I
INTRODUCTION

1.1 Background

Intestinal parasites are parasites that populate the gastro-intestinal tract in human and other animals. They can live throughout the body, but most prefer the intestinal wall. Means of exposure include ingest ion of undercooked meat, drinking infected water and skin absorption. The major groups of parasites include protozoan and parasitic worms-helminthes. The two main types of intestinal parasites are helminthes and protozoa. Helminthes are worms with many cells. The common intestinal helminthes are the *Ascaris lumbricoides*, hookworms and *Trichuris trichiura.* In their adult form, helminthes cannot multiply in the human body. Protozoa have only one cell, and can multiply inside the human body, which can allow serious infections to develop. Intestinal parasites are usually transmitted when someone comes in contact with infected feces (for example, through contaminated soil, food, or water). The common protozoa are Giardia and amoebiasis. Principally intestinal parasitic diseases are preventable diseases. But the prevalence of intestinal parasitic diseases is not expectedly decline due to human behaviors like walking barefoot, sanitation and feeding behaviors.

Disease caused by *Enterobios vermicularis, Giardia lamblia, Ancylostoma duodenale, Entameoba histolytica* occur. Evermucularis or pinworm causes irritation and sleep disturbances. Giardia causes nausea, vomiting, malabsorption, diarrhoea and weight loss. Sewage treatment, proper hand washing and consumption of boiled water can be preventive. *Ancylostoma duodenale* and *Neisseria Americanas* are hook worms that cause blood loss, anemia pica and wasting. *Entameoba histolytica* can cause intestinal ulcerations, bloody diarrhea and weight loss.

In Nepal, over seventy percent of morbidity and mortality are associated with infectious diseases and is also reflected in the “top ten diseases” of Nepal. Of them, intestinal parasitosis alone constitutes one of the major causes of health problems. The reported rate of intestinal parasitosis in some rural areas approaches nearly one hundred percent has been

attributed to the lack of hygienic and sanitary awareness among locals. Over 70% of households in rural communities in Nepal still do not have latrine. Intestinal parasitosis is more common among people living in poor community.

Intestinal parasitic infections are endemic worldwide and a major public health problem in the developing countries which affects about 3.5 billion people worldwide (Shakya et al. 2009). Numbers of infected peoples are often more than that of non-infected people in developing countries. There is evidence that individuals harboring such infections may suffer highly from intestinal parasites. Intestinal parasitoses have been described as the greatest single worldwide cause of illness and disease. The high prevalence of these infections is closely related to poverty, illiteracy, poor hygiene, lack of access to potable water and hot and humid tropical climate. Parasitic helminthes and protozoa are responsible for some of the devastating and prevalent diseases of humans. In some tropical areas, the prevalence of parasitic infections is nearly 100 percent (Uga et al. 2004)

In Nepal, the outbreaks of Acute Diarrheal Diseases [ADD] occur frequently in many districts. Every year more than five million human beings die due to unsafe drinking water, unclean domestic environments and improper excreta disposals. Cope these outbreaks, the Ministry of Health, DHS and EDCD established a mechanism for minimizing outbreaks [EDCD 2002-2003].

Nepal is a least developed country among the developing countries of the world. The country has approximately 26 million population and about 85% people live in rural area. The current study area is located in mid- western region of Nepal. Tharu of the Rajhena VDC belongs to lower socioeconomic groups. Initially these peoples are living as slaves recently got freedom but economically independence. Tharu in the Terai of Nepal are known to have been a community dependent on agriculture for making a living.

Intestinal parasitic diseases are still prominent in the tropical and sub-tropical areas of the world and are more common in undeveloped or developing nations. The prevalence of intestinal diseases in different areas and countries can indirectly reflect the local sanitation conditions and living conditions. Intestinal parasites can be categorized into two types—protozoan and worms. Common protozoa include amoeba, *Giardia lamblia*, and

Cryptosporidium spp. On the other hand, common parasitic worms include roundworms, hookworms, whipworms, pinworms and tapeworms.

The diseases caused by these intestinal protozoan parasites are known as giardiasis, amoebiasis, and cryptosporidiosis respectively, and they are associated with diarrhoea. *Giardia* is the most prevalent parasitic cause of diarrhoea in the developed world, and this infection is also very common in developing countries. Amoebiasis is the third leading cause of death from parasitic diseases worldwide, with its greatest impact on the people of developing countries. The World Health Organization (WHO) estimates that approximately 50 million people worldwide suffer from invasive amoebic infection each year, resulting in 40-100 thousand deaths annually. Cryptosporidiosis is becoming most prevalent in both developed and developing countries among patients with AIDS and among children aged less than five years. Spread of these protozoan parasites in developing countries mostly occurs through faecal contamination as a result of poor sewage and poor quality of water. Food and water-borne outbreaks of these protozoan parasites have occurred, and the infectious cyst form of the parasites is relatively resistant to chlorine. Other species of protozoan parasites can also be found in the human gut, but they are not pathogenic, except *Microsporidia* sp.

There are four species of intestinal helminthic parasites, also known as geohelminths and soil-transmitted helminths: *Ascaris lumbricoides* (roundworm), *Trichiuris trichiuria* (whipworm), *Ancylostoma duodenale*, and *Necator americanicus* (hookworms). These infections are most prevalent in tropical and subtropical regions of the developing world where adequate water and sanitation facilities are lacking. Recent estimates suggest that *A. lumbricoides* can infect over a billion, *T. trichiura* 795 million, and hookworms 740 million people. Other species of intestinal helminthes are not widely prevalent. Intestinal helminthes rarely cause death. Instead, the burden of disease is related to less mortality than to the chronic and insidious effects on health and nutritional status of the host. In addition to their health effects, intestinal helminth infections also impair physical and mental growth of children, thwart educational achievement, and hinder economic development. Soil-transmitted helminth infections are invariably more prevalent in the poorest sections of the populations in endemic areas of developing countries. The goal is to reduce morbidity from soil-transmitted helminthes infections to such levels that these infections are no longer of public-health importance.

E. vermicularis

E. vermicularis, commonly referred to as the pinworm or seatworm, is a nematode, or roundworm. Humans are the only known host, and about 209 million persons worldwide are infected. More than 30 percent of children worldwide are infected. The worms live primarily in the cecum of the large intestine, from which the gravid female migrates at night to lay up to 15,000 eggs on the perineum. The eggs can be spread by the feco-oral route to the original host and new hosts. Ingested eggs hatch in the duodenum, and larvae mature during their migration to the large intestine. Fortunately, most eggs desiccate within 72 hours. In the absence of host autoinfection, infestation usually lasts only four to six weeks. Disease secondary to *E. vermicularis* is relatively innocuous, with egg deposition causing perineal, perianal, and vaginal irritation. Pinworm infection should be suspected in children who exhibit perianal pruritus and nocturnal restlessness.

G. lamblia

G. lamblia is a pear-shaped, flagellated protozoan that causes a wide variety of gastrointestinal complaints. Giardia is arguably the most common parasite infection of humans worldwide. Because giardiasis is spread by fecal-oral contamination, the prevalence is higher in populations with poor sanitation, close contact, and oral-anal sexual practices. The disease is commonly water-borne because Giardia is resistant to the chlorine levels in normal tap water and survives well in cold mountain streams. Food-borne transmission is rare but can occur with ingestion of raw or undercooked foods.

The life cycle of Giardia consists of two stages: the fecal-orally transmitted cyst and the disease-causing trophozoite. Cysts are passed in a host's feces, remaining viable in a moist environment for months. Ingestion of at least 10 to 25 cysts can cause infection in humans. When a new host consumes a cyst, the host's acidic stomach environment stimulates excystation. Each cyst produces two trophozoites. These trophozoites migrate to the duodenum and proximal jejunum, where they attach to the mucosal wall by means of a ventral adhesive disk and replicate by binary fission. Giardias grow in the small intestine. Some trophozoites transform to cysts and pass in the feces. After an incubation period of one to two weeks, symptoms of gastrointestinal distress may develop, including nausea, vomiting, malaise, flatulence, cramping, diarrhea, and weight loss.

A. duodenale and *N. americanus*

Two species of hookworm, *A. duodenale* and *N. americanus,* are found exclusively in humans. *A. duodenale,* or "Old World" hookworm, is foundin Europe, Africa, China, Japan, India, and thePacific islands. *N. americanus,* the "New World" hookworm, is found in the Americas and the Caribbean, and has recently been reported in Africa, Asia, and the Pacific. It is distinguished from its slightly larger European cousin by its semilunar dorsal and ventral cutting plates at the buccal cavity compared with *A. duodenale's* two pairs of ventral cutting teeth. Both species share a common life cycle. Eggs hatch into rhabditiform larvae, feed on bacteria in soil, and molt into the infective filariform larvae. Enabled by moist climates and poor hygiene, filariform larvae enter their hosts through pores, hair follicles, and even intact skin. Maturing larvae travel through the circulation system until they reach alveolar capillaries. Breaking into lung parenchyma, the larvae climb the bronchial tree and are swallowed with secretions. Six weeks after the initial infection, mature worms have attached to the wall of the small intestine to feed, and egg production begins. The greatest concern from infection is bloodloss.

E. histolytica

Amebiasis is caused by *E. histolytica,* a protozoan that moves through the extension of finger-like pseudopods. Spreading occurs via the fecal oral route, usually by poor hygiene during food preparation or by the use of "night soil" (crop fertilization with human waste), as well as by oral-anal sexual practices. Spreading is frequent in persons who have a deficient immune system. Approximately 10 percent of the world's population is infected, yet 90 percent of infected persons are a symptom. After malaria, it is likely that *E. histolytica* is the world's second leading protozoan cause of death. The two stages in the *E.histolytica* life cycle are cysts and trophozoites. Infective cysts are spheres that have one to four nuclei and can be spread via the fecal-oral route by contaminated food and water or oral-anal sexual practices. Ingested cysts hatch intotrophozoites in the small intestine and continue moving down the digestive tract to the colon. Also like Giardia, some ameba trophozoites become cysts that are passed in the stool and can survive for weeks in a moist environment. However, trophozoites can invade the intestinal mucosa and spread in the blood stream to the liver, lung, and brain.

1.2 Study area and study population

Banke district is situated in the height of 129 meters to 1290 meters from sea level. The district is a part of Bheri zone and is located in the Mid-Western Region with Nepalgunj as the district headquarters. The district covers an area of 2337 km square. The population of the district is 438608 as per census of 2058 B.S. (2002AD). Its literacy rate is 58% and the main profession of the residents in this district is agriculture.

Nepalgunj is a municipality in Banke District, on the Terai plains near southern border with Bahrainch district, Uttar Paradesh state of India. It is 16 km south of Kohalpur and the east west Mahendra Highway. It is the administrative center of Banke District as well as Bheri zone. It is also the main transport hub for Nepal's Mid-Western and Far-Western regions. The nearest Indian border is about 8 km south and Bahrainch city is about 55 km south of the city center.

Capital of the district is Nepalgunj and there are 46 VDCs in the district. The study area 'Rajhena' is the one of the village among 46 VDCs of Banke district. Rajhena is a village development committee in Banke district in the Bheri zone of southern Nepal. At the time of the 1991 Nepal census, it had a population of 7593 and had 1265 houses in the village.

Rajhena village is a small area where most of the people belong to Tharu communities. Most Tharu people prefer living in Badaghar called longhouses with big families of many generations, sometimes 40-50 people. All household members pool their labour force, contribute their income, share the expenditure and use one kitchen. The most striking aspects of their environment are the decorated rice containers, colorfully painted verandahs and outer walls of theirs homes using only available materials like clay, mud, dung and grass. Most of the people get water from shallow tube well. Families farm their small plots of lands or labor on theirs lands. Most of the Tharu households own a statue of a traditional god. Animals such as pigeons, hens and chickens are used for sacrificial purpose. The gods are believed to have the ability to heal diseases and sickness. The people in the village used to rear pigs and eat pork.

The economic status of people of the area is very poor. So, this area is backward in health, education and hygiene. Most of the adult population was illiterate. Soil contamination from faces was rampant. Treatment facilities were only available in local market. It is the poor

environment in which most of the people resort to open fields for defecation and most of the houses did not have latrine.

1.3 Significance of study

Intestinal parasitic infections are globally endemic and have described as constituting the greatest single world-wide cause of illness and diseases. Intestinal parasitic infections are linked to lack of sanitation, lack of access to safe water and improper hygiene; therefore they occur wherever there is poverty. Intestinal parasitic infections deprive the poorest of the poor of health, contributing to economic instability and social marginalization. The poor people of under developed nations experience a cycle where under nutrition and repeated infections lead to excess morbidity that can continue from generation to generation. People of all generation are affected by this cycle of prevalent parasitic infections.

Intestinal parasitic infections have always been an important public health problem in the tropics, particularly in developing countries. Chronic infections impair physical and mental growth and development of children in general. Furthermore intestinal parasites may increase susceptibility to infections with other intestinal pathogens. It is therefore important to identify the problems and tackle it in the interest of public health.

Rajhena of Banke district have high temperature and humidity where poor sanitary and hygiene standards of region, especially low standards of public sanitation, lack of safe sources of drinking water or domestic sewage treatment facilities as well as widespread use of excrement as manure to irrigate cultivated fields are the major factors which influence prevalence of diseases. Here most of the people belong to Tharu community and main profession of the residents in the villages is agriculture. They lacked access to opportunity in the state mechanisms. So, their educational and socio-economic status is very low.

Surveys on the intestinal parasite infections are important in this region because they reflect sanitary conditions of the community and produce basic data for the control of parasitosis in the future. Rajhena is a rural and developing village in the Banke district. Most of the people in the village are illiterate and even they do not know about parasites and parasitic diseases. So, the main aim of this survey is to create awareness to the people living in this village. The

study of intestinal parasites in the people of Rajhena village has been done for the first time to find the prevalence of infections on the basis of age, sex, occupation and to give the idea about the preventive measures of such parasites which help to aware the people towards intestinal diseases. Moreover, the present study might play a role to help the future investigators to advance this knowledge and throw light on different problems faced by rural communities.

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

1.4 Limitation of the study

- This research has been carried out for the partial fulfillment of the requirement for the Degree of Master of Science and Technology in Zoology. Therefore, intensive research could not be possible because of the lack of resource with in short span of time.
- Stool sample of all the individual of the community were not observed.
- The study was focused only limited population.The study was carried out to determine the prevalence of intestinal parasites seasonally but the study does not reveal why some parasites were more predominant other were not.
- Drinking water sample were not examined for its purity.

1.5 Objective of the study

1.5. a. General objectives

- To determine the prevalence of parasitic infections among Tharu communities of Banke district in Rajhena VDC.

1.5. b. Specific objectives

- To study the age, and sex-wise distribution of intestinal parasites among tharu communities of Banke district in Rajhena VDC.
- To study the intestinal parasitic symptoms in relation to socio-economic condition, feeding habit, hygiene and sanitation and make them aware regarding tidy habits.
- To provide the medicines by consulting medical doctor for infected persons.
- To facilitate the approach of regular examination of intestinal parasites.

1.6 Hypothesis

H_0 =There is no significant differences in prevalence rate of intestinal parasites among Tharu communities of Banke district in Rajhena VDC.

H_1 =There is significant differences in prevalence rate of intestinal parasites among Tharu communities of Banke district in Rajhena VDC.

II

LITERATURE REVIEW

2.1 History of Parasitology

Up to the middle of the seventeenth century knowledge of Parasitology was limited to recognition of the existence of a few common external parasites such as lice, fleas and few internal parasites like tape worms, pinworms and guinea worms. They were considered as natural products of human bodies.

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

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

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

From the middle of twentieth century, the works on parasites regarding different aspects; i.e. distribution, life cycle, pathogenesis, treatments and controls became fast and went wide spread.

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

2.2 Literature Review in the Context of World

Al Balla et al. (1993) determined the prevalence of pathogenic intestinal parasites among preschool children in Saudi Arabia through a randomized multi stage sampling of 800 school children. The overall prevalence of intestinal parasite among children was 18.4%. Out of the 1461 children positive for parasites, 183(12.5%) had mixed parasitic infection. Prevalence among preschool children was highly associated with older age, rural resistance and no

municipal water supply, inadequate latrine type, low level of parental education, abdominal diarrhea.

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

Virk et al. (1994) worked on prevalence of intestinal parasites in rural are of district and Shahjahanpur Uttar Pradesh. Out of 381 individuals examined 111 i.e. 29.2% were found positive for one or the other intestinal parasite *A. lumbricoides* superseded all the parasite by showing positivity of 17.85% followed by hookworm 7.87%, tapeworm 3.41%, *H. nana* 3.15%, *E. vermicularis* 0.52%, *T. trichiura* 1.05%, *E. histolytica* 2.36% and *G. lamblia* 0.26%.

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

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

Kobayashi et al. (1997) studied the intestinal infection of 128 children in Khammovane Province, Southeastern Sao Paulo, Brazil. Prevalence of helminthes infection was 77.3% in children under 6 years age group, 88.5% in the age group 6-10 years and 81.8% in the age group above 11 years. The parasites were *Ascaris* 48.4%, *Trichuris* 43.8%, hookworm 37.5% and *Opisthorchis viverrini* 37.5%.

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

Ludwig et al. (1999) worked on correlation between sanitary condition and intestinal parasitosis in the population of Assis, State of Sao Paulo. A total of 18366 stool samples were collected from six sanitary centers of Assis during 1990 to 1992. The general prevalence of enteroparasites was 25.3%. The most frequently found enteroparasites were *G. lamblia* (8.7%), *A. lumbricoides* (5.5%), *T. trichiura* (2.7%) and *H. nana* (1.97%). In Marialues, a low income neighborhood, the prevalence was 17%, 13.1%, 5.9% and 4.2% respectively. The age group 3-12 years showed the largest number of infected individuals.

Paul et al. (1999) carried out a study to determine the prevalence of intensity of intestinal helminthes infections. The children were between 7-13 years of age and belonged to lower socio-economic status. Stool samples collected were processed by modified formalin ethyl acetate sedimentation technique. 177 children were infected with one or more of the intestinal parasites viz., *A. lumbricoides*, *T. trichuria* and hookworm. The overall prevalence of infection was 82%. *A. lumbricoides* was the most common parasite with a prevalence of 75% followed by *T. trichiura* of 66% and hookworm of 9%.

Toma et al. (1999) carried out questionnaire survey and studied prevalence of intestinal helminthes infections in Barru, Sulawesi, Indonesia. A total of 654 fecal samples were collected and examined. The most common enteroparasite were *A. lumbricoides, T. trichiura,* hookworm and *S. stercoralis, H. nana* infection was also confirmed. *T. trichiura* was most common followed by hookworm and *A. lumbricoides* in both 4-14 and over 15 years age group. The prevalence of hookworm infection was significantly higher in males than in females of older age. The inhabitant with higher education background had significantly lower infection rates of *Ascaris lumbricoides* and *Trichuris trichiura*. The prevalence of hookworm infection was not significantly different between in inhabitant owning latrine and without it, but prevalence of *Ascaris* and *Trichuris,* differed significantly.

Lee et al. (2000) examined stool and cello tapenal swab carried out in August 1997 on handicapped people at an institution located in Chorwongun, Kangwon-do, Korea. A total of

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

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

Toma et al. (2001) studied on *Strongyloides* infection conducted by faecal examination and subsequent treatment of the population on a model Island (Kume Island) in Okinawa, Japan for 5 years from 1993 to 1997. More than 1200 persons, accounting for 17% to 20% of the person and subjected, received faecal examinations each year. The positive rate in 1993 was found to be 9.7%.

Smith et al. (2001) conducted a cross sectional survey between January and March 1998 in four rural community in Hondurus, Central America. He examined the prevalence and intensity of *Ascaris lumbricoides* and *Trichuris trichiura* infections among 240 faecal specimens of 62 households. The overall prevalence of *A. lumbricoides* and *T. trichiura* was 45% and 38% respectively. The most intense infections of *A. lumbricoides* and *T. trichiura* were found in children aged 2-12 years old.

Tai-soon et al. (2001) investigated the state of intestinal infections in two rural villages in Chitwan district, Nepal, in 1999. Stool examination was performed with a total 300 specimens from school children by formalin-ether sedimentation technique. The prevalence rate of intestinal parasite infection in the surveyed areas was 44.0%. The prevalence rate in Jerona was slightly higher than male without statistically significant difference E. coli was

the most commonly found protozoan parasite (21.0%) followed by *G. lamblia* (13.7%) and other (5.3%). Hookworm was the most prevalent intestinal helminthes (13%) followed by *T. trichiura* (3%) and other (5%) 43 specimens (14.3%) showed mixed infections.

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

Alakpa et al. (2002) conducted a cross sectional laboratory based study in Lagos Metropolis state in South Western Nigeria during March 1999 to April 2000. In total 1109 stool samples were collected during the period of study 11 (0.95%) were confirmed to be positive to *cyclospora cayetanensis*oocytes. Other parasites were also detected including *cryptosporidium, Entamoeba, Ascaris, Trichuris, strongyloides sp.* and hookworm.

Buchy (2003) worked on intestinal parasites in the Mahajanga region West Coast of Madagascar. A total of 401 stool and 112 sera samples were collected from OPD patients of Mahajanga's Hospital during November 1996 to January 1997. The examination of stool specimens revealed 67.6% overall prevalence. The frequency of protozoa was higher 47.7% than helminthes 23.4%. The specific prevalence was *H. nana* 25% and *Taenia saginata* / *Taenia solium* 0.75%. Out of 112 sera examined 50% of sera contained antibodies (anti *A. lumbricoides* and anti *S. stercoralis).*

Kim et al. (2003) carried out small state survey to investigate the status of intestinal protozoa and helminthes infection of inhabitants in Roxus City, Mindoro, and the Philippines. A total 301 stool samples were collected. The overall positive rate was 64.5% and that of male and female were 56.6% and 72.5% respectively. The highest infected helminthes was

A.lumbricoides (51.2%) followed by *T. trichiura* (27.6%), hookworm (8.0%) and *E. vermicularis* (0.3%). The protozoan infection status revealed that *E. coli* was the most frequent (15.0%). *Iodamoeba butschlii* and *E. histolytica* were found but few. The multiple infection more than two parasites was 29.6% and double infection with *A. lumbricoides* and *T. trichiura* was common. The intestinal helminthes infections were highly prevalent in this area.

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

Deepmala et al. (2004) investigated on the prevalence of intestinal parasitic infections in human population of Darbhanga region of Bihar. In the epidemiological survey of intestinal parasitic infection, out of 2553 stool samples examined, 920 (36.03%) were found to be positive for protozoan parasites, 1162(15.52%) for helminthes and 471(18.45%) for mixed infection. In overall infection, males and even those of 21-30 years age group showed higher prevalence rate (55.55%) than females (44.45%).

Singh et al. (2004) studied on helminthic infection of the primary school going children in Manipur. Out of 1010 stool samples collected from the primary school going children between age group 5-10 years, 248(24.5%) were positive for various helminthes. Among the positive cases, 110(26.3%) were from urban area and 138(23.4%) were from the rural areas of Manipur. Maximum number of parasitic infection were found in 5-6 years age group having 27% *Ascaris lumbricoides*, 19.6% *T.trichiura*, 2.18% *H. nana*, 0.99% hookworm, 0.09% *S. stercoralis.*

Adnan et al. (2005) conducted a study among the children in Gaza. In this study 92 stool specimens were collected and analyzed by wet mount iron haemotoxylin staining, antigen detection of *Entamoeba histolytica.* The total number *E. histolytica* identified by PCR was 64 (69.6%) that of E. dispar was 21 (22.8%). Mixed infection with both *E. histolytica* and *E.*

dispar was evident in 7 species (7.6%). In this result approximately 30% of suspected clinical amoebiasis cases were –ve for *E. histolytica.*

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

Goz et al. (2005) conducted the study on distribution of intestinal parasites in children ranging from 6-14 yrs. Old coming from the 23 Nisam Primary School in Hakkari. In this study, a total of 114 stool samples i.e. 60 male and 54 female students were examined. One or more intestinal parasites were found in 66(57.8%). *Giardia intestinalis* (28.9%), *Blastocystis hominis* (23.6%), *Entamoeba coli* (12.2%) and *Ascaris lumbricoides* (6.14%) were most prevalent parasites.

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

Fan-ping et al. (2006) studied on prevalence of *Taenia saginata* infection in people consuming pig meat (pork). The epidemiology of I. *saginata* in some part of Asia is confusing in that beef does not appear to be the source of infection. After the experiment, it was found that strains of pig seem to be favorable animal models for experimental studies of *I. saginata* like tapeworm with SEM pig the most favorable.

Chandrasena et al. (2007) investigated the intestinal parasitic infections and the growth status among a group of children internally displaced by war in Sri Lanka. There was a high prevalence of growth retardation (wasting, stunting and underweight being 41%, 28% and

69.9% respectively) and intestinal parasitic infections (40.2%) among the study population. Provision of adequate food, purified drinking water, sanitation and broad-spectrum antihelmintics is recommended.

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

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

Robert et al. (2008) carried out as study to determine the prevalence of intensity of intestinal helminthes infections in the peri-urban area of Botecatu. Children were between 7 to 13 years of age and belonged to lower socio-economic status. Stool samples collected were processed by modified formalin ethyl acetate sedimentation technique. 187 children were infected out of 280 children with one or more of the intestinal parasites viz. *A. lumbricoides, T. trichiura* and Hookworm. The overall prevalence of infection was 66.7%. *A lumbricoides* was the most common infection with a prevalence of 7.5% followed by *T. trichura* of 61% and hookworm of 4%.

Cristanol et al. (2008) studied on profile of intestinal helminthes in school aged children in the city of Abidjan. A total of 1021 fecal samples from school children aged from 4-15 years were collected and examined. The overall prevalent species were *T. trichiura* 28.3%, *A. lumbricoides* 20.3%, hookworm 5.9%, *S. stercoralis* 2.3%, *H.nana* 1.1% and *E. vermicularis* 0.2%. The males were more infected than females. Most infected group was 12-13 years while least infected group was 3-5 years age group.

Brucel et al. (2009) carried out an epidemiological study on *H. nana* in ciego re desuta, Cuba. A total of 3500000 stool samples were collected during 2006 to 2007. The microscopic examination of 3500000 stools revealed 250 (i.e. 0.008%) eggs of *H. nana*. There were more cases in children than in adults, with male prevailing over females.

Prodeus et al. (2009) studied on intestinal parasitic infections in the University campus of Aagra. Fecal samples of 2069 persons complaining for abdominal discomfort were examined. Out of total samples 1520 samples (73.4%) were found to be positive for *E. histolytica, A. lumbricoides, and G. lamblia*. Among them, *E. histolytica*, showed highest prevalence rate (37.55%) followed by *G. lamblia* (13.6%), while *A. lumbricoides* showed the least infections rate (4.96%).

Lim et al. (2009) studied on the prevalence of intestinal parasites amongst Organ Asli (Indigenous) in Malaysia. Studies reported that the infection rate of intestinal parasitic infections in Orang Asli communities has reduced from 91.1% in 1978 to 64.1% in subsequent years. Although the result was encouraging. It has to be integrated with caution with nearly 80% of studies carried out after 1978 still reported Asli communities, prior to 1978 hookworm infection is the most predominant STS but today trichuriasis is the most common STH infection.

Mumtaz et al. (2009) studied the frequency and risk factors for intestinal parasitic infection in children under five years of age at tertiary care hospital. A cross sectional survey of 269 children and 185 were found positive case i.e. 68.8% children. Majority of children were of 4-5 years of age. Less than one third (20.4%) showed moderate malnutrition $P = 0.05$ while 44.6% were found to have mild anemia $p<0.01$. *Giardia lamblia* was most common 2.53% identified.

Chang et al. (2010) studied on the prevalence of intensity intestinal helminthes infections in Okinawa, Japan. The children were between 5 to 15 years of age and belonged to lower socio-economic status. Stool sample collected were processed by modified formalin ethyl acetate sedimentation technique. 209 children were infected with one or more of intestinal parasites viz. *A. lumbricoides*, *T. trichiura*, hookworm. The overall prevalence of infection was 78.32%. *Ascaris lumbricoides* was the most common infection with a prevalence of 68.32% followed by *T. trichiura* 13.6% and hookworm of 9.16%.

Stebursal et al. (2010) worked on epidemiology of *Hymenolepis nana* infection in primary school children in west Bengal. 516 stool samples were collected. The result of study revealed 18% of children infected with *H. nana*. The above results suggested that, the prevalence of *H. nana* was not in large scale.

2.3 Literature Review in the Context of Nepal

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

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

Gongol (1972) studied a case of round worm infestation in gall bladder.

Soulsa (1975) carried out a survey of the prevalence of intestinal parasites in Pokhara and found very high incidence. He observed that dirty finger nails might play an important role in the transmission of intestinal parasites.

Lynch and Party (1978) worked on prevalence of hookworm and other helminthes in British Gorkha recruits reported 89% of healthy appearing individuals were infested with hookworm, 49% with roundworm and 36% with whipworm.

Acharya (1979) reported that the intestinal infestations like giardiasis, amoebiasis, ascariasis, ancylostomiasis, fascioliasis and taeniasis were common in Nepal.

Nepal and Palfy (1980) reported about a study of prevalence of intestinal parasites in the Mahanchal Panchayat. Out of 225 examined stool samples, 95% were positive. The most common parasites were roundworm (63.5%) followed by hookworm (34.2%), *E.histolytica* (28.8%) and *G. lamblia* (28.4%).

Khetan (1980) carried out the study of the incidence of parasitic infection in Narayani zone. Stool examinations of 2073 patients were done between the years 1977-1980. Out of the total

samples 1522 stool samples had worm infection, of which 458 samples had *Ascaris*, 591 had hook worm, 203 had *Trichuris*, 175 had *G. lamblia* and 83 had other infections.

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

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

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

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

Shrestha, (1983) carried out a survey study in Bhaktapur district showed 99% stool were positive for the egg of soil–transmitted helminthes. Among them, 94% were *A. lumbricoides*, 42% were *T. trichiura* and 11% were hookworm. Similarly from panchkhal 41% of total stool examined were positive for the eggs of helminthes. 75% cases were of *T. trichiura*, 37% of hookworm and 19% of *Ascaris lumbricoides.*

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

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

Suguri et al. (1985) conducted to find the helminth infections, in 737 Nepalese people living in the Gandaki, Dhaulagiri, Lubing and Sagarmatha zone of Nepal and in 26 Japanese living

in Kathmandu from February to April in 1975, employing the so called thick smear method. The overall helminth infection rate was found 36.8% including roundworm (50.3%), hookworm (44.1%), whipworms (47.6%), pinworms (1.2%) and *Taenia* sp. (0.1%). The positive rate was the lowest in Bhairahawa (53.8%) and the highest in Darbang (98.8%). In Namche Bazar, round worm infection rate was the highest (70.3%) and that of hookworm was the lowest (0.2%).

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

Gupta and Gupta (1988) collected 285 stool samples in Kirtipur. Out of 192 (67.36%) positive stool samples, 49 (25.52%) were infected with protozoan parasites, 9.12% by *G. lamblia* and 9.47% by *E. histolytica* and remaining 155 (80.72%) were positive for helminthes parasite, *A.lumbricoides* (40%), *T. trichiura* (25.26%), *A. duodenale* (4.56%), *H. nana* (2.46%) and *T. solium* (0.55%).

Houston and Schwarz (1990) studied about helminthes infections among Peace Corps volunteers Station in various rural regions of Nepal indicated 14% were positive for hookworm, 3% for whipworm and 82% for roundworm infections.

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

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

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

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

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

Rai et al. (1999) *Ascaris,* Ascariasis and its recent scenario in Nepal had suggested *Ascaris* as leading human parasite and also reported as major causes of public health problem. The study reported that over 75% people were infected by *A. lumbricoides* in rural areas, whereas hospital based study in Kathmandu over a period of one decade also shown a static annual prevalence with mean of approximately 35%.

Rai et al. (2000) investigated the contamination of soil with helminthes eggs in Kathmandu valley and outside valley in Nepal. Out of 156 total samples, 122 were taken from Kathmandu valley and 34 samples from outside valley. The overall soil contamination rate was 36.5%. The prevalence was uniform in Kathmandu valley (36.3%) during wet season compared with the observed in dry season (33.3%) but without significant different ($p<0.02$) altogether 5 species of nematodes were recorded (A. *lumbrcoides, Toxocara sp*), *T. trichiura, Capillaria sp.* and *Trichostrongylus* and 2 species of cestoda (*H. nana and H. diminuta*). *A. lumbricoides* was prominent in Kathmandu valley while *Trichostrongylus* was the commonest outside of valley.

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

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

Rai et al. (2002) studied intestinal parasites among school children in a rural hilly area of Dhading district, Nepal. A total of 423 school children were included and 254(60%) of them were found to be positive for intestinal parasite. *A. lumbricoides* was the most common (69.6%) parasite detected followed by hookworm (19.2%), whipworm (5.9%). *G. lamblia* was only protozoan parasite detected in this study (5.2%) whereas Dalit had significantly higher prevalence (74.1%).

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

Karki et al. (2004) conducted a study among Magars in Barangdi VDC of Palpa from July 2002 o June 2003. A total of 157 samples were examined and to total prevalence was 66.88%. The highest prevalence rate was found to be due to *A. lumbricoides* (50.32%) followed by hookworm (24.2%), *T. trichiura* (17.2%), *Taenia sp.* (8.28%), *H. nana* (6.37%) and *S. stercoralis* (1.91%).

Parajuli (2004) studied on the prevalence rate of intestinal parasite in Mushar community in Chitwan district. A total of 183 stool samples were examined of which 77.05% were positive. Female had higher prevalence (79.2%) than male (74.4%). *A. lumbricoides* had higher prevalence (48.08%) followed by *A. duodenale* (34.94%), *T. trichiura* (22.4%), *E. histolytica* (15.3%), *S. stercoralis* (8.19%), *G. lamblia* (7.65%), *H. diminuta* (4.37%), *H. nana* (2.73%) and *Taenia* sp. (1.63%).

Chaudhari (2004) carried out a study in Machchhegaun VDC from February 2002 to January 2003. A total of 306 samples were examined, among which 76.6% positive with at least one

kind of parasite. The prevalence of parasite was higher in male (86.5%) than female (70.0%). Highest prevalence rate was for *A. lumbricoides* (43.4%) followed by *T. trichiura* (22.5%), *G. lamblia* (16.1%), *C. cayetanensis* (7.2%), *E. histolytica* (2.5%), *C. parvum* (1.7%), hookworm (1.7%), *E. coli* (1.7%), *I. butschlii* (1.2%), *H. nana* (0.8%), *E. vermicularis* (0.4%) and *E. nana* (0.4%)

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

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

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

Raghav et al. (2008) investigated the states of intestinal parasitic infections in rural village in Siraha district, Nepal in 2007. They examined 430 stool samples. The total prevalence rate of intestinal parasite infection in surveyed areas was 63.20%. Female had higher prevalence (77.04%) than male (62.12%). *A. lumbricoides* had higher prevalence (41.23%) followed by *A. duodenale* (33.92%), *T. trichura* (22.3%), *E. histolytica (*15.3%), *S. stercoralis* (6.12%), *G. lamblia* (18.2%), *H. nana* (3.23%), *H. diminuta* (3.25%) and *Taenia sp.* (2.3%).

Rosino et al. (2009) published the 'Socio-Economic Status of Nepal'. They experimentally proved the different issues and condition of Nepalese. They showed that most of the people of rural areas were suffering from different types of parasitic infections as well as very low economic status. They examined 1500 stool samples from Terai region and got 84.2% of the samples were positive.

III

MATERIALS AND METHODS

This study is carried out for determining the prevalence of intestinal parasites among tharu community of Rajnena VDC of Banke district. The stool samples was collected from the study area and brought at Microbiology Department of Neplalgunj Medical College Teaching Hospital Kohalpur for laboratory diagnosis.

3.1 Study Design

The study design is based under laboratory examination.

3.2 Sample Size

The stool samples were collected and examined from people above 10 years of age.Two hundred fifty stool samples were collected from the people of Rajhena VDC, ward no. 5, 6&7 (above 10 years of age).

3.3 Stool Sampling

Two hundred fifty peoples were randomly selected for study purpose. Sterile stool sample collecting vials with detail instruction required for stool collection provided to selected peoples for study population. The door to door house hold survey was conducted for the stool collection. The stool samples were collected and brought to laboratory and the potassium dichromate was put in the vials containing stool as preservatives and then kept in refrigerator of lab but were not allowed to freeze.

3.4 Equipments and Materials

I. Compound microscope
II. Refrigerator
III. Sampling vials
IV. Slides
V. Cover slips

VI. Gloves
VII. Sticks
VIII. Needle
IX. Cotton or filter paper
X. Forceps

3.5 Chemicals

I. 2.5% Potassium dichromate
II. Normal saline
III. Iodine solution
IV. 10% formalin

3.6 Laboratory Work

All the laboratory works were done in "Microbiology Department of Neplalgunj Medical College Teaching Hospital Kohalpur" under the supervision of experts of lab.

3.6. a. Macroscopic Examination

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

3.6. b. Microscopic Examination

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

Both unstained and stained preparations of stool smears were done. For the preparation of a slide, a drop of normal saline was taken on the clean glass slide. Then small amount of stool was added to the slide by the help of sticks and cover-slip was placed over them. Excess of liquid was removed with the help of filter paper or cotton. For stained preparation of stool smear, iodine solution was used.

The prepared slides were first examined under the low power (10x objectives) of microscope for the presence of helminthes eggs. Then they were examined under high power (40x objectives) of microscope for identification of helminthes eggs, larvae and protozoan

trophozoites and cysts. For the further confirmation, stool samples were examined by the experts of "Microbiology Department of Neplalgunj Medical College Teaching Hospital Kohalpur".

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

3.7 Data Analysis

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

IV
RESULTS

Surveillance study and stool samples collection and examination were done in 250 people of 'Tharu' community, ward 5, 6 & 7 of Rajhena VDC. The study was performed in two ways:

4.1 Stool examination.

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

4.1RESULTS OF STOOL EXAMINATION

⁾ General Prevalence of the Intestinal Parasites of the peoples of Rajhena VDC.

Out of 250 people 78(31.20%) were found to be infected with one or more types of intestinal parasites. The major groups of parasites found are protozoans and helminthes.

Table1: General Prevalence of Intestinal Parasites of thepeoples of Rajhena VDC.

Name of the VDC	Total No. of Samples Examined	No of Positive Cases	Positive %	No of negative Cases	Negative %
Rajhena	250	78	31.20	172	68.8

) Sex-wise Prevalence of Intestinal Parasites

Out of 250 examined stool samples, 134 were of male and 116 were female. Out of 134 male stool samples examined, 46(34.32%) were found to be positive. Likewise out of 116 female stool samples examined, 32(27.58%) were found to be positive for intestinal parasites. Hence, the infection rate was found higher in male than female.

Statistically, the difference in sex- wise prevalence of parasites of the people was found insignificant (χ^2=1.3166, p>0.05).

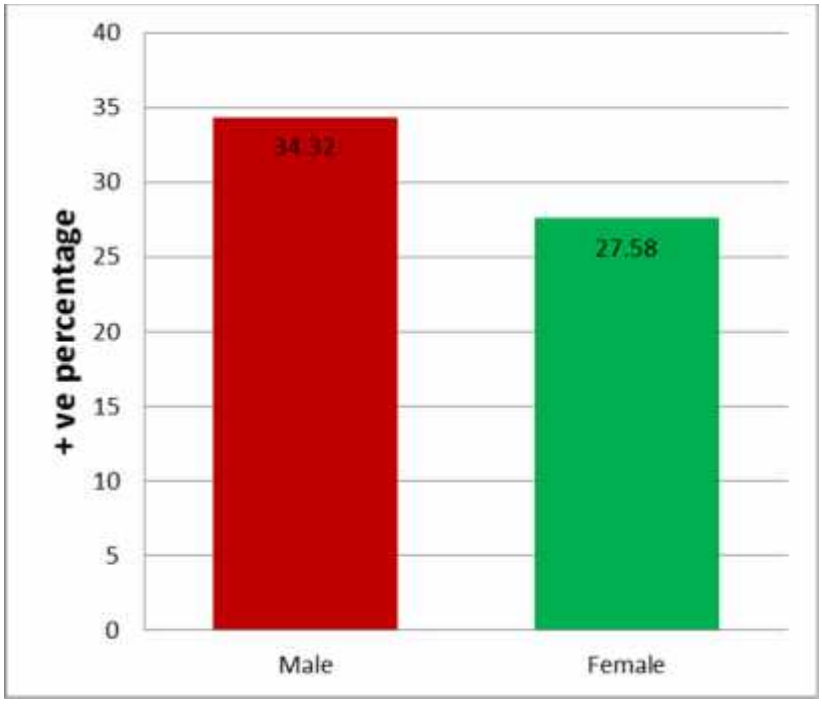

Fig 1: Sex-wise Prevalence rate of Intestinal Parasites

) Age Group-wise Prevalence of Intestinal Parasites

There was age limit for study population i.e. above 10 years old. The entire study is categorized into three age groups. The prevalence of parasitic infection was found in age group of 10-30years 60 (32.96%) and 31-50years16 (26.23%) and age group 51above 2(28.57%).

Statistically, no significant difference regarding parasitic infection was found in different age groups (χ^2=0.9893, p>0.05).

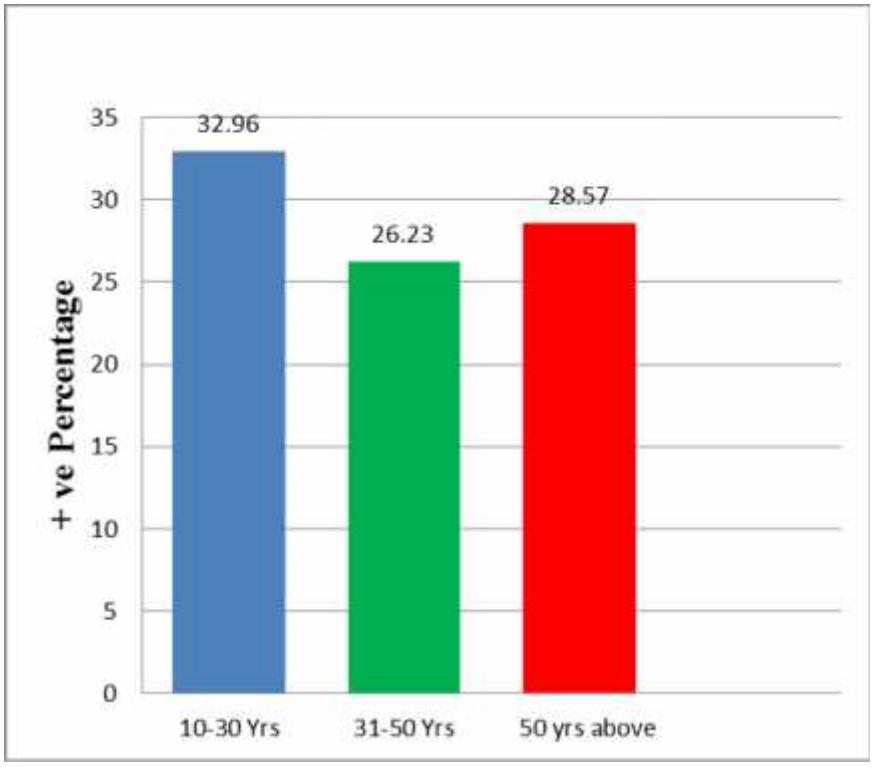

Fig 2: Age Group-wise Prevalence of Intestinal Parasites

) Prevalence of Specific Intestinal Parasites

Overall prevalence showed that the infection of *Ancylostoma lumbricoides*was found to be maximum, 28(11.2%) followed by *Giardia lamblia*, 21(8.4%) then *Entamoeba histolytica*, 14(5.6%), *Ancylostoma duedonale*,6(2.4%), *Trichuris trichiura*,5(2%) and *Hymenolepsis nana*,5(2%) and *Taenia solium*,4(1.6%).

Table 2: Prevalence of Specific Intestinal Parasites in Total

S.N.	Parasites	Total Infection	% Infection in Total 250
1	*G. lamblia*	21	8.4
2	*E. histolytica*	14	5.6
3	*T. solium*	4	1.6
4	*H. nana*	5	2
5	*A. lumbricoides*	28	11.2
6	*A.duodenale*	6	2.4
7	*T.trichiura*	5	2

⟩ Intensity of Infection

The infection of single parasite was more common than double and triple species infection. Out of total 78 positive cases, there were 67(85.89%) single infections while 9(11.54%) double and 2(2.56%) with triple infections.

⟩ Intensity of Single Infection

Out of 67 positive cases, the intensity of *Ascaris* was found to be maximum 28(35.89%) cases followed by *G. lamblia* with 17(21.79%) cases, *E. histolytica*with 11(14.10%) cases whereas *T. solium* and *T. trichiura* was found equal with 4(5.12%) cases and *H. nana* with 3(3.84%) cases.

Table 3: Intensity of Single Infection

S.N.	Parasites	No.	% Out of Total +ve Cases (78)	No. of Infected Male	No. of Infected Female
1	*G .lamblia*	17	21.79	10	7
2	*E. histolytica*	11	14.1	5	6
3	*T.solium*	4	5.12	2	2
4	*H. nana*	3	3.84	2	1
5	*Ascaris*	28	35.89	18	10
6	*T.trichiura*	4	5.12	3	1
Total		**67**	**85.89**	**40**	**27**

J Intensity of Double Infection

Altogether 9 cases were found as double infection out of 250 stool samples examined.

Table 4: Intensity of Double infection

S.N.	Parasites	No.	% Out of Total +ve Cases(78)	No. of Infected Male	No. of Infected Female
1	*A. lumbricoides+G. lamblia*	3	3.84	2	1
2	*A. lumbricoides+ T. trichiura*	*2*	2.56	1	1
3	*A. lumbricoides + E. histolytica*	2	2.56	1	1
4	*G. lamblia + H. nana*	1	1.28	-	1
5	*A.duodenale +E.histolytica*	1	1.28	1	-
Total		**9**	**11.53**	**5**	**4**

J Intensity of Multiple Infection

Only 2 cases were found as multiple infectionsout of 250 stool samples examined. *Ascaris* and *G. lamblia* were common with *H.nana* and *E. histolytica.*

Table 5: Intensity of Multiple Infections.

S.N.	Parasites	No.	% Out of Total +ve Cases(78)	No. of Infected Male	No. of Infected Female
1	*A. lumbricoides +G. lamblia +H.nana*	1	1.28	1	-
2	*A.lumbricoides+ G.lamblia + E. histolytica*	1	1.28	1	-
Total		**2**	**2.56**	**2**	**-**

4.2 RESULTS OF SURVEY ANALYSIS

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

4.2. a. Hand washing-wise Prevalence of Intestinal Parasites

The prevalence of parasitic infection was found to be maximum 41.44% in those people who used soil as cleaning agent to clean hands.

Statistically, difference in the prevalence of intestinal parasites of the people according to method of cleaning of hands was significant (χ^2=19.805, p<0.05).

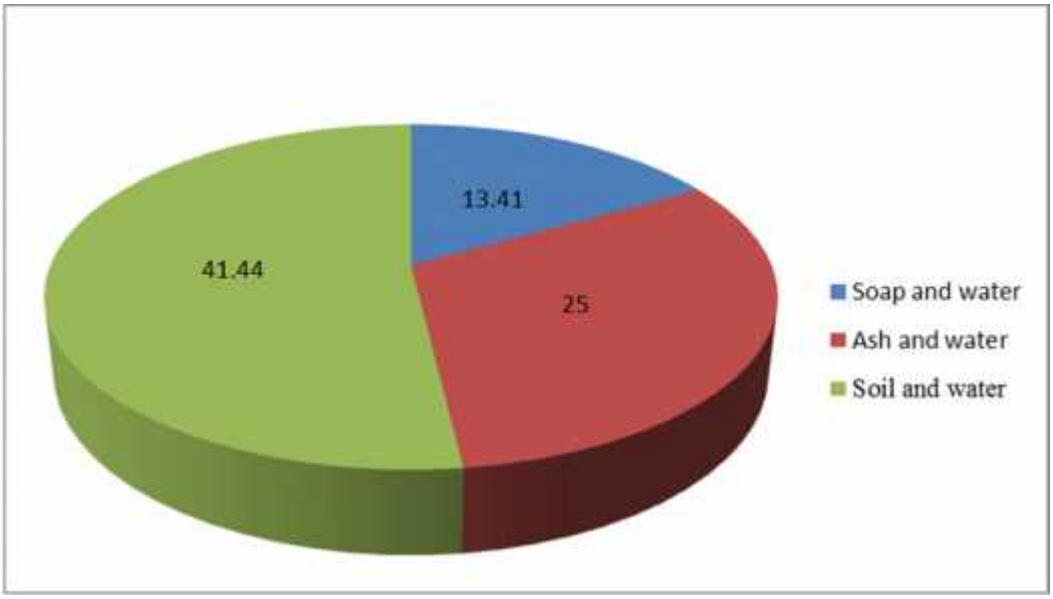

Fig 3: Hand washing-wise Prevalence of Intestinal Parasites

4.2. b. Food Habit-wise Prevalence of Intestinal Parasites

Out of 250 interviewed people, 185 were non-vegetarian and only 65 were vegetarian. Among 185 non-vegetarian people, 72(38.91%) were infected with intestinal parasites whereas among 65 vegetarian people, 6(9.23%) were infected with intestinal parasites. It shows non-vegetarian are at high risk of intestinal parasites.

Statistically, the difference in the prevalence of intestinal parasites of the children on the basis of food habits was found significant (χ^2=19.75, p<0.05).

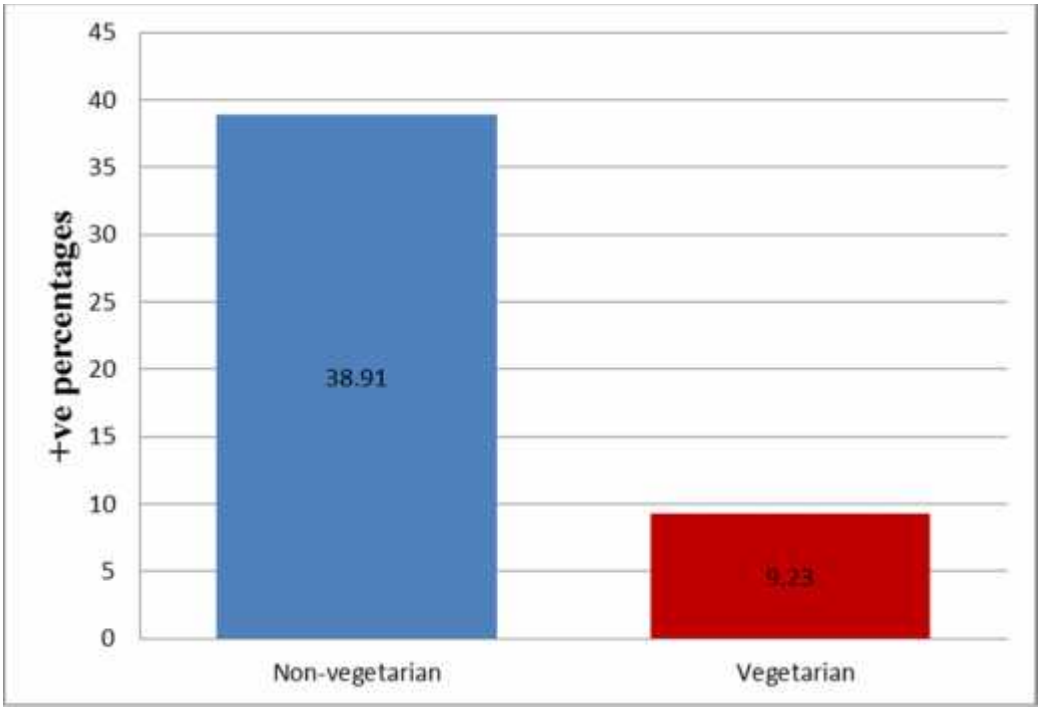

Fig 4: Food Habit-wise Prevalence of Intestinal Parasites

4.2. c. Occupation-wise Prevalence of Intestinal Parasites

The prevalence of parasitic infection was found to be maximum 35.60% of those peoples who work as a farmer followed by labour group was33.34%, house wife 31.57%, student 28.12%, business man 20% & service holder 8.34%. No involvement found among builder group.

Statistically, difference in the prevalence of intestinal parasites of the people according to their occupation was insignificant (χ^2 =6.2426, p>0.05).

Table6: Occupation-wise Prevalence of Intestinal Parasites

S.N.	Occupation of Parents	No. of Respondents	No. of Positive Samples	Positive %
1	Farmer	118	42	35.60
2	Student	32	9	28.12
3	House wife	76	24	31.57
4	House builder	4	00	00
5	Business	5	1	20
6	Labourer	3	1	33.34
7	Service holder	12	1	8.34
Total		**250**	**78**	**31.20**

4.2. d. Defecation Place-wise Prevalence of Intestinal Parasites

The prevalence of parasitic infection was found maximum 54(40.29%) out of 134 people who used to defecate at open field and minimum infection 6(11.53%) out of 52 people who used safe toilet as defecation place.

Statistically, the difference in the prevalence of intestinal parasites on the people on the basis of defecation place was significant (χ^2 =14.81, p<0.05).

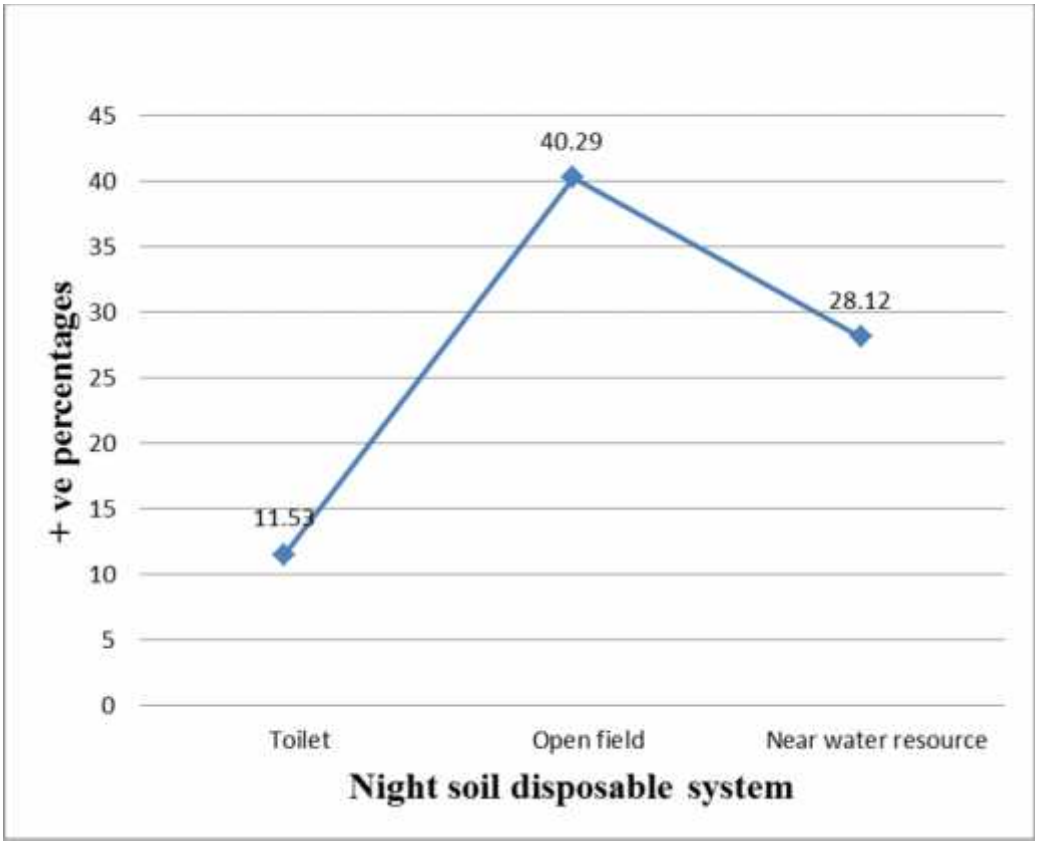

Fig 5: Defecation Place-wise Prevalence of Intestinal Parasites

4.2. e. Livestock and Domestic Animals Ownership-wise Prevalence of Intestinal Parasites

Out of 250 interviewed people, most of them 208 had livestock and domestic animals mainly pigs, buffaloes, cows, goats, ducks, hens and dogs. The prevalence of parasitic infection was found 72(34.61%) out of 208 in those people who had the livestock and domestic animals while 6(14.28%) out of 42 was found in those people who didn't have the livestock and domestic animals.

Statistically, the difference in prevalence of intestinal parasites of the peoples on the basis of livestock and domestic animals ownership was found insignificant (χ^2 =6.728, p>0.05).

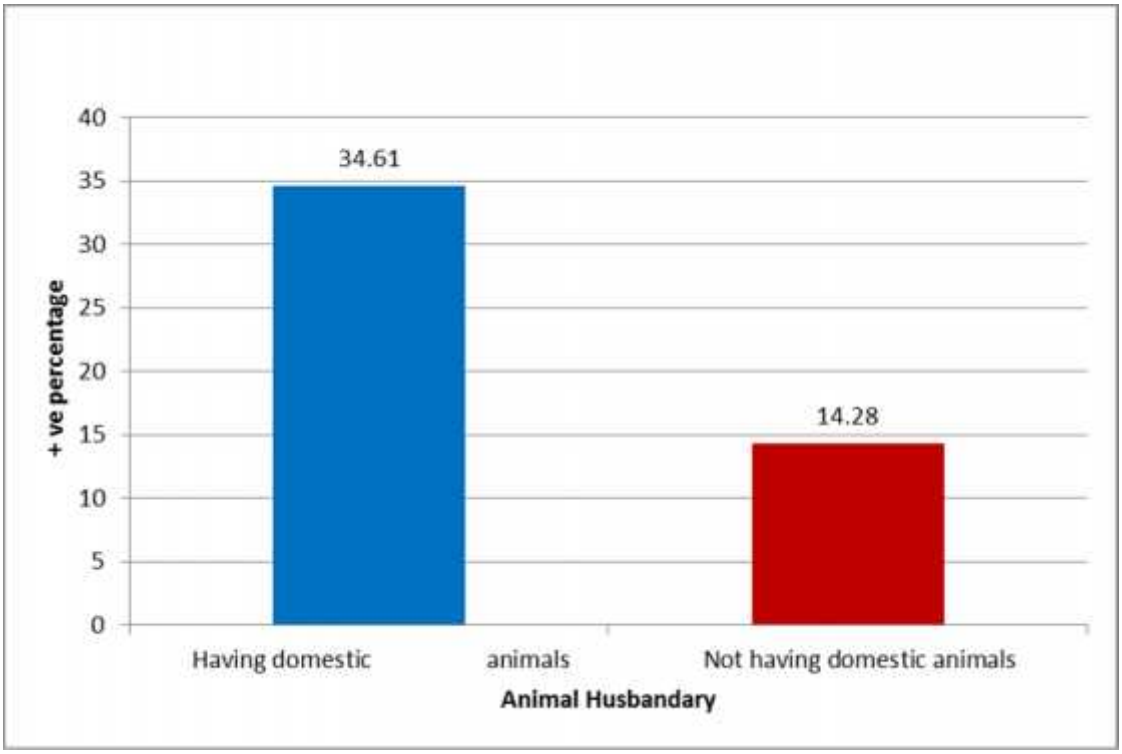

Fig6: Livestock and Domestic Animals Ownership-wise Prevalence of Intestinal Parasites.

4.2. f. Prevalence of Intestinal Parasites on the Basis of Awareness towards Intestinal Parasites

From survey analysis, it was found that the awareness towards intestinal parasite was poor. Out of total 250 people, only 35 showed keen interest towards intestinal parasites whereas 215 were unknown of it. Only 4(11.42%) out of 35 were infected with intestinal parasites who were aware of it whereas 74(34.41%) out of 215 were infected with intestinal parasites who were unknown of it.

Statistically, the difference in prevalence of intestinal parasites of the people on the basis of awareness towards intestinal parasites was found insignificant (χ^2 =7.41, p>0.05).

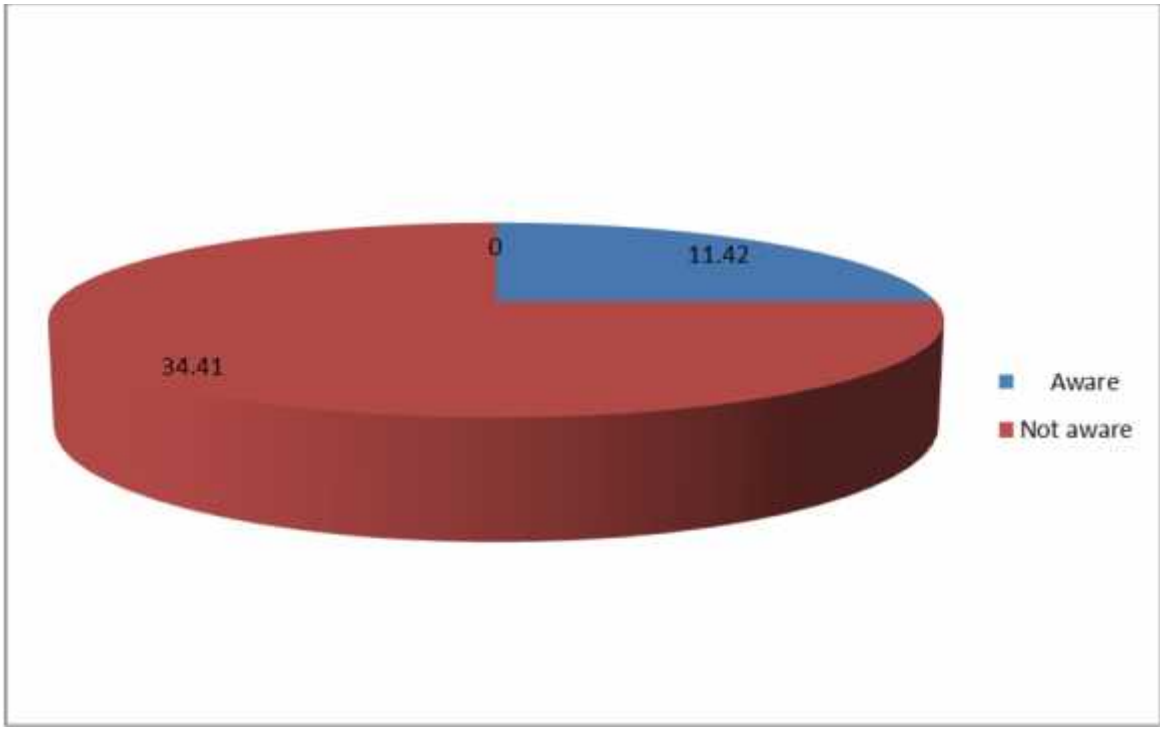

Fig 7: Prevalence of Intestinal Parasites on the Basis of Awareness towards Intestinal Parasites.

4.2. g. Treatment Method-wise Prevalence of Intestinal Parasites

From survey analysis, it is found that most of people 106 believe in traditional methods of treatments, such as Dhami, Jhakari, Guruwa, Baidhya etc. and 46 people believe in direct taking medicine. So, maximum intestinal parasitic infection 61 (57.54%) out of 106 was found in people who believed in traditional methods for treatment of intestinal parasites.

Statistically, the difference in prevalence of intestinal parasites of the people on the basis of treatment method was found significant (χ^2 =68.o3, p<0.05).

Table 7: Treatment Method-wise Prevalence of Intestinal Parasite

S.N	Category	No. of Respondents	No. of Positive Samples	Positive %
1	Direct taking medicine	46	13	28.26
2	Consulting doctor	98	4	4.08
3	Traditional Methods	106	61	57.54
Total		**250**	**78**	**31.20**

V

DISCUSSIONS

Like other developing countries, intestinal parasitic infestation is a major health problem in Nepal. The high prevalence of these infestations is closely correlated to poverty, poor environmental hygiene and impoverished health services. *Ascaris lumbricoides*, *Trichuris trichura* and hookworm are the major helminthes parasites whereas *Giardia lamblia* and *Entamoeba histolytica* are the major protozoan parasites (Warren and Mahmoud 1984, Walsh 1986). In Nepal, about 4.8% of people died due to cholera and diarrhea (CBS 2002). Morbidity because of intestinal parasites has always been an important public health problem in tropical regions (Sherchand et al. 1996).

The present study revealed that out of 250 people of Rajhena VDC, ward no. 5, 6 and 7, 78(31.2%) was infected by different kinds of intestinal parasites. This approximately resembles with the findings of Rai et al. (1991), Virk et al. (1994), Sawal (2005) and Manandhar (2006) with the percentage prevalence of 30.9%, 29.2%, 29% and 33.48% respectively. Conditions most frequently associated with remarkable prevalence included the water source, defecation site, personal hygiene and some extent of education.

In concerning of sex-wise prevalence of intestinal parasites of people, the result showed that comparatively male (34.32%) were more infected than females (27.58%). Statistically, the difference in sex-wise prevalence of parasites was found insignificant. This result resembles with Chaudhari (2004) while dis-resemble with Rai and Gurung (1986), Tai-Soon et al. (2001) and Raghav et al. (2008) in which the prevalence rate of intestinal parasite infections in female was higher than male. This may indicate that there are equal possibilities of transmission of parasites among people due to over dispersal of parasites in all the communities.

Regarding the age group, the prevalence of parasitic infection was highest in age group of 10-30 years (32.96%) followed by 51 years above (28.57%) and 31-50 years(26.23%). The reason behind this may be due tothe maximum no. of people belonged in 10-30 years of age group in study. Deepmala et al. (2004) found that intestinal parasites were higher among 21-

30 years age group. Statistically, no significant difference regarding parasitic infection was found in different age group (χ^2=o.9893, p>0.05).

The positivity of intestinal parasites contain seven types – *G. lamblia* (8.4%), *E. histolytica* (5.6%), *T.solium* (1.6%), *H. nana* (2%), *A. lumbricoides* (11.2%), hookworm (2.4%) and *T. trichiura* (2%). These parasites were also reported by Sharma et al. (1971) among auxiliary health worker's student in Kathmandu and Karki, (2007) in school children of Mulpani VDC, Kathmandu.

The prevalence of *Ascaris lumbricoides* was the highest (11.2%) among intestinal parasites. This present study coincides with the study of several workers such as Sharma et al. (1971) in which the commonest infestation found was roundworm, Nepal and Palfy (1980) in which the prevalence rate of roundworm was (63.5%), Rai and Gurung (1986) in which the incidence of roundworm was the highest (35%), Rai et al. (1999) in which *Ascaris*, Ascariasis and its recent scenario in Nepal had suggested *Ascaris* as leading human parasite and also reported as major causes of public health problem. Similarly Shrestha (2001), Chaudhari (2004), Manandhar (2006), Karki (2007) and Raghav et al.(2008), are some of examples having the highest prevalence of *Ascaris. Ascaris lumbricoides* is followed by *A. duodenale* (2.4%), *H. nana* (2%), *T. trichiura* (2%) and *T. solium* (1.6%) among helminthes in the present study.

In the present study *T. solium* was found in 4 cases i.e. 1.6% which resembles with Parajuli (2004) in Mushar community in Chitwan and Raghav et al. (2008) in Siraha in which prevalence rate of *Taenia sp*. is 1.63% and 2.3% respectively. Most of the households of the community are pig keepers and this may be due to their consumption of improperly cooked pork meat.

Regarding the protozoan parasites, the prevalence of *G. lamblia* was the highest (8.4%) followed by *E. histolytica* (5.6%) which resembles with the findings of Khetan (1980) in Narayani zone, the prevalence rate of *G. lamblia* was highest (8.5%) than *E. histolytica* (4%). Rai et al. (1991) also reported that *G. lamblia* was the most common followed by *E.histolytica.* Gianotti (1993) reported *Giardia lamblia* (5.9%) followed by *E.histolytica* (5.3%).

In the present study among the 78 positive samples, 67(85.89%) were found with prevalence of single species infection while 9(11.54%) double and 2(2.56%) with prevalence of triple species infection. In double species infection, *A. lumbricoides* was found in all cases except in one case while in triple species infection, *A. lumbricoides* and *G. lamblia* were found to be most dominant parasites from helminthes and protozoa. This also showed that *A. lumbricoides* and *G. lamblia* were highly influenced among low socioeconomic community and coincides with the study presented by Rai et al. (1994), according to which the annual rate of the positivity for soil transmitted helminthes (i.e. *A. lumbricoides*) had the highest prevalence rate than others (i.e. *T.trichiura* and hookworm).

The World Health Organization noted that human behavior may influence the prevalence and intensity of intestinal infections (WHO 1981). So, the human behavior such as washing hands with soil is one of the examples. Maximum infection (41.44%) was found in those people who used soil as cleaning agent. According to Olesen et al. (2001), households without soap had a 2.6 times higher risk of being infected with parasites.

Prevalence of intestinal parasites is also directly affected by feeding habit of people. So, maximum infection (38.91%) was found in non-vegetarian people and only 9.23% infection was found in vegetarian people. The difference in the prevalence of intestinal parasites of the community in vegetarian and non-vegetarian was found significant.

Similarly, the highest prevalence (35.60%) was found in those people who are farmer. This may be due to the reason that most of them are uneducated and they don't have any knowledge of parasitic infection. All the time they have to work in field playing with soil and become the victim of soil transmitted helminthes infection. Gurbacharya (1981) observed that the infection by soil transmitted helminthes in Bhaktapur and Panchkhal area were higher than any other type of parasite. Ribeiro et al. (2003) have suggested that "No satisfactory knowledge about soil-transmitted helminthes and "daily contact with soil" were the most important risk factors. Minimum infection (8.34%) was found in those people who are service holder. This may be due to reason that most of them are educated and have knowledge about parasitic infection. So, they follow hygienic feeding habits. Statistically, no significant difference was found in the prevalence of intestinal parasites of the people according to their occupation.

The present study revealed that only 20.8% people use toilet and maximum 53.6 % use open field as defecation place. Rai et al. (2001) had reported from rural village elsewhere in Nepal that over 80.0% of households had no toilet. So, maximum infection (40.29%) was found in those people who defecate on open field. Statistically, the difference in the prevalence of intestinal parasites on the basis of defecation place was significant (χ^2 =14.81, p<0.05).

The prevalence of intestinal parasites was greater (34.61%) in people having livestock and domestic animals ownership. This may be due to insufficient sanitary facilities, lack of personal hygiene and living nearby livestock and domestic animals, that is, congested housing conditions.

The present study revealed that a significant proportion of the population had lack of awareness about the intestinal parasites. Out of 250 respondents, 215 were found not aware of intestinal parasites among which 34.41% were found with parasitic infection. They don't have the idea of means and modes of intestinal parasitic transmission. This result shows that knowledge of parasitic infection is very poor in the community due to lack of usage of posters and leaflets in villages to increase the public health information and awareness about parasitosis.

Similarly, the present study also tried to know the methods of treatments on intestinal discomfort by respondents. Out of 250 people, 98 were found to believe in consulting doctor among which 4.08% were found with intestinal parasitic infection and 106 were found to believe in traditional methods such as Dhami, Jhakari, and Guruwa etc. among which 57.54% were infected. So, maximum infection was observed in people who believe in traditional methods. It is due to lack of knowledge, attitudes and bad cultures.

VI

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The study was carried out in order to observe the prevalence of intestinal parasites among tharu community of Rajhena VDC. Out of 250 samples, 78(31.20%) were recorded as positive in which the infection rate was higher in male (34.32%) than female (27.58%). The higher prevalence rate was found in age group of 10-30 years (32.96%). Overall prevalence showed that the infection of *Ascaris lumbricoides* was found to be maximum, 28(11.2%) followed by *Giardia lamblia*, 21(8.4%) then *Entamoeba histolytica*, 14(5.6%), *Ancylostoma duodenale*, 6(2.4%), *Trichuris trichiura*, 5(2%) and *Hymenolepsis nana*, 5(2%) and *Taenia solium*, 4(1.6%).

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

6.2 Recommendations

From the present research work, despite of improving health status of Tharu communities of Banke district again place for improving regarding health education and sanitation. Following recommendations are extracted for prevention and control of intestinal parasites-

- People should take care of sanitary improvements including personal hygiene and environmental sanitation.
- People should use latrine for defecation.

- Nation should establish sanitary toilet to the poor community.
- People should avoid walking barefoot. Farmers should be inspired to use boots and gloves during working in field.
- Pure and safe drinking water facility should be made easily accessible for the tribal community.
- Basic health program should be conducted time to time in communities for raising awareness towards the parasitic infections, prevention and control. For this, posters and leaflets should be used extensively.
- People should be made aware about their feeding behaviour and use of boiled water for drinking purpose.
- The research work on the prevalence of intestinal parasites and prevention should be encouraged.

VII

REFERENCES

- Acharya, S. 1979. Malnutrition and diarrhoel disease. Journal of Instituteof Medicine, **1**(2): 21-23.
- Alakpa, Fagbenro-Beyioku, A.F. and Clarke 2002. *Cyclospora cayetanesis* in Stools Submitted to Hospital in Lagos, Nigeria, Journal of International Diseases. **1**: 39-42.
- Balla, A., Salesh, R., Sekeit, M. A., Suliman, R., Rashed, S., Hashed, A.; Mogbil, A., Hedaithy, A., Abdularhaman, M. and Mazrous, A. 1993. Prevalence of pathogenic intestinal parasites among preschool children in Al-Medina district Saudi Arabia. Annals of Saudi Med, **13**(3): 259-263.
- Bol, J.P.M. and Roder, E.C. 1981. Soil transmitted nematodes in Lalitpur district in Nepal.Journal of Institute of Medicine, **3**(2): 167-178.
- Brucel, Lee. Chen, Student, C.M., 2009. Epidemiological Study on *H.nana* in Ciego re desuta, Cuba. Zhonghua Min Guo Gei, **16**(6): 155-160.
- Buchy, P.C. 2003. Intestinal parasitoses in the Mahajanga region, west coast of Madagascar. Bull Soc Pathol Exot, **96**(1): 41-45.
- CBS 2012. Population Census-2011. National Planning Commission Secretariat Central Bureau of Statistics, Ram Shah-path Thapathali, Kathmandu, Nepal.
- Celik, T., Daldal N., Karaman, U., Ozlem, M., Aycan and Atambay, M. 2006. The incidence of intestinal parasites among primary school children in Malatya. TURKIYE PARAZITOLOJI DERGISI, **30**(1): 35-38.
- Chandler, A.C. and Read, C.P. 1961. Introduction to Parasitology, John Wiley and Sons, Inc. New York London.
- Chandrasena, T.G.A.N., Hapuarachchl, H.C., Dayanath M.Y.D, Pathmeswaran, A. and de Silva, N.R. 2007. The intestinal parasitic infections and the growth status among a group of children internally displaced by war in Sri Lanka. Tropical Doctor, **37**(3): 163-165.

- Chang, T. Y., Hasegawa 2010. Prevalence of Intestinal Helminthes Infectionsin the Children of Okinawa (Japan*).* Japanese Journal of parasitology. **46** (3): 126-130.
- 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 March 23-26. Royal Nepal Academy of Science and Technology, SSZ-PS-8. 333p.
- Cristanol. D., Ocampo, R.I., Vidal, Stefen 2008. Intestinal Parasitic Infection amongSchool Aged Children in the City of Abidjan. Asian Journal of Medicine and Public Health **86** (6)**:** 368-371.
- Culha, Gulnaz, Duran, G.G., Duran, N. and Canpolat. A. 2005, printed in biological abstract, June-30, 2006. The distribution of intestinal parasites in students of the Mustafa Kemal University School of Health. TURKIYE PARAZITOLOJI DERGISI, **29**(4): 258-260.
- Deepmala, K. and Sinha, K.P. 2004. Prevalence of intestinal parasitic infections in human population of Darbhanga region of Bihar. Journal of Parasitology and Applied Animal Biology, **13**(1-2): 77-80.
- EDCD (Epidemiology and Disease Control Division), Teku. Annual report, 1999-2005.
- Estevez, E.G.; Levine, J.A. and Warren, J. 1983. Intestinal parasites in a remote village in Nepal. Journal of Clinical Microbiology, **17**(1): 160-161.
- Fan-ping, Sterdon, S.L., and Roder 2006. A Survey on Intestinal Parasites of the People in Kashrung. Kaohsiung Journal of Medical Science. **16** (0): 453-458.
- Fernandez, M.C., Verghese, S., Bhuvaneswari, R., Elizabeth, S.J., Mathew, T., Anitha, A. and Chitra, A.K. 2002. A comparative study of the intestinal parasites prevalent among children living in rural and urban setting in and around Chennai. Journal of Communicable Disease, **34**(1): 35-39.
- Gianotti, A. 1990. Intestinal parasites of Nepal. Journal of Nepal Medical Association, **28**: 242-247.
- Gongol, D.N. 1972. A case of roundworm infestation in gall bladder. Journalof Nepal Medical Association, **11**: 5-6.

- Goz, Yosar, Aydin, A. and Tuncer, O. 2005, printed in biological abstract June-30, 2006. Distribution of intestinal parasites in children from the 23 Nisam Primary School in Hakkari. TURKIYE PARAZITOLOJI DERGISI, **29**(4): 268-270.
- Gupta, R. and Gupta, H.N. 1988. Studies on the infestation rate of human intestinal parasites of Kirtipur. Journal of Nepal Medical Association, **26**(4): 23-29.
- Gurbacharya, D.L. 1981. Problem of soil transmitted helminthiasis in Nepal. Journal of Nepal Medical Association, **19**(4)**.**
- Hadju, V., Lani, K.A., Stephension, S., Noor, N.N., Hussni, O.M. and Dwight, D.D. 1995. Intestinal helminthiasis nutritional status and their relationship. A cross-sectional study in urban slum school children in Indonesia, Southeast Asia. Journal of Tropical Medicine and Public Health, **26**(4): 719-729.
- Hassan, S. I. 1994. Parasitic infections in primary and secondary schools in Giza Governorate, Egypt. Journal of Egyptian Society of Parasitology, **24**(3*)*: 587-601.
- Houston, R.P. and Schwarz, E. 1990. Helminthic infections among peace corps volunteers in Nepal. Journal of Nepal Medical Association, **263**: 273-274.
- Integrated Family Planning and Parasite Control Project (IFPPCP). Annual progress report, 1980.
- Karki 2007. "Prevalence of Intestinal Parasites among Students of Ananda Bhairab Lower Secondary School of Mulpani, Kathmandu." A Dissertation Submitted for Partial Fulfillment in Central Department of Zoology, T.U. 2007.
- Khetan, R.P. 1980. Incidence of parasitic infestations in Narayani zone. Journal of Nepal Medical Association, **18**(4): 29-31.
- Kim, B.J., Ock, M.S., Chung, D.I.I, Yong, T.S. and Lee, J.K. 2003. The status of intestinal parasite infection of inhabitants in the Roxus city, the Philippines. Korean Journal of Parasitol, **41**: 113-115.
- Kobayashi, J. and Hideo, H. 1997. Studies on prevalence of strongyloides infection in Holobar and Maceio, Brazil. Rivista do Institute de Medicine, Tropical deo, Sao, Paulo, **38**(4): 279-284.

- Lee, J.D., Wang, J.J., Chung, L.Y., Chang, E.E., Lai, L.C., Chen, E.R. and Yen, C.M. 2000. A Survey on intestinal parasites of the school children in Kaohsiung Country. Kaohsiung Journal of Medical Science, **16**(9): 452-458.
- Lee. J.W., Park, Grab-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.
- Lim, Sato, Tkara, Kobayashi and Miyagi 2009. Prevalence of Intestinal Parasitesamong the Orang Asli Communities in Malasiya. Journal of Communicable Disease **39** (4): 365-370.
- Ludwig, K.M., Frel, F., Filho, F. A. and Ribeiro, J.T. 1999. Correlation between sanitation conditions and intestinal parasitosis in the population of Assis, State of Sao, Paul.Rev. Soc. Bras. Med. Trop,**32**(5)**:** 547-555.
- Lynch. P and Parry, E. 1978. Prevalence of Hookworm and other Helminthes in British Gorkha Recruits and the Efficiency of Pyrantel Pamoatee (Combination) as an antihelminthic in this situation. Trans. Royal, Soceity of Tropical M.Ed. Hygiene Vol. **72**: 658-659.
- Mafiana, C.F., Sodipe, M.B. and Kaleaso, B.I. 1998. Soil transmitted helminth parasites of human in a city in South-western Nigeria. Helminthologia (Bratislava), **35**(4)**:** 203-208.
- Manandhar 2006. “Intestinal Parasitic Infections among the Children of Ganesh Secondary School of Bhaktpur District.” A Dissertation Submitted for Partial Fulfillment in Central Department of Zoology, T.U. 2006.
- Miller, S.A., Carlos, L.R., Elan, R. and Vicente, S. 2003. Intestinal parasitic infection and associated symptoms in children attending day-care centers in Trujillo, Venezuela. Tropical Medicine and International Health, **8**(4):342-347.
- Mumtaz, Randeep and Stafen 2009. Intestinal Parasitic Infection and Risk Factors inChildren of Tertiary Care Hospital. Journal ofInstitute of Medicine **8**: 33-38.
- Musa, B., Najla, Sehari, A. and Hawas, A. 2007, printed in biological abstract, May-15, 2008. Intestinal parasitic infections among school children in Tripoli, Libya.Journal of theEgyptian Society of Parasitology, **37**(3): 1011-1016.

- Navisky, R.C., Dreytuss M.L., Shrestha J., Khatry S.K., Stoltztus R.J. and Lbonico M.A. 1998. *Ancylostoma duodenale* in Responsible for Hookworm Infections among Pregnant Women in the Rural Plains of Nepal.Journal of Parasitology**. 84**: 647-651.
- Nepal, N. and Palfy, B. 1980. A study on prevalence of intestinal parasites in the Mahanchal Panchayat and their relation with haemoglobin levels. Journal of Institute of Medicine, **2**(2): 175-182.
- Olesen, A., Samuelson, H. and Onyango-Ouma, W. 2001. A study of risk factors for intestinal helminth infections using epidemiology and anthropological approaches. Journal of Biosocial Science, **33**: 569-584.
- Parajuli R.P., Mishra P.N. and Joshi D.D. 2004. Prevalence of Intestinal Prasites in Mushar Community of Chitwan District Fourth National Conference on Scienceand Technology. March 23-26. Royal National Academy of Science and Technology, 2004, SSZ. PS-9, 334 P.
- Paul, I., Gnanamani, G. and Nallam, N.R. 1999. Intestinal helminth infections among school children in Vishakhapatnam.Indian Journal of Pediatrics, **66**(5): 669-673.
- Predeus, Kim Kyong, Leem, Shansel and Levine 2009. Prevalence of Intestinal Parasites in the Studnets of University Campus, Aagra. Journal of Tropical Medicine and Public Health. **36** (3)**:** 464-470.
- Raghav, Hauston, R.P. 2008. Parasitic Infections among the People of MusharCommunity in Siraha District. Journal of Communicable Disease. **34** (3)**:** 290-293.
- Rai, S.k. and Gurung, C.K. 1986. Intestinal parasitic infection in high school level students of Birgunj City. Journal of Institute of Medicine, **8**: 33-38.
- Rai, S.K. and Rai, G. 1999. *Ascaris*, Ascariasis and its present scenario in Nepal. Journal of Institute of Medicine, **21**: 243-245.
- Rai, S.K., Hiari, K., Abe, A., Ishiyama, S., Rai, G., Ono, K. and Uga, S. 2002. Intestinal parasitoses among school children in rural hilly area of Dhading district, Nepal.
- Rai, S.K., Kubo, T., Nakamishi, M., Sumi, K., Shibata, H., Matsuoka, A. and Shrestha, H.G. 1994. Status of soil transmitted helminthic infection in Nepal. The Journal of Japanese Association of Infectious Disease, **68**(5): 625-630.

- Rai, S.K., Nakanishi, M., Upadhayay, M.P. et al. 2000. Effect on intestinal helminth infection on rational and B-contene status among rural Nepalese. Nutritional Research, **20**: 15-23.
- Rai, S.K., Nakasnishi, 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, Thailand, Proceeding of the Asian Conference in Medical Laboratory Technology.
- Rai, S.K., Shrestha, S.K., Bajracharya, M.K., Budhathoki, K. and Kubo, T. 1994. Status of intestinal parasites at T.U. Teaching Hospital, Kathmandu, Nepal. Journal of Institute of Medicine, **17**(3-4): 134-142.
- Rai, S.K., Takeo, M., Kazuo, O., Yako, O.,Shoji, U., Rai, N.and Shrestha, H.G. 2000-2001. Intestinal parasitosis in an "Unknown Disease Outbreak" hit rural hilly area in western Nepal. Journal of Nepal Medical Council, **2**(2): 61-64.
- Ribeiro, M., M.C. and Junior, O.M. 2003. Prevalence and risk factors for soil-transmitted helminthiases in school children from the rural zone of the municirality of Uberlandia, Minas Gerais, Brazil.Rivista de Patologia Tropical, **32**(1): 105-115.
- Robert, Palty, B. Bheli, Jimpa and Cross. J.H. 2008. Prevalence of Intensity of Intestinal Parasites in the Peri-Urban Area of Botecatu. Journal of Institute of Medicine **69** (5)**:** 630-636.
- Rosino, R.P., D.S. 2009. Socio-Economic Status of Nepal. Journal of Institute of Medicine **4** (2)**:** 121-123.
- Shakya, B., Bhargava, D., Shrestha, S. & Rijal, B.P. 2009. Intestinal Parasitosis. Journal of Institute Of Medicine, **31**(3), 13-16.
- Sharma, B.P. 1965. Roundworms and their infestations. Journal of Nepal Medical Association, 3(2): 120-123.
- Sharma, R.P. and Tuladhar, N.R. 1971. A study on intestinal parasites amongst auxiliary health workers in Kathmandu. Journal of Nepal Medical Association, **9**: 247-261.
- Sherchand J.B. and Shrestha M.P. 1996. Prevalence of *Cryptosporidium* infection & infection in Nepal. J. Diarrheal Dis. Res, **14**:81-84.

- Sherchand, J.B., Ohara, H., Sherchand, S., Cross, J.H. and Shrestha, M.P. 1997. Intestinal parasitic infection in rural areas of southern Nepal. Journal of Institute of Medicine, **19**: 115-121.
- Shrestha, I.L. 1983. Soil transmitted helminthiasis. Journal of Institute of Medicine, **5**(2): 193-196.
- Singh, H., Lokhendra, N., Bajrachand, S. and Singh, Y.I. 2004. Helminthic infestation of the primary school going children in Manipur. Journal of Communicable Disease, **36**(2): 111-116.
- Smith, H.M., Dekaminsky, R.G., Niwas, S., Sota, R.J. and Jolly, P.E. 2001. Prevalence and intensity of infections of *Ascaris lumbricoides* and *Trichuris trichiura* and associated socio-demographic variables in four rural Hondurus communities.Memorias do Instituto Oswald Cruz, **96**(2): 167-174.
- Sorensen, F., Mahroof, I., Amarasinghe, D.K.C., Indira, H. and Dassenaieke, T.S. 1996. The prevalence and control of soil-transmitted nematode infections among children and worm in the plantations in Sri-Lanka. Ceylon Medical Journal, **41**(2): 37-41.
- Soulsa, V.O. 1975. Intestinal parasitism in Pokhara. Journal of Nepal Medical Association, **15**(4): 9-13.
- Stebursal, N.R., Mahfouz, A.A. 2010. Study on *H. nana* infection in Children of West Bengal. Indian Journal of Pediatrics **68** (6): 680-684.
- Suguri, S., Tongu, Y., Inatomi, S. and Pradhan, H.D. 1985. A survey on human parasitic infection in Nepal.Japan Journal of Parasitology, **34**: 285-291.
- Tai-soon, Y., Sim, S., Jongween, L., Heechoul, O., Myung-Ho, K. and Hyunsoo, K. A. 2001. Small scale survey on the status of intestinal parasites infectious in villages in Nepal.The Korean Journal of Parasitology, **38**(4):275-277.
- Toma, H., Shimabukuro, I., Kobayashi, J., Tasaki, T., Takara, M. and Sato, Y. 2001. Community control studies on *Strongyloides* infection in a model Island of Okinawa, Japan, South-east Asian. Journal of Tropical Medicine and Public Health, **31**: 383-387.
- Toma, A., Miyagi, I., Kamimura, K., Tokuyama, Y., Hasegawa, H., Solmo, M., Dahlan, D., Majid, I., Hasanuddi, I., Ngatimin, R., Mogi, M. and Kuwabara, N. 1999. Questionnaire Survey and Prevalence of Intestinal Helminthic Infection in Barru

Salvwesi, Indonesia. South Asian Journal of Tropical Medicine and Public Health. **30** (1): 68-77.

- Uga, S., Rai, S.K. & Kimura K. 2004. Parasites detected from diarrhoeal stool samples collected in Kathmandu, Nepal. Southeast Asian J Trop Med Public health, **35**, 19-23.
- Virk KJ, Prasad RN, Prasad H. Prevalence of intestinal parasites in rural areas of district Shahjahanpur, Uttar Pradesh. J Common Dis 1994; **26:103**-8.
- Walsh, J.A. 1986. Problems in recognition and diagnosis of amoebiasis: Estimation of the global magnitude of morbidity. Rev. Infect. Dis, 228-238.
- Wani, Ahmad, S., Ahmad, F., Zarger, S.A., Ahmad, Z., Ahmad, P. and Tak, H. 2007, printed in biological abstract April-30, 2008. Prevalence of intestinal parasites and associated risk factors among school children in Srinagar City, Kashmir, India. Journal of Parasitology, **93**(6): 1541-1543.
- Warren, K.B. and Mahmoud, A.A.F. 1984. Tropical and Geographical Medicine. New York, Mc Graw-Hill Book Company.
- WHO 1981. Intestinal Protozoan and Helminthic Infections. Report of WHO Expert Committee. Technical Report Series: 666.
- Williams- Blangero, S., Subedi, J., Upadhayay, R.P., Manra, D.B., Khadka, K., Jirel, S., Robinsos, E.S. and Blangero, J. 1998. Attitudes towards helminthic infection in the Jirel population of eastern Nepal. Soc. Sci. Med. **47**(3): 371-379.

ANNEX-I

PHOTOGRAPHS

Photo No. 1: Tharu community

Photo No. 2: Tharu people

Photo No.3: Laboratory work

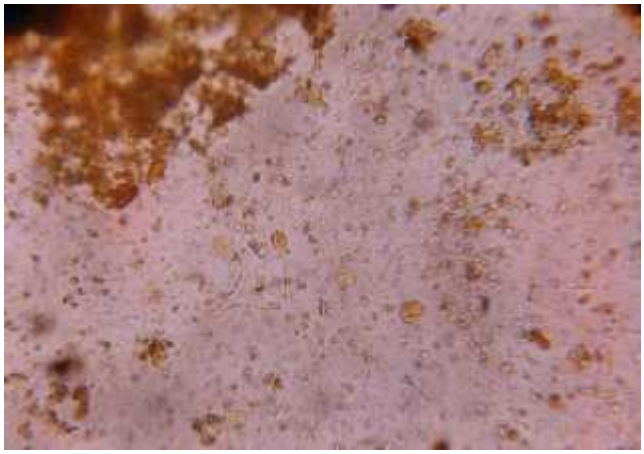

Photo No. 4: Cyst of *Entamoeba histolytica* (400x)

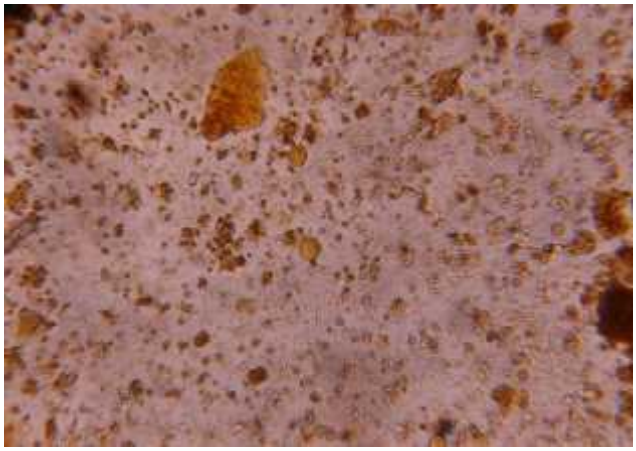

Photo No. 5: Cyst of *Giardia lamblia* (400x)

Photo No. 6: Egg of *A. lumbricoides* (400x)

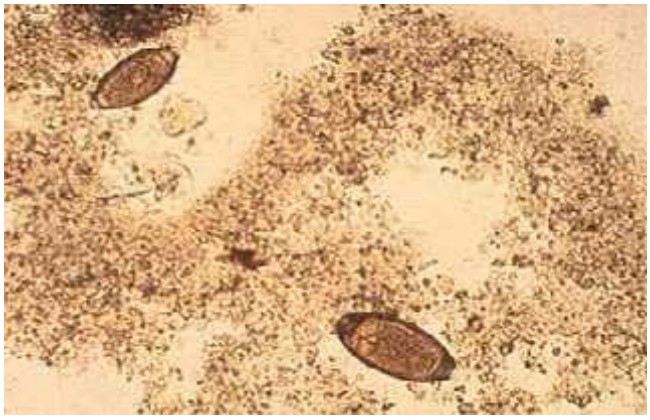

Photo No. 7: Egg of *T. trichura* (400x)

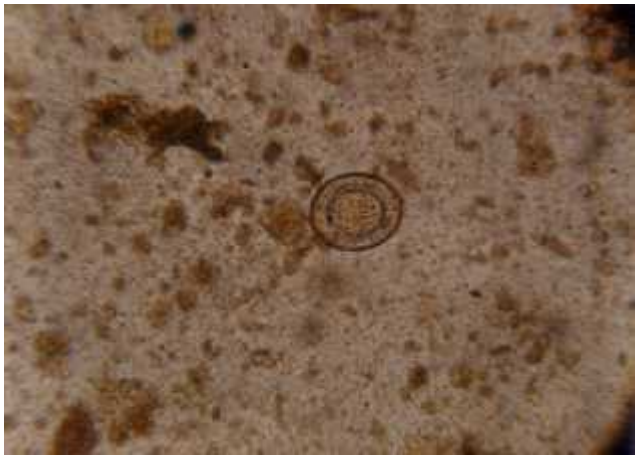

Photo No.8: Egg of *H.nana* (400x)

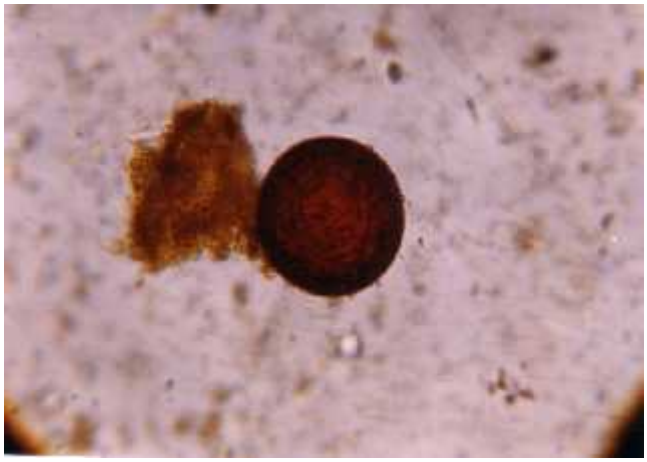

Photo No. 9: Egg of *T. solium* (400x)

ANNEX-II

QUESTIONNAIRE

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

Caste----------

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

School Type- Government/ Boarding/ Child Centre Care

1. Where do you defecate?

   a) Toilet b) Open field

   c) Near water resource

2. From where do you get drinking water?

   a) Tap b) Well

   c) Tube well

3. How do you drink water?

   a) Direct tap water b) Boiled

   c) Filtered d) Using germicides

4. How do you wash your hands?

   a) Soap and water b) Soil and water

   c) Ash and water

5. When do you wash your hands?

   a) Before meal b) After meal

   c) After working in field c) All of above

6. Do you cut your nails regularly?

   a) Yes b) No

7. Do you have domestic animals in your home?

a) Yes b) No

8. If yes, then what are they?

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

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

9. Do you eat meat?

a) Yes b) No

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

a) Fish b) Mutton

c) Chicken d) Ducks

e) Others

11. Have you ever been infected by intestinal parasites?

a) Yes b) No

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

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

a) Yes b) No

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

a) Yes b) No

15. How do you treat in case of infection?

a) Direct taking medicine b) Consulting doctor

c) Traditional methods