I

INTRODUCTION

Parasitism

Parasitism is defined as an intimate and obligatory relationship between two heterospecific organisms during which parasites are metabolically dependent on host (Chang, 1999).

Parasites are those organisms that receive nourishment & shelter from another organism where they live & host is the organism that harbours the parasites (Chatterjee, 1998).

The parasites are biologically & ecologically associated with host. The effects of parasites on host are not constant but depend upon various factors. Sometimes is not so evident while sometimes producing adverse effect on host leading to pathogenic condition.

Parasites are a major invader of people in developing countries. Parasitic infections are the most wide spread like all chronic human infections. It often causes debility and fatal diseases. Many new opportunistic and reemergence of disease are reported from different parts of the world. People are more susceptible to infection of parasitic disease due to the unhygienic management, malnutrition and ignorance about complicated life cycle of the parasites. Parasites are easily transmitted from individuals to individuals; that is animal-to-animal, animal to man, & man to man through a wide range of means.

The health and economic status of tropical and subtropical countries are influenced by the prevalence of many essentially chronic diseases, particularly those due to parasites (Belding, 1956).

In Nepal major causes of death among adults, after acute respiratory tract infection, are diarrhoea, vomiting and malnutrition. Poverty, ignorance and diseases characterize Nepal like in most third world countries. Literacy, poverty, malnutrition, high infant

mortality rate, inadequate health facilities, poor water supply and unsanitary conditions have led the country to a very poor socio- economic condition (Chhetri, 1993). The health status is also dominated and badly affected by parasitic diseases.

Intestinal Parasites

The intestinal parasites are those parasites that inhabit the intestinal region of the host and get nourishment from there.

Intestinal parasitosis is highly prevalent in rural communities of Nepal (Sherchand *et al*., 1997)) and constitutes an important cause of morbidity and mortality among Nepalese. In certain areas, prevalence has been found to be over 90 % (Rai *et al*., 2000).

Its high prevalence in the country causes decreased work capacity and productivity of children and adults increases maternal and foetal morbidity & mortality, premature delivery, low birth weight , slower cognitive development, poor school performance, increased absenteeism in school children, decreased ability to grow or procure food and prone to many infection of the diseases by the citizen. Hence, the country suffers from the poverty, malnutrition and infection (Chhetri, 1997).

Thus the public health importance of intestinal parasitosis continue because of its high prevalence, global distribution and affects on both nutritional and immune status of individuals (WHO, 1987). Many intestinal parasites are also known to cause Vitamin A deficiency leading to the “Night Blindness” and “Keratomalacia” (WHO, 1981).

Millions of people across the globe are not getting the oral health care because governments are not aware enough about their problems. By 2025, there will be about 1200 million people over 65 years according to UN estimates. Failure to address oral health need today could develop in to a costly problem tomorrow (WHO, 2005).

Types of intestinal parasite ranges from virus, bacteria protozoan to helminth. But commonly prevalent and endemic intestinal parasites are protozoan parasites and helminth parasites.

Intestinal protozoan parasites

Protozoan parasites consist of a single cell like unit that is morphologically and functionally complete (Chatterjee, 2001). They cause serious health problems for human. Some common intestinal protozoan parasites are: *Entamoeba histolytica, Giardia lamblia, Iodomeba butshchlii, Endolimax nana, Chilomastix mesnili, Enteromonas hominis, Entamoeba coli, Isospora belli, Trichomonas hominis, Balantidium coli, etc.*

Intestinal helminth parasites

The helminth parasites are multi-cellular, bilaterally symmetrical, triploblastic animals. They belong to the phyla Platyheminthes and Nemathelminthes .They are endo-parasites of intestine and blood of human body and cause different disease. Most helminth parasites come under heading of intestinal infections. Many parasitic helminths require one or more intermediate hosts to complete their life cycle. They have well developed reproductive system and they produce enormous numbers of egg and larva as a result of parasitic adaptation.

The relative importance of the major groups of helminth may be roughly judged by Stoll's (1947) estimate that among 2200 million people, about 72 million people are infested by cestode, 148 million by trematode and over 2000 million by nematode (Crag & Faust).

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

Williams-Blangero *et al.,* (1998) showed that intestinal worm infections including roundworm (*Ascaris lumbricoides*), hookworm (*Ancyclostoma duodenale*) and whipworm (*Trichuris trichiura*) affect a quarter of the world's total population and are major international health concern. Some common intestinal helminthes parasites are: *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Trichuris trichiura*, hookworm, *Strongyloides stercoralis, Taenia solium, Taenia saginata, Enterobius vermicularis, Hymenolepis nana, etc.*

The aim of present study is to record the prevalence of pinworm (*Enterobius vermicularis*) in the study area.

Enterobiasis

Enterobiasis is an intestinal parasitic infestation caused by the oxyurid nematode, *Enterobius vermicularis.* It is the only oxyurid nematode that causes infestation in man.

The oxyuroideans are commonly referred to as pinworms. They have simple, direct life cycles with the egg being the infective stage. Representatives of this family are parasites of both vertebrates & invertebrates.

Enterobius vermicularis	Human
Leidynema appendiculata	Cockroach
Syphacia obvelata	Rat & mouse

Enterobius vermicularis is also known as the threadworm, pinworm or seat-worm. This is the human worm widespread in temperate climates but, unlike most helminthes, rare in tropics. Probably every child in the temperate zone areas has been infected not once, but many times in early childhood. Once it reaches a household, it is likely to infect every member of a family. Due to the response of sanitations & public health the adults are rarely infected.

Children, especially early school aged are most frequently infected with this parasite. The geographic distributary of *E. vermicularis* is worldwide, especially in temperate zone. Hitchcock (1950) has reported that at least 51% of Alaskan Eskimos are infected; Cates (1953) has reported a 26.85% infection rate among students of five elementary schools in and around Tallahassee, Florida; Zaiman *et al*. (1952) have reported a 58% infection rate among the pupils in a preschool nursery in San Francisco, California; Ricci (1952) has reported a starting infection rate of 77.14% among Sicilian children but in the same population only 6.09% of the adults were infected. This figure shows at least 500 million persons are infected by this parasite in the world. [Cheng, T.C. (1986)]

Fortunately it is relatively harmless, although it may cause restlessness & irritability in young children. [Smyth, J.D. (1994)]

Leuckart (1865) was the first to describe the complete life cycle of the parasite.
[Parija, S.C. (2004), Chatterjee, K.D. (1980)]

Morphology

Adult worm

The adult worms, which have an opalescent white appearance, are thread like small & active and have typical oxyurid morphology. They are visible to naked eye. True buccal capsule is absent. The adult worm characteristically has a pair of cervical alae (wing like expansion) at the anterior end and a conspicuous double bulb oesophagus.

The adult male measures 2mm to 5mm in length & 0.1mm to 0.2mm in breadth. The posterior end is blunt, sharply curved and has a conspicuous terminal copulatory spicule. The males die immediately after fertilizing the females, therefore are rarely seen.

The adult female is longer, 8mm to 13mm in length & 0.3mm to 0.5mm in breadth, straight and has a tapering end. The female reproductive organs are paired and T-shaped. A large number of eggs varying from 4,672 to 16,888 in numbers with an average of 11,105 eggs are present in the uteri of gravid female. The uteri fill up the entire body of the female worm. The adults live up to 2 months. The gravid female worms live in the large intestine. They remain attached to the mucosa of the caecum, vermiform appendix and adjacent parts of the large intestine.

Infective form

The embryonated eggs are infective to humans. The eggs are colourless and non- bile stained. They measure 50μm to 60μm in length & 20μm to 32μm in breadth. They are typically Plano-convex with one flattened side and one convex side. The transparent eggshell is composed of a hyaline outer albuminous layer, a shell proper composed of two layers of chitin, and an inner embryonic layer. The deposited eggs enclose a

motile larva, which is typically coiled. [Cheng, T.C. (1986); Smyth, J.D. (1994); Parija, S.C. (2004)]

Clinical manifestations

- Most patients are a-symptomatic.
- In symptomatic cases, the most complaint is perianal & perineal pruritus, usually nocturnal or in the early morning. Other complaints include abdominal pain, irritability & restlessness, which are caused by the female worms laying her eggs on anal area.
- In severe infection, behavioral changes such as sleep disturbances, neurosis, nail bite, grinding teeth at night, have also been observed in the infected children.
- The adult worms can also cause appendicitis. [Parija, S.C. (2004)]

Epidemiology

One of the most common roundworm infections, pinworm infections probably affects about 200 million people across the world, including about one third of the population in the United States. Of all age groups, school children are most at risk for pinworm infections.

Pinworm infection is the most common worm infection in the United States. School-age children, followed by preschoolers, have the highest rates of infection. Cases of pinworm infection are seen most often at schools, day care centers and other institutional settings.

Enterobiasis is one of the most common helminthes infections in USA & in European countries. The frequency of infection in some regions of USA may be as high as 12% of the general population and the prevalence of the infection in the children is reported to be nearly 20% and an estimated 40 million people are infected.

Globally the prevalence rate for *E. vermicularis* is much higher in temperate regions than in tropics. The frequencies of egg carrier rates are vary by country from 0.1 to 98.4%.

Enterobiasis is one of the common intestinal helminthes infections in children throughout Indian sub-continent.

Human faces are the chief source of infection. Soiled bed, urine, tabletops, doorknobs & bathroom fixtures, having the eggs on their surfaces are also other important sources of infections.

Human are practically the only host of *E. vermicularis*. No animal reservoir is present.

Enterobiasis is more commonly seen in children than in adults. It is more frequent in school or preschool children & in crowded conditions. Poor personal hygiene, over crowding & relative resistance of eggs to desiccation is the various factors responsible for spread of the disease in the community. [Parija, S.C. (2004)]

Pinworm infection does not cause severe morbidity/mortality unless ectopic infection occurs. This rare complication occurs in individuals with conditions that compromise the integrity of the bowel wall (e.g., inflammatory bowel disease). Parasites migrate through the bowel wall and are found in extra colonic sites. Ectopic Enterobiasis has been described at the vagina, the salpinx, the inguinal area, the genital area, the pelvic peritoneum, the omentum, the liver, and even the lungs.

No racial and sexual predilection is reported. The highest rate of infection occurs in parents aged 30 to 39 years, typically because of transmission of infective eggs from their children aged 5 to 9 years.

Significance / Justification of the study

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

This study was conducted to find out the relation of pinworm infection with respect to the pre-school aged children of different school, feeding habit, drinking habit and personal & environmental sanitation in the several wards of Bharatpur Municipality. The present study includes stool examination as well as cello-tape anal swab method to find out the prevalence of pinworm infection that is a quite unique and different work.

Thus, this study will provide us the following information.

1. Since it is minor disease no one interested to invest more time & money for its investigation but it provides the information to the people.
2. Though the disease minor, cause several other secondary diseases; bacterial infection and even appendicitis.
3. As the samples were taken from perianal or perineal region the person feels shy or dirty to investigate.
4. It helps everybody to focus on hand washing, especially before eating.
5. It provides good knowledge, attitude and practice, especially for the junior kids.

II

OBJECTIVE

General objective:

To determine the prevalence of *Enterobius vermicularis* in relation to socio-economic & environmental factors in Bharatpur Municipality.

Specific objective:

- To determine the prevalence of Enterobiasis among early school age children.
- To determine the socio-economic aspects in relation to *Enterobius vermicularis.*
- To assess the knowledge, attitude and practices in study area in relation to transmission of intestinal parasites (*Enterobius vermicularis*).
- To bring awareness about different aspects of intestinal parasites (*Enterobius vermicularis*).
- To develop the recommendation for further planning regarding the control of *E. vermicularis*.

III

LITERATURE REVIEW

This chapter reviews the fundamental literature on Enterobiasis and various researches on it. Pinworm infections are contagious. People become infected by unknowingly ingesting microscopic pinworm eggs that can be found on many different surfaces, including: bed linens, towels, clothing (especially underwear), toilets, bathroom fixtures, food, drinking glasses, eating utensils, toys, kitchen counters, desks or lunch tables at school, sandboxes, etc.

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 & few internal parasites like tapeworms, *Ascaris*, pinworm s & guinea worms. However they were considered as natural products of human bodies. Even Rudolphi & Bremser also supported this idea (Chandler and Read, 1961).

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

During the later half of 17th century Francesco Redi, "Grandfather of Parasitology" stated that maggots are developed from eggs of flies .At the same time, Leeuwenhoek perfected microscopes and discovered *Giardia* in his own stool and other protozoan in rain water, saliva etc. (Chandler and Read, 1961).

Rudolphi (Linnaeus of Parasitology) classified all the parasites known up to his time.
In 1758, *Enterobius vermicularis* was first described by Linnaeus & Leuckart first worked out the life cycles of *Enterobius vermicularis* in 1865 and later, Losch in 1875 proved its pathogenic nature.

Literature Review in Global Context

Virk, *et al.,* (1994) worked on prevalence of intestinal parasites in rural area of district

and Shahjahanpur Utter Pradesh. Out of 381 individuals examined 111 i.e. 29.2 % were found positive for one or the other intestinal parasite. *Ascaris lumbricoides* superseded the entire parasite by showing positivity of 17.85% followed by hookworm 7.87 % tapeworm 3.41% *Hymenolepis nana* 3.15% *Enterobius vermicularis* 0.52% *Trichuris trichiura* 1.05% *Entamoeba histolytica* 2.36% and *Giardia lamblia* 0.26%

Navarrete, *et al*., (1994) worked in prevalence of infection by intestinal helminthes and protozoa in school children from a coastal locality in the province of Valdivia Chile. During July –August (1989), 219 chorological samples from primary school children were obtained and examined. The most predominant intestinal parasites were *Entamoeba histolytica* 18%, *Giardia lamblia* 27.9%, *Ascaris lumbricoides* 12.7%, *Trichuris trichiura* 32%, *Enterobius vermicularis* 1.6% and *Hymenolepis nana* 0.4%. The high prevalence of intestinal parasites in that study was related to sanitary condition of houses and fecal contamination of the estuary of the Valdivia River.

Makhlout, *et al*., (1994) carried out a study on parasite infection among children living in two orphanages in Cairo. Children living in institution, as orphanages are more exposed to intestinal parasitism since crowding and behavioral pattern contribute greatly to the spread of parasitic infection. The 20 children out of low of 6 to 12 years age out of 100 were studied as control. The result of the study revealed 69% of orphanage children were positive for parasitic infection. *Enterobius vermicularis* was the commonest parasite among both group followed by 10% of *Giardia lamblia*, 9% of *Entamoeba histolytica*, 82% of *Hymenolepis nana* and in case of control group 15% of *Giardia lamblia* and 10% of *Entamoeba histolytica*.

Saha, *et al*., (1995) worked on intestinal parasitism. A childhood problem in rural Bengal, a total of 221 stool samples were obtained from rural community children below 4 years of age suffering from gastrointestinal complaints during November 1992 to April 1994. *Giardia lamblia* 17.2% *Entamoeba histolytica* 8.1%, *Enterobius vermicularis* 12.2%, *Ascaris lumbricoides* 8.1% was found to be common amongst intestinal parasites. A significantly lower infection rate was observed in children below one year 24.4% as compared to older age group 66.4%.

Al-Maldani, *et al*., (1995) worked on prevalence of intestinal parasitic infections. Among Asian female housekeepers in Abha district Saudi Arabia. A group of 5518 female Asian housekeepers working in Albha district of Saudi Arabia were examined during 1990 to 1992.The study revealed on overall prevalence of 45.6%. The common parasites was found to be *Trichuris trichiura* 28.8%, *Ascaris lumbricoides* 22.2%, hookworm 14.9%, *Enterobius vermicularis* 0.8%, *S. Stercoralis* 0.6%, *Entamoeba histolytica* 1.2%, *Hymenolepis nana* 0.2% and *Giardia lamblia* 0.1%.

Panaitescu, *et al*., (1995) carried out a study of the incidence of intestinal and systemic parasitosis in a group of children with handicaps revealed high incidence of parasitic infections with physical and psychic handicaps. In 231 children examined 294 parasitic infections were diagnosed. The result of the study revealed specific prevalence of 18.1% of *Giardia lamblia* 2.59% of *Entamoeba histolytica*, 15.5% of *Hymenolepis nana* 9.9% of *S. Stercoralis* 6.9%of *Ascaris lumbricoides* and 16.47% of *Enterobius vermicularis* with main symptoms of trouble of appetite.

Kobayashi, *et al*., (1995) worked on prevalence of intestinal parasitic infection in five farms in Holambra, Sao Paulo, Brazil. An October 1992, 222 stool samples were collected from people of five farms in Holambra and examined. The result of study revealed 70% overall prevalence rate. The prevalence of common intestinal parasites recovered was 5.4% of *Ascaris lumbricoides*, 8.6% of *Trichuris trichiura*, 19.8% of *N. americans*, 10.4% of *S. Stercoralis* 1.4% of *Enterobius vermicularis*, 0.9% of *Hymenolepis nana* and 10.4% of *Giardia lamblia*.

Menan, *et al*., (1997) studied on profile of intestinal helminth in school-aged children in the city of Abidjan. A total number of 1001 fecal samples from school children aged from 4 to 15 years were collected and examined. The overall prevalence for intestinal parasites was 36.5%. The more prevalent species were *Trichuris trichiura* 23.4%, *Ascaris lumbricoides* 15.5%, hookworm 6.3%, *S. Stercoralis* 1.4%, *Hymenolepis nana* 1.1% and *Enterobius vermicularis* 0.2%. The males were found to be more infected than females. Most infected group was 12-13 years while least infected group was 4-5 years aged group.

Nikolic, *et al*., (1998) carried out a study on intestinal parasitic infection in Servia. A total of 5981 stool samples were collected from school children of 7 to 11 years age group during 1984 to 1993. The more prevalent intestinal parasites recovered were *Entamoeba histolytica* 0.02%, *Giardia lamblia* 6.8%, *Hymenolepis nana* 0.06%, *Enterobius vermicularis* 14.7%, *Ascaris lumbricoides* 33% and *Trichuris trichiura* 1.8% with overall prevalence of 24.6%

McPherson, *et al*., (1999) carried out a cross sectional point prevalence study of intestinal protozoan and helminthes in school children aged 6 to 12 years age in three schools in St. George's Parish Gronada. A total of 315 samples were collected and examined. The specific prevalence was 36% of *Giardia lamblia*, 12% of *Entamoeba histolytica*, 0.41% of hookworm, 1.3% of *Enterobius vermicularis*, 5.3% of *Trichuris trichiura* and 1.4% of *Ascaris lumbricoides*. Protozoan was found to be common than helminth due to easy availability of wide spectrum of antihelminthics than antiprotozoal

Lee, *et al*., (2000) examined stool and cello-tape anal swab carried out in august 1997 on handicapped people at an institution located in Chorwongun, Kangwon-do, Korea. A total of 112 stool samples (78 males and 34 females) were collected revealed 3 cases of *Trichuris trichiura* and one case of *Enterobius vermicularis* infection. The overall prevalence rate was 35.7%. More than two different kinds of parasite s were found in 42% of the positive stool samples (17 cases). The infection rates protozoan cysts were as follows: *Entamoeba coli* (25%), *Entamoeba histolytica* (1.8%), *Endolimax nana* (21.4%), *I. butshchlii* (1.8%) and *Giardia lamblia* (0.9%). In cello-tape and anal swab examinations (165 samples) the prevalence ratio of *Enterobius vermicularis* was 20.6%.

Janakiran, *et al*., (2001) worked on prevalence of intestinal parasitic infection among patients attending Adichmchanagiri Hospital and Research Centre, BG nagar Mondya, Karnataka. Total of 4,133 stool samples were collected from OPD patients suffering from diarrhoea and other gastrointestinal disturbance during August 1994 to July 1999. Out of 4,133 stool samples examined 599 (14.49%) were positive for either protozoan (7.79%) or helminth (6.7%) parasites. Majority of them, 97.98% was detected with single type's pathogen and the rest 2.02% with more than one

pathogens. The species-wise prevalence of intestinal parasite was: *Giardia lamblia* 4.66%, *Entamoeba histolytica* 4.13%, hookworm 5.03%, *Ascaris lumbricoides* 0.44%, *Hymenolepis nana* 0.15%, *Trichuris trichiura* 0.07% and *Enterobius vermicularis* 0.12%.

Luca, *et al*., (2001) conducted a research among 48 patients with acute diarrhoea with mixed etiology admitted in the hospital during 1995 to 1998. Twelve cases (24%) were mixed bacterial infections with the following microorganisms association: *Salmonella* + *Shigella* (10 cases), *Salmonella* + *Yersinia enterocolitica* (1case), *Salmonella* + Rotavirus (1case), 16 cases (44%) had mixed digestive infection with parasites, in double or triple associations: *Giardia intestinalis* + *Ascaris lumbricoides* (10 cases), *Giardia intestinalis* + *Ascaris lumbricoides* + *Entamoeba coli* (1 case), *Giardia intestinalis* + *Enterobius vermicularis* (3 cases), *Ascaris lumbricoides* + *Trichuris trichiura* (2 cases)

Uchoa, *et al*., (2001) conducted a parasitological survey of children from five community day-care centre from Niterio City, Rio de Janeiro, Brazil in 1999. Out of 218 stool samples of children surveyed 120 (55%) had positive samples for intestinal parasites the most frequently found protozoan parasite was *Giardia lamblia* (38.3%) followed by *Entamoeba coli* (26.6%), *Endolimax nana* (17.5%), *Entamoeba histolytica* (11.6%) and *Blastocystis hominis* (2.5%). The most common helminth parasite was *Ascaris lumbricoides* (30%) followed by *Trichuris trichiura* (26.6%), *Hymenolepis nana* (0.8%) and *Enterobius vermicularis* (0.8%). Monoparasitism was found in 57.5% of positive cases.

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 parasites was 91%. *Ascaris lumbricoides* was the most common helminth parasite detected 52.5% followed by *Trichuris trichiura* 45.69% *Ascaris duodenale* 37.6% where as *Giardia lamblia* (16%) was the most common protozoan parasite detected followed by *Entamoeba histolytica* (4%) in contrast under urban setting. Out of the 199 stool samples tested the positivity rate was 33%. *Giardia lamblia* was the most common parasite detected 22.6%

followed by *Entamoeba histolytica* 10.6%. Other intestinal parasites such as *Trichuris trichiura* 2.01%, *Hymenolepis nana* 1.01%, *Enterobius vermicularis* 0.5% and *Ascaris lumbricoides* 0.5% were found to have much lower prevalence in comparison to the rural area.

Waikagul, *et al*., (2002) conducted a cross sectional study of the prevalence of intestinal parasitic infections at eight schools in Boklav district and four schools in Chelerm Prakiet district, Nan Province, in January and February, 2001. A total of 10% fecal samples were examined using the formalin ether sedimentation technique. Results revealed that the rate of helminth infection was 60.6% while protozoa accounted for 36.2% of infections. Mixed infections were common, resulting in a total prevalence of parasites of 68.1%. Helminth parasites, listed by frequency of infections were *Ascaris lumbricoides* (21.7%), hookworm (18.5%), *Trichuris trichiura* (16.3%), *Opisthorchis viverrini* (1.7%), *S. Stercoralis* (0.9%) and *Enterobius vermicularis* (0.9%). The protozoan infections were *Entamoeba coli* (25.8%) *Giardia lamblia* (5.3%) *Endolimax nana* (2.5%) *Entamoeba histolytica* (1.4%) *B. hominis* (0.8%) *Chilomastix mesnili* (0.3%) and *Iodomeba butschlii* (0.1%)

Bong-gin, *et al*., (2003) carried out small state survey to investigate the status of intestinal protozoa and helminth infection of inhabitants in Roxus city, Mindoro, Philippine. A total 301 stool samples were collected. The overall positive rate was 64.5% and that of male 56.6% and the female 72.5%.The highest infected helminth was *Ascaris lumbricoides* (51.2%) followed by *Trichuris trichiura* (27.6%) hookworm (8%) and *Enterobius vermicularis* (0.3%). The protozoan infection status revealed that *Entamoeba coli* were the most frequent (15.0%). *Iodomeba butschlii* and *Entamoeba histolytica* were found but few. The multiple infection more than two parasites was 29.6% and double infection with *Ascaris lumbricoides* and *Trichuris trichiura* was common. The intestinal helminth infection was highly prevalent in this area.

Han-jong, *et al*., (2003) carried out a national scale prevalence of intestinal parasitic infection among school children in Laos. A total of 29846 stool samples were collected from primary school children from May 2000 to June 2002 and examined once with the cellophane thick smear technique. The cumulative egg positive rate for

intestinal helminth was 61.9%. By species the rate for *Ascaris lumbricoides* 34.9%, hookworm 19.1%, *Trichuris trichiura* 25.8%, *Opisthorchis viverrini* 10.9%. *Taenia* spp.0.6% and *Hymenolepis* spp. 0.2%. An additional small-scale survey by cellophane anal swab detected *Enterobius vermicularis* eggs in 35.7% of 451 school children aged 6 to 8 years in Khammuane, Vientiane.

Mosala, *et al*., (2003) conducted a survey to find a true prevalence of pinworm (*Enterobius vermicularis*) infection among children in Qwa–Qwa, South Africa. The surveys of gastrointestinal parasite carried out in South Africa have, except for one, constantly shown very low *Enterobius vermicularis* prevalence of below 5%. A study carried out in the mountainous Qwa-Qwa area of the free state to measure the true infection rate of this nematode using scotch tape method and to compare it with the 0.4% prevalence reported from the same area using fecal analysis among 969 school going children .A prevalence of 45.3% amongst 148 pediatrics (hospital based) children was recorded using adhesive tape, which suggests that *Enterobius vermicularis* is not only the most abundant helminthes in this high-altitude region but is also the second most abundant of all the intestinal parasites infecting children there.

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

Astal, (2004) performed an epidemiological survey of the prevalence of parasites among children in Khan Younis Governorate, Palestine. The prevalence of intestinal parasite was determined for 1,370 children. The age of the children ranged from 6 to 11 years for stool samples, inspection, direct smear microscopy, floatation and sedimentation techniques were used. The general prevalence of intestinal parasite was 34.2%. Different types of intestinal parasites were detected during this survey. *Ascaris*

lumbricoides seems to be the most common parasite (12.8%) where as *Giardia lamblia* had a prevalence of 8%, *Entamoeba histolytica* 7%, *Entamoeba coli* 3.6%, *Trichuris trichiura* 1.6% and *Hymenolepis nana* 1%. The prevalence of *Enterobius vermicularis* was determined using scotch tape method. A total of 20.9% of the children examined were infected and there was sex variation in the prevalence of Enterobiasis.

Tashima, *et al*., (2004) had conducted a study to analyses the parasite occurrence in children from 0 to 12 years old at university of western Sao Paulo clinical laboratory in relation to socio economic profile of the attended children. Stool samples were examined and a questionnaire was applied with the objective of knowing the patients age, sex, medical attendances, characteristics of habitations, provisioning of water, dejection and domestic waste fates, use of footwear and clinical signs. The software EPI INF O6 (version 6.04b) was used for the elaboration of the data bank structure and analysis after previous data codification among 1000 children analysed, as many as 21.3% presented some kind of parasite. The most frequent protozoan was *Giardia lamblia* (7.3%) followed by *Entamoeba coli* (3.9%). The most frequent helminth was *Enterobius vermicularis* (1.9%) followed by *Hymenolepis nana* (0.5%). The most frequent protozoan association was *Giardia lamblia* /*Entamoeba coli* (0.9%).

Delialioglu, *et al*., (2005) carried out a comparison of levels of total serum IgE of 36 children infected with *Enterobius vermicularis* and of 25 healthy children between 7 and 12 years of age. The mean value of IgE in Enterobiasis in children was 363.79 $\pm$ 397.06 IU/ml (medium $\pm$ SD) and 177.14 $\pm$ 224.64 IU/ml (medium SD) in the control group and it was found that there was no significant stastical difference ($p = 0.163$).

Gundug, *et al*., (2005) worked on intestinal parasitosis in children with gastrointestinal symptoms associated with socio-economic conditions in Manisa Region. The aim of this study was to determine the prevalence of intestinal parasitosis in children with gastrointestinal symptoms and to evaluate its association with socio-economic and environmental factors. The saline-iodine method and trichrome staining examined stool samples of 3216 children. The cellophane tape method was also performed on 2160 children. According to the educational levels and the economic status of families, the patients were classified as coining from underdeveloped,

developing and developed areas. In 770 (23.9%), out of 3216 stool samples, various parasites were detected by saline-iodine method and trichrome staining. The most common parasite was *Giardia intestinalis* (40.1%) followed by *Entamoeba coli* (10.2%) *Enterobius vermicularis* eggs were detected by the cellophane tape method in 221 (10.3%) out of 2160 patients. The positive cases were evaluated according to the socio-economic and environmental criteria and most of them were found to have come from underdeveloped and developing areas.

Park JH, *et al*., (2005) carried out a survey to determine the status of *Enterobius vermicularis* infection among children living on western and southern coastal islands of the Republic of Korea, children (3-10 years) in 39 kindergartens and primary schools were examined using the cello-tape anal swab method. Out of 1,661 children examined, 307 (18.5%) were found to be positive for *E. vermicularis* eggs. The highest infection rate (59.3%) was found in a kindergarten and a branch school of Shinyang primary school on Chujado, Jeju-do (Province). Remarkable differences in egg positive rates were observed in different localities. The egg positive rate for boys (21.3%) was significantly higher than that of girls (15.4%) (P = 0.02). However, positive rates were not significantly dependent on age. The results of the present study show that *E. vermicularis* infection is highly prevalent among pre-school and primary school children living on the western and southern coastal islands of the Republic of Korea, and indicate the need for efforts to control this infection.

Sayyari, *et al*., (2005) conducted a national survey of prevalence of intestinal parasitic infections in the Islamic Republic of Iran. A random sample of 53995 people aged 2+ years, from 12,495 families, 45,128 stool samples were analysed by formalin ether precipitation. Intestinal infections were found in 19.3% of study population (19.7% male, 19.1% female). *Giardia lamblia* (10.9%) *Ascaris lumbricoides* (1.5%) *Entamoeba histolytica* (1%) and *Enterobius vermicularis* (0.5%) were the most common infections. The infection rate was highest in 2-14 years age group (25.5%) and in rural residents (23.7%)

Ali-Celiksoz A, *et al*., (2005) carried out a survey to find out the number of students with Enterobiasis and /or Taeniasis in primary schools of Sivas. Among the 2,029 students in 6 primary schools, 316 (15.6%) were positive to *Enterobius vermicularis*

eggs and 32 (1.6%) were positive to *Taenia* spp. eggs by the cellophane tape method. The egg positive rates of *E. vermicularis* and *Taenia* spp. ranged from 9.4% to 27.2% and from 0.8% to 2.6% respectively among six schools. The egg positive rate of *E. vermicularis* was found to be significantly different among these schools ($X^2 = 31.96$, $P < 0.05$), whereas there was no significant difference between the schools for *Taenia* spp. ($X^2 = 4.37$; $P > 0.05$). The rate (18.7%) of *E. vermicularis* in the urban slum regions was higher than the rate (11.5%) in the urban central regions ($X^2 = 19.20$; $P < 0.05$). Above results demonstrate that the egg positive rate of *Enterobius vermicularis* and *Taenia* spp. was still prevalent among primary school children.

Wongjindanov *et al*., (2005) performed a survey for the current rate of *Giardia lamblia* infection in three different districts in two provinces of Thailand, Surin and Samut Sakhon, in March 2002, October 2003 and March 2004. Out of 3358 healthy individuals from rural Surin Province, 75 cases (i.e., 2.2%) were found *Giardia lamblia.* 30 of which were below 10 years of age. By comparison, 656 individuals from sub-urban Samut Sakhon province volunteered and 43 (6.5%) were positive of *Giardia lamblia*. Other intestinal parasite, both helminth and protozoa, were also identified from these two groups; hookworm, *Enterobius vermicularis*, *Strongyloides stercoralis*, *Trichuris trichiura*, *Taenia* spp., *Entamoeba histolytica*, *Entamoeba coli*, *Endolimax nana*, and *Blastocystis hominis*.

Literature Review in National Context

Sharma and Tuladhar (1971) carried out a study on intestinal parasites among auxiliary health workers student in Kathmandu. They examined 80 stool specimens of whom 10 did not show any infestation, the rest 70 were suffering from different types of infestations The commonest infestation found was roundworm (*Ascaris lumbricoides*) followed by hookworm (*Ascaris duodenale*). Other infestations were *E. histolytica*, *Giardia lamblia* and *Trichuris trichiura*, *Enterobius vermicularis* was found in only one case. In some cases, mixed infestations were also seen.

James, *et al*., (1983) published a medical report from isolated communities in Baitadi District. On which the intestinal parasites were also reported. According to the field lab of study area, out of 37 samples collected from the patient complained of diarrhoea or worms, only 20 samples i.e. 54.05 % were found to be infected with

intestinal parasites. In the field, among the 20 respondents 14 (i.e.70%) with *Ascaris lumbricoides*, 9 (i.e.45%) with *Entamoeba histolytica*, 1 (i.e.5%) with *Trichuris trichiura* and 1 (i.e.5%) with hookworm were found to be infective. Similarly 35 samples were collected from this study area and analyzed in Duke University Medical Center (DUMC) in Durham, North Carolina USA. Study revealed 29 samples i.e. 87.9% positive for *Ascaris lumbricoides*, 5 i.e. 15.2% for *Entamoeba histolytica*, 4 i.e. 12.1% for *Giardia lamblia*, 2i.e. 6.1% for *Trichuris trichiura*, 2 i.e. 6.1% for *S.* s*tercoralis* and 1i.e. 3% for *Enterobius vermicularis*.

Suguri, *et al*., (1985) conducted a survey to find the helminth infections, in 737 Nepalese people living in the Gandaki Dhaulagiri Lumbini and Sagarmatha zone of Nepal and in 26 Japanese living in Kathmandu from February to April in 1975 employing the so called thick smear method. The overall helminth infection rate was found 86.8% including roundworm (50.3%) hookworm (44.1%) whipworm (47.6%) pinworm (1.2%) and *Taenia* spp. (0.1%). The positive rate was the lowest in Bhairahawa (53.8%) and the highest in Darbang (98.8%). In Namchebazzar, roundworm infection rate was the highest (70.3%) and that of hookworm was the lowest (0.2%)

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

Sherchand, *et al*., (1997) carried out stool survey on intestinal parasite in rural village of Dhanusha District, Southern Nepal. Out of 604 children of aged 0-9 years examined, 63.1% were found positive for at least one intestinal parasite. Hookworm infection superseded all the parasites by showing a positivity of 11.6%. Other parasites found were *Ascaris lumbricoides*, *Trichuris trichiura*, *Enterobius vermicularis*, *S. Stercoralis*, *Hymenolepis nana*, *Entamoeba histolytica*, *Entamoeba coli*, *Giardia lamblia*, *Cryptosporidium*, *Cyclospora*, etc.

Sarala, *et al*., (1998) carried out a cross sectional intestinal parasitic survey in primary school children of Godar VDC from 9 October to 15 October, 1998. Out of 219 children examined 192 (87.7%) were found positive for one or the other intestinal parasites. *Ascaris lumbricoides* superseded all parasites by showing a positivity of 14.6%. Other parasites found were hookworm (11.5%), *Trichuris trichiura* (9.4%), *Giardia lamblia* (7.8%), *Hymenolepis nana* (5.2%), tapeworm (4.2%), *Entamoeba histolytica* (4.2%), *Enterobius vermicularis* (3.1%), *Entamoeba coli* (2.1%) and *Cryptosporidium* spp. (1.0%).

Tai-Soon YONG, *et al*., (2000) conducted a small-scale survey on the status of intestinal parasite infections in two rural villages (Chitrasar, Jerona) in Chitwan district, Nepal in 1999. Stool examination was performed with a total of 300 specimens from elementary schoolchildren by microscope following formalin-ether sedimentation technique. The prevalence rate of intestinal parasite infections in the surveyed areas was 44.0%. The prevalence of infections of schoolchildren rate in Jerona (48.8%) was slightly higher than that in Chitrasar (37.9%). The prevalence rate was slightly higher in females (46.3%) than that in males (42.1%) without statistically significant difference. *Entamoeba coli* was the most commonly found protozoan parasite (21.0%) followed by *Giardia lamblia* (13.7%) and others (5.3%). Hookworm was the most prevalent intestinal helminth (13.0%) followed by *Trichuris trichiura* (3.0%) and others (5.0%). Forty-three specimens (14.3%) showed mixed infections The cyst positive rate of intestinal protozoa infections were 21.0%, 13.7%, 3.7%, 2.3% and 0.3% for *Entamoeba coli*, *Giardia lamblia*, *Entamoeba histolytica*, *Entamoeba dispar*, *Endolimax nana* and *Iodamoeba buetchilii*, respectively. The egg positive rate of helminth infections were 13.0%, 3.0%, 1.7%, 1.7% and 1.3% for hookworm, *Trichuris trichiura*, *Ascaris lumbricoides*, *Hymenolepis nana* and *Fasciola hepatica*, respectively. Three-pinworm egg positive cases were found out of 300 examines (1%) on stool examination, suggesting high prevalence of pinworm infections in schoolchildren.

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 in female (70.0%). Highest prevalence rate was for *Ascaris lumbricoides* (43.4%), followed by *Trichuris trichiura* (22.5%), *Giardia lamblia* (16.1%), C.

cayetanensis (7.2%), *Entamoeba histolytica* (2.5%), *C. parvum* (1.7%), hookworm (1.7%), *Entamoeba coli* (1.7%), *Iodomeba butschlii* (1.2%), *Hymenolepis nana* (0.8%), *Enterobius vermicularis* (0.4%) and *Endolimax nana* (0.4%).

Ghimire and Misra (2005) conducted a cross sectional descriptive type of study from April to October 2005 in Kirtipur, Kathmandu and Gunjanagar VDC, Chitwan, Nepal. A total of 400 stool samples were collected and examined by standard formalin-ethyl acetate concentration method, direct light microscope, modified acid fast stain, Oculo-micrometer and bisporulation assay. The total prevalence of intestinal parasites was 42% (168/400) in which the prevalence of males and female was 35.2% (58/165) and 46.8% (110/235) respectively with statistically significant ($p<0.05$, 95% CI).The prevalence of individual parasites in 400 persons was recorded as *Ascaris* 41 (10.3%), *Giardia* 33 (8.3%), *Entamoeba* 21 (5.3%), *Trichuris* 5 (20%), *Hymenolepis* 16 (4%) hookworm 15(3.8%), *Strongyloides* 10 (2.5%), *Cyclospora* 7(1.8%), *Cryptosporidium* 4 (1%) and *Enterobius* 1 (0.25%). Out of 168 positive samples, only 12 persons (7.1%) showed co-infection. In this study the prevalence of helminth and protozoan was 61.3 % (103 out of 168) and 38.7% (65 out of 168) respectively.

IV

MATERIALS AND METHODS

Materials

Compound microscope, cello-tape glass slides and slide box, cover slips forceps brushes, Stiger (tapes), marker, sample vials, gloves, Ocular & stage micrometer, pen, pencil, record form / register etc.

Chemicals

Normal saline, Lugol's iodine solution (1% wt by volume), potassium dichromate solution (2.5% wt. by volume), soap, formalin, alcohol, ether, etc.

Study Area

Nepal is situated in the central part of Asia in between 26°22"to 30°27" North Latitude and 80°4"to 88°12"East Longitude. Nepal has a total area of 1,47,181 sq. km. This Area is about 0.03% of the world and 0.3% of Asia.

Chitwan district is bordered with Bihar of India in the south, Makawanpur & Parsa districts in the east, Dhading & Gorkha districts in the north and Nawalparasi & Tanahun districts in the west, in the southern part of central development region, Nepal. Physically, this district is situated between 83°55' to 84°48' and 27°21' to 27°46' north latitude and east longitude. The total area of this district is 2218 sq. km and it ranges from 144m to 1947m altitudes from sea level. Demographically, Chitwan has been divided into 4 constituent areas, 13 Ilakas, 2 municipalities and 36 VDCs. with total populations 472048. Out of this 73.07% people live in village area where as 26.93% people live in city areas. Among them 90% of people concentrated at plane valley, while the rest 10% in Mahabharat hill.

Bharatpur is district headquarter (209m). Bharatpur municipality is located east to Narayani River between Gaindakot, Mangalpur, Narayanpur, Gitanagar & Patihani

VDCs in the west, Ratnanagar Municipality & Jutpani, Bachhauli VDCs in the east, Chitwan National Park in the south and Devghat and Kabilas VDCs in the north respectively. The Municipality along with ward numbers 13 and 14 are characterized by different ethnic groups comprising Brahmin, Chhetri, Newar, Tharu, Gurung, Tamang, Magar, Darai, Chepang, Damai, Kami, Sarki, Majhi, Dhobi, Bote, Kalwar, Kanu, Koiri, Teli, etc. comprising the total population of 89,323 (45,858 male and 43,465 female). In ward-13, the total population was 3226 (1567 male and 1659 female) and in ward-14, the total population was 2993 (1483 male and 1510 female) (CBS 2002)

Agriculture (Poultry, Paddy, Maize, Cattle) is the main source of economy. The houses are often with RCC buildings as well as adjacent cattle sheds made of bamboos with thatched roof. The annual rainfall ranges from 1400 to 2200 mm and the relative humidity varies between 60% and 85%. Temperature ranges from minimum 7ºC to maximum 39ºC.

The microscopical observation was carried out in Sagun Pathology Laboratory Clinic located at Saheed Chowk in Bharatpur municipality of Chitwan district, Nepal.

Study period

The total study period was of one year, from August 2004 to November 2005.

Study Population

Out of 163 preschool children below 12 years, 125 scotch tape swab slides were collected from perianal folding and 38 stool samples were collected from them in the vials.

Plate No. 1. A classroom environment

Plate No. 2. Providing instruction about fixing cello tape at perianal region and slide.

Plate No. 3: Collecting Primary Data from the respondents.

Plate No. 4: Collecting Primary Data from the respondents with the help of local people

Plate No. 5: Fixing of Adhesive Cello tape at the perianal region of a boy.

Plate No.6: Fixing of Adhesive Cello tape at the perianal region of a girl.

Plate No.7: Collecting sample slides

Plate No.8: Taking off Adhesive Cello tape from the perianal region of a girl.

Plate No.9: Adhesive Cello tape fixing on the glass slide after taking out from perianal region.

Plate No.10: Observation of collected samples through microscope

Plate No.11: Collecting data from the suspected patients (second time) at their own home.

Plate No. 12: Collecting slide samples from the suspected patients (second time) at their own home.

Plate No. 13: With teacher & students Kailashnagar Ni.Ma.Vi., B.N.Pa.-13, Kailashnagar, Chitwan.

Plate No. 14: With teachers & students Shree Rastriya Pra.Vi., B.N.Pa.-14, Torikhet, Chitwan.

Plate No. 15. Pinworm.

Plate No. 16. Eggs of pinworm.

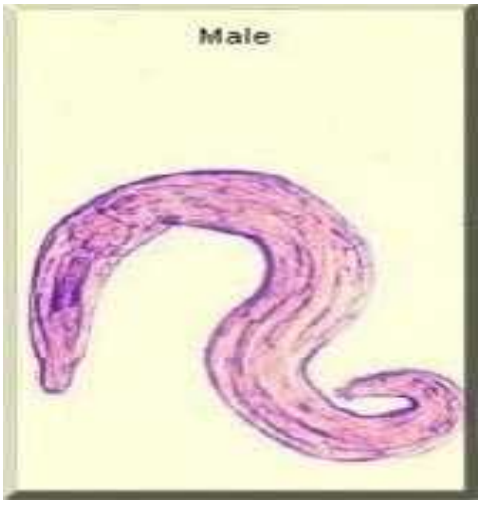


Plate No.17. Adult Pinworm.

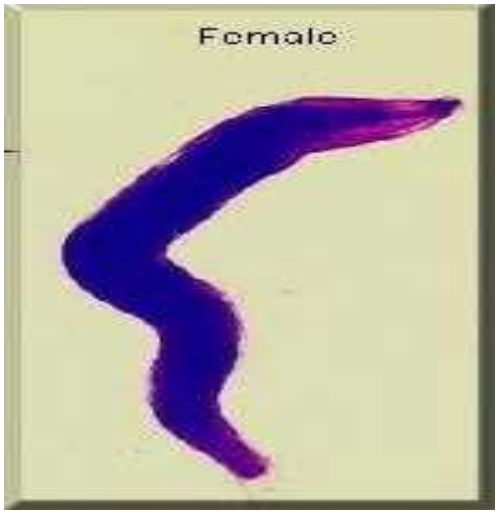


Plate No. 18. Adult Pinworm.

Sample collection

Collection of scotch tape swab slide samples

In this process, transparent adhesive tape was pressed firmly against perianal skin of the children before going to bed. Then this sticky tape was spread on to a microscope slide to collect the sample of Enterobiasis. These samples were collected in the next morning before the child goes to the toilet & took bath.

Collection of stool samples

In this process, individual children were provided a sterile stool collecting vials with detail instruction required to collect stool samples. These samples will be collected early in the morning, next day.

Methodology

Questionnaire survey

Questionnaire is the important tool during survey study. The questionnaire was pre-tested by the local people. The questionnaire was translated in Nepali language so that the respondent could understand the questions very clearly since almost all of them do not understand the English language.

During questionnaire survey, the questions were asked verbally to the child as well as their parents. The questions asked to them were about their general information i.e. name, age, address, sex, economic status, education, knowledge about the disease, food habits, socio-economic condition, environmental and other factors, etc.

Macroscopic examination

Immediately after collection before adding preservative, the macroscopic examinations of stool samples were done. Macroscopic examinations were performed to observe the colour of stool, odour of the stool, solidity or consistency of stool, presence of mucus & blood, and presence of gravid segments or adult worm in the

stool. Pinworm, whipworm, hookworm, segment of tapeworm, large roundworm may be seen in the stool usually after medication.

Microscopic examination

Both stained & unstained stool smears as well as scotch tape swab slide samples were examined under low power objective from one end of slide to another end so that whole field was examined properly.

Generally cyst of protozoan parasites & eggs of helminth parasites were observed under the microscope. Occasionally the trophozoites of protozoan parasites, larva stage of *S. stercoralis* and adult as well as eggs of pinworm were also observed in stool smear

Data collection

The data collection was based on the primary as well as secondary data. Primary data was collected from questionnaire survey and microscopical findings. Secondary data was taken from the published and unpublished sources.

Data analysis

Thus obtained data from the examination of stool and scotch tape swab slides as well as questionnaire survey and other secondary sources were presented and analyzed using appropriate statistical tools. Analysis of data was done on the basis of age, sex, literacy, profession, and locality wise social & cultural aspect of children of the study area. This analyzed data was interpreted by representing with table, bar-diagram and pie chart, drawing graphs of suitable data.

V

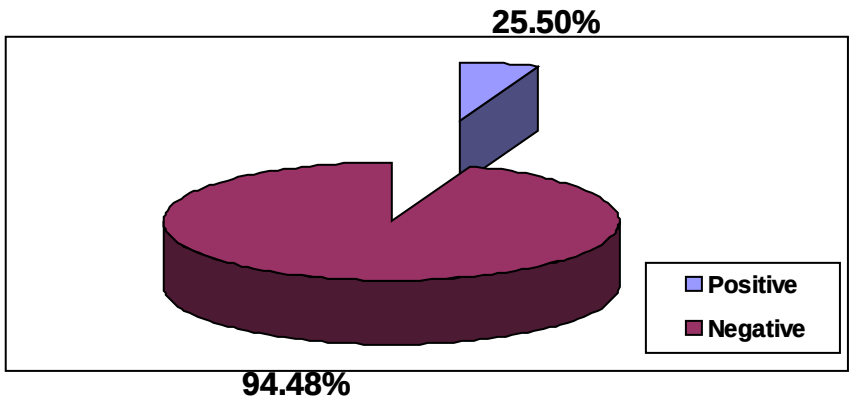
RESULTS

A total of 163 scotch tape swab slides and stool samples were collected from early school aged children below 12 years studying and living nearby Rastriya Pra.Vi., Torikhet, B.N.Pa.-14 and Kailashnagar Ni.Ma.Vi., Kailashnagar B.N.Pa.-13 and then examined at Sagun Pathology, Narayangarh, Chitwan during August 2004 to November 2005.

General prevalence of Pinworm

Among 163 samples, only 9 were found to be positive and the remaining 154 were negative to pinworm infection i.e. the prevalence for positive rate was found to be 5.52%. There is a difference among frequencies of positive & negative rates of Enterobiasis. (χ^2 = 98.53; df = 1; and at 0.05 significant level).

Figure No.1: Enterobiasis positivity rate



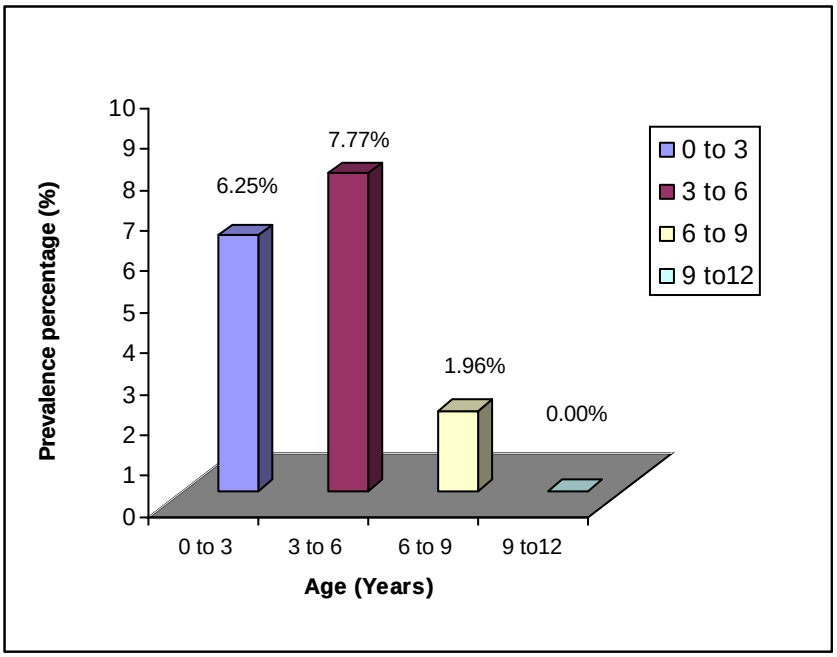
Age-wise prevalence of Pinworm

The result of the study indicates that the maximum number of positive cases were from the age group 3 to 6 years and minimum from 9 to 12 years. Of the total infected children, the highest age specific slide positivity rate was found to be in age group 3 to 6 years (7.77%) and lowest in 9 to 12 years age group (0.00%). The distributions of pinworm among the children were found to be significant according to their age. (χ^2 = 2.35; df = 3; and at 0.05 significant level).

Table No. 1: Age-wise prevalence of Pinworm

Age (years)	Number of total observed cases (n =163)	Pinworm	
		Positive cases (n = 10)	Percent (%)
0 to 3	16	1	6.25
3 to 6	90	7	7.77
6 to 9	51	1	1.96
9 to12	6	0	0.00

Figure No. 2: Age-wise prevalence of Pinworm



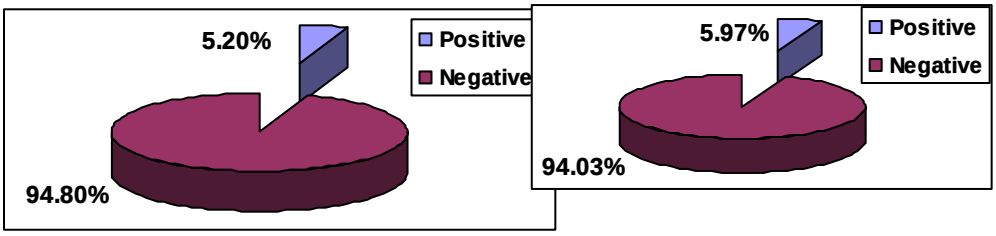
Sex-wise prevalence of Pinworm

In relation to sex, out of 96 males, 5 were positive for pinworm infection and out of 67 females, 4 were positive for it i.e. the prevalence for positive rate was found to be 5.20% and 5.97% respectively. The prevalence of pinworm showed no significant differences between male & female. (χ^2 = 0.06; df = 1; and at 0.05 significant level).

Table 2: Sex-wise prevalence of Pinworm

Sex	No. of total observed cases (n =163)	Pinworm	
		Positive cases (n=9)	Percent (%)
Male	96	5	5.20
Female	67	4	5.97

Figure No.3. Pie-chart analysis of positive samples Vs negative samples shows sex-wise prevalence of pinworm.



(a) Male (b) Female

Pinworm infestation in relation to environmental aspect

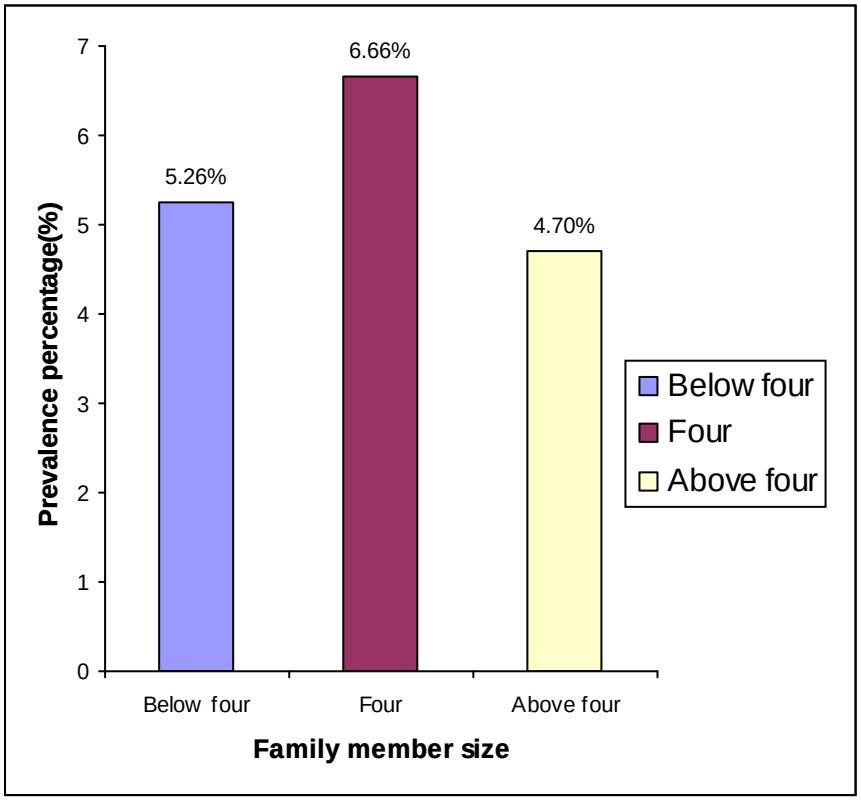
Family size and pinworm infestation

Among 163-study population, majority of children were from Joint family. The maximum numbers of positive cases were found in family member size 4(6.66%) or more than 4(4.70%), followed by 1 case in family size below 4 (5.26%). Statically no difference was found in the prevalence of pinworm according to the different size of family members. (χ^2 = 0.222; df = 2; and at 0.05 significant level).

Table No. 3: Prevalence of pinworm on the basis of family size.

Family member size	No. of total observed cases (n=163)	Pinworm	
		Positive cases (n=9)	Percent (%)
Below four	19	1	5.26
Four	60	4	6.66
Above four	84	4	4.7

Figure No. 4: Prevalence of pinworm on the basis of family size.



Prevalence of pinworm on the basis of socio-economic aspect

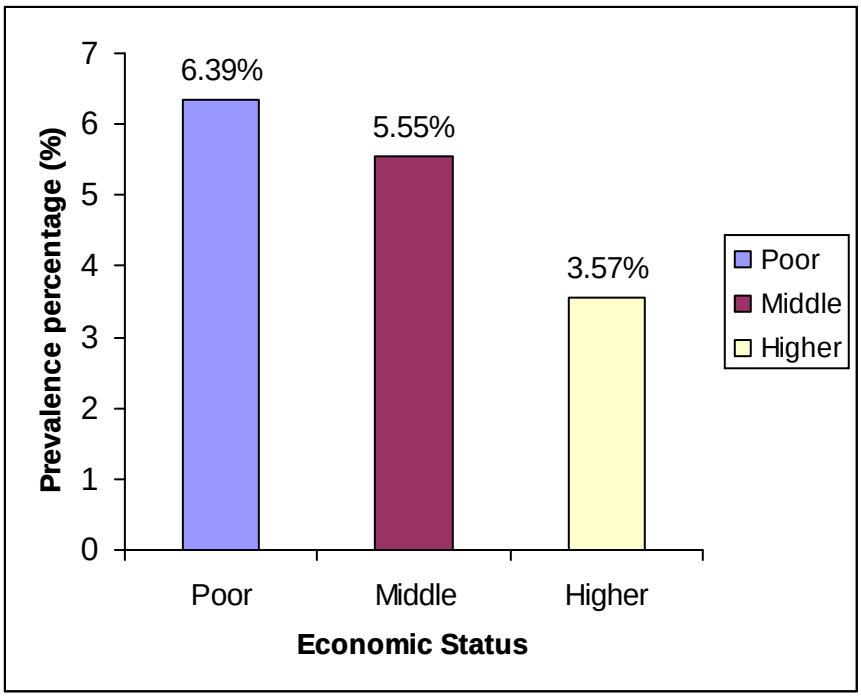
Out of 163 children, the majority of them were from middle class income group (72 cases) family but the higher positive rate for pinworm infection was from poor class family i.e. 4 out of 63 cases (6.39%). The prevalence of pinworm showed no significant differences in contest to economic status of the family.

(χ^2 = 0.027; df = 2; and at 0.05 significant level).

Table No. 4: Prevalence of pinworm on the basis of economic status.

Economic Status	No. of total observed cases (n=163)	Pinworm	
		Positive cases (n=9)	Percent (%)
Poor	63	4	6.39
Middle	72	4	5.55
Higher	28	1	3.57

Figure No. 5: Prevalence of pinworm on the basis of economic status.



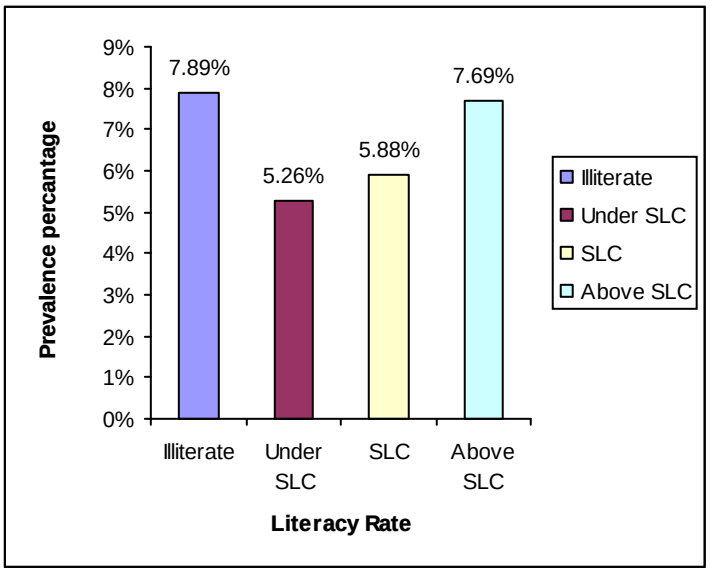
Prevalence of pinworm in children in relation to parent's (mother) literacy rate.

Among 163-study population, majority of children were from literate family. The maximum number of positive cases was found in literate 5 (5.26%), followed by illiterate 2 (7.89%), SLC 1 (5.88%) and above SLC 1 case (7.69%). Statically the prevalence of pinworm showed no significant differences as per the mother literacy rate. (χ^2 = 4.776; df = 3; and at 0.05 significant level).

Table No. 5: Literacy rate of parent (mother) and pinworm infestation in their kids

Literacy rate	No. of total observed cases (n=163)	Pinworm	
		Positive cases (n=9)	Percent (%)
Illiterate	38	2	7.89
Under SLC	95	5	5.26
SLC	17	1	5.88
Above SLC	13	1	7.69

Figure No 6: Literacy rate of parent (mother) and pinworm infestation in their kids.



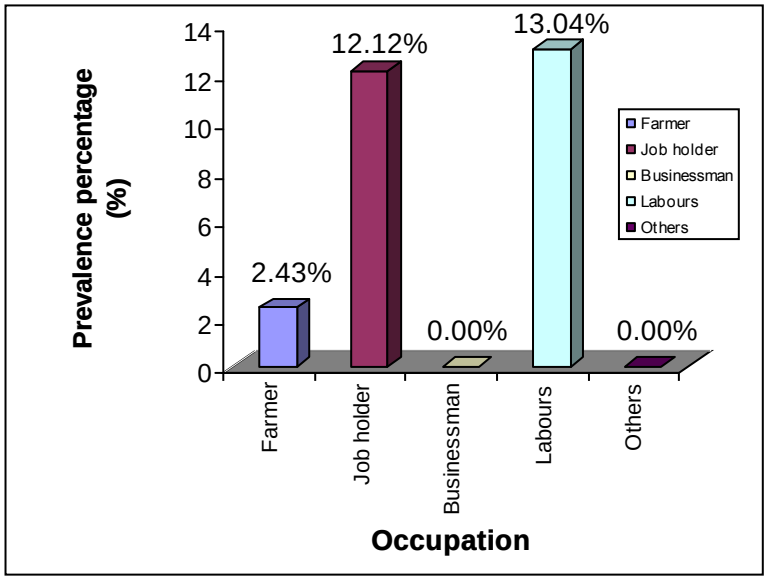
Prevalence of pinworm in relation to parent's (father) occupation.

During the study, children of various occupational group individuals were included. Majority of them were from farmers and a few of them were from jobholders and businessmen. The higher number of pinworm infection was observed among the children from job holders 4 (12.12%) followed by the others from labours 3 (13.04%), farmers 2 (2.43%), businessmen 0 (0.00%) and others 0 (0.00%). The prevalence of pinworm showed no significant differences in relation to father's occupation.
(χ^2 = 7.74; df = 4; and at 0.05 significant level).

Table No. 6: Prevalence of pinworm on the basis of occupation (Father's)

Occupation	No. of total observed cases (n=163)	Pinworm	
		Positive cases (n=9)	Percent (%)
Farmer	82	2	2.43
Jobholder	33	4	12.12
Businessman	7	0	0.00
Labours	23	3	13.04
Others	18	0	0.00

Figure No. 7: Prevalence of pinworm on the basis of occupation (Father's)



Pinworm infestation in relation to environmental aspect (Class-wise)

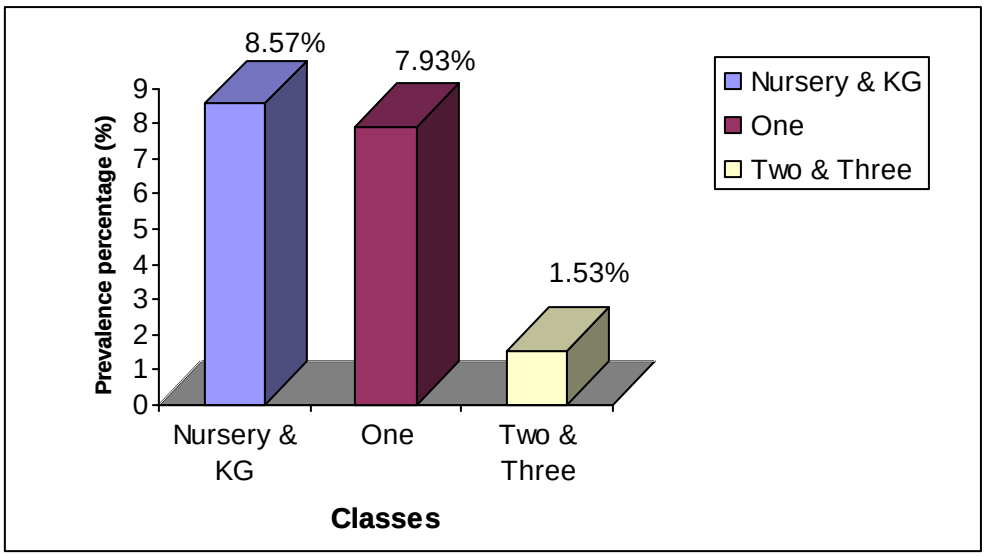
From the study it reveals that out of 163 individual children, among the presented, 35 kids were in Nursery & KG, 63 in class one and the remaining 65 in class 2 & 3. The higher positive rate for pinworm infection was from class one i.e. 5 out of 63 cases (7.93%). The prevalence of pinworm showed no significant differences among the children who study in different grades up to three.

(χ^2 = 2.666; df = 2; and at 0.05 significant level).

Table No.7: Class-wise prevalence of pinworm

Classes	No. of total observed cases (n=163)	Pinworm	
		Positive cases (n=9)	Percent (%)
Nursery & KG	35	3	8.57
One	63	5	7.93
Two & Three	65	1	1.53

Figure No. 8: Class-wise prevalence of pinworm



Pinworm infestation in relation to environmental aspect

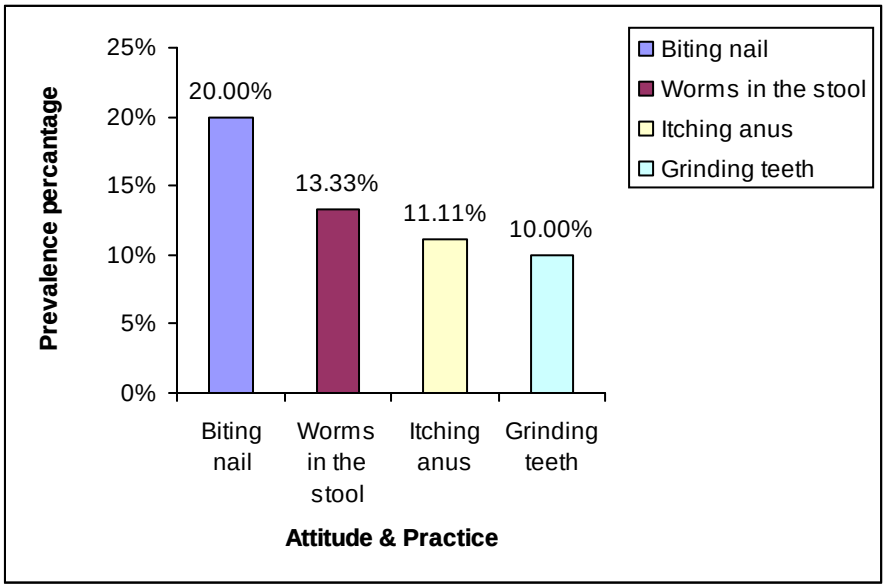
(Attitude and Practice)

From the study it reveals that out of 163 individuals, 25 used to bite nail, 27 of them were seen having worms in their stool, 45 of them were suffering from itching anus and 30 used to grind teeth at night. Percentage of pinworm infection for biting nail 20% (5/25*100), itching anus 13.33% (6/45*100), worms seen in the stool 11.11% (3/27*100) and grinding teeth at night 10.00% (3/30*100). The distribution of pinworm among the children was found to be significant according to the environmental aspect (Attitude & Practice). (χ^2 = 1.586; df = 3; and at 0.05 significant level).

Table No 8: Pinworm infestation in relation to environmental aspect (Attitude and Practice)

Attitude & Practice	No. of total observed cases (n=163)	Pinworm	
		Positive cases (n=9)	Percent (%)
Biting nail	25	5	20.00
Worms in the stool	45	6	13.33
Itching anus	27	3	11.11
Grinding teeth	30	3	10.00

Figure No. 9: Pinworm infestation in relation to environmental aspect (Attitude and Practice)



Prevalence of Pinworm in relation to the use of different preventive measures adopted by respondent.

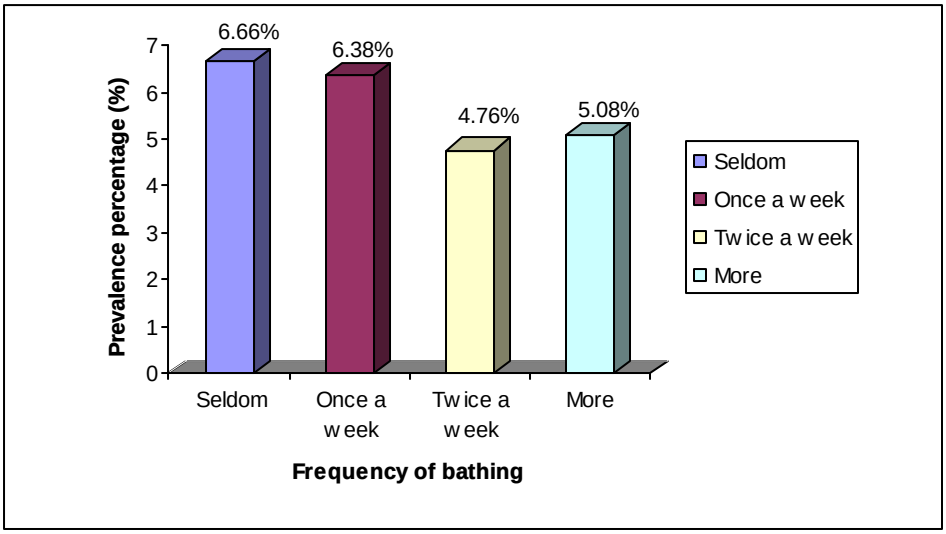
Bathing and pinworm infestation

In relation to different preventive measures majority of students (59) used to bath more than twice a week, followed by once a week (47), by twice a week (42) and use seldom (15). The highest percent of positive cases were from the pupils of taking bath seldom, i.e. 6.66% and the lowest percent from those who took bath twice a week, i.e. 4.76%. The prevalence of pinworm showed no significant differences as per the bathing of children. (χ^2 = 1.221; df = 3; and at 0.05 significant level).

Table No. 9: Bathing and pinworm infestation.

Bathing	No. of total observed cases (n=163)	Pinworm	
		Positive cases (n=9)	Percent (%)
Seldom	15	1	6.66
Once a week	47	3	6.38
Twice a week	42	2	4.76
More than twice a week	59	3	5.08

Figure No. 10: Bathing and pinworm infestation



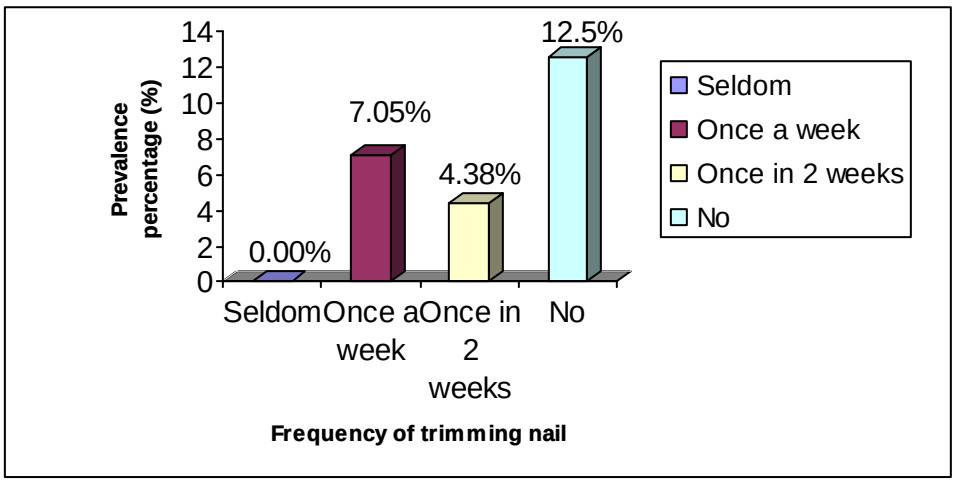
Trimming nails and pinworm infestation

From the study the result revealed that, out of 9 positive cases, 6 (7.05%) trimmed nail once a week whereas 2 (12.5%) did not trim nail at all and 1 (4.38 %.) trimmed nail once in two weeks. Statically difference was found between the prevalence rates of pinworm in the habit of trimming nails. (χ^2 = 9.221; df = 3; and at 0.05 significant level).

Table No. 10: Trimming nails and pinworm infestation

Trimming Nail	No. of total observed cases (n=163)	Pinworm	
		Positive cases (n=9)	Percent (%)
Seldom	25	0	0.00
Once a week	85	6	7.05
Once in two weeks	23	1	4.38
No	16	2	12.5

Figure No. 11: Trimming of nails and pinworm infestation



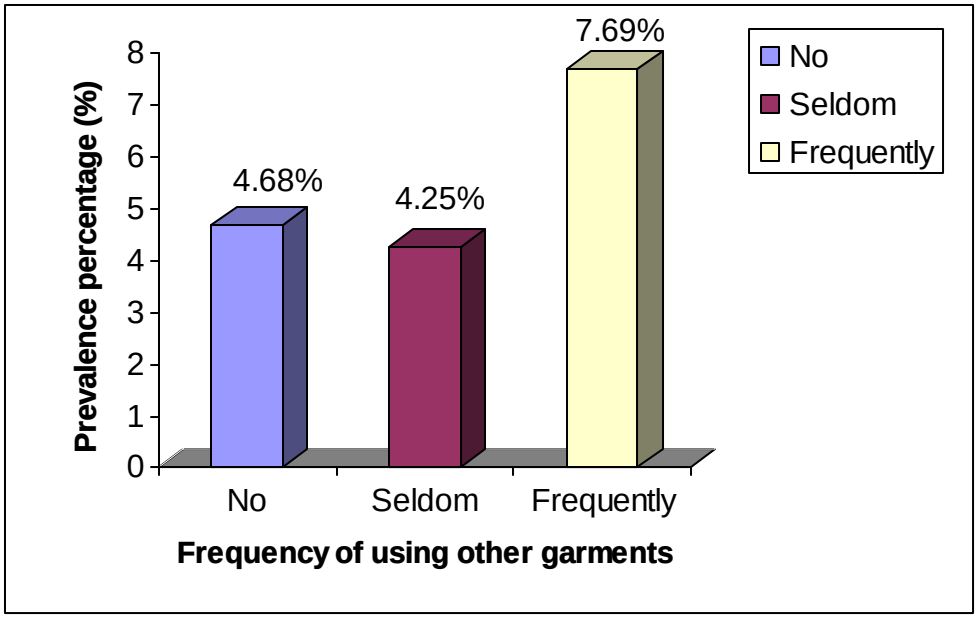
Using other garments (or underwear) and pinworm infestation

In relation to different preventive measures adopted by the respondents, a majority of children (64) did not use other's garments and underwear, 47 children seldom used other garments and underwear whereas 52 children frequently used other garments and underwear. Among the nine positive cases the prevalence of pinworm was very high (7.69%) in comparison to others in children who frequently wore other garments or underwear. The prevalence of pinworm showed no significant differences in children using other garments or underwear. (χ^2 = 0.666; df = 2; and at 0.05 significant level).

Table No. 11: Prevalence of pinworm in relation to the use of other's garments & underwear adopted by respondents.

Using other garments or underwear	No. of total observed cases (n=163)	Pinworm	
		Positive cases (n=9)	Percent (%)
No	64	3	4.68
Seldom	47	2	4.25
Frequently	52	4	7.69

Figure No. 12: Prevalence of pinworm in relation to the use of other's garments & underwear adopted by respondents.



VI

DISCUSSION AND CONCLUSION

The gastro-intestinal parasites of human are cosmopolitan in distribution, posing serious health problem in developing countries as Nepal, where illiteracy, ignorance, poverty are inter locked owing to their ubiquity & despite their high rate of infections in these countries, physicians & public health authorities show little interest in their control (WHO, 1981). These diseases are ranked 20 most fatal infections in tropical countries of Asia, Africa, and Latin America in 1977-1978 (Davis, 1980)

WHO (1981) noted that human behaviour might influence the prevalence and intensity of intestinal infection. So the human behaviour such as open air defecation and cultural practice such as growing vegetables in fecally polluted gardens as well as wearing others garments were all found to be contributing factors in transmission of parasites.

The aim of the present study was to find out the number of students with Enterobiasis in primary schools of Bharatpur-13 (Torikhet) & 14 (Kailashnagar). Among the 163 students in 2 schools, 9 (5.52%) were positive to *Enterobius vermicularis* eggs by the adhesive cello-tape method. This result demonstrates that the egg positive rate of *E. vermicularis* was still prevalent among primary school children.

This parasite was also reported by Sharma & Tuladhar (1971) in Kathmandu, James et al. (1983) in Baitadi, Sarala *et al*. (1998) in Godar VDC, Tai-soon Yong *et al*. (2000) in Chitrasar and Jerona, Chitwan, Chaudhari (2004) in Machchhegaun and Ghimire & Misra (2005) in Kirtipur and Gunjanagar.

Prevalence of Enterobiasis in this study was found higher than the finding of other parasitologists of Nepal. This is because the study was done by cello-tape method attached to the perianal area unlike the previous studies which were done only by examination of stool samples, given that the eggs of *E. vermicularis* is generally not found in stool samples.

The present study showed females were more infected (5.97%) than males (5.20%). This might be due to immunity system, urinary tract infection, illiteracy, and usual contact with infected soil, food and feces.

Regarding the age groups, the highest prevalence (7.77 %) was found in 3 to 6 years age group. Children of this age group mostly spend their time in the playground playing with mud, biting nail & clothes, sucking fingers, scratching anus, using other's garments & underwear and eating food without washing their hands. The minimum prevalence was observed in elderly group of children of age group 9 to 12 years (0.00%). This might be due to their awareness towards the personal hygiene.

In the present study among 163-study population, majority of children were from joint family. The maximum numbers of positive cases were found in family member size 4(6.66%) or more than 4(4.70%), followed by 1 case in family size below 4 (5.26%).

Out of 163 children, the majority of them were from middle class income group (72 cases) family but the higher positive rate for pinworm infection was from poor class family i.e. 4 out of 63 cases (6.39%). The result indicated that the pinworm infection was more in poor people. This is due to the reason that the general people mostly of low income group and they do not pay much attention towards their surrounding cleanliness and personal hygiene.

Among the children of Kailashnagar & Torikhet the result of study revealed that, awareness of pinworm was the highest in majority of children, were from literate family. The maximum numbers of positive cases were found from under SLC & illiterate family. The awareness towards the prevention of pinworm seems to be directly associated with the literacy rate. Hence, it can be concluded that education plays a key role in building up of positive social attitude towards common infections, mode of disease transmission in society and its adverse impacts in society due to pinworm.

Regarding the study of occupation of father majority of children was from farmers and a few of them were from jobholders and businessmen but the study revealed that highest prevalence of pinworm among children was from labours. This is because of

poor personal hygiene and lack of parental care on health & sanitation due to low socio-economic status.

From the study it reveals that out of 163 individual children, among the presented, 35 kids were in Nursery & KG, 63 in class-one and the remaining 65 in class - 2 & 3. The higher positive rate for pinworm infection was from class one i.e. 5 out of 63 cases (7.93%). It is because the students of grade one do not get more time from their parents as compared to the junior, and due to lack of personal hygiene as compared to the children of higher classes.

The prevalence of pinworm is largely favoured by factor like biting nail. From the study it reveals that out of 163 individuals, 25 used to bite nail. Percentage of pinworm infection for biting nails 20%.

The study reveals that out of 163 individuals, 45 suffered from itching anus and 3 used to grind teeth at night. Percentage of pinworm infection for itching anus was 13.33%, and grinding teeth at night was 20.00%.

In relation to different preventive measures majority of students (59) used to bath more than twice a week, followed by once a week (47), by twice a week (42) and use seldom (15). The highest percent of positive cases were from the pupils of taking bath seldom, i.e. 6.66% and the lowest percent from those who took bath twice a week, i.e. 4.76%. Since the eggs are usually found on the perianal region of infected persons as gravid females migrate nocturnally outside the anus and ovipositing while crawling on the skin of perianal area. So there was a great prevalence of pinworm in the children who seldom take bath.

Regarding behaviour of cutting nails, majority of children did not cut nail regularly. This practice also helped in accelerating the prevalence of pinworm. As they do not know about the bad impact of not trimming nail they do not concentrate for cutting nails at fixed intervals. From the interview and study, it was found that 12.5% did not trim nail at all, 4.38 % trimmed nail once in two weeks and 7.05% trimmed nail once a week among the positive cases.

In relation to different preventive measures adopted by the respondents, a majority of children (64) did not use other's garments and underwear, 47 children seldom used other garments and underwear whereas 52 children frequently used other garments and underwear. Among the nine positive cases the prevalence of pinworm is very high (7.69%) in children who frequently wore other's garments or underwear.

The human are the only known reservoir host and are most often affected. Clinical symptoms often encompass severe nocturnal anal pruritus, when female worms deposit an abundance of eggs in the perianal region. The disease is highly contagious and is transmitted via the fecal-oral route. Insufficient hand hygiene, contaminated bed linens and clothes may play a role in transmission.

At last, the study area is highly inhabited by different castes with different life style. They lack health education and technical knowledge, which after all breeds poverty. Poverty and social discrimination result high illiteracy, which in turns is responsible for lack of awareness in health and hygiene, poor sanitary condition. Thus these are contributing factors for high prevalence of pinworm in those communities.

VII

RECOMMENDATIONS

The findings based on the present study showed that the pinworm is not a major public health problem in ward No. 13 & 14 of Bharatpur municipality of Chitwan district. Though this, in our study, where the prevalence of pinworm was found to be 5.52 %. In order to decrease this rate of prevalence there are some measures needed to be undertaken. The following recommendations have been made on the basis of the result for effective control and deduction of pinworm & its prevalence in the area.

Basic health education programmes should be conducted time to time in communities for raising awareness towards the parasitic infections, prevention and control of it.

1. People especially the children should be made aware about their feeding behaviour.
2. Public health education in the school curriculum must be made compulsory.
3. People should be encouraged for sanitary improvements including personal hygiene and environmental sanitation.
4. Children should be reminded to wash his or her hands after using the toilet, after playing outside, and before eating.
5. Parents should be encouraged to keep their child's fingernails short and clean.
6. Infection often occurs in more than one family member. So all infected family members and /or classmates who are infected should be treated at the same time.
7. If a child has a pinworm infection, the articles used by victim like underwear, paijamas, blankets, towels, and clothing should be treated by hot water to destroy eggs.
8. Change and wash clothing and bedding should be done frequently.
9. Children should be discouraged children from activities such as sucking fingers or nail biting and scratching the anal area to avoid re-infection.
10. The research works on the prevalence of intestinal parasites and prevention should be conducted.

REFERENCES

Al-Maldani, A. and Mahfouz, A.A., (1995). Prevalence of intestinal parasitic infections among Asian female housekeepers in Abha district Saudi Arabia. *South East Asian J. Trop. Med. Public Health* 26(11) 135-137.

Astal, Z., (2004). Epidemiological Survey of the prevalence of parasites among children in Khan Younis governorate, Palestine. *Parasitology Research* **94**(6) December: 449-451.

Belding, D.L., (1956). Textbook of Parasitology. Appleton – Century – Crofts, New York,

Bong-Jin, K., Mee-Sun, O., D-ong-II, C., Tai-Soon, Y and Kyu-Jee., L (2003). The intestinal parasite infection status of inhabitants in the Roxus city, The Philippines. *Korean Journal of parasitology*.**41**(2):113-115

CBS (2002). Population Census (2001). Government of Nepal. *National Planning commission secretariat Central Bureau of statistics.* Ram Shah Path, Thapathali, Kathmandu, Nepal.

Ali CELI·KSOZ, Mehmet ACIOZ, Serpil DEGERLI, Ahmet ALI·M, Cetin AYGAN (2005). Egg positive rate of Enterobius vermicularis and Taenia spp. by cellophane tape method in primary school children in Sivas, Turkey *The Korean Journal of Parasitology* Vol. 43, No. 2. 61-64,

Chandler, A.C. and Read, C.P., (1961).*Introduction of Parasitology*. John Wiloy and Sons, Inc. New York, London.

Chatterjee, K.D., (2001). *Parasitology and Helminthology*. Chatterjee Medical Publishers, India.

Chaudhari, B., Mishra, P.N. and Sherchand, J.B. 2004. Prevalence of Human intestinal parasites in rural village development committee, Machchhegaun,

Kathmandu. Fourth National Conference on Science and Technology March23-26, Nepal Academy of Science and Technology; SSZ-PS8. 333p.

Cheng. T.C., (1999), General Parasitology. Academic Press, California.

Chhetri, M.K., (1997). Parasite Infection in Nepal. *J. Nep. Med. Assoc*. 35: 60-65.

Craig, C. and Faust, E.C. (1943).Lea and Febiger, Philadelphia.

Delialioglu, Nuran, Gonul Aslan, Candan Ozturk, Handan Camdeviren and Gurol Emekdas *TURKIYE PARASITOLOJI DERGISI* **29** (3) 2005: 180-182.

Fernandez, M.C., verghese, 5, Bhuvaneshwasi, R., Elizabeth, S.J., Mathew, T., Anita, A., and Chitra, A.K., (2002). A comparative study of the intestinal parasites prevalent among children. Living in Rural on Urban setting in an around Chinnai. *Journal of communicable disease*.34 (i): 35-39.

Ghimire T.R. and Mishra P.N. (2005) Intestinal Parasites and Haemoglobin Concentration in the People of Two Different Areas of Nepal. *Journal of Nepal Health Research Council* Vol.3 No.2 October 2005; 1-7.

Gunduz, Turan, M. Mete Demirel, Tonay Inceboz, Selma Tosun and Kor Yereli. *TURKIYE PARASITOLOJI DERGISI 29* (4) 2005: 264-267.

Han-jong, Jong-Yil Chai, Duk-Young Min, Seung-Yull Cho, Keeseon S E O M, Sung-Jong Hong, Wooh-Mok Sohn, Tai-Soon Yong, Giovanni Deodato, Hanne Standgaard, Bounlay Phommasack, Cheong-Ha Yun and Eui-Hyug Hoang. (2003). Prevalence of intestinal parasite infections on a national scale among primary school children in Laos. *Parasitology Research* **91**(4) October 267-272.

Janakiran, k., Shetty, S.K., Peaddy, K.V. and Lalithamma, B.P., (2001). Prevalence of Intestinal Parasitic Infection among patients attending Adichunchagiri Hospital and Research Centre, B.G. Nagar, Mandya (Karnataka). *Journal of communicable disease*.**33** (4): 297-299.

Kobayashi, J., Hasegawa, H., Forli, A.A., Nishimura, N.E., Yamanaka, A. Shimabukuru, T. and Sata, Y., (1995). Prevalence of intestinal parasitic infection in five farms in Holambra Sau Paulo Brazil. *Rev. Inst. Med. Trop Sao Paulo.* **37** (1) 15-18.

Lee, J.W., Park, Gab-Man, P., D.U. Lee, Soon-Jung, P. and Tai-son, Y.,(2000) Intestinal Parasitic Infections at an institution for the handicapped in Korea. *Korean Journal of Parasitology.***38**:119-121.

Luca, C., Luca, V., Turcu, T., Mihalache, D., Finitnaru, R., Teodorescu, I., Miftode, E., Corcaci, C., Leca, D., and Hurmuzache, M.(2001). Clinical and Biological study of acute diarrhoea with mixed etiology in 48 patients. *Rev. Med. Chir. Soc. Med. Nat. Iasi*. **105** (3): 536-40.

Mc Pherson, C.N.L., Barakat, J.P. and Evans. D., (1999). A cross sectional prevalence study of the protozoan and helminths infections in school children 6-12 years of age in Grenada. *WHO Regional publication of south East Asia series* (3) 16.

Makhlout, S.A. Sarwat, M.A., Mahmoud, D. M and Mohamad, A.A., (1994). Parasitic infection among children living in two orphanages in Cairo. *1. Egypt. Soc. Parastol.* **24**:137-145.

Menan E.L., Nebavi, N.G., Adjetey, T.A., Assavo, N.N., Kiki Barro, P.C., and Kone, M., (1997). Profile of intestinal helminthiasis in school aged children in the city of Adidjan. *Bull Soc, Pathol. Exot* **90** (1) 51-54

Mosala, T.I. and C.C. Appleton (2003). True prevalence of pinworm (*Enterobius vermicularis*) infection among children in Qwa-Qwa, South Africa. *South African Journal of Science* **99** (9-10) September-October 465-466.

Navarrete, N and Torres, P., (1994). Prevalence of infection by intestinal helminths and protozoan, in school children from a coastal locality in the province of Validivia, Chile. *Bol. Chil. Parasitol*. vol 49 No. 34: 79-80.

Nikolic, A. Djurkovia, D.O. and Bobic, B., (1998). Intestinal parasitic infections in Serbia, *Srp. Arh. Cetok. Lek. Vol*.126, No. 1-2; 1-5.

Olsen, A., Samvelson, H.and Onyango-Ouma, W., (2001). A study of risk factors for intestinal helminths infection using epidemiology and Anthropological approaches. *Journal of Biasocial Science.* **33**: 569-584.

Panaitescu, D., Caprarv, T. and Bugarin, V., (1995). Study of the incidence of intestinal and systemic parasitosesin group of children with handicaps. *Roun Arch Microbial, Immunol.* **54** (1-2) 65-74.

Parija, SC, (2004). Medical Parasitology. Medical Book Publishers Chennai, New Delhi.

Park JH, Han ET, Kim WH, Shin EH, Guk SM, Kim JL, Chai JY (2005). A survey of Enterobius vermicularis infection among children on western and southern coastal islands of the Republic of Korea. *[Korean J Parasitol. 2005]*. Department of Parasitology and Tropical Medicine, Seoul National University College of Medicine, Seoul National University Medical Research Center, Korea.

Rai, S. K., Nakashishi, M., Khadka, J.B., Shrestha, M. K., Sharma, C.M. and Shrestha, H.G., (1991). Intestinal Parasitoses in Kathmandu, Nepal. Asian conference in Medical Laboratory Technology, 4th Bangkok. *Thai and proceeding of the Asian conference in Medical Laboratory Technology.*

Rai, S.K., Uga, S., Ono, K. and Rai, G. (2000). Contamination of soil with helminths parasites eggs in Nepal. *Southeast Asian J. Trop. Med. Public health*, 31: 388-393.

Romanenko, N.A. (2003). Hygienie issues related with prevention of parasitic diseases. *Gig Santi* **3**: 16-18

Saha, S.S., Mohanty, B. Behl, J.P. and Kumar A (1994). *G. lamblia* and other intestinal parasite in Aizawl, Mizoram, *J. com. Dis*. **26** (4): 237-239.

Sarala Sherchand, Hiroshi Ohara, Hajime Matsuda, Jeevan B. Sherchand (1998). A Cross sectional study on intestinal parasitic infections in Primary school children of Godar VDC, Nepal. *JONAMELS* Vol-1 No.1-Nov-1998: 61-64.

Sayyari, A.A., F. Imanzadeli, S.A. Bagheri Yazdi, H. Karami and M. Yaghoobi. (2005) Prevalence of intestinal parasitic infections in the Islamic Republic of Iran. *Eastern Mediterranean Health Journal* **11**(3): 377-383.

Sharma, R.P. and Tuladhar, N.R. (1971). A study on intestinal parasites among auxiliary health workers in Kathmandu. *J. Nep Med Assoc*., **9**:257-261.

Sherchand, J.B., Ohara, H., Sherchand, S., Cross, J.H. and Shrestha, M.P., (1997). Intestinal parasitic infections in Rural Areas of Southern Nepal. *J. Inst. Med*., **19**:115-21

Smyth, J.D. (1994). Animal Parasitology, Cambridge University Press.

Stoll, N.R., (1947). The Wormy World. *J. Parasitol*, **33**:1-17.

Suguri, S., Tongu, Y., Inatomi, S., and Pradhan, H.D., (1985). A survey on Human parasitic infection in Nepal. *Journal of Parasitology*, **34**; 285-291.

Tai-Soon YONG, Seobo SIM, Jongweon LEE, Heechoul OHRR, Myung-Ho KIM, and Hyunsoo KIM (2000). A small-scale survey on the status of intestinal parasite infections in rural villages in Nepal. *The Korean Journal of Parasitology* Vol. 38, No. 4, 275-277, December 2000

Tashima, Nair Toshiko and Maria Jacira Silva Simoes, (2004). Enteroparasite occurence in fecal samples analysed at the University of Western Sao Paulo-Unoeste Clinical Laboratory, Presidente Prudente, and Sao Paulo State, Brazil. *Revista do Institute de Medicina Tropical de Sao Paulo* **46**(5) September:243-248.

Uchoa Clavdia, M.A., Alexandre, G.B., Otilio, M.P. and Alexandre, D.M., (2001). Intestinal Parasitism. Prevalence on Day-care centers of Niterol city, Rio de Janeiro, Brazil. *Revista do Instute Adolfo Lutz*. **60**(2): 97-101.

Virk, K.J., Prasad, R.N. and Prasad, H., (1994). Prevalence of intestinal parasites in Rural Areas of District Shanjahanpur. *Utter Pradesh J. Com.dis*. **26** (2) 103-108.

Waikagul, J., Krudstood, S., Radomyos, B., Chalemrut, K., Jonsuk unitgual P., Kojima S., Looareesuwan sand Thaineav W. A cross-sectional study of intestinal parasitic infections among school children in Nan Province Northern Thailand. *Southeast Asian J. Trop. Med. Public Health 2002*, **33**: 456-461.

W.H.O. (1981) Intestinal Protozoan and Helminthic Infections: *Report of WHO Expert Committee, Tech Rep. Ser*: 666.

W.H.O. (1987) Intestinal Protozoan and Helminthic Infections: *Report of WHO Expert Committee, Tech Rep. Ser*: 749.

W.H.O. (1998). Guidelines for the Evaluation of Soil-Transmitted Helminthiasis and Schistosomasis at community level. *Mime graphed document*. WHO/CTB/SIP/98. World Health Organization, Geneva.

W.H.O. (2005). Bulletin of the WHO. *The International J. Public Health.* **83**(8).
W.H.O. (2005). Bulletin of the WHO. *The International J. Public Health.* **83**(9).

Williams-Blangero, S., Subedi, J., Upadhayay, R.P., Manral, D.B. Khadka, K., Jirel, S., Robinson, E.S. and Blangero, J. (1998). Attitudes towards Helminth Infection in the Jirel Population of Eastern Nepal. *Soc. Sci. Med*., **47**:371-379.

Wongjindanon, N., Suksrichavalit, T., Subsutti, W., Sarachart, T., Worapisuttiwong, U. and Norramatha, P. (2005). Current infection rate of Giardia lamblia in two Provinces of Thailand. *Southeast Asian J. Trop. Med. Public Health*.36 Suppl **4**: 5-21.

Annex – 1

QUESTIONNAIRE

Family Demographic Information

S.No. Date:

Student's Name: Class: Age: Sex:

- Father's name: Age:
- Address: Zone District
  VDC/NP Ward
- Occupation: Farmer ( ) Job holder ( ) Labour( )
  Businessman ( ) Others ( )
- Educational Status: Illiterate ( ) SLC( )
  PCL/10+2 ( ) University ( )
- Mother's name: Age:
- Address: Zone District
  VDC/NP Ward
- Occupation: Farmer ( ) Job holder ( ) Labour( )
  Businessman( ) Others ( )
- Educational Status: Illiterate ( ) SLC( )
  PCL/10+2 ( ) University ( )
- Family size: Male: Female:
- No. Of Brothers: No. Of Sisters: Total:

KNOWLEDGE ABOUT DISEASE

1. Do you know about the disease Enterobiasis?

   Yes ( ) No ( )

2. If yes, what are the clinical symptoms?

   High fever ( ) Itching ( )

   Irritability ( ) Restlessness ( )

3. If no, have you felt any itching after the bed?

   Yes ( ) No ( )

4. Then what do you feel?

   a) Bacterial infection ( ) b) Irritability ( ) c) Restlessness ( )

5. Do you know about its transmission? If yes;

   Water ( ) Food ( ) Air ( )

   Vector ( ) Sex ( ) Contact ( )

6. Do you think the Enterobiasis transmission can be prevented?

   Yes ( ) No ( )

7. What are the preventative measures of Enterobiasis?

   a) Personal Hygiene ( ) b) Medicine ( )

   c) Avoiding others Garments ( ) d) Unknown ( )

8. What do you suppose to do if you get the disease?

   a) Consult Doctor ( ) b) Aurvedic ( ) c) Dhami ( )

   d) Personal cleaning ( ) e) Nothing ( )

9. Have you ever heard/seen people have died of Enterobiasis?

   Yes ( ) No ( )

ATTITUDE & PRACTICE TOWARDS ENTEROBIASIS

1. Have your kids ever been attacked by Enterobiasis?

   Yes ( ) No ( )

2. Where do they get treatment?

   Health Post ( ) Clinic ( ) Hospital ( ) Not ( )

3. Is that patient completely treated?

   Yes ( ) No ( )

4. If no, what happened?

5. Do they take bath regularly?

   Twice a week ( ) Once a week ( )

   After toilet ( ) Sometimes ( )

6. Do they bite their fingertips or nails?

   Yes ( ) No ( )

7. Do they use other under garment?

   Yes ( ) No ( )

8. If yes, used

   Sometimes ( ) Regularly ( ) Rarely ( )

9. Had anybody or Organization launched a programme for it's aware?

   If yes, then, whom? When?

10. Suggestion for prevent of Enterobiasis?

11. Finding of microscopic examination.

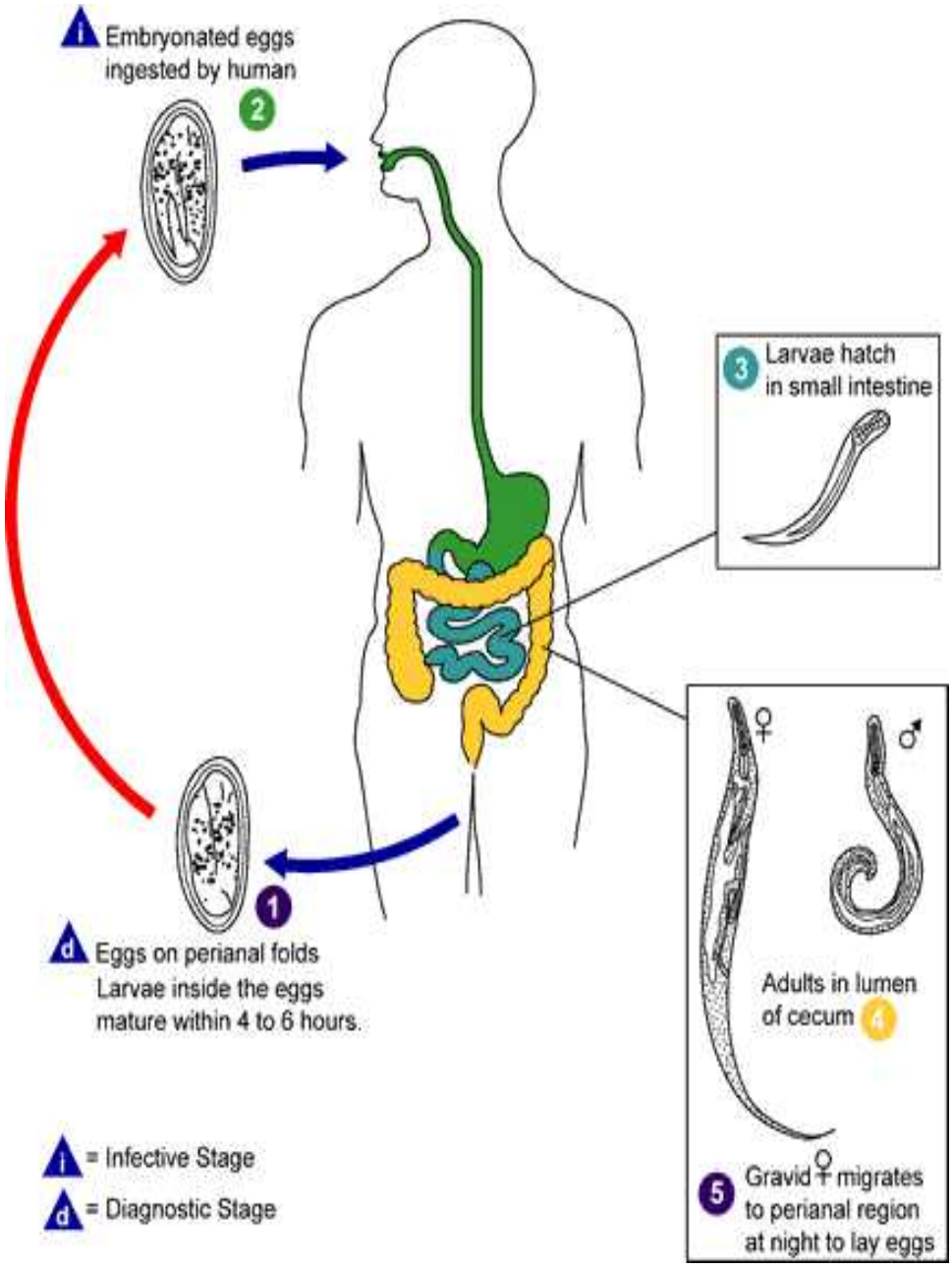
Annex - 2

Life Cycle

The life cycle of *E. vermicularis* is simple, direct and is completed in a single host. Man is the natural host; no intermediate host is required. Both males & females are commonly attached to the epithelial wall of host's intestine. After copulation gravid females become packed with eggs. These females migrate to the posterior parts of intestine during night, and deposit their eggs. These eggs adhere to the perianal skin folds. Most female migrate back into the large intestine after ovipositing & die; however, some pass to the exterior, while others explode while laying eggs. Males die soon after copulation.

Deposited eggs enclose a motile larva. Infection or reinfection become established when the host ingests these infective eggs. These eggs are usually picked up from bedclothes or fingernails that become contaminated while the host scratches the itchy perianal zone caused by the migrations of the females. However, the lightweight eggs can be airborne & inhaled. Retro-infections are possible when larvae hatching from perianally located eggs migrate back up the intestinal tract.

When these ingested eggs reach the duodenum the escaping larvae migrate posteriorly and undergo three molts in the process and develop into adults by the time they reach the large intestine. The life cycle of this worm completes within two months. [Cheng, T.C. (1986)]



Life Cycle Diagram of *Enterobius vermicularis*

Source: www.dpd.cdc.gov/dpdx/default.htm

Annex-3

Pathophysiology:

Usually, no symptoms occur when pinworms inhabit the caecum and adjacent areas. Diarrhea can occur during acute infection because of inflammation of the bowel wall.

The primary symptoms, itching or prickling sensation of the perianal area, are produced when a gravid female worm migrates to the anal area and inserts her tail pin into the mucosa for ovideposition.

Although histological findings of acute appendicitis demonstrated pinworm at the section, this correlation is not significant.

Frequency:

- **In the US:** Infection is most common in crowded living conditions and in persons who are institutionalized, but the prevalence of infection in some regions may be as high as 12% of the general population.
- **Internationally:** Egg carrier rates vary by country from 0.1-98.4%.

Mortality/Morbidity:

Pinworm infection does not cause severe morbidity unless ectopic infection occurs. This rare complication occurs in individuals with conditions that compromise the integrity of the bowel wall (e.g., inflammatory bowel disease). Parasites migrate through the bowel wall and are found in extra colonic sites. Ectopic Enterobiasis have been described at the vagina, the salpinx, the inguinal area, the genital area, the pelvic peritoneum, the omentum, the liver, and even the lungs.

Race: No racial predilection is reported.

Sex: No sexual predilection exists.

Age: In adults, the highest rate of infection occurs in parents aged 30-39 years, typically because of transmission from their children aged 5-9 years.

Medical Care:

- Antihelminthics are active against *E vermicularis.*
- Reinfection with *E vermicularis* immediately after completing drug therapy is common. Additionally, young worms can be resistant to drugs.
    - Eggs remain infective in the environment for 2 weeks after deposition.
    - Reinfection from other persons who test positive for eggs is common.
    - Tests for worms have a high false-negative rate. Therefore, successful eradication requires that individuals take at least 3 doses of medication, separated by 3 weeks. In institutionalized settings, 3 doses separated by 3 weeks have been necessary to achieve successful eradication.
- The recommended treatment includes the following:
    - Simultaneously treat all family members and/or classmates who are infected.
    - Prescribe drugs at least 3 times at 3-week intervals.
    - Personal and group hygiene must be improved. Individuals must wash their hands before eating. Discourage children from activities such as sucking fingers.

If large numbers of schoolchildren test positive for eggs, the result of treatment is best if all classmates and family members of the children who are infected are treated 3 times at 3-week intervals. If less than 30% of class members test positive for eggs, treating only the children who have positive test results reduces the positive rate for eggs in that class.

Further Outpatient Care:

- Follow-up examination is necessary for a person who is positive for eggs after chemotherapy to determine whether reinfection exists. Although the first single examination may be negative for *Enterobius* eggs, a follow-up perianal swab is necessary if the patient has continuous complaints of perianal itching or prickling pain.

Deterrence/Prevention:

- Personal and group hygiene must be improved.
    - Individuals must wash their hands before eating.
    - Discourage children from activities such as sucking their fingers.

- Treatment is much more effective if the child's family and classmates are treated at the same time.

- Washing sheets, clothes, and towels in a washing machine using regular laundry soap can eliminate eggs. However, eggs become non-infective after 2 weeks. Therefore, an emphasis on washing and environmental cleaning does not significantly improve the effectiveness of therapy.

Prognosis:

- Eradicating Pinworm in a group of persons who are institutionalized is difficult. Continuous follow-up examination is necessary.

- Therapy is much more effective if the child's family and classmates are treated at the same time.

Patient Education:

- Focus on hand washing, especially before eating.

- Washing sheets, clothes, and towels in a washing machine using regular laundry soap can eliminate eggs. Eggs become non-infective after 2 weeks.

Therefore, an emphasis on washing and environmental cleaning does not significantly improve the effectiveness of therapy.

Medical/Legal Pitfalls:

- Failure to properly diagnose Enterobiasis is a pitfall. The tools used to diagnose Enterobiasis are not very sensitive or specific. Perianal swabs only can detect the female worm when her life cycle is terminated (after egg production). Therefore, the false-negative or false-positive results can be a medical and/or legal pitfall.