PREVALENCE OF INTESTINAL PARASITES IN ELDERLY PEOPLE OF DEVGHAT, TANAHUN DISTRICT, NEPAL

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LETTER OF APPROVAL

On the recommendation of supervisor **Mr. Janak Raj Subedi** this thesis submitted by Sapana Chhetri entitled **"PREVALENCE OF INTESTINAL PARASITES IN ELDERLY PEOPLE OF DEVGHAT, TANAHUN DISTRICT, NEPAL"** is approved for the examination of the Tribhuvan University in partial fulfillment of the requirements for Master's Degree of Science in Zoology with special paper Parasitology.

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CERTIFICATE OF ACCEPTANCE

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DECLARATION

I hereby declare that the work present in this thesis entitled **"Prevalence of intestinal parasites in elderly people of Devghat, Tanahun District, Nepal"** has been done by myself and has not been submitted elsewhere for the award of my degree. All the sources of information have been specifically acknowledged by references to all the author(s) or institution(s).

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ABSTRACT

Intestinal parasites are one of the most significant causes of infections among the elderly in developing countries. This study was conducted to assess the prevalence of intestinal parasites among elderly people (60+ years of age) of Devghat, Tanahun in October, 2017. A total of 120 stool samples (45 from kuti, 45 from community, and 30 from oldage home) were collected randomly and preserved in 2.5% potassium dichromate. The samples were examined by direct smear and concentration methods in the parasitological laboratory of Central Department of Zoology, Kirtipur, Kathmandu. Knowledge, attitude and practices (KAP) of the people were analysed using prepared questionnaire. Data were analysed by R software package and $p<0.05$ were used as statistically significant. Overall prevalence rate was found to be 48.3% with infection in female (49.32%) slightly higher than in male (46.81%). But, statistically there was no significant difference in the sex-wise prevalence of the intestinal parasites. Finding of the study showed that, the trend of infection among elderly was in increasing order with the increase of age. Altogether, four species of the intestinal parasites were detected. Among them *Ascaris lumbricoides* (82.75%) and *Entamoeba coli* (8.62%) were the commonest helminth and protozoa respectively. The distribution of helminthic infection (44.16%) was much higher than the protozoan infection (4.17%). The study showed that the prevalence of single infection (45.83) was higher than double infection (2.5%). The oldage home had higher prevalence rate (60%) then kuti and community which showed prevalence rate 44.44%. Most of the people (84.17%) were unaware and (15.83%) people were aware about the intestinal parasitic infection. Thus, physical weakness, insufficient sanitary practices, malnutrition and decreased immune system makes elderly more susceptible to intestinal infections.

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LIST OF ABBREVIATIONS

AIDS	-	Acquired Immuno Deficiency Syndrome
CBS	-	Central Burea of Statistics
CF	-	Calibration factor
CI	-	Confidence Interval
cm	-	Centimeter
GCN	-	Geriatric Centre Nepal
GoN	-	Government of Nepal
gm	-	Gram
HAART	-	Highly Active Antiretroviral Therapy
HIV	-	Human Immune Deficiency Virus
IPI	-	Intestinal Parasitic Infection
IP	-	Intestinal Parasite
KAP	-	Knowledge, attitude and practice
Km	-	Kilometer
RBC	-	Red Blood Cell
ml	-	Milliliter
mm	-	Millimeter
NaCl	-	Sodium Chloride
NGO	-	Non-Governmental Organization
NHRC	-	Nepal Health Research Council
OAA	-	Old Age Allowance
P-value	-	Probability value
rpm	-	revolution per minute
sp	-	species
STH	-	Soil transmitted helminth
TU	-	Tribhuvan University
TUTH	-	Tribhuvan University Teaching Hospital
VDC	-	Village Development Committee
WHO	-	World Health Organization
µm	-	Micrometer

1. INTRODUCTION

1.1 Background

Parasites are the organisms that live on other organisms or hosts and obtain food from the expense of its hosts to survive. Some parasites grow, reproduce or invade organs that make their hosts sick resulting in a parasitic infection while some parasites don't affect their hosts. Protozoan, helminthes and ecto-parasites are three main classes of parasites which are capable of producing diseases in human beings. Intestinal parasites are those inhabiting the gastro-intestinal tract of humans and other host and the infections caused by them are called as intestinal parasitic infections. IPI is cosmopolitan in distribution. Major cause of morbidity and mortality to the public health, particularly in developing countries is IPI (Savioli *et al*., 2004). IPIs is commonly transmitted by both direct and indirect routes via oral-faecal, ingestion of contaminated food, vegetables, drinking water (Mata, 1982; Montresor *et al*., 1998; WHO, 1996; Zaglool *et al*., 2011).In addition some flies play a vital role of mechanical vectors for some intestinal parasites such as *Ascaris lumbricoides, Hymenolepis nana, Entamoeba histolytica* and *Giardia lambia* (Getachew *et al.,* 2007). The spread of parasites is also closely related to education, socio-economic status, environmental and sanitary conditions as well as absence of safe drinking water and inadequate medical care (Celiksoz *et al*., 2005; Karan *et al.,* 2012). Housemaids and asymptomatic food handlers are considered as the most potential source of infection for many intestinal parasites (Andargie *et al*., 2008; Sharif *et al*., 2015).Rate of infection of intestinal parasites depend upon species, climate, age, gender, immune system, nutritional status of the host and differ from person to person (Alum *et al*., 2010). In majority of cases IPIs are asymptomatic; however it causes clinical symptoms such as chronic diarrhea, watery diarrhea, nausea, vomiting, dehydration, abdominal pain, iron deficiency, malnutrition, anemia, growth retardation in children, mental and physical health disorders (Alum *et al.,* 2010; Javaherizadeh *et al*., 2014).

Sixty percentage of the world's population is infected with intestinal parasites (Kang *et al.,* 1998). Estimation of WHO shows approximately 50 million people around the world is suffering from parasitic infection each year, resulting in 40-100 thousands deaths yearly (Dhanabal *et al.,* 2014). It is also reported that about $1/4^{th}$ of the world population has been infected by one or more species of intestinal parasites (Rai *et al*., 1998). Moreover, a total population of 3.5 billion per year is estimated to be affected by IPIs worldwide (Quihui *et al*., 2006). Amoebiasis, ascariasis, Trichuriasis and hookworm infection falls among the ten top most infections in the world (Rai *et al*., 1998). Developing countries are the one that are frequently affected by parasitic infection with majority of cases being seen among the school going children (WHO, 1996; Montressor *et al*., 1998). Protozoan parasites are associated with highest number of mortalities than others (Chan *et al*., 1994). In case with developing countries, the parasitic infections are mostly caused by intestinal helminths and protozoan whereas in developed countries commonly protozoan causes gastro-intestinal infection compared to helminths (Haque, 2007).

Nepal is a small landlocked and leas developed country located in South-Asia where intestinal parasites are significantly prevalent (Rai and Gurung, 1986; Kimura *et al*., 2005). Majority of population in the country depends on agricultural activities while working in the field one's chances to get infected with many pathogenic agents including virus, bacteria, protozoa and helminths increases; thus causing mild to severe form of intestinal diseases (Doni *et al*., 2015). About 70% of health problems in Nepal is because of the infectious diseases and diarrheal disease alone is one of the major cause of morbidity and mortality (Rai *et al*., 2001). Giardiasis, ascariasis, amoebiasis, ancyclostomiasis and taeniasis are common IPI in Nepal. Protozoan infection and helminthic infection rank third and fourth respectively in Nepal (Jaisawal *et al*., 2014). Morbidity and mortality in Nepal due to intestinal parasitosis is still high. WHO defines elderly as people of 60 years and above. Total population of elderly in world is 7 Arab 51 Crore (Saibule, 2017). Also, in Nepal people above 60 years are considered as elderly. According to the census of 2011, there were 2.1 million elderly inhabitants which constitute 81% of the total population in the country with growth rate 3.39% (CBS, 2011). Majority of elderly (85% +) in Nepal are living in rural areas being engaged in child care, cattle rearing, handicraft and many more. Elderly people mainly depend on agriculture and are living under the poverty which makes them unable to fulfil even basic needs. 80% of elderly in Nepal live with son and 2.7% live with their daughter. Dependency ratio stands at 84% (GCN, 2010).

Most of the researches in IPI are concerned with pediatric age group as they are the major victim of infection. However, it has been found common even among the elderly people. It has been reported as the most common health problems and a leading cause of death in elderly in Bangladesh and Myanmar whereas diarrhea is recognized as the commonest cause of hospitalization among them in Thailand and India too (WHO, 2004). *Trichuris trichiura* and *Ancyclostoma duodenale* infect nearly 2-3 billion people, especially in elderly in all around the world. Besides this *Giardia lambia, Entamoeba histolytica, Cryptosporidium parvum, Ascaris lumbricoides, Enterobius vermicularis* are the most repeatedly reported IP in them (WHO, 1997). Similarly, in Nepal elderly people are also the major victim of these infections because of poor sanitary and lower quality of life of majority of Nepalese families. Earlier studies in Nepal have revealed gastrointestinal complain as the major health complain of old people (Dhungana *et al*., 2004; Lueitel, 2003). Insufficient sanitary practice and poor personal hygiene due to physical disability and less self-care during old age leads elderly people more susceptible to gastro-intestinal infections. Rather than this, a large number of infected elderly people by IP are living in nursing home and old age home (Ahmadiara and Hajimoahammadi, 2018). Institutionalization of elderly people significantly increases the risk of infection from common source outbreaks such as food-borne epidemics and by person to person spread (Ratnaike, 1999).

1.2 Introduction to the intestinal parasites

Gastrointestinal parasites are the organisms that inhabit the gastrointestinal region of human or other organisms. Helminthes and protozoa are two common intestinal parasites of small and large intestine of human.

1.2.1 Intestinal protozoan parasites

Protozoal parasite consists of a single "cell-like unit", which is morphologically and functionally complete (Chatterjee, 2013). There are about 65,000 species of protozoa of which 10,000 are parasitic. Protozoal cell is composed of a cytoplasmic body and a nucleus. Nucleus controls the various functions and regulates reproduction. The mode of reproduction could be sexual or asexual. Asexual reproduction occurs by simple binary fission and multiple fission whereas sexual reproduction occurs by conjugation and syngamy.

Entamoeba histolytica and Amoebiasis

Entamoeba histolytica was first discovered by Losch in 1875 in stool of Russian suffering from dysentery. Each year about 40-50 million people are suffering from clinical amoebiasis, resulting upto 1000,000 death (Singh *et al*., 2009). Morphologically, it can be categorized into trophozoite, precyst and cyst. Trophozoite is feeding and growing stage. The shape of the parasite is not fixed because it changes its position constantly (Parija, 2004).

Giardia and Giardiasis

Giardia was originally observed by Van Leeuwenhoek in 1681, in his own diarrheal stool. It was described by Vilen Dusan Lambl in1859 and by Alfred Giard in 1895. It is cosmopolitan in distribution. It is located in duodenum and the upper part of jejunum in man. *Giardia* exists in two forms trophozoites and cyst. The size of the trophozoites is 14µm long by 7µm broad. Cyst is oval in shape and measures 12µm long by 7µm broad. Infection of man is brought about by ingestion of cysts through contaminated water source. *Giardia* causes Giardiasis. Malabsorption of fat, mild steatorrhea, fever, anaemia, abdominal cramps, anorexia, diarrhoea, headache, *et*c. are the symptoms produced by Giardiasis (Chatterjee, 2013).

Cyclospora and Cyclosporiasis

It is newly recognized protozoan parasite and causes disease named cyclosporiasis in man particularly in patients with AIDS. First human case was reported in Peru in 1985. It is worldwide in distribution. It has been recognized as both food and water borne pathogen endemic in many developing countries (Singh *et al.,* 2009). The parasites dwells within the epithelial cells of gastrointestinal tract of the host. Oocyst of parasite is spherical in shape and 8-10µm in diameter. It contains two sporocysts each containing two sporozoites. Acute watery diarrhoea with nausea, loss of appetite, abdominal pain, fever, fatigue, weight loss are common symptoms of the disease caused by *Cyclospora* (Chatterjee, 2013).

Cryptosporidium and Cryptosporidiosis

Cryptosporidium parvum is a coccidian parasite which causes cryptosporidiosis. It was first described by Tyzzer in 1907 whereas human case of cryptosporidiosis was first reported in 1976. It is worldwide in distribution. It is intra-cellular and resides in distal parts of jejunum, ileum and also the colon. Oocyst is the infective form of the parasite which exists in two forms (thick walled and thin walled). Oocysts are spherical or oval,

colourless measuring 1.5-5 μm in diameter. Cryptosporidiosis is an opportunistic infection. Gastrointestinal infection like acute watery diarrhoea, anorexia, nausea, vomiting, respiratory cryptosporidiosis, cholecystitis, hepatitis have been reported in severely immunocompromised patient whereas it seems self-limiting in immune-competent persons (Ghimire *et al*., 2004).

1.2.2 Intestinal helminthes parasites:

The helminthic parasites are multicellular, bilaterally symmetrical having 3 germ layers. Platyhelminthes and Nemathelminths are two phyla which are of importance to human beings. Platyhelminthes are generally flattened, leaf like or tape like segmented hermaphrodite whereas nemathelminths are elongated, cylindrical, unsegmented and dioecious. Platyhelminthes is divided into two classes; cestoidean and trematode while Nemathelminths has only one class Nematodea.

Ascaris and Ascariasis

Ascaris lumbricoides commonly called roundworms was discovered by Linnaeus in 1758. It has worldwide distribution being especially prevalent in developing countries with tropical and sub-tropical climate implicating as one of the cause of morbidity and mortality (Rai and Rai, 1999). The adults lives in the lumen of the small intestine (jejunum) of man. Morphologically, the female is longer, stouter than male, measuring 25-40 cm in length with diameter of 5mm. the posterior end of female worm is conical and straight. Male measures about 15-25 cm in length with a maximum diameter of 3-4 mm. Infection is caused by swallowing embryonated eggs with contaminated food and water. Fever, cough, dyspnoea, bloody sputum occur due to migration of larvae. Due to adult worm night blindness, malnutrition, urticarial, oedema of the face, conjunctivitis, irritation of the upper respiratory tract, intestinal obstruction, appendicitis, haemorrhagic pancreatitis are seen (Chatterjee, 2013).

Ancyclostoma and Ancyclostomiasis

Ancyclostoma duodenale was first discovered by Angelo Dubini in 1843. It is commonly known as “old world hookworm” and the disease is called Ancyclostomiasis, which is highly prevalent in tropics and subtropics. The adult worm resides in the human intestine, particularly in the jejunum (Cheng, 1999). As the anterior end of the worm is bent slightly dorsally, it is named as hookworm. Male is smaller about 8mm in length and has copulatory bursa. Female measures about 12.5 mm in length and the posterior end is tapering and lacks bursa. Eggs passing out in the faeces contains a segmented ovum with four blastomeres. It develops in the soil into filariform larva, the infective stage of the parasite. Ancyclostoma dermatitis, reddish itchy papule, bronchitis, brancho-pneumonia, anaemia, duodenal ulcer, steatorrhea (fatty diarrhoea), dry lusterless hair are some major symptoms of the disease (Chatterjee, 2013).

Trichuris and Trichuriasis

Trichuris trichiura was discovered by Linnaeus in 1771, which is commonly called ‘whipworm’. It is world-wide in distribution with common occurrence in warm moist regions. The worm is found in the large intestine of man, particularly in the caecum. The worm is sexually dimorphic in which male measures 30-45 mm in length with coiled

posterior end whereas female measures 35-50 mm in length with comma shaped posterior end (Chakraborty, 2004). The female lays eggs which are not infective to man initially. . Man get infected when embryonated eggs are swallowed with water and food. Appendicitis, abdominal pain, mucus diarrhoea, prolapse of rectum are the common symptoms of Trichuriasis (Regmi, 2012).

***Hymenolepis* and Hymenolepiasis**

Hymenolepis was first discovered by Bilharz in 1857 and it is the smallest intestinal cestodes infecting man (Arora and Arora, 2012). It is commonly called as 'Dwarf tapeworm. It is cosmopolitan in distribution and resides in the small intestine (distal portion of the ileum) of man. It measures 1-4 cm in length with a maximum diameter of 1 mm. Eggs liberated in the faeces are spherical or oval in shape measuring 30-45 μm in diameter. *Hymenolepis nana* doesn't require intermediate host and it doesn't multiply inside the body of the definitive host. The disease caused by it is called Hymenolepiasis and human get infected by faecal-oral route. The infection is more common in children. Abdominal pain, diarrhoea, headache, dizziness, anorexia, weight loss are the major clinical features (Chatterjee, 2013).

***Strongyloides* and Strongyloidiasis**

It was first observed in the stool of the French soldier in the Indo-china by Normand in 1876. Strongyloidiasis is the disease caused by this nematode. It is world-wide in distribution but common in Brazil, Far-East (Cochin-China and Philippines) and Africa. It has two forms i.e. parasitic and free living. The parasitic females are found in the mucous membrane of the small intestine. It reaches upto 2-3 mm in length and 30-35 μm in width. Females are ovo-viviparous. Two forms of larva i.e. rhabdiform larvae and filariform larvae are found. The filariform larvae are infective, longer and slender. Infection is caused by penetration of filariform larvae while walking barefoot on the faecally contaminated soil. It may cause mild to severe abdominal symptoms. Skin lesions, bronchopneumonia, diarrhoea with blood and mucus, malabsorption are the major pathological features (Arora and Arora, 2012).

***Taenia* and Taeniasis**

The description of *Taenia saginata* was given by Hippocrates and Goeze differentiated it from *T. solium* (Arora and Arora, 2012). It is commonly called as beef tapeworm. Adult worm localize in the upper jejunum of man. It measures about 5-10 metres in length. The scolex (1-2 mm in diameter) is not provided with rostellum or hooklets. Eggs are infective only to cattle. Humans get infected through eating the uncooked beef containing cysticerci called measly beef. The larval stage of *Taenia saginata* is known as *Cysticercus bovis.* Chronic indigestion, abdominal discomfort, anaemia, diarrhoea alternating with constipation are noticed in the patients.

Taenia solium commonly called pork tapeworm is discovered by Linnaeus in 1758. It is worldwide in distribution but is uncommon in Jews and Mohammedans who are not generally pork eaters. Adult worm is found in upper jejunum of man. It measures about 2-3 m in length. The scolex is 1 mm in diameter and has four circular suckers with a rostellum armed with a double row of alternating large and small hooklets. Eggs have similar characteristics to the eggs of *T. saginata* but it is infective to pig as well as to man.

Man acquires infection either by eating the inadequately cooked pork containing *cysticercus cellulosae* or by ingesting the eggs of *T. solium* in contaminated food and water. Occasionally abdominal pain, loss of appetite, mild diarrhoea, and hunger pain are the main symptoms (Chatterjee, 2013).

1.3 Provision of Government of Nepal for elderly people

The health policies in Nepal have mainly focused on maternal and child health and very few policies exist for the support of elderly. However, the condition is rather better than past as government of Nepal has formulated a National Policy on ageing and the problems of elderly have been addressed at a level in various act and their regulations. Despite of this, the implementation rate is not very effective due to limited available trained human resources and fund. So, there is a need for greater involvement of the government in geriatric care. Some of the provisions for elderly people are mentioned below:

- Constitution of Nepal has the provision of rights of senior citizens in article 41 which says, the elderly people shall have the rights to special protection and social security from the state (Constitution of Nepal, 2072)
- The ninth five year plan (1998-2002) addressed the coverage of social security of senior citizens for the first time. It confirmed to protect the senior citizens and utilize their knowledge, experience and capacity in national development. This plan also encouraged NGOs and the private sectors to establish old-age homes in all development regions. Similar provisions for senior citizens were followed by the successive periodical plan.
- Every public vehicles must reserve at least two seats to senior citizens and provide them 50% concession on travel fare. Medical service providers have to give priority in treatment and provide at least 50% concession to the senior citizens in chargeable medical treatment (Senior citizen act, 2006).
- Nepal is committed to the Madrid International Plan of Action on Ageing, 2002 and the Macau Plan of Action of Ageing for Asia and the Pacific, 1999 (Limbu, 2012).
- Following the Madrid Plan of Action on Ageing, 2002, the Government of Nepal has formulated National Plan of Action on Ageing 2062.
- Various programs have been launched by GoN for the welfare of the elderly like Old Age Allowance (OAA) for the people of 70 years and above, senior citizens treatment guidelines, 2061 to deliver health care services, senior citizens health facilities fund.

1.4 Objectives

1.4.1 General objectives

Prevalence of intestinal parasites in elderly people of Devghat, Tanahun district, Nepal.

1.4.2 Specific objectives

- To determine the prevalence of intestinal parasites in elderly people of Devghat.
- To determine the concurrency of the intestinal parasites in elderly people.

- To assess the knowledge, attitude and practice (KAP) about intestinal parasitic diseases among the elderly people of Devghat.

1.5 Significance of the study

Elderly people are considered as knowledge banks and ideal persons for the younger. They are regarded as live history. Physical disabilities, loss of memory, loss of immunity, mental disorder and less socialization are some of the formal characteristics of aging. They need love, care, respect and support. But due to globalization, family structure in Nepal has been changing. So in general they don't get sufficient care from their family and society and are compelled to live at old age home. Meanwhile majority of them are living in rural areas under the poverty. They suffer from deprivation, illiteracy, poor health, malnutrition, low living standard and restriction on mobility. As a result they are highly prone to various communicable diseases like diarrhea, dysentery which weaken their body. In addition physical weakness, insufficient sanitary practices and diminished immune system makes them more susceptible to intestinal infections. Moreover, instutionalized have increased rate of infection due to person to person contact. Even though suffering from IPI elderly people are not being well focused because most of the researches in IPI has been confined to children, as they represent future generation of any country. Thus, this study provides evidence for knowing the health status and quality of life of them living in an old age home and within family setup. This also supports to increase the knowledge about infection, needs of sanitation and draw attention of concerned departments.

1.6 Limitations of the study

- Many people denied to provide sample due to moral ethics.
- Differently able people couldn't be included.
- Problems like forgetfulness, constipation limited the sample size.

2. LITERATURE REVIEW

2.1 History of Parasitology

The study of animal and plant parasitism is known as parasitology. Humans are hosts to nearly 300 sps of parasitic worms and over 70 sps of protozoan (Ashford and Crewe, 1998). Homo sapiens emerged in eastern Africa about 150,000 years ago (Tishkoff *et al.*, 2001) and spread throughout the world (Templeton, 2002). During migration human brought some parasites with them and somewhere acquired on the way. So, the parasites infecting humans can be classified as heirlooms or souvenirs. Heirlooms are those parasites inherited from our ancestors in Africa whereas souvenirs are acquired from the animals with which we came in contact during migrations or agricultural practices. Globalization and urbanization facilitated the transmission of infections among humans. Many parasites were unknown until the discovery of the microscope in the mid-17th century. During the period of Linnaeus, people used to think that internal parasites were originated from accidental swallowing of free living organisms. At the same time, Leeuwenhoek discovered Giardia in his own stool (Chandler and Read, 1961). The science of helminthology really took off in the 17th and 18th century. Linnaeus described and named six helminth worms *Ascaris lumbricoides, Ascaris vermicularis* (*=Enterobius vermicularis*), *Gordius medinensis* (*=Dracunculus medinensis*), *Fasciola hepatica, Taenia solium and Taenia lata* (*=Diphyllobothrium latum*). *Ascaris lumbricoides* was first discovered by Linnnaeus in 1758. The life cycle in humans, including migration of larval stages was described by Japanese Paediatrician, Shimesu Koino in 1922. Owen discovered *Trichinella spiralis* in 1835 and it was Freidrich Zenker in 1860 who recognized the clinical significance of the infection. In 1838 *Ancyclostoma duodenale* was discovered by an Italian physician Angelo Dubini. And the disease caused by the worm was found by Wilhem Griesinger in 1854. In 1851 the worm *Shistosoma haematobium* was described by the German parasitologist Theodar Bilharz and Karl Theodor Ernst Von Siebold. In 1910, Marc Armand Ruffer found *Schistosoma haematobium* eggs in two Egyptian mummies dating from the 20th dynasty. *Giardia duodenalis* was seen by Leewenhoek and description of *Giardia* was given by Vilem Lambl in 1859. Friedrich Losch discovered *Entamoeba histolytica* in 1873. In 1876, Normand reported *Strongyloides stercoralis.* The discovery of life-cycle of filarial worm was made by Patrick Manson in 1877. *Leishmania donovani* was named after the discoverers, Leishman and Donovan, both of whom reported the organism simultaneously in 1903. The first case of *Cryptosporidium parvum* in human was recorded in 1976 independently by Nime (Nime *et al.*, 1976) and Meisel (Meisel *et al.*, 1976).

2.2 Scenario of intestinal parasitic infection in global context

Globally, intestinal parasitic infections are found as most common health problem (Kang *et al.,* 1998). About 3.5 billion people in the world are estimated to have infection of intestinal parasites, of which about 450 million are children (Okyay *et al.,* 2004; Hailegebriel, 2017; Chongbang *et al.,* 2016; WHO, 2013). This constitutes around 60% of the world's population (WHO, 2015). Similarly, each year approximately 50 million people around the world are estimated to have intestinal infection resulting 40-100

thousands deaths yearly (Dhanabal *et al.,* 2014). Nowadays intestinal parasitic infection has become a leading cause of morbidity and mortality (WHO, 2000). It has become important threat to healthy living in both developed and developing countries (Struntz *et al.,* 2014).

Several researches have been carried out in the American continents. In Mexico, IPI were found higher in children from lower-income families with unemployed and less educated mothers (Qhihui *et al*., 2006). Similar study conducted in north western Mexico revealed prevalence rate of 68% with protozoan 63% and helminth 16% (Cota and Morales-Figueroa, 2012). Jimenez *et al.* (2013) showed statistically significant association between malnutrition and the presence of IPI in children from Pantepec of Mexico. The prevalence rate was 62.8% with *A. lumbricoides* the most prevalent enteric parasite (33.6%). A research conducted in south eastern Brazil with 293 elderly respondents aged 60-106 years, 9.5% were found positive for intestinal protozoa. *G. intestinalis* (35.7%) was found to be most prevalent followed by *E. coli* (32.2%), *Cryptosporidium (*10.7%), and *Endolimax nana* (7.1%) (Girotto *et al.*, 2013). Of 1000 stool samples examined in Santa Luzia, Brazil 300 samples i.e. 30% were found infected with 7 different types of parasites; *Endolimax nana* being highly prevalent i.e. 33% (De lima *et al.*, 2016). Engroff *et al.* (2016) found 10.8% prevalence of IPI among 581 elderly people in Porto Alegra, Brazil. Among which *Endolimax nana* (42.7%), *Entamoeba coli* (33.8%), *Giardia lamblia* (8.8%), *Ascaris lumbricoides* (5.9%), *Strongyloides stercoralis* (4.4%), *Trichuris trichiura* (2.9%), and *Iodamoeba butschlii* (1.5%) are common parasites found. Study done by Faria *et al*. (2017) in Brazil taking samples from 3245 individuals of ages 1 to 93 years showed 569 individuals (17.5%) positive for one or more enteric parasite. Male (64.5%) were highly infected than female (35.5%). Also *G. intestinalis* was found to be common among children whereas *Endolimax nana* among adult. Ignacio *et al.* (2017), in his findings showed no statistical significant association was detected between poverty and employment among senior citizens. Similarly, research done in elderly patients in the same country prevalence rate of 30.5% was recorded of which 26.3% suffered mono-parasitism, 3.8% bi-parasitism and 0.4% poly-parasitism. Protozoa 80.8% was found to be pre-dominant over helminths 19.2% (Santos *et al*., 2017). In Peru, Stofer (2014) recorded 65% intestinally parasitized individuals out of 120 with higher parasitization in those rearing poultry. In the same country, Watts *et al.* (2014) found *T. solium* infection more in males than in females.

European continent has most of the developed counties of the world. However, she has also not remained untouched from parasitic infection and has somehow contributed in harboring some forms of parasitic infection. When fecal samples of 3938 asylum seekers arriving Stockholm were examined, 651 (17%) were found positive; *G. intestinalis* (10%) being the most prevalent (Persson, 1994). In Germany, 114 (67.1%) individuals were recorded to be infected with intestinal parasites. Among them female (56.1%) were found infected the most (Paschke *et al*., 2011). Also, hospital based study done in Italy by Masucci *et al*. (2011) examining 9456 faecal samples of 1-99 age groups revealed Italians being less infected (8.9%) than non-Italians (26.8%). Protozoa were predominant (96.8%) over helminths (4.7%) in it. Dudlova *et al.* (2016) conducted a research in Slovakia with

2760 samples divided into three age groups 1 month-7 years, 8-18 years and 19-88 years. From the examination, it was known that total prevalence of IPI was 6.81% where protozoan parasite infection was 2.64% and helminthic parasitic infection was 4.17%. Most common species of protozoa was *E. coli* (0.79%) and of helminths was *Ascaris lumbricoides* (3.37%). The lowest prevalence of protozoan infections (2.37%) and helminthiasis (0.92%) was recorded in the age group 19-88 years. El-Safadi *et al.* (2016) in his hospital based research in France showed the prevalence rate significantly higher in summer (23.2%) than in winter (13.7%).

Intestinal parasitic infection has also been reported from different countries of Africa continent. In Kissi district of Kenya 41.1 % prevalence rate was recorded of which 16.1% had protozoan infections, 22% helminth infections and 3% mixed infection (Nyarango *et al*., 2008). Onuoha (2009) research done in Nigeria revealed 74.3% infection rate of Ascariasis and 52.8% Ancyclostomiasis. Similarly, Amuta *et al.* (2010) conducted research in different age groups of reproductive stages of women in Nigeria and found 426 (56.8%) positive for IPI in 750 samples. Women at premenstrual and post menstrual stages were recorded higher prevalence rates with 72.8% and 63.9% respectively. The rate of isolating pathogens between age groups was highest among adult cases (65.6%) followed by children (58.1%) and mixed (26.8%) in Sub Saharan region (Fletcher *et al.*, 2011). In a research done in Ghanian Psychiatry hospital 13.51% of prevalence was recorded. Males had higher rate of prevalence than females (Duedu *et al*., 2015). Research conducted in Kenya among inmates showed higher prevalence among them than general population where 24.7% of inmates were infected. Protozoal infection was recorded 15.1%, helminths 5.2% and mixed 3.5%. Male inmates (21.8%) had significantly more IPI compared to females (8.1%). Inmates within ages 20-29 years were more infected 11.3% than age group above 60 years 0.6% (Rop *et al*., 2016). The prevalence is seen high in Sub-Saharan region due to poor sanitary habits, lack of access to safe drinking water and improper hygienic behaviour (Amoah *et al*., 2017).

Several researches done in Australian continent also shows prevalence of different intestinal parasites. In a research conducted among 201 pregnant women enrolled in hospital of Papua New Guinea, 163 (81%) were infected. Among them 65% and 35% were infected by protozoan and nematodes respectively (Suparat *et al*., 2013). Fletcher *et al.* (2014) recorded *Blastocystic* sp. (57%), *G. intestinalis* (27%) and *Dientomoeba histolytica* (12%) in Sydney during his survey. Similarly, IPI was found positive for 89% out of 311 Australian aborigines. The common parasites detected were *Trichuris* (86%), hookworm (36%), *Entamoeba* species (29%), *S. stercoralis* (19%) and *G. duodenalis* (10%). The positive case in males (47%) was significantly greater than in females 30% (Shield *et al*., 2015).

Asia, the largest continent in the world is the home of several developing countries. Poverty, illiteracy, ignorance, poor sanitation and poor personal hygienic behavior is high in the people of this continent. Due to this many intestinal parasites have been found endemic to this region (Tiwari *et al.*, 2013). The infection rate of 50 years and above people was found to be 50%, 28.4% and 51.26% in Bangladesh, Malaysia and China respectively (Rahman, 1993; Sinniah and Rajeswar, 1998; Feng *et al*., 2001; Dhungana *et*

al., 2004). In Tajikistan Matthys *et al*. (2011) research showed helminths and protozoan infection as 32% and 47.1% respectively. In the research the most common helminths species was *Hymenolepis nana* (25.8%) and protozoan species was *Giardia intestinalis* (26.4%). Similarly, *B. hominis* was highly prevalent in the elderly residing in Qatar (Abu madi *et al*., 2010). However, Tasawar *et al*. (2010) in their hospital based study at Multan found *E. histolytica* infection to be highly prevalent. In South-India, analysis of stool samples of 30 patient suffering from microcytic anemia showed patient with hookworm infection (Bhasin and Rao, 2011). Research done in Vietnam by Duc (2013) concluded the prevalence rate of helminth were generally higher in females and increase with age as well. *A. lumbricoides* infection was higher with light infection of *T. trichuria* and hookworm. Kumar *et al.* (2013) conducted a preliminary study in Tertiary care hospital of Uttar Pradesh detected 8 different types of parasites among total 692 stool samples with the prevalence rate of E. *histolytica* with 42.25%. 256 stool samples collected from South-Chennai revealed 194 positive cases of parasitic infection. During analysis it was found that the children and teenagers harbour increased number of parasites than old age (Dhanabal *et al.*, 2014). Fuhrimann *et al.* (2016) showed highest prevalence rate of IPI in peri-urban farmers (30%) out of 681 individuals in Vietnam.

In Uttarakhand hills the prevalence rate was detected as 11.62%. Female were parasitized more than males. Also, people who used open defecation, untreated water and engaged in agriculture were reported to be more infected. Infection rate was also seen more in people belonging to age group 51-60 years (Kotian *et al*., 2014). Food handlers in Iran were found chiefly infected by *G. lamblia* (53.9%) in a research conducted by Sharif et al. (2015). In a separate research conducted in Iran, Ahmadiara and Hajimohammadi (2017) drew a conclusion of increased risk of parasitic transmission in old people when they were institutionalized in elderly homes. Mareeswaran *et al.* (2018) showed IPI was higher in rural population 50.8% than urban population in Kancheepuram district of Tamil Nadu. Amonkar *et al.* (2018) in their research done in Maharashtra concluded quality of life of elderly was better within family set up rather than in old age homes.

It seems that there is no any part of the world which is free from the IPI and, is mostly distributed in Asian and African continent. Even highly developed countries harbor the varieties of the parasites.

2.3 Scenario of intestinal parasitic infection in context of Nepal

In context of Nepal, different scholars have contributed to explore the status of intestinal parasites prevailing in various parts of the nation. High rate of poverty and ignorance in our country has also supported in increasing the prevalence of parasitic infections. Sharma *et al.* (2004) said that intestinal parasitic infections were highly prevalent in all age groups and geographical regions of the country. Also, burden of intestinal parasitic diseases were seen increased in children, adult and elderly population (Shakya *et al*., 2006; Gyawali *et al*., 2009).Major burden of premature mortality due to diarrhoeal disease (65%) was seen in 0-14 age group followed by age group 60 above. Distribution shows higher burden in females of mid-western and far-western development region. Diarrhoea showed highest burden 27% in central region and lowest in eastern region 11%. Similarly higher in Terai 58% than hilly and mountain (Nepal Health Research

Council, 2018). *A. lumbricoides* was reported as the most dominant intestinal parasite to cause infection in different parts of Nepal (Rai and Gurung, 1986; Malla *et al.,* 2004; Shrestha *et al.,* 2012; Shrestha and Maharjan, 2013; Pandey *et al.,* 2015; Tandukar *et al.,* 2015). Other researches have shown *E. histolytica* as the major intestinal parasites in children and adult (Sherchand *et al.,* 2010; Agrawal *et al.,* 2012; Shakya *et al.,* 2012; Shrestha *et al.,* 2012; Singh *et al.,* 2013).

A research done in Banmala Community of Bhaktapur revealed higher infection in females than in males for the age group of 60-70 years (Gosai, 2005). However, in Chepang community elderly males were found highly infected than females (Majhi Tharu, 2006). Shakya *et al.* (2006) also found males being highly infected than females during his examination of 235 stool samples of elderly people in Kathmandu. The overall prevalence was recorded to be 41.7%. Moreover, the highest prevalence rate was recorded in government run elderly home (50.8%) followed by rural community (46.8%) and private elderly homes (21.2%). 300 stool samples taken from various age groups of three different areas in Bhojada, Chitwan district showed 16.67% males of age group 60-70 years and 33.33% females of the same age group were found infected by intestinal parasites (Adhikari, 2009). Analysis of data taken from 450 stool samples of three different wards in Mithuawa VDC by Sah (2009) showed 51.85% helminthic parasitic infection rate in elderly people. Research carried out at Deukhuri valley of Dang with 210 samples concluded 22.2% rate of prevalence among age group of 60-65 years (Khanal *et al.*, 2011).

Hospital based research of Agrawal *et al*. (2012) demonstrated 30.1% prevalence of IPI in Kathmandu. There was significant difference between males (34.2%) and females (26.3%). 90.4% had single parasitism whereas 9.6% had multi-parasitism. Also infection rate was found higher among patients from inside Kathmandu valley than outside of valley. Positive rate was higher in Dalit (37.5%) followed by Aadibashi-Janajati (34.3%) and Brahmin-Chhetri (22.6%). In Kumal's of Gaidakot prevalence of helminth parasites were recorded to be 48.99% with females (51.94%) being highly infected than males (45.83%). Also, age group 40 and above were infected the most (76.9%). The parasite hookworm was the most dominant followed by *Ascaris*, *Hymenolepis*, *Taenia*, *Strongyloides* and *Trichuris* (Gyawali, 2012). A lower prevalence rate 15.17% was recorded in Biratnagar. Patients of age group 5-14 years were infected most followed by age group above 45 years (Singh *et al.,* 2013).

In the mid-western region of Nepal, overall prevalence of 46.28% was recorded in a survey done with Police combatants and their families as respondents. 96% showed single infection with *A. lumbricoides* and hookworm infection frequently recorded. Males were less infected than females. Also, it was also noted that infection rate was higher in non-gazetted junior officers than other higher ranked officers (Poudel *et al*., 2014). Bhattachan *et al*. (2015) revealed 23.3% positive cases of intestinal parasitosis among children of Chitwan. He also found girls with higher positive cases than boys though there was no any significant difference. Moreover, infection was higher in children using drinking water from well (29.9%) than tap water (21.9%).

In Pokhara very low prevalence rate 3.12% was recorded during a hospital based research conducted by Supram *et al*. (2015). Eight different types of parasites were encountered, *G. lamblia* being the commonest. The majority of patients infected were of age group less than 18 years (43.05%) followed by 18-49 years (35.76%), 50-64 years (11.92%) and above 65 years (25%). Similarly, in a research conducted by Chongbang *et al*. (2016) in children of squatter community of Dharan displayed boys (45.8%) being more infected than girls (37.5%). Out of 112 stool samples collected from HIV patients undergoing HAART therapy from Tribhuvan University Teaching Hospital (TUTH) revealed 13.9% positive cases with infections in females 1.4 times more than in males. Similarly, illiterate were about two times more likely to be infected with parasites than the literate ones (Ghimire *et al.*, 2016).

Jaisawal *et al*. (2016) did research in Mukta Kamaiya of Dhangadi district. He showed 19% prevalence rate with *Ascaris* infection the most (60%) followed by *H. nana* (20%), *G. lamlia* (15%) and *T. trichiura* (1%). Females were seen to be infected more (55%) than males (45%). However, in research done with Muslim respondents in Janakpur males were seen to be infected more than females. The overall prevalence was recorded to be 72.67% and 50% of elderly among them were infected (Yadav and Prakash, 2016). Similarly, males were seen predominant in the research of Baral *et al*. (2017) conducted in Dharan. On the contrary, females were seen predominant (26.9%) over males (19.4%) in research conducted with respondents from slum area of Pokhara. The overall prevalence was recorded 24.1% in it (Tiwari *et al*., 2018).

3. MATERIALS AND METHODS

3.1 Study area

The study was conducted in Devghat. Devghat is a holy place located in Tanahun district in Gandaki zone of Central Nepal. It lies in $84^{O}22'30''$ E to $84^{O}30'30''$ E and $27^{O}42'30''$ N to $27^{O}47'30''$ N. It lies 200 m -575 m from the sea level. Devghat, one of the holiest places in Hindu mythology, is located at the junction of the Seti-Gandaki and Krishna-Gandaki rivers. It is 5 km north-west from the city Narayangarh and 150 km south-west from the capital city Kathmandu. It is blessed with many natural features due to its geography and climate including tropical forest, wild animals and birds. Devghat is also known as "Shree Harihar Chhetra" and "Aadiprayag". Various temples and caves of Hindu gods and goddesses and saints including goddesses Sita's cave, Bashistha cave, Radha-krishna temple. Harihar temple, Galeshwor temple, etc. lies here. Religious activities are performed in Ashrams in all year round. Huge fair is observed each year in Makar Sankranti. Devghat has three high schools, one post graduate college, three retirement home projects and one ayurvedic health center. Many health volunteers from different health organizations provide free health check-ups camps on a regular basis. Radio Devghat 102.6 MHz in a community radio station run here to promote local culture. A suspension connects the area to Chitwan district. Many elderly people come Devghat to avoid being a burden to their children, to escape ungrateful offspring or because they have no children to look after them in their old age and perform the necessary rites when they die.

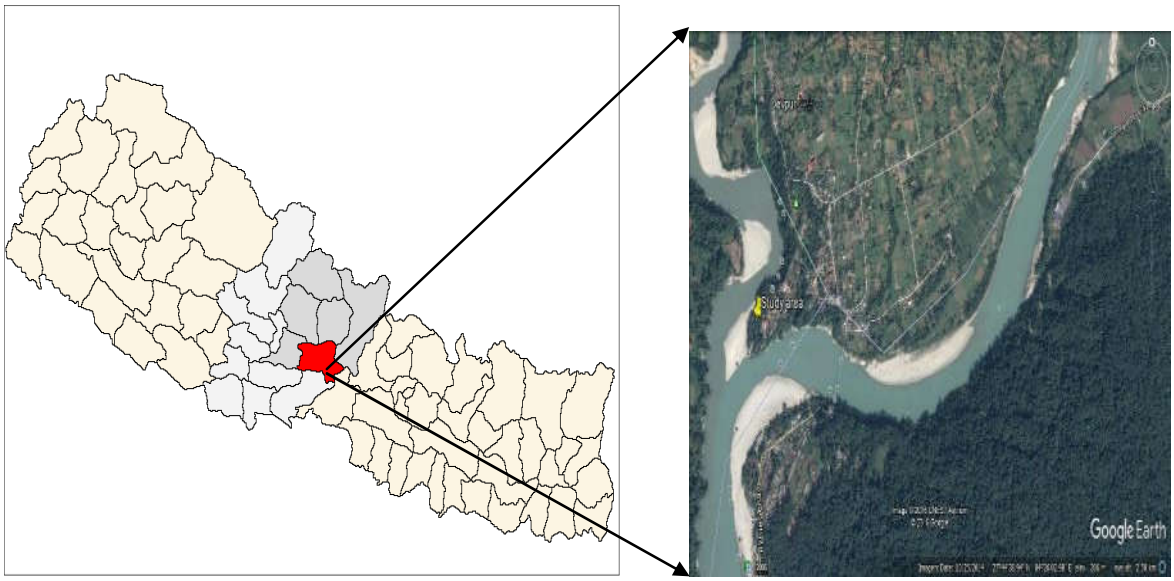

Figure 1 Map of study area

3.2 Study duration

The present study was conducted from October, 2017 to March, 2018 including field survey, lab work and writing thesis.

3.3 Materials

3.3.1 Apparatus required

Compound microscope, Ocular and stage micrometre, Filter paper, Cotton, Slides and cover slips, Tray, Forceps, Gloves and masks, Needles and sticks, Sampling vials, Centrifuge machine and tubes, Test tubes and test tube racks, Funnel, Dropper, Beaker, Petridish, etc.

3.3.2 Chemicals

2.5% Potassium dichromate, Iodine solution, 0.5% Normal saline and Distilled water

3.3.3 Preparation of solution

1. Potassium dichromate

2.5 gm of Potassium Dichromate was weighted accurately with the help of electric balance and dissolved in 100 ml of distilled water (Chatterjee, 2013).

2. Normal saline

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 Conboy, 2012)

3. Iodine solution

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 bottle (Zajac and Conboy, 2012).

3.4 Methods

3.4.1 Study design

The study design was designed to assess the intestinal parasitic infection in the elderly people of Devghat, Tanahun district, Nepal. The study design includes;

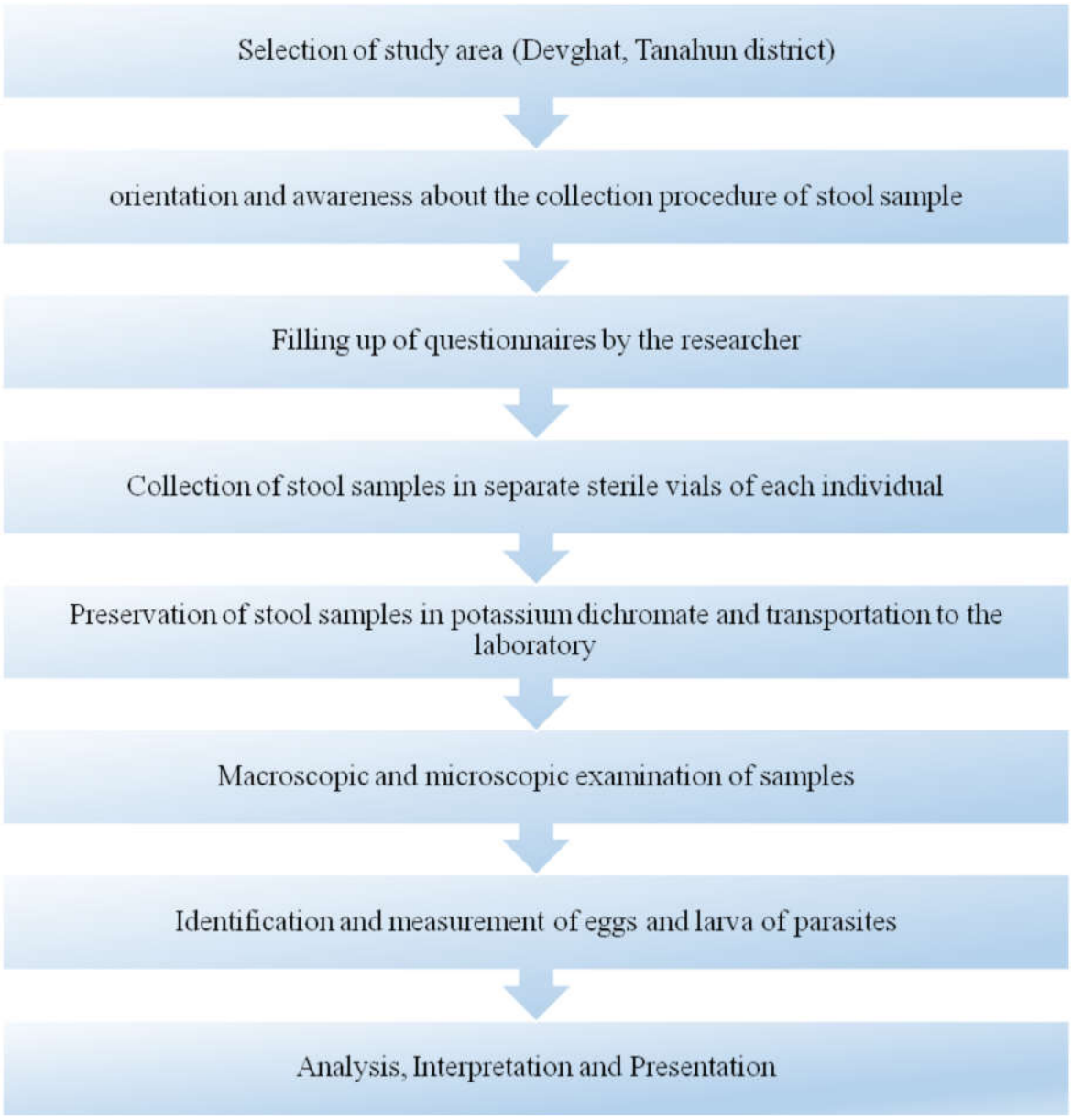

Figure 2 Flow chart of study design

3.4.2 Sample size

The total sample size of the present study was 120 from different age and sex of elderly people at Devghat. The study of population were divided into five age groups i.e. 60-70 years, 70-80 years, 80-90 years, 90-100 years and 100-110 years of age. The data were collected by questionnaire method.

3.4.3 Stool collection

One hundred and twenty peoples were randomly selected for the study purpose. After proper instructions, sampling vials and application sticks were given to the selected individuals for collection of stool sample. From each individual about five gm. fresh stool samples were collected. Each of the specimens was checked for its labelling and quantity. The collected stool samples were preserved in potassium dichromate (2.5%) and transported to the Parasitology Laboratory of Central Department of Zoology for further investigation of eggs and adults of intestinal parasites.

3.5 Laboratory work

All the laboratory works were done in Parasitology Laboratory of Central Department of Zoology, TU, Kirtipur, Kathmandu under the guidance and supervision of supervisor.

3.5.1 Microscopic examination of stool samples

3.5.1.1 Direct method of observation

This examination was done for the detection and identification of helminth eggs or larva and protozoal cysts, oocysts, trophozoites by wet preparation i.e. unstained smear preparation and stained smear preparation (Chatterjee, 2013)

1. Unstained preparation of stool smear

A portion of stool sample was picked up with a wooden application and emulsified with freshly prepared normal saline on a clean glass slide. The resulting mixture was made thin, and its consistency was made clear. A clean coverslip was placed over it and the excess fluid if any was removed with the help of blotting paper. The slide was fixed in microscope and examined under low power 10X objective (Chatterjee, 2013).

2. Stained preparation of Stool smear

The iodine stained preparation was used for this purpose which was diluted in the ratio of 1:5 with distilled water (Chatterjee, 2013).

3.5.1.2 Indirect method of observation

Beside the direct stool smear preparation and examination method, for some doubtful samples, indirect method of examination was also applied.

Concentration method

The procedures for the concentration of the eggs can be carried out either by floatation or sedimentation techniques.

1. Differential floatation technique

3 grams of stool were taken in a beaker and about 15 ml of water was added and stirred properly. The mixture was than filtered. The filtrate was put in glass tube and centrifuged at 1000 rpm for 5 minutes. The tube was taken out without disturbing and it was poured in beaker. Eggs were concentrated at the bottom of test-tube after centrifugation. The sediment remained in test-tube was filled with NaCl to develop convex surface at the top of the tube. Then coverslip was placed at the top and left for 10 minutes. After that coverslip was transferred to microscope for observation (Chatterjee, 2013).

2. Sedimentation technique

First of all about 1 gram of stool sample was emulsified in about 4 ml of 10% of Formol saline solution and stirred. The solution was filtered. The filtrate was put in another test tube and ether was added. The final mixture was centrifuged at 2000 rpm for 2 minutes and allowed to settle. Than the supernatant fluid was thrown and sediment was tested under microscope by unstained and stained smear. All the preparation was first examined under the low power (10X) objective and ocular starting from one corner of the coverslip to another corner than it was examined under the high power (40X) (Chatterjee, 2013).

3.6 Calibration of eggs and cysts

Eggs and cysts were measured by using ocular and stage micrometer, the length, breadth and diameter of parasites eggs and cysts were measured with the calibration factors;

Calibration factor (C.F.) for 10X=10.37 micrometer

Calibration factor (C.F.) for 40X=2.588 micrometer

3.7 Identification of the eggs and cysts

The identification and confirmation of the eggs and cysts were made by comparing the structure, color, size of eggs and cysts from published books, literature, journals and internet sources.

3.8 Questionnaires

A set of question was used to collect necessary information about the knowledge, attitude and practices of elderly which included population of different age groups and sex. Short questionnaires were designed which included;

a) Socio-demographic: address, age, gender and socio-economic status.
b) Behavioral data: hand washing habit, types of drinking water, food habit.

The entire questionnaires were checked for accuracy and completeness. The questionnaires are shown in the annex.

3.9 Data analysis, interpretation and presentation

The collected data from field survey and laboratory findings were statistically analyzed with the help of Microsoft excel 2013 and Pearson's Chi-squared test performed by R 3.3.1 version software package. The 95% confidence interval (C.I.) was used to display the accuracy of the data analysis and $P<0.05$ was considered for the statistically significance difference. The obtained data were also presented in the table, pie-chart, bar diagram and column diagram.

4. RESULTS

The study was conducted among the elderly people of Devghat of Tanahun district. 120 stool samples of different age and sex groups were collected in total and examined from October, 2017 to March, 2018. The result of the present study is divided into two categories.

4.1 Results of stool examination

4.1.1 General Prevalence of Intestinal Parasites:

On examination of 120 stool samples, the general prevalence of the intestinal parasites were found to be 58 (48.33%). Among total positive samples, the prevalence of helminthic infection 53 (44.16%) were higher than the protozoan infection 5 (4.17%).

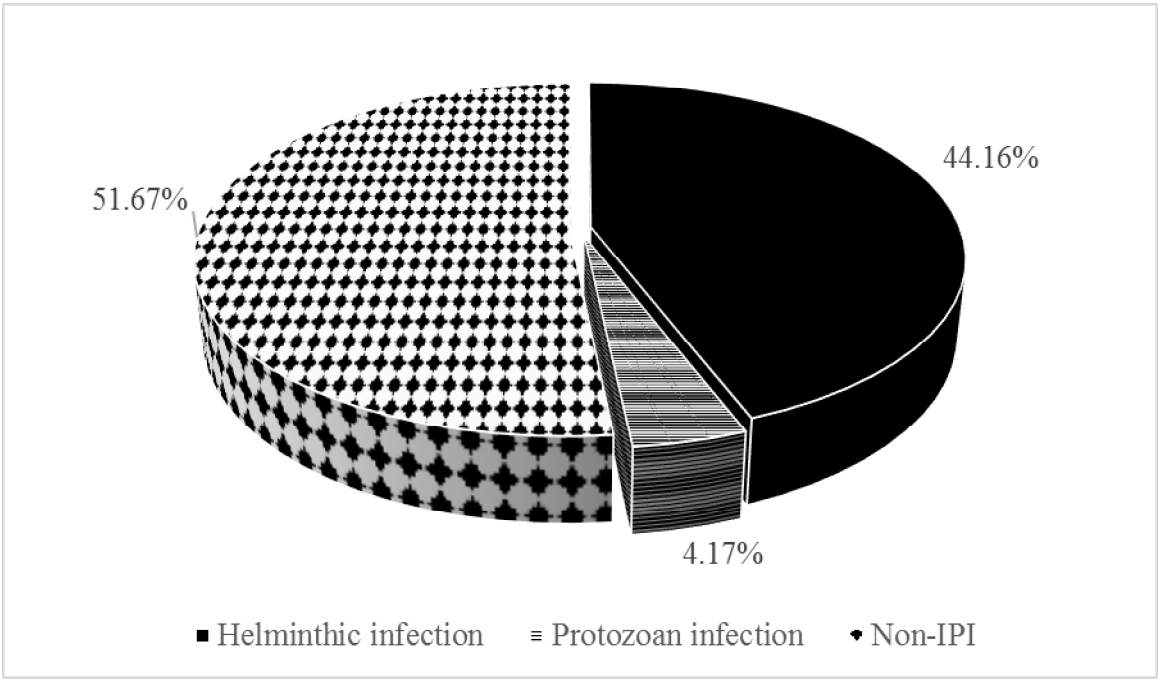

Figure 3 General prevalence of intestinal parasites.

4.1.2Sex-wise prevalence of intestinal parasites

In total of 120 samples, 47 were of males and 73 were of females. Out of 47 samples examined from male, 22 (46.81%) were found to be positive. Similarly, out of 73 samples examined from female, 36 (49.32%) were found to be positive. Hence, infection rate was found higher in female than in male. Statistically, there was not significant difference in the prevalence of intestinal parasites between male and female (χ^2=0.00657, df=1, p=0.9354).

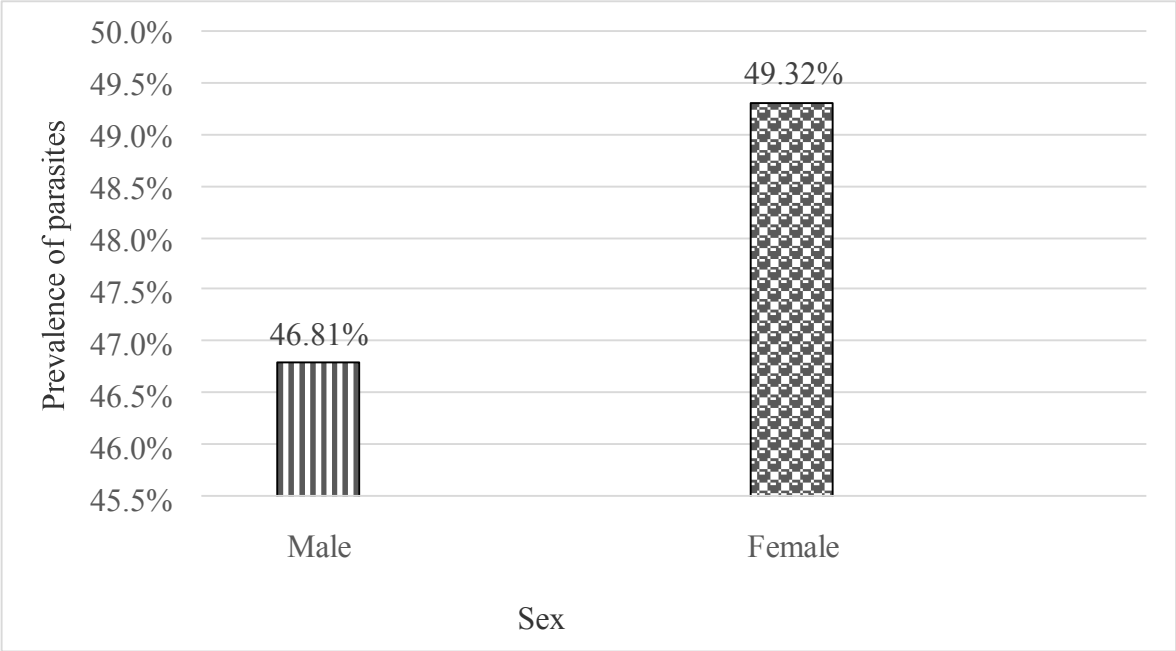

Figure 4 Sex-wise prevalence of intestinal parasites

4.1.3Age group wise prevalence of intestinal parasites

The study population was divided into 5 different age groups i.e. 60-70, 70-80, 80-90, 90-100 and 100-110. Out of which the occurrence of intestinal parasites were maximum 3 (100%) in age group of 100-110 and minimum 14 (33.33%) in 60-70 years age group. Statistically, it was found that there was significant difference in the prevalence of intestinal parasites (χ^2=11.422, df=4, p=0.02221).

Table 1. Age-wise prevalence of intestinal parasites

S.N.	Age (years)	Total no. of samples	Positive cases	Positive %
1	60-70	42	14	33.33
2	70-80	38	17	44.74
3	80-90	33	21	63.64
4	90-100	4	3	75
5	100-110	3	3	100
Total		120	58	

4.1.4 Prevalence of individual intestinal parasites

Out of 120 stool samples examined, four intestinal parasites were identified with highly prevalence of *A. lumbricoides* followed by hookworm, *E. coli* and *T. trichiura.*

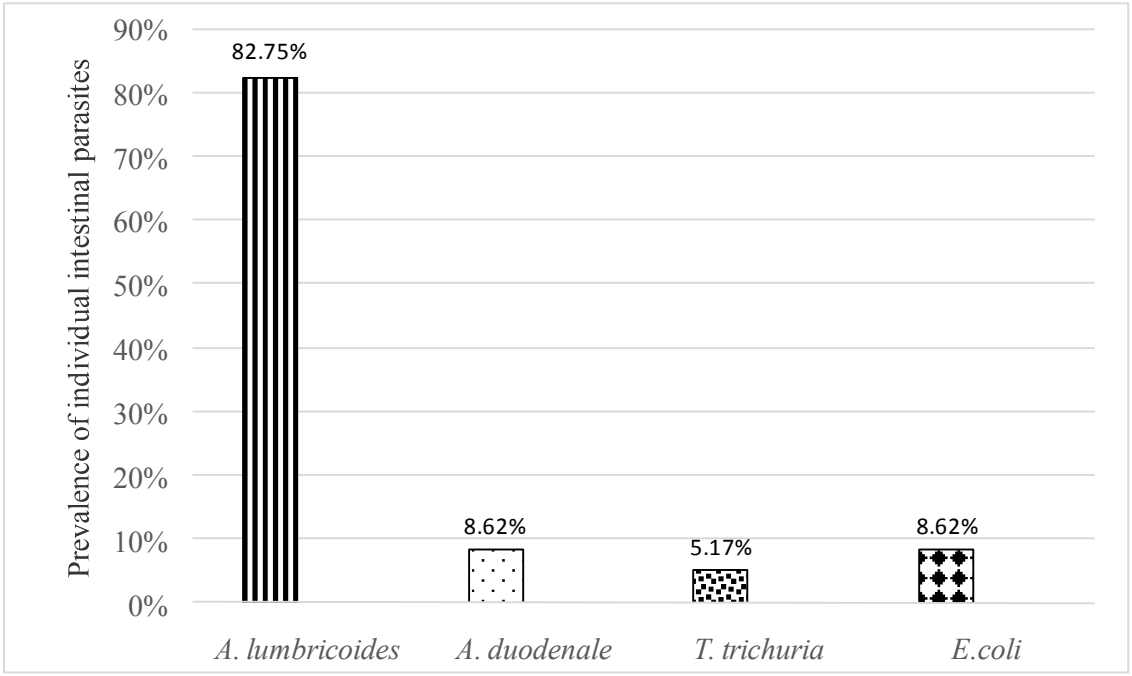

Figure 5 Prevalence of individual intestinal parasites

4.1.5 Concurrency of intestinal parasites

Out of 58 (48.33%) positive samples, 55 (45.83%) samples were found to have single infection whereas only 3 (2.5%) samples were detected to have double infection.

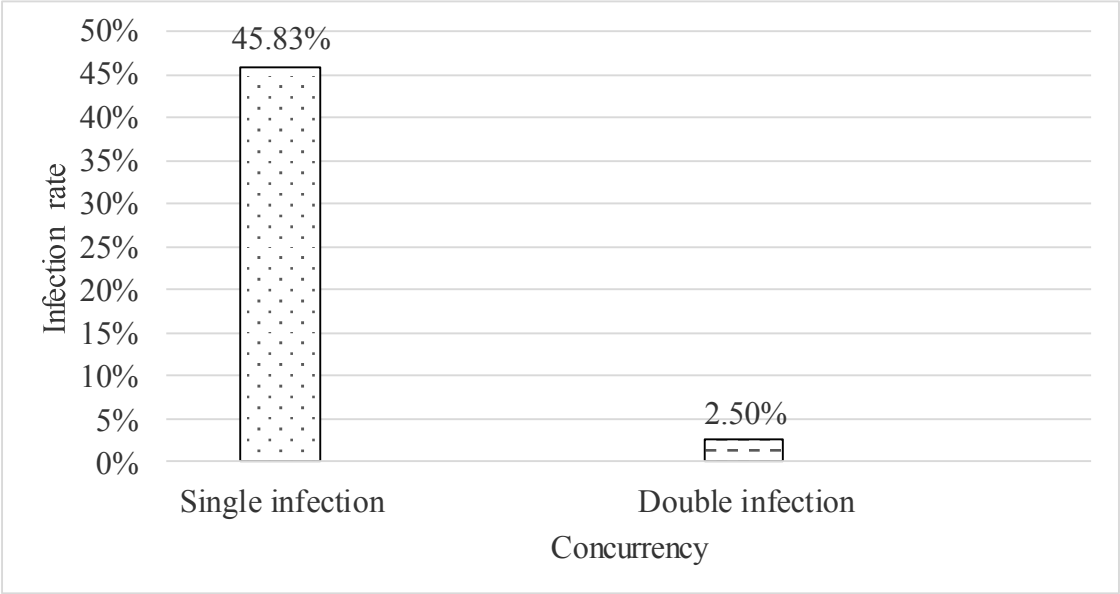

Figure 6 Concurrency of intestinal parasites

4.1.6 Prevalence of intestinal parasites on the basis of habitat.

A total of 45, 30 and 45 samples were taken from people inhabiting in kuti, old age home and local inhabitants respectively. Within which 20 (44.44%) from Kuti, 18 (60%) from old age home and 20 (44.44%) from local inhabitants were found infected. Statistically, there was not significant difference in parasitic infection between elderly people living in different places (χ^2=2.1802, df=2, p=0.3362).

Table 2. Prevalence of intestinal parasites on the basis of habitat

S.No.	Habitat	Total respondents	Male infected	Female infected	Positive cases (%)
1	Kuti	45	9	11	44.44
2	Old age home	30	5	13	60.00
3	Local inhabitant	45	8	12	44.44

4.1.7 Prevalence of intestinal parasites as person in a room

From the survey it was known that 15 people lived single, 84 people lived with partner i.e. 2 people in a room, 5 people lived sharing a common room and 16 people lived in two rooms with 8 people in each. Out of them, people living in a group of 8 were found to be highly infected (68.75%). Statistically, there was not significant difference between the infection rate and person sharing room (χ^2=3.5778, df=3, p=0.3108).

Table 3. Prevalence of intestinal parasites (Number of persons per room)

S.No.	No. of persons per room	Total Persons	Infected	Infected %
1	Single	15	7	46.67%
2	2 persons	84	37	44.05%
3	5 persons	5	3	60%
4	8 persons	16	11	68.75%
	Total	120	58	

4.1.8 Intensity

Among the total positive samples many of them were recorded with mild infection which showed 1-5 eggs per field of slide.

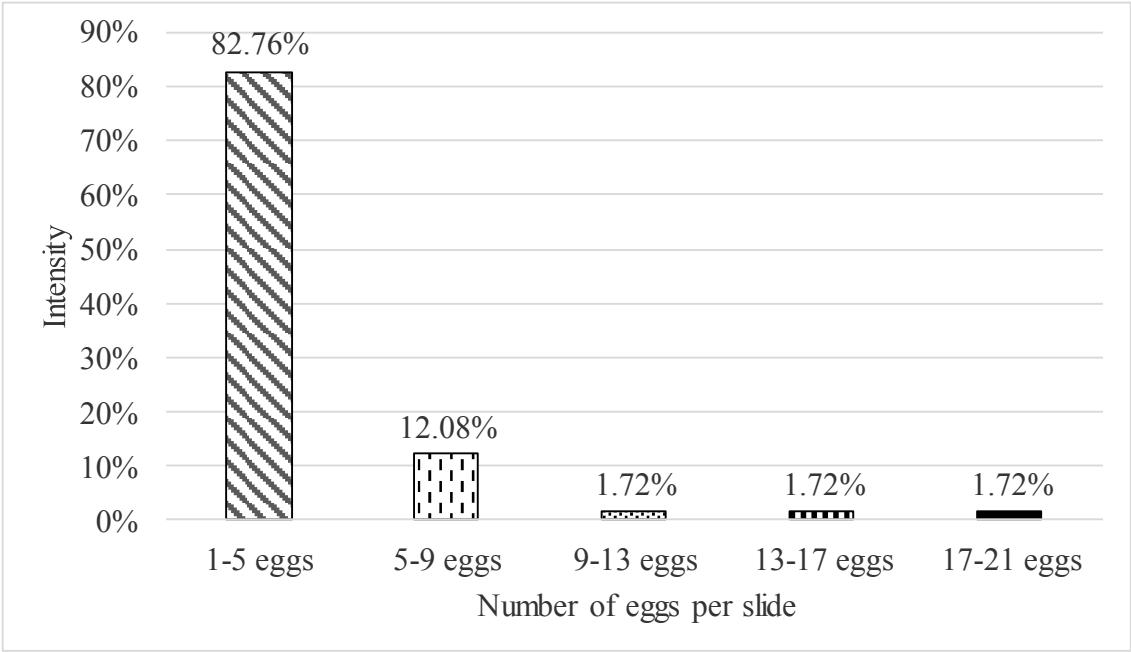

Figure 7 Intensity of eggs

4.2 Results of Questionnaire Survey Analysis

4.2.1 Knowledge of interviewed people

Elderly people were interviewed to know the level of their awareness on the basis of parasitic infection, knowledge of the transmission, control and prevention of the parasites. 101(84.17%) respondents were unaware and 19(15.83%) were aware. Male were more aware 14(29.79%) then female 5(6.85%).Statistically, there was not significant difference in parasitic infection rate and literacy among elderly (χ^2=0.7095, df=1, p=0.3996).

Table 4. Knowledge of parasites among elderly people and their infection rate

S.No.	Sex	No. of respondents	Aware			Unaware		
			No.	Infected no.	Infected %	No.	Infected no	Infected %
1	Male	47	14	5	35.71	33	17	51.52
2	Female	73	5	2	40.00	68	34	50.00
	Total	120	19	7	36.84	101	51	50.50

4.2.2 Handwashing wise prevalence of intestinal parasites

Out of 120 respondents, the prevalence of parasitic infection was found to be maximum 2 (66.67%) in those people who used only water as cleaning agent and minimum 51(46.78%) in those who used water and shop as cleaning agent. Statistically, there was not significant difference in prevalence of intestinal parasitic infection among different agent for cleaning of hands (χ^2=1.1508, df=2, p=0.5625).

Table 5. Handwashing wise prevalence of intestinal parasites

S.N.	Agent	Observation no	Positive cases	Positive %
1	Water only	3	2	66.67
2	Water and Soap	109	51	46.78
3	Water and Ash/Mud	8	5	62.5
	Total	120	58	48.33

4.2.3 Food habit wise prevalence of intestinal parasites

From the total respondents, 33 people living within family setup were known to be non-vegetarians. They were found to be highly infected 19 (57.57%) with intestinal parasites revealing the high risk of infection among them. On the contrary, 39 (44.83%) vegetarians were found infected. Statistically, there was not significant difference between the feeding habit and prevalence of intestinal parasites (χ^2=1.0884, df=1, p= 0.2968).

Table 6. Food habit wise prevalence of intestinal parasites.

S.N.	Feeding habit	No. of respondent	Infected	Infected %
1	Vegetarian	87	39	44.83
2	Non-vegetarian	33	19	57.57
	Total	120	58	

4.2.4 Prevalence of intestinal parasites on the basis drinking water

Out of 120 stool samples, the prevalence of parasitic infection was found to be maximum 17(54.84%) in people using water directly from tap whereas minimum 16(45.71%) in those using boiled water. Statistically, there was not significant difference among people applying different methods for purifying drinking water (χ^2= 0.71122, df=2, p=0.7007).

Table 7. Prevalence of intestinal parasites on the basis of drinking water

S.N.	Method of purification	No. of respondent	Infected No.	Infected %
1	Direct (No Purification)	31	17	54.84
2	Boiled	35	16	45.71
3	Filtered	54	25	46.30
	Total	120	58	

4.2.5 Livestock and domestic animals ownership wise prevalence of intestinal parasites

Most of the interviewed respondent 83 (69.17%) out of 120, didn't rear any livestock whereas 37 (30.83%) had domestic animals mainly cows, buffaloes, goats and poultry. Respondents with domesticated animals belonged to the community. The prevalence was found higher 21 (56.73%) among the people who had livestock and domestic animals while 37 (44.57%) was found in peoples who didn't have livestock and domestic animals. There was not significant difference in between the prevalence of intestinal parasites and livestock ownership (χ^2=1.0714, df= 1, p= 0.3006).

Table 8. Livestock and domestic animals ownership wise prevalence of intestinal parasites.

S.N.	Animal husbandry	Observation no.	Positive cases	Positive %
1	Having domestic animals	37	21	56.73
2	Not having domestic animals	83	37	44.57
	Total	120	58	

5. DISCUSSION

Human parasitic infection is a global problem with wide variation in intestinal parasite from region to region, different geographical areas, communities and ethnic group's even seasonal variation are also known (Tedla, 1986). Intestinal parasitic infection is still an important cause of morbidity and mortality in the developing world (Tanowitz *et al*.,2001). Little is known about the prevalence of IPI in elderly people as most studies have been conducted on school-aged children. In this context the overall prevalence of intestinal parasitic infection in the present study, carried out among elderly people of Devghat, Tanahun, Nepal was found to be 48.33%. This result showed agreement with other published reports by (Oliveira *et al*., 2003; Gyawali, 2012; Kipyegen *et al*., 2012; Nyantekye *et al*., 2014; Poudel *et al*., 2014; Mishra and Tripathi, 2016). Somewhat this result is higher than finding of (Gunduz *et al*., 2005; Shakya *et al*., 2006; Duedu *et al*., 2015; Chongbang *et al*., 2016; Dudlova *et al*., 2016; Rop *et al*., 2016; Sapkota *et al.*, 2016; Tiwari *et al*., 2018). However, this result was comparatively lower than (Amuta *et al*., 2010; Khanal *et al*., 2016; Yadav and Prakash, 2016). This differences might be due to sample size, place, health awareness, and living standards of people and examination techniques.

The prevalence of helminthes 44.16% was found to be higher than that of the protozoan 4.17%. This finding is in accordance with the results of similar studies carried in different parts of Nepal, (Gyawali, 2012; Poudel *et al*., 2014) and elsewhere (Elias *et al*., 1997; Dudlova *et al*., 2016). On the contrary, higher prevalence of protozoan was reported in other studies from Nepal (Agrawal *et al*., 2012, Sah *et al*., 2013; Sapkota *et al.*, 2016; Baral *et al*., 2017) and elsewhere (Matthys *et al*., 2011; Erisman *et al.*, 2016; Santos *et al*., 2017; Asires *et al*., 2019). Among the helminth parasites *A. lumbricoides* was the most common observed parasites. Same result was also seen in past studies (Onuoha, 2009; Duc, 2013; Poudel *et al*., 2014; Gonclaves *et al*., 2016; Dhital *et al*., 2016; Jaisawal *et al*., 2016; Asires *et al*., 2019). But study of Kumal community of Gaidakot (Gyawali, 2012) and South India (Praharaj *et al.*, 2017) showed hookworm as the most prevalent helminths. This might be due to the unhygienic behavior, over dispersion of *Ascaris* egg in the environment as adult female worms are very fertile and frequent contact with soil. However, not taking deworming tablets in regular basis was also playing the supportive role for higher prevalence of helminths over protozoan.

This study showed the trend of infection among elderly was in increasing order with the increase of age. Apart from this, the study highlighted that there was no association between age and parasitic infections. This findings were identical with the studies of Kenya (Kipyegen *et al*., 2012, Kimosop *et al*., 2018). But the studies by (Singh *et al*., 2013; Diongue *et al*., 2017; Santos *et al*., 2017) showed the distinct result. This might be due to decrease in immunity power with increase in age, less able to maintain personal hygiene and cleanliness of their surroundings. Gender-wise parasitic infection rate was slightly higher in female which is comparable with studies done by (Shrestha *et al*., 2007; Gyawali, 2012; Kipyegen *et al*., 2012; Poudel *et al*., 2014; Jaisawal *et al*., 2016; Sapkota

et al., 2016; Diongye *et al*., 2017; Nyundo *et al*., 2017; Forson *et al*., 2018; Tiwari *et al*., 2018). But the result contradicts with (Agrawal *et al*., 2012; Duedu *et al*., 2015; Rop *et al*., 2016; Yadav and Prakash, 2016; Baral *et al*., 2017). All these studies showed no significant association between gender and parasitic infections. Involvement of female in childcare, their lower educational status, more soil contact during growing vegetables more often than males is responsible for increased risk in them. Moreover, this possibility could be due to higher number of female respondents involved in the study.

In the present study of the infected elderly, 45.83% showed mono-parasitism and 2.5% with bi-parasitism. Other studies conducted both in geriatric and community in Nepal (Agrawal *et al*., 2012; Shrestha, 2013; Tiwari *et al*., 2018) and elsewhere in world (Nyantekyi *et al*., 2014; Mishra and Tripathi, 2016; Dafalla *et al*., 2017) was in agreement with it. But in contrary, multi-parasitism was seen higher in Fujian Province (China) in 1998 and lower in the same place in 1999 (Feng *et al*., 2001). However, rates of mono-parasitism and multi-parasitism were found to be independent of the gender of the elderly people (Shakya *et al*., 2006).The highest parasitic infection rate was found in government elderly home than community and "Kuti". This finding matched with the study done among elderly of Kathmandu Valley (Mishra and Chalise, 2018; Shakya *et al*., 2006). Crowdedness, level of sanitation and degree of care provided by caretaker might be the risk factors. The IPI in community as well as "Kuti" was closer to that of government elderly home. This reflected the poor living status of elderly in Nepal.

Overall 84.17% were unware about the cause, symptoms, prevention and control of IPI. The result was alike with the several studies done in Nepal (Sah, 2012; Yadav, 2014; Pandey *et al*., 2015). Similarly, with the study of Ethiopia among community members by Nyantekyi *et al*., 2014. This showed knowledge of parasitic infection was very poor among elderly due to illiteracy and public health awareness. Generally, consuming water without treatment for drinking purpose had higher prevalence rate 54.84% (Bhandari *et al.*, 2011) also stated that the use of unboiled water resulted high prevalence of parasitic infection. Studies done by Kipyegen *et al*. (2012), Girrotto (2013) and Fiez-Haded *et al*. (2016) showed direct association between source of water and IPI. Higher possibility of getting infection might be due to contaminated water sources, improper water treatment, handling and storing method at home. The infection was found higher 54.84% among those people who used only water as cleaning agent which seemed similar to that of Regmi (2012), Yadav (2014), Sah *et al*., (2016), Yadav and Prakash (2016). This might be due to the lack of health awareness and health education.

Infection rate was higher 56.73% in people rearing livestock. This result was comparable with Yadav (2014), Oli (2016) who also reported high prevalence in people having livestock. This might be due to the insufficient sanitary conditions, lack of personal hygiene and having nearby livestock. The present study showed the prevalence of intestinal parasites was greatly influenced by feeding habits. Among total respondents 57.57% were positive for non-vegeterians. This result was in agreement with other studies (Pokharel, 2005; Kandel, 2008; Adhikari, 2009; Pandey *et al*., 2015). However, Maharjan (2004) showed that distribution of intestinal parasites was independent of food habits. Culture and traditions of different castes and ethnic groups are responsible factors for the

prevalence of intestinal parasites. The prevalence of intestinal parasites among elderly of Devghat, Tanahun district reflects the need of public health awareness programs regarding personal hygiene, proper environmental sanitation, using safe water. Continuous mass deworming programs should be launched from time to time.

6. CONCLUSION AND RECOMMENDATION

6.1 Conclusion

Infections of parasites are closely related to hygiene and sanitary condition. This study highlights that health status of elderly is still very pitiable. The overall prevalence of intestinal parasites was recorded to be 48.33% with highest positive rate in government run elderly home (60%). Helminths infection were predominance to protozoan infection. Out of four species of parasites identified, *A. lumbricoides* was the most common parasite. IPI was highest among age group 100-110. Slightly higher infection was seen in female than in male. The study revealed that mono-parasitism was higher than bi-parasitism. There was significant difference in the prevalence of intestinal parasitic infections regarding age where insignificant difference was with sex, habitat, knowledge, handwashing habit, food habit, and drinking water wise and rearing livestock. This study reflected that elderly people don't get sufficient care from their family. Due to physical weakness, insufficient sanitary practices, decreased immune system and lack of awareness they were more likely to get infected with intestinal parasites. Thus it is very necessary to conduct awareness programs to uplift their knowledge level about diseases and the importance of healthy practice. Not only that, government should conduct health camps time to time along with mass treatment for the effective control.

6.2 Recommendations

Based on conclusion, it was recommended that:

- Basic health education program regarding knowledge of health and hygiene should be launched from time to time.
- Proper use of toilet, having proper treated drinking water, preferring fresh and clean foods, maintaining well hygienic conditions are recommended.
- Proper health education should be given to the caretaker since, transformation and persistence of intestinal parasitic infection are majorly influenced by human behavioral activities.
- Molecular study of the parasites should be done.

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ANNEX-1

Photographs

Photograph 1: Adjusting slide under microscope

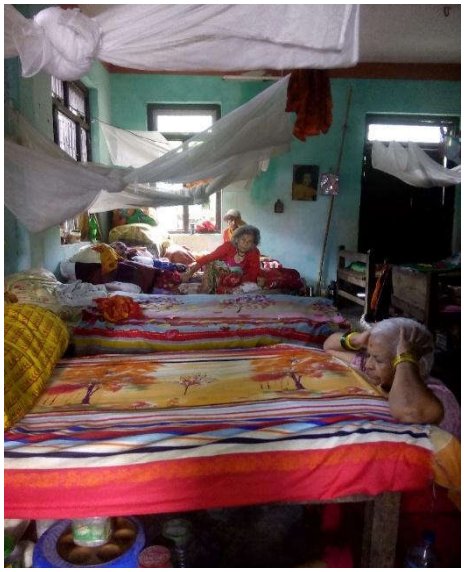
Photograph 2: Examining under microscope

Photograph 3: Researcher filling up questionnaire form interviewing the respondent

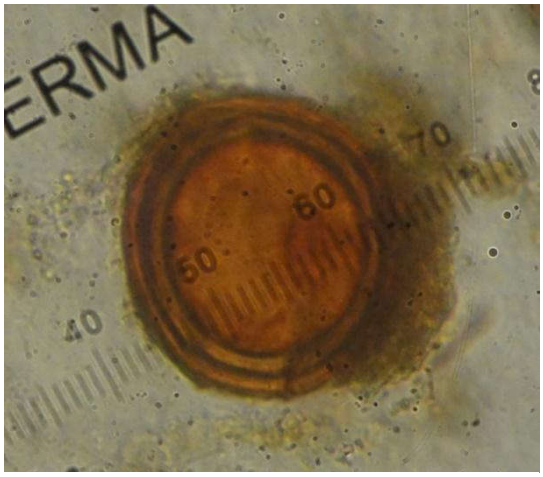
Photograph 4: Researcher instructing about sample collection in vial

Photograph 5: Researcher with the members of old age home

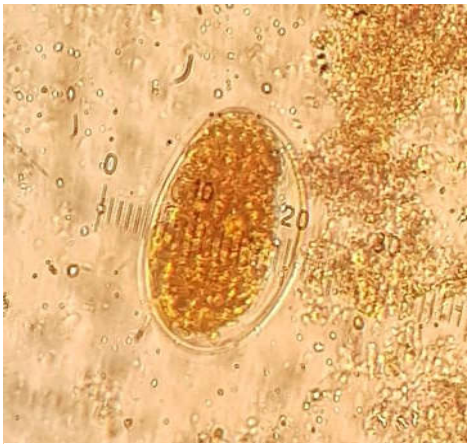
Photograph 6: Condition of Kuti in Devghat



Photograph 7: Bedrooms in old age home

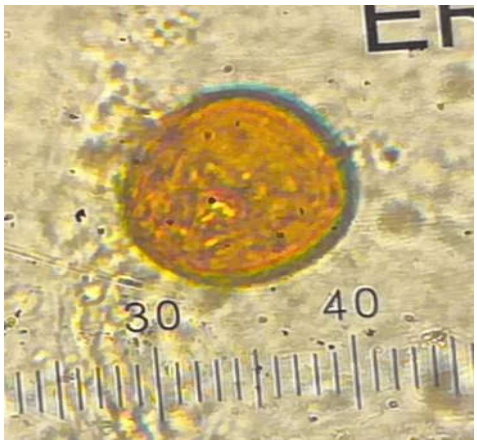


Photograph 8:*Ascaris lumbricoides*



Photograph 9: Hookworm

Photograph 10: *Trichuris trichiura*



Photograph 11: *Entamoeba coli*

ANNEX- 2

Questionnaires

S.No:

Name of the respondent: Address:

Date: Age: Gender:

1. Are you literate?

a. Yes b. No

2. How many person share a room? .....

3. Where do you go for defecation?

a. Toilet b. Open field c. Others

4. Do you wash your hands after defecation?

a. Yes b. No c. Sometimes

5. Where do you get drinking water from?

a. Tap b. River c. Others

6. How do you use water?

a. Direct b. Boiled c. Filtered

7. Do you have separate water supply for drinking, washing, bathing and cooking?

a. Yes b. No

8. When do you wash hands?

a. Before meal b. After doing household work c. Both of them

9. What do you use to clean hands?

a. Water only b. Water and shop c. Water and ashes

10. How do you prepare your meal?

a. Yourself b. Collectively c. Staffs of the old age home

11. Do you have animal husbandry?

a. Yes b. No

If yes, what? .....

12. Do you wash raw food which you eat?

a. Yes b. No

13. Do you know any disease caused due to lack of sandal?

a. Yes b. No

14. Have you taken deworming tablets before?

a. Yes b. No

If yes, when?

a. 1 week before b. 1 month before

c. 6 months before d. Don't know

15. What type of way you apply in case of infection?

a. Traditional methods *(Dhami)* b. Direct taking medicines

c. Ayurvedic medicine d. Consult doctors

16. Do you know the causes of diarrhoea?

a. Yes b. No

If yes, what are they?

……

17. Do you know the methods of prevention of worm infection?

a. Yes b. No

If yes, what are they?

……

Name of the interviewer:

Date:

ANNEX- 3

Identification keys for eggs and cyst of parasites found:

Name of parasites	Measurement of eggs and cyst (in µm)		Morphological characters	References values (Arora and Arora, 2012; Chatterjee, 2013)
	Length	Breadth		
Trichuris trichiura	50	22	Double shelled brown in color, barrel shape with two mucous plugs.	50-55µm ×22-25 µm
Ascaris lumbricoides	-	48	Round or oval in shape, brownish in color, surrounded by thick shell.	60-75 µm ×40-50 µm
Hook worm	55	35	Oval in shape, surrounded by transparent cell membrane, contain segmented ovum.	55-65 µm ×35-40 µm
Entamoeba coli	-	25	Cyst is colorless, round or oval shape, surrounded by smooth cyst wall.	15 µm ×25µm