STUDY ON INTESTINAL PARASITIC INFECTIONS IN *BADI*, *THARU* AND HIGH CASTE COMMUNITY OF KAILALI AND KANCHANPUR DISTRICTS

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BY

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RECOMMENDATION

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ABSTRACT

Present study was carried out in *Badi, Tharu* and high caste community to determine the prevalence of intestinal parasitic infection. High caste people were selected from Malakheti VDC 1 and 3, Kailali. *Badi* people were selected from Malakheti VDC ward no.1 and 3, Kailali and from Raikwar Bichawa VDC ward no 3, Kanchanpur. *Tharu* were selected from Krishnapur VDC ward no. 3 Kanchanpur. This study also specifies the correlation between parasitic infection and sanitary facilities, source of drinking water, public health awareness, occupation, socio-economic status and others among these ethnic groups. The study was conducted from September 2009 to May 2010. Altogether 378 samples were collected (123 from *Badi,* 128 from *Tharu* and 127 from high caste community). The samples were formalin fixed and brought to Kathmandu. The laboratory processing of sample was carried out at Shi Gan health Foundation, Maharajgunj, Chakrapath, Kathmandu. The samples were examined using direct wet mount using iodine solution after the samples had been concentrated by formalin-ether sedimentation technique. The overall prevalence of intestinal parasites was found to be 35.19%, out of which 24.06% had multiple parasitism and 75.94% had monoparasitism. Males were marginally more infected (36.00%) than females (34.48%) ($p>0.05$). Prevalence of intestinal parasitic infections was same in *Badi* (47.97%) and *Tharu* (47.66%) community, but lower in high caste community (10.24%). Males had higher prevalence than females in *Tharu* (male; 50.79%, female; 44.62%) and in high caste (male; 11.32%, female; 9.72%) community, whereas females had higher prevalence in *Badi* community (male; 43.86%, females; 50.52%). Prevalence of multiple parasitism was 19.51%, 4.69% and 1.57% in *Badi*, *Tharu* and high caste community respectively. Among positive stool samples, hookworm was most common helminthes (46.62%) and *Giardia* was most common protozoa (36.09%). Total of 6 parasites; hookworm, *Giardia, E. histolytica*, *E. coli, H. nana* and *B. hominis* were detected. Hookworm occurred in highest prevalence in *Tharu* (34.38%) community and all other parasites occurred in highest prevalence in *Badi* community (*Giardia:* 28.46%, *E. histolytica*: 24.06%, *E. coli*: 6.50%, *H. nana*: 4.88% and *B. hominis*: 2.43%). Children (0-15 years) were marginally more infected (36.08%) than adults (34.24%) ($p> 0.05$). Among children, prevalence of intestinal parasitic infection was highest in *Badi* (56.72%), followed by *Tharu* (40.94%) and high caste (10.61%) community.

Prevalence of intestinal parasitic infection was found to be same among people of agriculture (42.00%) and other (42.74%) occupation but lower among people with study occupation (18.01%). The rate of parasitic infection was very high among those suffering from recent gastrointestinal disease (87.25%) than among non sufferers (1.31%) ($p<0.01$). The rate of intestinal parasitic infection was higher among those who had taken anti-parasitic drugs within past 6 month (70.59%) than among those not having drugs (31.69%) ($p<0.01$). Higher prevalence of intestinal parasitosis was observed among those who did not wash their hand (81.11%) than among those who washed their hand (20.83%) before eating ($p<0.01$). Prevalence of intestinal parasitosis was found to be higher among those who did not cut their nail (82.02%) than among those who cut their nail (20.76%) regularly ($P<0.01$). People who drunk non treated water were suffered more (48.62%) than who drink treated water (8.00%) ($p<0.01$). Higher prevalence of intestinal infection was found among those not having toilet (57.87%) than among those having toilet at home (10.50%) ($p<0.01$). Hence prevalence of intestinal parasitic infection was studied along with correlation of different parameters.

Key words: *Badi*, *Tharu*, high caste, intestinal parasites, Kailali District, Kanchanpur District, Malakheti VDC, Krishnapur VDC, Raikwar VDC.

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LIST OF ABBREVIATIONS

AF	Acid Fast
A. lumbricoides	*Ascaris lumbricoides*
B. hominis	*Blastocystis hominis*
C. cayetanensis	*Cyclospora cayetanensis*
C. mesnili	*Chilomastix mesnili*
E. coli	*Entamoeba coli*
E. hartmani	*Entamoeba hartmani*
E. histolytica	*Entamoeba histolytica*
E. nana	*Endolimax nana*
H. nana	*Hymenolepis nana*
I. butschii	*Iodamoeba butschii*
N. americanus	*Necator americanus*
Pos n.	Positive number
S. stercoralis	*Strongyloides stercoralis*
STH	Soil Transmitted Helminthes
Total n.	Total number
T. trichiura	*Trichuris trichiura*
VDC	Village Development Committee
WHO	World Health organization

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CHAPTER I

1.1 INTRODUCTION

Gastroenteritis is one of the major public health problems in the world having cosmopolitan distribution. More than half of the population in the world are suffered from gastroenteritis and suffer great economic loss due to parasites. About one fourth of the world population is estimated to be infected by one or more species of parasites (Rai *et al.*, 1998).

Intestinal parasitic infections are most common among all parasitic infections in the world. Intestinal parasites are endemic in most tropical and sub-tropical countries, particularly in developing countries and are most common cause of diarrhoeal diseases. Due to diarrhoeal diseases, at least 5 million deaths per year occur in developing countries (Sakya *et al.*, 1999). Gastroenteritis is the major death causing disease in Nepal. Every year 30-40 thousand people die of gastroenteritis (Bista *et al.*, 1994).

There are different predisposing factors that increase susceptibility to gastrointestinal disturbances. Some such predisposing factors include age related immune system dysfunctions, altered intestinal colonic motility and changes in intestinal normal flora. Gastric acidity is one of the known immune barriers that protect against intestinal parasites and its absence may increase the probability of developing infectious diarrhoeal diseases. Disturbance in intestinal motility due to neuromuscular diseases such as stroke, diabetes or microvascular atherosclerosis is common in elderly and may predispose to colonized by enteropathogens.

Intestinal parasitic infections cause significant morbidity and mortality in the population, especially children of tropics and sub-tropics, due to lack of adequate sanitary practice, poor personal hygiene, illiteracy, overcrowding and low construction level (Chan *et al.*, 1994).

Low socio-economic status, lack of sanitary practice, lack of public health awareness, illiteracy and other living condition prevalent in Nepalese society leads to be the victim of intestinal parasitic infections. Especially, village areas are more affected by intestinal parasites, where early outbreaks of intestinal parasitosis occurs causing significant mortality and morbidity.

Nepal is a small and impoverished country located in south Asia where intestinal parasites are prevalent (Rai and Gurung, 1986; Rai *et al.*, 1994a, 1994b, 1995, 1997, 1998, 2000a, 2000b; Sherchand *et al.*, 1996, 1997; Ishiyama *et al.*, 2001, 2003; Ono *et al.*, 2001). Health status of the population is an indicator of the socio-economic development of the country. Health status is influenced by a variety of factors like income and living standards, housing, water supply, education, sanitation, working place, employment, consciousness, accessibility and affordability of health care delivery services, social security and participation in the socio-political activities of the community, recreation and human rights (RECPHEC, 1997).

Intestinal parasitic infections are cause of significant mortality and morbidity in the population, especially children of tropics and sub tropics, due to lack of personal hygiene, sanitary condition, low socio-economic status, illiteracy, deficient life condition and overcrowding (Chan *et al.*, 1994).

Children are more commonly infected than adults in Nepal (Rai *et al.*, 1986). There is strong association between giardiasis and malnutrition among Nepalese children (Chaudhary *et al.*, 2000). Similarly, soil contamination with hemlines eggs in Nepal is higher in wet season. Intestinal parasitic infections like giardiasis, ascariasis, amoebiasis, ancylostomiasis, fascioliasis and taeniasis are common in Nepal (Acharya *et al.,* 1997). It is because of the dirty fingers and nails which might play an important role in the transmission of intestinal parasites (Soulsa, 1975).

Malabsorption, diarrhoea, impaired work capacity, blood loss and reduced growth rate due to intestinal parasitic infections cause important heath and social problem (WHO).

1.2 BACKGROUND INFORMATION OF STUDY POPULATION

Nepal is a country having cultural and ethnic diversity. It is recognized as multi cultural and multi caste country. Different parts of Nepal are inhabited by people of different culture, ethnicity and caste. The racial, cultural, social and religious systems are diversified according to the diversity of the castes of living with respect to geography. The different multi-caste are assumed to be "*Tibeto-Burmans*" and "*Indo-Aryans*" including *Brahmin, Chhetri, Tharu, Teli, Dhobi, Muskar, Sharki, Damai, Badi* and *Kami.*

Different geographical areas of Nepal do not differ only with respect of cultural, religious and ethnic diversity. There are vast differences in socio-economic status, literacy, public health awareness, income and living conditions among people that inhabit different geographical locations.

Kailali District is situated in far western part of Nepal. It is connected to Kanchanpur District in west, to Dadeldhura and Doti Districts in North, to Surkhet in north-east, and to India in south. Malakheti VDC is situated in western pat of the Kailali District. Malakheti VDC is occupied by people of different ethnicity such as *Tharu, Brahmin, Chhetri, Tharu, Dalits* including *Badi, Sunar, Damai, Kami, Lohar* and *Sarki*.

Kanchanpur is situated in far western part of Nepal. It is connected to Kailali in east, Dadeldhura in north and India in south and west. Raikwar VDC is situated in east of Kanchanpur District and is connected to Malakheti VDC of Kailali District. Malakheti VDC and Raikwar VDC are separated by Mohana River, which is also a boarder of Kailali and Kanchanpur Districts. Although people of different ethnic groups are found in Raikwar VDC, majority of them are *Tharu*. The *Tharu* have a great written history but it never came into light and history that we read today about these people came out in a distorted manner. This unique community was shrouded in mystery for almost three thousand years. They were the landlords of whole Tarai before the unification of Nepal. Some scholars have propounded the fictitious and baseless theory regarding the origin of the *Tharu* creating confusion in the minds of population in understanding the glorious part of this ethnic group of the southern plains of Nepal. Some historian stated that *Tharu* migrated from Thar Desert between 13 to

16th century. But, fact was that long years back Tarai area was known as Tarai and the people who lived in Tarai were called *Tharu.* Anyway, it is rightly said by the scholar that the *Tharus* are the settler of Tarai and are the pioneers of civilization.

Low socio-economic status, illiteracy, lack of public heath awareness and poor sanitary condition make the *Tharus* vulnerable to serious public heath problems including intestinal parasitic infections. Their involvement in socio-political activities and government services is also very low.

Badis are situated in Dang, Kailali, Kanchanpur and some other districts of Nepal. Majority of the *Badi* population is confined in Dang District. They mainly occupy the village areas of these districts. Literacy rate of *Badi* population is too low. *Badi* community is mainly engaged in agriculture occupation. Many females of *Badi* community are commercial sex workers.

Although data relating the heath status of the *Badi* community is not available due to lack of previous research in this community, it can be inferred that low socio-economic status, illiteracy, lack of public health awareness, poor sanitary condition and deprivation of health care services prevalent in *Badi* community are major risk factors for many health problems including intestinal parasitic infections. *Badi* community is also a high risk group for sexually transmitted diseases because most females of *Badi* community are commercial sex workers.

In this study, *Brahmins* and *Chhetri* are included in high caste community. There are vast differences in culture, socio-economic status, literacy rate, public health awareness and sanitary conditions among these *Badi*, *Tharu* and high caste communities. High caste community makes upper social class in the society. Literacy rate is higher in this society. Socio-economic condition of this society is higher in comparison to *Badi* and *Tharu* community. Although majority of people of this society are involved in agriculture, some people are also involved in other occupation such as Business, government services etc.

Thus, this study about the comparison of prevalence of intestinal parasitic infections among these three communities of totally different socio-economic and other living conditions may be helpful for determination of effect of socio-economic and other living conditions on intestinal parasitic infections.

This study about the prevalence of intestinal parasitic infections among *Badi* and *Tharu* community of Nepal may be fruitful for demarcation of health status with their low socio-economic status and also for the determination of models of outbreaks of the newly emerged parasites with their clinical and epidemiological aspects.

Moreover, this study may guide the researchers for the further studies on the health status of *Tharu* and *Badi* and help the planners in launching appropriate plans and policies on their health care.

The present study throws light on different problems faced by the rural communities notifying the infection of the intestinal parasites.

CHAPTER II

OBJECTIVES OF THE STUDY

General objectives

To determine the prevalence of intestinal parasitic infection in *Badi, Tharu* and high caste community of Kailali and Kanchanpur Districts.

Specific objectives

1. To determine the prevalence of intestinal parasitic infection in *Badi, Tharu* and high caste community.
2. To know the socio-economic status and sanitary condition as well as public health awareness of *Badi, Tharu* and high caste community.
3. To correlate the prevalence of parasitic infection to various factors such as sanitary condition, occupation, type of drinking water, age, sex and gender.
4. To determine the prevalence of parasitic infection with socio-economic condition.
5. To determine the difference in sanitary condition, public health awareness, socio-economic condition among *Badi, Tharu* and high caste community and to correlate these differences with difference in prevalence of intestinal parasitic infections.

CHAPTER III

3. REVIEW OF LITERATURE

3.1 GLOBAL SCENERIO

Abut 80% all illness and disease in the world is caused by inadequate sanitation, unsafe water and unavailability of water (WHO, 2000), intestinal parasitosis being one of them. Both the protozoa and helminthes are responsible for the intestinal infections leading to high mortality and morbidity, particularly in developing countries.

The study conducted by Arfaa in 1981 in California showed that stool examinations of 186 *Indochinese* refugees and 90 immigrants from Mexico and resettled in California, have shown that 60% of refugees and 39% of immigrants were infected with one or more species of pathogenic protozoa and helminthes. The mean prevalence of infection among refugees and immigrants, respectively were hookworm (25.0% and 2.0%), whipworm (22.0% and 12.0%), *Ascaris* (20.0% and 12.0%), *G. lamblia* (11.0% and 11.0%), *Strongyloides* (9.0% and 1.0%), and *E. histolytica* (2.0% and 4.0%). *Clonorchis sinensis* was found in 13.0% of refugees and *H. nana* in 9.0% of immigrants.

The survey conducted by Park *at al.* (2004), determined the extent of intestinal parasites in Bat Dambang, Cambodia. The overall infection rate of intestinal parasites was 25.7% (boys, 26.2%; girls, 25.1%), and the infection rates of intestinal helminthes by species were as follows; *Echinostoma* spp. (4.8%), hookworm (3.4%), *H. nana* (1.3%) and *Rhabditis* spp. (1.3%). The infection rates of intestinal protozoa were*; E. coli* (4.8%*), G. lamblia* (2.9%), *I. butschlii (*1.4%), *E*. polecki (1.1%) and *E. histolytica* (0.8%). All children infected were treated with albendazole, praziqantel or metronodazole according to parasite species. The results showed that intestinal parasites were endemic in Bat Dambang, Cambodia.

Milano *et al.* (1995), investigated to evaluate the importance of enteroparasitosis in a young urban population. Serial stool samples were analyzed and Graham tests were performed in each infant. The degree of nutrition of each infant was also studied. Environmental data were collected via semi-structured surveys. Soil samples were tested to determine the degree of soil contamination. The following species identified were; *B. hominis*, *E. vermicularis,* *Coccidios* spp, *G. intestinalis,* hookworm, *S. stercoralis, T. trichiura, A. lumbricoides, E. coli, E. nana* and *Taenia* spp. The prevalence among children was 73.5%. The frequency of intestinal parasitosis was largest in the population from 3 to 8 years. The homes of children analyzed were brick houses with tin roof and access to tap water. Of these, 79.5% houses had bathrooms. The remaining used outdoor latrines. In 95.5% of these houses, the residents live with one or more dogs and cats. The soil collected from nine houses was contaminated with infectious form of *T. canis* and *Ancylostomideos*. The relationship between parasitosis and latrines and overcrowding were verified. Five cases of malnutrition were detected (4.4%).

In a community based study among pediatrics of Saudi Arabia, 21.1% were found to harbor intestinal parasites; the most affected age group being 5-9 years and no difference in gender wise distribution. Specific prevalence rates were *G. lamblia* (9.0%), *E. histolytica* (5.0%) *and E. vermicularis* (2.0%) (Assuhaimi *et al*., 1995).

Anderson *et al*. (1993), carried out the research on distribution of intestinal helminthes infection in rural village in Guatemala. Fecal egg count scores were used to investigate the distribution and abundance of intestinal helminthes in the population of rural village. Prevalence of the major helminthes were 41% with *A. lumbricoides*, 60% with *T. trichiura* and 50% with *N. americanus*. Infected females had higher burdens of *T. trichiura* than infected males in all age classes of population; there were no other effects of host gender. Analysis of association between parasites within hosts revealed strong correlations between *A. lumbricoides* and *T. trichiura* within households. Association between a variety of household features and heavy infections with *A. lumbricoides* and *T. trichiura* were described.

Hasswell *et al*. (1989), studied the distribution of *A. lumbricoides* within a community and found significant variation in the intensity of infection between households in community. The number of family members living in the house strongly influenced the mean *Ascaris* burden and proportion of relatively heavy infections within adults and children. This finding suggests that the density of people in a house positively influences the frequency of exposure to infective stages of *A. lumbricoides*, which in turn plays a major role in determining which individual will harbor heavy infections. A. comparative examination of hypothetical treatment strategies suggests that, for *Ascaris* infection in this community, targeting age groups with anti helminthic treatment would probably be more cost effective in the long term in reducing the abundance of this parasite than selective treatment of individually identified heavy infections.

Ibrahim *et al.* (1993), conducted retrospective study among expatriate workers in Al-Ain city, United Arab Emirates to determine the prevalence of pathogenic parasites infection. Stool specimens were examined. Overall prevalence was 23.1%. The most common parasites found included; *Ancylostoma* spp (6.7%), *A. lumbricoides* (6.6%), *T. trichiura* (6.2%) and *G. lamblia* (2.4%). The distribution of intestinal parasites among exapatriates was different for all nationalities. The results showed that *G. lamblia*, was more prevalent among *Iranians* (54.7%) and *Pakistanis* (42.2%), *Ancylostoma* spp was found to be more prevalent among *Sri lankans* (22.3%) and *Indians* (39.6%). *A. lumbricoides* was more prevalent among *Bangladeshis* (3.1%) and *T. trichiura* was more prevalent among *Philippinos*.

Fagberno-Beyioku *et al.* (1987), examined microscopically the stool sample from 1,659 children, aged 15 years and below in metropolitan Lagos. It showed a (71.1%) and (68.3%) infection with *T. trichiura* and *A. lumbricoides*, respectively. While in infection rate with hookworm was 22.5%. Infection with more than one parasite was also very common. Those children whose households had no toilet facilities had the lowest infection frequency with the intestinal parasites, while those who used bucket as their means of fecal disposal had highest rates.

Saito *et al*. (1996), surveyed for intestinal parasites using thin smear and floating method for fecal examination in resident in Caazapa Department, Paraguay. Out of 608 samples of residents in Boqueron, a community of Caazapa Department, 343 (56.5%) were found positive. The most prevalent parasite was *N. americanus* (27%) followed by *E. coli* (19.8%), *G. lamblia* (12.7%), *A. lumbricoides* ((4.8%) and others. The infection rate with *G. lamblia* and *A. lumbricoides* were more frequent in children than in adults.

Suigunan *et al.* (1996), carried out survey among rural and urban settlers and two tribal groups viz; *Nicobarese* and *Onges*, of Andaman and Nicobar islands in 1996. The survey was conducted between preschool aged children and adults. Among the preschool children, *Nicobarese* showed the highest overall prevalence rate (80.5%) followed by urban (46.7%) and rural (38.6%) preschool children. *A. lumbricoides* was the commonest form of parasite encountered in all the groups of preschool children, followed by *T. trichiura*. The school aged children among rural settler showed an overall prevalence rate of 61.1% which was significantly higher than among the rural preschool children. The *Nicobarese* and *Onge* adults showed significantly overall prevalence rates of 72.2% (71.1% vs 48.6%) compared to rural adults. In all the groups studied, ascariasis was the commonest form of parasitosis except in *Onges* among whom trichuriasis and giardiasis were more common than ascariasis.

Obiamiwe and Nmorst (1991), examined 862 fecal samples from male and female donors of nine age groups (1-90years) in three geographical zones; after examination of concentration of formal-ether concentration technique they found the overall percentage incidence of six parasites which were encountered as follows*;* *E. coli* (19.75%), *E. histolytica* (3.9%), *G. lamblia* (91.45%), hookworm (29.4%), *A. lumbricoides* (38.2%) and *T. trichiura* (7.3%).

Wiesenthal *et al.* (1980), screened 165 *Meo Laotians* stool samples for intestinal parasites. One hundred twenty nine had at least one pathogenic parasites detected. Hookworm was most commonly detected, followed by *G. lamblia*, *T. trichiura* and *A. lumbricoides.* Hookworm and overall infection were more frequent in persons 4 years of age and older, while giardiasis, ascariasis and trichuriasis were the most common in the 4 to 14 years age group. Most infections were helminthic and no public health consequence in the United States. However, giardiasis was seven times as prevalent in refugee children as in general US population, poising a potential public health risk in child care settings.

The study conducted by Fontobonne *et al.* (2001) into the ethno-epidemiological profile of the Pankararug indigenous group in the State of Pernambuco, Brazil, identified multiple intestinal parasites in nearly all members of the community. For the detection, possible environmental risk factors were undertaken using the database from previous survey. The sample consisted of 84 families from the original sample of 112. The selection was based on number of stool tests performed in the family. The mean number of parasites species was 5.0 per family, for a mean family size of 6.1 members. Other household characteristics and hygienic habits did not significantly influence this number. It has been concluded that multiple intestinal parasitism in Pernambuco community was frequent, to the point of being the rule, and that it relates essentially water source and treatment.

For the evaluation of role of intestinal parasites on nutritional status in three rural areas of Brazil, measurements of weight and height were performed along with three stool samples collected on consecutive days of parasitosis analysis. Scores of the standard deviation (z score) for the weight-for-height and height-for-age were used to characterize the growth profile. A high prevalence of intestinal parasites was detected, with *G. lamblia* (44.0%), *E. nana* (43.0%), *A. lumbricoides* (41.0%), and *T. trichiura* (40.0%) being the most prevalent. Eleven percent of children were classified as showing stunting. Inadequate daily caloric intake was observed in 78% of population and the proportion of those with inadequate protein intake was 34% (Saldiva *et al.*, 1999).

The study conducted by Pamela *et al.* (2003), in Florida, showed 75 (31.15%) children had 1 or more type of organism; 60 (80.0%) of these were infected with 1 type of parasite, 12 (16.0%) with 2 types and 3 (4.0%) with 3 types. Parasite screening result were not significantly associated with either age or sex. *G. lamblia* was the most commonly identified organism which appeared in 38 (50.6%) of the children; only 8 (10.7%) were infected with intestinal helminthes.

Bangs *et al.* (1996), examined on two occasions to determine the prevalence of intestinal parasites in Indonesia. Overall 478 samples i. e. 10% of the population from three villages were sampled. Using standard wet mounts techniques, 15 different species of parasites were found. Hookworm was the most prevalent parasites in all age groups. The other helminthes were *A. lumbricoides* (46.0-57.0%) and *T. trichiura* (15.0-25.0%).

Cachin-Bonila *et al.* (1992), studied the prevalence of intestinal helminthes parasites in a sub urban community of Maracaibo, Venezuela by examination of stool from 342 individuals, using iron haematoxylin stained fecal smears and formalin-ether concentration. The overall infection parasitic infection rate was (80.4%) and (65.8%) of the population had the multiple infections. *T. trichiura* (71.9%) and *A. lumbricoides* (54.0%) were the most common parasites, particularly in schoolchildren. The high rates of parasitic and multiple infections reflect the low socio-economic status of the community studied.

Lee *et al.* (1994), examined fecal specimens of a total 52,522 patients by formalin-ether sedimentation or direct smear method. The overall egg positive of helminthes was (6.5%). The egg positive rate of each species of helminthes was *C. sinensis* (3.2%), *T. trichiura* (2.0%), *A. lumbricoides* (0.2%), *Trichostrongylous orientalis* (0.1%), *Taenia* spp. (0.05%), *H. nana* (0.03%), *E. vermicularis* (0.02%), *S. stercoralis* (0.1%) and *Diphylloboyhrium latum* (0.0045). In comparison to previous data, *A. lumbricoides* and *T. trichiura* has been found in decreasing ratio.

A cross section study of fresh stool samples from 175 healthy children at the Wesley Guild hospital, Ilesa, Nigeria showed that 58 (33.1%) had various parasites while 4.0% had poly parasitism. Among the 175 children, 23 (13.1%), 18 (10.3%), 9 (5.1%), 8 (4.6%), 6 (3.4%) and 1 (0.6%) had *A. lumbricoides*, *N. ericanus*, *E. histolytica*, *S. stercoralis*, *T. trichiura* and *G. lamblia* respectively. While 51 (29.1%) children had single parasites, 7 (4.05) had poly parasitism; 4 (2.3%) had *A. lumbricoides* and *E. histolytica* while 3 (1.7%) had *A. lumbricoides* and *N. americanus* (Jao *et al.,* 2005).

Mamo *et al.* (1989), studied from about 5% of the residents of Akaki by Kato thick smear technique. For helminthic infections the prevalence of various parasites were *S. mansoni* (1.5%), *A. lumbricoides* (40.70%), *T. trichiura* (27.5%), *E. vermicularis* (2.25%), *T. saginata* (3.2%) and *H. nana* (0.6%).

Abo *et al.* (1993), determined the prevalence of intestinal helminthiasis among students of Nigeria. Of the 200 students between ages 10-20 years old examined, 86 (43%) were found infected. The most commonly found worm were hookworm, *A. lumbricoides, T. trichiura* with mean egg per gram of 4800, 2600 and 1250 respectively.

The evaluation of the impact on drug treatment on infection by *A. lumbricoides, T. trichiura* and hookworm in a rural community from the sugar-cane zone of Pernabuco, Brazil was performed. Individual diagnosis was based on eight slides (four by the Kato-Katz method and four by the Hoffman method) per survey. Infected subjects were assigned to two groups for treatment with either albendazole or metronidazole. Prevalence of infection was significantly decreased ($p<0.05$) one month after treatment; *A. lumbricoides* (from 47.7% to 24.5%). One year after treatment, infection by *T. trichiura* and hookworm remained significantly below pre-control levels (Zani *et al.*, 2004).

G. lamblia (15.2%) and *H. nana* (20.4%) were the two most frequently reported species in a study of intestinal parasite from 1683 aboriginal people in Western Australia. Concurrent infection with two species of parasites was statistically significant in the 0 to 3 years age group only ($p<0.001$), and it was suggested that in older age groups the presence of one of parasites may in some way inhibit the development of other. *H. nana* infection was more common in males than in females ($p<0.001$). Hookworm and *S. stercoralis* infection were confined to the tropical north of the state. The total or near total absence of infection with *A. lumbriciodes, T. trichiura,* and *Entamoeba* spp (all frequent in Eastern Australian aboriginal communities) was noted (Jones, 1980).

A prospective study was performed to determine the prevalence of *B. hominis* infection in schoolchildren from Bolivar City. Altogether 446 children, between 5 and 14 years old were examined, using direct examination of faces and Willis method. They were also evaluated clinically. Results showed that *B. hominis* had a prevalence of 16.85%. In 39 (52.0%) schoolchildren they found other parasites along with *B. hominis*, the most frequent was *T. trichiura* as helminth and *G. lamblia* as protozoa. *B. hominis* alone was found in 36 cases (48%) (Devara *et al.*, 1997).

Infection with *E. histolytica* was studied in two slum communities Brazil. Twenty-eight index patients colonized with *B. hominis* were identified. Three stool specimens from the index patient and their household contacts were gathered over a 45 day period and tested for *E. histolytica* by means of a specific enzyme linked immunosorbent assay-based detection kit. Blood samples were also collected at the start of the study, at 45 days, and at 6 months and analyzed for *E. histolytica*-specific antibody. High rates of colonization were seen in family units. Colonization was self-limited, with 85% of colonized patients clearing their infections within 45 days (Braga *et al.*, 2001).

A community based study of *Blastocystis* and other intestinal parasites was done in the Asaro Valley, Papua New Guinea. Apart from infants, nearly everybody had at least one infection, and the mean number of infections per person was around 2.7. The graph of age specific prevalence for *Blastocystis* is similar in shape to those for *E. coli* and *E. nana*, indicating probable similarity in transmission patterns and host response (Ashford *et al*, 1992).

Xu *et al* (1995), sampled randomly in 2848 different sites, with about 500 people from each sites. By examination of the stool using Kato-Katz thick smear and larval culture techniques, overall prevalence of *A. lumbricoides*, *T. trichiura* and hookworm infection were found in the age group of 5-9, 10-14 and 15-19 years and among adults for hookworm students, farmers and fisherman were the occupational group with high prevalence.

A community based study was conducted among randomly selected 300 children aged less than 5 years selected from three camps of the police force in Khartoum, Sudan. The commonest infections were giardiasis (12.1%), taeniasis (10.4%) and enterobiasis (7.4%). Non pathogenic *E. coli*, *E. histolytica* and *T. saginata* were detected in 2.7%, 0.7% and 1.7% of stool specimen respectively. Children aged between 3 years and above were the most affected group and the infection rate was highest among the illiterate, overcrowded and large sized families. Malnourished children comprised 9.4% of the study group but there was no significant association between malnutrition and the overall prevalence of intestinal infections, although *G. lamblia* significantly affected the malnourished group (Karrar *et al.*, 1995).

In a study by Phompida *et al.* (2001), in Vientiane Municipality, the prevalence of hookworm, *T. trichiura* and *A. lumbricoides* was found to be (9.8%), (5.3%) and (4.3%) respectively. Majority of infected were healthy adults.

A study was conducted to relate personal data, socio-cultural and environmental characteristics and the presence of symptoms with frequencies of *G. lamblia* spp. and *B. hominis* among a rural population in Buenos Aires Province, Argentina. Of the surveyed population, 3.7% were infected with only *Giardia* spp and 22.9% with *B. hominis* and 2.3% were infected with both protozoa. The frequency of infection according to sex; 6.1% of males were infected and 1.6% of females by *Giardia* spp, 26.7% and 19.5% by *B. hominis*, and 2.4% and 2.2% by both parasites, respectively. *Giardia* spp. was detected in only three adults (over 14 years), but *B. hominis* was more frequent in adults than in children (Minville *et al.*, 2004).

Kappus *et al.* (1994), examined stool specimen and found high prevalence of protozoan along with helminthes. The most commonly identified helminthes were nematodes; hookworm (1.5%), *T. trichiura* (1.2%) and *A. lumbricoides* (0.8%).

The status of intestinal parasites infection among residents of nationwide geographical areas in the republic of Korea had been studied. Fecal samples of 4,137 people (men: 2170, women: 1967) had been examined. The helminth eggs, larvae, and protozoan cysts were found in 322 (7.8%) of the 4,137 specimen examined. The helminth species detected were *C. sinensis* (in 259 specimens; 6.3%), *Metagonimus* spp. (14; 0.34%), *Pygidium summa* (5; 0.12%), unidentified heterophyids (24; 0.58%), *Echinostoma* spp. (4; 0.1%) *Gymnophalloides seoi* (4; 0.1%), *P. westermani* (1; 0.02%) and *S. stercoralis* (larva positive) (1; 0.02%). The protozoan detected were *E. coli* (9; 0.22%), *G. lamblia* (1; 0.2%) and *Isospora* spp. (1; 0.02%) (Chai *et al.*, 2006).

A small scale survey was performed in children of the residential institution and street communities in Metro Manila, Philippines. A total of 284 stool samples were collected. The scotch tape and swab were adapted to investigate the infection status of *E. vermicularis*. It was found that 62.0% of the children examined were positive for one or more parasites. Multiple infection were observed in 34.2% of the children. Among 172 children who gave detail information, the prevalence of *A. lumbricoides, T. trichiura* and hookworm were 36.0%, 44.8% and 7.0% respectively. Of the children examined, 47.7% were found to be harboring parasitic protozoan such as *G. histolytica, G. lamblia* and *B. himinis*. The most prevalent protozoan parasite was *B. hominis* with an infection rate of 40.0%. (Eleonar *et al.*, 2004).

The prevalence of *C. cayetanensis* among apparently healthy persons in Peru was conducted. One group included those consulting private physician and next included people from marginal areas. They had common complain of abdominal pain and diarrhoea. The incidence rate has been found to be 41.6% and 7.3% respectively among two groups. He reported higher rate among young and elder adults up to 60 year old. (Burstein *et al.*, 2005).

The study conducted in community of rural Coted Ivoire found the prevalence of hookworm, *E. histolytica*, *E. dispar* and *S. mansoni* to be 45.0%, 42.2% and 39.8% respectively. Three quarters of population harbor multi parasites (Raso *et al.*, 2005).

In order to investigate the epidemiological situation of intestinal parasite infection in Laos parasitological survey were carried out in the Vientiane Municipality. The cumulative egg positive rate for intestinal helminth was 61.9%. By species, the egg positive rates were *A. lumbricoides* (34.9%), hookworm (19.1%), *T. trichiura* (25.8%), *Opisthorchisviverrini* (10.9%), *Taenia* spp. (0.6%) and *Hymenolepis* spp. (0.2%). The northern mountainous regions such as Phongsaly, Huaphan or Saysomboune Province showed a higher prevalence (over 70%) of soil transmitted helminthes. On the other hand, *S. mansoni* eggs were detected *E. vermicularis* eggs in (35.7%) of 451 schoolchildren aged 6-8 years in Vientiane Municipality. Meanwhile, the mean blood hemoglobin level of hookworm infected children was not lower that of children not affected with hookworm, suggesting that nutritional factors are more important than parasitic infection (Rim *et al.*, 2003).

G. lamblia (15.2%) and *H. nana* (20.4%) were the two most frequently reported species in a study of intestinal parasite from 1683 aboriginal people in Western Australia. Concurrent infection with two species of parasites was statistically significant in the 0 to 3 years age group only ($p<0.001$), and it was suggested that in older age groups the presence of one of parasites may in some way inhibit the development of other. *H. nana* infection was more common in males than in females ($p<0.001$). Hookworm and *S. stercoralis* infection were confined to the tropical north of the state. The total or near total absence of infection with *A. lumbriciodes, T. trichiura*, and *Entamoeba* spp. (all frequent in Eastern Australian aboriginal communities) was noted (Jones, 1980).

A survey of intestinal parasites was conducted in Napsan on the island of Palawad, Philippines. A total of 353 stool specimens were obtained from 155 males and 198 females ranging in age from one and half month to 70 years. *A. lumbricoides* (34.8%), hookworm (34.8%), and *T. trichiura* (25.2%) were the most common helminthes encountered, while *E. coli* (27.2%) and *E. nana* (22.2%) were the common protozoans (Oberst and Alquiza, 1987).

Sayyari *et al.* (2005), in a national survey of intestinal parasitosis in Iran, intestinal parasitic rate were detected as 19.35% (19.7% male, 19.1% female). In the study, *G. lamblia* (10.9%), *A. lumbricoides* (1.5%), *E. histolytica* (1.0%) and *E. vermicularis* (0.5%) were the most common parasites. The infection rate was highest in the 2 to 14 years age group (25.5%) and in rural residents (23.7%). The prevalence rate of *T. saginata, T. colubriformis, T. trichiura* and *A. duodenale* were (0.2%), (0.2%), (0.1%) and less than (0.1%) respectively. The total prevalence of intestinal parasites among people of age group 40 to 69 was (15.0%) which was greater than among people of 69 years (11.6%). The prevalence of individual parasites were *G. lamblia* (5.0%), *A. lumbricoides* (1.2%), *E. vermicularis* (0.1%) and *E. histilytica* (0.7%).

In the study conducted at South Kalimantan Province of Indonesia by Cross *et al.* (1976), 1 to 8 different intestinal parasitic infections were detected in 97.0% of the people. Those parasites most frequently found were *T. trichiura* (83.0%), *A. lumbricoides* (79.0%) and hookworm (65.0%) followed by *E. coli* (37.0%), *H. nana* (12.0%), *E. histolytica* (12.0%), *G.*

lamblia (5.0%), *E. hartmani* (2.0%), *C. mesnili* (2.0%). Other parasites found were *E. vermicularis*, *S. stercoralis* spp., *Echinococcus* spp., *H. diminuta* and *T. hominis. G. lamblia* was found more often in younger people and *E. coli, I. butschlii* and hookworm in the older age group. Hookworm occurred more frequently in males and *A. lumbricoides* in females.

3.2 SAARC COUNTRIES SCENERIO

Stool samples from 880 residents in urban slums in Dhaka, Bangladesh, were collected and examined for intestinal parasites. Information on many potential risk factors for infections were obtained by questionnaire from respondents in each household studied. In a crude univariate analysis of data, several of the factors were found to be significantly associated with *S. stercoralis* infection. Most of these factors were covariate with one another and with poverty generally (Hall *et al.*, 1994).

Allen *et al.* (2004), served in the western region of Bhutan to assess prevalence and intensity of soil transmitted helminth (STH) infections after 15 years of school deworming in the country. Stool samples were collected from each child as well as nutritional indicators and general information on each school. The survey found a cumulative prevalence of (16.5%) with STH 4.8% in schools treated in the last three months and 24% in the untreated schools. An unexpected finding was that the tapeworm infection rate of 6.7%. The results indicate a high re-infection rate in this area. WHO recommends 50% prevalence as the threshold for the establishment of community intervention.

The study was carried out at the northern part of Bangladesh to determine the impact of sanitary latrine use and of health education on intestinal parasites in school-aged children. The children were between 5 and 13 years of age and stool samples revealed that more than half (53%) of the studied samples were still infected with one or more intestinal parasites even after 4 years of intervention. Ascariasis was found to have highest prevalence (36.2%) and the hookworm the lowest (10.7%). Intestinal parasite infection was significantly lower

($p<0.05$) among those who used a sanitary latrine and received health education (Hosain *et al.*, 2003).

Singh *et al.* (2004), studied parasitic infection among primary school going children between the age group 5 to 10 in the urban and rural areas of Manipur. A total of 248 (24.5%) were positive for various helminthes. Among the positive cases, 110 (26.3%) were from the urban area (city) and 138 (23.4%) from the rural areas of Manipur. Maximum number of parasitic infection occurred in the age group of 5 to 6 years (27.0%) in both sexes. Among the parasites, *A. lumbricoides* was the commonest (19.6%) followed by *T. trichiura* (2.18%), *H. nana* ((0.99%), tapeworm (0.19%), hookworm (0.09%), *S. stercoralis* (0.09%), *E. vermicularis* (0.09%).

Stool samples were collected 3 to 6 months post-treatment to study the rate of reinfection. The cure rate for *A. lumbricoides*, *T. trichiura* and hookworm were 70.8%, 68.7% and 93% respectively. Reinfection rate after 3 month successful treatment were 19.6% for *A. lunbricoides*, 30.9% for *T. trichiura* and 11.3% for hookworm. After six months post-treatment, the prevalence of reinfection was the highest with *T. trichiura* (43.6%) followed by *A. lumbricoides* (35.3%). The rate of reinfection with hookworms was lower (11.3%) after six months post treatment. The rate of re infection with *A. lumbricoides* and *T. trichiura* were higher in children below 15 years of age, compared to adults. Hookworm reinfection was higher in the adult age group (15 to 39 years). The rate of new infection in previously uninfected subjects was lower compared with the rates for re-infection (Narain *et al.*, 2004).

Stool survey was carried out in slum villages of Dadraul and Bhawal Khera PHC's of district Shahjahanpur (Uttar Pradesh). Among them, 29.2% were found positive for one or more other intestinal parasite. *A. lumbricoides* superseded all the parasites by showing a positive of 17.8%. Other parasites found were hookworm, *H. nana*, tapeworm, *T. trichiura*, *E. vermicularis*, *E. coli* and *G. lamblia*. The highest positivity was encountered in the age groups between 6 to 14 years (Virk *et al.*, 1994).

Several reports of patients with cysticercisis from many countries in Asia such as India, China, Indonesia, Thailand, Korea, Taiwan and Nepal are a clear indicator of the wide prevalence of *T. solium* cyasicercosis and taeniasis in these and other Asian countries. It is also a major cause of epilepsy in Bali (Indonesia), Vietnam and possibly Nepal. Seroprevalence study indicates high rates of exposure to the parasite in several countries. (Vietnam, china, Korea and Bali of Indonesia) with rates ranging from 0.02 to 12.6%. An astonishingly high rate of taeniasis of (50.0%) was reported from areas of Nepal populated by pig farmers. Undoubtedly, cysticercosis is a major public heath problem in many Asian countries affecting several million people by not only causing neurological mortalities but also imposing economic hardship on impoverished populations (Rajshekhar *et al.*, 2003).

Hookworm prevalence rate was found to be 29.0% among people in 2 villages of Malasiya (Cheghani *et al.*, 1989). A. study conducted in some semi urban region of Bangladesh inhabited by the fisherman found the parasite positive rate of 50.0% (Rehman, 1993).

Gilgen *et al.* (2001), conducted a randomized clinical intervention trial over 24 weeks on a tea state in north-east Bangladesh to investigate the effect of iron supplementation and antihelminthic treatment on the labor productivity of adult female tea pluckers. A total of 553 full-time tea pluckers, not pregnant and non breast feeding, were randomly assigned to one of the four intervention groups; group 1 received iron supplementation on a weekly basis, group 2 received anthelminthic treatment at the beginning and half way through the trial (week 12), group 3 received both iron supplementation as a group 1 and antheminthic treatment as group 2, and group 4 was a control group and received placebos. However, there was a negative association for all three worms (*A. lumbricoides, T. trichiura* and hookworm) between the intensity of helminth infections (eggs/g faces) and all measures of labor productivity. Lower haemoglobin value and anemia (<120g/l Hb) were both associated with lower productivity and more days sick and absent. Taller women with greater arm circumference were able to pluck more green leaves, earn high wages and were absent less often.

Ascaris lumbricoides infestation (ALI) is one of the most common helminthic diseases of the gastrointestinal tract and may cause severe surgical complications, especially in children. A case of a 5 year old Pakistani girl treated in Italy for acute abdomen in which ALI was detected during surgical exploration (Mosiello *et al.*, 2003).

A study was conducted in Srilanka in total of 192 stool samples from the adult and preschool children. *E. histolytica* was not seen in any of the samples*; Giardia* cyst and *Cryptosporidium* oocyst were seen in 3.and 1 samples respectively from preschool children. The overall prevalence of geohelminth infection was (21.3%) among the adults and (24.5%) among the children. *A. lumbricoides* was the predominant species in both populations (De Silva *et al.*, 1994).

The study was undertaken to measure the impact of periodic deworming with albendazole on growth status and incidence of diarrhoea in children aged 2 to 5 years in an urban setting in India. The two study groups received two doses of albendazole (400mg) or placebo six month apart. Mean weight increased significantly in the anbendazole group compared to control group in three month, six month and nine month following treatment ($p<0.01$, $p<0.01$ and $p<0.001$) respectively). The albendazole group also experienced fewer episodes of diarrhoea than their control counterparts (relative risk 1.3, 95% CI: 1.07-1.53) with a 28% reduction (Sur *et al.*, 2005).

The study conducted in the union territory, Chandigarh, India estimated the prevalence of intestinal parasitic infection in different population groups. The prevalence of intestinal parasitic infections in different population groups were detected. The prevalence of intestinal parasitic infection was found to be 14.6% with highest prevalence of 19% from the slum areas. Children were the most commonly affected group (18%) with those from slums showing the highest prevalence (24.6%). The most common parasite was *Giardia* (5.5%) followed by *H. nana* and *A. lumbricoides* (2.8% and 2.7% respectively), (Khurana *et al.*, 2004).

The study was conducted in Konkor, Gadap, District East, Karachi to determine the prevalence of intestinal parasites infection. Out of 263 residents, 185 tested for intestinal parasites and 88 (47.5%) had pathogenic parasites. The distributions of parasites were *G.*

lamblia (50%) and *E. histolytica* (48.86%). Statistically none of the socio-demographic variables were associated except education and age group (Siddiqui *et al.*, 2002).

In developing countries many enteric infection are caused by acid sensitive pathogens. Study was conducted in 185 Bangladeshi men admitted to hospital for treatment of enteric infection. Patients with dysenteriae (amoebiasis, n=24 and shigellosis, n=19) and culture-negative diarrhoea (n=69) had similar mean gastric acid levels (basal, 3to 5 mmol/h; stimulated, 11 to 17 mmol/h) which remained stable in those patients studied throughout 12 weeks of convalescence. Gastric acid level was not associated with *A. duodenale* or *S. stercoralis* co-infection, fever, use of tobacco, chewing betel nut. Factor which impairs gastric acid secretion may predispose to diarrhoeal disease in developing countries (Evans *et al.*, 1997).

Stool samples from 880 residents in urban slums in Dhaka, Bangladesh, were collected and examined for intestinal parasites. Information on many potential risk factors for infections were obtained by questionnaire from respondents in each household studied. In a crude univariate analysis of data, several of the factors were found to be significantly associated with *S. stercoralis* infection. Most of these factors were covariate with one another and with poverty generally (Hall *et al.*, 1994).

Analysis of egg and worm count of *Ascaris* recorded at various intervals following a mass helminthic treatment program was done in a south Indian fishing community. Three indices of infection in the community are prepared, namely the presence and intensity of egg output (at 2, 6 and 11 month following treatment) and the number of worm expelled following an 11 month period of re-infection. Detailed examination of these measurements revealed significant association with patient sex and age. Although 85.0% of both males and females harbored *Ascaris* initially, the prevalence following 11 month re-infection was decreased, due to significantly lower proportion of males being re-infected. By 11 month of re-infection, the age intensity profiles of output were similar to those observed at initial treatment in the older age groups (10 years and above) and in male children (Elkins *et al.*, 1988).

3.3 NATIONAL SCENERIO

Rai *et al.* (2000), intestinal helminthes and its effect on vitamin A, retinol and vitamin B carotene, was studied in Okharpauwa VDC (Nuwakot District) and 79 inhabitants (mainly adults) of Boya VDC (Bhojpur District) living at an altitude of 2000 m. Most common helminth detected was *A. lumbricoides* followed by *T. trichiura* in Okharpauwa VDC and by hookworm in Boya VDC respectively. Mixed helminth infections were relatively low (7.3% in Okharpauwa VDC and 11.1% in Boya VDC). The retinol and beta carotene were estimated by high performance liquid chromatography (HLPC). The retinol concentration in helminth eggs positive children significantly increased after one month of anti-helminthic (albendazole) treatment ($p>0.05$). No significant difference in serum retinol concentration was observed among helminth eggs positive and negative inhabitants of Boya VDC ($p>0.05$).

Sherchand *et al.* (1997), a stool survey on intestinal parasites and its transmission factors were carried out in rural village of Dhanusha District, southern Nepal. Out of 604 children aged between 0-9 years examined, 363 (60.1%) were found positive for one or more intestinal parasites. Hookworm infection superseded all the parasites by showing a positivity of 11.6%. Other parasites found were *A. lumbricoides, T. trichiura, Oxyuris vermicularies, S. stercolaris*, tapeworm, *H. nana, E. histolytica, E. coli, G. lamblia, C. parvum, C. cayetanensis, I. belli, O. viverrini, S. mansoni* and *I. butschii*. The parasites load was found slightly higher in female children (58.1%) compared to male children (41.9%).

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

Rai *et al.* (1999), a hospital based study in Kathmandu showed ascariasis as major causes of public health problem in Nepal though the extent of ascariasis-associated morbidity and mortality has not been investigated yet. In some rural areas, over (75.0%) people are infected with this parasite.

The prevalence of intestinal parasitic infection was carried out in Tribhuvan University Teaching Hospital, in Kathmandu. Stool samples were examined. Among the various types of protozoan parasites, the most common was *G. lamblia* followed by *E. histolytica* (Rai *et al.,* 1995).

A study conducted in Jiri revealed that the prevalence of whipworm, roundworm and hookworm among *Jirel* were (18.1%), (25.3%) and (73.5%) respectively. Similarly, prevalence of whipworm, roundworm and hookworm among *Sherpa* above were 11.2%, 23.6% and 46.1% respectively. Similarly, the prevalence of whipworm, roundworm and hookworm among *Hindu* of age group 45 above were (7.1%), (26.2%) and (59.5%) respectively. The study found the increasement in multiple helminthic infections with increasement in age (Blangero *et al.*, 1993).

Ishiyama *et al.* (2001), has reported the parasite prevalence of 72.4% among school children in Kathmandu. *Indo-Aryans* were found to have marginally high rate of infection. Among which 46.9% had multiple infections. *T. trichiura* (30.4%) was found to be the commonest helminth and *G. lamblia* (17.0%), the commonest protozoan. No bacterial enteropathogens were reported in the study population.

Rai *et al.* (1997), studied the health and sanitary status of Boya Village. The number of households having latrine increased significantly ($p<0.05$) in one year period but without significant impact on the reduction of intestinal helminthes infection ($p>0.05$). *A. lumbricoides* was the commonest intestinal parasite followed by hookworm and others. Public piped line water was provided to (32.6%) households while remaining (48.4%) and (19.0%) were using natural tap and *Kuwa* water, respectively. No association between the type of water source and gastroenteritis was observed. There was poor hygienic condition. The majority of the complaints were gastrointestinal.

The parasitic infection rate of (50.0%) has been reported by the studies conducted in the Nepalese communities from 1997-1995 by different organizations. *A. lumbricoides* and *G.*

lamblia topped the list respectively among helminthes and protozoans. Similarly, the hospital records showed the infection rate of 30 to 40% (Chhetri, 1997).

CHAPTER IV

4. MATERIALS AND METHODS

4.1 Subject and site of the study

The laboratory investigation of this part of dissertation was carried out in Shi Gan Health Foundation, Maharajgunj, Chakrapath, Kathmandu. The study period was from September 2009 to May 2010. The stool samples were collected from *Badi*, *Tharu* and high caste community of Malakheti VDC-1, 3 of Kailali District, Krishnapur VDC-3 and Raikwar VDC -3 of Kanchanpur District.

4.2 Sample collection

Labeled, clean, dry, disinfectant free, wide mouthed plastic containers were distributed to the study population requested them to bring about 20 grams stool sample next morning. Brief description about the importance of the examination of stool to detect parasite was given before distribution of containers. They were advised not to contaminate the stool with water and urine. The containers were labeled with patient's name, code number, date and time of collection. During the process of specimen collection, a questionnaire accompanying the queries about their age, sex, clinical history, hygiene practice and nutritional behavior was filled. Stool samples were collected next morning from each person.

4.3 Transportation of the samples

The collected samples were immediately fixed with 10% formal saline mixing equal part of saline and stool. The formalin fixed stool samples were brought to Kathmandu in plastic container.

4.4 Laboratory processing of the samples

Each sample was processed as follows:

4.4.1 Macroscopic examination of stool

This includes the visual examination of stool sample based on the color, consistency, presence of blood or mucus, presence of adult worm or segments.

a. Color

Based on the color, the specimen were categorized into two groups i.e. normal (yellowish brown) and abnormal (muddy, black, pale etc.)

b. Consistency

Based on consistency, stool specimens were categorized as formed, semi formed and loose. The trophozoites are usually found in soft or loose stool whereas the protozoa cysts are usually found in formed or semi formed stool. Helminthic egg and larva are found in any type of stool specimen.

c. Blood and mucus

The stool specimens were observed whether it contains blood or mucus or not. Blood and mucus may be found in stool from patient with amoebic dysentery, intestinal schistosomiasis, and invasive balantidiasis and in severe *T. trichiura* infection. Other non parasitic conditions in which blood and mucus may be found include bacillary dysentery, *Campylobacter* enteritis, ulcerative colitis, intestinal tumor and haemorrhoids.

d. Adult worm and segments

The stool specimens were observed whether it contains adult worm and segments or not. The adult worm of *A. lumbricoides* and *E. vermicularis* are often seen in the stool specimen. Tapeworm segments may be occasionally seen in stool specimen.

4.4.2 Microscopic examination of sample

This is required for the identification of protozoal cysts, oocytes, trophozoites and helminthic egg or larva. Microscopic examination was carried out by saline and iodine wet mount method and modified acid fast staining. The slides were observed under the low power followed by high power and in case of acid fast stained smear by oil immersion. Parasites were identified by their morphology, motility and staining characteristics.

4.4.2.1 Saline wet mount

It is used to detect helminthic egg and larva, protozoal cyst and trophozoites. A drop of normal saline is taken in a clean glass slide, a pinch of stool is mixed with it, and mixture is covered with cover slip and observed under microscope.

4.4.2.2 Iodine preparation method

It is used mainly for detecting protozoal cysts; however, helminthic eggs are also stained and can be detected. Iodine stained cysts show pale retractile nuclei, yellowish cytoplasm and brown glycogen materials. The trophozoites are killed hence their motility lost in iodine mount.

A drop of 5 times diluted Lugol's iodine was taken in a slide and a pinch of stool was mixed with it. The preparation was covered with a cover slip and was examined under low power and confirmed under high power.

4.4.2.3 Modified acid fast (Ziehl-Neelson) staining.

It is required of accurate identification of the oocysts of *C. parvum, I. belli, C. cayetanensis* and spore of *Microsporidium*. The oocysts are acid fast and stained red or pink against blue background stained with methylene blue. Both hot and cold method of staining can be used with equal sensitivity. This study follows the cold Kinyoun method as follows;

a. A fecal smear was made on a glass slide and dried in air.
b. The smear was fixed with absolute methanol for 3 min
c. The slide was flooded with carbol fuchsin for 15 to 20 minutes and then washed with tap water.
d. The smear was then decolorized with 1% sulfuric acid for 15 to 20 sec.
e. The smear was washed with tap water and then counterstained with 0.5% methylene blue for 1 minute.
f. The slide was washed with tap water, air dried, and examined under 40X followed by oil immersion.

4.4.2.4 Concentration of parasites

The stool specimen was subjected to concentration when the dried smear revealed no parasites. This concentrates the egg, larva and cysts when they are present in small number and increases the sensitivity of microscopic examination. Trophozoites are destroyed in the process. There are several floatation and sedimentation techniques of concentration but formalin-ether sedimentation technique and sucrose floatation technique were used in this study.

4.4.2.4.1 Formalin- ether sedimentation technique

This is the most sensitive method of concentrating cysts, eggs and larva without distortion of their morphology. It takes short time and chance of error is minimum. This technique is as follows;

i. About 1 gram of feces is emulsified in about 4 ml of 10% formalin in a test tube.

ii. A further 3-4 ml of 10% formalin is added and the tube is capped and shaken well.

iii. The suspension is sieved through double gauze in a funnel into a 15 ml centrifuge tube.

iv. Three to four ml of diethyl ether is added and tube is vigorously shaken for 5 min.

v. The tube is centrifuged immediately at 3000rpm for 5 min.

vi. The layer of debris formed between diethyl ether and formalin is removed along the slide of tube with a glass rod.

vii. The supernatant layer of liquid is discarded and the sediment is examined by saline and iodine wet mount.

4.4.2.4.2 Sucrose floatation technique

This technique concentrates the oocysts of *C. parvum, I. belli, C. cayetanensis.* This is performed as follows

i. Using a wooden applicator stick, about 1 gram of stool is mixed with 5 ml of 10% formalin in a test tube.

ii. The suspension is filtered through 3 layers of cotton gauze in a test tube

iii. The third fourth of tube is filled with the saturated sucrose solution.

iv. The tube is centrifuged at 2000 rpm for 10 min.

v. The material on the top of the tube is picked up with the loop and smear is made on slide.

vi. The modified acid fast staining is performed and observed under 40X followed by oil immersion.

4.5 Recording of the results

After lab processing of the samples, the results obtained were recorded in note book. Then it was recorded in computer.

4.6 Report distribution

After results were obtained by lab processing, the records obtained were distributed to the respective patients.

4.7 Statistical analysis

Chi-square test was used to determine significance in difference. Association of intestinal parasitosis with various variables was tested. Results were considered significance if p value is less than 0.05.

CHAPTER V

RESULTS

A total of 378 samples (128 from *Tharu*, 127 from higher caste and 123 from *Badi* community) were included in this study. Prevalence of intestinal parasites were measured based on various variables.

Table 1: Gender wise prevalence of intestinal parasitic infection

Sex	Total n	Pos n	Pos %	p value
Male	175	63	36.00	p>0.05
Female	203	70	34.48	
Total n	378	133	35.19	

Prevalence was found to be 36.00% and 34.48% among male and female respectively. The difference was not statistically significant ($p>0.05$) (Table: 1).

Table 2: Prevalence of intestinal parasitic infection based on occupation

Occupation	Total n	Pos n	Pos %	p value
Agriculture	150	63	42.00	p'<0.01
Student	111	20	18.01	$p^{*}<0.01$
Others	117	50	42.74	$p^{**}>0.05$
Total n	378	133	35.19	

Note: p* = p value between student and other occupation, p** = p value between agriculture and other occupation, p'= p value between student and agriculture occupation

Prevalence of intestinal parasitic infections were found to be same among people having agriculture (42.00%) and other occupation (42.74%), and the prevalence of parasitic infection among student was lower (18.01%). The difference of parasitic prevalence between student and people with agriculture occupation was statistically significant (p'<0.01). Similarly, difference between student and people with other occupation was statistically significant ($p^{*}<0.01$) but the difference was not statistically significant between agriculture and other occupation ($p^{**}>0.05$) (Table: 2).

Table 3: Prevalence of intestinal parasitic infection based on hand washing habit before eating

Hand washing	Total n	Pos n	Pos %	p value
Yes	288	60	20.83	P<0.01
No	90	73	81.11	
Total n	378	133	35.19	

Prevalence of intestinal parasitic infection was found to be very high among those not washing hand (81.11%) than among those washing hand (20.83%) before eating .The difference was statistically significant (p<0.01) (Table: 3).

Table 4: Prevalence of intestinal parasitic infection based on nail cutting habit

Nail cut	Total n	Pos n	Pos %	p value
Yes	289	60	20.76	P<0.01
No	89	73	82.02	
Total n	378	133	35.19	

Prevalence of intestinal parasitic infection was found to be very high among those not cutting nail (82.02%) and lower among those cutting nail (20.76%). The difference was statistically significant (P<0.01) (Table: 4).

Table 5: Prevalence of intestinal parasitic infection based on type of drinking water

Type of drinking water	Total n	Pos n	Pos %	p value
Treated	125	10	8.00	P<0.01
Untreated	253	123	48.62	
Total n	378	133	35.19	

Prevalence of intestinal parasitic infection was found to be very high among those who drunk non-treated water (48.62%) and lower among those who drunk treated water (8.00%).The difference was statistically significant (p<0.01) (Table: 5).

Table 6: Prevalence of intestinal parasitic infection based on current gastrointestinal symptoms

Current intestinal symptoms	Total n	Pos n	Pos %	P value
Yes	149	130	87.25	P<0.01
No	229	3	1.31	
Total n	378	133	35.19	

There was vast difference in prevalence of intestinal parasitic infection among those suffering from recent intestinal disturbances (87.25%) and among non sufferers of such disturbances (1.31%). The difference was statistically significant (p<0.01) (Table: 6).

Table 7: Prevalence of intestinal parasitic infection based on taking anti parasitic drugs within past 6 month

Drug taking	Total n	Pos n	Pos %	p value
Yes	34	24	70.59	P<0.01
No	344	109	31.69	
Total n	378	133	35.19	

Prevalence of intestinal parasitic infection was found to be higher among people having anti parasitic drugs within past 6 month (70.59%) and lower among people not taking drug (31.69%). The difference was statistically significant (p<0.01) (Table: 7).

Table 8: Prevalence of intestinal parasitic infection in relation to presence of toilet at home

Toilet at home	Total n	Pos n	Pos %	P value
Yes	181	19	10.50	P<0.01
No	197	114	57.87	
Total n	378	133	35.19	

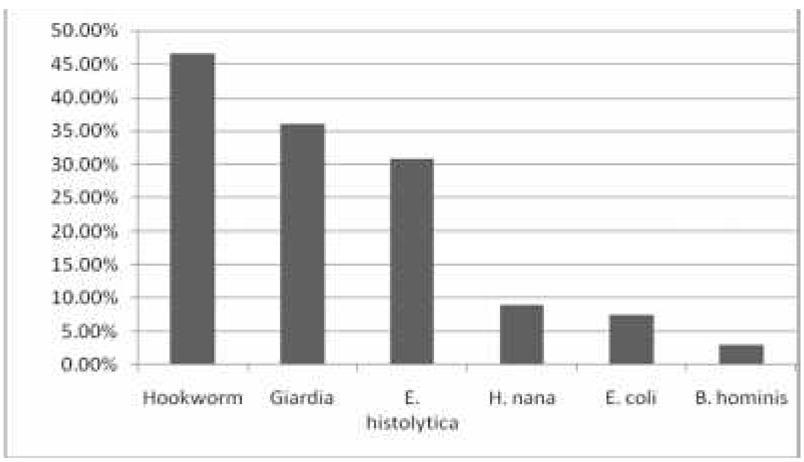
Prevalence was found to be higher among those not having toilet (57.87%) than among those having toilet at (10.50%) home. The difference was statistically significant ($p<0.01$) (Table: 8).

Table 9: Prevalence of intestinal parasitic infection based on age group

Age group	Total n	Pos n	Pos %	p Value
0-15	194	70	36.08	p>0.05
> 15	184	63	34.24	
Total n	378	133	35.19	

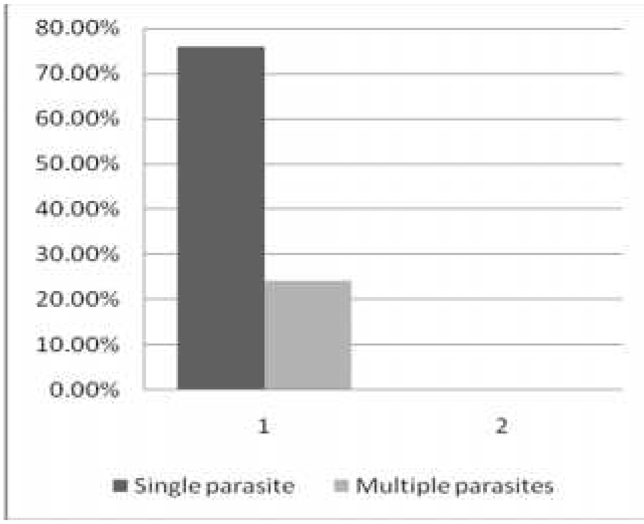
Prevalence was found to be slightly higher among children of age group 0-15 (36.08%) than among people of age group greater than 15 (34.24%). However, the difference was not statistically significant ($p>0.05$) (Table: 9).

Figure 1: Prevalence of individual parasites among studied population



Among the 133 total parasites detected, hookworm was the most common (46.62%), followed by *Giardia* (36.09%), *E. histolytica* (30.82%), *H. nana* (9.02%), *E. coli* (7.52%) and *B. hominis* (3.01%) (Figure: 1).

Figure 2: Comparison of single and multiple parasitism.



Out of 133 positive samples, multiple parasitisms occurred in 32 (24.06%) samples and single parasite was detected in 101 (75.94%) samples (Figure: 2).

Table 10: Prevalence of intestinal parasitic infection based on ethnic group

Ethnic groups	Total n	Pos n	Pos %	P value
Tharu	128	61	47.66	p'<0.01
High caste	127	13	10.24	$p^{*}<0.01$
Badi	123	59	47.97	$p^{**}>0.05$
Total n	378	133	35.19	

Note: p* =p value between *Tharu* and high caste, p**= p value between *Badi* and *Tharu*, p' = p value between *Badi* and high caste.

Prevalence of parasitic infection was found to be same in *Badi* (47.97 %) and *Tharu* community (47.66%) but very low in high cast community (10.24%). The difference between *Badi* and *Tharu* community was not statistically significant ($p^{**}>0.05$). The difference was statistically significant between *Badi* and high caste community (p'<0.01). Similarly, the difference between *Tharu* and high caste community was also statistically significant ($p^{*}<0.01$) (Table: 10).

Table 11: Prevalence of intestinal parasitic infection in children (0-15 age) of different ethnic group

Ethnic group	Total n	Pos n	Pos %	P Value
Badi	67	38	56.72	p'<0.01
Tharu	61	25	40.94	$p^{*}<0.01$
High caste	66	7	10.61	$p^{**}>0.05$
Total n	194	70	36.08	

Note: p*= p value between *Tharu* and high caste, p**= p value between *Badi* and *Tharu*, p'= p value between high caste and *Badi*.

Prevalence of intestinal parasitic infection was highest in *Badi* community (56.72%), followed by *Tharu* (40.94%) and high caste (10.61%) community. The difference was not statistically significant between *Badi* and *Tharu* community ($p^{**}>0.05$). The difference was statistically significant between *Badi* and high caste community (p'<0.01). Similarly, the difference was statistically significant between *Tharu* and high caste community ($p^{*}<0.01$) (Table: 11).

Table12: Prevalence of intestinal parasitic infection among females of different ethnic group

Ethnic group	Total n	Pos n	Pos %	p value
Badi	66	34	50.52	p'<0.01
Tharu	65	29	44.62	$p^{*}<0.01$
High caste	72	7	9.72	$p^{**}>0.05$
Total n	203	70	34.48	

Note: p*= p value between *Tharu* and high caste, p**= p value between *Badi* and *Tharu*, p'= p value between high caste and *Badi*.

Prevalence of intestinal parasitic infection was highest in *Badi* community (50.52%), followed by *Tharu* (44.62%) and high caste (9.72%) community. The difference was not statistically significant between *Badi* and *Tharu* community ($p^{**}>0.05$). The difference was statistically significant between *Badi* and high caste community (p'<0.01). Similarly, the difference was statistically significant between *Tharu* and high caste community ($p^{*}<0.01$) Table: 12).

Table13: Prevalence of parasites among males of different ethnic group

Ethnic group	Total n	Pos n	Pos %	p Value
Badi	57	25	43.86	p'<0.01
Tharu	63	32	50.79	$p^{*}<0.01$
High caste	55	6	11.32	$p^{**}>0.05$
Total n	175	63	36.00	

Note: p*= p value between *Tharu* and high caste, p**= p value between *Badi* and *Tharu*, p '= p value between high caste and *Badi*.

Prevalence of intestinal parasitic infection was highest in *Tharu* community (50.79%), followed by *Badi* (43.86%) and high caste (11.32%) community. The difference was statistically significant between *Badi* and high caste community (p'<0.01). Similarly, the difference was statistically significant between *Tharu* and high caste community ($p^{*}<0.01$). But the difference was not statistically significant between *Badi* and *Tharu* community ($p^{**}>0.05$) (Table: 13).

Table 14: Prevalence of multiple parasitisms in different ethnic groups

Ethnic group	Total n	Pos n	Pos %
Tharu	128	6	4.69
High caste	127	2	1.57
Badi	123	24	19.51
Total n	378	32	11.81

Prevalence of multiple parasitism was highest in *Badi* (19.51%), followed by *Tharu* (4.69) and high caste (1.57%) community (Table: 14).

Table 15: Prevalence of hookworm infection in different ethnic groups

Ethnic group	Total n	Pos n	Pos %	p Value
Badi	123	10	8.13	P'<0.01
Tharu	128	44	34.38	$p^{*}<0.01$
High caste	127	6	4.72	$p^{**}>0.05$
Total n	378	62	16.40	

Note: p*= p value between *Tharu* and *Badi,* p** =p value between *Badi* and high caste, p'= p value between high caste and *Tharu.*

Prevalence of hookworm infection was highest in *Tharu* (34.38%), followed by *Badi* (8.13%) and high caste (4.72%) community. The difference was statistically significant between *Tharu* and high caste community (p'<0.01). Similarly, the difference was statistically significant between *Tharu* and *Badi* community ($p^{*}<0.01$). But the difference was not statistically significant between *Badi* and high caste community ($p^{**}>0.05$) (Table: 15).

Table 16: Prevalence of *E. histolytica* infection in different ethnic groups

Ethnic group	Total n	Pos n	Pos %
Badi	123	32	24.06
Tharu	128	8	6.25
High caste	127	1	0.79
Total n	378	41	10.85

Prevalence of *E. histolytica* was highest in *Badi* (24.06%), followed by *Tharu* (6.25%) and high caste (0.79%) community (Table: 16).

Table 17: Prevalence of *E. coli* infection in different ethnic groups

Ethnic group	Total n	Pos n	Pos %
Badi	123	8	6.50
Tharu	128	2	1.56
High caste	127	0	-
Total n	378	10	2.65

Prevalence of *E. coli* infection was highest in *Badi* (6.50%), followed by *Tharu* (1.56%) group. The parasite was not detected in high caste community (Table: 17).

Table 18: Prevalence *H. nana* infection in different ethnic groups

Ethnic group	Total n	Pos n	Pos %
Badi	123	6	4.88
Tharu	128	4	3.13
High caste	127	2	1.57
Total n	378	12	3.17

Prevalence of *H. nana* infection was highest in *Badi* (4.88%), followed by *Tharu* (3.13%) and high caste (1.57%) community (Table: 18).

Table19: Prevalence of *B. hominis* infection in different ethnic groups

Ethnic group	Total n	Pos n	Pos %
Badi	123	3	2.43
Tharu	128	1	0.78
High caste	127	0	-
Total n	378	4	1.06

Prevalence of *B. hominis* infection was highest in *Badi* (2.43%), followed by *Tharu* (0.78%) group. The parasite was not detected in high caste community (Table: 19).

Table 20: Prevalence of *Giardia* infection in different ethnic groups

Ethnic group	Total n	Pos n	Pos %	P value
Badi	123	35	28.46	p'<0.01
Tharu	128	9	7.03	$p^{*}<0.01$
High caste	127	4	3.15	$p^{**}>0.05$
Total n	378	48	12.70	

Note: p*= p value between *Tharu* and *Badi*, p**= p value between *Tharu* and high caste, p '= p value between high caste and *Badi.*

Prevalence of *Giardia* infection was highest in *Badi* (28.46%), followed by *Tharu* (7.03%) and high caste (3.15%) community. The difference was statistically significant between *Badi* and high caste community (p'<0.01). Similarly, the difference was statistically significant between *Badi* and *Tharu* community ($p^{*}<0.01$). But the difference was not statistically significant between *Tharu* and high caste community ($p^{**}>0.05$) (Table: 20).

Photograph I: An egg of hookworm (iodine mount, 40×)

Photograph III: A cyst of *G. lamblia* (iodine mount, 40×)

CHAPTER VI

DISCUSSION AND CONCLUSION

Discussion

Nepal is small and impoverished country with several parasites and bacterial infections (Rai *et al.*, 2001, 2002a) consisting one of the important cause of morbidity and mortality (Rai *et al.,* 2001, 2002a). The present study is done to determine prevalence of intestinal parasitic infection in *Badi*, *Tharu* and high caste community. There are vast differences in socio-economic status, culture, public health awareness and literacy among these communities. Therefore this study was done to know whether these differences affect parasitic infection rate among these communities.

The present study revealed overall prevalence of 35.19% among studied population. There is higher prevalence of intestinal parasitosis among *Badi* (47.97%) and *Tharu* (47.66%) communities than among high caste community (10.24%). Higher prevalence of parasitic infection among *Badi* and *Tharu* communities could be due to poor sanitary condition, lack of public health awareness, low socio-economic status and deprivation of health education among people of these communities. Previous study by Sharma (2007) in Rajapur VDC of Bardia District showed higher prevalence of intestinal parasitosis among *Tharu* community. This could be due to difference in location of study, parasite detection technique, season of the year and sample size.

Though the difference was not statistically significant, prevalence of intestinal parasitosis was slightly higher among males (36.00%) than among females (34.48%) in this study. This finding is in contrast with some previous studies (Rai *et al.,* 1995, 2004b; Singh *et al.,* 1993; Xu *et al.,* 1995; Sharma, 2007). Finding of this study was in agreement with previous report by Sayyari *et al.* (2005), in a national survey of intestinal parasitosis in Iran; the parasitic infection rates were 19.1% (females) and 19.7% (males). Earlier report from Nepal (Rai and Gurung, 1986; Ishiyama *et al.,* 2001) indicated that both males and females are equally exposed to infection and also indicate that the gender may or may not play a role in parasitosis depending on region and other environmental and behavioral factors.

In this present study, hookworm occurred as predominant parasite (16.40% prevalence) than any other intestinal parasitic infections. This finding is in contrast with previous reports from Meo Laotians (Wiesenthal *et al.,* 1980; Milao *et al.,* 1995) that reported higher prevalence of protozoal infection than helminthic infections. Other studies from Nepal among general population have found higher prevalence of helminthic infection (Rai and Gurung, 1986; Rai *et al.*, 1995, 2000; Sherchand *et al.*, 1996; Sharma *et al.*, 1994; Sharma, 2007). High prevalence of hookworm infection is due to soil contaminated with hookworm larva because of open defecation and farming in field with bare foot. Hookworm occurred as predominant parasite among *Tharu* community. High prevalence could be due to defecation in open field, soil contaminated with hookworm larva, farming and fishing with bare foot. Most members of *Tharu* community are involved in fishing and farming occupation.

Except hookworm, prevalence of all other parasitic infection; *Giardia* (28.46%), *E. histolytica* (24.06%), *E. coli* (6.50%), *H. nana* (4.88%) and *B. hominis* (2.43%) infection were higher in *Badi* community than in other communities. This high prevalence could be due to lack of personal hygiene, low socio-economic status, deprivation of heath education and lack of pure drinking water.

Gender wise prevalence of parasitic infection in all three ethnic groups was also studied. In *Badi* community, prevalence is higher among females (50.52%) than among males (43.86%). But in *Tharu* and high caste community, higher prevalence was found among males (*Tharu*; 50.79%, high caste; 11.32%) than among females (*Tharu*; 44.62%, high caste; 9.72%). Higher prevalence of parasitic infection among females in *Badi* community was probably due to occupation and other behavioral factors. Higher prevalence of parasitic infection among males of *Tharu* community could be due to their occupation and other factors. People of *Tharu* community, especially males, are involved in fishing. Fishing with bare foot could be the factor for higher prevalence of parasites among males of *Tharu* community because hookworm infection is major parasite detected in *Tharu* community.

Among children, highest prevalence of intestinal parasitosis was found in *Badi* community (56.72%). This higher prevalence could be due to lack of proper care of children by their parents, lack of public heath awareness, poor sanitation and bad personal hygiene.

Prevalence of intestinal parasitosis was higher among people with agriculture (42.00%) and other (42.74%) occupation than among students (18.01%). Low prevalence among students could be due to public heath awareness, improved personal hygiene and sanitation among students.

Percentage of monoparasitism were higher than multiparasitism in this study. These finding agreed with other previous results (Saldiva *et al.,* 1999; Phetsouvannh *et al.,* 2001). Prevalence of multiple parasitism was exceptionally high among people of *Badi* community. Higher prevalence in *Badi* community could be due to lack of personal hygiene, low socio economic status, deprivation of health services and lack of public health awareness among people of *Badi* community.

The prevalence of parasitic infection was higher in children than in adults. However, the result was not statistically significant. This finding was in agreement with the previous reports from Fagberno-Beyioku *et al.* (1987), Sagunan *et al.* (1996), Cachin-Bonilla *et al.* (1992), Rai *et al.* (1997) and Sharma (2007). This could be attributed to childish activity like eating, playing outside, walking with bare foot which causes larva to penetrate in skin.

The parasitic prevalence rate was higher among people not having toilet (57.87%) compared with among people having toilet (10.50%). It is consistent with study conducted by Rai *et al.* (2002b), Sorensen *et al.* (1994), Toma *et al.* (1999) and Sharma (2007). The difference was statistically significant ($p<0.01$). Lack of toilet affects the environmental sanitation on prevalence of soil-transmitted helminthes. Due to lack of proper toilet, open defecation around the houses, fields, roads and play grounds increases the chance of parasitic infections.

There was vast difference in prevalence of parasitic infection among those washing their hand (20.83%) and among those not washing their hand (81.11%) before eating. Most of the people of *Tharu* and *Badi* community did not wash their hand before eating. Furthermore, they washed their hand after toilet with ash and mud rather than by soaps, which are the main source of soil-transmitted helminthes that again enable people to be infected with parasites.

The prevalence of parasitic infection was higher among those drinking non treated water (48.62%) and lower among those drinking treated water (8.00%). None of the members of *Badi* and *Tharu* community reported drinking of treated water. Contaminated water is the major source of many intestinal parasitic infections. Higher prevalence of protozoal infections could be due to this source of water. Despite this contaminated source of water, hookworm infection is more prevalent than intestinal protozoa among members of *Tharu* community. Hookworm infection could be more closely related with fishing and farming occupation of *Tharu* community.

Unexpectedly higher prevalence of intestinal parasitosis was found among those having anti parasitic drugs (70.59%) than among those not having such drugs (31.69%). This higher prevalence could be due to ineffectiveness of the drug supplied due to various reasons such as date expiry of drugs, taking drug without lab diagnosis, taking drug in insufficient dose etc. Persons who complained recent gastrointestinal disease had prevalence of 87.25% and those who did not complain gastrointestinal symptoms had prevalence of 1.31%.

Present findings of intestinal parasitosis, especially in *Badi* and *Tharu* community, indicated that health status of Nepalese is still very poor. Approximately two-third of the health problems in Nepal are due to infectious diseases (Rai *et al.*, 2001b). Frequently epidemic occurs with high rate of morbidity and mortality. Among the various types of infectious diseases, intestinal parasitosis (mainly soil transmitted helminthiasis) alone constitutes major health problem in Nepal (Rai and Gurung 1886; Rai *et al.*, 1994a, 1995, 1997, 1998).

The government of Nepal and private sector are also taking part in promotion of health services to every citizen. In spite of these efforts, no significant progress has been made in controlling of intestinal parasitic infections in Nepal. Therefore, more effort is expected towards this and more practicable and reasonable policy has to be implemented without ambivalently.

Many factors are involved in failure of the parasitic control program such as human behaviors (eating, occupation), their beliefs (culture, religion), natural phenomena (climate, rain, flooding) and the most serious problem was partial co-operation of the people in mass treatment.

To the best of our knowledge, this is the first research of this kind in the country, in terms of *Badi* ethnic group. As there were not any previous researches done focused on *Badi* community, this has resulted lack of comparison of our findings with other regarding in different parameters.

Although this study provides lots of information regarding the state of intestinal parasitosis in *Badi*, *Tharu* and high caste community, there are some important limitations of this study

i. Due to time factor and other obstacles, the study had to be confined over limited sample size. Findings that are more significant would have occurred if more population were included.

ii. Result that is more reliable had been revealed if stool samples from single individual on three consecutive days were taken.

iii. Members of *Badi* community, especially females, did not give clear information regarding their occupation. Correlation of intestinal parasitosis with occupation had been revealed clearly if clear information regarding occupation was obtained.

Conclusion

The parasitic infections are found closely related with socio-economic status, occupation, literacy, public health awareness, sanitary and hygienic condition among *Badi*, *Tharu* and high caste community. Vast difference in socio-economic status, literacy, occupation, sanitary practice, personal hygiene, public health awareness and culture among these communities are causes for significant difference in rate of intestinal parasitic infection detected. Prevalence of parasitic infection was highest in *Badi* community (47.97%), followed by *Tharu* (47.66%) and high caste (10.24%) community. Unexpectedly higher prevalence of intestinal parasitosis was observed among those having anti parasitic drug (70.59%) than among those not having anti parasitic drug (31.69%). This unexpected result reflects ineffectiveness of drug which may be due to various factors such as date expiry of drug, drug taking in improper dose etc. Among helminthes, hookworm occurred in highest prevalence (16.40%) and among protozoa, *Giardia* occurred in highest prevalence (11.64%). Highest prevalence of hookworm in *Tharu* community (34.38%) is closely related with their fishing and farming occupation and lack of sanitary practice. Higher prevalence of all other parasites in *Badi* community is related with low socio-economic status, lack of sanitary practice, poor personal hygiene, illiteracy, deprivation of public health services and lack of public health awareness. Consequently, in order to decrease the rate of intestinal parasitosis in these communities, in is necessary to increase public health awareness, improve sanitary practice via education, improve socio-economic status and increase public health services.

CHAPTER VII

SUMMARY AND RECOMMENDATIONS

Summary

1. Total of 378 stool samples were collected; 123 from *Badi*, 128 from *Tharu* and 127 from high caste community in Malakheti VDC-1 and 3 of Kailali and Raikwar VDC-2 and 4 of Kanchanpur Districts.

2. Overall prevalence of intestinal parasitic infection was found to be 35.19%, among them 75.94% had multiple parasitism and 24.06% had monoparasitism.

3. Prevalence among males was higher (36.00%) than among females (34.48%).

4. Prevalence in *Badi* community was highest (47.97%), followed by *Tharu* (47.66%) and high caste community (10.24%).

5. In *Badi* community, females were more affected than males (females; 50.52%, males; 43.86%), whereas males were more affected than females in *Tharu* (males; 50.79%, females; 44.62%) and in high caste (males; 11.32%, females; 9.72%) community.

6. Children of age group (0-15 years) were marginally more affected (36.08%) than adults (34.24%).

7. Prevalence of intestinal parasitic infection among children (0-15 years) of *Badi, Tharu* and high caste community were found to be 56.72%, 40.94%, and 10.61% respectively.

8. Hookworm was most predominant among helminthes (16.40% prevalence) and *Giardia* was most predominant among protozoa (11.64% prevalence). Other parasites detected were; *E. histolytica, E. coli, B. hominis* and *H. nana.*

9. Hookworm occurred in highest prevalence in *Tharu* community, all other parasites occurred in highest prevalence in *Badi* community.

10. People who did not wash their hand before meal were affected more (81.11%) than those who washed their hand (20.83%) before meal.

11. People who did not cut their nail regularly were affected more (82.02%) than those who cut their nail (20.76%).

12. People who drunk non treated water were affected more (48.62%) than those who drunk treated water (8.00%).

13. Prevalence of intestinal parasitic infection was very high among people suffering from recent gastrointestinal disease (87.25%) and very low among non sufferers (1.31%).

14. Unexpectedly, higher prevalence of intestinal parasitic infection was found among people taking anti-parasitic drugs within past six months (70.59%) than among people not taking (31.69%).

Recommendations

1. Keeping in view of high prevalence of intestinal parasitic infections, especially in *Badi* (47.97%) and *Tharu* (47.66%) community, this may represent the present situation of the background of ethnic group. However, this type of studies should be undertaken throughout the country in order to get clear-cut picture.

2. Periodic administration of anti parasitic drugs is recommended and awareness creating activities with regard to controlling intestinal parasitic infections should be launched.

3. Predisposing factors such as hand washing before meal, regular nail cutting, type of drinking water and use of toilet are found associated significantly. Therefore, sanitary practices to improve these situations are recommended.

4. Of the various parasites detected, hookworm was most prevalent. Therefore, use of toilet and use of protective wares such as shoes during walking are recommended.

5. Most protozoal parasites such as *E. histolytica, Giardia* etc are highly prevalent in *Badi* community. This indicates contamination of water supply and lack of personal hygiene. Therefore, improvement in sanitary condition through public health awareness programs and proper management of water supply from concerned sectors is recommended.

6. Unexpectedly, higher prevalence of intestinal parasitic infections was observed among people taking anti parasitic drugs. This indicates ineffectiveness of the drug supplied. Therefore, concerned sector should check the effectiveness of the drug supplied.

7. Since transmission and persistence of intestinal parasitic infections are influenced by human behavior and culture, appropriate health education measures should be applied at all levels of program implemented.

CHAPTER VIII

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APPENDIX -I

MATERIALS AND CHEMICALS USED

1. Chemicals and reagents

Methanol

Sodium chloride

Ethanol

Basic fuchsin

Diethyl ether

Formaldehyde

Iodine crystals

Sulphuric acid

Sucrose crystals

2.5% potassium dichromate

2 Materials required

Conical flask

Test tube

Beaker

Measuring cylinder

Glass slides and cover slips

Dropper

Pipettes

Test tube stand

3. Equipments

Microscope

Refrigerator

Centrifuge

APPENDIX-II

MICROBIOLOGICAL PROFILE

Date: ……….

Serial no: ………. Name: ……………………..

Gender: …………. Age: ………

Educational status: ………… Weight: ………..

Height: ……………. Occupation:…………

Patient's clinical history:

…………………………………………………………………………………………………

……………………………………………………………………………

Questionnaire:

1. How many members are there in your family?........................
2. Which is the source of water you use to drink? I. Hand pump II. Tap III. River IV. Kuwa
3. Which type of water do you drink? I. Boiled (Treated). II. Non boiled (Non-treated).
4. Do you wash your hand after toilet? I. Yes II No
5. What you use to wash your hand after toilet? I. Soap II. Mud III. Ash
6. Do you wash your hand before meal? I. Yes II. No
7. Do you have a toilet in your home? I. Yes II. No
8. Do you cut your nail regularly? I. Yes II. No
9. Do you suffering from gastrointestinal disease recently? I. Yes II. No
10. Have you taken anti parasitic drug within past six months? I. Yes II. No?

Report of stool examination

Macroscopic examination	Microscopic examination
Color: Consistency: Blood and mucus: Worm segments:	Saline mount: Iodine mount: Concentration techniques
Treatment:	

Authorized signature:………………