PREVALENCE OF PINWORM (*Enterobius vermicularis*) AND OTHER INTESTINAL PARASITES AMONG THE PRIMARY LEVEL CHILDREN OF GOVERNMENT SCHOOL, CHHAMPI, LALITPUR

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Submitted To

Central Department of Zoology

Institute of Science & Technology

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Kirtipur, Kathmandu Nepal

November, 2017

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 the sources of information have been specifically acknowledged by references to the author(s) or institution(s).

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This is to recommend that the thesis entitled "**PREVALENCE OF PINWORM (*Enterobius vermicularis*) AND OTHER INTESTINAL PARASITES AMONG THE PRIMARY LEVEL CHILDREN OF GOVERNMENT SCHOOL, CHHAMPI, LALITPUR**" has been carried out by **Karuna Khadka** 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 institutions.

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LETTER OF APPROVAL

On the recommendation of supervisor "**Dr. Mahendra Maharjan**" this thesis submitted by **Karuna Khadka** entitled "**PREVALENCE OF PINWORM (*Enterobius vermicularis*) AND OTHER INTESTINAL PARASITES AMONG THE PRIMARY LEVEL CHILDREN OF GOVERNMENT SCHOOL, CHHAMPI, LALITPUR**" is approved for the examination and submitted to 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

This thesis work submitted by **Karuna Khadka** entitled **"PREVALENCE OF PINWORM (*Enterobius vermicularis*) AND OTHER INTESTINAL PARASITES AMONG THE PRIMARY LEVEL CHILDREN OF GOVERNMENT SCHOOL, CHHAMPI, LALITPUR"** has been accepted as a partial fulfillment for the requirements of Master's Degree of Science in Zoology with special paper **Parasitology.**

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LIST OF ABBREVATIONS

Abbreviated form	Details of abbreviations
CDZ	Central Department of Zoology
CBS	Central Bureau of Statistics
WHO	World Health Organization
VDC	Village Development Committee
TU	Tribhuvan University
et al	and his associates
χ^2	Chi-Square
P-value	Probability Value
IPI	Intestinal Parasitic Infection
KAP	Knowledge, Attitude and Practices
No.	Number
Yrs	Years

ABSTRACT

Enterobius vermicularis is worldwide in distribution and a major health problem specially among children of developing countries including Nepal. *E. vermicularis* is detected from perianal region rather than stool sample whereas other intestinal parasites can be collected from stool sample. The present study was carried out to determine the prevalence of *E. vermicularis* along with other intestinal parasites in the primary level children aged between 2-13 of Shree Chhampi Devi Higher Secondary School, Chhampi, Lalitpur, Nepal. A total of 107 scotch tape (cellophane tape) samples along with stool samples were collected for detection of *E. vermicularis* and other intestinal parasites. Microscopic examination was conducted for the identification of parasites. Among them, *E. vermicularis* infection was observed in 10.28% of children with almost equal prevalence in both male and female. Age wise high prevalence was found among the age group 5-7 yrs old (4.67%). The infection rate was not significantly associated with ethnic group (P=0.17), since the prevalence rate was highest in Janajati children (54.54%) compared to others. Itching behavior and nail biting behavior were significantly associated with the prevalence rate of *E. vermicularis* (P=0.01, P=0.023) respectively. Other intestinal parasites by stool examination revealed five different species of intestinal parasites. Among them, *E. coli* (27.66%) was the most prevalent protozoan parasite while in case of helminthic parasites, *Ascaris lumbricoides* (51.06%) was most prevalent followed by *Trichuris trichiura* (8.51%), *Taenia solium* (6.38%) and Hookworm (6.38%).The prevalence rate of intestinal parasites showed the significant association with ethnic groups (P=0.00102), knowledge of parents and attitude. Similarly, there were significant association with cleaning vegetables (P=0.015), nail cutting habit (P=0.0001) and use of antihelminthetic (P=0.028). Thus, IPI is still a major health problem among primary level school children and it should be regarded as public health and awareness, sanitation and hygiene practices should be improved.

1. INTRODUCTION

1.1 Background

Enterobius vermicularis is commonly known as pinworm, is a common nematode parasite among children. Pinworm infection (enterobiasis, syn. oxyuriasis), though not usually dangerous remains one of the commonest parasitic infection (Cadwell, 1992). The disease is typical of cosmopolitan communities, particularly those with a high concentration of infants, is found predominantly in the low or social classes with a poor socio-economic and and hygiene level (Habbari *et al.*, 2000). It is estimated that 200 million people are infected worldwide (WHO, 1987). Due to its contagious nature, enterobiasis tends to occur more among large families and institutions such as schools, hostels and asylums especially with crowded conditions (Brooker and Bundy, 2009).

The pinworms are typically reside in the caecum, appendix and distal ileum, where they adhere to the mucosa. Although many infections are asymptomatic, perianal itching, especially at night, is the most common symptom (Russel, 1991). The most prominent symptom of the disease resulting itching, particularly at night, restlessness and insomnia are common and and sometimes gastrointestinal symptoms such as abdominal pain, nausea and diarrhea are also present (Lagasse *et al*., 2008). Pinworm eggs can be transmitted to the other children family members and items in the house (Kliegman *et al*., 2007). The principle mode of transmission of *E. vermicularis* is direct contact between infected and uninfected persons (Patsantara *et al*., 2016).

In children, nervousness, insomnia, nightmares and even convulsion have been attributed to enterobiasis (Shoup, 2001). Continual scratching by the patients to the perianal area may injure skin and cause secondary bacterial infections (Quasem and Salam, 2007). Disease secondary to *E. vermicularis* is relatively innocuous, with egg deposition causing perneal, perianal and vaginal irritation (MacPerson, 1999). Rarely, more serious disease can result, including weight loss, urinary tract infecion and appendicitis (Saxena *et al*., 2001, Dickson *et al*., 2003). It is difficult to detect *E. vermicularis* eggs in stool because they are detectable only in approximately 5% of the cases (Chu *et al*., 2012). Swabbing needs to be done at night to coincide with oviposition or first thing in the morning prior to washing or cleaning the perianal region (Brooker and Bundy, 2009). Definite diagnosis of *E. vermicularis* is made based on detecting mature parasites in stool but the most efficient one is the cellophane tape technique by which 99% of positive cases can be detected (Lee *et al*., 2000). Continuous monitoring of infection rates is key to successful disease control (Kang *et al*., 2006).

1.2 General Intestinal Parasites

Intestinal parasitic infection along with enterobiasis is highly prevalent throughout the developing countries of the world. It is common among the people with low personal and environmental hygiene and low socio-economic class. They are acquired by ingestion, inhalation of parasitic oocyst or eggs and penetration of skin by infective form of larvae. The intestinal parasitic infections are among the most common infections of school are children in developing countries (Alborico *et al*., 1999). They are important threats to healthy living in developing countries (Kia *et al*., 2008). These infections are most common in school children and lead to nutritional deficiency, anemia, growth retardation and impaired learning ability (Baragundi *et al*., 2011).

It is estimated that about 3.5 billion people in the globe are affected while 450 million are ill as a result of intestinal parasitic infections, the majority being children (WHO, 2000). The most common intestinal parasites includes: *Entamobea coli, Entamobea histolytica, Giardia lamblia, Hymonelopis nana, Ascaris lumbricoides, Ancyclostoma duodenale, Trichuris trichiura, Strogyloides stercoralis* etc. School children are the prime victims of intestinal parasitism that affect their physical development, school attendance and ability to learn (Jash *et al*., 2007). Epidemiological researches in different countries have shown that socio-economic, sanitary and environmental conditions are important underlying causes in the endemicity of parasitic infections (Bakr *et al*., 2009, Steehard *et al*., 2009).

1.3 Objectives

1.3.1 General objective

To determine the prevalence of *E. vermicularis* and other intestinal parasites among the primary level children of government school of Chhampi, Lalitpur district, Nepal.

1.3.2 Specific objectives

i. To determine the prevalence of *E. vermicularis* among the primary level children of government school of Chhampi, Lalitpur.

ii. To determine the prevalence of other intestinal parasites among those children.

iii. To assess the knowledge, attitude and practices (KAP) regarding the enterobiasis and other parasitic infection.

1.4 Significance of the study

Most of the developing countries including Nepal have a major health problem particularly *with E. vermicularis* and other intestinal parasites especially among the children . Although, sufficient information are available for intestinal parasitic infection, information regarding enterobiasis is still not sufficient. For these reason, *E. vermicularis* and other intestinal parasites research has become important to decrease the parasitic infection. In addition to it, people's ignorance, illiteracy, poor sanitary conditions, hygiene and food habit of children are directly related to the parasitic infections among the children. So that present study was carried to determine the status of *E. vermicularis* and other intestinal parasitic infection among school children and to assess the knowledge, attitude and practices in relation to *E. vermicularis* and other intestinal parasites. The result will provide the baseline scenario of intestinal parasitic infection along with enterobiasis among the school children of Chhampi, Lalitpur, which will ultimately help to formulate control plan strategy in future.

2. LITERATURE REVIEW

2.1 Global context

E. vermicularis

Enterobiasis is a common parasitic disease reported highly among children. The prevalence of *E. vermicularis* infection among children has been reported in many parts of the world, with infection rates varying considerably, depending on the sex, age groups and localities studies. The most infected groups are children living in crowded environment with hygiene and exposure being important factors (Cook, 1994).

The infection is more prevalent in cool and temperate zones where people tend to bath less often and change their underclothes less frequently (Garcia and Bruckner, 1993). Positivity of scotch tape anal swab for ova of *E. vermicularis* is a very important landmark and tool evaluating the epidemiological characters of pinworm infecting a community and clinical diagnosis of infected individuals since other comparable techniques are not commercialized yet (Cruz *et al*., 2013).

Several studies have shown that *E. vermicularis* along with other intestinal parasitic infection from various countries. Pinworms are the most common helminth infection in The USA and Western Europe, with prevalence rates in some communities of as high as 30-50% (Burkhart and Burkhart, 2005). The overall prevalence of enterobiasis has been reported very high 42% from aged between 5-14 yrs from Peru (Gilman *et al*., 1991), Chile (Mercado *et al*., 1996) i.e. 35.2% and Argentina (Pezzani *et al*., 2004) i.e. 41.42%. Similarly, Devera *et al*., (2006) reported 91.1% prevalence among students aged 5-14 in Ciudad Bolivar, Venezuela. Gamboa *et al*., (2011) showed that enterobiasis infection is correlated with nutritional status and socio-economic environmental conditions in children.

E. vermicularis has been reported from various countries of European continent like Turkey, Sweden, Italy etc (Artan *et al.,* 2008, Herrstrom *et al.,* 1997 and Celiksoz *et al*., 2010). *E. vermicularis* infection was found high (33%) among 4-6 yrs children of both sex with positive association to that of their finger sucking behavior in Sweden (Herrstrom *et al*., 1997). Gualdieri *et al.,* (2011) reported 0.4% of *E. vermicularis* along with other intestinal parasites among 514 immigrants in South Italy whereas 10.1% of prevalence was reported in primary school children in Turkey (Aksoy *et al.,* 2007). Enterobiasis among preschool children was 5.1% and the association between family size, household income, education level of the parents, employment status of the mother and enterobiasis were found to be significant in Turkey (Artan *et al*., 2008). Celiksoz *et al*., (2010) studied the effects of enterobiasis on primary school children with prevalence 10.5% which also showed prevalence rate high in male (53.8%) than in female (46.2%) in Sivas of Turkey. In Turkey, oxyuriasis was observed among 10.4% of children and was significantly associated with residential structure, number of rooms in house, parent's educational level and student's social status (Yazgan *et al*., 2015). In a study conducted in

Norway, 18% of children developed *E. vermicularis* infections, most of whom were age 6-11 yrs (Boas *et al*., 2012).

E. vermicularis infection is highly prevalent in African continent due to the poverty and poor personal hygiene. Alo *et al*., (2011) in Nigeria examined the eggs of *E. vermicularis* in the finger nail of primary school children and claimed that finger nails were the source of transmission of intestinal parasites including *E. vermicularis*. Similarly, in same country perianal itching was shown to be correlated with enterobiasis (Out-Basseg *et al*., 2011). A high prevalence of enterobiasis has been reported from Qwa- Qwa, South Africa (Mosala and Appleton, 2003). *E. vermicularis* was more prevalent among the agricultural worked school children and concluded that the problem of child labor is serious in rural part of South Africa (Kotb *et al*., 2011). Another survey in rural South Africa found 16.6% positive for helminth eggs along with *E. vermicularis.* Among those school children the most important risk factors of helmintiasis reported includes gender, toilet type used at home, and not reporting to wash hands with soap before eating were all associated with the presence of eggs on hands of school children (Cranston *et al*., 2015).

Enterobiasis has been reported from various countries of Asia. Nithikathkul *et al*., (2001) reported higher prevalence of *E. vermicularis* i.e. 38.7% among primary school students aged between 6-10 yrs in Samut Prakan Province of Thailand whereas another report showed 19.9% enterobiasis in other four provinces of Thailand (Bunchu *et al*., 2011). A higher rate of infection in boys than the girls was reported in Taiwan, Srilanka and Philippines (Chu *et al*., 2012, Feiz *et al*., 2013 and Cruz *et al*., 2013). While Al-Shadood (2015) studied the association between *E. vermicularis* infection and enuresis among children in A-Najaf city, Iran showed the infection rate (37.89%) higher in females than males. Similarly, eggs positive rate of primary school children in Geoje island, Korea was 9.8% with higher prevalence in female than male (Kim *et al*., 2003). Similarly, the prevalence of enterobiasis has been reported high in female (73.69%) than in male (32.38%) in Iran (Nourazian and Youssefi, 2011). However, the prevalence of enterobiasis has been reported higher in boys than that of girls in Korea (Park *et al*., 2005, Lee *et al*., 2011).

In relation to age group, a higher prevalence of *E. vermicularis* has been reported in 5-7 yrs children of rural area of Malaysia with insignificant association in terms of age and gender (Cruz *et al*., 2013). High prevalence of enterobiasis was reported among 5-10 yrs in Bangkok metropolis i.e. 38.59%. (Nithikathkul *et al*., 2001). The prevalence of enterobiasis has been reported higher in school children (29.5%) than the preschool children (21.51%) in Iraq (Kadir and Amin, 2011). Similarly, the children of age group 6-10 yrs old has been reported more susceptible to enterobiasis followed by 11-15 yrs and 16-20 yrs old in Iraq (Raza and Sami, 2009).

The infection rate among preschool children in kindergartens was 10.2% and the multivariate logistic analysis indicated that the bed management, education level of mothers, frequency of washing anus and private toilet were independent risk factors for *E. vermicularis* infection in Shenzhen, China (Kuang *et al*., 2015). Comparatively less

prevalence of enterobiasis has been reported in several previous studies in Iraq (Raza and Sami, 2009) i.e. 2.25%. Lee *et al*., (2011) showed the total prevalence of enterobiasis 10.5% in Korea and 5.9% among the children of aged between 6-12 yrs old in South Jordan (Ammoura, 2010).

Research articles reviewed by Moosazadeh *et al*., (2017) indicated that higher prevalence of enterobiasis exists in all age and sex group children of Iran. Thumb sucking, fingernail trimming, taking antihelmintic medication against enterobiasis, parents knowledge of enterobiasis was correlated significantly with the incidence of positive rates among kindergartens children in Busan, Korea (Kim *et al*., 2010). Enterobiasis among preschool children of Xinxiang city, Henan Province of Central China had reported to be 12.75% in 2003 and 5.13% after 10 yrs and among selected personal hygiene factors, hand washing before eating, sucking fingers or toys and scratching around the anus, were all associated with enterobiasis (Wang *et al*., 2016). Significant association of anal itching as well as nail chewing behavior of children have been shown in elderly and mentally retarded person of Iraq (Rasti *et al*., 2012). Forson *et al*., (2017) reported the statistically significant association between children infected with intestinal parasites and close proximity to domestic animals or pets was observed (P=0.0284).

Intestinal Parasites

Intestinal parasitic infection is mainly related to public health and personal hygiene. Infection is specially common among children in kindergartens and primary schools (Park *et al*., 2005). Intestinal parasitic infections are common in tropical and subtropical regions of developing countries (Baragundi *et al*., 2011). The parasitic infections among the school children showed correlated with poor hygiene and sanitary conditions of the schools in India (Sehagal *et al*., 2010). Over 270 million pre-school age children and over 600 million school age children live in areas where soil-transmitted helminth (STH) parasites are intensively transmitted, and are in need of treatment and preventive interventions (WHO, 2012).

Intestinal helminthes affect more than one-sixth of World's population (De Silva *et al*., 2003, Bethony *et al*., 2006 and Harhay *et al*., 2010) with children and pregnant woman at particularly high risk (Quihai *et al*., 2006, Harhay *et al*., 2010). About 12% of global disease burdens caused by intestinal parasites is observed among children with age ranges from 5 to 14 yrs in developing countries (Awasti *et al*., 2003). *Ascaris lumbricoides* is responsible for about 1.2 billion infections globally while *Trichuris trichiuria* and hookworm infection accounts about 759 million and 740 million respectively (Alum *et al*., 2010). The higher prevalence of intestinal infection was reported in Iran and Argentina (Tappeh *et al*., 2010, Gamboa *et al*., 2011). Parasitic infection was well correlated with their nutritional status and socio-environmental condition from a suburban of La planta, Argentina (Gamboa *et al*., 2011). Several research work have been carried out in Asia regarding the intestinal parasites. Various geo-helminths particularly, with *Ascaris lumbricoides* followed by *Hymonolepis nana*, *E. vermicularis*, Hookworm, Whipworm, Tapeworm etc has been reported from India, China, Iran etc in primary

school children (Wani *et al*., 2004, Wang *et al*., 2016, Bahmani *et al*., 2017). Among the reported soil-transmitted helminths, *Ascaris lumbricoides* has been reported with the highest prevalence from various studies (Auta *et al*., 2013, Wani *et al*., 2009, Wani *et al*., 2010). Ugochi *et al*., (2015) reported higher prevalence of *A. lumbricoides* (41.5%) followed by Hookworm (23.8%), *Trichuris trichiura* (1.2%), *Taenia solium* (1.2%), *Entameoba histolytica* (36.6%) and *Giardia lamblia* (1.8%) among primary school children in three geopolitical zones of Imo state, Nigeria. Lower maternal educational level and occupational status, low family income, big family size and poor personal hygiene practices increases the infections (Al- Mohammed *et al*., 2010). Similarly, the significant association between parents jobs and intensity of parasitic infection was reported among primary school children in Iran (Turki *et al*., 2017).

Despite of improved socio-economic conditions and elevated living standards, surprisingly it is still a public health problem even in developed countries, like United States (Merid *et al*., 2001). Intestinal parasites that remain prevalent in the United States include *E. vermicularis, G. lamblia, A. duodenale, Necator americanus* and *E. histolytica* (Kucikn *et al*., 2004). Research carried out in different countries has shown that the socioeconomic situation of the individuals is an important cause in the prevalence of intestinal parasites (Jamaiah and Rohelo *et al*., 2005). School children are always at the highest risk of acquiring parasitic infection due to their dirty habits of playing or handling infected soil, unhygienic toilet practices, drinking and eating of contaminated water and food (Nematian *et al*., 2004). A very high prevalence (61.6%) of IPI has been found in the children of rural villages with the highest prevalence of *A. lumbricoides* in Lucia (Kunup and Hunjan, 2010).

Several studies have been carried out about intestinal parasitic infection in African continent. In African school children, malnutrition associated to intestinal parasites is a common problem (Walker and Walker, 1997). The prevalence of IP among children was higher in female than male and regarding to age infection was significantly higher among children in age groups (6-11 yrs) than in older ones (12-17 yrs) in Nigeria (Wosu and Onyeabor, 2014). Dankwa *et al*., (2015) reported pit latrine facility emerged as a risk factor for infection among primary school pupils in Coastal areas of the Cape Coast Metropolis, Ghana. While a study carried out in Babile town of Eastern Ethiopia, reported nine species of IP among children with poor personal hygiene however prevalence of intestinal helminthic infections was not related to the availability, type and usage of latrines (Tadasse, 2005). High prevalence of IPI were reported among school children in Sub Saharan African countries including 27.7% to 95% (Mathewos *et al*., 2014, Andualem *et al*., 2014) in Ethiopia, 90% in central Sudan (Muhajir *et al*., 2017), 50.0% in Rwanda (Emile *et al*., 2013), 48.7% in Tanzania (Speich *et al*., 2013) and 84.7% in Burkina Faso (Erisann *et al*., 2016). Ahmed *et al*., (2017) reported 36.50% with one or more intestinal parasites *A. lumbricoides, H. nana, E. vermicularis* and *G. lamblia* among school children in Asmara, Africa.

Several research work in European countries showed Intestinal parasites are still a major health problem. In Europe, high prevalence of IPI have been reported in immigrants

(20.8%, Rosso and Miotti, 1991) and institutions for the mentally retarded (55.5%, (Giacometti *et al*., 1997) in Italy, among immigrants children in Spain (48%), (Huerga and Lopez-Velez, 2004) and in refugees living in Sweden (17%), (Persson and Rombo, 1994). Balci *et al*., (2010) showed the association of intestinal parasites with socio-economic status and environmental factors in children aged between 1-15 yrs old in Denizli, Turkey. Similarly, in the same country, Donl *et al*., (2015) reported 44.6% prevalence of intestinal parasitic infection with age, gender, illiteracy of the households, poverty, absence of toilets, lack of safe potable water, geophagia (soil eating habit) and being a child of a seasonal farm worker were the most significant factors associated with IPI in southeastern Anatolian region of Turkey. Drinking contaminated water and close contact with animals have been postulated as the main routes for the transmission of *G. duodenalis* to humans in Albania (Berrilli *et al*., 2006).

Single infection (13.6%) of IPI has been reported highest than double (1.3%) infection in Ghana and 68.8% single, 24.2% double, 6.7% triple, quadruped 0.3% was reported among children in Cambodia (Forson *et al*., 2017, Moore *et al*., 2015). Similarly, the rates of single and double parasitic infection among students were 19.6% and 16.2% respectively in Bahir Dar, Ethiopia (Hailegebriel, 2017). However the overall prevalence 33% with 90% double infection among school children was reported in Gashky, West of Iran (Babakhani *et al*., 2017).

These organisms may infect 3-12 yrs age group child with high intensity (Albanico *et al*., 1999, Savioli *et al*., 1992) due to use of drinking water and poor personal hygiene (Al-Ahga and Teodorescu, 2000) which are major causes of morbidity and mortality among school aged children. The problem of IPI are more serious in Sub-Saharan Africa, Asia and Latin America associated with inadequate water supply, environmental sanitation, fast population growth and other economic and social problems (Mohammed *et al*., 2015). Poor knowledge regarding mode of transmission of IPI, practice of defecation in open air and not washing hands after defecation are issues of great concerns (Ahmed *et al*., 2017).

2.2 National Context

Earlier studies has reported *E. vermicularis* infection along with other intestinal parasites from different parts of country (Sharma *et al.*, 1965, Sherchand 1997, Chaudhary 2003, Kunwar 2009, Shrestha and Maharjan 2013, Shah *et al*., 2013, Dahal and Maharjan 2015). Reddy *et al.*, (1998) reported prevalence of enterobiasis 2.8% in children of Bharatpur, Chitwan and Pandit (2004) reported 5.52% enteriobiasis in the school children in Chitwan. While a study carried out among the children of Bhutanese Refugee camp of Jhapa showed high prevalence i.e. 16.19% of enterobiasis (Sharma, 2009). Similarly, Dahal and Maharjan (2015) reported 12.72% prevalence of enterobiasis among children and among protozoan parasities *E. coli* (29.62%) was most prevalent followed by *E. histolytica* (24.07%) and *G. lamblia* (11.11%) while in case of helminthes parasites, *A. lumbricoides*(16.16%), *Trichuris trichiura* (11.11%), *H. nana* (3.07%) and *H. diminuta* (3.07%) in Barbhanjyang VDC, Tanahun.

Like other developing countries, intestinal parasitic infection is a major health problem mainly among school children. Shrestha and Maharjan (2013) reported low prevalence of *E. vermicularis* (0.40%) whereas higher prevalence of *Ascaris lumbricoides* (22.63%), followed by *Trichuris trichiuria* (6.06%), *Strongyloides stercoralis* (1.82%), Hookworm (1.62%), *Taenia solium* (1.01%) and *Hymonolepis nana* (0.81%) among school children of Bhaktapur district. High prevalence of parasitic infection among the children was reported from various part of Kathmandu valley with highest prevalence of protozoan parasite *G. lamblia* (Thapa Magar *et al*., 2011, Pradhan *et al*., 2013 and Bhandari *et al*., 2015). Similarly, Shah *et al*., (2013) reported high prevalence of *G. lamblia* among the school children of Itahari.

High prevalence of intestinal parasites have been reported from various parts of Nepal. In Dhading district, 60% among school children (Rai *et al*., 2002), 45.83% among the children of aged between 3-12 yrs old in Kirtipur area (Maharjan, 2004), 45% among the kindergarten children of Khusibbu, Kathmandu (Maharjan *et al*., 2013), 41.4% among children of Squatter community in Dharan Municipality (Chongbang *et al*., 2016). However, comparatively less prevalence of IPI have been reported from other parts of countries, 11.3% among the school children of Dharan District (Shah *et al*., 2013), 27.67% among school children of Bhaktapur district (Shrestha and Maharjan, 2013), 20.5% among the school children of aged between 5-15 yrs old in Gurukul High School, Jatuwa (Gupta, 2009).

There are number of published reports which implicate about intestinal parasitic infection with poor nutritional status among children of school age. Mukhiya (2012) reported 19.8% (68/342) protozoan parasites and the prevalence rate in boys and girls were 16.9% and 22% respectively and positive rate was highest in Dalit (20.3%) and least in Indo-Aryan (19.6%) at public school in Kamalamai, while Sherchand *et al*., (2010) reported the occurrence of intestinal parasitosis was 51.9% with higher prevalence of parasitic infection in girls (58.0%) than boys (46.5%) and in age group of 8-12 yrs (58.8%) with no statistical significant of parasitic infection with gender and age group among school going children in Kathmandu. Male children were more infected (45.8%) than the female children (37.5%) with highest prevalence in 4-8 yrs age group and positive rate was higher in Dalit (59.7%, 43/72) and least in Tibeto-Burman (27.1%, 22/81) in Dharan Municipality, Sunsari (Chongbang *et al*., 2016). Yadav and Satyam (2017) reported high incidence of intestinal parasitic infection higher in boys (61.85%) than that of girls (53.84%), among school children of Kathmandu valley aged between 6-10 yrs.

Intestinal parasitic infection alone contributes to great extent in the cause of diarrhea and is one of the most common public health problems in Nepal (Rai *et al*., 1998)). The common intestinal helminths reported from Nepalese children includes *A. lumbricoides* (Reddy *et al*., 1998, Rai *et al*., 2001, Rai *et al*., 2002, Chaudhary 2003, Maharjan 2004, Shakya *et al*., 2012, Shrestha and Maharjan 2013, Chongbang *et al*., 2016), hookworm (Young *et al*., 2000 and Shah *et al*., 2013) and *T. Trichiura* (Pradhan 2001, Sharma *et al*., 2004, Khanal 2005, Shah 2009). Shah *et al*., (2013) reported *Taenia solium* (5.3%) as the

most prevalent helminth followed by hookworm (2%), *A. lumbricoides* (1.9%) among school children of Dharan.

Regarding to age, Chandrashekhar 2005 reported highest positive rate in 6-10 yrs age group and the burden of parasitic infection among the school children, coupled with poor sanitary conditions in schools in Kaski District. Prevalence rate of parasites has been found higher in male children (21.77%) than that of female children (18.75%) in Biratnagar (Gupta, 2009). Children aged 11-15 yrs belonging to agricultural family were most commonly affected (Tandukar *et al*., 2013).

Dahal and Maharjan (2015) reported higher single infection (60%) followed by double (31.11%), triple (6.66%) and quadruple (2.22%) among children of Barbhanjyang VDC, Tanahun district. Similarly, single infection of IPI has been reported highest than double and triple infection in Kirtipur and Rautahat (Maharjan 2004, Shah 2009). The intestinal parasitic infection was associated with river as water source, open defecation site and lack of personal hygiene (Lone *et al*., 2011). Hand washing practice and type of drinking water were the source of drinking water and burden of parasitic infection was correlated with poor sanitary condition of school (Tandukar *et al*., 2013).

3. MATERIALS AND METHODS

3.1 Study Area

Chhampi, is one of the ward located in Godawari Municipality-9, Lalitpur District, Bagmati zone, Central Region, Nepal. The estimate terrain elevation above sea level in 1489 meters. It is located in 27°35'44.88" latitude and 85º18'35.99" longitude. It covers 5.52 km^2 area and denstity 860.53 in h/km^2 .

Chhampi had a population of 4,753 (CBS,2011) and main occupation of the population is agriculture. There were one government school and two private schools. Most of parents of Government school children are farmer and daily labor whereas the parents of private schools children are private and government jobholders and also involve in business. The economic condition of parents of government school children are poor than those of parents of private school children.

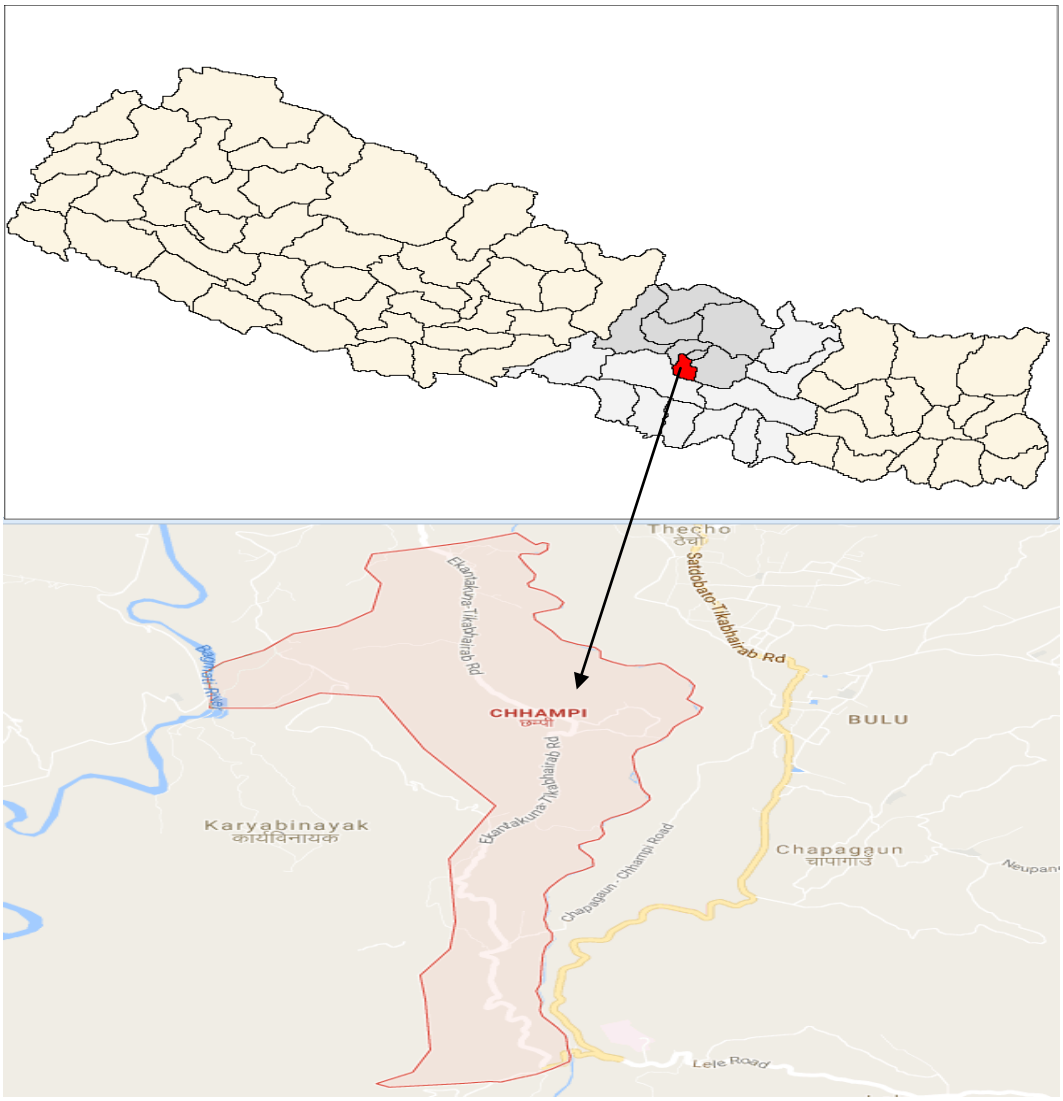


Figure 1-Map of study area

3.2 Materials Required

3.2.1 Equipments

i. Cellophane tape (Scotch tape)

ii. Sample vials

iii. Forceps

iv. Glass slides

v. Cover slides

vi. Gloves

vii. Mask

viii. Tray

ix. Compound Microscope

3.2.2 Chemicals

i. Normal saline

ii. 2.5% Potassium dichromate

iii. Iodine solution

iv. 70% alcohol

v. Dettol Handwash

3.2.3 Preparation of 2.5% Potassium Dichromate

2.5 gm of potassium dichromate was weighed and dissolved in 100 ml of distilled water. This solution was used for the preservation of parasites which contained in the feacal matters (Zajac and Colony, 2012).

3.2.4 Preparation of Normal Saline

Normal Saline 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).

3.2.5 Preparation of Iodine Solution

The iodine solution was prepared by dissolving 10gm of potassium iodide in 100 ml of distilled water and 5 gm of iodine crystals (powered) are slowly added in it. The solution was then filtered and kept in a stopper. It was diluted about 5 times distilled water. The solution was used in a stained preparation for the visualization of internal organelle of the protozoan parasites as well as helminth eggs (Zajac and Colony, 2012).

3.3 Methods

3.3.1 Scotch tape sampling for enterobiasis

A total of 107 primary school children aged between 2-13 of Shree Chhampi Devi Higher Secondary school in Chhampi, Lalitpur District, was included representing more than 50% of total primary level children of the school who wished to participate in the present study. Three parents and teachers meeting was conducted in the school to explain the aim and objectives of the study. The parents were well explained about the methods of the sample collection.

Scotch tape samples collection was used. A glass slide and transparent adhesive (one side) tape with identification tag was provided to each parent with detailed collection methods writing the numbers, name, age, sex and class of the children were recorded in record file. Each parent was shown how to attach the adhesive cello tape around the perianal area of their child with sticky side of the scotch tape and they were also requested to use the procedure before bathing or defecating on early morning. The samples were collected next day morning from each of the parents and if not collected that day was requested for next day.

115 materials were distributed and 110 were submitted for the examination. Out of 110 were returned, three did not have the identification tags and were excluded from the analysis. The samples were transported in slide box with identification tags to the Central Department of Zoology, Tribhuvan University, Kirtipur, Kathmandu, Nepal. The scotch tape samples were examined microscopically without staining and identification was made based on shape and size of eggs (Photograph 4 and 5).

3.3.2 Stool Sampling for intestinal parasites

Similarly samples vials were provided to the parents of same children whose Scotch tape samples were collected (Photograph 3). They were requested to collect about 5 gm of stool early morning with the help of clean stick provided with clean plastic vials. They were oriented to avoid contamination of stool sample with other matters. The samples were collected in next day morning from each parents and if not that day were requested for next day.

3.3.3 Preservation

Immediately after collection, 2.5% potassium dichromate solution was kept in the vials containing faecal matter for preservation.

3.4 Laboratory analysis and identification

The collected stool samples were processed for microscopic and macroscopic examination and the eggs were identified on the basis of morphological characters (Arora and Arora, 2012).

3.4.1 Macroscopic examination

The collected stool samples were macroscopically examined for the blood, adult, segments of cestodes as well as larvae of the parasites.

3.4.2 Microscopic examination

The samples were microscopically examined using direct smear method with normal saline as well as iodine stain (Photograph 4).

Unstained smear preparation of stool

A small portion of stool sample was taken with the help of small stick and emulsified with freshly prepared normal saline on a clean glass slide. A clean cover slip was placed it and excess of fluid was removed with the help of cotton.

Stained preparation of stool smear

The stained smear preparation was required for the identification and study of nuclear matter of the protozoan cyst and trophozoites. The stained smear was prepared in the similar manner as prepared to unstained smear.

3.6 Methods of observation

Both stained and unstained smear preparations were first observed under the low power (10X objective) of the compound microscope. Examination was started from one end of the slide to another for whole field examination. Samples were examined under high power (40X) when necessary for detailed diagnosis.

3.7 Identification of cysts, eggs of parasites

Cysts and eggs of parasites were identified on the basis of shape, size and colour by using digital camera and identification was done as described by Arora and Arora, (2012) (Photograph 7,8,9,10,11).

3.8 Socio-behavioural Survey

The children's parents were asked to complete structured questionnaires to co-relate socio-behavioural aspect along with Knowledge, Attitude and Practices regarding the *E.vermicularis* along with other intestinal parasites (Photograph 1).

Photograph 1: Questionnaire Survey

3.9 Data analysis and Interpretation

The obtained data were analyzed according to sex age ethnic group behaviours of children rate of intensity, parents profession. The analyzed data was interpreted by representing with table and graph. Prevalence was assessed by using R 3.4.1 software.

4. RESULTS

4.1 Results of cellophane tape and stool examination among primary school children of government school Chhampi , Lalitpur District

4.1.1 General Prevalence of *E. vermicularis*

Out of 107 (55 male and 52 female) children examined, 10.28% were found to be positive for *E. vermicularis* infection. *E. vermicularis* infection was found to be 10.90% and 9.26% in male and female respectively. Sex wise prevalence was found to be insignificant (χ^2=2.77e-31, p value=1).While age wise prevalence indicated high among children between age group 5-7 yrs but it was also found to be insignificant (χ^2=0.352, P=0.84) (Table 1).

Table 1: Prevalence of *Enterobius vermicularis* in primary level children of Chhampi, Lalitpur

Age groups(years)	**Male %** **N=55**	**Female %** **N=52**	**Total (N=107)**
2-4	3.6%	1.9%	2.80%
5-7	5.45%	3.84%	4.67%
8-10	1.82%	3.84%	2.80%
Total	10.90%	9.62%	10.28%

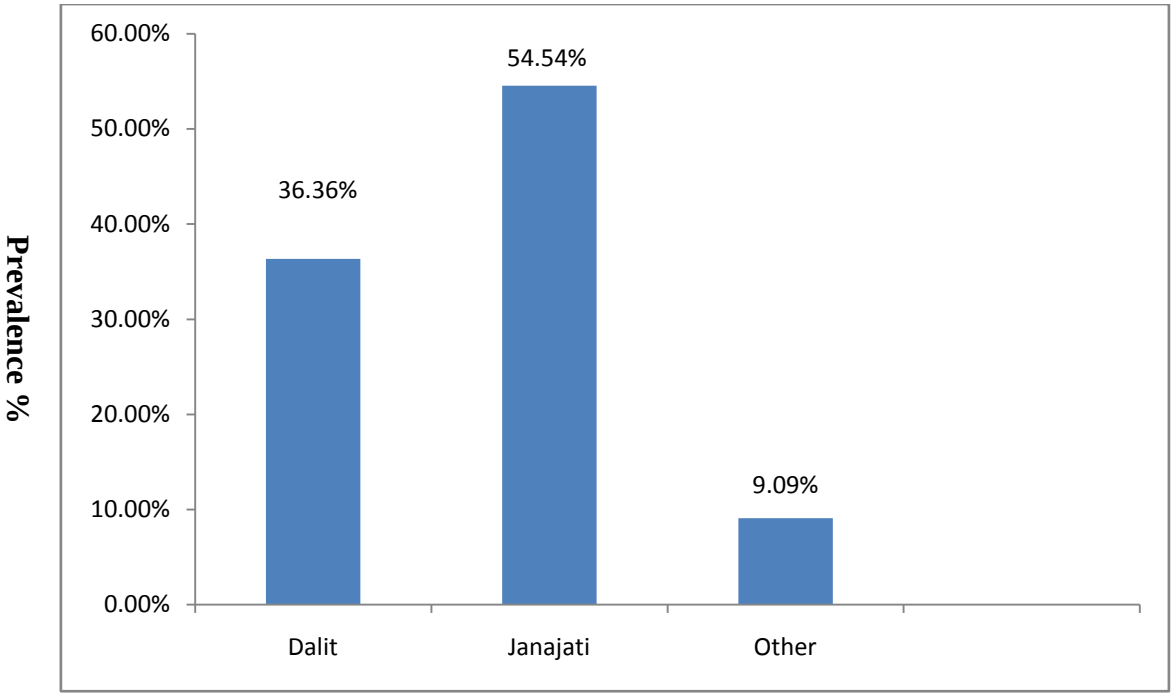


Figure 2: Prevalence of *Enterobius vermicularis* with ethnic group wise

Ethnically Sarki, Damai and Kami were kept in Dalit group. Newar, Magar and Gurung were kept in Janajati group whereas Brahman, Chhetri and Thakuri were kept in others. The highest prevalence of *E. vermicularis* was found among Janajati children (54.54%). Distribution of *E. vermicularis* to that of ethnic groups was statistically not significant (χ^2=3.84, P=0.15) (Figure 2).

Table 2. Children's Behavioural Practices in Relation to *E. vermicularis* infection

Behaviors	Practices	Infection	χ^2	P value
Itching habit	Yes No	9(81.81%) 2(18.18%)	6.62	0.01
Nail biting habit	No Sometimes Frequently	2(18.18%) 6(54.54%) 3(27.27%)	7.58	0.023
Playing with domestic pets	Yes No	7(63.63%) 4(36.36%)	2.47	0.12

The prevalence of *E. vermicularis* was found to be directly related to the itching behaviour of the children and was highest (81.81%) which was statistically significant (χ^2=6.62, P=0.01) with the itching habit. Similarly, *E. vermicularis* infection was also significantly associated with nail biting habit (χ^2=7.58, P=0.023). In case of playing behaviour with domestic pets was not found to be directly associated with *E. vermicularis* infection (χ^2=2.47, P=0.12) (Table 2).

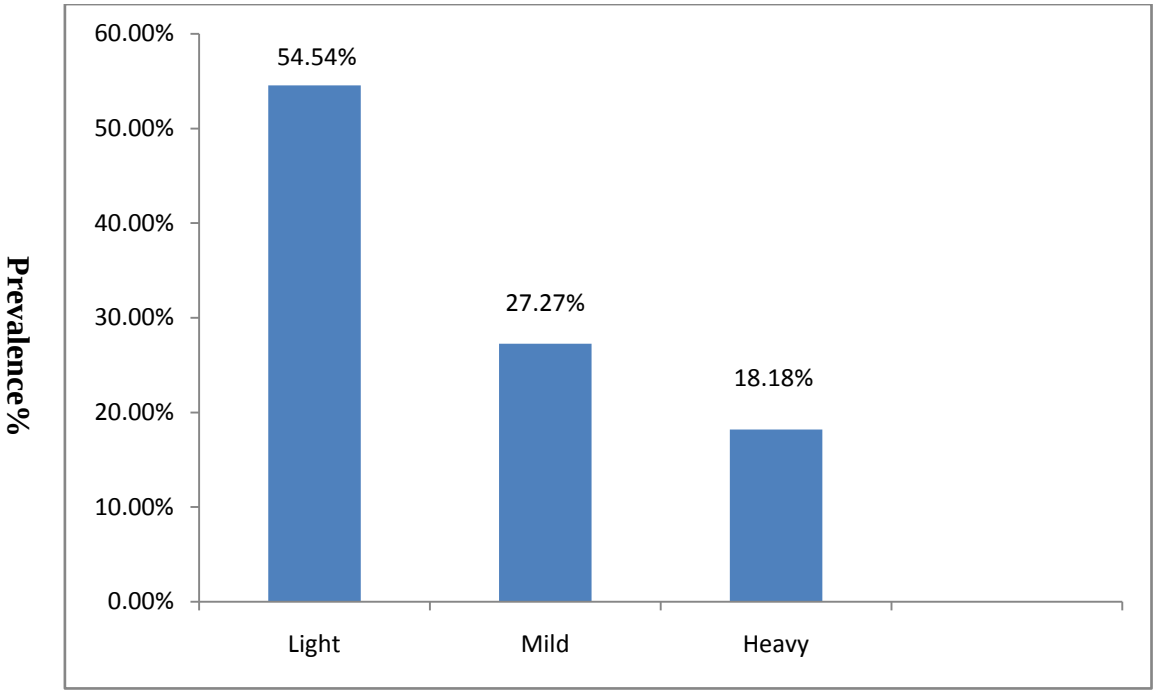


Figure 3: Intensity of *Enterobius vermicularis* infection in children

Intensity of infection was classified as light, mild and heavy infection. If there was less than 2 eggs, it was considered as light infection, 2-4 eggs mild and more than 4 eggs was considered as heavy infection. Maximum children had light infection (54.54%) compared to mild and heavy infection (Figure 3).

Photograph 2: Collection of stool samples

Photograph 3: Observation of Scotch tape samples

Photograph 4: Egg of *E. vermicularis*(10X40X)

Photograph 5: Eggs of *E. vermicularis* (10X40X)

4.2 Prevalence of Intestinal Parasites in primary level children of Government school of Chhampi, Lalitpur

Five different species of intestinal parasites were found among the children of school children. A total of three parasitic groups were recovered from children, protozoan, cestode and nematode. Among them nematode parasites were found to be highly infected parasites as compared to others. In nematode parasites *Ascaris lumbricoides* (51.06%) was found highly prevalent among school children. Interestingly, (6.38%) of children were found infected with cestode parasite, *Taenia solium* which is zoonotically important parasite.

Table 3: Overall prevalence of intestinal parasites in children

Parasites	Species	Prevalence
Protozoa	*Entamoeba coli*	13(27.66%)
Cestode	*Taenia solium*	3(6.38%)
Nematode	Hookworm	3(6.38%)
	Trichuris trichiura	4(8.51%)
	Ascaris lumbricoides	24(51.06%)

The prevalence of intestinal parasites was found to be almost similar in male 20(36.36%) and females 19(36.53%) (Table 4). Among the three age-groups categorized, the prevalence of intestinal parasites was found higher in 11-13 yrs old age group 12(11.21%), followed by 5-7 yrs old age group 11(10.28%), 8-10 yrs old age group 10(9.34%) and 2-4 yrs old age group 6(5.60%) children (Table 4).

Table 4: Prevalence of intestinal parasitic infection in primary level children of government school of Chhampi, Lalitpur district

Age group(years)	Male (n=55)%	Female (N=52)%	Total (N=107)%
2-4	5.45%	5.76%	5.60%
5-7	18.18%	3.84%	10.28%
8-10	5.45%	13.46%	9.34%
11-13	7.27%	13.46%	11.21%
Total	36.36%	36.53%	36.44%

However, statistically not significant difference was observed between parasitic disease prevalence among age group (χ^2=1.23, P=0.75). Similarly, statistically no significant difference was observed between sexes and IPI (χ^2=1.64e-30, P=1).

Out of 107 children examined, the occurrence of single infection was highest 32(82.05%) followed by double 6(15.38%) and triple 1(2.56%) (Figure 4). The prevalence was found higher in Janajati 20(51.28%) followed by Dalit 14(35.89%) and others 5(12.82%) (Figure 5) which was statically significant (χ^2=13.77, P=0.00102). Among four types of parent's profession high prevalence was found in laborer parent's children 20(51.28%) followed by farmer's children 11(28.20%), jobholder's children 6(15.38%) and businessman's children 2(5.12%) which was statically not significant (χ^2=2.37, P=0.499) (Figure 6).

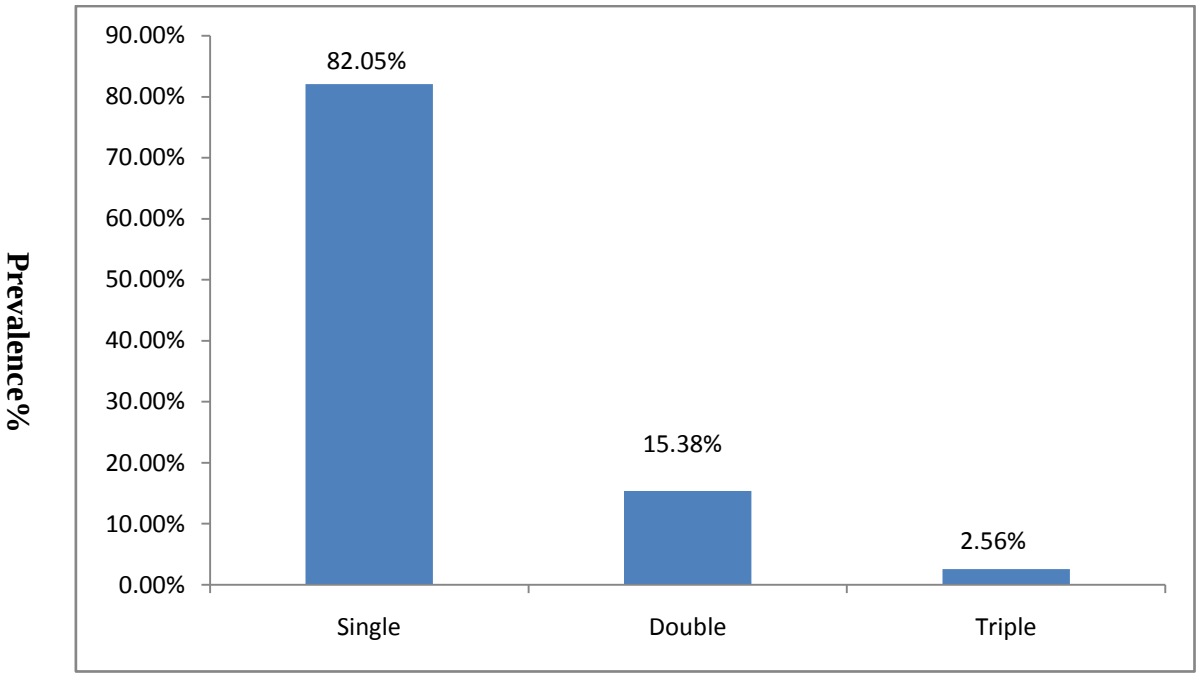


Figure 4: Concurrency of intestinal parasites

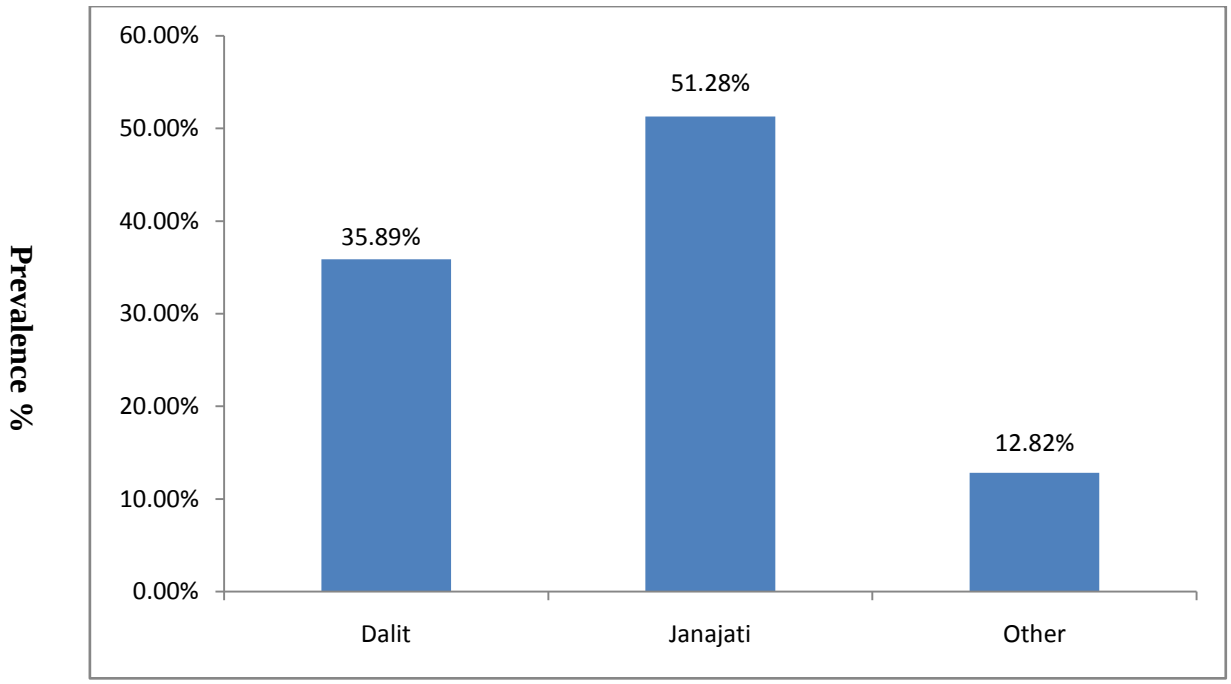


Figure 5: Prevalence of intestinal parasites with ethnic groups of children

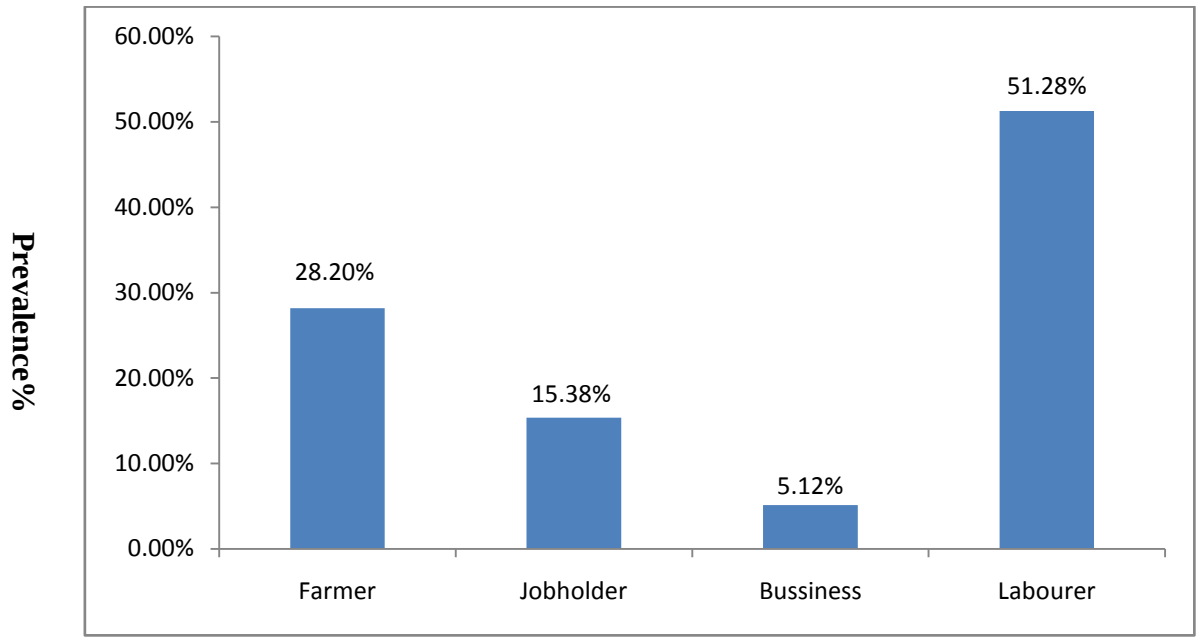


Figure 6: Prevalence of intestinal parasites with parent's profession

4.3 Assessment of Knowledge, Attitude and Practices (KAP) in relation to intestinal parasitic infection

Proper knowledge, good attitude and practice (KAP) towards intestinal parasites can significantly mitigate the spreading of intestinal parasitic infections. The self administrated questionnaire was used to record KAP of parents against intestinal parasitic infection.

4.3.1 Assessment of knowledge

Knowledge regarding intestinal parasites, their mode of transmission and preventive methods were assessed. Most of the parents had either seen parasites particularly *Ascaris lumbricoides* commonly called "juka" or had heard about it. Similarly in relation to their mode of transmission very few people had knowledge as "water" contamination with faecal matter is major source. While most of them were aware about preventive practices such as washing hand, cleaning vegetables, defecation in toilet and nail cutting habit (Table 5).

Table 5. Assessment of Knowledge

Knowledge	Number	IPI	χ^2	P value
Knowledge on IP				
Yes	77	38.46%	31.57	1.921e-08
No	30	61.54%		
Mode of Transmission of IP				
Know	25	10.26%	4.79	0.028
Don't know	82	89.74%		
Prevention method of IP				
Don't know	15	5.13%	17.37	0.0001
Partially know	20	38.46%		
Know	72	56.41%		

4.3.2 Assessment of Attitude

The attitude towards playing with domestic pets, walking on barefoot and defecating on open place were assessed. Most of the parents know that domestic pets like cats, hens and dogs can transmit various zoonotically important diseases. Similarly most of them know about the walking on barefoot is one of the cause of Intestinal parasites. In case of defecation on open place, most of parents know defecating on open place causes transmission of various diseases like Cholera, Diarrhea (Table 6).

Table 6. Assessment of Attitude

Attitude	Number	IPI	χ^2	P value
Do you think playing with domestic pets can cause IP?				
Yes	38	7.69%	20.09	4.325e-05
No	15	25.64%		
Don't know	64	66.66%		
Do you think walking on bare foot cause IPI?				
Yes	50	15.38%	35.70	1.768e-08
No	42	51.28%		
Don't know	15	35.89%		
Do you think defecating on open place cause IPI?				
Yes	70	38.46%	19.87	4.84e-05
No	27	43.58%		
Don't know	10	17.95%		

4.3.3 Assessment Survey on the Prevalence of Parasitic Infections in Relation to Practices

Most of the children use water sealed toilet and very few of them defecate on open place. The result revealed that defecation was not significantly associated with parasitic infection (χ^2=4.97, P=0.175).

The students who use water only for hand washing 62/107, had higher infection rate 25 (40.32%) as compared to the students using soap and water 47/107, had lower infection rate

14 (29.78%) which was not found to be significant (χ^2=0.874, P=0.35).

Students using drinking water directly without any treatment, acquired higher infection 27 (50.94%) as compared to filter water and piyush whereas children using boiling water had no parasitic infection. Drinking water consumption had significant parasitic association (χ^2=10.703, P=0.01).

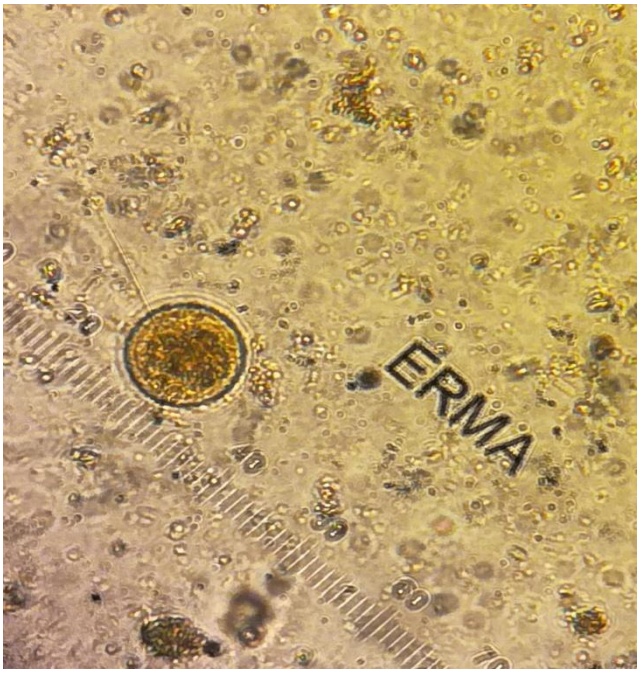
There was significant association of prevalence of intestinal parasites in methods of cleaning vegetables and fruits (χ^2= 10.36, P=0.015) .Most of the children use all the method of cleaning vegetables and fruits like washing, rubbing and without washing. High prevalence was found among children rubbing fruits and vegetables.

The nail cutting habit was significantly associated with the prevalence of parasitic infection (χ^2=20.61, P=0.0001). High prevalence was found among the children who cut their nail when he/she feels necessary (31.88%).

The present study showed that intake of anti-helminthic drugs before was significantly associated with the IPI among the study children (χ^2=9.09, P=0.028). However, high prevalence was found among the children who had taken antihelminthic drugs before six months (35.29%) (Table 7).

Table 7: Assessment of intestinal parasitic infection in relation to practice

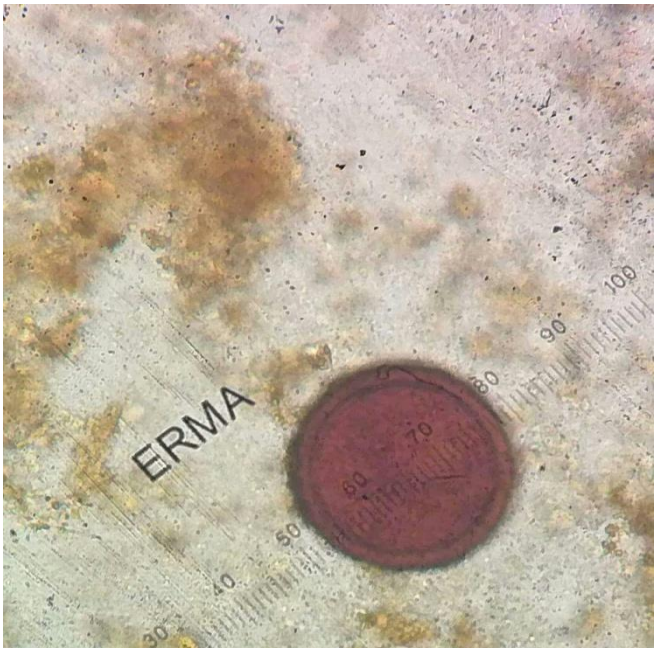
Variables	Practices	Infection	χ^2	P-value
Defecation	Open	80%	4.972	0.1739
	Dug	50%		
	Bore	50%		
	Water seal	33.33%		
Handwash	Water only	40.32%	0.874	0.35
	Water and soap	29.78%		
Drinking water consumption	Direct	50.94%	10.703	0.01
	Filter	22.72%		
	Piyush	33.33%		
	Boiling	0%		
Cleaning vegetables	By water	70%	10.395	0.015
	By rubbing	37.20%		
	Without cleaning	100%		
	All the above	26.92%		
Nail cutting habit	Once a week	20%	20.609	0.000126
	Once in 2 week	15.38%		
	Sometimes	86.66%		
	When feels necessary	31.88%		
Use of antihelminthetic	Before a week	0%	9.078	0.028
	Before 1 month	29.03%		
	Before 6 month	35.29%		
	Before 1yr or above	58.82%		



Photograph 6: Cyst of *Entamoeba coli*

Photograph 7: *Trichuris trichiura*

Photograph 8: Egg of Hookworm



Photograph 9: Egg of *Ascaris lumbricoides*

Photograph 10: Egg of *Taenia solium*

5. DISCUSSION

Enterobiasis is an infection which predominates in preschool and school children who are easily exposed to inadequate sanitation and overcrowded conditions and who have more active contact with each other than adults (Lohiya *et al*., 2000). It is usually endemic in kindergartens and primary school, due to easy transmission from infected to uninfected children (Li *et al*., 2015).

Out of 107 school children, 10.28% were found to be infected by enterobiasis. This prevalence rate is similar to the 12.72% infection in children of Barbhanjyang VDC, Tanahun district, Nepal (Dahal and Maharjan, 2015). Similarly the present study is also similar to other previous studies in Korea (Kim *et al*., 2003, Lee *et al*., 2011) and China (Wang *et al*., 2016).

However enterobiasis among children in this study is comparatively less than several other previous studies in USA and Turkey (Burkhart and Burkhart 2005, Artan *et al*., 2008), Peru (Gilman *et al*., 1991), Argentina (Pezzani *et al*., 2004), South Italy (Gualdieri *et al*., 2011), China (Wang *et al*., 2016). Similarly very low prevalence i.e. 0.40% was reported from Bhaktapur district, Nepal (Shrestha and Maharjan, 2013), 5.52% in Chitwan district, Nepal (Pandit, 2004). Low prevalence among school children may be due to the increase awareness, personal hygiene and deworming programmes in schools.

Comparatively prevalence of *E. vermicularis* was very high in Venezuela i.e. 91.1% (Devera *et al*., 2006), in USA and Western Europe (Burkhart and Burkhart, 2005), in Chile 35.2% (Mercado *et al*., 1996), in Argentina 41.42% (Pezzani *et al*., 2004), in Sweden 33% (Herrstrom *et al*., 1997). The high rate of infection in those places may be due to the cultural behaviour, climatic condition, fast growth of population and economic status. The high rate of infection in school aged children than smaller aged children are more likely to be in close contact with each other and are exposed to unsatisfactory sanitary environment.

Sex wise analysis revealed nearly equal prevalence but higher (10.90%) in male children compared to female children (9.62%) without significant association in prevalence of enterobiasis between two sexes. Similar findings have also reported previously in Turkey (Celiksoz *et al*., 2010), in Korea (Park *et al*., 2005, Lee *et al*., 2011), in Nepal (Pandit, 2004). A higher rate of infection in male than the females was reported in Srilanka, Taiwan and Philippines (Chu *et al*., 2012, Feiz *et al*., 2013 and Cruz *et al*., 2013). The high rate of infection in male may be due to they spend more time outside and have more chance to contact with infected children, thus acquiring infection. Similar rate of infection among both sexes may be due to the reason they both share similar type of environment and feeding habit. However, Kim *et al*., (2003) in Korea, Nourazian and Youssifi (2011) in Iran reported high prevalence among female compared to male children.

Regarding to the age groups though there was no significant association in prevalence rate in age groups, the high prevalence rate was found in 5-7 (4.67%) followed by 8-10 (2.80%) and 2-4 (2.72%) children. The higher prevalence rate observed in 5-7 yrs as

compared with older ones might be due to the reason that this age group mostly exposed to outside the house playing outdoor games and might be contact with contaminated soil and water. The minimum prevalence of enterobiasis among 2-4 yrs age group might be due to the parental care specially by mothers. Similar result have also been reported by Raza and Sami (2009) in Iraq, Ammoura (2010) in South Jordan, Cruz *et al*.,(2013) in Philippines, Chai *et al*., (2013) and Nithikanthkul *et al*., (2001) in Thailand, Dahal and Maharjan (2015) in Nepal.

Ethnically children were categorized into three groups i.e. Dalit, Janajati and others. The prevalence was found to be higher among Janajati children (54.54%) as compared to Dalit children (36.36%) and others (9.09%) which was directly associated with poor socio-economic condition, poor personal hygiene, illiteracy etc.

During the surveillance study, it was found that the prevalence of *E. vermicularis* with itching behaviour of children was statistically significant (P=0.01) while highest prevalence (81.81%) among the children who had itching habit around the perianal regions compared to non-itching (18.18%). The present result was in agreement with the result of Rasti *et al*., (2012), Out-Basseg *et al*., (2011) which showed the significant relation between perianal itching as well as nail biting behaviour of children and enterobiasis. The present finding also coincides with result presented by Wang *et al*., (2016) in which washing before eating, sucking fingers and toys and scratching around the anus, were all associated with enterobiasis. However in this study, there was no significant association of enterobiasis and playing with domestic pets, the result agreed with children infected with intestinal parasites and close proximity to domestic animals or pets (Forson *et al*., 2017).

The present study found that the high prevalence of intestinal parasites in children of Chhampi, Lalitpur District. Out of 101 children, 39 (36.44%) were found to be infected by at least one species of parasites. Similar prevalence of IPI was determined in some studies in Nepal (Rai *et al*., 2002, Shrestha and Maharjan 2013, Dahal and Maharjan 2015, Chongbang *et al*., 2016), in Saudi Arabia (Al-Mohammed *et al*., 2011), in Africa (Ahmed *et al*., 2017). However, very high prevalence of IPI were reported among school children in Sub Saharan African countries (Mathewos *et al*., 2014, Andualem *et al*., 2014) in Ethiopia, in central Sudan (Muhajir *et al*., 2017), in Rwanda (Emile *et al*., 2013), in Tanzania (Speich *et al*., 2013) and in Burkina Faso (Erisann *et al*., 2016), in Iran and Argentina (Tappeh *et al*., 2010, Gamboa *et al*., 2011). This high rate of prevalence may be associated with poor socio-economic status, improper hygienic conditions, fast growth of population, lack of knowledge and sharing a house with domesticated animals and pets were the good indicator of the IPI.

Though, there was no significant association between IPI and sexes of children, nearly equal prevalence was reported among male children and female children. Similar finding have been reported previously, Chandrashekhar (2005), Chongbang *et al*., (2016), Yadav and Satyam (2017) in Nepal. This may be due to the similar outdoor activates and greater contact with other children and the environment of male and female children. But in

contrast, Wosu and Onyeabor (2014) showed higher prevalence among female children in Nigeria which has not been scientifically explained. Similarly, there was no significant association between age and IPI. High prevalence rate was reported among 11-13 yrs (11.21%), age group followed by 5-7 yrs (10.28%), 8-10 yrs (9.34%) and 2-4 yrs (5.60%) old age group. Similarly, finding has been reported in previous studies (Gupta 2009, Sherchand *et al*., 2010, Tandukar *et al*., 2016). This may be due to this age group spend much time playing outside the house and chances of greater exposure to the contaminated environment.

Altogether, five different species of intestinal parasites were found among the school children belonging to protozoan, cestode and nematode which includes protozoan parasites, *E. coli* (27.66%) and helminthes parasites *A. lumbricoides* (51.06%), *T. trichiura* (8.51%), Hookworm (6.38%) and *T. solium* (8.51%). Among them, *E. coli* was the most prevalent intestinal protozoan parasite which is similar to result (29.62%) presented by Dahal and Maharjan (2015). This might be due to use of drinking water without treatment. However, highest prevalence of *G. lamblia* was reported (Thapa Magar *et al*., 2011, Pradhan *et al*., 2013 and Bhandari *et al*., 2015) from Kathmandu valley and Itahari (Shah *et al*., 2013). But Ugochi *et al*., (2015) reported *E. histolytica* as most prevalent protozoan parasites in Nigeria.

Ethnically high prevalence rate was found among Janajati (51.28%) children as compared to Dalit (35.89%) and others (12.82%). This result is similar with the result of Dahal and Maharjan (2015) in Tanahun District. This may be due to Janajati in Nepal have a relatively low literacy rate, unhygienic habits and low socio-economic status, poverty, availability of clean drinking water. In contrast, Mukhiya (2012) in Kamalamai and Chongbang *et al*., (2016) in Sunsari reported high prevalence among Dalit which may be due to poor personal hygiene, improper sanitation and crowding index. In this study, the prevalence rate of IPI was found higher among laborer (51.28%), children followed by farmer (28.20%), jobholder (15.38%) and businessman (5.12%). This may be related to low family income of parents and the result was agreed with significant association between parents jobs and intensity of parasitic infection among primary school children in Iran (Turki *et al*., 2017).

The present study suggests that there is an association between intestinal parasitic infection and parental knowledge on IPI (P=1.92e-08), mode of transmission of IP (P=0.028) and prevention method of IP (P=0.0001) which is similar to the previous studies in Nepal (Maharjan 2004 and Sharma 2009), in Eritrea Ahmed *et al*., 2017). Similarly, parents attitude towards IPI between domestic pets, bare foot and defecation in open place were significantly associated but the parasitic prevalence has not been scientifically explained in other studies. However, personal hygiene and attitude of parents and children seem improve due to the education.

The current study has demonstrated that children who didn't wash their hands before meals and after defecation were at higher risk of getting infection. Defecation in open air and hand washing before a meal and after defecation are very important hygienic practice

to avoid IPI transmission. In this study, defecation and hand wash practices were without significantly associated with IPI. This may be due to the improvement of awareness of parents and children. However, Nematian *et al*., (2004), Al-Mohammed *et al*., (2010), Donl *et al*., (2015), Dahal and Maharjan (2015) and Ahmed *et al*., (2017) reported the significant association. This may be due to the poverty, illiteracy, poor sanitation, negligence etc.

Regarding to other practices drinking water consumption, cleaning vegetables, nail cutting habit and use of antihelminthic were significantly associated with IPI. The high rate of prevalence of IPI among children who use water without treatment may be due to the contamination of water was similar with Tandukar *et al*., (2013). The significant association between nail biting habit and IPI may be due to the faecally contaminated fingers. Similarly, the significant association between IPI and use of antihelminthic may be due to the sufficient dose of antihelminthic among school children.

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The present study was carried out to determine the prevalence of *E. vermicularis* as well as other intestinal parasites among the primary level school children of Chhampi, Lalitpur District, Nepal. Morning Scotch tape (cellophane tape) as well as stool samples were collected in a slide box and clean vials respectively from those children whose parent's orientation was done and materials were distributed a day before evening along with structured questionnaire survey to access knowledge, attitudes and practices in relation to the *E. vermicularis* and other general intestinal parasites.

Out of 107 Cello tape samples examined, the prevalence rate of *E. vermicularis* was found to be 10.28%. The male children were more infected by enterobiasis than the female without statistically significant (P=1). In case of age wise distribution of enterobiasis, higher prevalence rate was found in 5-7 yrs old age group followed by 2-4 and 8-10 years old age group without significant difference (P=0.84). Regarding the ethnical distribution, the highest prevalence of *E. vermicularis* was found among the Janajati children compared to Dalit and others without statistically significant association (P=0.15). Light infection of enterobiasis was found to be higher followed by mild and heavy infection. In case of behavioral practices of children in relation to *E. vermicularis* infection, itching around the anal region was found to be statistically significant (P=0.01) and nail biting habit (0.023) whereas playing with domestic pets was without statistically significant (P=0.12).

Out of 107 stool samples examined, the prevalence of intestinal parasites apart from the *E. vermicularis* was found to be 36.44%.The prevalence of IPI was found almost similar in male and female children but no significant difference was observed. However, no significant association was observed between IPI and age group, 11-13 yrs old age group was found to be more infected followed by 5-7 yrs, 8-10 yrs and 2-4 old yrs age group. In case of ethnic groups, the highest prevalence of IPI was observed among the Janajati children followed by Dalit and others with significant difference. Regarding the intestinal parasites, the prevalence rate of *E. coli* was found to be highest followed by *A. lumbricoides*, *T. trichiura*, *T. solium* and Hookworm. High prevalence was found among laborer's children, followed by farmer, jobholder and businessman without statistical association. The prevalence of the single infection of intestinal parasites was higher followed by double and triple infection in the school children.

The prevalence of the IPI was observed highest in those children whose parents had less knowledge about the intestinal parasitic infection and their transmission, prevention and control. Similarly, the prevalence of IPI in children in relation to defecation place, methods of cleaning of vegetables and fruits and time of use of anti helminthic drugs were statistically significant. The highest prevalence of IPI was seen those who didn't use soap for washing hand, drink water directly without treatment and not trim nail timely.

6.2 RECOMMENDATIONS

For the effective control of enterobiasis and intestinal parasitic children among primary level school children, following recommendations have been suggested.

i. People should be encouraged to improve their personal and group hygiene.

ii. Children should be discouraged from activities such as finger sucking.

iii. Basic health education programmes about enterobiasis and intestinal parasites should be conducted time to time.

iv. Use of boil water should be encouraged.

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ANNEX-1

QUESTIONNAIRE

Name: Age: Sex: Profession:

Address:

1. Do you have toilet in your home?

a. Yes b. No

If yes, what type of toilet?

a. Yes b. No

2. Where does your child defecate?

a. Toilet b. Open place

3. Where do you get drinking water from?

a. Tap water b. Well

4. Do you treat drinking water?

a. Yes b. No

If yes, How?

a. Boiling b. Filter c. Piyush d. Sodish

5. Does your child wash your hand after toilet and before meal?

a. Yes b. No

If yes, How?

a. Water only b. Water and soap c. Ash

6. Does your child walk with bare foot?

a.. Yes b. No

7. Does your child cut your nail regularly?

a. Once a week b. Sometime

c. Once in two week d. When he/she feels necessary

8. Does your child have the habit of nail biting?

a. Yes b. No

If yes, when?

a. Sometimes b. Frequently

9. How do you and your child clean vegetables/fruits?

a. Only rubbing on clothes b. By using tap/well water

c. Without cleaning d. all above

10. Does your child bath regularly

a. Yes b. No

If yes, when?

a. Once a week b. Twice a week c. Once in two week

11. Does your child play with domestic pet?

a. Yes b. No

12. What type of food habit does your child have?

a. Goats b. Dogs c. Cats d. Hens e. Other

13. Does your child itch around anus region?

a. Yes b. No

If yes, When?

a. Early in the morning b. At the day time c.At the evening d. At night

14. Has your child take anti-helmintics before?

a. Yes b. No

If yes, how long time before?

a. Before a week b. Before two week c. Before one month

d. Before six month e. Before one year

KAP related questions:

1. Do you know how diarrhoea and dysentery is called?

a. Yes b. No

If yes, indicate the causative agent?

a. *Entamobea histolytica* b. *Giardia lamblia* c. Others

2. Do you know about intestinal parasites?

a. Yes b. No

If yes, what are they?

a. Roundworm b. Tapeworm c. Pinworm d. Others

3. Do you know what the cause of itching around the perianal region are?

a. Yes b. No

If yes. What are they?

a. Pinworm b. Scabies

4. Do you know pin-worm?

a. Yes b. No

If yes, what does it cause to human being?

5. How do you treat if your child get pinworm infection?

a. Direct taking medicine b. Consultation with doctor c. Other