PREVALENCE OF GASTROINTESTINAL PARASITES IN EARTHQUAKE VICTIMS OF CHAUTARA MUNICIPALITY OF SINDHUPALCHOK DISTRICT, NEPAL

AAGYA GHIMIRE

T.U. Registration No. : 5-2-37-300-2008

T.U. Examination Roll No. : 2/070

Batch : 2070/71

A thesis submitted in partial fulfillment of the requirements for the award of the degree of Master of Science in Zoology with special paper Parasitology

Submitted to

Central Department of Zoology

Institute of Science and Technology

Tribhuvan University

Kirtipur, Kathmandu

Nepal

June, 2016

DECLARATION

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

Date: ……. **……..**

Aagya Ghimire
T.U. Registration No. : 5-2-37-300-2008
T.U. Examination Roll No. : 2/070
Batch: 2070/71

TRIBHUVAN UNIVERSITY ☎ 01-4331896
CENTRAL DEPARTMENT OF ZOOLOGY
Kirtipur, Kathmandu, Nepal.

Ref.No.:

RECOMMENDATION AND LETTER OF APPROVAL

This is to recommend and approve that the thesis entitled **"PREVALENCE OF GASTROINTESTINAL PARASITES IN EARTHQUAKE VICTIMS OF CHAUTARA MUNICIPALITY OF SINDHUPALCHOK DISTRICT, NEPAL"** has been carried out by **Aagya Ghimire** for the partial fulfillment of **Master's Degree of Science in Zoology** with special paper **Parasitology**. This is her original work and has been carried out under my supervision. To the best of my knowledge, this thesis work has not been submitted for any other degree in any institution.

Date ……..

……
Prof. Dr. Ranjana Gupta
Supervisor and Head of Department
Central Department of Zoology
Tribhuvan University
Kirtipur, Kathmandu, Nepal

TRIBHUVAN UNIVERSITY ☎ 01-4331896
CENTRAL DEPARTMENT OF ZOOLOGY
Kirtipur, Kathmandu, Nepal.

Ref.No.:

CERTIFICATE OF ACCEPTANCE

This thesis work submitted by **Aagya Ghimire** entitled **"PREVALENCE OF GASTROINTESTINAL PARASITES IN EARTHQUAKE VICTIMS OF CHAUTARA MUNICIPALITY OF SINDHUPALCHOK DISTRICT, NEPAL"** has been approved as a partial fulfillment for the requirements of **Master's Degree of Science in Zoology** with special paper **Parasitology**.

EVALUATION COMMITTEE

…….....

Prof. Dr. Ranjana Gupta
Head and supervisor
Central Department of Zoology
Tribhuvan University
Kirtipur, Kathmandu, Nepal

……... **…….....**

External Examiner **Internal Examiner**

Date: …….

ACKNOWLEDGEMENTS

I would like to express my heartful gratitude to my supervisor honorable Head of Department Prof. Dr. Ranjana Gupta, Central Department of Zoology, T.U. for her kind cooperation and support. I am grateful to all my teachers and all the staffs of Central Department of Zoology, T.U., Kirtipur, Kathmandu, Nepal for their continuous aspiration and motivation.

I would like to express my deepest gratitude to my family member Sarala Ghimire, Prabesh Ghimire and Dr. Chhabindra Poudel for their support and inspiration in my whole academic career.

I would like to specially thank my friend Bishnu Achhami, Sandhya Sharma, Sapana Khaiju, Pujan Adhikari, Lekha Surungi Magar and Rajesh Sah for their support during the thesis.

Last but not the list I would like to acknowledge all my friends for their kind support throughout my dissertation work and all those people of Chautara municipality who helped me directly or indirectly to complete this work.

Aagya Ghimire

CONTENTS

LIST OF TABLES

Table Title of tables Pages

LIST OF FIGURES

Figure Title of figure Pages

LIST OF PHOTOGRAPHS

LIST OF ABBREVATIONS

Abbreviated form	Details of abbreviations
CDZ	Central Department of Zoology
W.H.O	World Health Organization
T.U	Tribhuvan University
$\chi 2$	Chi-Square
d.f	Degree of freedom
No.	Number
et al	and his associates
μm	micrometer
NPC	National planning commission

ABSTRACT

An earthquake of intensity 7.6 magnitude on April 25, followed by 6.8 magnitudes on May 12, 2015, affected 35 districts of Nepal including Sindhupalchok. This study was conducted between March to December, 2015 to determine the prevalence of intestinal parasites in the population displaced by earthquake in camps of Chautara municipality. The displaced population inhabiting in camps were using common toilet with poor sanitary condition, the camps lacked garbage disposal and tap water was the major source of drinking. The study was based on stool examination and questionnaire survey. Altogether 82 stool samples were collected and examined by direct wet mount method. The baseline household survey was carried out with prepared questionnaire to determine knowledge and practices regarding intestinal parasites. The overall prevalence of intestinal parasites was 54.88% where helminthic infection was higher than protozoan infection. All together five different intestinal parasites were identified among them *Ascaris lumbricoides* identified as a most common parasite. Out of different age groups 0-20 year's age group has maximum prevalence whereas 20-40 age groups have minimum prevalence. Statistically significant difference was found in infection rate among different age groups of people ($\chi 2 = 11.474$, $P < 0.05$). Sex wise prevalence showed parasitic infection higher in female (60%) than in male (50%) with statistically insignificant association ($\chi 2 = 0.2$, $P > 0.05$). Single infection was found higher followed by double and multiple infections. Prevalence of parasitic infection shows significant difference with awareness, hand washing behavior, methods of using drinking water and use of deworming tablet, whereas insignificant association with site of defecation and source of drinking water. Thus, a high prevalence of intestinal parasites was found in people living in temporary houses after 2015 earthquake in Chautara and to control the parasitic infection health awareness, well managed public toilet and provision of anthelminthic drug is must.

1. INTRODUCTION

1.1 Background

Parasitic infections caused by intestinal helminth and protozoan parasites, are among the most prevalent infection in humans in developing countries (Haque, 2007). Parasites are the opportunistic organisms which attack or infect the person having low immunity power as well as poor sanitary condition (Chatterji, 2009). Poor sanitary condition can also be brought by the natural disaster. A number of infectious diseases have been associated with natural disasters which include diarrheal disease, acute respiratory infection, malaria, measles, dengue etc (Goyet, 2004). Natural disasters occur in every part of the world. One of the examples of the disaster is the earthquake. Recent big earthquake are the Indonesian earthquake with the subsequent Southeast Asian tsunami in 2004, the Haitian earthquake in 2010 and the Sichuan earthquake in 2008.

In 1934, an earthquake of Magnitude 8.4 caused serious damages to 60% of the buildings in the Kathmandu Valley and killed about 4,300 people. It is a cause for great concern that the next great earthquake may occur at any time after around 70 years of silence (JICA, 2002). At present, Nepal has experienced a catastrophic earthquake of magnitude 7.6 on 25th April followed by earthquake of 6.8 magnitudes after 17 days (NPC, 2015). Out of a total of 35 districts, Sindhupalchok is one of 14 severely affected districts in Nepal (WHO, 2015). Between the two earthquakes, 95% of houses of Sindhupalchok were destroyed and many people were injured (Nayak, 2015).

Nevertheless, an upsurge in the transmission of infectious disease and outbreaks following natural disasters are associated with prolonged after-effects of the earthquake (Nayak, 2015). After major earthquake almost all houses and other buildings in the immediate area may be destroyed. Water and electricity supplies are suddenly curtailed. The survivors have to live in crowded circumstances under conditions usually emerged in post-earthquake crisis. All of these reasons give favorable condition for parasite to rise. Intestinal parasitic type ranges from virus, bacteria, and protozoa to helminthes. But commonly prevalent and endemic types of intestinal parasites are protozoans and helminthes. Helminthes are worms with many cells. In their adult form, helminth cannot multiply in the human body. There are four species of intestinal helminthes parasites, also known as geohelminths and soil transmitted helminthes: *Ascaris lumbricoides*, *Trichuris trichiura*, *Ancylostoma duodenale* and *Necator americanicus*. Protozoa have only one cell, and can multiply inside the human body which can allow serious infection to develop. The most common protozoa are amoeba and *Giardia lamblia* and the diseases caused by these intestinal protozoan parasites are known as giardiasis, amoebiasis which is associated with diarrhea. Principally intestinal parasitic diseases are preventable diseases but the prevalence of intestinal disease is not expectedly decline due to human behaviors like walking barefoot, sanitation and feeding behavior.

1.2 Some of the major diseases associated with earthquake

Beyond damaging and destroying infrastructure, earthquake can lead to outbreaks of infectious diseases. Outbreaks of infectious diseases may be reported when earthquake disasters results in displacement of population into overcrowded and unplanned shelters, with limited access to food and safe water. Access to safe water can be damaged by an earthquake. Diarrheal disease outbreaks can occur after drinking contaminated water and have been reported after earthquake and related displacement. Diarrheal diseases were the leading cause of death (40%) in disaster and camp settings (Connolly *et al*., 2004). During 2005 earthquake in Pakistan, about 42% increase in diarrheal disease was found in a poorly equipped and unplanned refugee camp (WHO, 2005). After the 2003 Bam earthquake in Iran, 1.6% of the 75,586 persons displaced were infected with diarrheal diseases. This was due to several factors such as poor hygiene, crowding, lack of potable water and ineffective sanitation (Akbari *et al*., 2004). An investigation conducted in EI Salvador in 100 households after 2001 earthquake showed that 137 persons out of 594 (22%) experienced diarrheal infections (Woersching *et al*., 2004). Similarly, other parasitic disease such as Giardiasis, Enterobiasis has also been associated with earthquake. Giardiasis was the most frequent parasitic infection among children living in post- earthquake camps in Armenia, Colombia (Suarez *et al*., 2002). The rate of Giardiasis and Enterobiasis was found to be significantly higher among children who were still living in temporary houses and schools years after earthquake (Ozturk *et al*., 2004).

In Pakistan, after the 2005 south Asia earthquake, over 1,200 cases of acute hepatitis and more than 400 clinical cases of measles were common in areas with poor access to safe water among the displaced population (WHO, 2006). Acute respiratory infections were the major causes of illness and death among displaced population, particularly in children less than five years of age. Risk factor among displaced persons includes crowding and lack of nutrition. Cases and death by acute respiratory infection accounted for the highest among those displaced by the 2005 earthquake in Pakistan (WHO, 2006). After the January 1994 southern California earthquake an unusual outbreak of coccidiomycosis occurred which is not transmitted from person to person and is caused by the fungus *Coccidioides immitis,* which is found in soil in certain semiarid areas of North and south America and the outbreak was associated with exposure to airborne dust after the landslides in the aftermath of the earthquake (Schneider *et al*., 1997). An evolving cholera epidemic with a high case- fatality rate was found nine months after earthquake in Haiti (WHO, 2005). Extreme rise in malaria cases occurred after an earthquake in Costa Rica Atlantic region in 1991 that was associated with changes in habitat that were beneficial for breeding of mosquito (Saenz *et al*., 1995).

1.3 Objectives

General objective

To determine the prevalence of gastro-intestinal parasites in earthquake human victims in Chautara municipality of Sindhupalchok district.

Specific objectives

- Morphometric identification of gastro-intestinal parasites among earthquake victims.
- To study the age and sex wise distribution of intestinal parasites among earthquake victims.
- To determine the occurrence of single and concurrent infections with different groups of parasites.
- To know the level of public awareness i.e. knowledge and practices of people about intestinal parasites in study area.

1.4 Research question

1. What is the rate of prevalence of intestinal parasites in the victims of earthquake residing in camps?
2. Are people infected with single or multiple infections?
3. What is the knowledge and practice of people towards intestinal parasites?

1.5 Significance

Intestinal parasitic infections are globally endemic constituting the greatest cause of illness and diseases. Intestinal parasitic infections are linked to improper hygiene, lack of sanitation and lack of access to safe water; therefore they occur wherever there is poverty.

An intestinal parasitic infection is an important public health problem in tropics, particularly in developing countries. Susceptibility to infections with other intestinal pathogens may increase by intestinal parasites. It is therefore important to identify the problems and tackle it in the interest of public health.

The study of intestinal parasites in the people of Chautara municipality has been done for the first time to find the prevalence of infections on the basis of age and sex. After different natural disasters the population within affected area will become infected with different parasitic diseases due to the poor sanitation condition and the quality of food and water they consume. This research will help in finding the parasitic diseases that are caused due to the recent earthquake since their hygienic condition is low than before. This research will also give some idea of the gastro-intestinal parasite and in some extent give knowledge in controlling parasitic infection after natural disaster.

1.6 Limitations

- Due to lack of cooperation stool sample of all the individual inhabiting in temporary camps were not observed.
- Drinking water sample were not examined for its purity.
- No question about animal contact was done.

2. LITERATURE REVIEW

2.1 In global context

Saurez *et al.,* (2002) conducted a study to determine the prevalence of giardiasis in children living in post –earthquake camps from Armenia (Colombia). Out of total sample of 217, *Giardia* cysts were observed in 60.4% and trophozoites in 4.6% of the sample.

Jafari *et al*., (2002) studied that after the Bam earthquake in 2004, 6241 cases were refer to the clinic due to acute respiratory tract infection. And it was also found that 738 cases refer to the clinic because of gastrointestinal infection which was the second common cause of referring to the clinic.

Ozturk *et al.,* (2004) conducted a study to determine the parasitic infection rate associated with the post-earthquake unhealthy living condition & related epidemiological risk factor. Two population living & studying in different socio-economic condition as a result of the earthquake were compared Group 1 (study Group) consisted of 326 children living & studying in transitory houses and classes and group 2 (control) consisted of 127 children living in normal houses & studying normal classes. Selotype procedure was applied in both populations. In group 1, *Enterobius vermicularis* eggs were observed in 13.5 percent of selotype sample & in group 2, eggs were observed in 5.5 percent of selotype sample. The rate of Enterobiasis & Giardiasis was found to be higher in children still living and studying in temporary houses & school years after the earthquake. It has then concluded that the rate of Enterobiasis increased in population living in crowded unhealthy condition.

Nakamura (2005) reported that after the natural disaster and Indian Ocean Tsunami disaster in Japan there has been increase in various diseases such as epidemic of tuberculosis, diarrhea, various parasitic infection, malaria, measles and acute respiratory infection.

Karmakar *et al.,* (2008) conducted a study on post- earthquake of rotavirus gastroenteritis in Kasmir, India. The earthquake led to contamination of drinking water such as tap water, river and stream. This lead to an outbreak of rotavirus between October and December 2005, among infants and small children, transmitted by the faecal- oral route and perpetuated by person- to- person transmission. The overall attack rate was 20% in children under 4 years of age.

Mohamed *et al.,* (2009) reported that four of infective parasites were identified from individuals in all displaced area of Kassala. These were *Giardia lambia* (12.3%), *Hymenolepis nana* (4.9%), *Entamoeba histolytica* (0.4%) and *Trichuris trichiura* (0.2%).
Gen *et al.,* (2011) studied the influence of earthquake in Wudu district, China and found that after the earthquake, the monthly incidence of diarrhea was significantly higher than before. Three hundred & ninety –three stool samples from children were examined. The rate of intestinal worm infection was 32.3%. In term of specific intestinal worm the rate

of *Ascaris lumbricoides* infection was 29.8% & the rate of whipworm infection was 3.6%, rates of intestinal worm infection for children in all age group exceed 20%.

Shah (2010) reported that in Kaghan valley of Pakistan diarrhea & dysentery were the most common disease in earthquake victim and its highest number of cases was noticed in July which is a rainy season and in spring water is contaminated with rain water similarly helminthes infestation was found in all age groups and both sexes.

Isidore *et al.,* (2012) in the 2005 earthquake in Pakistan reported 42% increase in diarrhoeal infections. And also reported that during the Bam earthquake in 2003 out of 75,586 persons who were displaced in Iran found infected by 1.6% with diarrhoeal diseases. The similar case was also reported in Indonesia after the 2004 tsunami were 85% of the survivors in the town of Calang experienced diarrhoeal illness after drinking from contaminated wells and also in Thailand, the 2004 Indian tsunami also contributed to a significant increase in diarrhoeal disease incidences.

Zhong (2013) studied the impact of the earthquake on Lushan and Tianquan countries & found that Schistosomiasis transmission were high after the earthquake, since the stream & damaged ditches were blocked up, potentially leading to the spread of oncomelania snail and the people who were relocated due to the earthquake may have higher exposure to contaminated environment.

Abu-Madi et *al.,* (2016) carried out study to find out the role of immigrants in outbreaks of parasitic disease in Qatar. The prevalence of intestinal protozoan infections was analyzed by stool examination was 29,286 records of subjects referred at the Hamad Medical Corporation over the course of a decade (2005 to 2014, inclusive). And it was found that the overall prevalence of combined protozoan infections was 5.93%, were the most common protozoan was *Blastocystis hominis, Giardia duodenalis, Chilomastix mesnili, Entamoeba coli, Entamoeba hartmanni, Endolimax nana, Iodamoeba butschlii, Entamoeba histolytica/dispar, Cryptosporidium* sp.

Salman *et al.,* (2016) carried a study that was conducted to estimate the prevalence of *Giardia lamblia* and other intestinal Parasites among Iraqi displaced people (IDPs). Where 417 stool samples were collected from peoples in 12 districts in Kirkuk Province, whom they live with the poor hygienic condition and low level of sanitation. The analysis of samples found that the overall rate of intestinal parasitic infection was 19.66 %, this rate was divided in to 10.31 % for *Giardia lamblia* and 9.35 % for other 9 intestinal parasites. *Blastocyst homonis* 4.17 %, *Entamoeba histolytica* 1.67 %, *Cryptosporidium parvum* 1.43 %, *Entamoeba coli* 0.71 %, *Cyclospora cayetanensis*, 0.49 %, and 0.23 % for each of *Entamoeba hartmani*, *Iodomoeba butschili, Hymenolepis nana* and *Ancylostoma duodenale*. The report showed that *Giardia lamblia* was highly found among peoples aging from 1 year to 10 years than in other age groups.

Khanum *et al.,* (2013) carried out a study to find the occurrence of intestinal parasites among the teachers, students and staffs of Dhaka University. 350 stool samples were examined in the pathology department of Medical center of university of Dhaka. Four

species of intestinal parasites were identified. The overall prevalence rate in the present study was 23.14%.The most common diagnosed were *Ascaris lumbricoides*(11.14%) followed by *Entamoeba histolytica*(4.86%), *Giardia intestinalis* (3.71%) and *Trichuris trichiura*(3.43%).The seasonal pattern showed the highest (30%) prevalence occurred in rainy season and lowest (17.19%) in winter season. Female showed the higher prevalence (30.56%) than male (22.29%).

Abede and Desalegn (2014) conducted a study to determine the prevalence of intestinal protozoan among students visiting Wallega University student clinic. A total of 850 students were examined, an overall prevalence of 19.9% was positive among this 111(31.6%), 44(12.5%) and 8(2.3%) were infected with *E. histolytica, G. lamblia*, and *cryptosporidium parvum* respectively.

Haffu *et al*., (2014) carried a study to find the prevalence of intestinal parasites among school children in Arba Minch town, Southern Ethiopia. The overall prevalence of intestinal parasites was 27.7% out of 498 stool sample. The predominant parasites were *E.histolytica* 12.9% followed by *A. lumbricoides* 10.6%, *H. nana* 4.2% and *G. lambila* 4.2%.

Duedu *et al.,* (2015) conducted a study to find the prevalence of intestinal parasites and Association with Malnutrition at a Ghanaian orphanage. Parasitic infections were detected from stool samples collected and analyzed by standard parasitological technique. The overall prevalence was 15.8%.Among the sample the parasites detected were *Ascaris lumbricoides* (5%), *Trichuris trichiura* (1%), Hookworm (1%), *Clonorchis sinensis*(2%), *Fasciola hepatica* (2%), *Hymenolepis nana* (2%), *Schistosoma mansoni*(3%), *Taenia* sp. (1%), *Strongyloides stercoralis*(2%) and *Giardia duodenalis*(1%). Significant association was found between malnutrition and parasitic infections. The prevalence of intestinal parasites among inmates is high.

Alwabr *et al.,* (2016) reported that in a study conducted to determine the prevalence of intestinal parasites among school children of Al-Mahweet Governorate, Yemen the overall prevalence was found to be 90% out of 200 stool samples examined. Nine species of intestinal parasitic were found. *Entamoeba histolytica* cysts (22.5%), *Schistosoma mansoni*(36.5%), amorphous amoebae (22.5%), *Trichuris trichiura*(18%) and *Enterobius vermicularis*(13%) were the most common diagnosed. Multiple intestinal parasites were also found being higher among the children (75.5%). Male were more infected (46.5%) than female (43.5%) and there was significant difference among the different age groups of the studied children.

2.2 In context of Nepal

No articles or reports were found regarding the prevalence of parasitic infections of human being of any earthquake affected areas of the recently occurred earthquake .

Sharma and Tuladhar (1971) studied the prevalence of intestinal parasite amongst auxiliary health workers students in Kathmandu which showed high prevalence (87.50) with *A. lumbricoides* as the common infection.

Jamarkattel (2007) studied on the parasite in Jalari and Kumal communities in Leknath municipality, Kaski, Nepal and found that more than 50% of people were infected with intestinal parasites.

Maharjan (2009) carried a study in the gastro-intestinal parasites of Kanti Children Hospital in Kathmandu, associated with the type and source of drinking water. She reported that out of 300 stool samples, 109 (36.3%) were found to be positive for intestinal parasites. With the help of questionnaire interviews were conducted in a total of 300 children's guardian. Among them, the highest rate (62.38%) of the infection was found in children using tap water. The lowest rate (3.67%) was found in children using jar water. Among 109 (36.3%) positive cases, the highest rate (34.9%) was found in children using unboiled water and lowest rate (8.2%) was found in children using Halogen treated water.

Shakya *et al.,* (2009) studied about Intestinal parasitosis among general population and hospital patients in Nepal. 0.7% was positive out of 2221 fecal samples. Infection rate was found to be equal in both male and female (20.2% and 21.2%).The patients of age group greater than 60 had the highest rate of infection. The most common helminth and protozoan parasite were *Ascaris lumbricoides* and *Entamoeba histolytica*. Other parasites were Hookworm (18.3%), *Hymenolepis nana*(2.6%), *Taenia solium*(2.6%), *Strongyloides stercoralis*(1.3%) and *Giardia lambila*(5.5%).

Khanal *et al.,* (2011) conducted a study to determine the prevalence of intestinal worm infestations among school children in Kathmandu, Nepal. A total of 142 stool samples from healthy students were examined by formal ether concentration technique. The overall prevalence of intestinal parasites was found to be 17.6%.The infection was found to be high in male (22.0%) than in female (13.5%). 6-8 years aged children were highly infected (21.4%) followed by 9-12 years old (18.6%). 13-16 years of age were significantly less infected (10.7%) compared to other ($p<0.05$).The prevalence of intestinal parasites was found to be *Trichuris trichiura* (32.0%), *Ascaris lumbricoides* (20.0%), *Hymenolepis nana*(16.0%), Hookworm (8.0%) and 24.0% cases showed mixed parasitic infections.

Khanal *et al.,* (2011) studied the status of intestinal parasitosis among hospital visiting patients in Deukhury Valley, Dang, Nepal. A total of 210 stool samples examined by direct smear technique and prevalence were found to be 21.4% in which 23.5% in male and 19.3% in females. Children's less than 15 years of age were more infected as compared to more than 60 years peoples and 15-60 years aged peoples. In adults the most common parasitic infection found were protozoan as compared to helminthic infection. The prevalence was significantly high (68.8%) among people having low socio-economic status compared to others (31.1%) ($P<0.05$). The most common diagnosed were

E.histolytica (48.8%), *Ascaris lumbricoides* (31.1%), Hookworm (13.3%), *Trichuris trichiura* (4.4%) and *Taenia* species (2.2%).

Maharjan *et al.,* (2013) studied about the prevalence of intestinal parasitic infection of Kindergarten children. A total of 101 samples from children's were collected and reported following normal saline and iodine wet mount method. Macroscopic and microscopic studies were also performed. The overall prevalence of intestinal worm infestation was found to be 45.5% (n=46). *Giardia lamblia* showed highest prevalence 56.5% and infection with *Ascaris lumbricoides* was found lowest 8.7%. Children who drink filtered water were more infected than those drinking boiled and filtered water.

Tandukar *et al.,* (2013) carried out a study to find the prevalence of intestinal parasitosis in school children of Lalitpur district of Nepal. 1392 stool samples were collected from school children of two governments, two private and two community school of the same district. Overall prevalence was found to be 16.7%. *Giardia lamblia* prevalence was found to be highest (7.4%) followed by *Entamoeba histolytica* (3.4%) and *Cyclospora cayetanensis* (1.6%).Small children of aged 11-15 years and person belongings to family of agriculture workers were most commonly affected. Type of drinking water and hand washing practice also showed significant difference.

Shrestha and Maharjan (2013) conducted a study to determine the prevalence of intestinal helminth parasites among school children of Bhaktapur district, Nepal. Four hundred ninety five stool samples were taken from the children o two school and examined by direct smear method. Seven species of helminth parasites were identified. The most common diagnosed were *Ascaris lumbricoides*(22.63%), *Trichuris trichiura*(6.06%), *Strongyloides stercoralis*(1.82%), Hookworm (1.62%), *Taenia* sp.(1.01%), *Hymenolepis nana* (0.81%) and *Enterobius vermicularis*(0.40%).The infection in case of male and female children was almost found to be equal and statistically no significant difference was found. Single infection was found to be 78.83% out of 137 positive cases. Double and multiple infections were found among 18.98% and 2.19% of students.

Ara (2014) conducted studied on prevalence of intestinal parasitic infection among muslim population of Chorni VDC, Parsa Nepal. Out of total of 400 samples collected and examined it was found that the *Ascaris lumbricoides* (75.75%) highest prevalence followed by *Hymenolepis nana* (15.15%), *Ancyclostoma duodenale*(3.78) and *Entamoeba histolytica* (0.75%).

Ghimire *et al.,* (2014) conducted a study to determine the prevalence of intestinal parasitic infection among school going children of Eastern part of Nepal. Overall prevalence was found to be 97 (29.1%) out of 300 stool samples. Among the total samples 35 (36.1%) were protozoan, 39 (40.2%) were helminthes and 23(23.7%) were mixed type. *Giardia intestinalis* 30 (30.9%) and hookworm 18 (18.6%) were the commonest protozoan and helminthes respectively. Similarly *A. lumbricoides* 15 (5.2%), *H. nana* 6 (6.2%) and *Entamoeba histolytica* 5 (5.2%) were also found. Multiple parasitism was detected in 23 (23.7%) children.

Sah *et al.*, (2014) carried out a study among 935 Government and private school children of Dharan to find out the parasitic prevalence. Overall infestation was found to be 24.4%. According to species wise prevalence *Taenia* species was found to be very high (5.5%) in comparison to other worm i.e. Hookworm (2%), *Ascaris* (1.9%), *Trichuris trichiura*(1.0%), *Hymenolepis nana* (0.7%) and *Enterobius vermicularis*(0.3%). Similarly, in case of protozoal infection, *Giardia lamblia*(6.8%) was seen higher than *Entamoeba histolytica*(6.1%). Hand washing before meal, skin, nail and cloths shows significant difference in the prevalence of parasitic infection.

3. MATERIALS AND METHODS

3.1 Study area

The study was conducted from March to December, 2016 in Chautara municipality of Sindhupalchok district.

3.2 Introduction to Chautara municipality and characteristics of the camps

The study area was situated in Chautara municipality of Sindhupalchok district which is located about 328km east of Kathmandu. It is surrounded by four VDCs – Pipaldada, Kubende, Sanosirubari and Chautara. It lies between 27°46'0" latitude and 85°42'0" longitude. The municipality stands at the elevation of approximately 1600m above the sea level. The geological condition of the municipality is high hills. This municipality is rocky in some areas. After the earthquake 2015 the study site was more prone of landslide. The study site is also rich in water system. The major river is Kubendekhola which is permanent river where water level slightly decreases in winter season. Beside this, there are numerous streams but after the earthquake water flow has been stopped in most of the streams. The climate is warm and temperate in Chautara. The average temperature is 17.8°C. The driest month is November with 10mm of rainfall. The greatest amount of precipitation occurs in July, with an average of 606mm. The warmest month of the year is June, with an average temperature of 22.6°C. This municipality is mainly the inhabitants of farmer, teacher and government employ. People mainly depend upon agriculture. The main food crops are rice, maize, millet and green vegetables. The main castes of this municipality are Sherpa, Newar, Brahmin, Chhetri, Magar, Tamang etc. The major languages spoken are Nepali, Newari and Tamang.

A prospective study was carried out to determine the prevalence of gastrointestinal parasites in earthquake victims of Chautara municipality of Sindhupalchok district, Nepal. A total of 240 people lived in temporary housing camps built under the supervision of non-governmental organization. This study was conducted in 15 camps from March to December, 2016 which were established in Chautara municipality after April, 25th and May 12, 2015 earthquake. The camp was located in open space, very close to their original settlement. There was lack of proper garbage disposal services in camps. However electricity was available for all camps. The source of drinking water and the type of toilet used by earthquake affected people were recorded. Water supply varied between camps: in some camps water was provided from tap in others from spring and in some camps jar water was also provided. Tap water was the major source of drinking water and was used in 10 camps. The types of hygienic room service were the common toilet service with poor sanitary condition that consisted of one latrine for each 9-10 families placed in the center of camp. The place for food storage and disposal of food waste was also recorded.

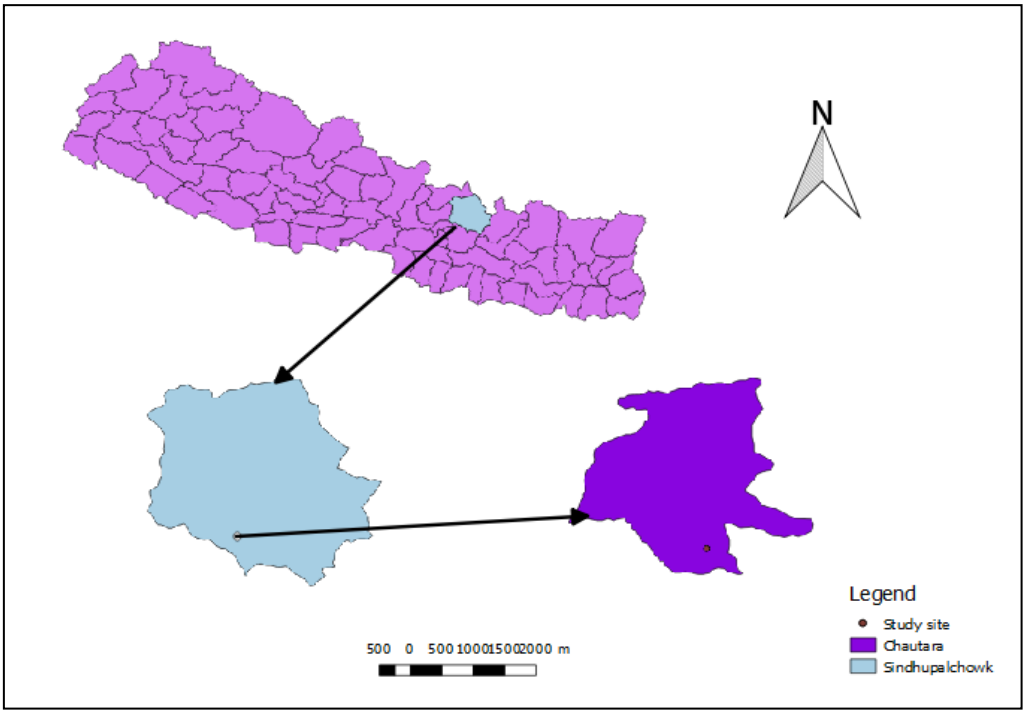

Figure 1. Map of Study area.

3.3 Materials

3.3.1 Equipments

Vials for sample collection, compound microscope, filter paper or cotton, tray, coverslip, forceps, needle, sticks, slides.

3.3.2 Chemicals

2.5% Potassium dichromate, dettol soap, 0.5% normal saline, 10% formaline, iodine solution.

3.3.3 Preparation of Potassium Dichromate:

2.5 gm of Potassium Dichromate was weighed accurately with the help of electric balance and dissolved in 100 ml of distilled water. This solution was used for the preservation of parasite found in the stool (Zajac and Colony, 2012).

3.3.4 Preparation of Normal Saline:

Normal saline was used for observing the characteristics movement of parasites. This solution was prepared by dissolving 8.5 gm of Sodium Chloride in 1000 ml of distilled water, which was used in unstained preparation (Zajac and Colony, 2012).

3.3.5 Preparation of Iodine Solution:

Iodine solution was used for studying the internal characters and identifying species of protozoan parasites. Iodine solution was prepared by dissolving 10 gm of potassium

iodine in 100 ml of distilled water and slowly adding 5 gm iodine crystals in it. The solution was filtered and then kept in a bottle (Zajac and Colony, 2012).

3.4 Methods

Two methods were used for the present study: stool sample examination and questionnaire method.

3.5 Study Design

3.5.1 Sample size

Out of a total of 240 earthquake affected people residing in the camps of Chautara municipality, the samples were collected from 82 (36.61%) individual. The study of the population was divided into 4 age groups i.e. 0-20, 20-40, 40-60 and 60 above.

3.5.2 Sample collection

82 earthquake victims were selected for the study purpose during March to December, 2016. Then proper instructions were given to the people regarding the collection of the stool sample, and they were given wide mouthed, clean, leak proof, labeled containers and application sticks. From each person, a small amount of fresh stool was collected. Each of the specimens was checked for its labeling and quantity.

3.5.3 Preservation

The collected stool samples were preserved in potassium dichromate (2.5%) and transported to the CDZs laboratory for the further investigation of eggs, and adult of intestinal parasites.

3.6 Laboratory work

The samples were processed for macroscopic and microscopic examination. All the laboratory works were done at Central Department of Zoology, TU, Kirtipur, Kathmandu under the supervision of a supervisor.

3.6.1 Macroscopic examination

The stool samples were examined by naked eyes for its consistency, colour, odour and presence of blood and mucus. Adult helminth parasites like *Ascaris* are easily visible; Hookworms and proglottids of cestodes may be present.

3.6.2 Microscopic examination

3.6.2.1 Saline wet mount examination:

A minute portion of stool was taken with the help of a small stick and emulsified with normal saline and a drop of it was taken on a clean glass slide. Then a cover slide was placed gently over it so as to spread out the emulsion into a thin, fairly uniform and transparent layer and excess of fluid were removed with the help of filter paper.

3.6.2.2 Stained preparation of stool smear:

Stained preparation was required for identification and the study of nuclear characters of protozoan cysts and trophozoites. A small portion of stool was taken in a clean slide and a drop of iodine was added. Then a cover slide was put over it (Zajac and Colony, 2012).

3.7 Methods of observation

Both stained and unstained smear was prepared and fixed in the microscope and examined under the low power 10X objective. The observation was started from the end of the slide to another. When the parasites, eggs were seen then objects were centered and focused on the high power for detailed diagnosis.

3.8 Identification of cysts, eggs of parasites

Cysts and eggs of parasites were identified on the basis of morphological characters (shape, size and colour) by using different books (Arora and Arora, 2012; Chatter jee, 2009) internet sources, published and unpublished articles.

3.9 Questionnaires

The questionnaires were done to know about the knowledge, and practices of the victims of Chautara municipality which include a population of different age groups and sex. Short questionnaires were designed which included (a) socio-demographic: address, age, gender and socio-economic status. (b) behavioural data: hand washing habits and source of drinking water. (c) Participant's present medical history: any complaints of abdominal pain/discomfort, nausea and vomiting. Old people were interviewed in their mother tongue. The entire questionnaires were checked for accuracy and completeness. A set of questionnaires is shown in the annex.

3.10 Data analysis and Interpretation

All data, as well as laboratory findings, were analyzed according to their age, sex, feeding habit, and infection rate. Thus, analyzed data was interpreted by representing with table and pie-chart. Association of intestinal parasites with age and sex were analyzed. Prevalence was assessed by using R 3.3.1 software. The total observed value was assumed as examined samples whereas the expected value is assumed as a positive sample.

4. RESULTS

4.1 Results of stool examination in earthquake affected people still living in camp of Chautara municipality

4.1.1 General prevalence of the intestinal parasites in earthquake victims

A total of 82 earthquake victims were enrolled in the study and their stool samples were examined microscopically. The results revealed that the prevalence of intestinal parasitic infection was found to be 45(54.88%) among the earthquake victims.

Table 1. General prevalence of the intestinal parasites in earthquake affected people of Chautara Municipality

Total no. of samples examined	No of positive cases	Positive%	No. of negative cases	Negative%
82	45	54.88%	37	45.12%

4.1.2 Morphometric measurement of gastrointestinal parasites

Parasites were measured morphometrically with the help of stage micrometer and ocular micrometer. Ocular micrometer is of uknown length and was embedded inside eyepiece whereas stage micrometer is known length and fixed on slide. The calibration factor was calculated and by multiplying this factor with the length of parasite the actual length and breadth of species was calculated.

Table 2. Morphometric measurement of parasites

	According to Chatter jee (2009)		**According to observation**
Parasite	**Shape**	**Size**	**Size (average)**
Ascaris lumbricoides	Round or oval	Length:- 60-75µm Breadth: 40-50µm	Length:-61.92µm Breadth:-56.76µm
Ancylostoma duodenale	Barrel-shaped	Length:- 65µm Breadth: 30µm	Length:-64.05µm Breadth:-41.28µm
Trichuris trichiura	Spherical or oval	Length: 50 µm Breadth: 25 µm	Length:-59.34µm Breadth:-23.22µm
Hymenolepsis nana	Oval or elliptical	30-45µm in diameter	43.86µm in diameter
Entamoeba histolytica	Spherical	10-15µm in diameter	18.06µm in diameter

4.1.3 Distribution of Protozoan and Helminthic infection

Out of 45 positive samples the distribution of helminthic infection were higher 42(93.32%) than the protozoan infection 3(6.66%) among Chautara people of Sindhupalchok district.

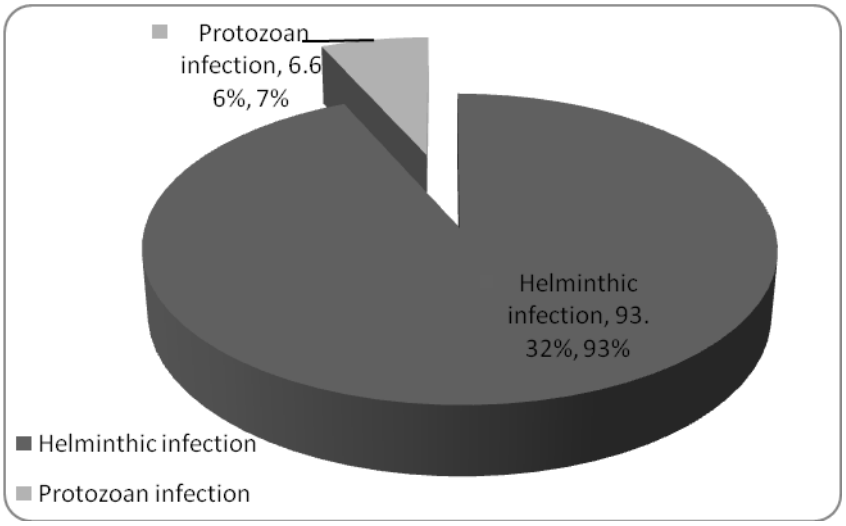

Figure 2.Prevalence of Protozoan and Helminthes infection.

4.1.4 Age wise-prevalence

Table.3 revealed that the distribution of intestinal parasite was maximum (76.92%) in 0-20 years of age group and minimum (35.29%) in 20-40 years of age group. Statistically, there is significant difference between parasitic infection in different age group (χ^2=11.474, P<0.05).

Table 3. Age group wise-prevalence of intestinal parasites

Age(years)	Number of samples Examined	Positive cases	
		No.	%
0-20	26	20	76.92
20-40	34	12	35.29
40-60	15	10	66.67
60 above	7	3	42.86

4.1.5 Sex-wise Prevalence of Intestinal Parasites

Out of 82 stool samples examined, 42 were of male and 40 were of female. Out of 42 male stool samples examined, 21(50%) were found to be positive. Similarly, out of 40 female stool samples, 24(60%) were found to be positive for intestinal parasites. Hence the infection rate was found higher in female than male (Figure 3). Statistically, there was no significant difference in the prevalence of intestinal parasite with the sex of Chautara people. (χ2=0.2, P>0.05)

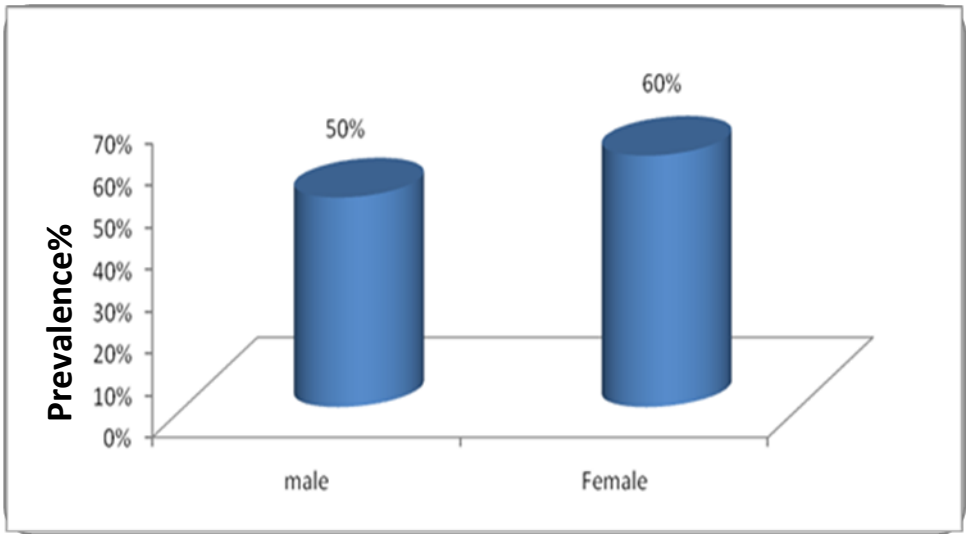

Figure 3.Sex-wise prevalence of Intestinal parasites.

4.1.6 Prevalence of Specific Intestinal Parasites

Earthquake victims were found to be infected with five species of parasites. Among them 27(60%) were infected with *Ascaris lumbricoides* among 27 infected 12(44.44%) were male and 15(55.55%) were female. Similarly, 5(11.11%) with *Trichuris trichiura*, which include 4(80%) male and 1(20%) female. 3(6.66%) with *Entamoeba histolytica*, which consists of 2(66.66%) male and 1(33.33%) female. 1(2%) with *Ancyclostoma duodenale* that was found only in male1(100%) and finally 9(20%) with *Hymenolepis nana* in which 2(22.22%) were male and 7(77.77) were female (Table 4).

Table 4. Infection rate of specific Intestinal parasites.

Parasites	Total infected cases		No. of infected			
	No	%	Male	%	Female	%
Ascaris lumbricoides	27	60	12	44.44	15	55.55
Trichuris trichiura.	5	11.11	4	80	1	20
Entamoeba histolytica	3	6.66	2	66.66	1	33.33
Ancylostoma duodenale.	1	2.22	1	100	-	0
Hymenolepis nana	9	20	2	22.22	7	77.77
Total	45	100	21	46.66	24	53.33

4.1.7 Intensity of infection

The infection of single parasite was more common than double and triple infection. Out of total 45 positive cases, there were 38(84.44%) single infection while 5(11.11%) double and 2(4.44%) with multiple infection.

- Intensity of single infection

Out of 45 positive cases, the intensity of *Ascaris lumbricoides* was found to be maximum 25(55.55%) cases followed by *Hymenolepis nana* with 8(17.77%) cases, *Trichuris trichiura* 3(6.66%) cases whereas *Entamoeba histolytica* and *Ancylostoma duodenale* was found to be equal with 1(2.22%) cases.

Table 5.Intensity of single infection.

Parasites	No.	% of +ve cases(45)	No of infected male	No of infected female
Ascaris lumbricoides	25	55.55	12	13
Trichuris trichiura	3	6.66	2	1
Entamoeba histolytica	1	2.22	1	0
Ancylostoma duodenale	1	2.22	1	0
Hymenolepis nana	8	17.77	1	7
Total	38	84.44	17	21

- Intensity of double infection

Altogether 5 cases were found as double infection out of 82 stool samples examined.

Table 6. Intensity of double infection

Parasites	No.	% of + ve cases (n=45)	No of infected male	No of infected female
Ascaris lumbricoides+ *Hymenolepis nana*	2	4.44	1	1
Ascaris lumbricoides + *Entamoeba* histolytica	1	2.22	-	1
Ascaris lumbricoides + *Trichuris trichiura*	2	4.44	1	1
Total	5	11.11	2	3

- Intensity of multiple infection

Out of 45 positive cases, the intensity of multiple infections was found to be 4.44% in the earthquake victims of Chautara municipality.

Table 7. Intensity of multiple infections

Parasites	No.	% of +ve cases (45)	No of infected male	No of infected female
Ascaris lumbricoides+ *Hymenolepis nana*+ *Entamoeba histolytica*	1	2.22	1	-
Ascaris lumbricoides + *Entamoeba histolytica* + *Trichuris trichiura*	1	2.22	1	-
Total	2	4.44	2	0

4.2. Results of questionnaire survey analysis among earthquake victims of Chautara municipality

Interview was carried out from the Chautara people whose stool examination was done. For this a set of questionnaire were asked and it was mainly focused on factor that could relate with intestinal parasitic infection such as knowledge and practices regarding intestinal parasites among the earthquake victims.

4.2.1 Assessment of knowledge

Knowledge of earthquake victims towards intestinal parasites was categorized into three groups on the basis of knowledge towards cause, symptom and prevention of parasitic diseases. Out of 82 respondents, 33 (40.24%) were knowing about cause and 49 (59.75%) of the respondents were not aware towards cause of parasitic infection. Assessment reveals that there was statistically significant difference between knowledge of earthquake victim towards cause and prevalence of intestinal parasitic infection (Table 8).

Only 28 (34.14%) have knowledge about symptoms of worm infection and remaining 54 (65.5%) were unaware out of total respondent. Statistically there was significant difference between knowledge about symptom and prevalence of intestinal parasitic diseases.

Similarly, 37 (45.12%) victims knows about the prevention and 45 (54.87%) were unaware of it. Most of them said that drinking boiled water and washing hand after defecation is the preventive measure against parasitic diseases. Analysis reveals that there was also statistically significant association between knowledge towards prevention and parasitic prevalence.

Table 8. Knowledge assessment

Variables for knowledge	Total cases=82(%)	Positive cases, N=45(%)	χ^2- value	P-value
Knowledge about cause of parasitic diseases			7.6448	0.005694
Yes	33(40.24%)	12 (36.36%)		
No	49(59.75%)	33 (67.34%)		
Knowledge about symptom of parasitic diseases			11.883	0.0005665
Yes	28(34.14%)	8 (28.57%)		
No	54(65.85%)	37 (68.51%)		
Knowledge on prevention of parasitic diseases			10.613	0.001123
Yes	37(45.12%)	13 (35.13%)		
No	45(54.87%)	32 (71.11%)		

4.2.2 Assessment on practice

Hygiene and sanitation of earthquake victims play important role on acquiring parasitic infection. Maximum victims 30(36.58%) wash their hands only with water after defecation, assessment revealed that there was statistically significant association with intestinal parasitic infection indicating washing hand without soap after defecation showed important risk factor for parasitic diseases(Table 9).

Out of 82 respondent 75(91.46%) victims used toilet as defecation place and remaining 7(8.53%) used to defecate at open field. Statistically, the difference in the prevalence of intestinal parasites on the people on the basis of defecation place was insignificant. The use of direct water without treatment is a leading cause of parasitic infection. Those who drink direct water were highly infected 28(87.5%) than other who drinks water by purification. Assessment revealed that there was significant difference between parasitic prevalence and methods of drinking water. Although maximum earthquake victims used tap water rather than jar and spring water for drinking propose showed almost similar prevalence of parasitic diseases with statistically insignificant association. Deworming tablet is important for the treatment of parasitic disease. Overall assessment showed that victims who had taken deworming tablet within six months were least infected with parasites with statistically significant association.

Table 9. Practice assessment

Variables for practice	Total cases, N=82(%)	Positive cases, N=45(%)	χ^2- value	P-value
Hand washing			18.462	0.0003532
Soil and water	15(18.29%)	12 (80%)		
Soap and water	25(30.48%)	5 (20%)		
Ash and water	12(14.63%)	8 (66.66%)		
Water only	30(36.58%)	20 (66.66%)		
Site of defecation			0.015854	0.8998
Field	7(8.53%)	4 (57.14%)		
Toilet	75(91.46%)	41(54.66%)		
Methods of using drinking water			25.268	4.444e-05
Boiled	15(18.29%)	5 (33.33%)		
Filtered	17(20.73%)	4 (23.52%)		
Chemically purified	11(13.41%)	6 (54.54%)		
Sodish	7(8.53%)	2 (28.57%)		
Direct	32(39.02%)	28 (87.5%)		
Source of drinking water			0.50431	0.7771
Tap	50(60.97%)	26(52%)		
Jar	30(36.58%)	18(60%)		
Spring	2(2.43%)	1(50%)		
Intake of deworming tablet			20.245	0.0004467
No	47(57.31%)	33(70.21%)		
3 month before	5(6.098%)	1(20%)		
6 month before	14(17.073%)	1(7.14%)		
1 year before	10(12.19%)	6(60%)		
Don’t know	6(7.31%)	4(66.66%)		

5. DISCUSSIONS

Earthquake disasters are found to be the second most reported natural disaster after floods. Outbreaks of infectious diseases may be reported when the earthquake disasters result in substantial population displacement into unplanned and overcrowded shelters, with limited access to food and safe water. Diseases outbreaks may also result from the destruction of water system and the degradation of sanitary conditions directly caused by the earthquake. Among such disease intestinal infection represent a large and serious medical and public health problem in developing countries. It is estimated that 3.5 billion people are affected, and that 450 million are ill as a result of these infection, the majority being children (WHO, 1998). *Ascaris lumbricoides*, *Trichuris trichiura* and hookworm are the major helminthes parasites whereas *Giardia lamblia* and *Entamoeba histolytica* are the major protozoan parasites (Warren and Mohmoud 1984, Walsh, 1986).

The present study was conducted among the earthquake affected people living in the temporary shelter camps of Chautara municipality. The camps were overcrowded with many people sharing a common shelter. Many people were forced to use a common toilet with poor sanitary condition. They were seeking for permanent residence rather than unhealthy, temporary and overcrowded camps. They were also in a desperate need of proper health services and better sanitary facilities. The limited distributed food was not very nutritious and lacked a proper diet.

The study revealed that out of 82 earthquake victims inhabiting in camps of Chautara municipality of Sindhupalchok District 45 (54.88%) was infected by different kinds of intestinal parasites. This is greater with the finding of Gen *et al*., (2011) in a study conducted in Wudu district, China after the earthquake with the percentage prevalence of 32.3%. This might be due to immediate and proper management of victims in China whereas in Nepal, condition was poor even after eleven months of earthquake when the research was carried out.

The age of earthquake victims was divided into four groups, 0-20, 20-40, 40-60 and >60. High rate of parasitic infection was found among 0-20 years and low in 20-40 years age group. The high prevalence in 0-20 year's age group might be due to their unhygienic behavior and lack of sanitation also it may be due to their frequent involvement in activities that bring them in contact with the source of infection. While analyzing the infection rate in different group among earthquake victims in Kaghan valley, Pakistan reported maximum infection in 15-35 years age group and minimum infection in age group greater than 55 (Shah *et al.*, 2010).

Regarding the sex-wise prevalence of intestinal parasites, the results showed that comparatively female (60.0%) were more infected than male (50.0%). Statistically, there was no significant relationship in the prevalence of intestinal parasites with the sex of Chautara people. This result resembles with Shah *et al*., (2010) in which the prevalence of parasitic infection was found higher in female 123(59.0%) than male 84(41.0%) in the earthquake affected areas of Pakistan. While dis-resemble with Alwabr *et al*., (2016) in

which the prevalence rate of intestinal parasite infections in male was higher than female among school children of Yemen. The high prevalence rate of female may be due to involvement of female in various household activities, in the care of children during which they come in contact with faeces of children and they do not wash their hands properly and also may be due to usual contact with infected soil, water and food.

The total prevalence of intestinal parasites in Chautara municipality was *Ascaris lumbricoides* (60%), *Trichuris trichiura*(11.11%), *Entamoeba histolytica* (6.66%), *Ancylostoma duodenale* (2.22%), *Hymenolepis nana* (20%). Only *Entamoeba histolytica* was found among protozoan and among helminthes *Ascaris lumbricoides* was the highest and *Ancylostoma duodenale* was the lowest.

The prevalence of *Ascaris lumbricoides* was the highest (60%) among helminthes parasites. This present study coincides with the study of several workers such as Gen *et al*., (2011), in which the commonest infestation found was roundworm among the earthquake victims, Shah *et al*., (2010) in which *Ascaris* was the highest found parasites among the displaced population after the earthquake, Nakamura (2005) where *Ascaris* was higher after natural disaster. Similarly, Fernandez *et al*., (2007), Wani *et al*., (2007), Rashid *et al*., (2010), Shrestha and Maharjan (2013), Ara (2014) are also some of examples having the highest prevalence of *Ascaris*. This highest prevalence can be explained on the basis of less sandal wearing habits, usual contact of infected soil, water, food contaminated with embryonated eggs.

The common helminthes including *Ascaris lumbricoides*, *Trichuris trichuria*, *Ancylostoma duodenale*, *Hymenolepis nana* were reported from different countries such as in Palestine (Bdir and Adwan 2010), in India (Fernandez *et al*., 2002), Nepal (Shakya *et al*., 2009, Khanal *et al.,* 2011, Shrestha and Maharjan, 2013, Sah *et al*., 2014).

E.vermicularis commonly called pin worm are occasionally found during stool examination. This parasite has been reported from several countries like Japan, Pakistan, China and Columbia after the natural disaster (Ozturk et *al*., 2004, Shah, 2010, Gen *et al*., 2011, Saurez *et al*., 2002).

E.histolytica, G. lamblia, G. intestinalis, C.cayetanensis, C.parvum is the commonly distributed protozoan parasites among the earthquake victims. Most of the diarrhea is caused due to *E.histolytica* and *Giardia* species but occasionally by *C.cayetanensis*. In present study only *E.histolytica* was reported among them. However in a study conducted by Saurez *et al*., (2002) and Ozturk *et al*., (2004) *Giardia* was the most common protozoan parasites found among the victims living in camps. Mohamed *et al*., (2009) also reported that the prevalence rate of *Giardia* was higher than that of *Entamoeba* species in displaced area of Kassala after earthquake. But Bdir and Adwan (2010), Dash *et al*., (2010), Marothi and Singh (2011), Khanum *et al*., (2013), Haffu *et al*., (2014) reported that *Entamoeba* has higher prevalence than *Giardia*. Khanal *et al*., (2011) and Ara *et al*., (2014) resembles with the present finding in which only *Entamoeba* was the only protozoan diagnosed. The presence of *Entamoeba histolytica* in the present study

might be explained on the basic that, it is the second leading cause of death from parasitic disease worldwide (Stanley, 2003).

In the present study among 45 positive samples, there were 38 (84.44%) single infection while 5(11.11%) double and 2 (4.44%) with multiple infection. This result is similar with result shown by Shrestha and Maharjan (2013) and Abahussain (2005) with higher single infection compared to double and multiple infections.

The study revealed that a significant proportion of earthquake victims lack awareness towards the causes, symptoms and preventive measures of parasitic infection. The prevalence of intestinal parasites was found higher among the victims who lack knowledge regarding the parasitic disease. The lack of knowledge may be due to lack of conduction of any awareness campaign by concerned governmental and non-governmental bodies.

Present study showed that people living in the camps consume water from difference source such as tap, spring and also use jar water for drinking purpose. The prevalence of parasitic disease can be high due to intake of contaminated water from different sources after earthquake (WHO, 2010). This may be due to disruption of usual water sources and contamination of water by damaged sewage infrastructure after the earthquake. Results also showed that parasitic infection in the victims who consume jar water which suspects that even the jar water may not be free from contamination.

Various practices for hand washing can contribute to parasitic infection. This study showed that hand washing without soap and water can significantly increase the rate of parasitic infection. Similar result obtained from other research such as Gen *et al*., (2011) showed that after the earthquake a markedly higher proportion of people tended not to wash their hands before meals and after defecation with soap and water than did before the earthquake and due to this the monthly incidence of diarrhea and intestinal worm infection was significantly higher than before.

The present study revealed that 75(91.61%) use toilet and 7(8.53%) use open field for defecation after the disaster. Statistically the difference in the prevalence of intestinal parasites on the basis of defecation place was insignificant. Study shows only slight more risk of parasitic infection among people defecating openly. Even though the people who use toilet were also not free from infection. This may be due to poor and unhygienic condition of common toilet in the camps. Similar finding forwarded by Suarez *et al*., (2002) recorded that parasitic prevalence was higher among the victims who use common toilets after the earthquake.

Generally parasitic infection occurred due to consumption of direct water without proper treatment. Present study showed that the victims who consume direct water without purification were mostly infected with intestinal parasites and there was significant difference between parasitic prevalence and methods of drinking water. Similar finding obtained by Woersching *et al*., (2004) revealed that parasitic prevalence was higher among the earthquake victims who consume direct water. Weniger *et al*., (1983) reported

an outbreak of gastrointestinal illness affecting 780 people after natural disaster due to the intake of direct water in Montana (United States) whereas in Utah (United state) 1,230 people were affected with diarrhea due to consumption of unfiltered surface water after flooding (Perrotta *et al*., 1983). Deworming tablet decreases the risk of intestinal parasitic infection (Smith and Brooker 2010). In the present study earthquake victims who had taken deworming tablet 6 month before were less infected than who had not taken deworming tablet with statistically significant association.

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The overall prevalence of intestinal parasites among earthquake victims of Sindhupalchok district was obtained 54.88% where helminthic infection was higher than protozoan infection. Parasites were identified according to their morphology. All together five different intestinal parasites were identified such as *A. lumbricoides, T. trichiura, E. histolytica, A. duodenale and H. nana.*

Among them *A. lumbricoides* identified as a most common parasite followed by *H.nana.* Out of different age groups 0-20 year's age group had maximum prevalence whereas 20-40 age groups had minimum prevalence of parasites. Sex wise prevalence showed parasitic infection higher in female than male. Single infection was found higher followed by double and multiple infections.

Out of 82 earthquake victims 33(40.24%) have knowledge about the cause of parasite, 28(34.14%) about symptoms and 37(45.12%) about the prevention of parasites. Prevalence of parasitic infection showed significant relationship with hand washing behavior, methods of using drinking water and use of deworming tablet, whereas insignificant association with site of defecation and source of drinking water.

6.2 Recommendations

Based upon the discussion and conclusion derived from the present study, following recommendations for the effective control of intestinal parasitic infection among the earthquake victims have been suggested.

Health awareness campaigns should be conducted for the people displaced by the disaster and seeking temporary shelter at the camps.

Well managed public toilet should be built in each camp.

To minimize the risk of transmission of gastro intestinal parasites anti-helminthic doses should be rendered to the people.

7. REFERENCES

Abahussain, N.A. 2005. Prevalence of intestinal parasites among expatriate workers in Al-Khobar, Saudi Arabia. Middle East Journal of Family Medicine, **3**(3): 17-21.

Abede, A. and Desalegn, A. 2014.Prevalence of intestinal protozoan among students visiting Wallega University student's clinic. International Journal of Microbiology and Epidemiological Research (IJMER), **2**(1): 1-6.

Abu-Madi, M.A., Behnke, J.M., Boughattas, S., Al-Thani, A. and Dolphode, S.H. 2016. A decade of intestinal protozoan epidemiology among settled immigrants in Qatar. BMC infectious disease, pp. 2-9.

Akbari, M.E., Farshad, A.A. and Asadi-Lari, M. 2004. The devastation of Bam: an overview of health issues 1 month after the earthquake. Journal of public health, **118**: 403-408.

Alwabr, G.M.A. and Almoayed, E.E. 2016. Prevalence of intestinal parasitic infection among school children of Al-Mahweet Governorate, Yemen. European Journal of Biological Research, **6**.

Ara, S. 2014. Prevalence of intestinal parasitic infections among Muslim population of Chorni VDC, Parsa, Nepal. M.Sc. Thesis. Central Department of Zoology, Tribhuvan University, Kathmandu, Nepal.

Arora, D.R. and Arora, B.B. 2012. Medical parasitology, 3rd edition.

Bdir, S. and Adwan, G. 2010. Prevalence of intestinal parasitic infections in Jenin Governorate, Palestine: a 10 years retrospective study. Asian pacific Journal of Tropical Medicine, **7**:745-747.

Chatterjee, K.D. 2009. Protozoology, Chatterjee Medical Publisher, Calcutta.

Connolly, M.A., Gayer, M., Ryan, M.J. and Heymann, L.D. 2004. Communicable diseases in complex emergencies impact and challenges lancet, 364.

Craig, C.F. and Faust, E.C. 1943. Clinical parasitology, Lea and Febiger, Philadelphis. Cristanol, D., Ocampo, R.I., Vidal, S. 2008. Intestinal parasitic infection among school aged children in the city of Abidjan. Asian Journal of Medicine and public Health, **86**(6): 368-371.

Dash, N., Zarouni, M.A., Anwar, K. and Panigrahi, D. 2010. Prevalence of intestinal parasitic infection in Sharjah, United Arab Emirates. Journal of Human parasitic Diseases, **2**: 21-24.

Duedu, K.O., Peprah, E., Baidoo, I.A. and Kumi, P.F.A. 2015. Prevalence of intestinal parasites and Association with Malnutrition at a Ghanaian orphanage. Journal of human parasitic diseases, **7**: 5-9.

Fernandez, M.C., Verghese, S. and Bhuaneshwori, R. 2002. A comparative study of the Intestinal parasites prevalent among living in rural and urban settings in Chennai India, Journal of Communicable Disease, **34**(1): 9-35.

Furness, B.W., Beach, M.J. and Roberts, J.M. 2000. Giardiasis Surveillance-United states. MMWR CDC Surveillsumm, **49**(7): 1-13.

Gen, C., Wei, N.K. and Guo, Z. 2010. Influence of a "5.12" earthquake on sanitary habits, diarrhea, & intestinal worm infection of children in rural population of the Wudu area of Gansu province, Pathogens Biology Institute , School of Basic medical science, Lanzhoo university, Lanzhou 730000, China.

Ghimire, G., Pandeya, D., Adhikari, B. and Pradhan, M. 2014. Intestinal parasitic infection among school children. Medical Journal of Shree Birendra Hospital, **13**:14-18

Goyet, C. 2004. Epidemics caused by dead bodies: a disaster myth that does not want to die, Nepal Journal of Epidemiology, **15**: 297-299.

Haffu, D., Deyessa, N. and Agedew, E. 2014. Prevalence and determinant factors of intestinal parasites among school children in Arba Minch town, Southern Ethiopia. American Journal of Health Research, **2**: 247-254.

Haque, R. 2007. Human intestinal parasites. International Center for Diarrhoeal disease for Research, Bangladesh, **25**(4): 387-39.

Isidore, K.K., Aljunid, S., Kamigaki, T., Hammad, K. and Oshitani, H. 2012. Preventing and controlling infectious diseases after natural disasters, Pakistan.

Jafari, N.J., Radfar, M.H. and Ghofrani, H. 2007.Incidence of Infectious Diseases One Month after the Bam Earthquake (2004). Journal of Medical Science, **7**(4): 597-602.

JICA, 2002.The Study on Earthquake Disaster Mitigation in Kathmandu Valley, Nepal, Japan International Cooperation Agency.

Jamarkattel, M.P. 2007. Study on the prevalence of commonly occurring four human intestinal parasite in Jalari and Kumal communities in Leknath municipality, Kaski, Nepal. M.Sc. Thesis. Central Department of Zoology, Tribhuvan University, Kathmandu , Nepal.

Karmakar, S., Rathore, A.S. and Kadri, S.M. 2008. Post-earthquake of rotavirus gastroenteritis in Kashmir, India. Public Health.

Khanal, L.K., Choudhury, D.R., Rai, S.K., Sapkota, J., Barakoti, A., Amatya, R. and Hada, S. 2011. Prevalence of intestinal worm infestation among school children in Kathmandu, Nepal. Nepal Medical Colledge Journal, **13**(4): 272-4.

Khanal, L.K., Rai, S.K., Khanal, P.K. and Ghimire, G. 2011. Status of intestinal parasitosis among hospital visiting patients in Deukhary valley Dang, Nepal. Nepal Medical College, Jorpati, **13**(2): 100-102.

Khanum, H., Rahman, F. and Zaman, F. 2013. Occurrence of intestinal parasites among the teachers, students and staffs of Dhaka University. Journal of Asiatic Society, **39**(2): 239-246.

Lizundia, B., Shrestha, S.N., Bevington, J., Davidson, R., Jaiswal, K. and Jimee, G.K. *et al*., 2016. EERI earthquake reconnaissance team report: M 7.8 Gorkha, Nepal earthquake on April 25, 2015 and its aftershocks, May, earthquake engineering research institute: Oakland, California.

Maharjan, B. 2009. Prevalence of intestinal parasites in children who attended the Kanti Children Hospital in the age group 0-15 years. M.Sc. Thesis. Central Department of Zoology, Tribhuvan University, Kathmandu, Nepal.

Maharjan, R., Timilshina, M., Shakya, R., Bhattarai, S., Bhattarai, S. and Gurung, P. 2013. Prevalence of intestinal parasitic infection of Kindergarten children. International Journal of infection and Microbiology, **2**(3): 111-113.

Marothi, Y. and Singh, B. 2011. Prevalence of intestinal parasites at Ujjain, Madhya Pradesh, India: Five- year study. African Journal of Microbiology Research, **5**(28): 2711-2714.

Milder, J.E., Walzer, P.D., Kilgore, G., Ratherford, I. and Kelein, M. 1981. Clinical features of *Strongyloides stercoralis* in an Endemic Area of the United States Gasteroenterology, **80**: 1481-1488.

Mohamed, M.M., Ahmed, A.I and Salah, E.T. 2009. Frequency of intestinal parasitic infections among displaced children in Kassala Town. Khartoum Medical Journal, **2**(1): 175-177.

Nakamura, Y. 2005. Tendency for increasing severity of Natural disaster & the Indian ocean Tsunami disaster. Japan Medical Association Journal, **48**: 1-7.

Nayak, N. 2015. Earthquake after Month–myth or reality? Nepal Journal of Epidemiology, **5**(2): 465-467.

Neva, F.A. and Brown H.W. Basic clinical parasitology.1994, 6th ed. Connecticut, USA, Appleton and Lange. pp 128-133.

NPC. 2015. Post disaster needs assessment, Vol**. A**, National Planning Commission, Kathmandu.

Ozturk, C., Sahin, I., Yavuz, T., Ozturk, A., Akqunoglu, M. and Kaya, D. 2004. Intestinal Parasitic infection in children in post –disaster situations years after earthquake, Pediatrics International, **46**(6): 656-662.

Perrotta, D.M., Nichols, C.R., Nelson, A.P., Scanlon, L., Smith, G. and Johns, R.E. *et al*., 1983. Outbreak of diarrheal illness associated with natural disaster- Utah. Weekly morbidity and mortality Report, **23**:662-664.

Petri, WA. and Singh, U. 1999. Diagnosis and management of amoebiasis. Journal of clin infect Dis., **29**(5):1117-25.

Rashid, M.K., Joshi, M., Joshi, H.S.and Fatemi, K. 2010. Prevalence of Intestinal Parasites among school going children in Bareilly district, **2**(1): 80-86.

Robertson, J. and Koontz, H. 2015. "Magnitude 7.8 earthquake in Nepal and Aftershocks". Accessed on April 28, 2017

Sah, R.B., Pokharel, P.K., Poudel, I.S., Acharya, A., Jha, N. and Bhattarai, S. 2014. A study of prevalence of intestinal parasites and associated risk factors among the school children of Dharan, Eastern Region of Nepal. Indian Journal of Public Health Research and Development, **5**: 294-299.

Saenz, R., Bissell, R.A. and Paniagua, F. 1995. Post disaster malaria in Costa Rica. Prehosp Diaster Med., **10**:154-60.

Salman, Y.J., AI-Taee, A.R. and Abid, A.M. 2016. Prevalence of Giardia lamblia among Iraqi displaced peoples in Kirkuk province. International Journal of current microbiology and applied sciences, **5**(1):753-760.

Schneider, E., Hajjeh, R.A., Spiegel, R.A., Jibson, R.W., Harp, E.L. and Marshall, G.A. *et al*., 1997. A coccidiomycosis outbreak following the Northridge, Calif, earthquake. JAMA, **277**: 904-8

Shah, N., Abro, A.M., Khan, A., Anwar, F.and Aktar, H. 2010. Disease pattern in earthquake affected areas of Pakistan: Data from Kaghan valley. Journal of Ayurved Medical Colledge Abbottabad, **22**(3): 1-5.

Shakya, B., Bhargava, D., Shrestha, S. and Rijal, B.P. 2009. Intestinal Parasitosis. Journal of Intestinal of Medicine, **31**(3): 13-16.

Sharma, R.P. and Tuladhar, N.R. 1971. A study on intestinal parasite amongst auxiliary health workers student in Kathmandu. Journal of Nepal Medical Association, **9**(4): 257-261.

Shrestha, R. and Maharjan, M. 2013. Prevalence of intestinal helminth parasites among school-children of Bhaktapur district, Nepal. Nepalese Journal of Zoology, **1**: 48-59.

Smith, J.I. and Brooker, S. 2010. Impact of hookworm infection and deworming anaemia in non-pregnant population, a systemic review. Tropical Medicine and International Health, **15**(7): 776-795.

Stanley, S.L. 2003. Amoebiasis. Lancet (North American Edition). **361**: 1025-1034.

Stephenson, L.S., Latham, M.C. and Ottesen, E.A. 2000. Malnutrition and parasitic helminth infections. Parasitology **121**(Supplement): 523-38.

Suarez, L.F., Vasquezc, M.C., Loanyo, N., Gauero, M., Torres, E. and Gonzalez, M.M. *et al*., 2002. Giardiasis in children living in post earthquake camps from Armenia (Columbia). Journal of Biomedical Central, **14**: 2-5.

Tandukar, S., Ansari, S., Adhikari, N., Shrestha, A., Gautam, J. and Sharma, B. *et al*., 2013. Intestinal parasitosis in school children of Lalitpur district of Nepal. Journal of Biomedical Central, **10**: 186-1756.

Walsh, J.A. 1986. Problems in recognition and diagnosis of amoebiasis: Estimation of the global magnitude of morbidity. Review of Infectious Diseases Journal, 228-238.

Wani, A.S., Ahmad, F., Zargar, A.S., Ahmad, Z., Ahmad, P. and Tak, H. 2007. Prevalence of Intestinal parasites and Associated Risk factors among school children in Srinagar city, Kasmir, India. Journal of parasitology, **93**(6): 1541-1543.

Warren, K.B. and Mohmoud, A.A.F.1984. Tropical and Geographical Medicine. New York, MC Grow-Hill Book Company.

Weniger, B.G., Blaser, M.J., Gedrose, J., Lippy, E.C. and Juranek, D.D. 1983. An outbreak of waterborne Giardiasis associated with heavy runoff due to warm weather and volcanic ashfall. American Journal of Public Health, **73**: 868-872.

WHO. 1998. Control of tropical diseases. Geneva.

WHO. 2005. Acute water diarrhea outbreaks. Weekly Morbidity and Motality Report, **1**: 6.

WHO. 2006. Acute Jaundice syndrome. Weekly morbidity and motality Report, **23**: 8.

WHO. 2010. Public health risk assessment and interventions earthquake: Haiti, Geneva.

WHO. 2015. Nepal earthquake 2015 country update and funding request. World Health Organization, Kathmandu.

Woersching, J.C., Bsn, R.N., Snyder, A.C., Msn, R.N., Cen. And Acnp, C.S. 2004. Earthquake in EI Salvador: A descriptive study of Health concerns in a rural community and the clinical Implication- part II. Journal of Disaster Manage Response, **2**: 10-13.

Zajac, A.M. and Colony, G.A. 2012. Veterinary Clinical Parasitology. Eighth Edition. American Association of Veterinary Parasitologist.Blackwell Publishing, Oxford, U.K.

Zhong, B., Chen, L., Liu, Y., Wuz, S., Zhu, HQ. and Lu, D. *et al*. 2013. Risk assessment of schistosomiasis transmission in Sichuan Province. Chinese Journal of Schistomiasis control, **25**(3): 226-231.

ANNEX-1

Photographs

Field work

Photo no: 1

Photo no: 2

Photo no: 3

Photo no: 4

Photo no: 1, 2, and 3 Temporary houses build during the earthquake, photo no: 4 Latrine made during the earthquake

Laboratory work

Photo no: 5

Photo no: 6

Photo 5,6. Observation of stool sample under microscope in CDZs Laboratory.

Photo plates of GI parasites

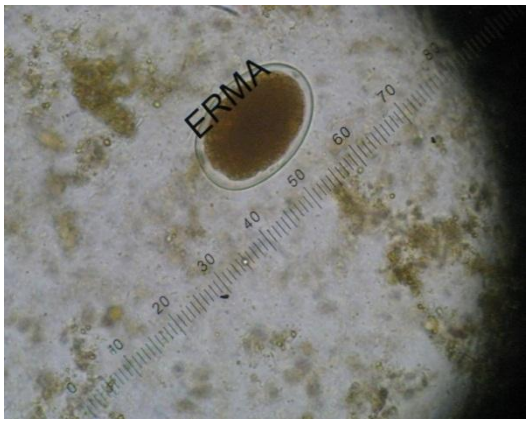

Photo 7.Egg of *Ancylostoma duodenale*.
(10X40X) 64.5µm

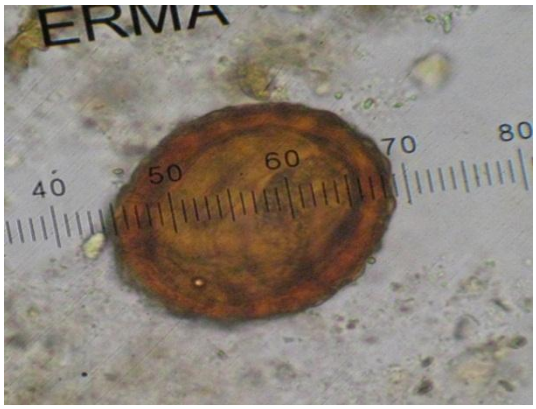

Photo 8. Egg of *Ascaris lumbricoides*
(10X40X) 61.92µm

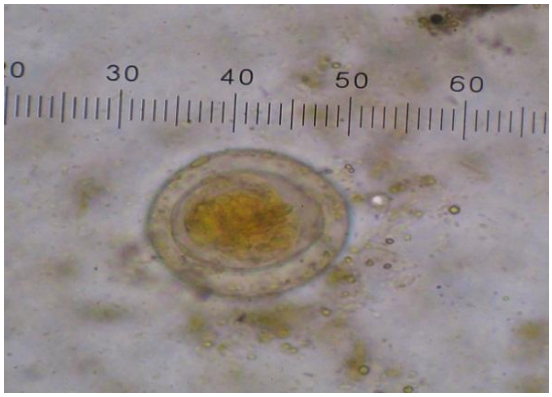

Photo 9. Egg of *Hymenolepis nana*

(10X40X) 46.44µm

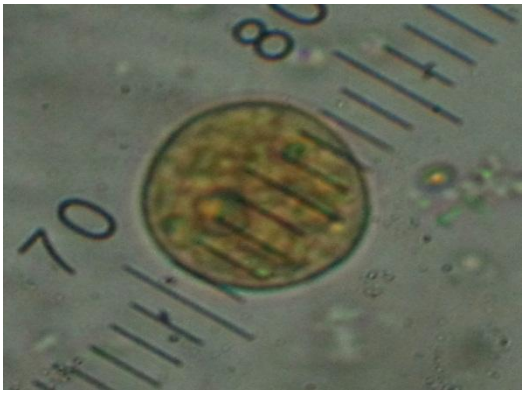

Photo10. Cyst of *Entamoeba histolytica*
(10X40X) 18.06µm

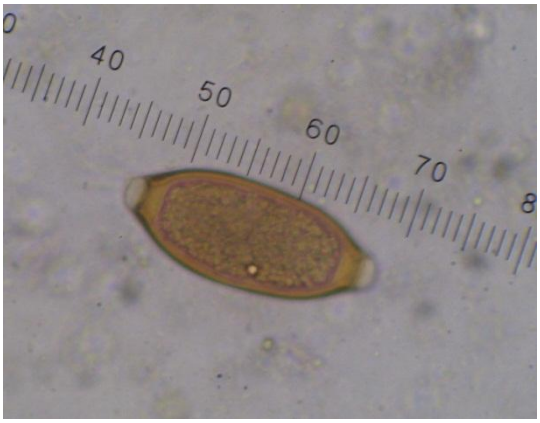

Photo 11. Egg of *Trichuris trichiura*
(10X10X) 59.34µm

ANNEX- 2

Introduction of Intestinal parasite

The intestinal parasites are those parasites which inhabit the intestinal region of the host and get nourishment from there. The intestinal parasites are generally the protozoan and helminthes.

Intestinal protozoan parasites

Protozoan parasite consists of a single cell like unit which is morphologically and functionally complete (Chatterjee, 2009).Some of the common intestinal protozoan parasites are *Entamoeba histolytica, Giardia lamblia, Endolimax nana, Enteromonas hominis, Entamoeba coli, Isospora belli, Trichomonas hominis, Balantidium coli, Cyclospora, Crypposporidium* etc.

Entamoeba and Amoebiasis

Amoebiasis is caused by *E. histolytica*, a protozoan that is 10 to 60 um in length and moves through the finger like pseudopods (Neva and Brown, 1994). It is transmitted by fecal-oral route, as well as by oral-anal sexual practices. *E. histolytica* is the world second leading protozoan cause of death after malaria (Petri and Singh, 1999).The parasites exist in three morphological forms tropozoites, precyst and cyst. Trophozoites is about 25 um across, has a single nucleus, and may contain red blood cells of the host. Precyst is smaller in size and is transitory stage. Cysts are spheres of about 12 um in diameter and are the infective stage. Amoebiasis can cause both intraluminal and disseminated disease.

Giardia and Giardiasis

Giardia lamblia is a pear-shaped, flagellated protozoan and is cosmopolitan in distribution. Between 1992 and 1997, the centers for disease control and prevention (CDC) estimated that more than 2.5 million cases of giardiasis occur annually (Furness *et al.,* 2000). It exists in two form trophozoite and cyst. Trophozoite measures 10-20um in length and 5-15um in width. It is a feeding stage. Mature cyst is oval and measure 11-14umx7-10um and is an infective stage. Giardiasis is spread by fecal-oral contamination the prevalence is higher in population with poor sanitation. Giardiasis caused disturbance in intestinal function, leading to malabsorption fats, persistent looseness of bowels and dull epigastric pain.

Intestinal helminthes parasites

The helminthes worms are macroscopic in size and often visible to necked eye. They belong to phylum platyhelminthes and nematohelminthes. Some of the common intestinal helminth parasites are *Hymenlepis nana, Hymenolepis diminuta. Ascaris lumbricoides, Trichuris trichiura, Ancylostoma duodenale, Entamoeba histolytica* etc.

Ancylostoma and Ancylostomiasis

Ancylostomiasis is caused by *Ancylostoma duodenale* commonly called as old world hookworm. They are found in Europe, Africa, China, Japan, India and the pacific island. The adult worm lives in the small intestine of man and is small, pinkish and fusiform in shape. The anterior end is curved dorsally, hence the name hookworm. The buccal is lined with a hard substance provided with six teeth, four hooks on ventral side and two knobs like on dorsal side and the male measure 8-11x0.4mm while female is 10-20x0.6mm(Craig and Faust, 1943).Life cycle is completed in a single host i.e. man. No intermediate host is required. The common symptoms of worm are gastro-intestinal disturbance, epigastric pain, dyspepsia, vomiting and diarrhoea.

Trichuris and Trichuriasis

This disease is caused by *Trichuris trichiura*, commonly called whipworm. It is a common human parasite that is reported to infect up to 800 million people throughout the tropical and temperate areas (Smyth, 1996). *T.trichiura* lives in the large intestine, particularly in the caecum and less commonly in the vermiform appendix and colon of man. Adult's worms are characteristically whip-shaped. The anterior three-fifth is very thin and hair like and the posterior two fifth is thick and stout, resembling the handle of the whip. The eggs are barrel-shaped with the mucous plug at each pole. Its life cycle is completed in a single host, man. No intermediate host is required. Man acquires infection by ingesting embryonated eggs with contaminated food and water. The symptoms are nausea, vomiting, diarrhea, appendicitis and prolepses of rectum. *Trichuris* dysentery, rectal prolepses, anemia, poor growth constitutes an important public health problem (Stephenson *et al.*, 2000).

Hymenolepis and Hymenolepiasis

Hymenolepiasis is caused by dwarf tapeworm. They are found in the upper two –third of the illieum. It measure upto 25mm to 40 mm in length by a maximum of 1mm diameter. Scolex is rhomboidal with four hemispherical suckers and a short rostellum armed with 20-30 spines in one ring proglottids are 200 in number. Eggs are spherical or oval in shape with two distinct membranes. It has thin and colorless outer shell and an inner membrane, containing a hexacanth embryo. The infection occurs through ingestion of food contaminated with eggs liberated along with the faeces of an infected man. Auto infection increases the number of parasites. Symptoms include abdominal pain and diarrhea.

Strongyloides and Strongyloidiosis

Strongyloides stercoralis is worldwide in distribution. *Strongyloides stercoralis* symptomatic in 50% of cases, with symptoms such as nausea, vomiting, abdominal pain and diarrhea (Milder *et al.,* 1981). Adult fertilize female buried under the mucosa of small intestine especially in duodenum and jejunum. Parasitic females measure 2-3mm in length and 30-50 um in width. Males are shorter and broader than females. The infection

occurs by the entry of filariform larvae which penetrate directly through skin, when coming in contact with soil. It can also transmit via breast milk (Stephenson *et al.,* 2000). In the intestine it produces symptoms like nausea, vomiting, blood and emaciation, anorexia and abdominal pain.

Ascaris and Ascariasis

Ascariasis is caused by *Ascaris lumbricoides*. It occurs among people living under the poor hygienic condition. Adult worm reside in the small intestine, particularly the jejunum of man. It is cylindrical, tapering gradually at the anterior end and somewhat less so at the posterior end. The head is provided with conspicuous lips. Sexes are separated. Males measures 15-30 cm in length and 3-4mm in diameter. Female is longer and stouter than the male and measures 25-40 cm in length and 5mm in diameter. The life cycle of *A. lumbricoides* is passed in only one host, man.

ANNEX -3

Questionnaires

1. Name: …….. Age: …… Sex…… Locality ……..

2. Occupation: ……..…

3. From where do you get drinking water?

i) Tap ii) spring iii) Jar

4. How do you use water for family?

i) Direct tap water ii) By boiling iii) by adding water purifying chemicals

iv) Filtered v) Sodish

5. Where do you defecate?

i) Field ii) Toilet

6. How do you wash your hand?

i) With soil and water ii) Soap and water iii) Ash and water iv) Water only

7. When do you wash your hand?

i) Before meal ii) After meal iii) After toilet

8. Have you taken deworming tablet before? Yes No

If yes, when? I) don't know ii) Three months before

iii) Six months before IV) Once year before

9 .Have you suffered by diarrhea/dysentery worm? Yes No

If yes, when? i) one week before ii) One month before

iii) Six months before IV) Now v) don't know

10. Do you know the causes of worm infection? Yes No

If yes, what are they ……..

11. Do you know the symptom of worm infection? Yes No

If yes, what are they?.....

12. Do you know the method of prevention of worm infection? Yes No

If yes, what are they? ……..