CHAPTER I

1.0 INTRODUCTION

1.1 General Background

Enterobius vermicularis, commonly known as pin-worm, is a small, round, white-coloured *oxyurid*, 2-13 mm long that infests the area around the anus and parts of the large intestine. It lives only in human and is the most commonly seen intestinal parasite in a primary care practice. Typically, it affects children between the ages of 5 to 15 years but it may infest individuals at any ages. It is widespread in temperate climates but rarely in tropics. Probably every child in the temperate region has been infected not once but many times in early childhood. Once it reaches a household, it is likely to infect every member of the family. Fortunately, it is relatively harmless, although it may cause restlessness and irritability in young children. [Parija S.C. (2004)]

Adult worms inhabit the caecum, appendix and adjacent portions of the ascending colon. In both male and female, a pair of wing-like expansions called cervical alae is present at the anterior extremity. The posterior end of the oesophagus is dilated into a conspicuous globular bulb. Male measures about 2-4 mm in length, its posterior third of the body is curved and usually dies after fertilizing the female. Female measures about 8-12 mm in length, its posterior extremity is straight and dies after oviposition. Eggs are laid on perianal region which are colourless, plano-convex in shape, surrounded by a transparent shell and contain coiled tadpole-like larva.

1.1.1 General Account: Life cycle of *Enterobius vermicularis*

Enterobius has the simplest life cycle which is completed in a single host. Each of the eggs newly laid on the perianal skin, containing a tadpole like larva completes its development in 24 to 26 hours time in the presence of oxygen. Infection occure by ingestion of these eggs. The egg sheath get dissolved by the digestive juice and the larvae escape in the small intestine where they develop into adolescent worms. After the worms become sexually mature, the male fertilizes the female and

dies. The gravid female then migrates from small intestine down to the caecum and colon, also the vermiform appendix and remains their until the eggs develop. The fertilized female then wanders down the rectum and comes out of the anus during night to deposit eggs on the perianal and perineal regions. The cycle is then repeated. The whole cycle is completed in 2-4 months time.

1.1.2 Mode of Infection

The eggs deposited and the crawling of female cause itching and scratching cause the transfer of eggs to the fingers and fingernails. While during eating or thumb sucking, the eggs are introduced into the mouth. Pinworm can also come from eggs that are airborne after shaking infested clothing and bed liner. Contact with toys and other handled objects can transfer eggs from one child's hand to anothers'. Sometimes pinworm also hatch on the skin around the anus and then crawl back into the intestine to start another round of infection and is referred as "Retro Infection".

1.1.3 Pathogenesis

The most significant pathological conditions are associated with gravid females. Their migration from the anus into perianal and perineal skin for oviposition causes a crawling sensation and pruritis. This results in scratching and scarification. The presence of worms inside the appendix at times may produce appendicitis. [Yildirin, et al., (2005); Markin, A.V. (1996)] In children, it causes nervousness, insomnia, nightmares and even convulsions. The presence of many worms in the rectum causes rectal discomfort. Although rare, dead pinworms have also been found in the granuloma in the liver and lungs. A necropsy case of a 40 year old emaciated pinworms penetrating the intestinal wall into the sub-serosa has also been reported.

Pinworms also cause vulvitis, vaginitis [Chen-Dong (1997)] and even salpingitis in female. [P. Ertan (1999); Arora, V.K. (1997)] This is more common among 11 to 20 year old girls. In males, it usually associated with tissue invasion of colon. Uncomplicated enterobiasis is never fatal. It also causes psychological trauma

to the patient, eosinophilia colitis [Jonathan, et al., (1995)], eosinophilia gastroenteritis. [Ruiz, et al., (2005)]

Laboratory Diagnosis: This depends upon

i) the finding of adult worm &

ii) demonstration of eggs.

1.1.4 Detection of Adult Worms

a) The worms are often discovered by the patient himself or by the parents of the children.

b) If there is any history of passage of small whitish worms in the faeces, the patient should be instructed to bring such specimens preserved in alcohol, or 10 percent formaldehyde, for examination.

c) The adult worms may be recovered from stool after a purge or an enema.

d) Inspection of the anal region at the time of commencement of itching may reveal the gravid females.

1.1.5 Demonstration of Eggs

Although oviposition in the bowel is exceptional, microscopical examination of stool for eggs of *E. vermicularis* either by a direct smear examination or by concentration method may occasionally be successful. Eggs are generally demonstrated in the scrapings from the perianal skin by a NIH swab, It is advisable to take the swab immediately after the patient wakes up in the morning. Eggs can also be recovered from under the finger nails and the washings from garments.

1.1.6 Treatment

The specific antihelmintics for enterobiasis are piperazine salts (hydrate, phosphate, citrate, tartarate or adipate), pyrvinium pamoate (povan), pyrantel pamoate, stilbazium iodide thiabendazole and mebendazole.

Mebendazole in a single oral doze of 100 mg is highly effective. Pyrvinium pamoate in a single oral dose of 5 mg/kg body weight is also equally effective.

1.1.7 Prevention and Control

It consists of

1) Treatment of infected children and other members of the family.
2) Improved personal hygiene and cleanliness such as cutting the nails short, washing the hands before eating, washing the bed linens and night dress daily and
3) Avoidance of putting the fingers in the mouth. This prevents auto infection especially in the children.

1.2 Objectives of the Study

General Objective

To determine the prevalence of *Enterobius vermicularis* in relation to socio-economic & environmental factors in Beldangi, Damak, Jhapa.

Specific Objectives

a) To determine the prevalence of Enterobiasis among Bhutanese Refugee children.

b) To determine the socio-economic aspects in relation to *Enterobius vermicularis.*

c) To assess the knowledge, attitude and practices in study area in relation to transmission of intestinal parasites (*Enterobius vermicularis*).

d) To bring awareness about different aspects of intestinal parasites (*Enterobius vermicularis*).

e) To develop the recommendation for further planning regarding the control of *E. vermicularis*.

1.3 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 Beldangi, Damak, Jhapa. The present study includes stool examination as well as cello-tape and 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.

1.4 Limitation of the study

Social researches being a vague subject possesses some kind of limitation in every field of experimentation. Financial problem, lack of proper equipment/facilities in the lab, time limitation etc. are the major problems during present work. The study is based on entirely primary data collected from the study area.

CHAPTER II

2.0 LITERATURE REVIEW

2.1 History (Global Context of Enterobiasis)

Knowledge of large parasitic worms extend back into prehistoric times. The physicians of ancient Egypt were familiar with several parasitic worms and insects. The famous Ebers papyrus (1550 B.C.) contains some of the earliest records of the presence of parasites in man. Assyrian and Babylonian writers mentioned hematuria, recognized round and flatworms. Persian writers recognized ascarids, pinworms, tapeworms and the Guinea worm. [Chandler and Read (1961)] Early Chinese and Indian literature refers to vermifuges, and to ascarids, pinworms, tapeworms and eyeworms from horses and camels. Hippocrates described the diagnosis and removal of the hydatid cyst and referred to pinworms in horses.

Enterobius vermicularis is commonly known as pinworm or seatworm which commonly infect children, worldwide in distribution but common in temperate and cold climates. It was first described by Linnaeus in 1758, and Leukart in 1865 worked out its life cycle. [Parija, S.C. (2004); Chatterjee, K.D. (1980)]

Nolan and Reardon, 1939, in one household examined, upto 90 percent of samples of dust taken from different parts contained eggs of *Enterobius vermicularis*. Hitchcock (1950) had reported that at least 51 percent of Alaskan Eskimos were infected. Zaiman *et al.*, (1952) had reported a 58 percent infection rate of enterobiasis among the pupils in a preschool nursery in San Francisco, California. Ricci (1952) had reported a startling infection rate of 77.14 percent among Sicilian children, but in the same population only 6.09 percent of the adults were infected. [Cheng, T.C. (1986)] Cates (1953) had reported a 26.85 percent infection rate of *Enterobius* among students of five elementary schools in and around Tallahassee, Florida.

Kassel *et al.*, (1954) had reported only a 9 percent infection rate of enterobiasis among five to nine years old in Tahiti, French Oceania.

Iwanezuk (1953) had reported that 8.6 percent of 1119 children upto four years of age in Warsaw, Poland, were infected by *Enterobius vermicularis*.

Cheng (1960) in surveying a group of children from a wide geographic range in the united States, found that 32.93 percent had infection from *E. vermicularis*.

Faulkner *et al.,* (1989) Fry and Moore, (1969) found eggs of *Enterobius vermicularis* in human coprolites (Petrified faeces) and dessicated materials from caves in Utah and Tennessee.

A recent Anthelminthic Study Group on Enterobiasis (1984) reported the success rates of various drugs as follows: Pyrantel, 94.1 percent; mebendazole, 67.6 percent; Piperazine, 67 percent. Ivermectin had been reported to be 86 percent effective (Ottesen, 1990).

Liu, Leo *et al.,* (1995) observed larvae of pinworms in diarrhoel stool of a homosexual man presented with severe abdominal pain and haemorrhagic colitis, eosinophilic inflammation of the ileum and colon.

Larvae were identified by using comparative morphology and molecular cloning of nematods rRNA genes.

Bahadur *et al.,* (1995) determined the effects of *Enterobius vermicularis* infection in intelligence quotient (I.Q.) and anthropometric measurement mearwement of Egyptian rural children numbered 239 (114 boys and 125 girls, aged 6-12 years) infected with *E. vermicularis* were selected. The physical growth of these children was irvestigated by taking some anthropometric measurement which included body weight, standing height, head circumference and triceps skinfold thickness. IQ was determined by using Goodenough "draw - a - ma" test. Blood haemoglobin concentration was also determined using a spectrophotometric method. Mean I.Q. of *E. vermicularis* infected children was statistically lower than that of their non-infected peers ($t = 2.02$, $P = 0.04$), while the non-infected peers ($t = 2.42$, $P = 0.02$). Infected male children showed significantly lower I.Q., than infected females ($t = 2.02$, $P = 0.04$). However, physical growth and haemoglobin concentration of E. vermicularis infected children were not statistically different from those of the non-infected control peers, in all age and sex sub-groups.

Karrar *et al.,* (1995) conducted a community based prospectively study among randomly selected 300 children aged less than five years selected from three camps of the police force to determine the prevalence and type of parasitic infection. From the

300 children, 298 stool specimens were examined. The enterobiasis was prevalent in 7.4 percent children aged between 3 years and the infection rate was highest among the illiterate, overcrowded and large sized families.

Lebedev *et al.*, (1996) reported the examination findings of helminthiasis in the population of the town of Anadyr, the settlements of Kanchalan, Kraseno, and in the reindeer-breeding teams of the Anadyr Destrict, Chukotka Autonomous District, Russia. The children infected with enterobiasis were shown to amount to 15.1 to 22.9 percent.

Nunez *et al.,* (1996) carried out a longitudinal study of enterobiasis in three day care centres of Havana city. The infection was prospectively studied during one year in 469 children attending three day care centres; each child was examined at 6 months intervals using up to three perianal swabs with adhesive tape and the disease was prevalent in 28 percent of the children examined. Infected children were treated with mebendazole, the prevalence rate dropeed to 13 percent and 12 percent in the following study periods. They also found the percentage (10%) of the children reinfeeted in all study periods. There was a high correlation between re-infection and perianal itching.

Chih *et al.*, (1996) studied the factors related to *Enterobius vermicularis* infection among pre-school children. A questionnaire was designed to interview parents of the children under study. Variables causing the infection among infected and non-infected children were analyzed. Their results indicated that there were significant relationship between infection and the items like having snacks; sucking fingers; size of the house; ways of cleaning of house; place of activities; parents cognuizing that anus is the polluted source of eggs; recognition of the cause and effect relationship between eating in the bedrooms and being re-infected with *Enterobius* by taking a shower and educational background of father.

Romanenko *et al.,* (1997) detected the risk factors and groups for enterobiasis, the efficiency of the treatment of children suffering from the disease with medamine, biologicals and Normase. It was shown that the risk factors may include an abnormal course of antenatality, minor developmental malformations (diastema, dystrophy, abnormalities of the eye, hand, foot etc.). Enterobiasis was found to have a negative influence on the physical, nervous and mental development and suppression of non-

specific immunity in children, which was suggested by the reduction in salivary lysozyme activity, which was lower than the normal level and on blood α-interferon production. There was strong evidence for the considerable immuno suppressive effects of enterobiasis on the formation of a post vaccinal immunityu against measles. When given in a single dose, medamine showed a 100 percent efficiency in the treatment of enterobiasis. Moreover, bificol, bifidumbacterin and Normase may be useful to enhance the treatment efficiency and children's recovery from enterobiasis.

Chung *et al.,* (1997) reported live female *Enterobius vermicularis* in the posterion fornix of the vagina of a Korean women. *E. vermicularis* eggs were demonstrated during microscopic examination of a smear taken from the posterior fornix of the vagina. On the endoscopic examination of her vagina, a live worm was found in the parterior fornix, the worm was removed and identified as a female *Enterobius vermicularis* based on morphology.

Pegelow *et al.,* (1997) conducted a parasitological survey of children aged 8 to 10 years from ten schools. A total of 348 fecal samples were examined by using modified kato-katz thick smear techniques, 365 blood samples for the measurement of hemoglobin concentration and anthropometric data were obtained from 404 participants. *Enterobius vermicularis* was found in 3 percent of the children examined.

Herrstrom *et al.,* (1997) conducted a cross - sectional survey with questionnaire for symptoms of infestation with *Enterobius vermicularis* and the children's habit of finger sucking. Perianal tape - test for identification of eggs was performed. It was found that more children seemed to be symptom free carriers of E. vermicularis. Finger sucking is considered only when treating infected children and especially those with relapsing symptoms.

Markin *et al.,* (1997) examined 20 educational schools in Rostor - on - Don, Russia, and identified 8 informative determinants of enterobiasis prevalence among them, such as the frequency of wet cleaning, the number of recreational rooms and gymnasia, and shifts of educational processes.

Arora *et al.,* (1997) made a fine needle aspiration diagnosis in a case of enterobiasis presenting with a subcutaneous abscess in the natal cleft. Eggs, as well as

fragments of cuticle of the adult worm were found; the morphology of both was best visualized in papanicolou-stained smears.

Cho *et al.,* (1997) picked up a female *Enterobins vermicularis* in a cellotape anal swab in South Korea.

Nikolic *et al.,* (1997) determined a strategy for the diagnosis of intestinal helminthes including *Enterobius vermicularis* and found anal tape which proved to be the single method sufficient for its diagnosis.

Machado *et al.,* (1998) evaluated the rate of infection by enteroparasites in a survey conducted with 900 stool samples from 300 children aging from four months to seven years randomly selected in 10 nursery schools. Samples were examined both by Baermann Moraes and Lutz methods. 265 of 300 children were infected with enteroparasites and the prevalence of enterobiasis was about 4 percent. Fan and Ping - Chin in 1998 carried out extensive surveys of *Enterobius vermicularis* infection among school children in Taiwan and Offshore islands. Among 6, 315 children an overall infection rate was 11 percent. The pre-school children had the highest rate of 14 percent.

Lee *et al.,* (1999) conducted a survey of helminthic infection was carried out in the residents of rural areas in Mongolia in 1998. A total of 738 samples were collected. Among 391 scotch-taped slides of anal swabs of children and of young teenagers, *E. vermicularis* eggs were detected in 138 cases (35.3%). With the fecal samples of 206 Kato-Katz thick smear slides from adults eggs of *Enterobius vermicularis* were observed in 9 cases. Enterobiasis was the major endemic disease which is related closely to the life-style of Mongolian.

Ertan *et al.,* (1999) studied the relationship between pinworm and urinary tract infections in young girls, with or without urinary tract infection, were examined for pinworms inorder to explore a possible relationship. Of the 55 young girls with urinary tract infection 20 (36.4%) had pinworm eggs in the perianal and perineal region monitored using the cellophane tape methods, while 9 (16.4%) of 55 young girls who had never previously and a urinary tract infection were found to have *Enterobius* eggs in at least one of the cellophane tape tests and the difference was found to be significant.

Azazy *et al.,* (1999) carried out the survey to determine the prevalence of intestinal and blood parasites among school children aged between 6 and 13 years. 958 stool samples (215 from rural areas and 743 from urban areas) for intestinal parasites were collected. Prevalence of *Enterobius vermicularis* in rural areas was 2 percent of specimens and in urban areas was 1 percent of specimens.

Guignard *et al.,* (2000) studied the prevalence of enteroparasites in a population belonging to a substitute home that gives shelter to orphaned and homeless children in Argentina using conventional methods of analysis. The home shelter 396 individuals. The overall parasitic infection pathogen and commensal organism included, yielded 84.8 percent and the prevalence of *Enterobius vermicularis* was 43.4 percent.

Sirivichayakul *et al.,* (2000) conducted a prospective observational study in a male orphanage in Bangkok to find out the prevalence of enterobiasis and its incidence after blanket chemotherapy using mebendazole. They found that the prevalence of enterobiasis was 28.9 percent. The incidence density of enterobiasis after blanket chemotherapy was 379.82 per 1000 person years which was quite high.

Kishk *et al.,* (2000) carried out a study in the prevalence of intestinal helminthes among pre-school childen and its relation to soil contamination in Alexandria. A cross sectional community based study was carried out in 6 districts. An equal member of families from each district (m = 50) having at least one child in the pre-school age group was included in the study. Stool samples were collected from each underive child and examined as well as ten soil samples were collected from the playing areas in each district and the mean number of eggs per gm. Soil was calculated. *Enterobius vermicularis* was prevalent in 3.54 percent. Soil examination demonstrated the presence of eggs of *Enterobius vermicularis*.

Lee *et al.,* (2000) conducted a study on intestinal parasites infection at an institution for the handicapped in Korea. Stool and cellotape anal swab examinations were carried out in August 1997 on handicapped people at an institution located in Chorwongun, Kangwondo, Korea. A total of 112 stool samples (78 males and 34 females) revealed 1 case of *Enterobius vermicularis* infection. In cellotape anal swab examinations (165 samples) the prevalence rate of *Enterobius vermicularis* was 20.6 percent (25.7% of males and 9.6% of females).

Lee *et al.,* (2000) conducted a survey on the intestinal parasites among school children in Taoyoan Hsiang, Kaohsiung country in 1999. Tape perianal examination of 302 children was done and the infection rate of *Enterobius vermicularis* was 25 percent.

Straka *et al.,* (2001) submitted the results of preventive parasitological examinations for intestinal parasites in pre-school and school children of the Tureic Region (Central Slovakia) in 1970-1979. The study was divided into three -cross - sections in the following decades (1970-1979; 1980-1989; 1990-1999). The occurrence of *Enterobius vermicularis*, despite its significant decrease in the recent decade, remained on a relatively high level.

Parija *et al.,* (2001) evaluated Lactophenol Cotton Blue (LPCB) stain for detecting eggs of *Enterobius vermicularis* in perianal surface samples of 200 children treated in the paediatrics ward and outpatients department of Jipmer Hospital in Pondichery from each child two anal surface samples were collected by scotch cellophane tape methods, one sample was pressed in the glass slide containing a drop of LPCB while the another was pressed on a slide without LPCB and examined by microscopy for presence of the egg. The anal sample collected from 50 children were positive for the eggs of *Enterobius vermicularis* 48 were detected by cellophane tape using LPCB and 36 by cellophane tape without LPCB. They, therefore, recommended scotch cellophane tape using LPCB as a simple, inexpensive and overall more sensitive method for detecting *Enterobius vermicularis* eggs in anal surface samples.

Cakar *et al.,* (2002) investigated the rate of parasite positivity in the samples which were sent to parasitology laboratory of Hacettepe University Medical School, between 1997-2001. A total of 58.15 specimens collected from 42 percent adult and 58 percent children were evaluated for the presence of parasites. Most of the samples (98%) were feces, and the remaining were sputum, cellotape, blood and cyst materials. *Enterobius vermicularis* (9.7%) was the most frequently encountered parasite.

Kim *et al.,* (2003) investigated the status of pinworm positive rate of primary school children in Geoje island using adhesive cellotape and swab method in 2002. Total egg positive rate of *Enterobius vermicularis* were 9.8 percent. Among there schools examined, Myeongsa primary school showed the highest egg positive rate

(12.6%) followed by Yeoncho [9.8% (26/266)] and Geoje [9.1% (35/385)]. As for the age groups, the second grade had the highest egg positive rate (15.3%) whereas the fifth grade showed the lowest egg positive rate (2.6%). The result confirmed that the egg positive rates of *Enterobius vermicularis* in primary school children in Geoje island were not significantly different from those in the whole country.

Song *et al.,* (2003) investigated the infection rate of *Enterobius vermicularis* in 1,191 pre-school children in 25 day care centres in Seoul, Korea by cellotape anal swab in 1999. The overall egg positive rate was 9.5 percent and the prevalence in the day care centres ranged from 0 to 31.1 percent. Children aged 6-7 years showed a significantly higher egg positive rate than younger children but infection rate was similar for boys and girls.

Da Silva *et al.,* (2003) searched for *Enterobius vermicuylaris* and other intestinal parasites in children living in a developmental centres as well as those attending four day care centres and elementary schools in Uberlandia, Brazil were examined by the Graham and Sedimentation techniques. Out of 187 children examined, 53 (28.3%) were infected, the prevalence rate of *Enterobius vermicularis* was 13.9 percent. The results re-inforced the relationship of prevalence of intestinal parasites and socio-economical aspects, as well as revealed *Enterobius vermicularis* as one of the most prevalent helminthes in children attending day care centres and elementary schools in Uberlandia.

Mosala *et al.,* (2003) carried out a study in the mountainous Qwa-Qwa area to measure the true infection rate of *Enterobius vermicularis* using the 'scotch tape method' and compared it with the results of surveys done previously by fecal analysis which was low. A prevalence of 45.3 percent amongst 148 paediatric (hospital based) children was recorded using adhesive tape, which suggested that *Enterobius vermicularis* was not only the most bundant helminthe in that high altitude region but was also the second most abundant of all the intestinal parasites infecting children there.

Rim *et al.,* (2003) investigated the epidemiological surveys were carried out an a national scale infection in Laos. Parasitological surveys were carried out on a national scale including 17 provinces and the Vientiane Municipality. An additional small -scale survey by cellophane anal swab, detected *Enterobius vermicularis* eggs in

35.7 percent of 451 school children aged 6-8 years in Khmmuane, Vientiane, Chawpassak Proviuce and the Vientiane Municipality.

Avetisyan *et al.*, (2004) made an analysis of many years official statistics on the number of individuals infected with intestinal helminthiasis and a retrospective analysis of those in 1986-2004 to study the current epidemiological laws on intestinal helminthiasis. The rate of enterobiasis was 25.9±1.0, higher in rural areas than in ruban areas.

Astal (2004) determined the prevalence of intestinal parasites for 1,370 children in Khan Younis Governorate, Gaza strip with the age ranging between 6 to 11 years. The prevalence of enterobiasis was determined using a scotch tape preparation. A total of 20.9 percent of the children examined were infected and there was zero variation in the prevalence enterobiasis.

Qzturk *et al.*, (2004) conducted a study to determine the parasitic infection rate associated with the post earthquake unhealthy living conditions and related epidemiological risk factors. Two population living and studying in different socio-economic conditions as a result of the earthquake were compared. Group 1 (study group) consisted of 326 children living and studying in transitory houses and classes and group 2 (control) consisted of 127 children living in normal house and studying in normal school classes. Selotype procedure was applied to both populations. Epidemiological data determining the socio-economic status of the population were collected by questionnaire. In group 1, *Enterobius vermicularis* eggs were observed in 13.5 percent of selotype samples and in group 2, eggs were observed in 5.5 percent of selotype samples. The rate of Enterobiasis and Giardiasis was found to be significantly higher in children still living and studying in temporary houses and schools years after the earthquakes ($P < 0.05$). It had then concluded that the rate of Enterobiasis increased in population living in crowded unhealthy conditions.

Nithikathkul *et al.*, (2005) determined if education in addition to medical treatment of enterobiasis could make a difference to the rates of infection. A total of 777 children (399 male and 378 female) from 11 elementary schools in five districts of Samut Prakan Province, Thailand were examined between December 2000 and March 2005. In 5 of the 11 schools studied, medical treatments were applied, followed by a programme of educating the children in the prevention of infection.

Children in the remaining 6 schools received medical treatment only and the study showed a decrease in infection among children who received supplementary education. The study therefore, showed that educating high risk individuals played a key role in the prevention of enterobiasis.

Sayyari *et al.,* (2005) made a national survey of the prevalence of intestinal parasites infections in the Islamic Republic of Iran on a random sample of families covered by local health centres affiliated to the medical universities. Out of 53995 people aged 2+ years, from 12495 families (0.1 of all families in 1999), 45128 stool samples were analyzed by formalin - ether pricipitation. *Enterobius vermicularis* was prevalent in 0.5 percent. The infection rate was highest in the 2-14 years age group (25.5%) and in rural residents (23.7%).

Chinglensana *et al.,* (2005) carried out a study in rural areas of Tezpur, Assam to asses tile symptomatology of parasite infected patients. Out of 732 children being examined for the presence of parasite diseases, 269 (36.7%) were found to harbour various intestinal parasites. The prevalence of *Enterobius vermicularis* was 7.4 percent. With regard to symptomatology, pain in the abdomen, altered bowel habit, diarrhoea, loss of appetite, anal prurites and isomnia.

Akkus *et al.,* (2005) investigated the effect of the social demographic characteristics and habits of hygiene of primary school children on the presence of *Enterobius vermicularis*. The subjects of this research were children with a low social-economic level in the government Primary schools found in the province of Karaman. The samples were taken from 5 classes out of the 15 classes found in the school. A suitable questionnaire along with the application of the cellophane tape method was used in ob taining information from the selected students, of the students included in the study, 45.9 percent were boys and 54.1 percent girls. Of the families of the students, 70.6 percents earned the standard minimum wage and below and 19.7 percent were in a medium economic level. *Enterobius vermicularis* was found in 76.2 percent of the students. The study showed that the presence of *E. vermicularis* in primary school chidren is still an important helath problem.

Gundez *et al.,* (2005) studied the prevalence of intestinal parasitoses in children with gastro-intestinal symptoms associated with socio-economic condition of

Manisa region. The cellophane tape method was performed to detect enterobiasis on 2160 children and was prevalent in 221 (10.3%) and out of 2,160 children.

Yazar *et al.,* (2005) carried out a study on distribution of intestinal parasites among patients who presented at the Department of Parasitology of the Erciyes University Medical School from 2000-2004. A total of 34883 stool samples were examined using native lugol and floatation/sedimentation methods and 9879 cellophane tape preparation were examined directly. Intestinal parasites were found in 9704 (27.8%) of the specimen. The prevalence rate of *Enterobius vermicularis* was 242 (0.7%).

Culha *et al.,* (2005) investigated the prevalence of intestinal parasites in female students (aged from 16-18 years) in the Mustafa Kemal University School of Health. 142 fecal and 136 cellophane tape preparations were examined. *Enterobius vermicularis* was found in 9 (6.61%) out of 136 cellophane tape preparations.

Alver *et al.,* (2005) investigated retrospectively the distribution and prevalence of intestinal parasited in patients who presented at the routine parasitology laoboratory of the Uludog University Medical Faculty, Bursa, during the 8 years from January 1993 - December 2000. A total of 32346 stool specimens were examined for intestinal parasites using native lugol and formal ethyl ether methods. Also, 10,897 cellophane - tape preparations were examined. Parasites were found in 8.14 of the samples. Of the patients, 46.32 percent were females and 53.68 male. Giardia intestinalis (3.63%) and *Enterobius vermicularis* (3.41%) were the most prevalent parasites.

Culha *et al.,* (2005) studied the Prevalence of intestinal parasites in 109 students (68 boys, 41 girls) in the1-6 age group in four different special day time nursing home and day centres in the Antakya district of Hatay was investigated. 86 fecal and 109 cellophane tape preparations were investigated. One or more parasites were detected in 18 (20.93%) out of 86 fecal specimen. 8 (7.40%) *Enterobius vermicularis* was detected in 109 cellophane tape specimens.

Park *et al.,* (2005) determined the status of *Enterobius vermicularis* infection among children living on western and southern Coastal Islands of Republic of Kores Children (3-10 years) in 39 kindergardens and primary schools were examined using

the cello-tape and swab method, during July and August 2000. Of 1661 children examined, 307 (18.5%) were found to be positive for *Enterobius vermicularis* eggs. The egg positive rate for boys (21.3%) was significantly higher than that of girls (15.4%).

Cazorla *et al.,* (2006) conducted a cross-sectional survey between August 2001 and July 2002, to investigate clinical and epidemiological data on pinworm infection among 427 pre-school and primary school age children of six rural communities from the semi-arid rregion of Falcon state, northwestern Venezuela children were evaluation clinically and parasitologically by the Graham method. Overall prevalence was high (63.23%). Infection rates were not significantly different between sex or age, suggesting similar transmission pattern and risk condition for all individuals.

Among the clinical findings and childrens' habits, only perianal itching, enuresis bruxism and finger sucking showed significantly higher percentages in infected children than in uninfected.

Bencke *et al.,* (2006) performed a coproparasitological analysis on 222 children living in the sub-urban community of the city of Porto Alegre, RS. In the group surveyed, 102 (49.9%) had positive samples for intestinal parasites. The age-group from 12-14 years old showed the largest number of infested individuals (58.8%) *Enterobius vermicularis* was found to be 5 out of 102 (Positive samples).

Celik *et al.,* (2006) studied the incidence of intestinal parasites among primary school children in Malatya, Turkey. Cellophane tape preparations and stool samples that had been prepared using direct mounting methods were examined. Parasitic infection was observed in 415 (22.5%) out of 1838 students and the highest rate of 10.6 percent was that of *Enterobius vermicularis*.

2.2 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*, 2 i.e. 6.1% for *Trichuris trichiura*, 2 i.e. 6.1% for *S. stercoralis* and 1 i.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 supreseded 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 school children 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 school children rate in Jerona (48.8%) was slightly higher than that in Chitrasar (37.0%). 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, *Tribhuris 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 school children.

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%), *Indomeba butschlii* (1.2%), *Hymenolepis nana* (0.8%), *Enterobius vermicularis* (0.4%) and *Endolimax nana* (0.4%).

Pandit (2004) carried out scotch tape, survey on Enterobiasis in Chitwan from 2004 to 2005. Out of 163 samples collected, 9 samples were found to be positive. In relation to say, the positivity rate was 5.20% in males and 5.97% in females. The prevalence was found to be highest in the kids of labours (13.04%).

Ghimire and Mishra (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.

CHAPTER III

3.0 MATERIALS AND METHODS

3.1 Description of Study Site

Damak lies in the extreme eastern part of Nepal which is in Jhapa district. It occupies latitude of $26^0$22' N to $26^0$50' N and longitude $87^0$39' East to $38^0$12' E.

The research work was conducted for the period of about 6 months. During the research period from time to time various samples were taken from the children having the age between 2 years to 9 years of both sexes randomly from all the communities residing the village. A sum total of 210 specimen (samples) were collected during the study period.

The Bhutanese Refugee Camp is located towards the north about 5 km from the nearest town, Damak. It had been estimated about more than a lakh of Refugees have been living in Beldangi VDC since more than 15 years. The community had shown the divisity in caste along these Refugee Camps. The majority of the people is belonging to Brahmin, Chhetri and ethnic groups like Rai, Limbu and some belongs to Magar, Damai, Kami etc. Their houses are built on the aid of more than 15 countries and is basically constructed with the bamboo and dry leaves of herbs. The basic facilities of clean water supply and proper defecating area are not in proper condition that are leading towards the infection of numerous helminthic parasites. The provision of proper health care centre, i.e. AMDA (Association of Medical Doctor's of Asia), is located about 3 km south of the Refugee camp. However, the major case of diseases are referred to the nearest zonal Hospital, i.e., Mechi Zonal Hospital, Bhadrapur, Jhapa.

3.2 Survey Study

A set of questionnaire was prepared and administered among targeted children the day previous to sample collection. Questionnaire was translated in Nepali so that the respondent could understand the questions much clearly. Questions were asked by

researcher myself. Parents of the children from whom sample was to be collected were met the previous day after filling up the questionnaire, samples were collected the next day in the morning.

3.3 Materials Required

i) Glass slides

ii) Cellophane tape

iii) Domestic swab collector

iv) Gloves

v) Marker

vi) Cover slips

vii) Microscope

viii) Potassium dichromate (2.5%)

3.4 Sample Collection

Sample, i.e. eggs of *Enterobias vermicularis* were collected by two methods.

a) By using cellophane tape

b) Swab collection using cotton and stick

Cellophane tape was placed on the skin near anus and then pulled off and put on a slide to observe under the microscope to look for eggs. Since NIH swab could not be found at the market during the study period, domestic swab made up of cotton and stick was used for scrapping the eggs and was observed. The samples were collected when the child were still on the bed. Scrapping collected by the domestic swab was kept in the potassium dichromate solution and observed the vary day in the lab of AMDA Hospital, Damak built on foreign aid. Specimens were also observed at Central Department of Zoology.

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.

3.5 Data Analysis

The obtained data from swab observation were classified into different categories, tabulated and analyzed. Analysis was done on the basis of age, sex, nail biting (cutting) habit, literacy of parents, sanitation among children, bed sharing by the children, school going and not going and prevalence of knowledge about Enterobius among parents. For the authenticity of analysed data, χ^2-test was performed.

CHAPTER IV

4.0 RESULT

Surveillance study and swab collection and examination were done in 210 children between age 2-9 years from January to June, 2009. The study was done among the children of all races in Beldangi VDC, Bhutanese Refugee Camp. Among the children studied, 96 were male and 114 were female. Swab was collected the very next day of the survey study by questionnaires to the parents of the children under study. The questions were prepared to know the awareness of the parents towards *Enterobius* which is found mostly in children.

Lack of hygienic behaviour is the potential risk of transmission of *Enterobiasis*. Parents of the children under study were taken interview about their knowledge of mode of infection towards *Enterobiasis* but none had idea about it. The result revealed that maximum number of children infected were found to be between the age of 3-7 years of age group and most of them were males.

Swab collection were done two times in 210 children within a period of 4 months. The result of the present study is divided into two categories.

Table No. 1: Age-wise Prevalence of *Enterobius vermicularis*

Total No. of Children under study = 210

Total males = 96, Total females = 114

Age Group	Total Samples	Total Infected	Male	Infected	Female	Infected
2-3	50	10	28	4.0	22	6.0
4-5	87	6	44	2	43	4.0
6-7	60	11	23	3	37	8
8-9	13	7	11	5	12	2.0

Out of the 210 sample population, 96 were of male and 114 of female of various age group between 2-9 years. The total number of infected rate was 34 which included 14 males and 20 females. The highest number of male infection was 5 of age group 8-9 years whereas of female was 8 of 6-7 year of age group.

Table 2: Sex-wise Prevalences of Pinworm in Different Locality

S. N.	Locality	Male			Female					Grand Total		
		Total No.	%	+ve no.	%	Tot. No.	%	+ve no.	%	Tot. No.	+ve no.	%
1	Locality 1	24	43.63	3	12.5	31	56.36	5	16.1	55	8	14.5
2	Locality 2	14	32.55	2	14.2	29	67.44	4	13.7	43	6	13.9
3	Locality 3	17	50	5	29.4	17	50	2	11.7	34	7	20.58
4	Locality 4	20	43.47	3	15	26	56.52	6	23.07	46	9	19.5
5	Locality 5	21	4.7	1	9.09	11	50	3	27.2	32	4	12.5
6	Total	96	43.93	14	16.27	114	56.06	20	17.54	210	34	16.19

Parasitic prevalence is not generally associated with localities. However maximum positive cases were recorded from locality 3, i.e., 20.58% while least positive cases were recorded from locality 5, i.e., 12.5%. Among five localities, as all the localities within the research lies in the same environmental condition, the prevalence of the parasites were irrespective to the temperature variation.

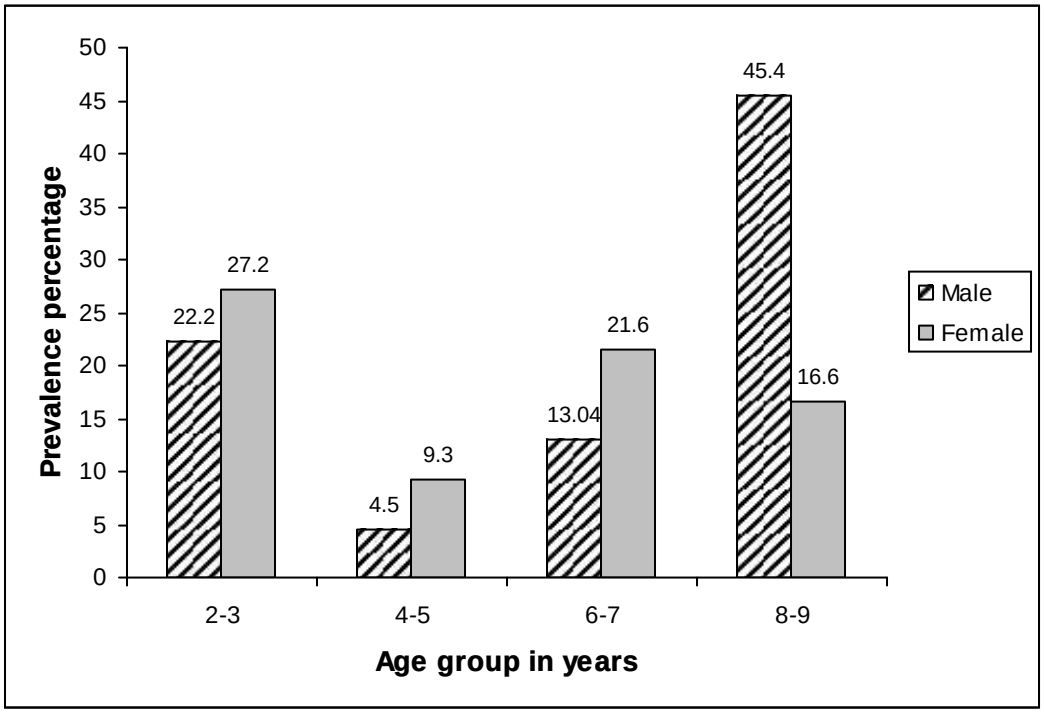
According to the different localities, locality-3 had the highest rate of positive infection i.e., 5 out of 17 and locality-5 had the least infected sample i.e. 1 out of 21. Similarly, among the female locality-4 had the highest infected number of sample, i.e. 6 out of 26 and locality-3 had the least number of female infection, i.e. 2 out of 17.

Table 3: Age & Sex-wise Percentage of the Prevalence of *Enterobius vermiculars*

S.N.	Age Group (yrs)	Male			Female			Total		
		Tot. no. of sample examined	No. of positive samples	%	Tot. No. of sample examined	No. of positive samples	%	Tot. no. of sample examined	No. of positive samples	%
1	2-3	28	4	22.2	22	6	27.2	50	10	25
2	4-5	44	2	4.5	43	4	9.3	87	6	6.89
3	6-7	23	3	13.04	37	8	21.6	60	11	18.33
4	8-9	2	5	45.4	12	2	16.6	13	7	30.43
Total		96	14	14.58	114	20	17.54	210	34	16.19

From the above table, the highest prevalence of the parasite was found to be in the group 8-9 years. Likewise, the least prevalence of parasitic infection was found in 4-5 years. Among the male, 45.4% of the positive result was obtained in the same group 8-9 years whereas the highest positive infection of the parasite was recorded in female of the age group 2-3 years. The least positive result was obtained in male of the age group 4-5 years, i.e., 4.5%. Similarly, the least infected female child age group was also 4-5 years, i.e. 6.89%.

Figure No. 1: Age wise prevalence of *Enterobius* parasite



4.1 Result of Survey Analysis and Swab Examination

Interview of respondent (parents of sample population) was also carried out in Beldangi population of children whose swab examination was done. Those parents who are unable to fill up the questionnaire, were helped by the researcher myself.

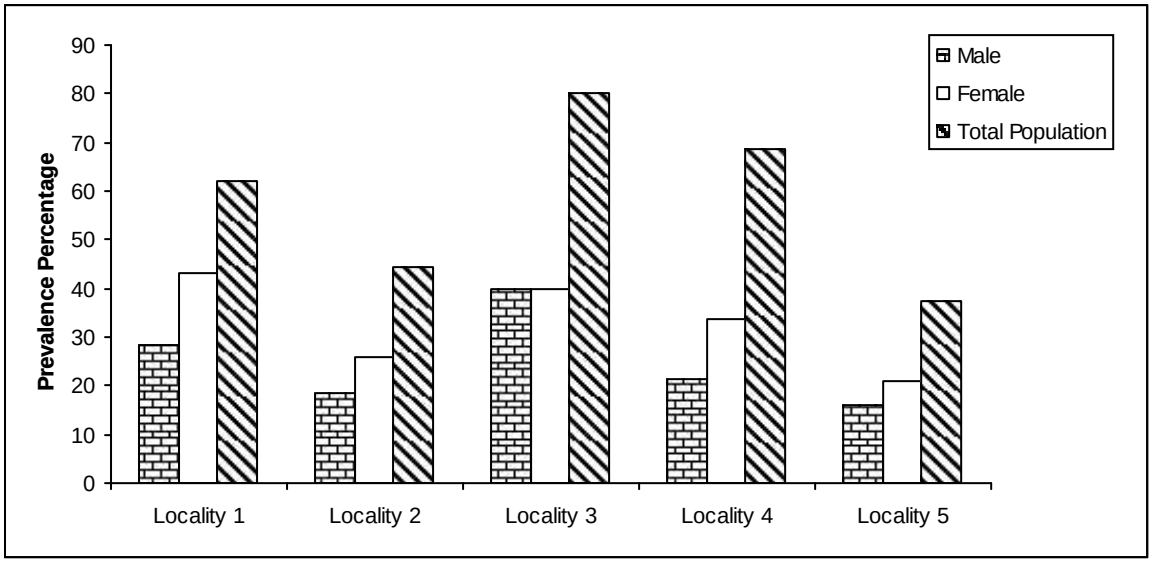
4.2 Age & Sex-wise Distribution of Population in Five Localities

Table No. 4: Age & Sex-wise Distribution of Population in 5 Localities

	2-4 years age group						5-7 years age group						8-9 years age group							
Locality	Male		Female		Total		Male		Female		Total		Male		Female		Total		Grand Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Locality 1	11	24.4	14	30.4	25	27.4	10	25	15	26.7	25	26.04	3	27.2	2	16.6	5	21.7	55	26.1
Locality 2	5	11.1	10	21.7	15	16.4	7	17.5	16	28.5	23	23.9	2	18.1	3	25	5	21.7	43	20.4
Locality 3	9	20	8	17.39	17	18.6	7	17.5	8	14.2	15	15.6	1	9.09	1	8.3	2	8.6	34	16.1
Locality 4	10	22.2	10	21.7	20	21.9	7	17.5	14	25	21	21.8	3	27.2	2	16.6	5	21.7	46	21.9
Locality 5	10	22.2	4	8.6	14	15.3	9	22.5	3	5.3	12	12.5	2	18.1	4	33.3	6	26.08	32	15.2
	45		46		91		40		56		96		11		12		23		210	

Out of 45 male samples between age group 2-4 years, 11 were found to be of locality 1 showing 24.4% highest among all, whereas locality 2 shows only 5 male samples, i.e. 11.1%. Out of 46 samples of female of the same age group, locality 1 shows the highest sampled area having 14 samples, i.e., 30.4% whereas locality 3 shows the lowest samples area, i.e., 8, i.e. 17.39%. In the age group between 5-7 years, locality 1 shows the highest sample collected area among male, 10, i.e. 25% of the total male of 40. Similarly, locality 2 shows the highest sampled area for parasite in female, i.e., 16, i.e. 28.5%. Out of 11 male samples of age group 8-9 years, localities 1 and 4 were used for maximum sample collection, a total of 6, 3 from each. Similarly, out of 12 female samples, 4 were sampled from locality 5 as highest number.

Figure No. 2: Illiteracy Condition Among 5 Localities



The above chart showed that illiteracy was higher in female i.e. 32% than in male i.e. 23.5%. Illiteracy was maximum at locality 3 i.e. 80% while illiteracy was minimum at locality 5 i.e. 37.5% among five locality.

Table No. 5: Showing Literacy and Illiteracy of 5 Localities

Localities	Illiterate						Literate						Grand Total	
I-V	Male		Female		Total		Male		Female		Total		No.	%
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
Locality 1	17	30.9	27	49.09	44	80	7	12.7	4	7.2	11	20	55	26.1
Locality 2	8	18.6	24	55.8	32	74.4	6	13.9	5	11.6	11	25.5	43	20.4
Locality 3	13	38.2	14	41.1	27	79.4	4	11.7	3	8.8	7	20.5	34	16.19
Locality 4	16	34.7	21	45.6	37	80.4	4	8.6	5	10.8	9	19.5	46	21.9
Locality 5	15	46.8	8	25	23	71.8	6	18.7	3	9.3	9	28.1	32	15.23
Total	69	42.3	94	57.6	163	77.6	27	57.4	20	42.5	47	22.3	210	100

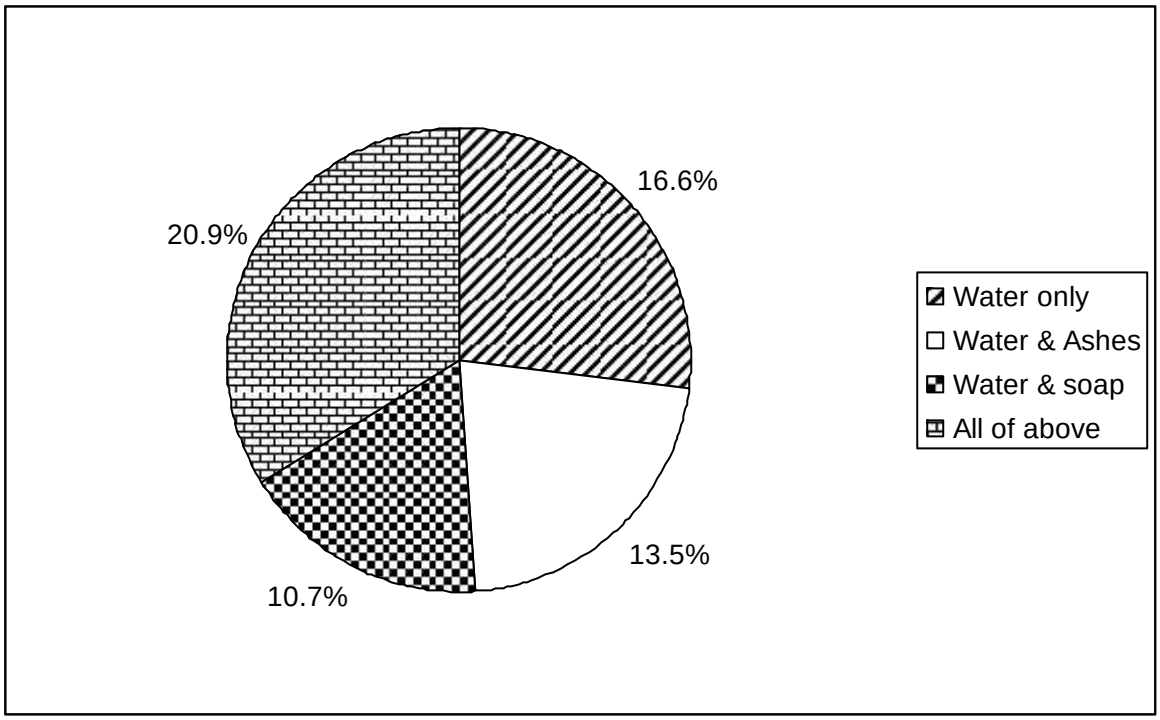
Regarding literacy condition, surveillance study revealed following result. In total, among 210 interviewed people 163, i.e. 77.6% were found to be illiterate while only 47, i.e. 22.3% were found to be literate. Regarding locality wise literacy only 9 i.e. 28.1% people out of 32 from locality 5 were found to be literate. This was the highest value among 5 localities whereas 9 out of 46 of locality 4 was the least literacy rate.

Table No. 6: Prevalence of *Enterobius vermicularis* According to Method of Cleaning Hands

S.N.	Category	No. of Respondent		Result obtained from swab examination	
		Number	%	Positive No.	+ve %
1	Water only	102	48.57	17	16.6
2	Water & Ashes	37	17.6	5	13.5
3	Water & soap	28	13.33	3	10.7
4	All of above	43	20.4	9	20.9
	Total	210	100	34	16.19

From the above table, it is revealed that maximum prevalence was recorded from those respondent who used only water to clean hand at different condition such as before cooking, before meal, after meal, after defecation, after working in field etc. Similarly, least prevalency, i.e., 10.7%, 3 out of 28 was recorded from those respondent who used water and soap to clean hand in different condition. In general, it was seen these people regularly use only water to clean hand after working in field, before meal and after meal. Sometimes they take meal without properly washing hand after working and defecation.

Figure No. 3: Methods of Cleaning Hands by Respondents



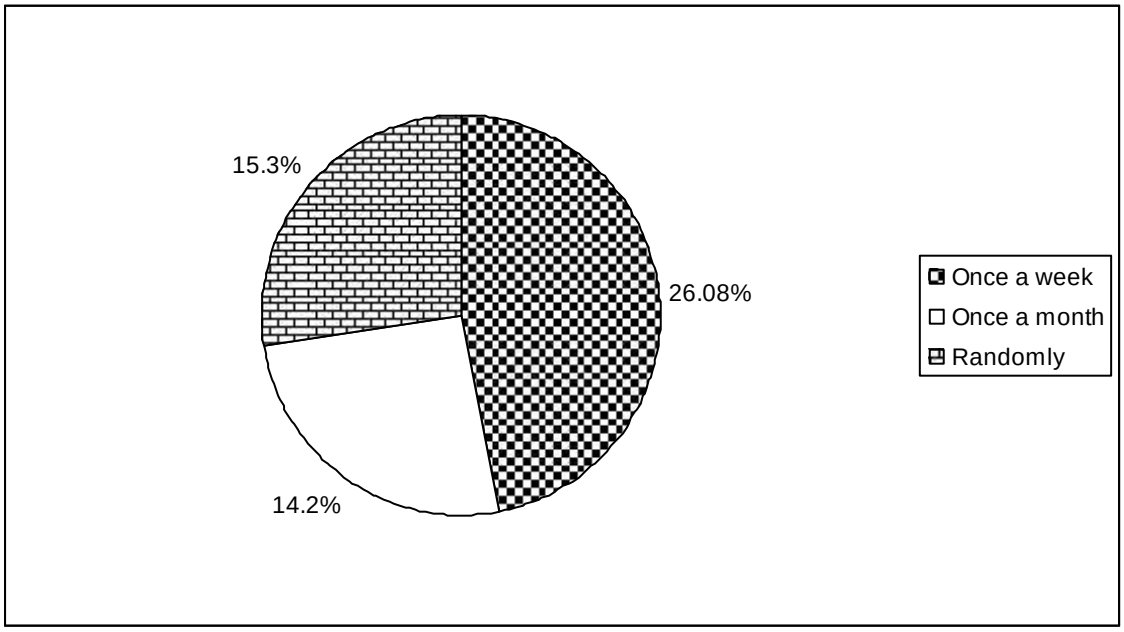
Out of 210 respondents, 102 (48.57%) respondents used water directly even in epidemic seasons whereas 17.6% and 13.33% used water and ashes, water and soap respectively to clean hands. Likewise, 43, i.e. 20.4% out of 210 respondents used all of methods to clean their hands. Majority of respondents do not regularly used above mentioned methods. It has also been revealed that the prevalence of parasite with those respondents who used water only was 16.6% and 20.3% was positive towards who temporarily used all above mentioned methods.

Table No. 7: Prevalence of Parasites According to Nail Cutting Habits

S.N.	Category	No. of Respondent		Result obtained from swab examination	
		Number	%	Positive No.	+ve %
1	Randomly	23	10.9	6	26.08
2	Once a week	70	33.33	10	14.2
3	Once a month	117	55.7	18	15.3
4	Total	210	100	34	16.19

From the above table, it is revealed that out of 23 respondents, 26.08% (no. 6) of them showed positive case for intestinal parasites, who cut their hair once a week. This may be due to lack of other irregular cleanliness habits. This was the highest prevalence among other categories. Similarly, out of 70 respondents cutting nail at the interval of a month, 33.33% (i.e. no. - 10) showed positive case for intestinal parasites. This was the lowest rate among 3 categories.

Figure No. 4: People's Habit about Nail Cutting



From the survey study it revealed that out of 23 respondents (10.9%) cutting nails in random intervals of time, 6 (26.08%) were infected. And out of 70 respondents (33.33%) cutting nails once a week, 10 respondents (14.2%) were infected. 117 (55.7%) respondents cut their nails once a month of which 18 were infected (15.3%).

Table No. 8: Comparison Between Treatment Practices and Prevalence of *Enterobius vermicularis* of Respondents

S.N.	Category	No. of Respondent		Result obtained from swab examination	
		Number	%	Positive No.	+ve %
1	Traditional methods	146	69.5	19	13.01
2	Direct taking medicine	20	9.5	8	40
3	Doctor consulting	44	20.9	7	15.9
4	Total	210	100	34	16.19

From the above table, it is revealed that out of 146 (69.5%) respondents treating the infection by traditional methods, 19 (13.01%) were infected. This was the highest prevalence in comparison to the other categories. Similarly, out of 20 (9.5%) respondents taking medicine without consulting the doctor, 8 i.e. 40% were infected. The infection rate was the lowest 7 (15.9%) out of 44 (20.9%) respondents consulting the doctor.

CHAPTER V

5.0 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 interlocked, owing to their ubiquity and despite their high rate of infections in these countries, physicians and public health authorities show little interest in their control (WHO, 1981). This infection is ranked among 20 most fatal infection in tropical countries of Asia, Africa, Latin America in 1977-1978 (Davis, A; 1980) The major helminth parasites are Roundworm, Hookworm, Whipworm, tapeworm whereas as protozoan parasites are *E. histolytica, G. lamblia, Cryptosporidium*. Round worm infect about 1×10^8 people and kill 20,000 people each year. Almost 4.8% of people dies due to cholera and diarrhoea in Nepal (CBS, 2002). Morbidity because of intestinal parasites has always been an important public health problem in tropical region (Sherchand, 1996).

Regarding the helminth parasites, several previous studies have shown that hook worm was the most common helminthic infection in Nepal (Esteven, 1983, Navisky, 1988). A few other studies reported that *A. lumbricoides* is the most common intestinal helminthic parasite in Nepal (Suguri, 1985; I.F.P.P.C.P., 1985; Geollman 1986; Gianotti 1993; Chettri 1997; Rai, 1997; Rai, 1999; Rai, 2001; Chaudhari, 2004). The present study does not concide with the previous study, conducted by various pathologist in Nepal. But this study concide with the result of research conducted among the household small children in Abha district, Saudi Arabia done by Al Maldani *et al.*, 1995, that had shown that *Enterobius vermicularis* was common parasite. Similar result was obtained by Menon (1997) in school aged children in the city of Abidjan, Toma (1999) in Indonesia. Hence result of this study is different from the previous study conducted by different parasitologist in Nepal.

Almost all the respondent community was found to have built their dwellings clustered together on the sides of jungles. They have little land areas but not fertile. So, it is not sufficient for bearing large household expenses. Lack of skilled labour

among these population is another factor responsible for low economic condition. All these have resulted the socially depressed and deprived condition of these, which is responsible for low economic condition and poor literacy rate among them. Regarding literacy condition, surveillance study revealed following. From the obtained data, it can be said that illiteracy was higher in female, i.e., 32% than in male i.e. 23.5%. Illiteracy was maximum at locality 3, i.e., 80% while illiteracy was minimum at locality - 5, i.e. 37.5% among five locality. This literacy has very important role to play in the awareness of population regarding health and hygiene.

Due to illiteracy, concern towards sanitation is very low. Regarding the sanitary condition of the study area, only 7.5% children were found to be using pit toilet. Remaining 376.5% and 33% children used pig shelter and open field respectively for defecation. This open field and pig shelter defecation was responsible for contamination of soil, vegetable as well as near by water river also. So that open field and pig shelter practice revealed maximum prevalence i.e. 33% and 37.5% respectively than pit toilet and organised, toilet, i.e. 25% and 7.5% respectively. These community visit in jungle with barefoot to collect food etc. This land had already contaminated so that increases the chance of infection from other parasites.

Jha, A (2004) showed that there was great variation in the type of helminthic parasite infection among the ethnic group in which highest in pode (66.1%) and lowest in Brahmin (3.84%). Like other ethnic group, Chepang is also one of the most backwardly directed group. In the present study, the numbers of respondents were chosen randomly among the various age groups. 50 of the sample were of age range between 2-3 years where 10 were found to be infected. It included 4 male and 6 female. Among the age range of 8-9 years, 15 was the sample number, out of which 7 were found to show positive infection. 5 were male and 2 were female respondent in this age group. In between the age of 2-9 years, 20 were female and 14 were male infected with *Enterobius vermicularis*. Perhaps, the larger rate of female infection may be due to less sanitation practices among the female than male.

Data that has been collected and analysed showing the male and female ratio in different localities infected with this parasite revealed that locality-3 was found to be highly infected zone with the prevalence of 20.58% of positive infection whereas locality-5 was with the least infection with the parasite with 12.5%, 13.9%, 19.5% and 14.5% was the infection percentage of the localities-2, 4 and 1 respectively. This may

be due to the fact that locality-5 was very near to the health post centre which get frequent medical advice than the other localities. Whereas locality-3 was very nearly settled in the jungle area that lack hygienic condition of the community. Among the sex and age-wise prevalence of the parasite 45.4% male were the highest prevalence of parasitic infection of the age group 8-9 years whereas in the case of female, 30.43% was the highest prevalence of the same age group ($\chi^2_{cal} = 9.25$, $\chi^2_{cal} > \chi^2_{tab}$, d.f. = 3, level of significance = 0.05).

In the context of survey analysis, the term literacy was used to indicate where the respondent were able to read and write, not in the condition of acquiring academic certificates. From the data interpretation, it was found that locality-2 was with the least male illiterate with about 18.6% whereas locality-5 was with about 46.8% illiterate. In the case of female, locality-2 was with the highest illiterate with about 55.8% whereas locality-5 with the least, i.e. 25% illiterate female. On the other side, i.e. literate, locality-4 was with the least literate male, i.e. 8.6% and the locality-5 with the highest i.e. 18.7%. In the case of female, locality-1 was with the least percentage of literate female i.e. 7.2% whereas, locality-2 with the highest with 11.6% literate female. As a whole, the total percentage of illiterate were quite higher than literate. That means, out of 210 sampled children, 163 were illiterate and 47 were only literate. This indicates the low economic condition, poor sanitation lack of proper health care provision prevailing in those localities which increases the number of parasitic infection ($\chi^2_{cal} = 7.28$, $\chi^2_{cal} > \chi^2_{tab}$, d.f. = 5, level of significance = 0.05).

The survey was also done to analysed the proper sanitation habit performed by the respondents. Under the study, the prevalence of *Enterobius vermicular* according to the method of cleaning hands was done. Out of 210 sample, 102 use to wash hand before and after eating and going toilet, whereas 37, 28, 43 were the numbers of child who used water and ashes, water and soap and all of the above respectively. Parasitic infection was commost mostly among those who used to clean with water only, i.e., 16.6% whereas who clean the hand with water and soap has least numbers of infection, i.e., about 10.7% of total sampled population ($\chi^2_{cal} = 10.1$, $\chi^2_{cal} > \chi^2_{tab}$, d.f. = 3, level of significance = 0.05).

Another sanitary practice, i.e., habits of nail cutting was analysed during the study. Out of 210 sample, 23 used to cut their nail randomly, i.e., whenever the

remember, they cut it which is about 10.9% of total sample. Those who used to cut once a week was about 70 and 117 cut only once a month. The study revealed that those, who used to cut their nail randomly has acquired the highest percentage of infection, i.e. 26.09% (6 out of 23) whereas those who cut once a week has the least value, i.e., 14.2% (10 out of 70 sample) ($\chi^2_{cal} = 8.13$, $\chi^2_{cal} > \chi^2_{tab}$, d.f. = 2, level of significance = 0.05).

Comparison between treatment practice and prevalence of *Enterobius vermicularis* of respondents was also performed. It revealed that 19, out of 146 sample got positive infection of parasite who consult traditional methods like, Dhami, Jhakri etc. whereas 8 out of 20 were found to be infected who used to consult pharmaceutical shops without prescribed by doctors that counts about 40% of infection. 7 out of 44 sample used to consult doctors for treatments, got infection of parasites that make about 15.9% (7 out of 44).

The high incidence of parasite in those group suggests that parasites were still remained in the surrounding environment and possibility of person to person transmission between children. These data show that treatment alone is not so satisfactory for control and prevention of parasite. This means that necessity of sanitary, awareness and other educational programme implementation should be done along with the treatment for control and prevention of intestinal parasites. They were also suggested to examine the swab in the interval of 3-6 youths.

At last, simple and lack of knowledge was found to be responsible for poverty. Poverty and social discrimination result as high illiteracy, which is responsible for lack of awareness of health and hygiene, poor sanitation condition and unhygienic primitive habit. Thus, these are found to be contribution factors for being this parasite to be endemic with prevalence. Hence, extensive study is needed for the determination of epidemiological and etiological factors that cause the high prevalence of intestinal parasites in present study community.

CHAPTER VI

6.0 RECOMMENDATIONS

Taking consideration of discussion and field experience, the recommendation for effective control of *Enteriobius vermicularis* among Bhutanese Refugees are also follows:-

1) People should be encouraged for sanitary improvement including personal hygiene and environmental sanitation.
2) Bed sharing habits should be discouraged to minimize the rate of transmission among the family children.
3) Blanket deworming should be implemented at least once a month especially during the peak season of infection.
4) Personal hygienic of cutting nails should be encouraged to the small children to minimize the infection.
5) Small children usually have the nail biting habit that leads towards the new infection. Such habits should be discouraged.
6) Itching around the peri-anal region occurs due to migration of parasites due to which the children usually scratch such area by nails. Such habit should be minimized.
7) Health workers should be trained to make them familiar with emerging parasitic infections.
8) Basic health education programmes should be conducted time to time in such communities for raising awareness towards the parasitic infection, prevention and control.
9) Defecating habits of children in open field should be avoided and toilet construction should be promoted.

CHAPTER VII

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