PREVALENCE AND ASSOCIATED RISK FACTORS OF INTESTINAL HELMINTH PARASITES AMONG MAGAR COMMUNITY OF NISDI RURAL MUNICIPALITY, PALPA, NEPAL

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T.U. Examination Roll No : ZOO 748/075

BATCH : 2075

2022/08/26

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

SUBMITTED TO

CENTRAL DEPARTMENT OF ZOOLOGY

INSTITUTE OF SCIENCE AND TECHNOLOGY

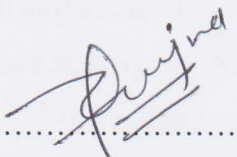
TRIBHUVAN UNIVERSITY

KIRTIPUR, KATHMANDU

August, 2022

DECLARATION

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



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RECOMMENDATION

This is to recommend that the thesis entitled "**Prevalence and associated risk factors of intestinal helminth parasites among Magar Community of Nisdi Rural Municipality , Palpa Nepal"** has been carried out by Ms. Srijana Thapa (Somai) for partial fulfillment of the requirement for Master's Degree in Zoology with the special paper of Parasitology. This is her original work and has been carried out under my supervision. To the best of my knowledge, this work has not been submitted for any other degree in any institution.

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LETTER OF APPROVAL

On the recommendation of supervisor Dr. Mahendra Maharjan this dissertation submitted by Ms. Srijana Thapa (Somai) entitled "**Prevalence and associated risk factors of intestinal helminth parasites among Magar Community of Nisdi Rural Municipality, Palpa Nepal"** is approved for the examination in partial fulfillment of the requirement for the Master's Degree of Science in Zoology with special paper Parasitology.

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CERTIFICATE OF ACCEPTANCE

This thesis work submitted by Ms. Srijana Thapa (Somai) entitled "**Prevalence of intestinal helminth parasites among Magar Community of Nisdi Rural Municipality, Palpa, Nepal"** has been accepted as a partial fulfillment for the requirement of Master's Degree of Science in Zoology with special paper Parasitology.

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ACKNOWLEDGEMENT

I am extremely grateful to my supervisor Assistant Dean, Dr. Mahendra Maharjan, Institute of Science and Technology for his invaluable advice , continuous support , guidance and patience during my study. I am thankful to our honourable Head of Department Professor Dr. Tej Bahadur Thapa , Central Department Of Zoology and T.U for providing me such an opportunity to carry out this dissertation work.

I am indebted to Miss Jhami Khamcha and Monika Rana for their constant help during field visit. I would also thank to my father Ram Bahadur Somai for his constant help and encouragement during field visit. I also acknowledge all the teachers and staffs of Central Department of Zoology for their continuous aspiration and motivation.

I would also like to thank the officials of the Nisdi Rural Municipality, Palpa for providing permission to carry out fieldwork. I am equally thankful to all the participants of Nisdi Rural Municipality for giving their consent and cooperation during sample collection. Nevertheless, I would like to offer special gratitude towards University Grant Commission (UGC) for financial assistances for the completion of the work.

TABLE OF CONTENT

LIST OF TABLE

LIST OF FIGURES

LISTS OF PHOTOGRAPH

LISTS OF ABBREVIATIONS

Abbreviated form	Details of Abbreviation
AOR	Adjusted odd ratio
COR	Crude odd ratio
CBS	Central Bureau Of Statistics
CI	Confidence Interval
et al.	And his associates
i.e.	That is
Km^2	Square Kilometer
MOHP	Ministry of Health and Population
NaCl	Sodium Chloride
OR	Odd Ratios
rpm	revolutions per minute
sp	species
spp.	several species
µm	micrometer

ABSTRACT

Intestinal helminthic infections are still the neglected public health problems worldwide. It represents a major cause of morbidity and mortality in high risk ethnic groups of rural communities. The present study was conducted in Nisdi Rural Municipality, Palpa Nepal. The cross sectional study was conducted and purposive sampling method was applied to choose the study subjects. Two hundred and eighty fresh stool samples of Magars including all age groups were collected and preserved in 2.5 % potassium dichromate solution. Structured questionnaire method was conducted for the identification of risk factors. The samples were examined microscopically using direct wet mount and concentration methods to determine the prevalence of intestinal helminthic parasites . The present study showed high rate of intestinal helminth infection i.e 31.07% along with taeniasis 2.5% in Magar Community of Nisdi Rural Municipality, Palpa. The most common intestinal helminth parasites were hookworm (12.5%) followed by *Ascaris lumbricoides* (11.8%), *Taenia* spp. (2.5%), *Hymenolepis nana* (1.7%), *Trichuris trichiura* (1.4%), *Strongyloides stercoralis* (1.1%) and *Enterobius vermicularis* (1.1%).

Univariate logistic regression revealed that people practicing the walking and working barefoot and occationally using the slippers or sandals (OR = 6.339, CI = 3.463-11.591), consumption of drinking water without treatment (OR=3.999, P=0.012), high number of family size >5 (OR = 2.389, 95% CI=1.4 -4.079), people having muddy house (OR= 2.282 95% CI = 1.258 -4.136) and source of drinking water as reservoir system (OR=1.716, 95% CI = 1.026-2.868) were the important risk factors for intestinal helminth infections . Similarly, the two important risk factors associated with taeniasis found in this community were not using latrine who preferred open defecation (OR =5.285, CI =1.149-24,306) and consumption of uncooked pork meat (OR=12.828, 95% CI= 1.521-108.6). Females (OR=2.2, 95% CI=3.809 -1.276) are at high risk of intestinal helminthic infections wheras males (OR =3.879, 95% CI=0.739-20.352) are at high risk of infection for taeniasis. Occupationwise, farmers are at greater risk of infection for both Intestinal helminth infection and taeniasis.

1. INTRODUCTION

1.1 Background

Intestinal helminthic infections are one of the most important socioeconomic and public health problems worldwide (Hortez et al. 2009). These infections are most prevalent throughout the tropics, especially among poor communities. Nepal is rich in social and natural diversity and home for people of different religion, caste, language and occupation (Baral et al. 2017). The countries sociological and topographical diversification influence directly and indirectly the peroidic epidemics of infectious diseases. Mostly the disadvantaged and maginalized communities living in this country such as Dalit, Chepang, Musahar and Tharu community people are infected with several infectious diseases including intestinal parasitosis due to their poor sanitation habit , lack of safe drinking water , little or no access to primary health care , lack of proper education and other basic services (Gyawali et al. 2013, Pokharel 2015).

According to the Nepal census of 2011, the Magar also spelled as "Mangar" and "Mongor" are the third largest ethnolinguistic groups of Nepal representing 7.1% of Nepal's total population. Palpa , Gulmi and Arghakhachi are the original home of the Magar people which is to the west of Gandaki river. Farming and military occupations are the primary source of income in Magar Community. Fried tarul (*Dioscorea alata*) and "Batuk" are the popular ethnic delicacies of Magar communities. Batuk is best served alongside pork and Kodo- ko – Raksi (local alcohol made from millet). Pig farming in Nepal has socio-economic and cultural importance for Magar ethnic groups. Farmers in rural areas of Magar communities predominantly reared two or three indigenous pigs (Gurung 1990). They rear pigs for meat, manure and to meet cultural beliefs . In rural Magar communities, pork is used during festivals such as New year and marriage and in exchange for other commodities. Farmers in rural communities reared pigs in scavenging system which may have increase the probability of zoonotic diseases transmission in this community.

1.2 Intestinal Helminth Parasites

World Health Organization (2000) showed that there is increasing trends in intestinal helminthic infections, particularly in developing nations. The most common intestinal parasites infecting various indigenous communities in Nepal reported are *Ascaris*

lumbricoides, Trichuris trichiura, Ancylostoma spp., *Strongyloides sterocoralis* , *Taenia* spp., *Entamoeba histolytica* , *Giardia lamblia* (Gyawali 2012, Adhikari et al. 2021). These infections are classified among the seven of the most common neglected tropical infectious diseases that afflict the bottom billion because of their prevalence and amneability to control (Hortez et al. 2009). In Nepal , over seventy percent of morbidity and mortality are associated with infectious diseases and is also reflected in the top ten diseases of Nepal (Rai 2013).

Taeniasis is a neglected zoonotic disease with serious public health consequences in endemic developing countries (Coral-Almedia et al. 2015). Taeniasis is an intestinal infection of human with the adult stage of the tapeworm of the genus *Taenia* i.e *Taenia saginata* and *Taenia sollium* (Joshi et al. 2007). The adult tapeworm occurs only in humans (Taeniasis) but infection with the larva stage cysticercosis can affect both pigs and human. Neurocysticercosis is identified as the most common cause of community acquired active epilepsy (Prasad et al. 2007). Humans are the only definitive host while pigs are intermediate host. Man may become intermediate host from the ingestion of eggs of the adult tapeworm resulting in a condition known as human cysticercosis. The tapeworm is transmitted to human by the absorption of *Taenia solium* eggs or when eating undercooked pork (Goussanou et al. 2014).

According to Pawlowski et al. (2005), over 20 million people in the world are estimated to be infected with cysticercosis or the taeniasis and it has wide – ranging medical, economic and social effects. Neurocysticercosis is considered as one of the main causes of epilepsy. In the developing countries of Asia, Latin America and Africa, neurocysticercosis is considered as one of the main causes of epilepsy (Pal et al. 2000).

1.3 Risk factors for helminth parasites

The prevalence of various species of gastrointestinal parasites varies in different regions because of varying environmental, social and geographical factors (Legesse and Erko 2004). Hence, studies on the prevalence of intestinal parasitic infections are more important to identify specific risk factors and formulation of appropriate control strategies (Rinne et al. 2005). Studies in different parts of the world have reaveled that the major risk factors in transmission of parasitic infection are age (Wordemann et al. 2006) , source of drinking water (Amuta et al. 2010, Ngui et al. 2011, Wani et al. 2007),

gender (Al – Shammari et al. 2001, Gelaw et al. 2013), family size (Wani et al. 2016), contact with animals (Dwivedi et al. 2007) and seasonal variations (Tuli et al. 2008). Similarly, study conducted by Boas (2012), Mamo (2014), Fuhrimann et al. (2016) have reveaded that farmers are at high risk of intestinal helminthic infections .

The transmission of the zoonotic pork tapeworm *Taenia solium* and *T. asiatica* depends on a combination of risk factors such as open defecation (Weka et al. 2013) , backward pig raising area, consumption of raw or uncooked pork and viscera (Devleesschauwer et al. 2013, Toquero et al. 2017), poor sanitation, unhygienic management, lack of latrines, lack of meat inspection , open defecation by human (KC and Kaphle 2019). The close relationship between humans and pigs in some rural areas, where the pigs live practically in the houses of the owners and feed on kitchen waste and and excreta, explains the prevalence of *Taenia solium* in Nepal (Joshi et al. 2004).

Despite socoeconomic development and demographic changes in Nepal over decades in Nepal, intestinal parasitic infections are still highly endemic, especially among indigenous communities. Magar ethnic groups are mostly pig farmers and pig consumers with very low hygiene and practices (Joshi et al. 2007). There is little information about intestinal helminth infection severity along with taeniasis and underlying risk factors. As pig are carriers of zoonotic parasite *Taenia*, Magar community are at high risk of diseases like taeniasis and neurocysticercosis . Therefore, this study is designed to measure the prevalence of intestinal helminthic infections and taeniasis and to identify the risk factors associated with helminthic infection among Magar Community of Nisdi Rural Municiality, Palpa Nepal.

1.4 Research Objectives

General objective

- To determine the prevalence and associated risk factors of intestinal helminth parasites among Magar community of Nisdi Rural Municipality.

Specific Objectives

- To determine the prevalence of intestinal helminth parasites of Magar community.

- To identify the associated risk factors of intestinal helminth parasites among the Magar Community.
- To determine the prevalence and associated risk factors of taeniasis in Magar Community of Nisdi Rural Municipality.

1.4 Rational Of The Study

Nisdi Rural Municipality is inhibited mostly by indigenous Magar ethnic groups. No extensive or structured studies on human helminth parasites have been conducted in Magar Community of Nisdi Rural municipality. Due to lack of research, many people are suffering from the infection and still unknown and unaware about the cause. Magar Community of this rural municipality are mostly pig farmers and pig consumers with very low sanitation so they are at high risk of diseases like taeniasis and Naeurocysticercosis . Thus, a cross sectional study is necessary to adress the prevalence of intestinal helminth parasites and taeniasis along with its mitigating measures at national healths.

2. LITERATURE REVIEW

2.1 Scenario of intestinal Helminth Parasites in World Context

Parasitic helminth of humans are major public health problems around the world which is particularly in developing and underdeveloped countries where transmission of geohelminth is accelerated by poor sanitation and hygiene (WHO 2004). According to Kuete et al. (2015), it has been estimaed that *Ascaris lumbricoides* infects 1,221 billion people; *Trichuris trichura 795* million and hookworm 740 million . Helminth infection remain a big challenge both in developed and developing countries. In developing countries, the disease may be attributed to lack of resources, regularly de – worm affected individuals in addition to development of parasite resistance to conventional drugs resulting from poor use of drugs (Manule, 2013).

Several research work have been done in Asia regarding the intestinal parasites.Various geo – helminths particularly *Ascaris lumbricoides followed by Hymenolepis nana, Enterobius vermicularis,* hookworm, whipworm, tapeworm etc has been reported from India, China, Iran etc. in primary school children (Wani et al. 2004). Among the soil transmitteed diseases, *Ascaris lumbricoides* was the most prevalent in different parts of Asia (Carney et al. 1997, Widjan et al. 2000, Allen et al. 2004). Some studies have shown that *Trichuris trichura* as common parasite (Ahmed et al. 2011 , Huet et al. 2012). Several other studies have found that hookworm as common parasite (Chandrasena et al . 2004, Inpankaew et al. 2014). But rescent studies in Asia showed prevalence of helminthic parasitic infection below 30% (Suntaravitun and Dokmaikaw, 2018, Agustina et al. 2022 and Rohimini et al. 2022). Similarly, prevalence rate reported from other Asian countries are were Kandahar, Afghanstan 22.7% (Suntaravitun and Dokmaikaw 2018), Chachoengsao Provience , Thailand 14.3% (Agustina et al. 2022) and Bali Province , Indonesia 21.8% (Rahimi et al. 2022).

The soil transmitted helminths (*Ascaris lumbricoides,* Hookworm and *Trichuris trichiura)* are most prevalent infecting an estimated one sixth of the global population. Intestinal rates are highest in children living in Sub –Saharan Africa followed by Asia, Latin America and the Caribbean (Harhay et al. 2010) . Omalu et al. (2013) found very high prevalence of intestinal parasites above 85% and *Ascaris lumbricoides* , Hookworm and *Trichuris* as major parasites in Africa . Some studies have reported Hookworm as common helminth parasites (Kabatereine et al. 2001, Easton et al. 2016).

Other common parasites prevalent in Africa include *Strongyloides stercoralis* (Emeka 2013, Kuete et al. 2015), *Trichuris trichiura* (Odo et al. 2016, Dada et al. 2016). The prevalence of intestinal helminth infections reported previously in South American countries and North American countries are Brazil -13.7% (Barbosa et al. 2018), Argentina -11.1% (Periago et al. 2018) and Canada 4.2% (Muller et al. 2022). Several studies in America have found *Ascaris lumbricoides*, Hookworm and *Trichuris trichiura* as common helminth parasites (Andrade et al. 1995, Escobedo et al. 2008, De lima et al. 2016, Incani et al. 2017).

2.2 Scenario of Intestinal Helminth Parasites in context of Nepal

In the context of Nepal, rescent study carried out in Chepangs of Nepal revealed that the highly prevalent intestinal helminth infection was *Ascaris lumbricoides* (41%), Hookworm (26%), *Trichostrongylus* (16%), *Strongyloides stercoralis* (13%), *Hymenolepis nana* (4%) and *Trichuris trichiura* (2%) (Adhikari et al. 2021) . Similar study carried out in Meche community of Jalthal VDC showed *Ascaris lumbricoides* topped the list followed by *Taenia solium* , hookworm and *Trichuris trichiura* (2%) (Dhakal and Subedi 2009). Shrestha and Maharjan (2013) reported high prevalence of *A. lubricodes* (22.63%) followed by *Trichris trichura* (6.06 %), *Strongyloides* (1.82%), hookworm (1.62%), *Taenia solium* (1.01%) and *Hymenolepis nana* (0.81%) among school children of Bhaktapur district. Singh et al. (2017) found 32.8% of the patient in Biratnagar were infected with different intestinal parasites and infection was higher in males (53.8%) than in females (46.2%). Similarly, Pandit et al. (2012) found prevalence rate of helminth parasites was more in females (16.7 %) than in males (8.8%) in Teaching hospital.

Prevalence of intestinal helminth infection was found 28.63% in Satar and Chaudhary communities of Britamode Municipality , Jhapa Nepal. Age - wise prevalence revealed high rate of infection among children, followed by old age and adults while sex – wise showed marginally higher infection in males in both communities (Chaudhary and Subedi , 2020). There have been few studies conducted in indigenous communities in different parts of Nepal (Sharma 1965, Biggs & Watmough 2012, Gyawali 2012).

2.3 Taeniasis

Taeniasis is ancient parasitic disease that has been rooted in developing countries and an emerging major health problem in global context (Sciutto et al. 2000). We et al.

(2016) reported that taeniasis is parasitic zoonosis among 17 major neglected tropical disease identified by WHO for research and control in Southeast Asia. In 2010, it was estimated that approximately 3,00,000 individuals were infected with *Taenia Solium* cysticercosis globally resulting in over 28,000 individuals (Tongerson et al. 2015).

A study carried out Ngowi et al. (2004) to assess the risk factors for the prevalence of porcine cysticercosis in Mbulu district, Tanzania revealed the prevalence of porcine cysticercosis was 17%. They reported that prevalence of porcine cysticercosis was found considerably higher in pigs reared in household lacking latrines than those reared in household s that were using latrines. Amar et al. (2016) found 1.54% of taeniasis in local public hospitals of Saudi Arabia. Biu and Hena (2008) conducted the faecal sample analysis of stool samples of humans of Nigeria and found 4.2% overall prevalence of Taeniasis, prevalence in male was found to be higher in males than females. Prasad et al (2007) examined eggs for *Taenia* and reported 18% prevalence. Similarly, a cross sectional survey carried out in 81 smallholder farms in Thika sub-County, Kiambu County, Kenya reported the prevalence of porcine cysticercosis was found to be 6.2%. Visual inspection and lingual palpation was done to 276 pig. The prevalence was low as compared to other parts in Kenya, this was first documentation of disease occurrence in this area (Nguhiu et al. 2012).

2.4 Scenario of taeniasis in the context of Nepal

In the context of Nepal, Taenia cyst were first observed more than thirty years ago in the pork meat slaughtered in Kangeswari, Kathmandu (Joshi et al. 2007) . Neurocysticercosis was reported in Nepal during December, 1997 along with its mode of infection (Joshi et al. 2007).

Gaire (2000) recorded the highest prevalence (43%) of taeniasis in Magar and Sarki ethnic groups of Syangja district and highest prevalence of taeniasis was found in age groups above 30 years and those who do not use latrine . Similarly, survey carried by Karki (2003) among Magar communities of Barangdi VDC of palpa district reported the prevalence of 8.28% taeniasis and highest prevalence was observed in the age groups of (21 – 30) years. In addition, study carried by Thapa (2000) at Vyash Municipality of Tanahun district revealed that 18% prevalence of taeniasis among Darai and Bhote ethnic groups.

Bhattachan et al. (2015) reported 21% prevalence of taeniasis in school children of Chitwan whereas Gyawali (2012) reported 2.01% of taeniasis in Kumal community and found only males were infected. Similarly, Singh Randhir et al. (2017) reported the prevalence of taeniasis 0.75% among patients attending Birat medical college, Biratnagar .

3. MATERIALS AND METHODS

3.1 Study Area

Nisdi Rural Municipality lies in eastern part of Palpa district, Province No. 5 of Nepal. It has 7 wards (Bakamalang -01, Sahalkot -02, Jhirubas -03, Mityal -04 , Galdha-05 , Archale -06 and Jayamere -07) scaterred across 195 km^2 with total population of 26,292 . According to Nisdi Rural Municipality profile census handbook, 2075, the total Magar population of this rural municipality is 22,823.

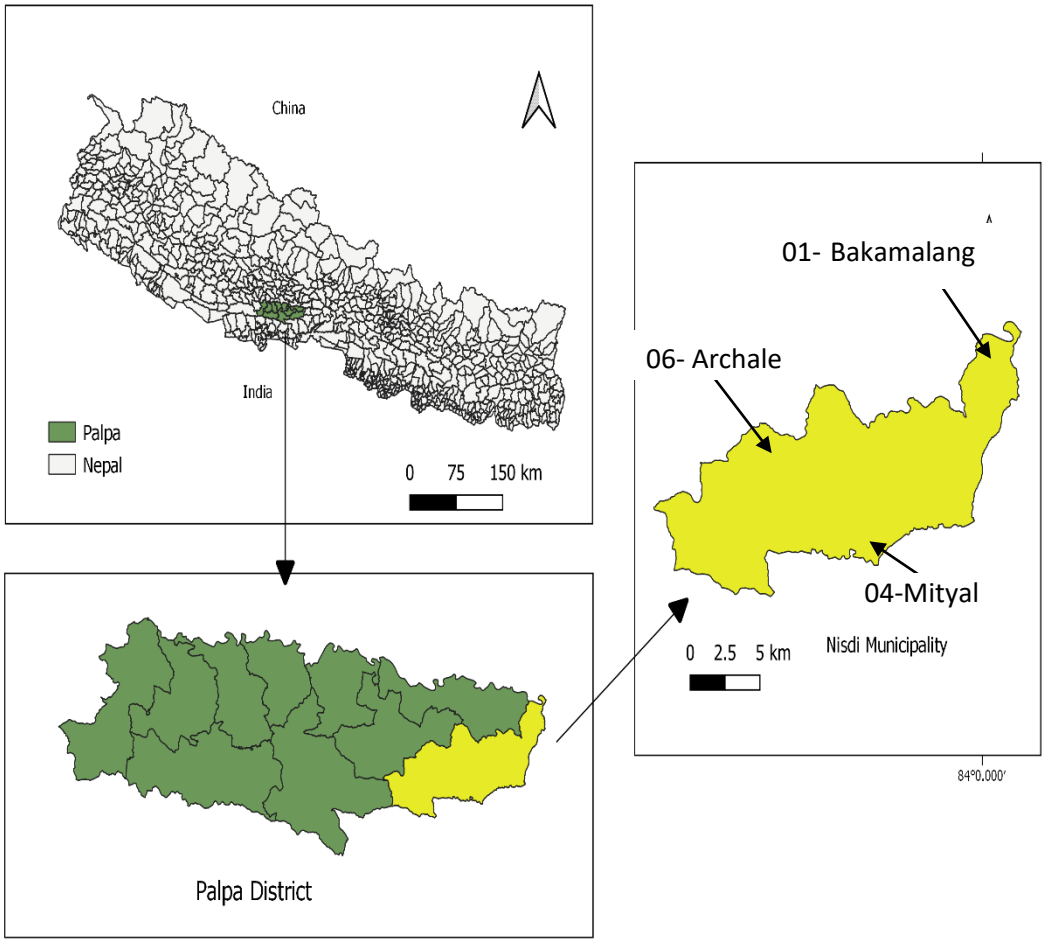

Figure 1: Map showing study area with sampling sites

For the study , Bakamalang -01, Mityal -04 and Archale -06 were selected purposively for sample collection due to following given criteria

- Geographically they are from east , west , north and south of the municipality so sample of these wards somehow represent of the whole rural municipality.
- Most of the members of these wards belongs to low socioeconomic status and many of them practice traditional pig farming as secondary occupation. Pork and pork products persist in the community. Agriculture is the main occupation of these community people (CBS 2011).

3.2 Materials Required

i. Compound microscope ii. Collecting vials

iii. Wooden applicator iv. Spoon

v. Glass slide vi. Cover slip

vii. Cotton viii. Gloves

ix. Forceps x. Stickers

3.3 Chemicals Required

i. Potassium dichromate (7.5%)

ii. Normal saline

iii. Lugols iodine

iv. 70% alcohol

v. Formal-ether solution and 10% formalin

3.4 Study Designs

For the present study, three wards i.e. Bakamalang – 01, Mityal - 04 and Archale - 06 of Nisdi Rural Municipality were selected. A cross sectional descriptive study was conducted from December 2021 to February 2022 among Magar communities

irrespective of ages and sex in selected households. Collected stool samples were examined macroscopically as well as microscopically for helminth parasites in general and *Taenia* in specific.

A cross-sectional study was made to assess the prevalence of intestinal helminth parasites along with its associated risk factors among Magar communities of Nisdi rural municipality. Sample collection was done from November 2021 to January 2022. Purposive sampling was done for ward selection and tried to cover maximum household from selected wards and then study participants was consecutively enrolled until the targeted sample size of two hundred and eighty was achieved. The study area was visited and different factors were surveyed like the personal hygiene, latrine condition, backward raising area of pig, drinking water supply, occupation and educational background. The information about the study area and the tradition and activities of the people were collected from community leaders and senior citizens .

Questionnaire survey

A structured questionnaire was administered in the local language to collect the demographic information including age , sex and occupation. Besides that other possible risk factors such as source of drinking water, dietary and cooking habits, personal hygiene , pig rearing practices, pork consumption behavior and development of subcutaneous or muscular nodules and history of passing helminth parasites were also included in questionnaire.

3.5 Ethics Approval

Informed consent was taken from each research participants. Similarly, ethical approval from office of Nisdi Rural Municipality was also taken.

3.6 Sample Size

Total sample size of the study was 280 stool sample, randomly selected from 3 wards (85 sample from Bakamalang , 85 sample from Archale and 110 from Mityal).

- Calculation of sample size by using given formula (Devi et al. 2021) :

$$\text{Sample Size (n)} = \frac{\frac{z^2 * p(1-p)}{e^2}}{1+\frac{z^2 * p(1-p)}{e^2 N}}$$

z = confidence level at 95%,

p= estimated prevalence i.e. 50 % m = margin of error at 6 %

N = 22,833 = Total Magar population

i.e. Calculated value = 264 . In current study, 280 stool sample was selected , 5% for non response or other uncertainties during data collection.

3.7 Stool sample collection

The participants was instructed to scoop a thumb sized stool sample of early morning in the provided sterile vials by clean stick and making sure not to contaminate the urine or soil. The collected sample was preserved in 2.5% potassium dichromate solution.

Examination of Sample

After collection, the sample was safely carried to laboratory of Central Department of Zoology (CDZ), Tribhuvan University, Kirtipur, Nepal. With the help of microscope by using both direct smear and concentration methods (floatation and sedimentation), parasitic eggs and larva was identified comparing the structure, color and size .

3.8 Sample examination

Macroscopic Examination

This method involves the examination of stool for its consistency, colour, odour and presence of mucus or blood. If gravid segment of tapeworm are present in stool, it may crawl under the specimen and found on the bottom of container.

Microscopic Examination

a) Saline wet mount: Arora (2016)

Saline wet mount was made by mixing a small quantity (about 2 mg) of faeces in a drop of saline placed on a clean glass slide. Then a cover slip was placed gently over it so as to spread out the emulsion into a thin, fairly uniform and transparent layer . The slide was fixed in microscope and than examined.

b) Iodine wet mount : Arora (2016)

Stool was emulsified in a drop of five times diluted solution of Lugol's iodine on a clean glass slide. Then a coverslip was placed and examined under microscope. This method was applied for observing the eggs, cyst and larva of parasites.

Concentration Method : Floatation and sedimentation Method (Adhikari et al. 2021)

a) **Saturated salt floatation technique** : 2 grams of the faecal sample were throughly mixed in a 12 ml of 0.9 % w/v sodium chlorode (NaCl) following filtration through a strainer into a 15 ml centrifuge tube . The filtrate was proceeded to centrifuge (1200 revolutions per minute, rpm × 5 minutes). The supernatant was then discarded , and the tube was completely and slowly filled with saturated NaCl solution and left undisturbed for 10 minutes, covering its mouth with a coverslip. Finally, coverslip was carefully removed and kept on a glass slide for microscopic examination at a total magnification 100x and 400x with or without Gram's and Lugol's iodine.

b) **Formalin – ethyl acetate (FEA) Sedimentation (Adhikari et al. 2021) :** Faecal sample of about 2 gram was throughly mixed in 12ml of 0.9% w/v NaCl in a 15ml centrifuge tube . Then the sample was centrifuged (1200 rpm ×5 minutes) and the supernatant was discarded. Thenafter,10% formalin and 3ml of ethyl acetate was added in the tube for subsequent centrifugation (1200 rpm×5 minutes). Finally , the supernatant was discarded , and the sediments were examined under a microscope at a total magnifiction of 100x and 400x with or without Gram's iodine.

3.9 Eggs, cyst and Larva Identification

Identification and classification of eggs, oocyst and cyst was done by using books of Arora (Arora 2016), and other published and unpublished articles and internet sources on the basis of morphological character.

3.10 Data analysis and intrepretation

The collected data were entered into Microsoft Excel 2013 spreadsheet . Data were analyzed by using SPSS version 28 software. Chi square ($\chi 2$) and Fischer's exact test

were done to test the association beween proportions. Significance was analyzed among different helminthic species. Age was classified into seven groups as (0-9) years, (10-19) years, (20–29) years, (30-39) years, (40-49) years, (50-59) years and 60 years and above (Joshi et al. 2004, Abbaszadeh Afshar et al. 2020). Association of GI helminthic infections with respect to demographic, socioeconomic, occupational and behavioral characteristics among the studied populations were analyzed. In all the cases , 95% confidence interval (CI) with $p < 0.05$ were considered for the statistically significant difference. Similarly, for identification of risk factor odd ratio was calculated by using logistic regression at 95% confidence interval. In addition , for the prevalence and identification of risk factors of taeniasis same method were applied.

4. RESULTS

4.1 Prevalence of intestinal helminth parasites among Magar community of Nisdi Rural Municipality

The present study was conducted among Magar Community of of Nisdi Rural Municipality, Palpa Nepal. Altogether 280 stool samples were collected and examined to determine the general prevalence of intestinal helminth parasites. Similarly, 280 structured questionnaire survey was conducted among the sample populations for the assessment of the risk factors for general intestinal parasites as well as one of the important zoonotically important helminth parasite, *Taenia* species.

Out of 280 stool samples examined, 87 (31.07%) were found to be infected with five different nematode intestinal helminth parasites along with two species of cestode parasites.

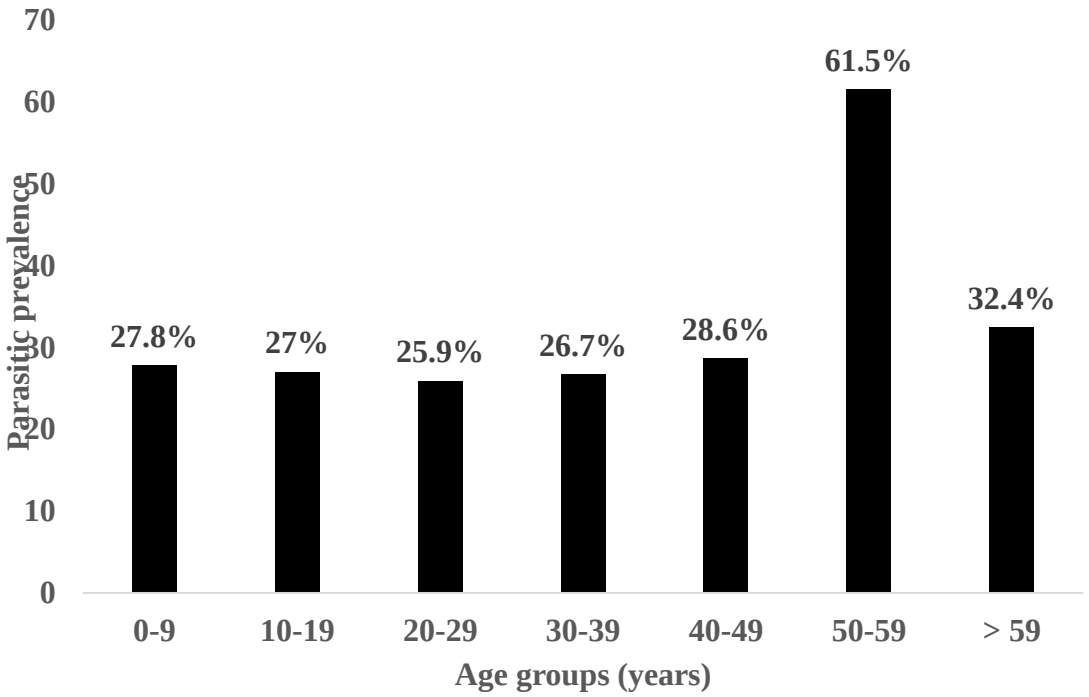

Figure 1: Agewise prevalence of Intestinal Helminth Parasites among Magar Community

Magar Community people were categorized into seven different age groups. Among them, highest prevalence intestinal helminth parasites was observed in age groups

above (50 -59) years i.e 61.5 % and lowest prevalence was found in age groups (20-29) years i.e 25.9% (Fig 1). Statistically , there was significant difference between the prevalence of intestinal helminth parasites in different age groups ($\chi 2$ =12.85, P = 0.045).

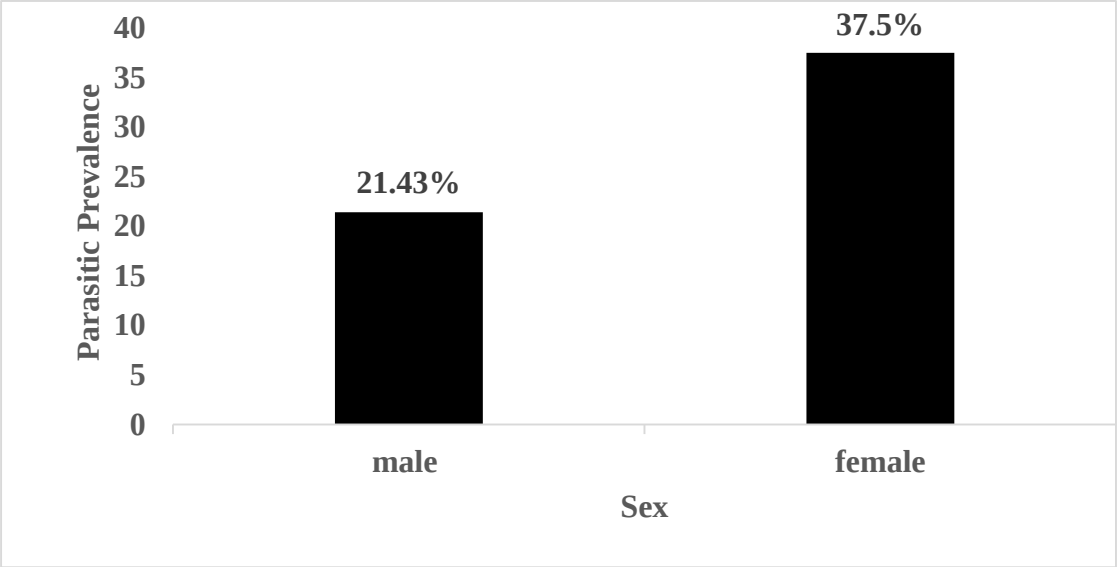

Figure 2: Sexwise prevalence of intestinal parasites among Magar Community

The prevalence of intestinal helminth parasites for male and female revealed 21.43% and 37.5% respectively showing higher prevalence in female than in male. Statistical analysis showed that intestinal helminth parasitic infection in females was significantly high compared to the male ($\chi 2$ = 8.104, P = 0.004).

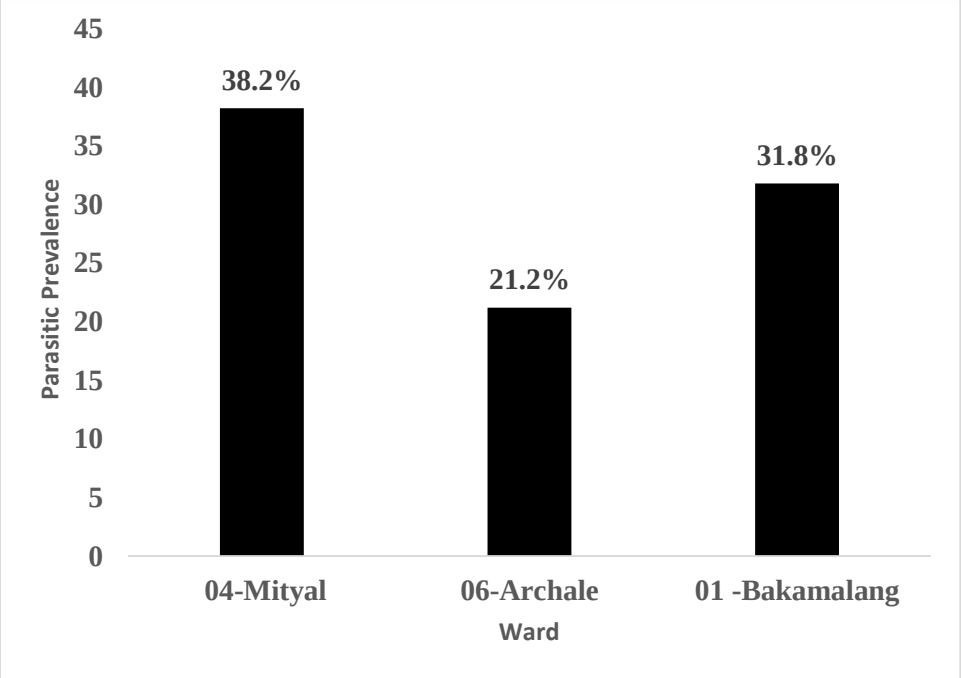

Figure 3: Wardwise prevalence of intestinal helminth parasites in Magar Community

Wardwise prevalence of intestinal parasitic infection showed 38.2%, 21.2% and 31.8% in 04 -Mityal, 06 – Archale and 01 – Bakamalang respectively, The result indicated that there is significantly high parasitic prevalence in Mityal and Bakamalang compared to Archle ward no. 06 of Nisdi Rural Municipality ($\chi 2 = 6.502$, $P = 0.039$).

Table 1 : Speciewise prevalence of intestinal helminthic parasitic infection:

Parasites	**Total Infected persons**	**Prevalence (N=280)**
Nematode		
Ancylostoma spp.	35	12.5%
Ascaris lumbricoides	33	11.8%
Trichuris trichiura	4	1.4%
Enterobius vermicularis	2	0.7%
Strongyloides sterocoralis	3	1.1%
Cestode		

Taenia spp.	7	2.5%
Hymenolepis nana	3	1.7%

Out of seven total species of helminth parasites found in Magar Community of Nisdi Rural Municipality, *Ancylostoma spp.* and *Ascaris lumbricoides* showed the highest prevalence whereas the prevalence of *Enterobius vermicularis* was found least i. e 0.7%. Similarly, prevalence of one of the zoonotically important parasite *Taenia* spp. was revealed 2.5%.

Specieswise prevalence of intestinal helminth parasites on the basis of age, sex and ward

Table 2: Specieswise prevalence of intestinal helminth parasites in different age groups

Parasites	**Age groups (years)**						
	0-9 (N=36)	**10-19 (N=63)**	**20-29 (N=27)**	**30-39 (N=45)**	**40-49 (N=49)**	**50-59 (N=26)**	**>59 (N=34)**
Nematodes *Ascaris lumbricoides*	6(16.7)	6(9.52)	0	6(13.3)	7(14.29)	6(23.07)	2(5.88)
Enterobius vermicularis	1(2.78)	0	1(3.7)	0	0	0	0
Trichuris trichiura	1(2.7)	0	0	0	0	2(7.69)	1(2.9)
Ancylostoma spp.	2(5.5)	10(15.87)	5(18.5)	4(8.89)	3(6.12)	6(23.07)	5(14.7)
Strongyloides stercoralis	0	0	0	0	1(2.04)	0	2(5.88)
Cestodes *Hymenolepis nana*	0	1(1.58)	1(3.7)	1(2.2)	0	0	0
Taenia spp.	0	0	0	1(2.2)	3(6.12%)	2(7.69)	1(2.9)

From Fischer's exact test, p-value less than 0.05 is taken as significant

Age wise specific parasitic prevalence indicated that the highest prevalence of *Ascaris lumbricoides*(23.07%) , *Trichuris trichiura* (7.69%), *Ancylostoma* spp. (7.69%) and *Taenia* spp. (7.69%) was found in age groups of (50 -59) years. Similarly, highest prevalence of *Enterobius vermicularis* (3.7%) and *Hymenolepis nana* (3.7%) were found in age groups (20 -29) years 3.7% whereas *Strongyloides stercoralis* was found highest in age groups above 59 years. Statistically, there was significant difference between different species of parasites and age groups ($\chi 2 = 0.000$, P = 0.000).

Table 3: Specieswise prevalence of Intestinal helminth parasites on the basis of sex.

Parasites	**Male (N = 112)**	**Female (N = 168)**	**Chi square Test**
Nematodes *Ascaris lumbricoides*	9(8.03%)	24(14.3%)	$\chi 2$= 2.5 ,d.f = 1 p =0.112 Non significant
Enterobius vermicularis	0	2(1.19%)	
Trichuris trichiura	2(1.79%)	2(1.19%)	
Ancylostoma spp.	8(7.14%)	27(16.1%)	$\chi 2$= 4.89 ,d.f = 1 p =0.027 significant
Strongyloides stercoralis	1(0.9%)	2(1.19%)	
Cestodes	1(0.9%)	2(1.2%)	
Hymenolepis nana *Taenia* spp.	5(4.46%)	2(1.19%)	

Ascaris lumbricoides i.e 14.3% and *Ancylostoma spp.* i.e 16.1% were found to be higher prevalent in female than in males. *Trichuris trichiura, Strongyloides stercoralis, Enterobius vermicularis* and *Hymenolepis nana* were below 2% in both

male and female . Similarly, *Taenia* spp. was found least prevalent in female i.e 1.19% in comparison to male i.e 4.46%. Statistically, there was no significance difference in the prevalence of *Ascaris lumbricoides* in between male and female i.e ($\chi 2$ =2.5, P = 0.112) but significant difference was found in prevalence of *Ancylostoma* spp. ($\chi 2$ = 4.89, P = 0.027).

Table 4: Wardwise prevalence of intestinal helminth parasites .

Parasites	**Wards (Prevalence)**		
	01 – Bakamalang (n =85)	**04 – Mityal (n =110)**	**06 - Archale (n = 85)**
Nemtodes *Ascaris lumbricoides*	15(17.6%	12(10.9%)	6(7%)
Enterobius vermicularis	0	2(1.8%)	0
Trichuris trichiura	0	2(1.8%)	2(2.4%)
Ancylostoma spp.	7(8.2%)	23 (20.9%)	5(5.9%)
Strongyloides stercoralis	3(3.5%)	0	0
Cestodes *Hymenolepis nana*	0	1	2(2.4%)
Taenia spp.	2(2.3%)	2	3(3.5%)

Among three wards, *Ascaris lumbricoides* was found highly prevalent in wards Bakamalang -01 (17.6%) and Archale -06 (7%) whereas *Ancylostoma spp.* was found highly prevalent in ward Mityal- 04 (20.9%). *Strongyloides stercoralis* was only found in ward Bakamalang -01 (3.5%) and *Enterobius vermicularis* was found only in ward Mityal -04 (1.8%). *Trichuris trichiura* and *Hymenolepis nana* were not found

in ward Bakamalang -01. Similarly, *Taenia* spp. was found in all three wards. Statistically, there was significance difference between the species wise prevalence of intestinal helminth parasites in three wards $\chi 2 = 31.244$, $P = 0.005$).

4.2 Assessment of the risk factors associated with intestinal helminthic parasitic infection among Magar Community of Nisdi rural municipality, Palpa.

Several socioeconomic, occupational and behavioral characteristics were evaluated for their association with prevalence of Intestinal helminth parasitic infections i.e Table 5. For identification of risk factors, 13 variables were assessed using univariate analysis.

Table 5: Univariate analysis of demographic factors and parasitic infection among Magar Community of Nisdi rural Municipality.

Characteristics	**Subgroups**	**Number of persons (N)**	**Prevalence (%)**	**P-value**	**Odds (95%CI)**
Age groups	0-9	36	10(27.8)	0.870	1.099(0.356-3.39)
	10-19	63	17(27.0)	0.917	1.056(0.379-2.94)
	20-29[a]	27	7(25.9)		
	30-39	45	12(26.7)	0.945	1.039(0.3351-3.075)
	40-49	49	14(28.6)	0.805	1.143(0.396-3.301)
	50-59	26	16(61.5)	0.0098*	4.571(1.421-14.705)
	>59	34	11(32.4)	0.585	1.366(0.445-4.193)
Sex	Male[a]	112	24(21.43)	0.004*	1
	Female	168	63(37.5)		2.2(3.809-1.271)
Occupation type	Laborers	31	11(35.5)	0.007*	5.250(1.466-18.806)
	Farmers	137	59(43.06)	0.000**	8.131(2.764-23.918)
	Students	54	12(22.2)	0.054	3.146(0.938-10.549)

	Military	10	1(10)	1	0.956(0.099 - 9.194)
	Business[a]	47	4(8.5)		1

[a] = reference variable, *= significant , **= Highly significant

Univariate analysis of logistic regresssion revealed that age group of (50 -59) years . Sexwise , females are significantly 2.2 times higher risk of infection of intestinal helminth parasites than males. Similarly, occupationwise farmers are at higher risk of infection 8.131 (2.764-23.918) followed by laborers 5.250 (1.466-18.806).

Table 6: Univariate analysis of risk factors and parasitic infection among Magar Community of Nisdi rural Municipality.

Variables	Subgroups	Number of persons (N)	Prevalence (%)	P-value	Odd Ratio (95% CI)
Source of drinking water	reservoir system	110	42(38.18)	0.039*	1.716((1.026 -2.868)
	Tap water[a]	170	45(26.47)		
Consumption of drinking water	With Treatment [a]	33	4(12.12)	0.012*	1
	Without Treatment	247	83(33.6)		3.669
Use of slipper/sandals/ shoes	Always[a]	134	17(12.68)	0.000**	1
	Never/ occational	146	70(42.42)		6.339(3.463 -11.591)
Latrine use	No	59	23(38.98)	0.139	1.567(0.861 -2.852)
	Yes[a]	221	64(28.95)		1
Handwash before and after defecation	Water only	218	74(33.9)	0.051	1.937(0.989-3.795
	Water and soap[a]	62	13(20.97)		1
Feeding habit	Non vegeterians	263	82(31.18)	0.879	1.08(0.371-3.187
	Vegeterians[a]	17	5(29.4)		1

Vegetables	Raw	263	82(31.18)	0.879	1.087(0.371-3.187)
	Cooked[a]	5	5(29.4)		
Consumption of drugs	Not within 6 months	261	82	0.643	1.283(0.447-3.680)
	Within 6 months[a]	19	5		1
House	Muddy house	190	69(36.32)	**0.006***	2.281(1.258-4.136)
	Concrete house[a]	90	80(88.89)		
Family size	Less than 5[a]	127	27(21.26)	0.001*	1
	More than 5	153	60(39.31)		2.389(1.4-4.079)

[a] = reference variable, *= significant , **= Highly significant

Univariate analysis revealed that people practicing the walking and working bare foot and occasionally using the sandals or slippers was the first significant risk factor of intestinal parasitic infection with the odds of 6.339. Then second important risk factor identified were consumption of drinking water without treatment (OR = 3.669, P = 0.012). Third important risk factors includes high number of family size (>5 people, OR = 2.389, p = 0.001) followed by people having muddy house (OR=2.28, P=0.006) and source of drinking water as reservoir system (OR =1.716, P=0.039).

4.3 Assessment of the risk factors associated with taeniasis among Magar Community of Nisdi Rural Municipality, Palpa

Several socioeconomic, occupational and behavioural characteristics were evaluated for their association with prevalence of Intestinal helminth parasitic infections i.e Table 6. For identification of risk factors , 12 variables were assessed using univariate analysis.

Table 7: Univariate analysis of the demographic factors associated with prevalence of Taeniasis in Magar Community of Nisdi Rural Municipality

Variables	**Subgroups**	**Number of persons (N)**	**Taenia Prevalence (%)**	**P- value (Fischer's Test)**	**Odds Ratio (95% CI)**
Age groups	0-9	36	0	0.368	0
	10-19	63	0	2.235	0
	20-29	27	0	0.435	0
	30-39[a]	45	1(2.2)		1
	40-49	49	3(6.1)	0.349	2.87(0.288-28.693)
	50-59	26	2(7.7)	0.270	3.667(0.316-42.552)
	>59	34	1(2.9)	0.840	1.33(0.080-22.109)
Sex	Male	112	5(4.46)	0.12	3.879(0.739-20.352)
	Female[a]	168	2(1.2)		1
Occupation type	Laborers	30	0	0.354	0
	Farmers	138	7		1[a]
	Students	54	0	0.194	0
	Military	10	0	1	0
	Business[a]	47	0	0.194	0

[a] = reference variable, * = significant, OR= odd ratio

The highest risk groups for taeniasis in this Magar Community was (50 -59) years age group with odds of 3.67 (0.136-42.55) followed by age group of (40 – 49) years . Sexwise, males are 3.789 times highly risk than females . Similarly, occupationwise farmers are at higher risk of infection but not significant for taeniasis.

Table 8: Univariate analysis of the risk factors associated with prevalence of Taeniasis in Magar Community of Nisdi Rural Municipality

Variables	**Subgroups**	**Number of persons (N)**	**Taenia Prevalence (%)**	**P- value (Fischer's Test)**	**Odds Ratio (95% CI)**
Pig rearing	Yes	190	6(3.16)	0.435	2.902(0.344-24.472)
	No[a]	90	1(1.1)		1
Observation of cyst during slaughtering	Yes	38	2(5.26)	0.243	2.633(0.492 - 4.085)
	No[a]	242	5(2.06)		1
Cyst edible	Yes	264	6(2.27)	0.341	0.349(0.039 - 3.086)
	No[a]	16	1(6.25)		1
Pork consumption	Cooked[a]	187	1(0.53)	0.006*	1
	Uncooked	93	6(6.5)		12.828(1.521-108.16)
Deworm pigs	Yes[a]	123	2(1.63)	0.472	1
	No	157	5(3.18)		1.990(0.379-10.437)
Feeding Habit	Vegeterian	16	0(0)	0.783	0
	Non vegeterian	264	7(2.65%)		1
Feeding excreta to pigs	Yes	35	2(5.71)	0.213	2.909(0.542-15.604)
	No[a]	245	5(2.04)		1
Heard about epilepsy	Yes	75	2(2.67)	1	1.096(0.208-5.773)
	No[a]	205	5(2.44)		1

Taeniasis is a cause of epilepsy	No	275	6(2.18)	0.142	0.112(0.011 - 1.110)
	Yes[a]	5	1(20)		1
Latrine use	No	54	4(7.4)	0.038*	5.285(1.149-24.306)
	Yes[a]	221	3(1.35)		1

Risk factors associated with prevalence of Taeniasis : univariate analysis

During questionnaire, several knowledge , attitude and practices were evaluated for prevalence of Taeniasis in Magar Community. For identification of risk factors , 11 variables were assessed using univariate logistic regression . The results showed that the people who preferred to consume uncooked pork meat were 12.828 times more likely to be infected with taeniasis than those who consume cooked pork meat (OR = 12.828, P= 0.006) . In addition, people who do not use latrine and preferred open defecation were 5.285 times more likely to be infected with taeniasis than those who preferred to use permanent latrine (OR = 5.285, P=0.038). Moreover, agewise and occupationwise showed that adults and farmers are at high risk of taeniasis infection.

5. DISCUSSION

The prevalence of intestinal helminth infection is still high in communities of developing country like Nepal. The high prevalence of these diseases in communities is due to low socio-economic status, unhygienic living conditions and scarcity of safe drinking water among those living in endemic areas.

The current study indicates the overall prevalence of 31.07% intestinal helminthic infection among the Magar Community of Nisdi Rural Municipality. Comparing our results with global population , the current prevalence rate was higher than the results reported previously in South American countries and North American countries such as Brazil -13.7% (Barbosa et al. 2018), Argentina -11.1% (Periago et al. 2018) and Canada 4.2% (Muller et al. 2022). Similarly, the current prevalence rate was also higher than reported from Kandahar, Afghanstan 22.7% (Suntaravitun and Dokmaikaw 2018), Chachoengsao Provience , Thailand 14.3% (Agustina et al. 2022) and Bali Province , Indonesia 21.8% (Rahimi et al. 2022). But , the overall intestinal helminthic parasitic prevalence (31.07%) in the current study was slightly lower than the findings from other indigenous groups of Nepal such as Chepang, Kumal , Mushar community (42.1% - 67%) from various parts of Nepal (Gyawali 2012, Adhikari et al. 2021).

Regarding the helminth infection in different age groups, high prevalence was obtained in the adults of age groups 50-59 years (33.3%) followed by age groups of above 59 years. The less rate of infection in children and teenagers may be due to more participation in Mass Drug Administration (MDA) program provided by the school and nearby health post. Whereas, high rate of infection in adults and senior adults might be due to less involvement in helminth drug administration .

In the present study, stool samples from females showed a higher rate of intestinal helminthic infection (63%) than males and significant difference was found ($P = 0.004$). This findings is similar to the study carried out in Chepang and Musahar Community which showed that the prevalence rate was higher in females 41.6% than in males 30.4% (Khadka et al. 2021). A similar study carried out in indigenous community of Gaidakot VDC also reported 58.6% of the stool samples collected from harbour helminth parasites which is higher than the males 49.1% (Gyawali et al. 2013). This might be due to the more exposure of females to the infective stages of parasitic

infection as they are involved in agriculture, household activities , child – caring and animal husbandry.

Three wards of Nisdi Rural Municipality, where study was conducted showed significant difference in prevalence rate ($\chi 2$ =6.502, P = 0.039). This may be due to different social, cultural, feeding habit , source of drinking water and economic status which allowed , different chances of infection.

The most common infection in the present study was hookworm infections followed by *Ascaris lumbricoides* at 12.5% and 11.8% respectively.This prevalence was almost similar to the study carried out in traditional pig farmers of Bali province , which found 15.1% prevalence of hoookworm and 9.2% prevalence of *Ascaris* spp (Agustina et al. 2022). Hookworm infections found in the present study is higher than the recorded from Brazil 7.1% (Barbosa et al. 2018) and Thailand 6.7% (Suntaravitun and Dokmaikaw 2018). However, study conducted in Chepang community of Nepal reported 26% prevalence rate of hookworm infection which is higher than the present study. But , study carried out in Satar, chaudhary (Chaudhary and Subedi 2020), Tharu (Khanal 2005) and Meche communities (Dhakal 2018) of Nepal encountered *Ascaris lumbricoides* was the most prevalent helminth parasites . Habit of walking and working barefoot and occationally wearing slippers could be the possible risk factors for higher infection of hookworm.

In the current study we reported eggs of *Hymenolepis nana* , a cestode parasite at the prevalence rate of 1.7% which was almost similar to that reported from Kenya 2% (Kuntz and Moore 1971) but lower than those from Nepal 3- 12 % (Bhattachan et al. 2015, Yadav and Prakash 2016), Brazil 5.32-31.2% (Aguiar et al. 2007, Rios et al. 2007, Silva et al. 2016), Vicoria 7.4% (Stevenson 1961) and Venezuela 6.9% (Chacin –Bonilla and Sanchez – Chavez 2000). *Trichuris trichiura* is another nematode that had a prevalence rate of 1.4% which was almost similar with prevalence rate in Thailand 1.3% (Suntaravitun and Dokmaikaw 2018) but lower than recorded from Malaysia 57% (Anur et al. 2014), Nepal 3 - 8% (Yadav and Prakash 2016, Khadka et al. 2021). The current prevalence rate was higher than those reported from Brazil 0.5% (Assis et al. 2013). Besides these parasites , other helminth parasites such as *Enterobius vermicularis , Strongyloides stercoralis, Hymenolepis nana* and *Taenia* spp. were found.

This study has determined risk factors for intestinal helminthic infections including the influence of age , sex and occupation. There was insignificant association between intestinal helminthic infections and age . With regard to sex , females showed 2.2 times higher risk of infection than males with significant associations p = 0.004. The prevalence of intestinal helminth infections is determined by the socio- economic characteristics and behavioural practices of the people (Anwar et al. 2018). It was discovered that high risk of intestinal helminthic infection was observed in farmers (OR=8.131, CI = 2.764 -23.918) , who worked in the fields. The results showed that farmers were 8.131 times more likely to contact on intestinal helminth parasitic infection than with business as primary occupation. Farmers are high risk group for intestinal helminthic infections in the present study is in line with the previous reports carried by Boas et al. (2012) , Mamo (2014), Fuhriman et al. (2016) and Gupta et al. (2016) in Norway, Ethiopia, Vietnam and Nepal respectively. This findings is also in agreement with the previous study conducted in the district of Lalitpur, where children belonging to the farmer parents were most commonly infected (Tandukar et al. 2013). Similarly, laborers are at second risk of infection (OR = 5.250 , CI = 1.466- 18.808) .

This study revealed that people practicing the walking and working bare foot and occationally using the sandals or slippers was the first significant risk factor of intestinal parasitic infection with the odds of 6.339. Similar study carried by Rahmie et al. (2021), Magaji (2020) and Pane et al. (2020) also revealed that not wearing footwear or walking barefoot is a significant risk factors for higher infection of intestinal helminth parasites. Higher prevalence of hookworm in the present study might be due to transmission of infective stage of larva through the skin between the toes , the dorsum of foot and the medial aspect of the sole.

The second important risk factor identified were consumption of drinking water without treatment (OR = 3.669, P = 0.012). People using untreated water (unboiled) for drinking purpose are higher risk of infection than those using treated water (boiled) . This findings is agreement to the work carried out in India (Wani et al. 2007). Boiling of water kills the microorganisms and reduce the transmission of parasitice infections . Therefore, habit of consumption of drinking untreated water could be probable risk factors for increased parasitic infection among Magar Community.

Third important risk factors includes high number of family size (>5 people, OR = 2.389, p = 0.001). Presence of five members or more in the family increased the risk of infection which may be attributed to the close contact within the croweded houses and lead to increase risk of intra –family transmission. This findings is in agreement to the work carried out in India Wani et al. (2007). Study carried by Forson et al. (2018), Ashenafi et al. (2014), Tadesse et al. (2005), Abera et al. (2014) , Kosar et al. (2017) and Ali et al. (1997) have also revealed that higher number of family size as important risk factors for transmission of parasites.

Other important risk factors for intestinal helminthic infections are people having muddy house (OR=2.28, P = 0.006) and source of drinking water as reservoir system (OR =1.716, P=0.039). Reservoir system includes kuwa and rainwater tank . Rainwater tank is a tank used to collect and store rain water runoff, typically from rooftops via pipes. It indicates that these factors are crucial in sucessibility and transmission of intestinal helminth parasites. Similar study carried by Betson 2020 and Rollemberg, 2015 have also revealed that reservoir water system have attributed for the transmission of parasite

The overall prevalence of Taeniasis in the present study was 2.5% which was almost similar to the prevalence of taeniasis reported by Gyawali (2012), McCleery et al. 2013, Gomes et al. 2014, Kumar et al. 2014 and Rahantamalala et al. 2022 which were 2.01%, 3%, 4.5% and 2.4% respectively. In contrast to this study, Bhattachan et al. 2015, Joshi et al. 2015 , Weka et al. 2013, Eke et al. 2014 showed high prevalence of taeniasis which were 21%, 18%, 9.6% and 8.45% respectively. The reason behind the low prevalence of taeniasis in the present study might be due to absence of free ranging pigs , not feeding human excreta to pigs and consumption of cooked meat by most of the people .

Age- wise prevalence of taeniasis showed that infection was found higher in age groups (50 -59) years followed by age groupss (40-49) years. Similar results was showed by Karki et al. 2003; Gomes et al. 2002 who found high prevalence of taeniasis in age groups (21-30) years . This may be due to ingestion of pork more by this age group in comparision to other age groups .The reason behind the absence of taeniasis in children and teenager might be small children eat only cooked meat and they are given by selection.

Present study shows males are at higher risk of infection than females (OR = 3.879, CI = 0.739 -20.352) but significant associations was not found between males and females. This result agree with study done by Biu and Hena (2008), Eke et al. 2014, Singh et al. 2017, Gyawali (2017) but disagrees with the study done by Prasad et al. 2007 in India which have found higher prevalence in female (14.1%) than males (12.1%). The high prevalence of taeniasis in males might be due to risky behavious such as tasting pork meat on the fire when it is not completely cooked after slaughtering of pig in the village . Females are at low risk of infection might be less consumption of uncooked pork meat as they are not involvement in slaughtering of pig.

During survey, it was found that many people haven't seen cyst while few of them have noticed cyst during slaughtering of pigs and people were almost pork consumers . Few Magar people were aware about *Taenia solium* infections in pig under a local name "Juneli" for cyst as its shape looks like seeds of Sorghum plant (*Sorghum bicolor)* . Locally, they used to call Juneli for the seeds of Sorghum plant. It is thought that cyst arise from feeding the pigs with rice washings . The Magar people were found to be ignorant of role of cyst in transmission of taeniasis and most of them believed that cyst are edible. Maharjan and Gaire (2010) carried out similar study in Magar community of Syanga district and revealed that farmers were aware of *Taenia solium* infections in pig in the name of "Chamley". Magar farmers of Syanga district also believed that cysts arise from the feeding of pigs with rice washings.

In the present study, univariate analysis showed that consumption of the undercooked pork meat and not using latrine are the two important significant risk factors associated with taeniasis in the Magar Community. During the study , community people of Nisdi Rural Municipality were interacted . Mostly male Magar community people enjoy burn meat along with liquor at the time of slaughtering which is one of the impotant risk of getting taeniasis infection which was supported by our findings. It was showed that the people who preferred undercooked pork meat consumption were 12.828 times more likely to be infected with taeniasis than those who consume only cooked pork meat (OR = 12.828, P= 0.006) . Prasad et al. (2007) had also revealed that factors associated with taeniasis were consumption of undercooked pork, frequency of consumption of pork, income of households and age above 15 years. The reason behind the higher infection of taeniasis for undercooked pork consumer in the present study

might be due to ingestion of cysticercus larva in undercooked meat. The result of the present study also revealed that consumption of undercooked meat was significantly asssociated with the prevalence of taeniasis (P = 0.006).

During the study peroid, observation was made that most of them have used latrine but in few cases, Magar people have habit of using open toilet inside the bush or in the crop fields which are the places where free roaming pigs get easily acess to human faeces . The result of the present study revealed that people who do not use latrine and preferred open defecation were 5.285 times more likely to be infected with taeniasis than those who preferred to use permanent latrine (OR = 5.285, P=0.038). Similar risk factor was identified by study carried out by Rahantamalala et al. 2022 for the prevalence of taeniasis in villages of Ranomafana rainforest , Madagascar. Higher risk for the people who preferred open defecation might be due to completion of lifecycle of the *Taenia* as pigs might get access to excreta contaminated with eggs of *Taenia* during open defecation.

Two epilepsy patient were found during the Survey. *Taenia* egg was found positive in stool sample of one epilepsy patient. The cause of epilepsy might be due ingestion of *Taenia* egg. Epilepsy cause by cysticercosis larva is also supported by the study carried by De Gorgio et al. 2005, Kanobana et al. 2011, Rajdhekhar et al. 2003 and Praet et al. 2009.

6. CONCLUSION AND RECOMMENDATIONS

CONCLUSION

The present study showed high rate of intestinal helminth infection i.e 31.07% along with taeniasis 2.5% in Magar Community of Nisdi Rural Municipality, Palpa. Age-wise prevalence of Intestinal helminth infection was found highest in adults (33.3%) of age groups (19 -59) years which was statistically insignifiant while sexwise prevalence showed that females were significantly higher infected than males ($\chi 2 = 8.104$, $P = 0.004$).Wardwise prevalence of intestinal helminth infection was found to be significantly higher in ward no 04-Mityal compared to 06-Archale and 01-Bakamalang. Regarding taeniasis, prevalence was found higher in males compared to females . Among different age groups, the prevalence of taeniasis was found only in adults and senior adults of age groups (19 -59) and above 59 years respectively. Occupationwise, prevalence of intestinal helminth parasites and taeniasis showed that farmers were highly infected.

The risk factors associated with infections of intestinal helminth parasites were people practicing the walking and working barefoot and occationally using the slippers or sandals , consumption of drinking water without treatment, high number of family size >5, people having muddy house and source of drinking water as reservoir system. Similarly, the two important risk factors associated with taeniasis found in this community were not using latrine who preferred open defecation and consumption of uncooked pork meat. During the questionnaire survey regarding taeniasis and cysticercosis , majority of respondents were unaware about cause of teaeniasis . Few of them have observed cysts in the name of "Juneli" and thought that cyst are edible. Maximum people of Magar community have heard about epilepsy but people are unknown that cysticercosis cause epilepsy

RECOMENDATIONS

- Ministry of Health and Population (MOHP) of Nepal should prepare a regular campaign for deworming programs not only in schools but also in community people for adults and senior adults .
- Habit of walking barefoot should be avoided that reduces the chances of soil transmitted helminth infection.

- Habit of defecationg in open field and consumption of uncooked meat should be avoided in order to cut off transmission life cycle of *Taenia.*

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PHOTO PLATES

Photo 1 : Distribution of vials with instructions

Photo 2: Questionnaire during sample collection

Photo 3: Collection of sample early in the morning

Photo 4 : Muddy house of Magar people

Photo 5 : Pig rearing near household

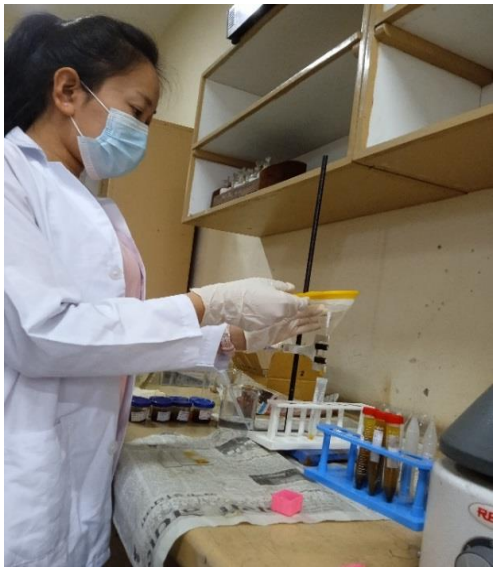

Photo 6: Processing of samples

Photo 7: Centrifugation of samples

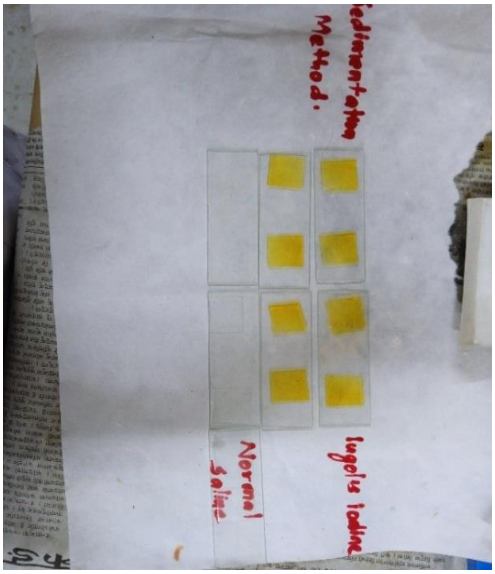

Photo 9 : Preparation of smear

Photo 9: Microscopic examination of smear

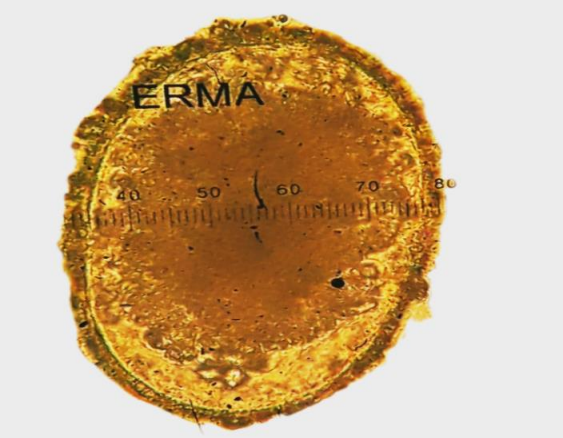

Photo 10: Unfertilized egg of *Ascaris lumbricoides* (90×55µm) at 400X

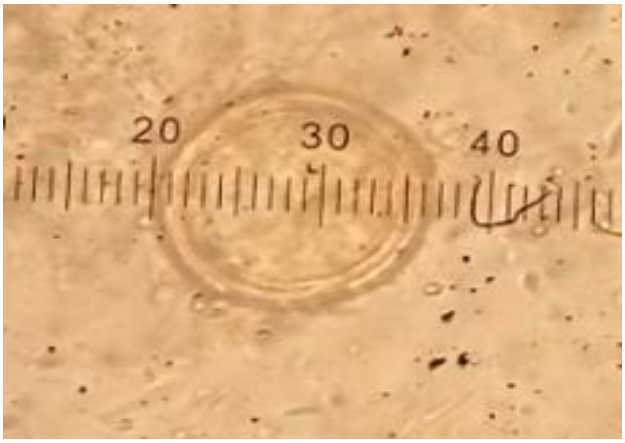

Photo 11 : Fertilized egg of *Ascaris lumbricoides*(44µm) at 400X

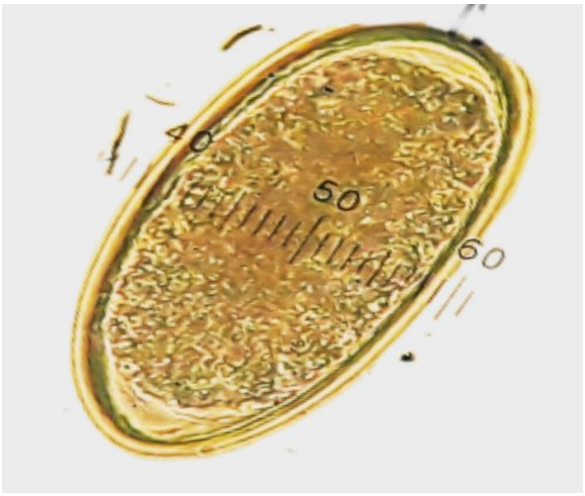

Photo 12 : Egg of *Ancyclostoma duodenale* (60×40 µm)

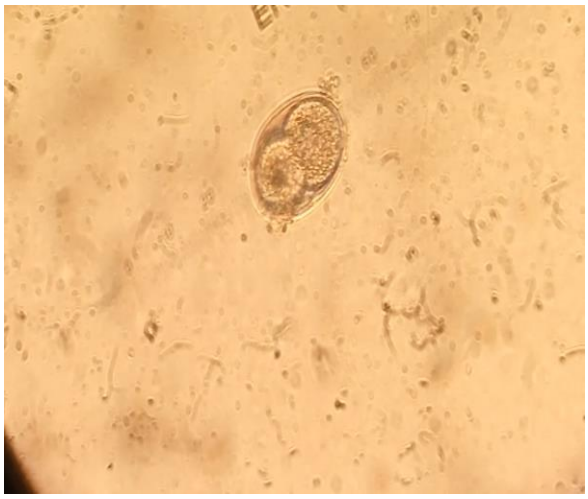

Photo 13 : Egg of *Ancyclostoma duodenale* (developing stage) at 400X

Photo 14 : Egg of *Enterobius vermicularis* (50×60 µm) at 400X

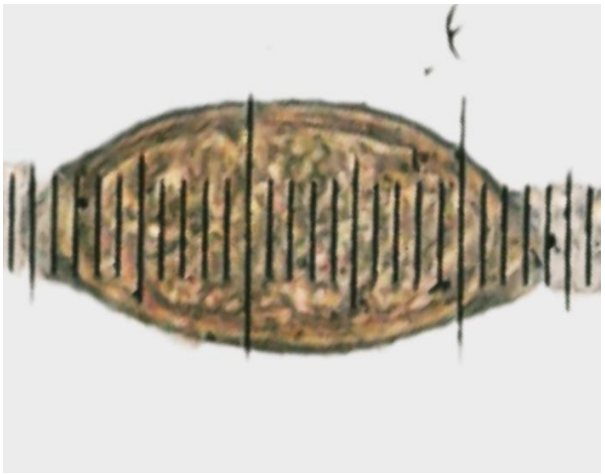

Photo 15 : Egg of *Trichuris trichiura* (52× 32 µm) at 400X

Photo 16: egg *Strongyloides stercoralis* (65×40 µm) at 400X

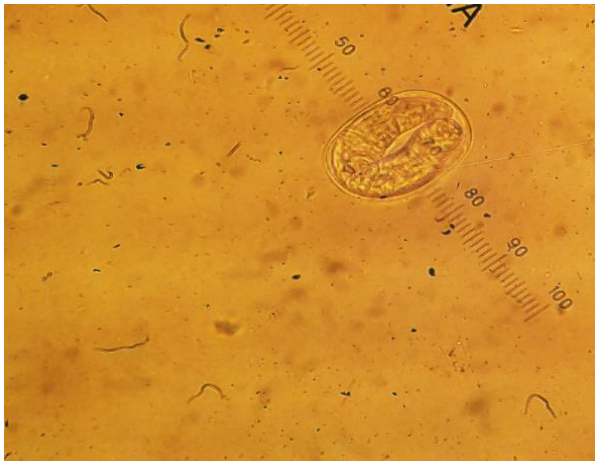

Photo 17 : Larva of *Strongyloides stercoralis* (50×36 µm) at 400X.

Photo 18 : Egg of *Hymenolepis nana* (36 µm) at 400X.

Photo 19 : Egg of *Taenia* sp. (32 µm) at 400X

Questionnaires for Respondents

1. Name , Age , Sex

2 Number of family members…….

a. Below 5 b. above 5

3. Do you consume meat ?

a.Yes b. No

4. Which meat do you consume frequently ?

a.Buffalo b. pork

5. What flavor do u make of meat ?

a. Fried b. soup c.sekuwaa d.others

6.Do you slaughter local pigs during occasions?

a. Yes b. No

7. Have you seen cyst in different parts of muscles?

a.Yes b. No

8. Do you think they are edible?

a. Yes b. no

9. Do you know how pigs get this infection?

a.Yes b. No

10. How frequently do you consume pork in a month?

a. once b. twice c. more than twice

11. Do you have your own toilet ?

a. Yes b.No

12. If no where do you defecate ?

a.Toilet b. open field

13. Have you ever seen tapeworm segments in your stool?

If yes i) himself/herself in family others

14. What do you do when found it in your stool?

i) Don't care b) Go for diagnosis and treatment c)other things you do

15 Does your pigs get access to human excreta ?

a.Yes b.No

16. Do you defecate in open field ?

A. Yes b. No

17. Do pigs feed on kitchen waste?

a. Yes b.No

18. What do you think that infectious causes?

a. . Water b.food c. meat d.others

19. Have you heard about epilepsy ?

a. Yes b. No

If yes

20. Heard epilepsy patient? Seen epilepsy patient?

a. Yes b. No

21. Do your family member had epilepsy?

a. Yes b. No

22. What usually do for epilepsy patient?

a. Hospital Treatment b)Ritual Treatment

i) treated ii)continued iii) death i) Treated ii)Continued

23. Source of drinking water ?

a. river b. tap water c. Kuwa d. other

24. Cause of epilepsy

a. genetic b. curse c.others

25. Do you wear slipper /sandle/shoes ?

a. Yes b. No

26. Do you wash your hand after toilet ?

a. Yes b.No

27. If yes , what do you use?

a. Water only b. Soap and water

28. Do you know about antihelminthic drug provided by the government?

a. Yes b. No