals

Microscope, Slides, Cover slip, Forceps, Needle, Globes, Tray, Cotton, Sampling bottles, Wooden applicator, Loops

Normal Saline water, 2.5% Potassium Dichromate solution, 5% Formalin solution, Iodine, Soap, Water

1) Questionnaire

The Questionnaire contained patient's name, age, sex, address, parent's occupation, food habit, drinking habit, type of drinking water used chemical symptoms etc.

4.2 Study Area

The study was carried out in the children attending OPD of the Kanti Children Hospital presenting complaints like diarrhea, dysentery, abdominal pain, vomiting, nausea anorexia, fatigue, fever, loss of appetite, fullness of stomach, respiratory infections, anemia, pneumonia, constipation, etc. It is the only government hospital for children in Kathmandu Valley.

4.3 Method

The study was mainly hospital based study so that the stool samples of children were taken at Kanti Children Hospital. The whole study was divided into two parts. First part of the study was questionnaire filling and second part was collection and examination of stool samples.

4.3.1 Sample Collection, Sample Size and Duration of Study

A total of 300 stool samples were collected from children aged 0 to 15 years. Among them, 174 (58%) were male and 126(42%) were female children. Stool samples were collected serially as patient came during the month of May 2007 to June 2007.

To ensure better condition during sample collection following precautions were taken:

- The sample vials were properly washed and dried but no antiseptic was used.
- Each sampling vial was labeled with code number like 1, 2, and 3… so on this coded as like questionnaire.
- Stool samples collected from children were examined by macroscopic and microscopic methods and were preserved in potassium dichromate solution if could not examined in fresh.
- During the study, questionnaires were distributed to those children's parents who could fill it themselves and for those who could not fill; it was filled by interviewer to record the necessary things according to the objectives of the study.

4.3.1 Stool Examination

The collected stool samples were brought at laboratory and examined by stained and unstained smear methods to observe various intestinal parasites.

I. Stained Preparation:

Stained preparation was used to conform the protozoan parasite by studying their nuclear characters. The Iodine stained preparation was used for this purpose.

Preparation of Iodine solution
It consist of,

Iodine crystal	1 gram
Potassium Iodine	2 gram
Distilled water	100 ml

Firstly, Potassium Iodide was dissolved in 100ml of distilled water and Iodine crystals were slowly added. The solution was then filtered and kept in stoppered bottle.

II. Unstained Preparation

Unstained preparation was used for identification of helminthes eggs or larval protozoan cysts and trophozoites. Freshly prepared normal saline was used this purpose.

Preparation of normal saline solution

It consists of

NaCl	40 gram
Distilled water	100 ml

40 gram NaCl was dissolved in 100 ml of distilled water. Then the solution was kept in a clean and dry bottle.

4.3.2 Macroscopic Examination

Macroscopic examination of the stool samples with the naked eyes was carried for presumptive diagnosis of several intestinal disorders by stools consistency, colour, blood, mucous contents and larva or adult worms. But it is not specific so microscopic examination was needed.

4.3.3 Microscopic Examination

Microscopic examination of stained and unstained preparation of stool samples was performed under binocular microscope firstly in 15x10 objectives and then 15 x 40 objectives.

Preparations of stool smear on normal saline and Iodine solution.

a. A slide was taken and a drop of normal saline solution was put in the middle of the left half and a drop of Iodine solution in the middle of the right half.
b. A small portion of stool sample was taken by using a wooden applicator and mixed with a drop of normal saline similarly, same stool sample was taken in next wooden applicator and mixed with a drop of Iodine solution in the slide mentioned above and made homogenous smear at both sides.
c. A coverslip was placed over each smear carefully so as to avoid air bubbles.
d. Firstly, saline preparation was examined under 15x10 objective then under 15x40 objectives and then Iodine preparation was examined in the same way.

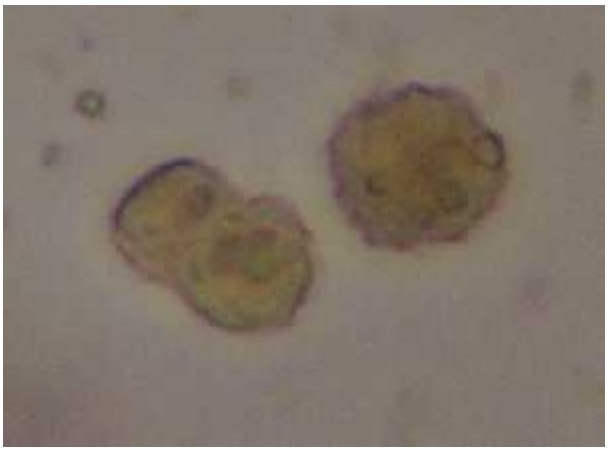
a. Kanti Children Hospital

b. Taking Interview

c. Preparation of slide

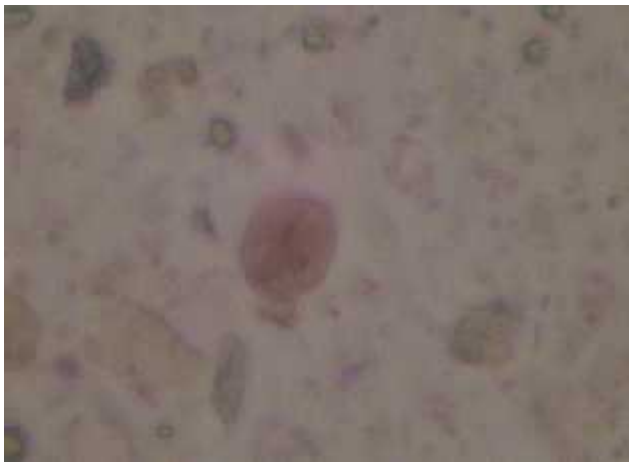
d. Microscopical observations

e. Microphotographing



f. Cyst of *E. histolytica*

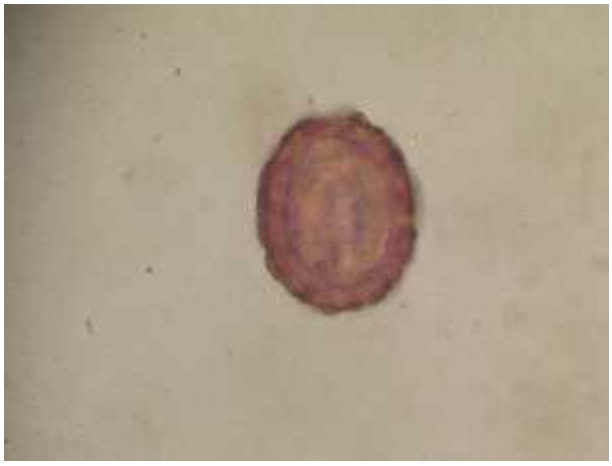
Plate.1



g. Cyst of *G. lamblia*

h. Egg of *Taenia*

i. Egg of *H. nana*



j. Egg of *A. lumbricoides*

k. Egg of Hookworm

l. Egg of *T. trichiura*

Plate.2

4.3.4 Identification

For the identification; size, shape, shell contains and external features were studied under microscope then systematic study of all characteristics of the eggs or cysts were carried out to confirm its identity.

4.3.5 Data Collection

The data were collected from laboratory data and the surveillance study by using questionnaires.

4.3.6 Classification and Tabulation

All the data were classified according to the need of the objectives and tabulation was done for summarizing the data and displaying statistically.

4.3.7 Data Analysis and presentation

The obtained data was analyzed by means of table bar diagrams and multiple bar diagrams.

5. RESULTS

A total of 300 stool samples of children of different age and sex groups visiting OPD of Kanti Children Hospital from different parts of Kathmandu and out of Kathmandu valley were collected and examined for intestinal parasites. The whole study was divided into two parts:

I. The first part of the study was conducted by means of interview and observation with the help of questionnaires containing questions regarding study topic and by observation.

II. Second part of the study was conducted by collecting stool samples from the children and examining them by macroscopic method and microscopic method under compound microscope for the intestinal protozoan and helminth parasites.

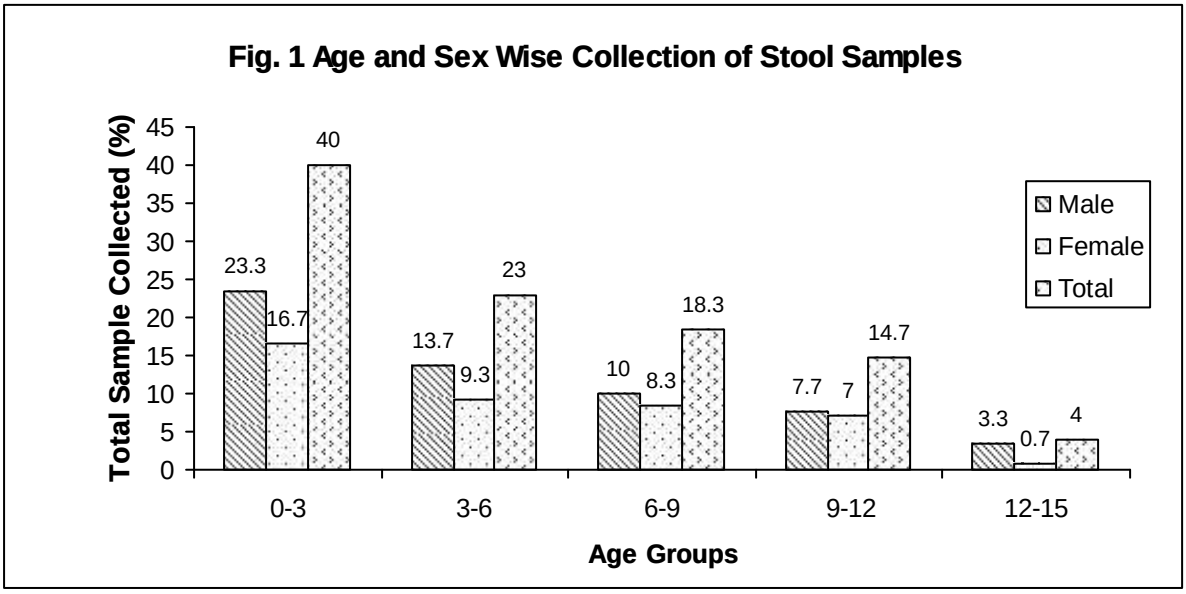
❖ Age and Sex Wise Collection of Stool Samples:

A total of 300 stool samples were collected and examined. Among them 174 were males and 126 were females and all of them were between 0-15 years age group. The lowest age of sample examined was 10 days and highest age was 15 years. By taking an age interval of 3 years the first group was between 0-3 years and the last group was 12-15 years. The maximum numbers of samples (120) were collected from 0-3 years, out of which 70(58.3%) were male and 50(41.7%) were female children. The least number of samples (12) were collected from 12-15 years age group, out of which 10(83.3%) were males and 2(16.7%) were female children (Table 1 and fig.1)

Table 1

Age and Sex Wise Collection of Stool Samples

Age group	Total No. of Samples Collected	%	No. of Samples Collected of Male children	%	No. of Samples Collected of Female children	%
0-3	120	40	70	58.3	50	41.7
3-6	69	23	41	59.3	28	40.6
6-9	55	18.3	30	54.5	25	45.5
9-12	44	14.7	23	52.3	21	47.7
12-15	12	4.0	10	83.3	2	16.7
Total	300	100	174	58.0	126	42.0



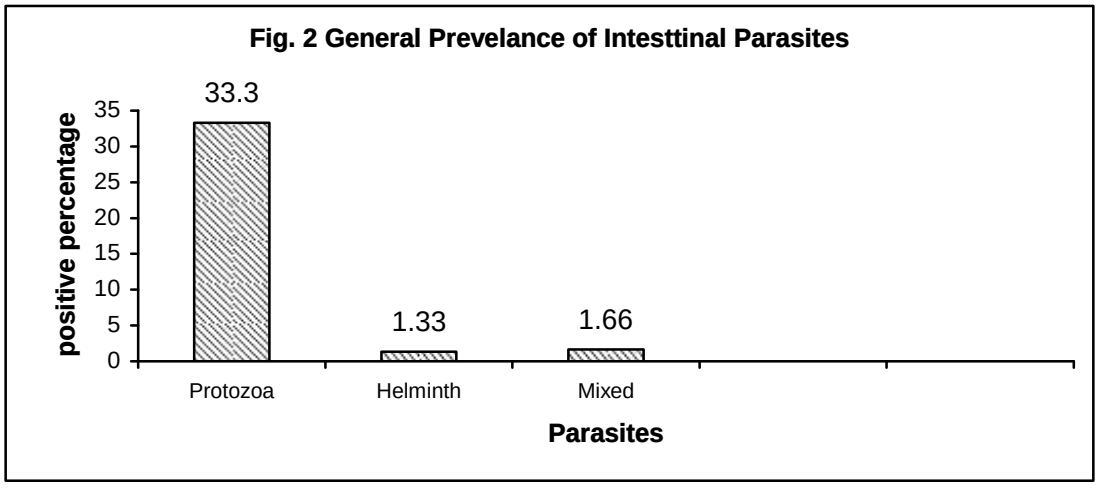
❖ **General Prevalence of Intestinal Parasites**

Among 300 stool samples examined, **109(36.3%)** were found to be positive for intestinal parasites. Among 109 positive samples, 100(33.3%) were positive for protozoan parasites and 4 (1.33%) were positive for helminthes and 5 (1.66%) showed mixed parasitic infection (Table 2 and fig.2).

Table 2

General Prevalence of Intestinal Parasites.

Total processed samples	Total positive Samples	parasites				Mixed infected samples	%
		Protozoa	%	Helminth	%		
300	109	100	33.3	4	1.33	5	1.66



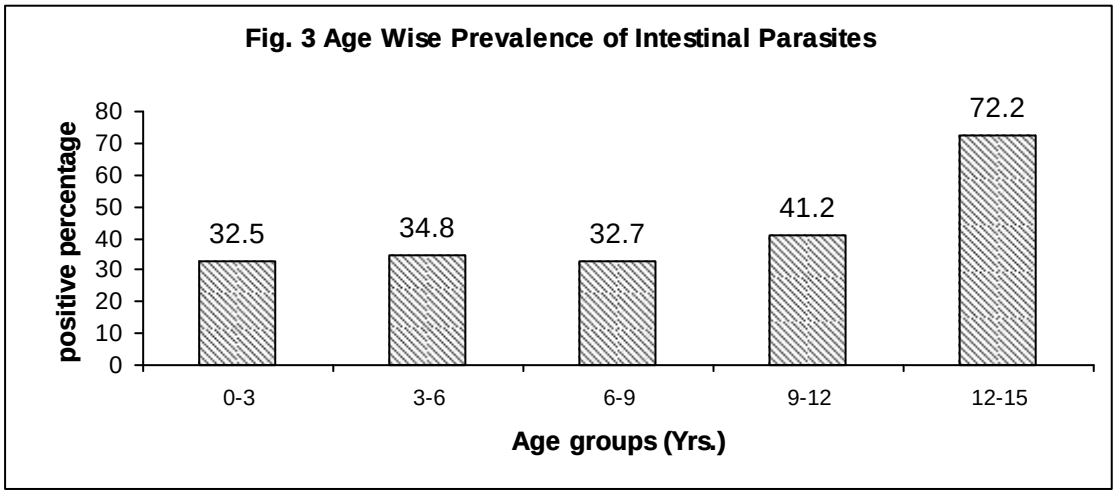
❖ **Age Wise Prevalence of Intestinal Parasites**

Among 5 age groups, the highest rate of infection 9 (72.0%) was found in the age group 12-15 years and the lowest rate of infection 39 (32.5%) was found in the age group 0-3 years (Table 3 and fig. 3).The infection rate in different age groups was found statistically to be insignificant (χ^2=22.31, df=4, P>0.05).

Table 3

Age Wise Prevalence of Intestinal Parasites

Age group(yrs)	Total No. of samples	No. of positive samples	Positive Percentage (%)
0-3	120	39	32.5
3-6	69	24	34.8
6-9	55	18	32.7
9-12	44	19	41.2
12-15	12	9	72.2
Total	300	109	36.3



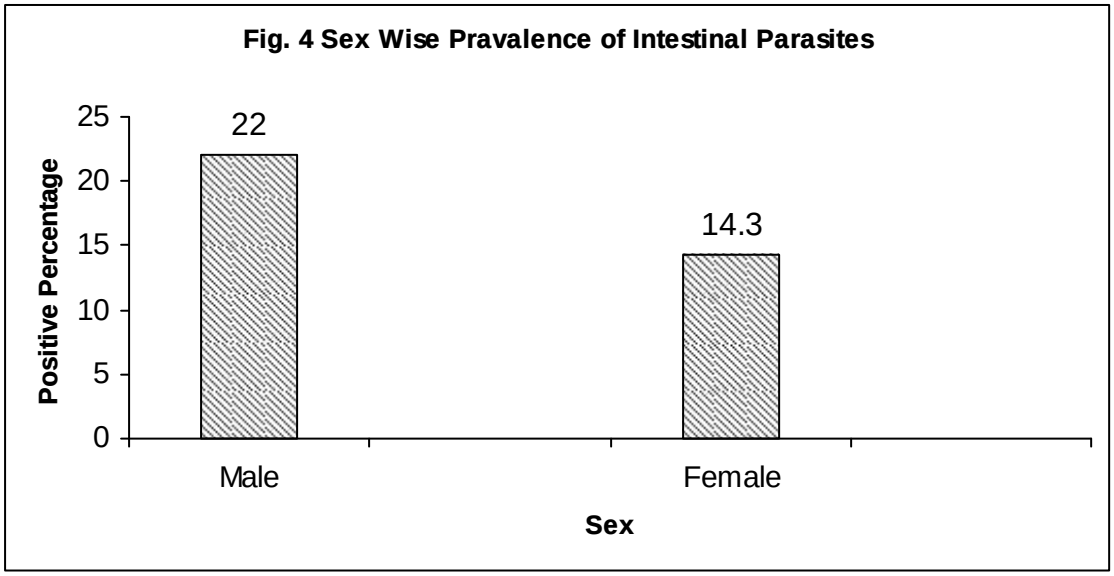
- **Sex Wise Prevalence of Intestinal Parasites**

Out of 300 stool samples examined, 174 were of male children and 126 were of female children. Among 174 male stool samples, 66(22.0%) were found to be positive. Similarly out of 126 female stool samples, 43(14.3%) were found to be positive for intestinal parasites (Table 4 and fig. 4). The infection rate was found higher in male children than female. Sex wise prevalence of intestinal parasites was found statistically insignificant (χ^2=4.48, df=1, P> 0.05).

Table 4

Sex Wise Prevalence of Intestinal Parasites

Sex	Total No. of samples	Positive cases	Percentage (%)
Male	174	66	22.0
Female	126	43	14.3
Total	300	109	36.3



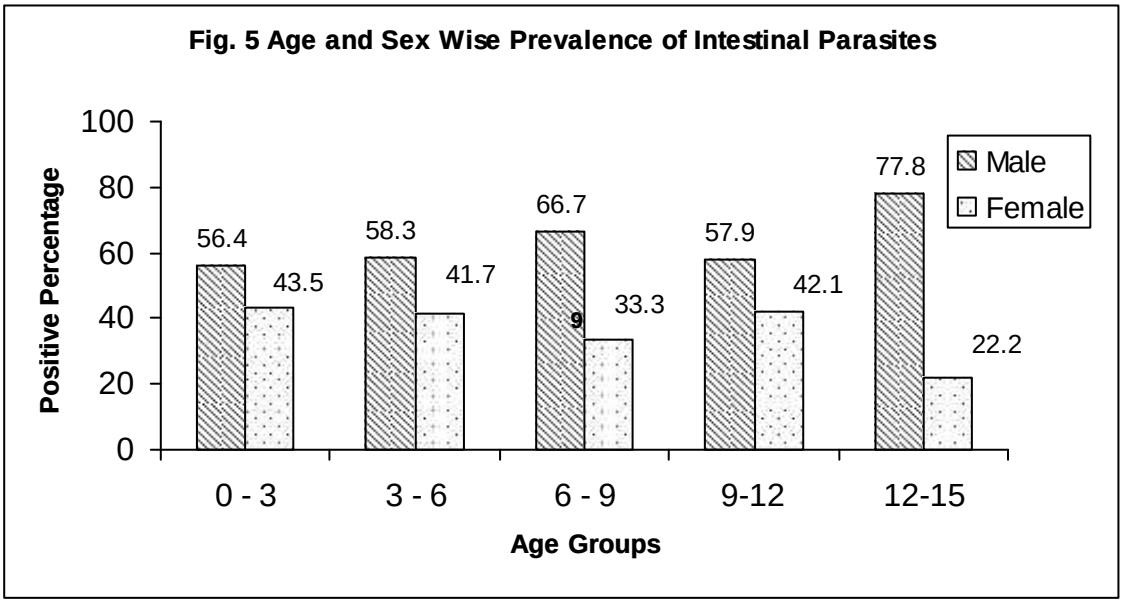
❖ **Age and Sex Wise Prevalence of Intestinal Parasites**

In case of male, the highest rate of infection 7(77.8%) was found in the group 12-15 years and lowest rate of infection 22(56.4%) was found in the age group 0-3 years. In case of female, the highest rate of infection 17(43.5%) was found in the age group 0-3 years and lowest rate of infection 2 (22.2%) was found in the age group 12-15 years (Table 5 and fig. 5).

Table 5

Age and Sex Wise Prevalence of Intestinal Parasites.

Age Group	Male Positive Samples	%	Female Positive samples	%	Total Positive samples	%
0-3	22	56.4	17	43.5	39	35.8
3-6	14	58.3	10	41.7	24	22.0
6-9	12	66.7	6	33.3	18	16.5
9-12	11	57.9	8	42.1	19	17.4
12-15	7	77.8	2	22.2	9	8.3
Total	66	60.6	43	39.4	109	100



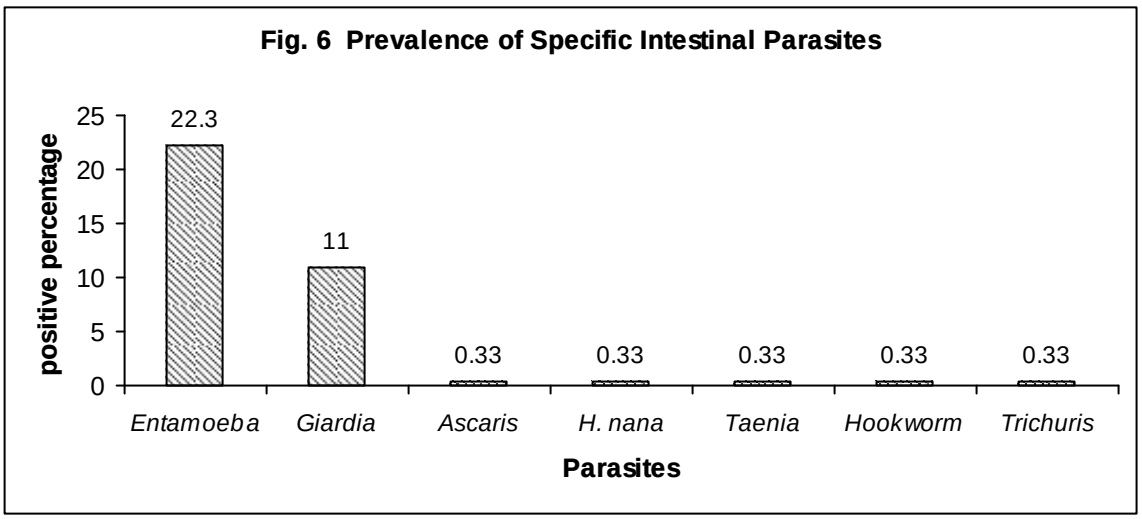
❖ **Prevalence of Specific Intestinal Parasites**

Out of 300 stool samples examined, 109(36.3%) were found to be positive for intestinal parasites. Protozoan parasites were found higher than helminth parasite. The most prevalent parasite was *Entamoeba*, 67(22.3%) followed by *Giardia*, 33(11.0%). All helminthes parasites *Ascaris*, *Taenia*, Hookworm, *Trichuris*, *H.nana* were found in same rate and it was 0.33%. Double infection was found in (1.66%) cases (Table 6 and fig.6).

Table 6

Prevalence of Specific Intestinal Parasites

Parasites	No. of Infected Male	No. of Infected Female	Total Infected	Positive Percentage
Protozoans				
Entamoeba	35	32	67	22.3
Giardia	25	08	33	11.0
Helminthes				
Ascaris	00	01	01	0.33
Taenia	01	00	01	0.33
Hookworm	01	00	01	0.33
Trichuris	01	00	01	0.33
Mixed				
Entamoeba+ Hymenolepis	01	00	01	0.33
Entamoeba+Ascaris	01	00	01	0.33
Tichuris+Ascaris	01	00	01	0.33
Giardia+Entamoeba	00	02	02	0.66



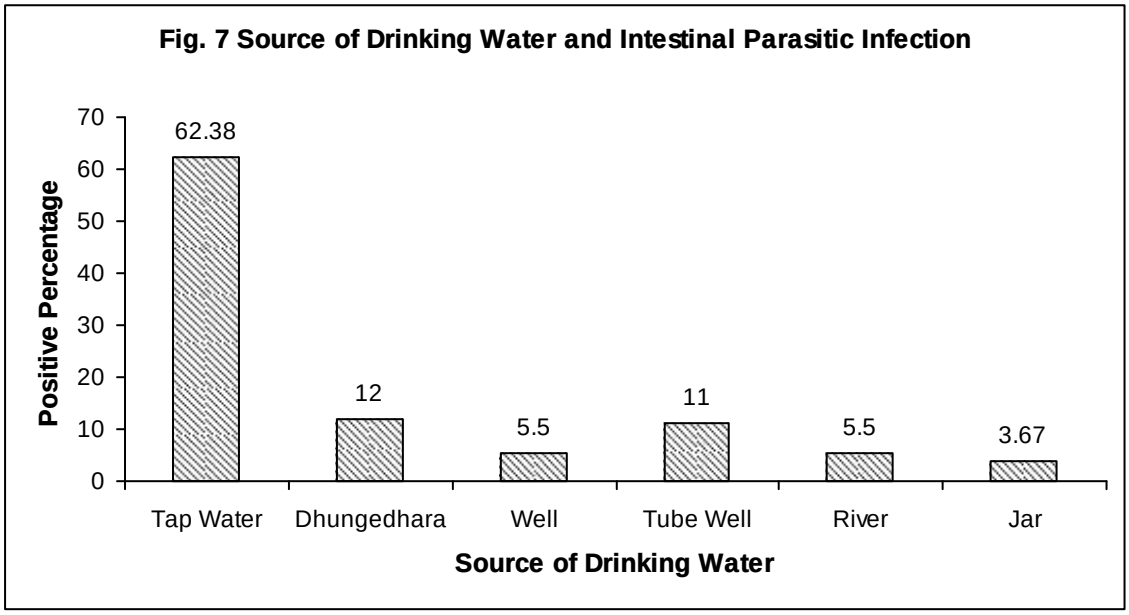
❖ Source of Drinking Water and Intestinal Parasitic Infection

With the help of questionnaire interviews were conducted in a total of 300 children's guardian. Among them, the highest rate (62.38%) of infection was found in children using tap water. The lowest rate (3.67%) was found in children using Jar water (Table 7 and fig.7).

Table 7

Source of Drinking Water and Intestinal Parasitic Infection

Source of water	Total No. of Samples collected	No. of positive cases	Positive Percentage
Tap water	158	68	62.38
Dhungedhara	50	13	12.0
Well	45	6	5.5
Tube well	20	12	11.0
River	12	6	5.5
Jar	15	4	3.67



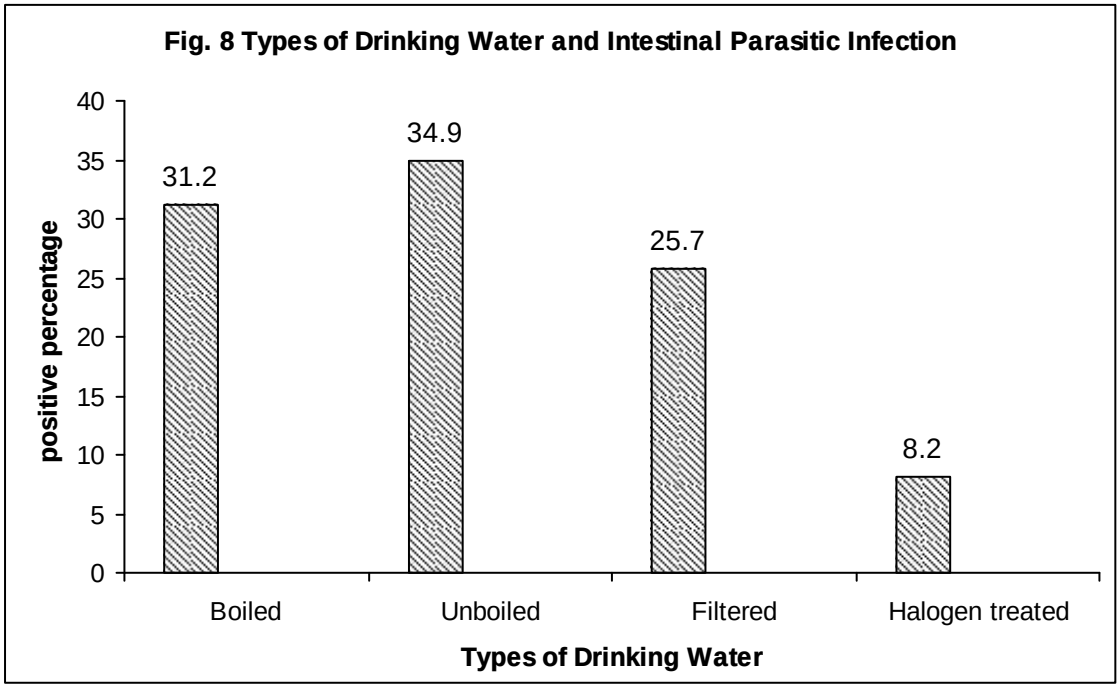
❖ Type of Drinking Water and Intestinal Parasitic Infection

Among 109(36.3%) positive cases, the highest rate (34.9%) was found in children using unboiled water and the lowest rate (8.2%) was found in children using Halogen treated water (Table 8 and fig.8). The infection rate according to type of drinking water used by children was found statistically insignificant (χ^2=18.15, df=3, P>0.05).

Table 8

Type of Drinking Water and Intestinal Parasitic Infection

Type of water	Total no. of samples collected	No. of Positive cases	Positive Percentage
Boiled	83	34	31.2
Unboiled	127	38	34.9
Filtered	50	28	25.7
Halogen treated	40	9	8.2



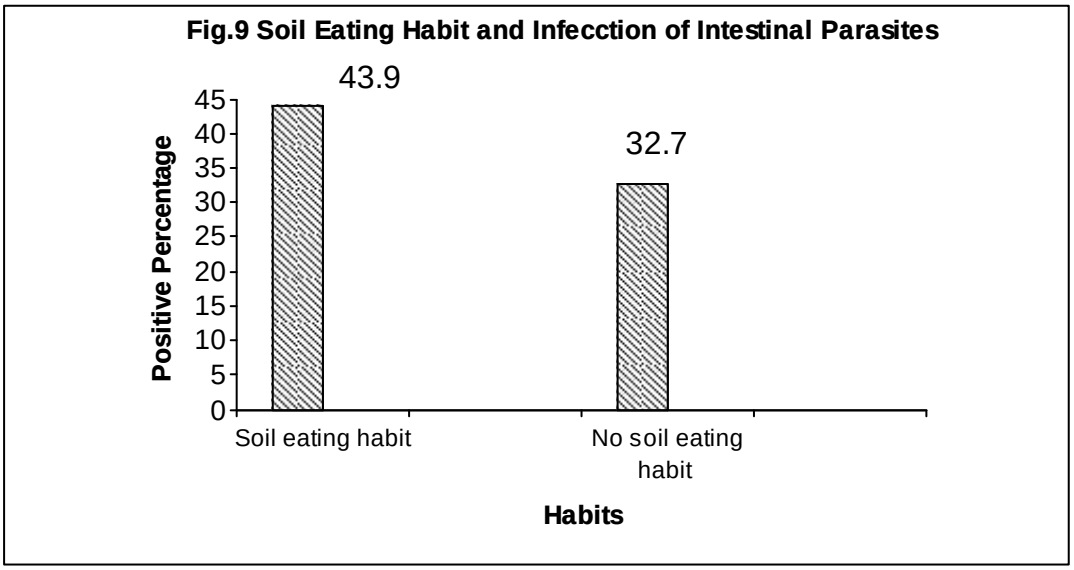
❖ Soil Eating Habit and Infection of Intestinal Parasites

Among 300 interviewed children 98 had soil eating habit among which 43(43.9%) were positive for intestinal parasites and 202 had no soil eating habit among which 66 (32.7%) were positive for intestinal parasites. The infection rate is slightly higher among children with soil eating habit (Table 9 and fig.9). But there was statistically no significant difference (χ^2=4.48, df=1, P>0.05).

Table 9

Soil Eating Habit and Infection of Intestinal Parasites

Habit	Total No. of samples collected	No. of positive cases	Positive Percentage
Soil eating habit	98	43	43.9
No soil eating habit	202	66	32.7



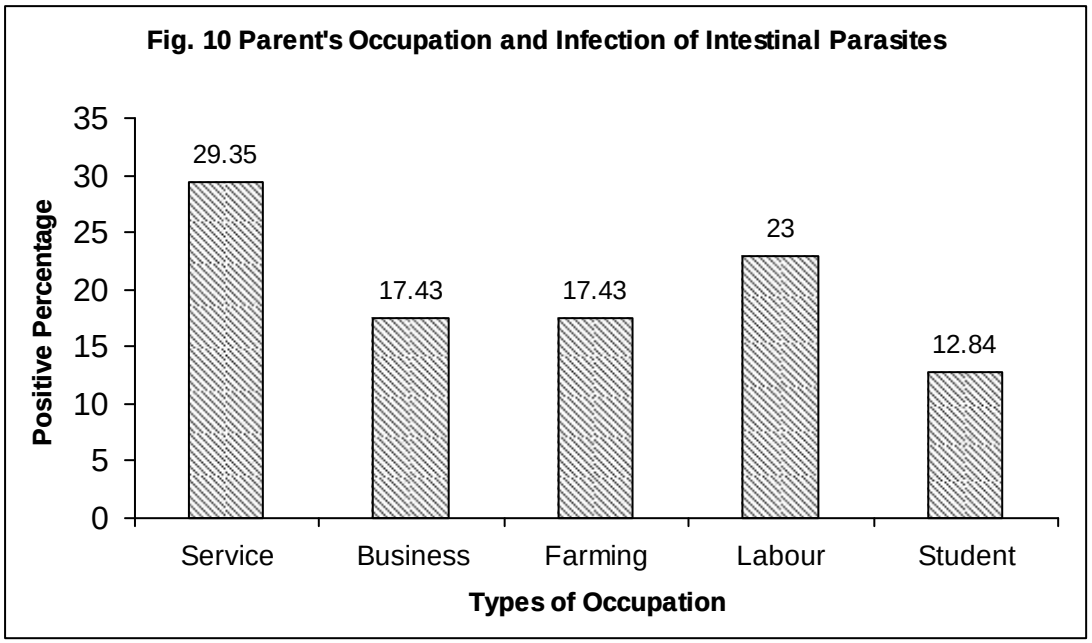
❖ Parent's Occupation and Infection of Intestinal Parasites in Children

Among 300 interviewed parents, 95(31.7%) were Job holders, 50(16.7%) were businessmen, 55(18.3%) were farmers, 66(22.0%) were labours, 34(11.3%) were students. The highest infection rate (29.35%) was found in parents with service and the lowest rate (12.84%) was found in children of parents who were students (Table 10 and fig.10). The prevalence of intestinal parasites according to the occupation of parents was found statistically significant (χ^2=8.72, df =4, P <0.05).

Table 10

Parent's Occupation and Infection of Intestinal Parasites

Occupation	Total No. of samples collected	No. of positive cases	Positive Percentage
Service	95	32	29.35
Business	50	19	17.43
Farming	55	19	17.43
Labour	66	25	23.00
Student	34	14	12.84



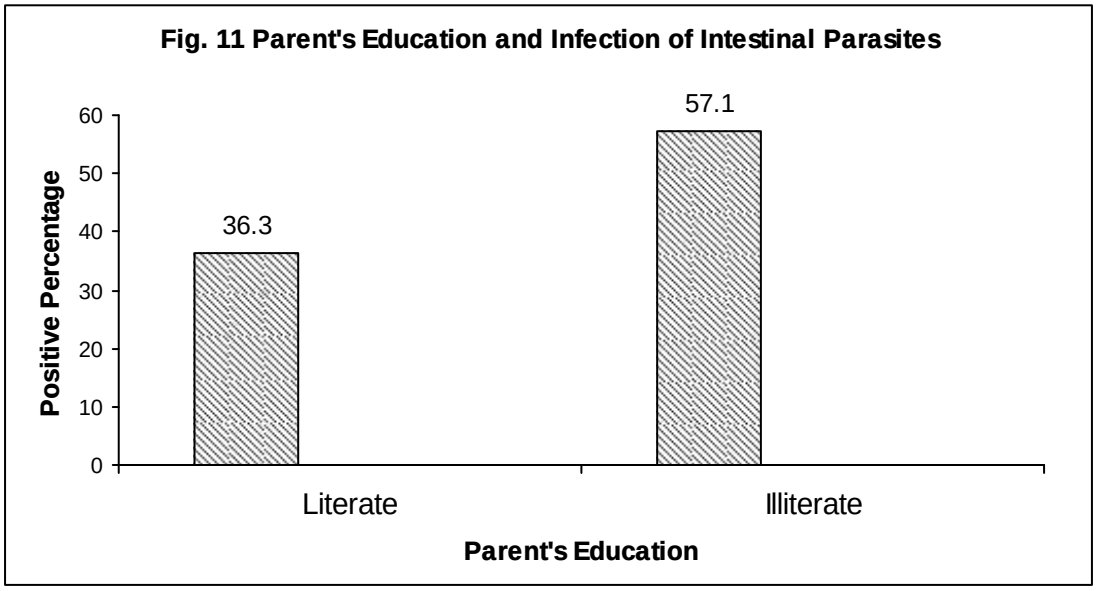
❖ Parent's Education and Infection of Intestinal Parasites

Among 300 interviewed parents, 168(56.0%) were literate and 132(44.0%) were illiterate. Infection rate was found higher in illiterate parent's children i.e. 57.1% than in literate parent's children i.e.36.3% (Table 11 and fig.11). The prevalence of intestinal parasites in children according to the education of their parents was found statistically insignificant (χ^2=1.54, df =1, P> 0.05).

Table 11

Parent's Education and Infection of Intestinal Parasites

Literacy	Total No. of samples collected	Positive samples	Positive Percentage
Literate	168	61	36.3
Illiterate	132	48	57.1



❖ Different Clinical Symptoms and Intestinal Parasites Positives Cases

Out of 109 intestinal parasite positive cases, 55 (50.4%) patients suffered from diarrhoea, 43 (39.4%) children suffered from Dysentery and 11(10.1%) children not suffered from diarrhea but had symptoms like constipation, fatique, Anorexia, Nausea, Anaemia and Abdominal pain (Table 12).

Table 12

Different Clinical Symptoms and Intestinal Parasites Positives Cases

Clinical Symptoms	No. of Positive Cases	Positive Percentage
Diarrhoea	55	50.4
Dysentry	43	39.4
Non-Diarrhoea	11	10.1
Constipation	4	3.7
Fatigue	12	11.0
Anorexia	10	9.2
Nausea	15	13.8
Anaemia	2	1.8
Abdominal Pain	28	25.7

❖ Awareness of Parasites, Their Transmission and Preventive Methods

In the present study, the awareness about the parasites to the children and their parents was found very low. No one was found to be aware about the protozoan parasites that cause diarrhea such as *Entamoeba* and *Giardia.* 118 (39.3%) were found to be aware about the helminth parasites. Among that 31 (10.3%) were aware about only *Ascaris*, 48 (16.0%) were about *Ascaris* and *Taenia* and 39 (13.0%) were aware about *Ascaris*, *Taenia*, *Trichuris* and Hookworm. But no one had knowledge about the transmission and preventive measures for helminthes.

Among 300 respondents, 205 (68.3%) had toilet and 95 (31.7%) had no toilet and used open fields for defecation.

Regarding hand wash before meals only 221 (73.7%) used to wash hands before meals and 179 (26.3%) did not wash hands before meals. Infection rate was found higher in children having no hand washing habit before meals i.e. 45 (56.9%)

6. DISCUSSION AND CONCLUSION

Intestinal parasites include both protozoan and helminthes harboring in the intestinal region of human body. Protozoan parasites are single celled and morphologically complete microscopic animalcule. The helminthic parasites are multicultural, bilaterally symmetrical animalcule that can be seen by naked eyes. Malnourished people living in poor sanitary conditions are more susceptible to intestinal parasitic diseases than the well nourished healthy once. This shows than environmental condition as well as living standard of the person plays an important role on the transmission of intestinal parasites. Beside poverty, lack of enough knowledge and conservative thinkings of the people are also main causes for the transmission of intestinal parasites in developing countries.

The study was mainly hospital based. Among 300 stool samples collected from the children of different age groups 109(36.3%) were found to be positive for intestinal parasites. 100(33.3%) harbored protozoan parasites, 4(1.33%) harbored both protozoan and helminthic parasite. This observation shows that hygiene and sanitation play an important role for the transmission of intestinal parasites because most of the parasites transmit through their ova and cyst which develop outside the body of the host i.e. in fecal infected soil, water and food children playing soil with hand and eat food which same hand without washing.

All the age groups of children can acquire intestinal parasitic disease in the present study groups and higher rate of infection was found in the age group 12-15 i.e. 72.0% which is similar with the study of Amanda, *et al*., (2006). In his study the highest rate of infection was found in the age group 12-14 years old children i.e. (58.5 %). Out of 300 stool samples 126 were from female and 174 were from male. Male children were more infected than the female children i.e. 66(37.9%) male children were infected while 43(34.1%) female children were infected. Andy, and Ataikiru, (2005) found same result as in present study. They found (60.81%) males were generally more infected than females. But statistically no significant difference was found in prevalence of intestinal parasites in between two sexes (χ^2=4.48,df=1,P>0.05).

Patel and Khandekar, (2006) surveyed the prevalence of intestinal parasites in students of 9-10 years of age at Dhahira region of Oman. The prevalence rate of intestinal parasites was 38.7%. The prevalence of protozoan infection was 36% while helminth infection was 9.4%. Among protozoans the prevalence of *E. histolytica* (24%) was higher than *Giardia* (10.5%) and *E. coil* (1.4%). The hookworm, *A. lumbricoides, T. trichiura, H. nana, Taenia, E. vermicularis* had very low prevalence.

Similarly in present study the prevalence of intestinal parasites was 36.3%. The prevalence of protozoan parasites was 33.3% while helminthes parasites were 1.33%. Among protozoans the prevalence of *E. histolytica* (22.3%) was higher than *Giardia* (11%). The hookworm, *A. lumbricoides, T. trichiura, H. nana* and *Taenia* in this study had very low prevalence (1.66%) mixed infection was seen. It may be due to utilization of drinking water from open streams, rivers and well, contaminated with high percentage of faeces, garbage due to wind or rain water.

Present study showed that the highest prevalence (62.38%) of intestinal parasites was found in tap water consuming children. This is because the water supply system of Nepal is unscientific. The untreated water of river or pond is directly supplied for drinking purpose from their source. In the rainy season, the over flooded water, the sewage water etc are contaminated with supply water. This is supported by Rai *et al.*, 2002.

Defecation near the water streams, wells and rivers also serve to contaminate the water resource responsible for parasites infection. Drinking direct water accelerates the infection due to minimum chances of contamination and transmission (Sherchand *et al.,* 1997-2001). Supporting this fact present study showed highest rate of prevalence in children having habit of drinking unboiled (direct) water i.e. 34.9% and lowest rate of prevalence (83.2%) was found in children drinking halogen treated water.

In the present study, soil-eating habit of children was also examined by questionnaire.(43.9%) children were found infected with intestinal parasites who had soil-eating habit which is greater than the prevalence of intestinal parasites with no-soil-eating habit (32.7%). There was statistically no significant difference between intestinal parasites and soil-eating habit of children (χ^2=4.48,df=1,P>0.05). This is because most of the common intestinal parasites transmit their ova or cyst which

develops in fecal infected soil, which can be mixed with water and food. Children play in soil with hand and eat food with same hand with out washing so avoiding children playing in soil could reduce incidence of infection to minimum.

The parasitic infection in children is related with the occupation of parents. The highest prevalence (29.35%) was found in children with parents having service. This may be due to lack of time to take care of their children. They have to reach in their office at the certain time and while returning back they feel tired, so they can't give time to their child in spite of their desire. The lowest prevalence (12.48%) was found in children with parents having no jobs. This may be due to having enough time to take care about their children's habits.

The parasitic infection in children is also related with the education of their parents. The highest prevalence (57.1%) was found in those children whose parents are illiterate than those children having literate parents. This may be due to lack of knowledge about the parasites, their way of transmission, preventive measures etc. in illiterate parents. So, it suggested that awareness programs about intestinal parasites must be increased to minimize its infection and transmission mostly about protozoan parasites than helminth parasites as infection rate is higher for protozoan parasites. This is also supported by Chaudhry *et al*., 2004. Statistically, no significant difference was found in prevalence of intestinal parasites with literacy of parents (χ^2=1.54,df=1,P>0.05).

In present study, 205(68.3%) respondents had toilet and 95 (31.7%) had no toilet and used open fields for defecation which helps in the transmission of parasite eggs, ova or cysts to the children.

Among 300 respondents only 221(73.7%) children had habit of washing hands before and after meals and after toilet and 79 (26.3%) didn't have such habit. The infection rate was higher in children with no hand washing habit before and after meals and after toilet i.e. 45 (56.9%). So, one of the most important ways to help prevent these parasitic diseases is to teach children the important of washing hands correctly with soap and warm water particularly after using toilet and before and after meal. Cifuentes, (2004) had also the same result. In his study a high health risk with intestinal parasites was detected among children from households with unsafe food hygiene practices and those with no hand washing habits.

7. RECOMMENDATIONS

From the present research work following recommendation is extracted for efficient prevention and control of intestinal parasites.

1.Water is the main source of transmission and spread of cyst and trophozoits. So, water should be used by boiling, filtering and using chemical like potassium, chlorine etc.

2. The mode of transmission is faeco-oral route. The faecal matter contaminates the water and soil. So, habit of defaecating at open field, on the bank of river or near the water resources should be prevented and personal or community latrine should be well managed.

3. Human excrement and night soil should not be used as agricultural fertilizer.

4. Children should not allow playing in dirty grounds as they may be contaminated with cysts.

5. There should be effective sanitary disposal of faeces and protection of water supplies from faecal pollution.

6. Walking barefoot, swimming in contaminated pools, lakes, streams should be avoided.

7. Personal cleanness and elementary hygienic conditions should be observed while taking meal and other health related activities.

8. Regular practice surveillance should be carried out to know the prevalence of intestinal parasites and should be encouraged.

9. Community health education must be introduced and classes should run to educate children in school on sanitary laws and hygiene.

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Annex-1

Questionnaire for Survey Work at Kanti Children Hospital

Name: Date:

Age: Address:

Sex: Occupation:

Religion: Literate/Illiterate:

1.Which is your source of drinking water?

a. Tap water b. River c. well d. Dhunge Dhara e. Tube well

2. What type of water do you drink?

a. Boiled b. Unboiled c. Halogen Treated d. Filtered

3. Do you use separate water supply for drinking washing, cooking etc?

a. Yes b. No

4. Do you have toilet in your house?

a. Yes b. No

5. Do you wash your hands after using toilet by soap?

a. Yes b. No

6. Do you wash your hands before meal?

a. Yes b. No

7. Do you know about the intestinal parasites?

a. Yes b. No

8. If yes, which one

a. Round worm b. Pin worm c. Tape worm d. Hook worm e. whip worm

9. Have you immunized your children?

a. Yes b. No

10. Have you given anthelminthic drug to your children?

a. Yes b. No

11. Do your children eat soil?

a. Yes b. No

12. Do your children play with pet animal?

a. Yes b. No

13. Do your children eat meat of any animal?

a. Buffalo b. Fish c. Goat d. Pig

14. Do you know about personal hygiene?

a. Yes b. No

15. What are the preventive measures?

a. Medicine b. Clean environment c. Personal hygiene d. unknown

16. Do your children walk with bare foot?

a. Yes b. No